SPIE Optics+Photonics

Conferences + Courses: 26–30 August 2007
Exhibition: 28–30 August 2007

San Diego Convention Center
San Diego California USA

Advance Technical Program

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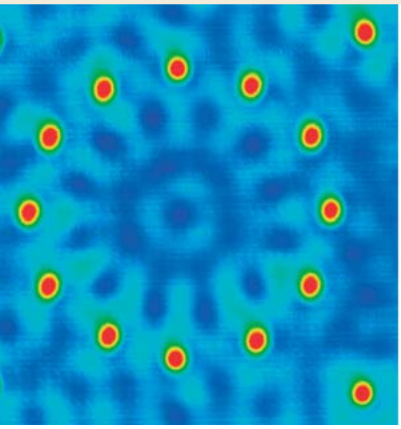

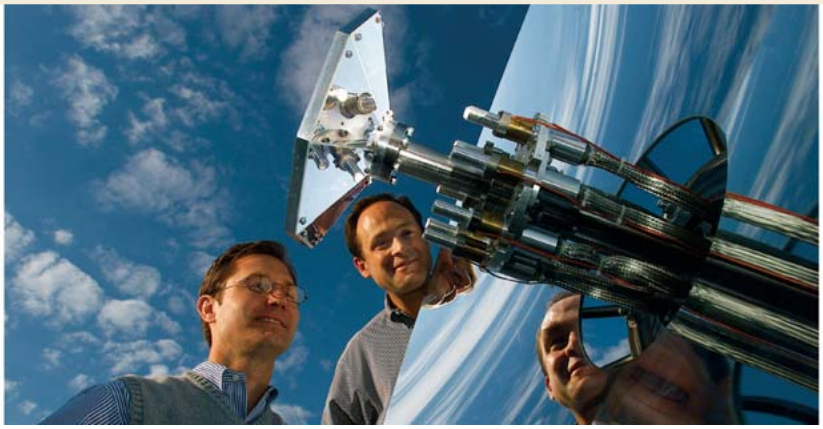

- **OPTICAL ENGINEERING AND APPLICATIONS**
- **NANOSCIENCE**
- **NANOENGINEERING**
- **ORGANIC PHOTONICS AND ELECTRONICS**
- **DETECTORS AND IMAGING**
- **PHOTONIC APPLICATIONS**
- **SOLAR AND ALTERNATIVE ENERGY**

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Left cover photo: Courtesy of National Institute of Standards and Technology.
Quantum Daisy. Twelve cobalt atoms arranged in a circle on a surface of copper produce a daisy-like pattern from the interference of electron waves. This image was made with a one-of-a-kind instrument that, acting autonomously, picks up and places individual atoms anywhere on a surface. NIST scientists are studying the quantum properties of different atom arrangements to help improve the design and fabrication of nanoscale devices.

Center cover photo: Courtesy of Oak Ridge National Laboratory.
LIGHTING THE WAY — From left, Alex Fischer, head of ORNL's Technology Transfer program, is shown with Jeff Muhs of ORNL's Engineering Science and Technology Division, who developed the hybrid solar lighting technology, April 10, 2003. It allows the sun's ray to light a room directly by using optical fibers to bring sunlight inside, and, in the future, indirectly by harnessing the remaining portion of sunlight (mainly infrared energy) to generate electricity that can power the room's light bulbs.

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Reserve your hotel early!
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NanoScience +Engineering

Part of SPIE Optics+Photonics

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David L. Andrews, Univ. of East Anglia Norwich (United Kingdom)

James G. Grote, Air Force Research Lab.

Kevin J. Liddane, Daylight Solutions

NanoScience

NanoEngineering

Solar Energy +Applications

Part of SPIE Optics+Photonics

Symposium Chair:

Ravi Durvasula, Lightfleet Corp.

Photonics Devices +Applications

Part of SPIE Optics+Photonics

Symposium Chair:

Zakya H. Kafafi, Naval Research Lab.

Organic Photonics and Electronics

Detectors and Imaging Devices

Applications

Optical Engineering +Applications

Part of SPIE Optics+Photonics

Special Programs

Optomechanics

Optical Design

Illumination Engineering

Optical Manufacturing and Testing

Advanced Metrology

Thin Films

Optical Systems Engineering

Remote Sensing Instrumentation

Astronomical Optics and Instrumentation

Image and Signal Processing

X-Ray, Gamma-Ray, and Particle Technologies

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All-Conference Welcome Reception

Convention Center Upper Level Terrace

Monday 27 August . . . . . 7:00 to 8:30 pm

All attendees are invited to relax, socialize, and enjoy refreshments and spectacular bay views. Please remember to wear your conference registration badge. Dress is casual.

SPIE Guest Hospitality Suite

San Diego Marriott Hotel and Marina, SPIE Suite

Monday-Thursday, 27-30 August . . . 8:30 to 10:00 am

Guests of attendees are invited to meet, relax, and enjoy a cup of coffee and breakfast breads in SPIE's Guest Hospitality Suite. This suite is for guests of attendees only. The hotel concierge will be available during the portion of this time to answer travel, shopping, and tourist questions.

SPIE Members Reception

For SPIE Members Only. Membership will be checked at the entrance for admission.
Coronado Terrace

Tuesday 28 August . . . . . 7:00 pm to 8:30 pm

All SPIE Members are invited to this reception in their honor. Come relax and talk with your colleagues. Refreshments will be served. Please note: this reception is limited to SPIE Members only. Membership cards or invitations will be requested at the entrance. If you join SPIE on-site, please bring your registration receipt. Dress is casual or business attire.

Poster Sessions

San Diego Convention Center Ballroom 20B

Monday 27 August . . . . . 6:00 to 7:30 pm

Tuesday 28 August . . . . . 8:00 to 10:00 pm

Wednesday 29 August . . . . . 5:30 to 7:00 pm

Conference attendees are invited to attend the poster sessions on Monday, Tuesday, and Wednesday evening. Each evening will represent a different set of conferences. Come view the posters, ask questions, and enjoy the refreshments. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

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Annual General Meeting of the SPIE Corporation

The Society of Photo-Optical Instrumentation Engineers

San Diego Marriott Hotel and Marina

Tuesday 28 August, 6:00 to 7:00 pm

Agenda:

1. Election Results

2. Report on the "State of the Society"

3. Treasurer's Report

4. Q&A with SPIE Officers

This is the general business meeting of the Society. All SPIE members are welcome and encouraged to attend. This is your forum for expressing your ideas about the Society. Results of the 2007 election will be announced and the President and the CEO will report on the State of the Society.

SPIE 2007 Annual Awards Banquet

San Diego Marriott Hotel and Marina, Marina Ballroom

Wednesday 29 August . . . . . 7:30 to 9:30 pm

Banquet and Awards Presentations

SPIE President Prof. **Brian Culshaw** presiding

SPIE President Prof. Brian Culshaw will preside over the 2007 Awards Banquet that will include the presentation of the 2007 Society awards, scholarship awards, and new Fellows of the Society. Join us for this gala event and enjoy a presentation by the 2007 Society Gold Medal recipient Dr. Joseph Goodman.

Tickets for the banquet are not included in the registration fee but may be ordered on the registration form, or purchased on site at the SPIE Registration Desk until 12 noon on Tuesday, 28 August. Tickets are $75 each.

Banquet Presentation

Foundations of a Successful and Satisfying Career: Education, Adaptability, Perspiration and Luck

Joseph W. Goodman, Stanford Univ.

This talk will give Dr. Goodman's opinions about the requirements for a successful and satisfying career. In a nutshell, the ingredients are the following: a broad and general undergraduate education with depth at the Masters or PhD level, adaptability and flexibility that will accommodate major changes of science and technology, hard work, and a large measure of luck. Examples from Dr. Goodman's experience will illustrate his points.

Biography: **Joseph W. Goodman** received an A.B. Degree from Harvard in Engineering and Applied Physics, and M.S and Ph.D. degrees, both from Stanford University in Electrical Engineering. After 4 years on the research staff at Stanford, he joined the faculty of the Department of Electrical Engineering. He chaired the department from 1989 to 1996, following which he served as Senior Associate Dean of Engineering until 1999. He retired from Stanford in January of 2001.

Dr. Goodman is the author of the books *Introduction to Fourier Optics* (now in its 3rd edition), *Statistical Optics, Speckle Phenomena in Optics,* and is co-author of *Fourier Transforms: An Introduction for Engineers.* He is the author of more than 200 scientific and technical papers, and has been primary research supervisor for 49 Ph.D.s. He has received numerous awards from the IEEE, the OSA, SPIE and the ASEE, including the SPIE Dennis Gabor Award and the Frederick Ives Medal, the highest award of the OSA. He served on the SPIE Board of Governors for two terms, 1980-1982 and 1988-1990.

Dr. Goodman was a co-founder of Optivision, Inc., ONI Systems (now part of Ciena), and served as a member of the board of directors of E-TEK Dynamics (now part of JDS Uniphase).

Fellows Luncheon

Tuesday 28 August . . . . . Noon to 2:00 pm

All Fellows of SPIE are invited to join your colleagues for an SPIE hosted luncheon. The 2006 fellows will be introduced and receive their Fellows pins. Please join us for this informal gathering and a chance to interact with other Fellows. Fellows planning to attend are asked to RSVP to Brent Johnson (brentj@spie.org).

Women in Optics Presentation & Reception

Monday 27 August . . . . . 5:00 to 6:30 pm

Open to all conference attendees; refreshments will be served. Look for location information in the Final conference program.

Dr. Jean Morrison, Vice Provost for Graduate Programs, Professor of Earth Sciences, Director of the Women in Science and Engineering (WiSE) Program, University of Southern California

The Women in Science and Engineering Program at USC: Programs and Progress 2000 - 2007

The establishment of the Women in Science and Engineering (WiSE) Program represents the serious commitment of the University of Southern California to address the under-representation of women in science and engineering. Since the launch of the program in 2000 with a $20 million gift to the endowment, WiSE has helped to more than double the number of tenured and tenure-track women faculty in the natural sciences, math, and engineering at USC through its faculty recruitment and retention programs. Its complimentary programs to address "pipeline issues" in support of undergraduates, graduate students, and postdoctoral scholars in these fields through a range of financial awards and activities have also grown in scope and impact. She will discuss the programs developed and administered by WiSE to address the obstacles to women's success in academic science and engineering. She will relay the perceived successes to date, and the challenges that remain in striving for gender equity in science and engineering at USC and beyond.

Biography: **Jean Morrison** is the vice provost for graduate programs with primary responsibility for oversight of the university's graduate affairs and of the USC Graduate School. Since 2002, she has overseen the Women in Science and Engineering (WiSE) program, which enables USC to address fundamental issues that hinder the hiring and retention of women in science and engineering. Since the program's inception in 2000, the number of tenured and tenure-track women in these fields at USC has doubled. A professor of earth sciences, Morrison is a metamorphic petrologist whose research addresses how the earth's crust evolves over time. In particular, she studies the isotopic composition of rocks and minerals to understand the role that fluids play in fault systems. She served as an editor of the Journal of Metamorphic Geology and as an associate editor of the American Mineralogist and the Geological Society of America Bulletin. She received her Ph.D. from the University of Wisconsin, Madison, in 1988; her M.S. from the University of Georgia in 1983; and her B.A. from Colgate University in 1980. In addition, she and her husband, Professor Lawford Anderson, have 2 young children, Sarah, age 11 and James, age 8.

All-Conference Plenary Session

Sunday 26 August . . . . . 6:00 to 7:30 pm

6:00 pm:

Technology to Enable our Solar Technology Future

Danielle Merfeld, GE Global Research

Abstract: The talk will start with an overview of the global market dynamics and drivers in the renewable energy space with a focus on solar photovoltaics. An assessment of the current state of the art in the field will show that photovoltaic technology has achieved an important role in real world applications, although important technical hurdles still exist. Significant advancements are required in each component of the PV supply chain including basic materials, cell and module technology, and system design, to enable widespread adoption. This talk will address in greater detail potential technical solutions provided by advancements in Silicon and novel materials with special emphasis placed on reducing costs through novel technology for cell manufacturing and module design.

Biography: **Danielle Merfeld** is the Director of Solar Technologies at GE's Global Research Center. She is currently responsible for managing the PV-related projects across the Center with topics including Si material development, PV cell design, balance of system, and grid connectivity. Prior to her current role, she spent 7 years managing the Semiconductor Technology Laboratory- a group focused on the development of wide band gap semiconductor devices such as UV light emitters, harsh environment sensors, high frequency and high power electronic devices. Dr. Merfeld received her B.S. degree in Electrical Engineering from the University of Notre Dame, and Ph.D. in Electrical Engineering from Northwestern University.

Dr. Merfeld has authored or co-authored over 60 papers in refereed technical journals and has given scientific presentations at conferences and symposiums around the world. She is member of several technical associations (MRS, APS, ECS, IEEE and SWE), is an adjunct professor at Georgia Tech, and sits on the advisory board for the ECSE department at Rensselaer Polytechnic Institute. Dr. Merfeld is also on the Editorial Board of the Journal of Material Science: Materials in Electronics and on the International advisory board of the Int. Conf. on Materials for Microelectronics & Nanoengineering.

6:45 pm:

The Concept of the Photon: Updated

Marlan O. Scully, Texas A&M Univ. and Princeton Univ.

Abstract: The photon concept is one of the most debated issues in the history of physical science. Some thirty years ago, Sargent and I published an article in Physics Today entitled "The Concept of the Photon," in which we described the "photon" as a classical electromagnetic field plus the fluctuations associated with the vacuum. However, recent developments view basic photon physics as much deeper than simple 'classical wave plus vacuum fluctuations' picture. In this talk I revisit the photon concept based on examples from these sources as well as recent work on Dicke superradiance in the one photon limit.

Biography: **Marlan O. Scully** received undergraduate training in Engineering Physics and Nuclear Engineering from the University of Wyoming and Rensselaer Polytechnic Institute and the Ph.D. in Physics from Yale University in 1966. He has held faculty positions at Yale, MIT, University of Arizona, University of New Mexico and the Max-Planck-Institut für Quantenoptik. He presently holds a joint appointment between Texas A&M and Princeton Universities.

He has been instrumental in many seminal contributions to laser science and quantum optics. These include: The Scully-Lamb quantum theory of the laser, the classical theory of the free electron laser, the theory of the laser gyroscope and especially the theory of correlated spontaneous emission noise quenching in such devices, the first demonstration of lasing without inversion and the first utilization of coherence effects to generate ultraslow light in hot gases. Furthermore Scully's work on quantum coherence and correlation effects has shed new light on the foundations of quantum mechanics and yielded new insights into quantum thermodynamics. He has been elected to the National Academy of Sciences, the Academia Europaea, and the Max Planck Society and has received numerous awards including the Charles H. Townes Award of the OSA, the Quantum Electronics Award of IEEE, the Elliott Cresson Medal of the Franklin Institute, the Adolph E. Lomb Medal of the OSA, a Guggenheim Fellowship, the Alexander von Humboldt Distinguished Faculty Prize, and the APS Arthur L. Schawlow Prize.

NanoScience + Engineering Plenary Session

Monday 27 August . . . . . 8:30 am to 12:00 pm

8:30 am:

Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms

Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

Abstract: The aim to build and apply optically driven mechanical systems at ever smaller scale runs into many problems. The use of the linear momentum and orbital and spin angular momentum solves many problems and provides means to drive such systems. Significant progress has been made by a number of groups in optically driven micromachines. The ultimate scale to which one can take such systems according to classical mechanics depends on Brownian motion and fabrication. At increasingly smaller scale the quantum effects become more important. However these effects are not obstacles but rather represent resources to be exploited in order to provide a way to the development of novel quantum technologies. The ultimate case is a Bose-Einstein Condensate that can be created and manipulated on an atom chip.

Biography: Professor **Halina Rubinsztein-Dunlop** is Head of the School of Physical Sciences and a Director of the Centre for Biophotonics and Laser Science at the University of Queensland. She obtained her PhD degree from the University of Gothenburg and Chalmers University of Technology in Sweden in 1978. She also holds a Docent Degree from the same University. At the University of Gothenburg she worked on the development of laser based methods for ultra-sensitive trace element analysis and established a strong research group in this area. Halina moved to the University of Queensland in 1989 where she today leads a large research group in experimental atom optics, laser micromanipulation and nano-optics. She also leads a program within which advanced single photon sources suitable for use in all-optical quantum computing and other quantum technologies will be developed. Halinas research interests are in laser physics, atom optics, laser micromanipulation, linear and nonlinear high resolution spectroscopy, and nano-optics. She is an expert in laser spectroscopy, atom optics and is internationally recognised for her work in laser micromanipulation. She is one of the originators of laser enhanced ionisation spectroscopy, She has over 160 publications in international peer refereed journals, six book chapters and a large number of international conference contributions and several invited talks. The work in atom optics under her leadership culminated in the demonstration of dynamical tunneling in a BEC in a modulated standing wave. Halinas group in laser micromanipulation was the first to demonstrate the transfer of angular momentum of light to microscopic particles.

9:00 am:

Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices

Liming Dai, Univ. of Dayton

Abstract: Polymers have long been used as electrically insulating materials: after all, metal wires are coated in plastics to insulate them. Various conjugated polymers with alternating single and double bonds can now be synthesized with unusual electrical, magnetic, and optical properties owing to the substantial π-electron delocalization along the polymer backbone. We have elucidated the mechanism through which the conductivity of "I2-doped" non-conjugated polydiene rubbers arises and demonstrated photolithographic generation of conducting polybutadiene patterns for optoelectronic applications. We have also developed various polymeric light-emitting diodes with novel features for multi-color emissions at ordinary household current and synthesized novel dendritic and C[sub]60[/sub]-containing optoelectronic materials for flexible photovoltaic cells. Additionally, the discovery of carbon nanotubes has created new opportunities for material science and nanotechnology. Having conjugated all-carbon structures, carbon nanotubes also possess certain similar physicochemical characteristics as conjugated polymers, apart from their superior thermal and mechanical properties. For some practical applications, however, carbon nanotubes need to be aligned/micropatterned, in a similar fashion as conducting polymers in optoelectronic devices. We have developed simple methods for the large-scale synthesis and micropatterning of highly aligned carbon nanotubes for various potential applications ranging from chemical/bio-sensors to field emitters for panel displays. We have also prepared novel aligned nanowires by either electrochemically depositing a concentric layer of an appropriate conducting polymer onto the individual aligned carbon nanotubes or chemically grafting polymer chains onto plasma-activated carbon nanotube surfaces whilst largely retaining the nanotube structural integrity. The combination of the unique physicochemical properties of fullerenes and carbon nanotubes with comparable optoelectronic properties of conjugated polymers has yielded some interesting synergetic effects. In this talk, the above work will be summarized, along with an overview of some recent developments in the field.

Biography: **Liming Dai joined** the University of Dayton in 2004 as the Wright Brothers Institute Endowed Chair Professor of Nanomaterials in the Department of Chemical and Materials Engineering with joint appointments as chemistry professor in the Department of Chemistry, and as Distinguished Research Scientist at the University of Dayton Research Institute. Dr. Dai received a bachelor's degree in chemical engineering from Zhejiang University in 1983 and a doctorate in chemistry from the Australian National University in 1990. He was a postdoctoral fellow in physics in the Cavendish Laboratory at the University of Cambridge from 1990 to 1992 and a visiting fellow in the Department of Materials Science and Engineering at the University of Illinois at Urbana-Champaign in 1992. Thereafter, Dai spent 10 years with the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia, where he built a world-renowned research team in nanomaterials. Before joining the University of Dayton, he was a polymer engineering faculty at the University of Akron. Dr. Dai's expertise lies across several fields, including the synthesis, chemical modification, and device fabrication of conjugated polymers, fullerene-containing polymers, and carbon nanotubes. He has published about 180 scientific papers, a research monograph on intelligent macromolecules, and an edited book on carbon nanotechnology. He also holds about 20 issued or filed patent applications. He is on the editorial board of two international journals and has received several awards including, IUPAC Young Observer Award in 2003, 2006 Sigma Xi's George Noland Research Award, and 2006 Outstanding Engineers and Scientists Award from the Affiliate Societies Council of Dayton.

9:30 am:

Brave New Nanoworld, without Apologies to Aldous Huxley

Akhlesh Lakhtakia, The Pennsylvania State Univ.

Abstract: Scientific progress has inspired futurists for centuries to conjure visions of utopias and dystopias. The emergence of nanosciences and nanotechnologies, and their confluence with life sciences as well as information science and technology, is bringing us closer to realizations of both types of visions. After succinctly surveying the salient features of nanosciences and nanotechnologies, and mapping out societal perspectives thereof, I will discuss the social and ethical implications of the emerging developments and suggest an educational strategy to properly harness their socially transformative power.

Biography: **Akhlesh Lakhtakia** is the Charles Grover Binder (Endowed) professor of engineering science and mechanics at the Pennsylvania State University. He earned the BTech and DSc degrees in electronics engineering from the Banaras Hindu University in 1979 and 2007, respectively, and the MS and PhD degrees in electrical engineering from University of Utah in 1981 and 1983, respectively. A Fellow of SPIE and OSA, he is currently the editor-in-chief of SPIE's online Journal of Nanophotonics. He has published widely on many topics in optics and electromagnetics, elastodynamics, materials sciences, and nanotechnologies.

10:30 am:

High Performance Organic Electronic Devices Based on Nano-Scale Engineering

Yang Yang, Univ. of California/Los Angeles

Abstract: Conjugated organic molecules and polymers have known to have semiconductor property with solution processing capability. This unique combination enables a new class of electronic and opto-electronic materials and devices. In this presentation, a detail investigation on the physical properties of conjugated molecules and polymers will be presented. The understandings of the basic optical and electrical properties of these molecules and polymers have leaded us to the invention novel devices and/or improvements of performance on existed device. For example, by controlling the interfacial dipole moment and the trap-state in luminescent materials, we are able to achieve nearly 40% internal quantum efficiency polymer LEDs. The concept of interface engineering is similar to the quantum well structure adopted in inorganic LEDs; however, with the simple solution possessing capability in polymer devices. On the other hand, the charge transfer and trapping concept in "donor-acceptor" system leads to a novel nonvolatile organic memory devices, which challenge traditional silicon flash memory. Finally, by controlling the polymer morphology, we have achieved the balance of carrier mobility between electrons and holes in our polymer solar cells, which has resulted 4.4% power conversation efficiency. In this presentation, we will present the results from those devices and their correlation with nano-scale engineering.

Biography: **Yang Yang** received his B.S. in Physics from the National Cheng Kung University in Taiwan in 1981, and his M.S. and Ph.D. in Physics from University of Massachusetts-Lowell, 1988 and 1992 respectively. He joined Prof. Bryan Kohler's group at UC-Riverside as a post-doc researcher from December 1991 to September 1992. He joined UNIAX Corporation (now du Pont Display) as a device physicist in October 1992. Yang joined the Department of Materials Science and Engineering of UCLA as an Assistant Professor in January 1997 and subsequently became Associate Professor in July 1998, and Professor in 2002. His research focuses on conjugated polymers, polymer LEDs, Memory devices, solar cells. He has published more than 120 refereed papers and given more than 50 invited presentations on his research work and has filed/granted 30 US patents. He received the following awards and honors: NSF Career Award: 1998; 3M Young Investigator Award, 1998; Who is Who in America, (1997- present); Professional Development Award, University of Massachusetts-Lowell, (1991). In the year of 2007, his group has achieved the following achevements: 4.4% efficiency polymer solar cell, 20 lm/watt white color polymer LED, organic transistor can be operated in less than 5V and reach several mA current.

NanoScience + Engineering Plenary Session continued

11:00 am:

Nanotechnology: New Tool for Diagnostics and Treatment of Cancer

Michael J. Heller, Univ. of California/ San Diego

Abstract: Generally, molecular or nanoelectronic devices and systems are envisioned as the more revolutionary application of nanotechnology. Many examples of individual molecular components with appropriate basic properties including carbon nanotubes and various organic molecules with electronic switching capabilities exist now. The research focus is now on the development of a viable technology that would allow billions of molecular/nanoelectronic components to be assembled and interconnected into useful logic/memory devices and systems. In addition to electronic applications, nanodevices and nanosystems with higher order photonic, mechanical, mechanistic, sensory, chemical, catalytic, and therapeutic properties are also envisioned. To date, it has not been possible to design a synthetic model of these solid-state photonic transfer systems with the efficiency of the biological system. The acceleration of a "molecular engineering" perspective may be key to enabling nanotechnology for cancer and other disease therapeutics, particularly if self-organization or self-assembly based scenarios are required for the integration of components into the higher order devices and systems.

Biography: **Professor Michael J. Heller** began at UCSD in July 2001. He has a joint appointment between the departments of Bioengineering and Electrical and Computer Engineering. Dr. Heller received his Ph.D. in Biochemistry from Colorado State Univ. His rich scientific experience includes working as an NIH Postdoctoral Fellow at Northwestern Univ., supervising the DNA Technology Group at Amoco Corp., and serving as the Director of Molecular Biology at Molecular Biosystems, Inc. In 1987 Dr. Heller was elected President and Chief Operating Officer at Integrated DNA Technologies. He was also a co-founder and the Chief Technical Officer at Nanogen, Inc., located in San Diego, California and the principal inventor of Nanogen's microelectronic-based DNA chip technology. His experience includes many areas of biotechnology, with particular expertise in DNA molecular diagnostics and fluorescent/optoelectronic based detection technologies. Dr. Heller's most recent work involved the development of integrated DNA chip devices and systems for genomic and biomedical research and clinical diagnostic applications.

11:30 am:

Commercialization of Nanotechnology: A Business Perspective

Sean Murdock, Nano Business Alliance

Abstract: Moving a theory or concept to the marketplace is a long process fraught with economic and financial challenges that can be equally as daunting as the technical challenges. Working to identifying applications that provide satisfactory return on investment for both the user community and the investment community is the focus of many organizations including the Nano Business Alliance. During this talk, the executive director of Nano Business Alliance will share his insights regarding those most promising applications spanning medicine, engineering, consumer products, and more. He will share the perspectives of business people and Wall Street where no matter how novel a new material may be, if it doesn't produce economic advantage for investors and shareholders, it is unlikely to survive the brutal reality of the marketplace. He will also discuss the key new nanotechnologies that will have the most global economic impact.

Biography: Prior to becoming the Executive Director of the NanoBusiness Alliance, **Sean Murdock** was the Executive Director and a founding board member of AtomWorks, an initiative formed to foster nanotechnology in Illinois and more broadly throughout the Midwest. Before that, Sean had more than 7 years experience in management consulting, most recently as Engagement Manager at McKinsey & Company. Sean served a variety of Fortune 500 companies, focusing primarily upon the industrial and chemicals sectors.

Sean has been very active in nanotechnology trade and economic development issues. He helped to organize and execute the first Nanotechnology Trade Mission to Europe in conjunction with the NanoBusiness Alliance and the U.S. Department of Commerce. He has also been engaged with senior officials of the U.S. Department of Commerce's Technology Administration on the potential impact of export control issues on nanotechnology development and commercialization.

He received his Masters in Business Administration and Masters in Engineering Management from Northwestern University. He holds a BA in Economics from the University of Notre Dame.

Solar Energy Plenary Session

Monday 27 August . . . . . 1:30 to 5:30 pm

1:30 pm:

The Solar-hydrogen Economy: An Analysis

Warren Reynolds, CEO, Eco-Engineers, Inc.

Abstract: The 20th Century was the age of the Petroleum Economy while the 21st Century is certainly the age of the Solar-Hydrogen Economy. The global Solar-Hydrogen Economy that is now emerging follows a different logic. Under this new economic paradigm, new machines and methods are once again being developed while companies are restructuring.

The Petroleum Economy will be briefly explored in relation to oil consumption, Hubbert's curve, energy ratio, and oil reserves.

There are four major driving factors for the establishment of the Solar Hydrogen Economy, i.e. global warming, air pollution, national security and the coming "Oil Crash". The New Energy decentralization pathway has developed many progressive features, e.g., reducing the dependence on oil, reducing the air pollution and CO_2.

The technical and economic aspects of the various Solar-Hydrogen energy options and pathways will be analyzed as well as debunking some the "hydrogen myths".

There are emerging Solar Hydrogen energy infrastructures in the U.S., Europe, China and Japan. Some of the major infrastructure projects in the transportation and energy sectors will be shown. An estimated logistic time-curve for the total conversion to the New Economy through 2045 will be given.

A proposed 200 MWe solar-hydrogen power plant for Las Vegas with selected energy options will be discussed.

Biography: **Dr. Reynolds** has over 35 years experience in the nuclear, chemical and pharmaceutical industries. For 10 years, he was a nuclear engineer for GE's Nuclear Energy Division doing work on nuclear fuel reprocessing and breeder reactor R&D. At the National Center for Toxicology Research, he conducted instrumentation development in mass spectrometry and a photodiode array detector as well as carcinogen detection. He was a division manager at Lockheed's Engineering and Management Services Company managing an EPA contract for the National Superfund Project. He was technical advisor to San Diego County's Hazardous Waste Enforcement Division. He has received an "IR-100" award for development of an air pollution monitoring instrument. He has over 280 technical reports and published papers as well as over 30 technical presentations

2:00 pm:

Solar Hydrogen Production by Tandem Cell System Composed of Metal Oxide Semiconductor Film Photoelectrode and Dye-Sensitized Solar Cell

Hironori Arakawa, Professor, Tokyo Univ. of Science (Japan)

Abstract: Water splitting by photoelectrochemical cell has such merits compared with powder photocatalyst as a separate gas evolution of H_2 and O_2, a suppression of backward reaction of water splitting and an efficient charge separation under applied bias. We have investigated solar hydrogen production using mesoporous and transparent oxide semiconductor films such as TiO_2 and WO_3 film photoelectrodses. Photoelectrode composed of TiO_2 film with 10μm thickness on FTO glass showed the photocurrent of 0.39mA/cm^2 under both applied bias of 0.4V vs RHE and solar simulator (100mW/cm^2, AM1.5). This is equal to 0.32% STH and about 1L/m^2 of H_2 will be produced under this condition. On the other hand, WO_3 film photoelectrode showed the photocurrent of 1.3mA/cm^2 under applied bias of 0.9V vs RHE and solar simulator. This is equal to 0.43% STH and about 1.3L/m^2 of H_2 will be produced under this condition. Solar energy conversion efficiency to H_2 production (STH) was obtained from the following equation (1),

$$\eta(\%) = J(1.23\text{-}E)/I \times 100 \quad (1)$$

where $\eta(\%)$ is a STH in % and J is a produced photocurrent in mA/cm^2 at E. E is an applied potential in voltage. I is solar irradiance, that is, 100mW/cm^2, AM1.5.

Then, tandem cell system was applied for water splitting under solar simulator. Tandem cell system is composed of Pt wire, mesoporous and transparent oxide semiconductor photoelectrode such as TiO_2 and WO_3, and a Black-dye-sensitized solar cell (BDSC). We prepared two types of BDSC. The one was a single unit cell having Voc of 0.7V. The other was two-series connected cell having Voc of 1.4V. In case of tandem cell composed of a TiO_2 photoelectrode and a single BDSC, both H_2 and O_2 gas evolution were observed without any applying bias under solar simulated light. STH was 0.52%, showing 1.5 times higher than that of TiO_2 photoelectrode system. A two-series connected BDSC did not improve much in photocurrent and STH compared with those of a single BDSC. However, in the case of tandem cell composed of a WO_3 photoelectrode and a two-series connected BDSC, photocurrent and STH were much improved compared with that of a single BDSC system. The best STH was 2.4%, which was about 5 times higher than that of TiO_2 tandem cell system. Other metal oxide semiconductor systems will be also introduced.

Biography: **Hironori Arakawa** is currently a professor of Industrial Chemistry, Faculty of Engineering at Tokyo University of Science. He received his Doctor of Engineering Degree from Tokyo Institute of Technology in 1976. After this, he joined National Chemical Laboratory, one of National Institutes under AIST Japan. He moved to Tokyo University of Science in 2004. His research is concerned with development of catalytic technologies with an artificial photosynthetic process. This includes catalytic hydrogenation of CO_2 to alcohols, hydrogen production from water by powder oxide semiconductor photocatalysts and photoelectrodes, and dye-sensitized solar cell. He received some awards such as Award of Japan Institute of Energy, Merits of Minister of Science and Technology Agency Japan and The Best Paper Award of ISEC/ASME and so on. He is the author and co-author of over 250 peer-reviewed publications in the areas of CO and CO_2 conversion, water splitting photocatalysis and dye-sesnistized solar cell.

2:30 pm:

New Opportunities in Concentrator Photovoltaics with Low-cost, 40% Efficient Multijunction III-V Solar Cells

Richard R. King, Principal Scientist, Photovoltaic Cell R&D, Spectrolab, Inc.

Abstract: Photovoltaics for solar electricity generation has been growing at a rate of over 30% per year for the last decade, with over 1.6 GW of solar cells produced in 2005. Concentrator photovoltaic (CPV) systems using very-high efficiency multijunction solar cells, with roughly double the efficiency of conventional flat-plate silicon solar panels, offer a path to bring the cost of solar electricity down still further, to the point at which it is cost-effective to replace conventional fossil fuel and nuclear power plants with non-polluting concentrator photovoltaics. Recent experimental advances in III-V multijunction solar cell design have resulted in a metamorphic, or lattice-mismatched, GaInP/ GaInAs/ Ge 3-junction cell with 40.7% efficiency (AM1.5D, low-AOD, 240 suns, 25°C), the first solar cell to reach over 40% efficiency, and the highest solar conversion efficiency yet demonstrated for any type of photovoltaic device. Device improvements in lattice-matched CPV multijunction cells have now resulted in 40.1% efficiency, also exceeding the 40% milestone. Many of the high-efficiency device structures from the experiments leading to these record performance cells have been incorporated in lattice-matched production concentrator cells, increasing the power output of fielded CPV systems, with further experimental efficiency advances planned for future generations of mass-produced concentrator cells. The value of these very high efficiencies is that they reduce the cost of all area-related components of a photovoltaic system, such as glass, encapsulation materials, metal support structures, and semiconductor material of the cells themselves, opening wide market areas for photovoltaics. Efficiency data from large-volume production and long-term field tests of concentrator III-V multijunction solar cells will be presented. The impact of very high cell efficiency on overall PV system cost is analyzed, plotting a route to large-scale, cost-effective implementation of concentrator photovoltaics at the multi-GW/year production level, and ultimately to meet a significant part of the world's ~1.7 TW demand for electric power.

Biography: **Dr. King** is a Boeing Technical Fellow, and Principal Scientist responsible for Photovoltaic Cell R&D at Spectrolab, Inc. He did his Ph.D. research on recombination in silicon solar cells at Stanford University. Dr. King's research on photovoltaics over the last 20 years includes work on high-efficiency multijunction cell designs, and metamorphic III-V materials for solar cells. Dr. King has led Spectrolab's development of multijunction terrestrial concentrator solar cells, recognized with R&D 100 and Scientific American 50 awards, and most recently achieving a record 40.7% efficiency, the first solar cell of any type to reach over 40%. Dr. King was inducted into the Space Technology Hall of Fame in 2004, and has over 80 publications on photovoltaics and semiconductor device physics.

Solar Energy Plenary Session continued

3:00 pm:

Module Design and Development: Progress and Opportunities

Doug Rose, Director of Module R&D, SunPower Corporation

Abstract: Worldwide production of flat-plate photovoltaic modules has increased dramatically, from 0.2 GW in 1999 to 2.4 GW in 2006, and is forecast to be 10GW in 2010. These production volumes, along with the recognition that module design has a large impact on module value, cost, and ease of production ramp, have greatly increased the interest in module conversion (i.e., the processes for taking cells and making a package suited for outdoor use). Module design impacts the value of a solar module by affecting its energy production per area, life span, and physical suitability (e.g., mounting ease and aesthetics) for its intended application.

This talk provides a brief overview of module conversion approaches and their impact on module value and cost. Analysis includes the impact of module efficiency and ease of mounting in various market segments. Results from SunPower Corporation are used to illustrate the many areas of intersection between the topics of this conference and module design and development. A production module with >19% total-area efficiency, a new interconnect approach, optical modeling, measurement of high capacitance modules, energy production of modules, module reliability testing, and reliability prediction are all described.

Biography: **Doug Rose** is Director of Module R&D at SunPower Corporation. He received an MSME from Stanford University and a Ph.D. in EE from the University of Colorado. His career spans 20 years of manufacturing technology development, thin-film PV research, and crystalline silicon cell and module development at GTE, NREL, First Solar, and SunPower Corp. Dr. Rose has 2 patents and 54 publications in the field of solar energy.

4:00 pm:

Delivering Service at Scale: Old Requirements for the New Energy Industry

Mark Culpepper, VP/Strategic Marketing, SunEdison

Biography: **Mark Culpepper,** VP/Strategic Marketing, has an extensive background in strategic marketing, working with companies such as Symbol, Cable & Wireless, Digital Island, Cisco and Montgomery Securities. Prior to SunEdison, Mark worked as VP of Business Development for Team Solar Inc., an installer of utility scale solar solutions based in Sacramento, California. Mark holds a BSFS from Georgetown University School of Foreign Service.

4:30 pm:

PV Solar Electricity Market and Technology Development

Winfried Hoffmann, CTO, Solar Business Group, Applied Materials, Inc.

Biography: **Dr. Hoffmann** is chief technology officer of the Solar Business Group and a member of the management board of Applied Materials GmbH, effective April 2, 2007. A solar industry veteran with nearly 30 years of experience, Dr. Hoffmann is responsible for technology development for Applied Materials in the U.S., Europe and Asia and will be based in Alzenau, Germany.

Dr. Hoffmann is also president of the European Photovoltaic Industry Association (EPIA), the world's largest industry association devoted to the solar electricity market. Dr. Hoffmann is also an executive committee member with the German Solar Industry Association (BSW).

Dr. Hoffmann began his career at NUKEM's solar division in 1979 and took over its leadership in 1985. In 1994, he formed the photovoltaic joint venture between NUKEM and Daimler-Benz Aerospace and became managing director of ASE (Applied Solar Energy) GmbH and Chairman of the Board of ASE Americas after the acquisition of Mobil Solar. In 2002, he was appointed Chairman of the Management board at RWE SCHOTT Solar GmbH. With the acquisition by SCHOTT in 2005, Dr. Hoffmann became a Member of the Management Committee of SCHOTT Solar, GmbH.

Dr. Hoffmann is a member of the Scientific Advisory Board of the Fraunhofer Institute for Solar Energy Systems (fhG-ISE) in Freiburg and a member of the supervisory board of the Institute for Solar Energy Research (ISFH) in Hameln, Germany.

Dr. Hoffmann has a doctorate degree in physics from the University of Freiburg, Germany.

5:00 pm:

The Solar Industry-DOE and NREL Programs to Accelerate Growth

Stephen J. Eglash, Consultant to the National Renewable Energy Laboratory

Abstract: As solar energy approaches grid parity, the solar industry faces tremendous opportunities and major challenges. Economic, environmental, political, and social interests are powerfully aligned in support of renewable energy and energy efficiency. Examples include the President's Solar America Initiative, new Department of Energy funding initiatives, and reshaped and re-energized programs at the National Labs. The SAI will inject $148 million into solar R&D in 2007. New DOE initiatives run the gamut from basic research on materials, devices, and processes, to applied research such as the Photovoltaic Component / System Incubator for component prototype and pilot scale production, to commercialization activities such as the Technology Pathway Partnerships for system development and manufacturing. The National Renewable Energy Lab is rethinking its research programs and streamlining its intellectual property policies to assure alignment with industry.

This talk will examine these initiatives and describe opportunities for companies, universities, investors, and others to participate in these government programs.

Biography: **Steve Eglash** is presently a consultant to the National Renewable Energy Laboratory. Previously, Steve was a principal at the venture capital firm Worldview Technology Partners, a vice president at SDL / JDSU, and a member of the technical staff at MIT Lincoln Laboratory. Steve has a Ph.D. and M.S. from Stanford University and a B.S. from the University of California at Berkeley.

Solid State Lighting and OLED Plenary Session

Tuesday 28 August . . . . . 8:30 to 10:00 am

8:30 am:

Solid State Lighting: Illumination and Communication

Ian E. Ashdown, Senior Research Scientist for TIR Systems Ltd. (Canada), Senior Software Engineer for Lighting Analysts Inc., and President of byHeart Consultants Ltd. (Canada)

Abstract: The solid-state lighting (SSL) market is in transition from glitzy color-changing displays to practical white light luminaires that will compete with incandescent and fluorescent lamps for general illumination applications.

With this change in focus, the SSL industry needs to better understand the needs of the architectural lighting community. More than just high-flux LEDs, we need to present SSL in the context of a lighting system that includes:

- Light-emitting diodes
- Thermal management
- Optics
- Drivers
- Power conversion.

We also need to understand what industry standards for photometry, colorimetry, lifetime and electrical safety requirements will be applied to these systems, and to design SSL products that satisfy the luminaire designer's needs.

Most important, we need to communicate what high-flux LEDs can do, and to listen to what the architectural lighting community is saying.

Biography: **Ian Ashdown** is well known and widely respected for his contributions to the advancement of lighting technology. He is a Fellow of the Illuminating Engineering Society of North America who has written extensively over the past 30 years on lighting research and development. He holds over 40 patents and patent applications related to solid state lighting.

His professional and personal interests have two common themes: an enduring love of mathematics and an endless fascination with light. These have led to explorations ranging from photometric theory and eigenanalysis to genetic algorithms and holographic techniques.

Ian is currently hard at work on two projects: 1) solid-state lighting research and development for TIR Systems; and 2) the next version of Lighting Analysts' AGI32 and AGI Light lighting design software. When he is not working, he prefers to hike at elevations above 8,000 feet in the Canadian Rockies, where you can almost see his home in West Vancouver some 500 miles away.

9:15 am:

Organic LEDs for Lighting Applications

Junji Kido, Professor, Yamagata University (Japan) and General Director, Research Institute for Organic Electronics (Japan)

Abstract: Recent progress in organic light-emitting devices (OLEDs) will be discussed. igh external quantum efficiencies (EQEs) of nearly 30% have been realized by using phosphorescent emitting materials. For the fabrication of such high efficiency devices, using wide-energy- gap organic materials, or high triplet excited energy materials, are very important to maximize quantum efficiency of phosphorescent OLEDs. The high luminous efficiency of 130 lm/W for green OLED and 60 lm/W for white OLED have been achieved. We developed novel OLED structures, called multiphoton emission (MPE) structure, comprised of multiple emissive units and charge generation layers (CGLs) connecting the emissive units. In the device, each CGL injects electrons and holes to the adjacent emissive units, resulting in connecting the emissive units in series. Thus, electrons and holes are generated in the device and recombine to generate photons. Such charge generation process leads to the improvement the quantum efficiency of the device. White light-emitting OLEDs with stacked structures were developed to improve driving lifetime. In these OLEDs, required drive current can be much reduced and lifetime of over 300,000 hrs at 5000 cd/m[sup]2[/sup] was achieved. Luminares using such white OLED panels were demonstrated.

This work was financially supported in part by the New Energy and Industrial Technology Development Organization (NEDO) through the "Advanced Organic Device Project" and "Organic Lighting Project".

Biography: **Junji Kido** has received his B.S. degree from Waseda University, Japan, in 1984 and the M.S. and Ph. D. degrees from Polytechnic University, New York, in 1987 and 1989, respectively. In 1989, he joined the department of polymer chemistry in Yamagata University in Japan. He has been the General Director for Research Institute for Organic Electronics founded by the Yamagata prefectural government since 2003.

Image and Signal Processing Plenary Presentation

Wednesday 29 August . . . . . 8:30 to 9:15 am

3D Home Theatre Systems

Kristina M. Johnson, Duke Univ.

Abstract: The future of home theatre entertainment is in delivering artifact-free, high-definition 3D imagery. Two-dimensional, theatre-sized display systems will be reviewed in terms of functional specifications such as size, weight, brightness, image and color quality, contrast, power consumption, human factors and pricing. The suitability for these systems to be adapted to three-dimensional home theatre applications will be presented. Reflective and transmissive displays operating in direct view and projection can be integrated into single, dual and three panel 3D systems. Each technology and specific architecture will be discussed in the context of delivering artifact-free, true-color 3D imagery taking into account the user experience and overall system cost. The state of the art in stereoscopic and holographic 3D displays will be reviewed and compared. System challenges for realizing high quality, 3D displays in the home will also be discussed.

Biography: **Dr. Kristina M. Johnson** is the Dean of the Pratt School of Engineering at Duke University. She received her B.S., M.S. (with distinction) and Ph.D. in electrical engineering from Stanford University. After a NATO post-doctoral fellowship at Trinity College, Dublin, Ireland, she joined the University of Colorado-Boulder's faculty in 1985 as an Assistant Professor, promoted to full Professor in 1994. From 1994 until 1999 Johnson directed the NSF/ERC for Optoelectronics Computing Systems Center at University of Colorado and Colorado State University. She has published over 140 refereed papers and proceedings, and holds forty-three patents. Dr. Johnson received the NSF Presidential Young Investigator Award (1985), the IBM Faculty Award, and the Dennis Gabor Prize, for "creativity and innovation in modern optics" (1993), and the Photonics Spectra Circle of Excellence Award for her design of the 128 x 128 liquid-crystal-on-silicon spatial light modulator (1994). Dr. Johnson is a recipient of the Colorado Technology Transfer Award by the Colorado Advanced Technology Institute (1997), the Council for Entrepreneurial Development Infrastructure Award in North Carolina (2001), was inducted into the Women In Technology International (WITI) Hall of Fame (2003) and received the Achievement Award, the highest honor from the Society of Women Engineers in 2004. A fellow of the Optical Society of America, IEEE and a Fulbright Scholar, Dr. Johnson is a director of SPIE, the International Society for Optical Engineering. She has helped start several companies including founder of ColorLink, Inc. and sits on the Board of Directors of several publicly traded companies including Mineral Technologies Inc., Boston Scientific Corporation, AES Corporation and Nortel (and is a former director of Guidant Corporation and Dycom Industries). Dr. Johnson currently serves on the advisory boards of the Colorado School of Mines, the Georgia Institute of Technology School of Engineering, the Duke Childrens' Classic, and the North Carolina Institute for Emerging Issues. She has previously served on the advisory committee to the NSF Engineering Directorate (Chair, 2003-04), Science Foundation Ireland, Smith College Pickering School, and Carnegie Mellon University.

Technical Special Events

Illumination Technical Event

Monday 27 August . . . . . 8:00 to 10:00 pm

Chair: **R. John Koshel,** Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona

We will present two topics: étendue and state-of-the-art concepts for displays. For the former, speakers from display manufacturers, such as Philips, will be on hand to discuss such display topics as:

- LED displays,
- Visual experience of viewing displays, and
- Future trends in displays.

For the étendue topic, a panel with a moderator will be convened to discuss this very important topic of illumination system design. Étendue describes the geometrical propagation characteristics of optical systems, and for illumination systems it provides a metric for design analysis and limitations. This provides a physical limit analogous to that of the diffraction limit of imaging/lens design. For both topics, each presenter will give a short overview, followed by questions from the audience. If you would like to participate as a presenter in either of these areas, or possibly in another area, please contact John Koshel (john.koshel@osa.org). At the conclusion of the planned agenda the floor will be open to impromptu presentations and questions. Light refreshments will be served. We look forward to your participation.

Lens Design Technical Event

Tuesday 28 August . . . . . 8:00 to 10:00 pm

Chairs: **Mary Turner,** Breault Research Organization, Inc.; **Steve Johnston,** Photon Engineering, LLC; **Rich Pfisterer,** Photon Engineering, LLC

"Let's Give 'Em Something to Talk About!"

We are in the process of inviting a panel of experienced, "recognized" professional lens designers to come and talk about...lens design! We want to hear about what they're designing, how they're going about doing it (what materials, software, techniques, etc.), and what problems they're encountering. We want to hear about technical and commercial trends in the marketplace. We want to hear who's making the optics! We want them to give us something to talk about!

Optomechanical/Instrument Technical Event

Tuesday 28 August . . . . . 8:00 to 10:00 pm

Chair: **Alson E. Hatheway,** Alson E. Hatheway Inc.

This is the annual meeting of the premier group of optomechanical engineers that design and analyze the world's optical instruments and systems. Our feature speaker will be Larry Stepp who will discuss,

Optomechanical Challenges of the Thirty Meter Telescope

The Thirty Meter Telescope (TMT) will be an extremely large, ground-based segmented-mirror optical-infrared telescope. Although similar in concept to the Keck Observatory 10-meter telescopes, each Keck telescope has just 36 hexagonal segments, while TMT will have 492! TMT faces new technical challenges because of its size and complexity and new programmatic challenges because of the strong pressure to limit its cost and complete its construction as quickly as possible. Larry Stepp is the TMT Telescope Department Head. His department is responsible for the telescope structure, optics and controls.

This gathering is open to all attendants to the Optics and Photonics Symposium. Anyone who wishes to put an item on the agenda should contact the Chair [Al Hatheway: aeh@aehinc.com]. One agenda item will certainly be the advance planning of our biennial conference on Optomechanics for year-after-next's (2009's) Optics and Photonics Symposium.

Following the speakers and other agenda items the floor will be open for our traditional 'Problems and Solutions Workshop' session so bring some challenges for the group.

Penetrating Radiation Technical Event

Tuesday 28 August . . . . . 8:00 to 10:00 pm

Chair: **Warnick J. Kernan,** National Security Technologies, LLC

The event brings together technologists and scientists with interests in neutron, x- and gamma-ray detection, spectroscopy, and imaging for all applications.

This meeting will feature a special presentation on "Exciting Results from the Swift Gamma-Ray Burst Explorer," Dr. Ann M. Parsons, NASA Goddard Space Flight Ctr.

X-Ray/EUV Optics Technical Event

Tuesday 28 August . . . . . 8:00 to 10:00 pm

Chair: **Forbes Powell,** Luxel Corp.

The X-Ray/UV Optics Technical Community is comprised of scientists and engineers involved in the design, development, and application of X-Ray/UV optical technologies. This meeting will feature a fast moving series of brief informal presentations in a format similar to that used at some conferences to preview poster session papers. Speakers will be allowed 2 viewgraphs and 5 minutes including questions to present whatever they think might be of interest to those present. Presenters will speak in the order they sign up at the meeting. After the last presentation we will open the meeting to a general discussion with no preset rules. We have used this meeting format for the last five years with good success.

In the past we have had an interesting mix of senior people giving brief updates on their current activities, and young scientists and engineers asking for help in finding information that might aid them in their work. For this reason, we would like to encourage broad attendance and participation in this meeting. It provides a good vehicle for "networking" and "mentoring" within this Technical Group's areas of endeavor. There will be two prizes for the best talks as judged by the audience present. One prize will be for the best talk by a senior person, and one prize will be for the best talk by a young person. Deciding on the winners has always added to the fun.

Panel Discussion: Life in the Cosmos

Tuesday 28 August . . . . . 8:00 to 10:00 pm

Panel Moderators:
Paul C. W. Davies, BEYOND - Ctr. for Fundamental Concepts in Science, Arizona State Univ.
Richard B. Hoover, NASA/National Space Science and Technology Ctr.

Panel Members:
Eric M. Galimov, V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry (Russia)
Francois C. Raulin, GDR CNRS Exobio (France)
Alexei Yu. Rozanov, Paleontological Institute (Russia)
David S. McKay, NASA Johnson Space Ctr.
Gilbert V. Levin, Spherix Inc.
Michael Storrie-Lombardi, Kinohi Institute
Jere H. Lipps, Univ. of California/Berkeley
David Deamer, Univ. California/Santa Cruz
Joseph Seckbach, The Hebrew Univ. of Jerusalem (Israel)

Polarization Technical Event

(No-Host Lunch)

Wednesday 29 August . . . . . 11:50 am to 1:20 pm

Chair: **Art Lompado,** Polaris Sensor Technologies, Inc.

Cochair: **Derek Sabatke,** Ball Aerospace & Technologies Corp.

This event is focused on research, development, engineering, and applications in fields of optics where polarization and its measurement are key issues. Held in conjunction with Conference 6682: Polarization Science and Remote Sensing III.

Workshop: Optics in Entertainment

Thursday 29 August . . . . . 8:30 am to 12:00 pm

Chairs: **Kristina M. Johnson,** Duke Univ; **Michael G. Robinson,** ColorLink, Inc.

The evolution of visual entertainment systems has relied on advances in optical materials, devices, and hardware/software systems to capture, transmit, store and display pictures with ever increasing clarity, resolution, color gamut, and brightness. With the advent of improved three-dimensional display technology, 3D high definition home and cinema projection will explode in the next decade.

This workshop will focus on the enabling optical technologies for future entertainment systems including, novel illumination devices, optical system design, digital and analog reflective, transmissive, transmission and emissive displays, making animation realistic, games for training, education and entertainment, image capture, processing storage and display. The ergonomic and human factors associated with visualizing new and innovative technologies will also be emphasized.

Motion picture workflow pipeline for 3D stereoscopic content generation from high-dynamic-range images for flat and hemispherical theaters, Mark J. Prusten, Optical Design Labs.; Michelle K. McIntyre, Total Eclipse Studios; Michael Magee, The Univ. of Arizona [WK1-1]

Optical systems in entertainment, Olha V. Malinochka, Kiev Univ. of Economy and Transport Technology (Ukraine) [WK1-2]

Performance improvements in back panel display lighting using near Lambertian diffuse high-reflectance materials, Bob, Y., Chang, Christina, M., Chase, Labsphere, Inc., [WK1-3]

Tele-counseling and social skill trainings using JGN–||; optical network and a mirror interface system, Sayuri Hashimoto, Univ. of Tsukuba (Japan); Nobuyuki Hashimoto, Citizen Active Co., Ltd. (Japan); Akira Onozawa, Eiich Hosoya, Ikuo Harada, NTT Microsystem Integration Labs. (Japan); Junzo Okunaka, National Institute of Information and Communications Technology (Japan) [WK1-4]

Examples of subjective image quality enhancement in multimedia, Milos Klima, Czech Technical Univ. (Czech Republic) [WK1-5]

Optically accelerated indicator based on multi-ring moiré patterns, Emin Gabrielyan, Switzernet (Switzerland) [WK1-6]

SPIE Works

SPIEWorks Career Fair

Special 2-Day Event!

Tuesday 28 August . . . . . 11:00 am to 3:00 pm

Wednesday 29 August . . 11:00 am to 3:00 pm

Job Seekers

Whether you are looking for a better job, re-entering the workforce or just starting your career, this career fair is a great place to start!

- Get 'face-to-face' time with employers and interview on the spot
- Learn more about the jobs available in our industry
- Network
- Post your resume online today! Visit SPIEworks.com

All SPIEWorks services are free to individuals seeking employment.

Employers

Don't Miss This Recruiting Opportunity—hire top talent at Optics + Photonics

SPIEWorks offers a customized recruitment package in conjunction with this conference. A typical Career Fair package includes:

- 2 x 6 draped table
- Job postings on the SPIEWorks website
- Resume access (includes data on who plans to attend the conference)
- A display banner on the homepage to promote your recruiting effort
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Events for Students

Student Chapter Leadership Workshop

Saturday 25 August . . . . . 8:00 am to 4:00 pm

Event by Invitation Only.

Join us for engaging speakers, professional development opportunities, and a chance to connect with Student Chapter Leaders from around the world! Collaborate with your peers, find new colleagues, and learn how to get the most from your Student Chapter involvement. You'll also learn the nuts and bolts of SPIE Student Membership Benefits such as Student Chapter funding, scholarships, travel grants, and visiting lecturers.

Please e-mail students@spie.org for more information.

Student Chapter Leadership Workshop

Sunday 26 August . . . . . 9:00 am to 12:00 pm

This event is open to all students.

The Leadership Workshop continues Sunday with break-out sessions focusing on specific member-requested topics. Come ready to share your thoughts and ideas.

Student Chapter Leadership Workshop Lunch

Sunday 26 August . . . . . 12:00 to 1:30 pm

Event by Invitation Only.

Student Chapter Leadership Workshop concludes with lunch and an open-floor forum for you to voice suggestions and feedback on the SPIE Student Services program.

Student Lunch with the Experts

Monday 27 August . . . . . 12:30 to 1:30 pm

Advance Sign-up Required. Seating Limited.

Enjoy a casual meal with colleagues at this engaging networking opportunity, hosted by SPIE Student Services. This event features experts willing to share their experience and wisdom on career paths in optics and photonics, and an awards presentation for Newport Spectra-Physics scholarship winners. Lunch is complimentary to all students.

Advance sign-up in the Marketplace by 5:00 pm Sunday required.

Newport and Spectra-Physics Research Excellence Travel Awards

The Newport Spectra-Physics Research Excellence Travel Awards Program provides financial support for university students to attend the two largest SPIE meetings in order to present their research. These travel grants are open to any student who has an accepted paper for presentation at Photonics West or Optics & Photonics. Recipients will be selected based on both the quality of the original research described in the submitted paper(s) and financial need.

For application information for this and other SPIE travel grants visit Scholarships and Grants online at SPIE.org/scholarships.

Hands-On Optics: Making an Impact with Light (HOO): Terrific Telescopes Workshop

WS852
Course level: Introductory
$20 / $25

Monday 27 August . . . . . 2:00 to 5:00 pm

This workshop will train attendees on the use of Terrific Telescopes, a hands-on activity kit intended to engage and enrich the math/science learning experience for students in the middle grades. It was developed as part of HOO, a four year program funded by a $1.7 million dollar grant from the U.S. National Science Foundation (NSF) to design and implement a science enrichment program for children ages 11 to 14 years old.

Intended Audience
Optics professionals, university students, and pre-college teachers.

Instructors
Constance E. Walker earned her Ph.D. in Astronomy from the University of Arizona and is Senior Science Education Specialist and Astronomer at the National Optical Astronomy Observatory in Tucson, AZ. She is part of a team responsible for the development and implementation of programs and workshops that train and partner pre-college teachers and community educators with professional and amateur astronomers. These programs involve students and their families in hands-on, inquiry-based activities in astronomy and science. She was instrumental in developing six modules plus the Terrific Telescope kit for Hands-On Optics.

Robert T. Sparks earned an M.S. in Physics from Michigan State University and is a Science Education Specialist at the National Optical Astronomy Observatory in Tucson, AZ. He taught high school physics, math and astronomy for 11 years before joining the HOO Team. He has been revising the HOO modules, planning and delivering HOO professional development workshops, and working on the development of new modules.

Student Exhibit Hall Section

Tuesday to Thursday . . . . . Exhibition Hours

Visit the student section of the exhibit, and see what our Student Chapters have to display as part of the "Eye to the Future" section.

Is your SPIE Student Chapter interested in participating in this exhibit? Email students@spie.org for details.

Essential Skills for Optics/ Photonics Professionals

These workshops will provide attendees with information, tips, and advice to help build a more successful career in the field of optics and photonics. Refine your job searching tools and gain a better understanding of some of the most important decisions you can make in the early stages of your career. For more information visit spie.org/ECPcourses

Intended Audience
These courses are intended primarily for students, recent graduates, and early-career professionals who want to improve the quality and effectiveness of their time spent at work or searching for an ideal career path.

The Craft of Scientific Presentations: A Workshop on Technical Presentations

WS667
Course level: Introductory
CEU .35 $75/$125 USD

Free to Student Members

Wednesday 29 August . . . . . 8:30 am to 12:30 pm

This course provides attendees with an overview of what distinguishes the best scientific presentations. The course introduces a new design for presentation slides that is both more memorable and persuasive from what is typically shown at conferences.

Intended Audience
This material is intended for anyone who needs to present scientific research. Those who either have not yet presented or have made several presentations will find this course valuable.

Instructor
Kathryn Pyle Krages, AMLS, MA, is assistant professor of medical informatics & clinical epidemiology at Oregon Health & Science University in Portland, where she teaches a scientific writing and communication course to OHSU graduate students, both on campus and via the Internet.

The Craft of Scientific Writing: A Workshop on Technical Writing

WS668
Course level: Introductory
CEU .35 $75/$125 USD

Free to Student Members

Wednesday 29 August . . . . . 1:30 to 5:30 pm

This course provides an overview on writing a scientific paper. The course focuses on the structure, language, and illustration of scientific papers.

Intended Audience
This material is intended for anyone who needs to write about scientific research. Those who either have not yet written a paper or have written several papers will find this course valuable.

Instructor
Kathryn Pyle Krages, AMLS, MA, is assistant professor of medical informatics & clinical epidemiology at Oregon Health & Science University in Portland, where she teaches a scientific writing and communication course to OHSU graduate students, both on campus and via the Internet.

Optimizing Your Resume

WS777
Course level: Introductory
CEU .20 $50/$100 USD

Free to Student Members

Monday 27 August . . . . . 1:30 to 3:30 pm

Today's job market pits you against hundreds, if not thousands, of candidates who have approximately the same credentials as you do. How do you stand out in the crowd? This workshop, which concentrates on students and recent graduates, will review a number of strategies, tips, and tools that you can use to increase the impact of your resume and cover letter. We'll examine ways to translate your educational experience into a format that is attractive to potential employers, and how to create tailored versions of your job search materials for multiple targets. The process of creating your resume will be discussed, with a focus on both layout/formatting and writing style. We'll also look at cover letters, lists of references, and other materials used in your job search.

Intended Audience
This material is intended primarily for students, recent graduates, and early-career professionals who want to improve the quality and effectiveness of their job search materials.

Instructor
John Cain is a former professional resume writer, and has written more than 500 resumes and cover letters for multiple industries and professions, focusing primarily on technical fields. He currently develops technical education programs for SPIE.

SPIEWorks Career Fair

Tuesday 28 August . . . . . 11:00 am to 3:00 pm
Wednesday 29 August . . . . . 11:00 am to 3:00 pm

Whether you are looking for a better job, re-entering the workforce or just starting your career, this career fair is a great place to start!

- Meeting directly with recruiters from top employers
- Learn more about employment opportunities
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- Interview for positions

Post your resume online today at SPIEWorks.com! Remember to sign back in before the event to indicate your plans to attend (employers have access to the resume database two weeks before the career fair and may use this information to schedule interviews in advance).

Essential Skills for Engineering Project Leaders

WS846
Course level: Introductory
CEU .35 $95/$115 USD

Wednesday 29 August . . . . . 1:30 to 5:30 pm

This workshop teaches skills needed to lead technical projects, drive innovation, and influence others. Attendees learn the difference between leadership and management, and how to develop specific leadership skills that are important to technical professionals who lead projects or need assistance from others to get things done. Participants engage in exercises that assess their individual leadership abilities and provide guidance for further skill development.

Intended Audience
This material is intended for early-career technical professionals who can benefit from improving leadership skills.

Instructor
Gary C. Hinkle is President and founder of Auxilium, Inc. His experience includes a broad variety of management and staff assignments with small, medium, and large companies involved in the development and manufacturing of high-tech products. Gary led several high-profile projects including the development of a U.S. Army vehicle maintenance system, and he directed the development of 9-1-1 systems used in the majority of Public Safety Answering Points in the U.S. He also served as engineering manager for the world's best selling oscilloscope product line at Tektronix. His design and management experience spans the electronics, mechanical and software engineering disciplines.

Volunteer for SPIE Committees!

Tuesday 28 August . . . . . 8:00 to 10:00 pm
Wednesday 29 August . . . . . 5:30 to 7:00 pm

Interested in becoming more involved with SPIE conferences? Talk with SPIE staff and learn more about SPIE volunteer opportunities in conferences and governance. Show us your enthusiasm by filling out a committee interest form, which will be sent to conference chairs. Forms will be available on-site; bring your resume or CV.

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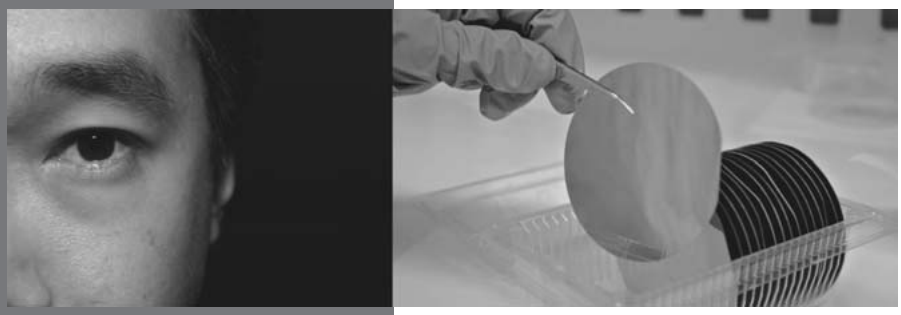

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Exhibition Hours:

Tuesday 28 August . . . . . 10:00 am to 5:00 pm
Wednesday 29 August . . 10:00 am to 5:00 pm
Thursday 30 August . . . . 10:00 am to 2:00 pm

Look who's exhibiting!

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Conference 6638

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6638

Photonic Metamaterials

Conference Chairs: **Mikhail A. Noginov**, Norfolk State Univ.; **Nikolay I. Zheludev**, Univ. of Southampton (United Kingdom); **Allan D. Boardman**, Univ. of Salford (United Kingdom); **Nader Engheta**, Univ. of Pennsylvania

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Sunday 26 August

SESSION 1 . . . . . Sun. 9:00 to 10:00 am

Keynote Session I

Chair: **Mikhail A. Noginov**, Norfolk State Univ.

Plasmonic metamaterials: the tale of two phenomena (Keynote, Invited Paper), N. Engheta, A. Alu, M. Silveirinha, J. Li, A. Salandrino, B. Edwards, Univ. of Pennsylvania [6638-01]

SESSION 2 . . . . . Sun. 10:20 am to 12:10 pm

Surface Plasmons

Chair: **Martin W. McCall**, Imperial College London (United Kingdom)

Two-dimensional plasmonic metamaterials *(Invited Paper)*, I. I. Smolyaninov, Univ. of Maryland/College Park . [6638-02]

The plasmonic Talbot effect *(Invited Paper)*, F. J. Garcia de Abajo, Consejo Superior de Investigaciones Científicas (Spain); N. I. Zheludev, M. Dennis, Univ. of Southampton (United Kingdom) . . . . . [6638-03]

Optical metamaterials based on thin metal films: from negative index of refraction to enhanced transmission and to surface wave guidance *(Invited Paper)*, V. Lomakin, Y. Fainman, Univ. of California/San Diego; Y. A. Urzhumov, G. Shvets, The Univ. of Texas at Austin . . . . . [6638-04]

En route to low-loss nanoplasmonics: improving silver, M. A. Noginov, G. Zhu, M. Mayy, M. Bahoura, V. I. Gavrilenko, Norfolk State Univ. . . . . [6638-05]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 4:00 pm

Optical Magnetism and NIMs

Chair: **Nikolay I. Zheludev**, Univ. of Southampton (United Kingdom)

Optical metamaterials: from metamagnetics with rainbow colors to negative refractive index *(Invited Paper)*, V. M. Shalaev, W. Cai, A. V. Kildishev, V. P. Drachev, U. K. Chettiar, H. Yuan, V. de Silva, Purdue Univ.; A. Boltasseva, Danmarks Tekniske Univ. (Denmark) . . . . . [6638-06]

Photon tunneling at material boundary by positive permeability metamaterials, A. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan) and Osaka Univ. (Japan); T. Tanaka, The Institute of Physical and Chemical Research (RIKEN) (Japan) and Japan Science and Technology Corp. (Japan); S. Kawata, The Institute of Physical and Chemical Research (RIKEN) (Japan) and Osaka Univ. (Japan) . . . . . [6638-07]

Covariant perspectives on negative refraction, M. W. McCall, Imperial College London (United Kingdom) [6638-08]

Causality principle and negative refraction with illustrations from surface plasmon polaritonics *(Invited Paper)*, M. I. Stockman, Georgia State Univ. . . . . [6638-09]

Slow light in negative-index waveguide-heterostructures *(Invited Paper)*, K. L. Tsakmakidis, O. G. Hess, Univ. of Surrey (United Kingdom) . . . . . [6638-10]

SESSION 4 . . . . . Sun. 4:10 to 5:40 pm

Metamaterials in IR Range

Chair: **Akhlesh Lakhtakia**, The Pennsylvania State Univ.

Electromagnetic modes of silicon carbide microstructures and their relevance to metamaterial design *(Invited Paper)*, J. A. Schuller, T. Taubner, M. L. Brongersma, Stanford Univ. . . . . [6638-11]

Optical properties of sub-wavelength hole arrays in SiC membranes *(Invited Paper)*, G. Shvets, Y. A. Urzhumov, D. V. Korobkin, B. Neuner III, The Univ. of Texas at Austin; C. A. Zorman, Case Western Reserve Univ. . . . . [6638-12]

Spoof plasmon THz metamaterials *(Invited Paper)*, S. Maier, Univ. of Bath (United Kingdom) . . . . . [6638-13]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Lunch Break

SESSION 5 . . . . . Mon. 1:30 to 3:00 pm

NIMS

Chair: **Larry R. Dalton**, Univ. of Washington

Ambidextrous light in a nonlinear left-handed world *(Invited Paper)*, N. M. Litchinitser, Univ. of Michigan; I. R. Gabitov, The Univ. of Arizona; A. I. Maimistov, Moscow Engineering Physics Institute (Russia); V. M. Shalaev, Purdue Univ. . . . . [6638-14]

The effects of dispersion, diffraction and nonlinearity management in negative index materials, P. P. Banerjee, G. T. Nehmetallah, Univ. of Dayton . . . . . [6638-15]

Mean field theory of metallo-dielectric photonic crystals with magnetic components: the long-wavelength limit, E. Reyes-Ayona, P. P. Halevi, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6638-16]

Fabrication and applications of negative refractive index matermaterials with chiral properties, E. Bahar, N. J. Ianno, Univ. of Nebraska/Lincoln . . . . . [6638-17]

SESSION 6 . . . . . Mon. 3:20 to 5:30 pm

Composites, Interfaces and Materials

Chair: **Akhlesh Lakhtakia**, The Pennsylvania State Univ.

Organic electro-optic/silicon photonic materials and devices *(Invited Paper)*, L. R. Dalton, P. A. Sullivan, Univ. of Washington . . . . . [6638-18]

Differential optical reflectance of water molecules absorbed on Au(111) surface, S. N. Williams, V. I. Gavrilenko, Norfolk State Univ. . . . . [6638-19]

Theoretical estimation of the optical response of carbon nanotubes interacting with dielectric crystal surface, M. M. Mestechkin, SSA . . . . . [6638-20]

Effect of interchain interaction on linear optical properties of conjugated polymers, A. V. Gavrilenko, T. D. Matos, C. E. Bonner, C. Zhang, S. Sun, V. I. Gavrilenko, Norfolk State Univ. . . . . [6638-21]

Gold nanorods synthesized with different surfactants, X. Kou, The Chinese Univ. of Hong Kong (Hong Kong China) . . . . . [6638-22]

Optical properties of metamaterials based on porous channel photonic structures and applications for optical devices, E. Y. Glushko, Institute of Semiconductor Physics (Ukraine) . . . . . [6638-23]

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Conference 6638

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Electrically controlled Bragg resonances of an ambichiral electro-optic structure: oblique incidence,** M. Dixit, A. Lakhtakia, The Pennsylvania State Univ. . [6638-38]

✔ **Equilibrium geometries and electronic structure calculations of divalent lead Pb(II) complexes with paramagnetic organic ligands,** H. Li, R. Bah, R. R. Rakhim, V. I. Gavrilenko, Norfolk State Univ. . . . . [6638-39]

✔ **Far-field focusing properties of 2D rod-type honeycomb lattice photonic crystals,** Y. Li, G. Li, Univ. of Science and Technology of China (China) . . . . . [6638-40]

Tuesday 28 August

SESSION 7 . . . . . Tues. 8:40 to 10:10 am

Fundamentals and Concepts

Chair: **F. J. Garcia de Abajo**, Consejo Superior de Investigaciones Científicas (Spain)

Optically switched energy transfer: single and dual beam control, R. G. Crisp, S. Li, D. L. Andrews, Univ. of East Anglia Norwich (United Kingdom) . . . . . [6638-24]

Light pressure on chiral sculptured thin films *(Invited Paper)*, B. M. Ross, A. Lakhtakia, The Pennsylvania State Univ. . . . . [6638-25]

Optical pulse dynamics in nanostructured Bragg gratings, I. R. Gabitov, The Univ. of Arizona . . . . . [6638-26]

Swamping of circular Bragg phenomenon revealed by durations and average speeds of videopulses transmitted through chiral sculptured thin films, J. B. Geddes III, Univ. of Illinois at Urbana-Champaign; A. Lakhtakia, The Pennsylvania State Univ. . . . . [6638-27]

SESSION 8 . . . . . Tues. 10:30 am to 12:20 pm

Luminescence, Gain and Lasing

Chair: **Vladimir M. Shalaev**, Purdue Univ.

On the possibility of gain control and special solitons in metamaterials *(Invited Paper)*, A. D. Boardman, N. J. King, Univ. of Salford (United Kingdom); Y. Rapoport, National Taras Shevchenko Univ. of Kyiv (Ukraine) . . . . . [6638-28]

Diffraction and dispersion management in active nanostructured metamaterials *(Invited Paper)*, V. A. Podolskiy, A. Govyadinov, Oregon State Univ. . . . . [6638-29]

Limits of luminescence efficiency enhancement by surface plasmon polaritons *(Invited Paper)*, J. B. Khurgin, Johns Hopkins Univ. . . . . [6638-30]

Dye doped porous silica as an all solid state device for random lasing, M. Berard, École Polytechnique (France) and Thales Research and Technology (France); V. Rachet, Thales Research and Technology (France); L. Khalid, T. Gacoin, École Polytechnique (France); J. Galaup, Lab. Aimé Cotton (France); J. Boilot, École Polytechnique (France) . . . . . [6638-31]

Lunch/Exhibition Break

SESSION 9 . . . . . Tues. 1:30 to 4:20 pm

Devices and Systems

Chair: **David L. Andrews**, Univ. of East Anglia Norwich (United Kingdom)

Strips, wires and grooves as plasmonic waveguides *(Invited Paper)*, A. Boltasseva, Danmarks Tekniske Univ. (Denmark); K. Leosson, T. Rosenzveig, Univ. of Iceland (Iceland); J. Jung, T. Søndergaard, S. I. Bozhevolnyi, Aalborg Univ. (Denmark); R. B. Nielsen, K. B. Jørgensen, R. H. Pedersen, A. Kristensen, Danmarks Tekniske Univ. (Denmark); I. Fernandez-Cuesta, Univ. Autònoma de Barcelona (Spain) . . . . . [6638-32]

Surface plasmon-polariton based ultra-short contra-directional coupler at optical frequencies *(Invited Paper)*, Y. Wang, A. Hemly, G. V. Eleftheriades, Univ. of Toronto (Canada) . . . . . [6638-33]

Metamaterials in information systems *(Invited Paper)*, Y. Fainman, Univ. of California/San Diego . . . . . [6638-34]

Optical hyperlens far field imaging beyond the diffraction limit *(Invited Paper)*, Z. Jacob, L. V. Alekseyev, E. E. Narimanov, Princeton Univ. . . . . [6638-35]

Rationally-engineered nanostructures for single-molecule SERS *(Invited Paper)*, M. Moskovits, S. Lee, G. Braun, N. Reich, Univ. of California/Santa Barbara . . . . . [6638-36]

SESSION 10 . . . . . Tues. 4:20 to 5:20 pm

Keynote Session II

Chair: **Allan D. Boardman**, Univ. of Salford (United Kingdom)

Chirality in photonic meta-materials (Keynote, Invited Paper), N. I. Zheludev, V. A. Fedotov, M. Rose, N. Papasimakis, Univ. of Southampton (United Kingdom); S. L. Prosvirnin, Institute of Radio Astronomy (Ukraine) . . . . . [6638-37]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 **Fabrication and Processing of Nanostructures** (Cao) Sunday 26, 8:30 am - 5:30 pm

SC497 **Nanophotonics** (Prasad) Sunday 26, 1:30 - 5:30 pm

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Conference 6639

Sunday 26 August 2007 • Proceedings of SPIE Vol. 6639

Nanophotonic Materials IV

Conference Chairs: **Zeno Gaburro**, Univ. degli Studi di Trento (Italy); **Stefano Cabrini**, Lawrence Berkeley National Lab.

Program Committee: **David L. Andrews**, Univ. of East Anglia Norwich (United Kingdom); **Angus J. Bain**, Univ. College London (United Kingdom); **Mireille H. Blanchard-Desce**, Univ. de Rennes I (France); **Robert W. Boyd**, Univ. of Rochester; **Aaron W. Harper**, Univ. of Southern California; **Ghassan E. Jabbour**, Arizona State Univ.; **Francois Kajzar**, Commissariat à l'Energie Atomique (France); **Dmitri I. Kovalev**, Univ. of Bath (United Kingdom); **Paras N. Prasad**, Univ. at Buffalo; **Younan Xia**, Univ. of Washington

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:00 am

Session 1

Electric field controlled photoluminescence spectroscopy on asymmetric semiconductor nanorods *(Invited Paper)*, A. L. Rogach, Ludwig-Maximilians-Univ. München (Germany) . . . . . [6639-01]

Large nonlinear optical properties in ternary quantum dots and nanorods, H. I. Elim, National Univ. of Singapore (Singapore) . . . . . [6639-02]

UV to red cooperative enhanced upconversion in nanocrystalline $BaZrO_3$: r^{3+},Yb^{3+}, J. S. Perez-Huerta, L. A. Díaz-Torres, E. De la Rosa, Ctr. de Investigaciones en Óptica, A.C. (Mexico); P. Salas, C. Angeles-Chavez, Instituto Mexicano del Petróleo (Mexico) . . . . . [6639-03]

Infrared characteristics of magnetic iron oxide nanoparticles, N. B. Singh, D. J. Knuteson, D. A. Kahler, A. Berghmans, B. Wagner, S. Mclaughlin, J. J. Hawkins, Northrop Grumman Corp. . . . . [6639-04]

SESSION 2 . . . . . Sun. 10:20 am to 12:10 pm

Session 2

Plasma induced formation of metal nanodots for enhanced Raman application *(Invited Paper)*, Z. Li, Hewlett-Packard Labs. . . . . [6639-05]

Optical processes of organic emitters in optical microcavity, C. Wu, K. Tien, H. Lin, C. Lin, H. Chang, T. Cho, C. Yang, C. Chang, National Taiwan Univ. (Taiwan) [6639-06]

Optical properties of silica opal templates in the infrared and visible, M. Auslender, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6639-07]

The role of surface states in a-axis GaN nanowires, A. H. Chin, NASA Ames Research Ctr. and ELORET Corp.; T. S. Ahn, Univ. of California/Riverside; H. Li, Univ. of Louisville and Lehigh Univ.; S. Vaddiraju, Univ. of Louisville and Massachusetts Institute of Technology; C. J. Bardeen, Univ. of California/Riverside; C. Ning, Arizona State Univ. and NASA Ames Research Ctr.; M. K. Sunkara, Univ. of Louisville[6639-08]

High index of refraction TiO_2 nanoparticle and silicone composites, T. C. Monson, D. L. Huber, A. F. Emery, J. L. Crandall, D. E. Fish, Sandia National Labs. . . . . [6639-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 2:20 pm

Session 3

Luminescence properties of rare earth doped ZrO_2 nanocrystals *(Invited Paper)*, E. De la Rosa, L. A. Díaz-Torres, D. Solis, T. Lopez-Luke, V. H. Romero, O. Meza, P. Segovia, Ctr. de Investigaciones en Óptica, A.C. (Mexico); P. Salas, Instituto Mexicano del Petróleo (Mexico); R. A. Rodriguez, Univ. de Guadalajara (Mexico) . . . . . [6639-10]

Influence of hydrogen passivation on the erbium excitation efficiency in silicon nanocrystal doped silica films, O. Savchyn, F. R. Ruhge, P. G. Kik, College of Optics & Photonics/ Univ. of Central Florida; R. M. Todi, K. R. Coffey, Univ. of Central Florida . . . . . [6639-11]

SESSION 4 . . . . . Sun. 2:20 to 3:30 pm

Session 4

Electrically driven thermal light emission from suspended carbon nanotube transistors *(Invited Paper)*, Y. K. Kato, Japan Science and Technology Agency (Japan); X. Wang, D. M. Mann, A. A. Kinkhabwala, E. Pop, J. Cao, L. Zhang, Q. Wang, Stanford Univ.; J. Guo, Univ. of Florida; H. Dai, Stanford Univ. . . . . [6639-12]

Carbon nanotube PIN diodes, K. Bosnick, National Institute for Nanotechnology (Canada); N. Gabor, P. McEuen, Cornell Univ. . . . . [6639-13]

Electrical and optical characterization of carbon nanotube-polyimide nanocomposites, J. H. Kang, C. Park, S. E. Lowther, J. S. Harrison, National Institute of Aerospace . . . . . [6639-14]

SESSION 5 . . . . . Sun. 3:50 to 5:40 pm

Session 5

Resonant energy transfer within a coloidal nanocrystal polymer host system *(Invited Paper)*, R. F. Mahrt, IBM Zürich Research Lab. (Switzerland); S. Kaufmann, ETH Zürich (Switzerland); T. Stoeferle, N. Moll, IBM Zürich Research Lab. (Switzerland) . . . . . [6639-15]

Nanoscale optical properties of nanocapped colloidal silica particle arrays, K. A. Tetz, J. Ziegler, R. Bekele, J. Y. Suh, E. U. Donev, R. F. Haglund, Jr., Vanderbilt Univ. . . . . [6639-16]

MOVPE growth and characterization of ZnCdS/ZnSSe QW structures, V. I. Kozlovsky, P.N. Lebedev Physical Institute (Russia); V. I. Kuntsevich, Moscow Engineering Physics Institute (Russia); D. Sannikov, P.N. Lebedev Physical Institute (Russia) . . . . . [6639-17]

Hydrothermal growth of periodic ZnO nanorod arrays using polystyrene sphere templates, Y. F. Hsu, Y. Y. Xi, A. B. Djurisic, W. Chan, C. Yip, The Univ. of Hong Kong (Hong Kong China) . . . . . [6639-18]

Synthesis of zinc oxide nanoparticles by hydrothermal method, A. N. Pacheri Madathil, V. Kuzhikattil Achuthan, M. K. Jayaraj, Cochin Univ. of Science & Technology (India)[6639-19]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Conference 6639

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Structural and photoluminescence characterization of nanocrystalline YAG: Yb^{3+}-Er^{3+} prepared with the addition of PVA and UREA,** R. A. Rodriguez, E. H. Tobar, Univ. de Guadalajara (Mexico); E. De la Rosa, L. A. Díaz-Torres, Ctr. de Investigaciones en Óptica, A.C. (Mexico); P. Salas, Instituto Mexicano del Petróleo (Mexico); A. Torres, The Univ. of Texas at Austin; M. Felix, J. Castañeda-Contreras, Univ. de Guadalajara (Mexico); M. J. Yacaman, The Univ. of Texas at Austin . . . . . [6639-20]

✔ **Nanostructured SnO_2-SiO_2 glass ceramic thin film as electroluminescent material: the impedance spectroscopy analysis,** N. Chiodini, M. Giussani, A. Lauria, A. Paleari, Univ. degli Studi di Milano-Bicocca (Italy) . . . . . [6639-21]

✔ **Nonlinear optical properties of free standing films of PbS quantum dots in the nonresonant femtosecond regime,** P. A. Kurian, V. Cherianath, Indian Institute of Technology Madras (India); A. nag, D. Goswami, Indian Institute of Technology Kanpur (India) . . . . . [6639-22]

✔ **Solid thin films of CdSe/ZnS nanoparticles: new ways for fabrication and application,** S. V. Daineko, A. A. Chistyakov, I. P. Druginin, A. O. Helmut, Moscow Engineering Physics Institute (Russia); V. A. Oleinikov, Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry (Russia); K. V. Zaharchenko, Moscow Engineering Physics Institute (Russia); V. A. Kolesnikov, M. G. Tedoradze, Institute of Physical Chemistry (Russia) . . . . . [6639-23]

✔ **Dopant concentration effect on the TL and OSL response of ZrO_2:Lu^{3+} nanocrystals under β-ray irradiation,** V. H. Romero, Ctr. de Investigaciones en Óptica, A.C. (Mexico); R. A. Rodriguez, Univ. de Guadalajara (Mexico); E. De la Rosa, Ctr. de Investigaciones en Óptica, A.C. (Mexico); R. Melendrez, M. Barboza-Flores, Univ. de Sonora (Mexico) [6639-24]

✔ **3D ordered nanogels and nanocomposites of polyacetylene: self-organisation, structure, properties,** V. M. Kobryanskii, Supermat International and Institute of Chemical Physics (Russia) . . . . . [6639-25]

✔ **Preparation of europium doped tin oxide, indium oxide and ITO nanocomposites,** P. Psuja, W. Strek, Polska Akademia Nauk (Poland) . . . . . [6639-26]

✔ **Electronic polarizabilities of ions in lithium tantalate (litao3) optical wave guide from natural birefringence data,** C. P. Vardhani, Andhra Mahila Sabha Arts and Science College for Women (India) . . . . . [6639-27]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm

SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

Conference 6640

Tuesday-Wednesday 28-29 August 2007 • Proceedings of SPIE Vol. 6640

Active Photonic Crystals

Conference Chairs: **Sharon M. Weiss**, Vanderbilt Univ.; **Ganapathi S. Subramania**, Sandia National Labs.; **Florencio Garcia-Santamaria**, Univ. of Illinois at Urbana-Champaign

Program Committee: **Paul V. Braun**, Univ. of Illinois at Urbana-Champaign; **Shanhui L. Fan**, Stanford Univ.; **Stephen H. Foulger**, Clemson Univ.; **Rachel Jakubiak**, Air Force Research Lab.; **Michal F. Lipson**, Cornell Univ.; **Ceferino López**, Instituto de Ciencia de Materiales de Madrid (Spain); **Michael J. Sailor**, Univ. of California/San Diego; **Ralf B. Wehrspohn**, Univ. Paderborn (Germany); **Pierre Wiltzius**, Univ. of Illinois at Urbana-Champaign

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:30 to 10:00 am

Novel Effects and Applications of Active Photonic Crystal Structures I

Chair: **Sharon M. Weiss**, Vanderbilt Univ.

Self-collimation photonic crystal based modulator and switching elements in silicon *(Invited Paper)*, D. W. Prather, A. S. Sharkawy, C. Chen, B. Miao, T. R. Hodson, S. Shi, Univ. of Delaware . . . . . [6640-01]

Passive and active nanophotonic devices for optical interconnect applications *(Invited Paper)*, R. T. Chen, The Univ. of Texas at Austin . . . . . [6640-02]

Negative index photonic crystals: new concepts in imaging and negative refraction *(Invited Paper)*, S. Sridhar, W. Lu, Northeastern Univ. . . . . [6640-03]

SESSION 2 . . . . . Tues. 10:30 to 11:50 am

Fabrication and Characterization of Active Photonic Crystal Structures I

Chair: **Rachel Jakubiak**, Air Force Research Lab.

Adding function to photonic crystals through optical trapping, multiphoton polymerization and spatially regulated electrochemistry *(Invited Paper)*, P. V. Braun, Univ. of Illinois at Urbana-Champaign . . . . . [6640-04]

Independently adjustable silicon Bragg wavelength selector, F. B. Koné, Y. Peter, École Polytechnique de Montréal (Canada) . . . . . [6640-05]

Three-dimensional photonic crystal templates: contrasts in laser diffractive holography and direct-write femtosecond writing *(Invited Paper)*, P. R. Herman, D. Chanda, L. Abolghasemi, Univ. of Toronto (Canada) . . . . . [6640-06]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:30 to 2:50 pm

Novel Effects and Applications of Active Photonic Crystal Structures II

Chair: **Florencio García-Santamaría**, Univ. of Illinois at Urbana-Champaign

Enhanced power conversion efficiency in solar cells coupled to photonic crystals *(Invited Paper)*, H. R. Miguez, A. Mihi, S. Colodrero, M. Ocaña, Instituto de Ciencia de Materiales de Sevilla (Spain) . . . . . [6640-07]

Tunable defect modes in chiral liquid crystals based on laser-induced modulation of helix, H. Yoshida, C. H. Lee, Y. Miura, A. Fujii, M. Ozaki, Osaka Univ. (Japan) . . . . [6640-08]

Enhanced light emission from silicon photonic crystals *(Invited Paper)*, M. Galli, D. Gerace, A. Politi, M. Belotti, M. Liscidini, M. Patrini, L. C. Andreani, Univ. degli Studi di Pavia (Italy); M. Miritello, A. Irrera, F. Priolo, Univ. degli Studi di Catania (Italy); Y. Chen, Ecole normale supérieure (France) . . . . . [6640-09]

SESSION 4 . . . . . Tues. 3:20 to 5:20 pm

Fabrication and Characterization of Active Photonic Crystal Structures II

Chair: **Paul V. Braun**, Univ. of Illinois at Urbana-Champaign

Fabrication techniques for photonic crystals *(Invited Paper)*, P. Wiltzius, Univ. of Illinois at Urbana-Champaign . . . . . [6640-10]

Computational inverse design of structures fabricated via interference lithography, J. W. Rinne, P. Wiltzius, Univ. of Illinois at Urbana-Champaign . . . . . [6640-11]

A novel method of photonic band-gap lithography of porous silicon heterostructures, H. Park, A. Stramel, D. Harju, S. M. Weiss, J. Dickerson, Vanderbilt Univ. . . . . [6640-12]

Characterization and functionalization of 3D visible photonic crystals with omnidirectional bandgap *(Invited Paper)*, Y. Lee, G. S. Subramania, A. J. Fischer, T. Luk, I. Brener, P. G. Clem, Sandia National Labs. . . . . [6640-13]

PbTe quantum dots multilayer for optical switching device, E. Rodriguez, Univ. Estadual de Campinas (Brazil); G. Kellermann, Lab. Nacional de Luz Sincrotron (Brazil); L. Moya, R. Sis Moreira, Univ. Estadual de Campinas (Brazil); A. F. Craievich, Univ. de São Paulo (Brazil); C. L. César, L. C. Barbosa, Univ. Estadual de Campinas (Brazil) . . . . [6640-14]

Wednesday 29 August

SESSION 5 . . . . . Wed. 8:10 to 10:20 am

Modeling and Simulation of Active Photonic Crystal Structures I

Chair: **Kai-Ming Ho**, Iowa State Univ.

Photonic crystal: dynamic, quantum and nonlinear properties *(Invited Paper)*, S. L. Fan, Stanford Univ.[6640-15]

Ultrafast all-optical switching of 3D photonic band gap crystals *(Invited Paper)*, T. G. Euser, FOM Institute for Atomic and Molecular Physics (Netherlands) . . . . . [6640-16]

Functional photonic band gap structures based on electromagnetically induced transparency in the conduction intersubband transitions of quantum wells, S. M. Sadeghi, McMaster Univ. (Canada); W. Li, Univ. of Wisconsin/Platteville; X. Li, W. Huang, McMaster Univ. (Canada) . . . . . [6640-17]

Gain-transfer-matrix method for photonic crystal laser simulations *(Invited Paper)*, X. Hu, M. Li, Z. Ye, K. Ho, Iowa State Univ.; J. Cao, M. Miyawaki, Canon Development Americas, Inc. . . . . [6640-18]

Localization and the invariant probability measure for photonic bandgap structures, G. J. Kissel, Univ. of Southern Indiana . . . . . [6640-19]

SESSION 6 . . . . . Wed. 10:40 to 11:20 am

Modeling and Simulation of Active Photonic Crystal Structures II

Chair: **Shanhui L. Fan**, Stanford Univ.

Magnetophotonic crystals: photonic band structure, eigenmodes and boundary effects, A. Khanikaev, A. V. Baryshev, Toyohashi Univ. of Technology (Japan); A. B. Granovsky, M.V. Lomonosov Moscow State Univ. (Russia); M. Inoue, Toyohashi Univ. of Technology (Japan) . . . . [6640-20]

Self-collimation in photonic crystals with anisotropic constituents, M. M. Siraj, J. W. Haus, Univ. of Dayton; P. N. Prasad, P. P. Markowicz, Univ. at Buffalo . . . . . [6640-21]

SESSION 7 . . . . . Wed. 11:20 am to 12:40 pm

Novel Effects and Applications of Active Photonic Crystal Structures III

Chair: **Ganapathi S. Subramania**, Sandia National Labs.

Subwavelength-thick dielectric gratings for bulk sensing, D. A. Fattal, M. Sigalas, Z. Li, R. G. Beausoleil, Hewlett-Packard Labs. . . . . [6640-22]

Dynamic lasing of pyrromethene 597 in 2D holographic-polymer dispersed liquid crystals (H-PDLCs): influence of columnar conformation *(Invited Paper)*, R. Jakubiak, Air Force Research Lab.; V. Tondiglia, L. Natarajan, R. Sutherland, Science Applications International Corp.; R. Vaia, T. Bunning, Air Force Research Lab. . . . . [6640-23]

Absolute emissivity measurements of 3D photonic crystal *(Invited Paper)*, T. Luk, I. F. El-Kady, R. A. Ellis, T. McLellan, G. S. Subramania, J. C. Verley, W. W. Chow, Sandia National Labs. . . . . [6640-24]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **(Ba,Sr)TiO_3-based planar photonic bandgap crystal,** K. Jim, D. Wang, C. Leung, C. Choy, L. H. Chan, The Hong Kong Polytechnic Univ. (Hong Kong China) . . . . . [6640-25]

✔ **Optical characterization and simulation of electrically pumped photonic crystal waveguides in the InP/InGaAsP/InP system,** P. Kaspar, R. Kappeler, D. Marti, F. Robin, H. Jaeckel, ETH Zürich (Switzerland) . . . . . [6640-26]

✔ **Coherent control of multiple quantum well active photonic band gaps via infrared dressing of superradiant excitons,** S. M. Sadeghi, McMaster Univ. (Canada); W. Li, Univ. of Wisconsin/Platteville; X. Li, W. Huang, McMaster Univ. (Canada) . . . . . [6640-27]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm

SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

SC608 Photonic Crystals: A Crash Course, from Bandgaps to Fibers (Johnson) Tuesday 28, 1:30 - 5:30 pm

Conference 6641

Sunday-Wednesday 26-29 August 2007 • Proceedings of SPIE Vol. 6641

Plasmonics: Metallic Nanostructures and their Optical Properties V

Conference Chair: **Mark I. Stockman**, Georgia State Univ.

Program Committee: **David J. Bergman**, Tel Aviv Univ. (Israel); **Sergey I. Bozhevolnyi**, Aalborg Univ. (Denmark); **Jochen Feldmann**, Ludwig-Maximilians-Univ. München (Germany); **Naomi J. Halas**, Rice Univ.; **Teruya Ishihara**, The Institute of Physical and Chemical Research (Japan); **Satoshi Kawata**, Osaka Univ. (Japan); **Fritz Keilmann**, Max-Planck-Institut für Biochemie (Germany); **Victor I. Klimov**, Los Alamos National Lab.; **Aaron Lewis**, The Hebrew Univ. of Jerusalem (Israel); **Olivier J. F. Martin**, École Polytechnique Fédérale de Lausanne (Switzerland); **Martin Moskovits**, Univ. of California/Santa Barbara; **Peter J. Nordlander**, Rice Univ.; **Lukas Novotny**, Univ. of Rochester; **Motoichi Ohtsu**, The Univ. of Tokyo (Japan); **John B. Pendry**, Imperial College London (United Kingdom); **Lewis J. Rothberg**, Univ. of Rochester; **Vahid Sandoghdar**, ETH Zürich (Switzerland); **George C. Schatz**, Northwestern Univ.; **Tigran V. Shahbazyan**, Jackson State Univ.; **Vladimir M. Shalaev**, Purdue Univ.; **Gennady Shvets**, The Univ. of Texas/Austin; **Yung Doug Suh**, Korea Research Institute of Chemical Technology (South Korea); **Din-Ping Tsai**, National Taiwan Univ. (Taiwan); **Nikolay I. Zheludev**, Univ. of Southampton (United Kingdom)

Sunday 26 August

SESSION 1 . . . . . Sun. 8:10 to 10:10 am

Specal Invited Session: Trends in Nanoplasmonics

Chair: **Mark I. Stockman**, Georgia State Univ.

Surface plasmon generation, propagation and detection *(Invited Paper)*, A. Polman, FOM Institute for Atomic and Molecular Physics (Netherlands) . . . . . [6641-01]

Quantum mechanics and electrodynamics studies of the optical properties of metal nanoparticles *(Invited Paper)*, G. C. Schatz, Northwestern Univ. . . . . [6641-02]

Active plasmonic structures and metamaterials *(Invited Paper)*, H. A. Atwater, Jr., H. J. Lezec, J. A. Dionne, C. E. Ross, L. A. Sweatlock, D. Pacifici, K. Diest, M. Dicken, V. Ferry, California Institute of Technology . . . . . [6641-03]

Coupled molecular and plasmon resonances *(Invited Paper)*, R. P. Van Duyne, Northwestern Univ. . . . . [6641-04]

SESSION 2 . . . . . Sun. 10:30 am to 12:10 pm

Developments in SERS and Surface Enhancement

Chair: **Albert Polman**, FOM Institute for Atomic and Molecular Physics (Netherlands)

Two photon vibrational probing using surface enhanced hyper Raman scattering *(Invited Paper)*, J. Kneipp, Harvard Medical School and Federal Institute for Materials Research and Testing (Germany); H. Kneipp, Harvard Medical School; K. D. Kneipp, Harvard Medical School and Harvard-MIT Division of Health Sciences and Technology . . . . . [6641-05]

Local enhanced fields in DNA templated plasmonic molecules, S. Bidault, A. Polman, FOM Institute for Atomic and Molecular Physics (Netherlands) . . . . . [6641-06]

Analysis of metal enhanced fluorescence on near-IR fluorophores, J. P. Anderson, M. Griffiths, V. R. Boveia, LI-COR Biosciences . . . . . [6641-07]

Plasmonic enhancement of organic photovoltaic devices *(Invited Paper)*, L. J. Rothberg, S. Pan, Univ. of Rochester . . . . . [6641-08]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 3:10 pm

Nonlinear and Active Nanoplasmonics

Chair: **Martti Kauranen**, Tampere Univ. of Technology (Finland)

Routes to active plasmonics: nanoparticle-molecule assemblies *(Invited Paper)*, N. J. Halas, Rice Univ. [6641-09]

Interacting localized-delocalized plasmonic nanostructures, M. Knight, F. Hao, P. J. Nordlander, N. J. Halas, Rice Univ. . . . . [6641-10]

Sum frequency generation from alkanethiol capped metallic nanoparticles and vibrational mode specific enhancement in nanoparticle aggregates, A. N. Bordenyuk, C. Weeraman, A. Benderskii, Wayne State Univ. . . [6641-11]

Nonlinear plasmonics with coupled gold nanoparticles *(Invited Paper)*, L. Novotny, M. Danckwerts, Univ. of Rochester . . . . . [6641-12]

SESSION 4 . . . . . Sun. 3:30 to 5:50 pm

Propagation Phenomena and Nanoplasmonics I

Chair: **Harry A. Atwater, Jr.**, California Institute of Technology

Sub-wavelength localizations of light through optical super-oscillations *(Invited Paper)*, N. I. Zheludev, F. M. Huang, Univ. of Southampton (United Kingdom); Y. Chen, Rutherford Appleton Lab. (United Kingdom); F. J. Garcia de Abajo, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [6641-13]

Coupling into slow surface plasmons, M. J. Preiner, N. A. Melosh, Stanford Univ. . . . . [6641-14]

Optical excitation of surface plasmons by tilted J0 Bessel beams, A. Carbajal-Domínguez, Univ. Juárez Autónoma de Tabasco (Mexico) . . . . . [6641-15]

Novel metal-dielectric structures for guiding ultra-long range surface plasmon-polaritons at optical frequency, R. Adato, J. Guo, The Univ. of Alabama in Huntsville . [6641-16]

Optical cloaking *(Invited Paper)*, V. M. Shalaev, W. Cai, U. K. Chettiar, A. V. Kildishev, Purdue Univ. . . . . [6641-17]

Non-adiabatic nano-focusing in tapered metallic rods, M. W. Vogel, D. K. Gramotnev, Queensland Univ. of Technology (Australia); D. F. P. Pile, Univ. of California/Berkeley; M. I. Stockman, Georgia State Univ.; R. C. McPhedran, The Univ. of Sydney (Australia); X. Zhang, Univ. of California/Berkeley . . . . . [6641-18]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Lunch Break

SESSION 5 . . . . . Mon. 1:30 to 3:10 pm

Spatial Control and Subwavelenth Localization

Chair: **Nikolay I. Zheludev**, Univ. of Southampton (United Kingdom)

The time-reversal subwavelength control in acoustics and electromagnetics *(Invited Paper)*, M. Fink, École Supérieure de Physique et de Chimie Industrielles (France) . . . [6641-19]

Electromagnetic enhancements and hotspots in electromigrated gaps, Y. Wu, D. Ward, D. Natelson, P. J. Nordlander, Rice Univ. . . . . [6641-20]

Controlled localization of optical energy in plasmon particle arrays, R. de Waele, F. Koenderink, A. Polman, FOM Institute for Atomic and Molecular Physics (Netherlands) . . . . . [6641-21]

Ultrafast nanoplasmonics *(Invited Paper)*, M. I. Stockman, Georgia State Univ. . . . . [6641-22]

SESSION 6 . . . . . Mon. 3:30 to 5:50 pm

Nonlinear and Controled Nanoplasmonic Phenomena

Chair: **Mathias Fink**, École Supérieure de Physique et de Chimie Industrielles (France)

Adaptive sub-wavelength control of nano-optical fields *(Invited Paper)*, W. Pfeiffer, M. Aeschlimann, M. Bauer, T. Brixner, Univ. Bielefeld (Germany) . . . . . [6641-23]

Gold nanorods for optimized two photon luminescence imaging of cancerous tissue, N. J. Durr, T. Larson, D. K. Smith, B. A. Korgel, The Univ. of Texas at Austin; K. Sokolov, The Univ. of Texas at Austin and The Univ. of Texas M.D. Anderson Cancer Ctr.; A. Ben-Yakar, The Univ. of Texas at Austin . . . . . [6641-24]

Gold nanorods as nano photothermal sensitizers in phase change memory media, J. W. M. Chon, P. Zijlstra, M. Gu, Swinburne Univ. of Technology (Australia) . . . . . [6641-25]

Local-field and multipole effects in second-harmonic generation from gold nanoparticles and nanodimers *(Invited Paper)*, M. Kauranen, S. Kujala, H. Husu, B. K. Canfield, Tampere Univ. of Technology (Finland); J. Laukkanen, B. Bai, M. Kuittinen, Y. P. Svirko, J. P. Turunen, Joensuu Yliopisto (Finland) . . . . . [6641-26]

Local field asymmetry drives second-harmonic generation from t-shaped gold nanodimers, B. K. Canfield, H. Husu, Tampere Univ. of Technology (Finland); B. Bai, J. Laukkanen, M. Kuittinen, J. P. Turunen, Joensuu Yliopisto (Finland); M. Kauranen, Tampere Univ. of Technology (Finland) . [6641-27]

Generation of nanospikes on Ag via laser ablation in liquid environment, G. A. Shafeev, General Physics Institute (Russia); A. V. Petrovskaya, Moscow Engineering Physics Institute (Russia) . . . . . [6641-28]

Tuesday 28 August

SESSION 7 . . . . . Tues. 8:10 to 10:10 am

Propagation Phenomena and Nanoplasmonics II

Chair: **Lewis J. Rothberg**, Univ. of Rochester

Surface plasmon polariton waves and their applications *(Invited Paper)*, Y. Fainman, Univ. of California/San Diego . . . . . [6641-29]

The role of phonon in the surface plasmon coupling with an InGaN/GaN quantum well, Y. Lu, C. Chen, D. Yeh, C. Huang, T. Tang, J. Huang, C. Yang, National Taiwan Univ. (Taiwan) . . . . . [6641-30]

MOS compatible ultra long range surface plasmon modes, C. G. Durfee III, T. E. Furtak, A. J. Sabbah, P. D. Flammer, Colorado School of Mines; R. E. Hollingsworth, ITN Energy Systems, Inc.; R. T. Collins, Colorado School of Mines . . . . . [6641-31]

Ultra small laser made of a semiconductor nanowire and a metal shell, C. Ning, Arizona State Univ.; A. Maslov, Canon Development Americas, Inc. . . . . [6641-32]

Plasmonic endoscope: guiding, magnifying, and focusing of infrared radiation on a nanoscale *(Invited Paper)*, G. Shvets, S. Trendafilov, The Univ. of Texas at Austin; J. B. Pendry, Imperial College London (United Kingdom); A. K. Sarychev, Ethertronics Inc. . . . . [6641-33]

SESSION 8 . . . . . Tues. 10:30 am to 12:10 pm

Concentration and Transformation of Energy on Nanoscale

Chair: **Yeshaiahu Fainman**, Univ. of California/San Diego

Nano-focusing of surface plasmons in metallic nano-structures *(Invited Paper)*, D. K. Gramotnev, Queensland Univ. of Technology (Australia); D. F. P. Pile, X. Zhang, Univ. of California/Berkeley . . . . . [6641-34]

Environmental optical sensitivity of gold nanodecahedra, I. Pastoriza-Santos, L. M. Liz-Marzan, Univ. de Vigo (Spain); F. J. García de Abajo, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [6641-35]

Accelerated Forster energy transfer between CdTe quantum dots in proximity to gold nanoparticles, V. K. Komarala, A. L. Bradley, The Univ. of Dublin, Trinity College (Ireland) . . . . . [6641-36]

Thermal effects in and near gold nanoparticles *(Invited Paper)*, J. Feldmann, T. A. Klar, Ludwig-Maximilians-Univ. München (Germany) . . . . . [6641-37]

Lunch/Exhibition Break

SESSION 9 . . . . . Tues. 1:30 to 3:10 pm

Control and Manipulation of Nanoplasmonic Phenomena

Chair: **Jochen Feldmann**, Ludwig-Maximilians-Univ. München (Germany)

Plasmonics: catalyzing the next wave of chipscale technologies *(Invited Paper)*, M. L. Brongersma, Stanford Univ. . . . . [6641-38]

Ultra-fast broadband response of photon-drag current at surface plasmon resonance, X. Yin, L. Hesselink, Stanford Univ. . . . . [6641-39]

Time-resolved second-harmonic generation from gold nanoparticle arrays, D. Ferrara, K. A. Tetz, M. D. McMahon, R. F. Haglund, Jr., Vanderbilt Univ. . . . . [6641-40]

Surface plasmon waveguiding and detection *(Invited Paper)*, J. R. Krenn, Karl-Franzens-Univ. Graz (Austria) . . . . . [6641-41]

SESSION 10 . . . . . Tues. 3:30 to 6:10 pm

Nanoplasmonic Eigenmodes and Nanoscale Phenomena

Chair: **Mark L. Brongersma**, Stanford Univ.

Plasmonic nanostructures: artificial molecules *(Invited Paper)*, P. J. Nordlander, Rice Univ. . . . . [6641-42]

Plasmon resonance of a gold nanostar: numerical plasmon hybridization, F. Hao, C. L. Nehl, J. H. Hafner, P. J. Nordlander, Rice Univ. . . . . [6641-43]

Atomic-scale plasmonics : how does plasmon behave in ultimately tiny systems?, T. Nagao, S. Yaginuma, C. Liu, T. Nakayama, National Institute for Materials Science (Japan); T. Inaoka, Iwate Univ. (Japan) . . . . . [6641-44]

Increased Landau damping of the surface plasmon resonance of gold nanoparticles at the onset of the interband transition, F. Hubenthal, F. Träger, Univ. Kassel (Germany) . . . . . [6641-45]

Plasmonics using electron microscopy *(Invited Paper)*, F. J. Garcia de Abajo, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [6641-46]

Experimental observations and numerical calculations of a 3D structured plasmon coupler, A. Ghoshal, G. Webb-Wood, P. G. Kik, College of Optics & Photonics/Univ. of Central Florida . . . . . [6641-47]

Competition of surface plasmon modes for dipole emission in optically active plasmonic nano-films, R. F. Oulton, D. A. Genov, D. F. P. Pile, V. Sorger, M. S. Ambati, X. Zhang, Univ. of California/Berkeley . . . . . [6641-48]

Wednesday 29 August

SESSION 11 . . . . . Wed. 8:10 to 10:10 am

Nanocircuits and Energy Localization

Chair: **Peter J. Nordlander**, Rice Univ.

Optical nanocircuit loading of nanoantenna structures *(Invited Paper)*, A. Alu, N. Engheta, Univ. of Pennsylvania . . . . . [6641-49]

Unifying model for giant enhancement and quenching of light emission from Au/CdSe, Y. Hsieh, Y. Chen, C. T. Liang, National Taiwan Univ. (Taiwan) . . . . . [6641-50]

Sub-diffraction imaging with subwavelength structured metallic films, C. Wang, X. Luo, C. Du, Institute of Optics and Electronics (China) . . . . . [6641-51]

Semiconductor active plasmonics, J. Gomez Rivas, FOM Institute for Atomic and Molecular Physics (Netherlands); J. A. Sanchez-Gil, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [6641-52]

Mapping local field distribution at metal nanostructures by near-field second-harmonic generation *(Invited Paper)*, M. Celebrano, M. Zavelani-Rossi, P. Biagioni, D. Polli, M. Finazzi, L. Duo', G. Cerullo, Politecnico di Milano (Italy); M. Labardi, M. Allegrini, Univ. di Pisa (Italy); J. Grand, P. Royer, P. Adam, Univ. de Technologie de Troyes (France) . . . . . [6641-53]

SESSION 12 . . . . . Wed. 10:30 am to 12:10 pm

Magnetic Phenomena and Molecular Nanoplasmonics

Chair: **Nader Engheta**, Univ. of Pennsylvania

Magnetic moments and magnetization of EM eigenstates of a composite medium near the quasistatic limit *(Invited Paper)*, D. J. Bergman, Tel Aviv Univ. (Israel) . . . . . [6641-54]

Optical and electronic properties of electrochemically active perylene tetracarboxylic diimide molecules, N. Davani, K. Shimizu, M. J. Preiner, N. A. Melosh, Stanford Univ. . . . . [6641-55]

Optical properties of nanostructured metallic films and surfaces containing magnetic media, A. Khanikaev, A. V. Baryshev, Toyohashi Univ. of Technology (Japan); A. A. Fedyanin, A. B. Granovsky, M.V. Lomonosov Moscow State Univ. (Russia); M. Inoue, Toyohashi Univ. of Technology (Japan) . . . . . [6641-56]

Spinplasmonics: a new route for active plasmonics *(Invited Paper)*, A. Y. Elezzabi, Univ. of Alberta (Canada) . . [6641-57]

Lunch/Exhibition Break

SESSION 13 . . . . . Wed. 1:30 to 3:20 pm

Propagation Phenomena and Nanoplasmonics III

Chair: **Abdulhakem Y. Elezzabi**, Univ. of Alberta (Canada)

Novel plasmonic dimple lens for nano-focusing of optical energy *(Invited Paper)*, S. Vedantam, H. Lee, J. Tang, J. Conway, M. Staffaroni, J. Lu, E. Yablonovitch, Univ. of California/Los Angeles . . . . . [6641-58]

Directional coupling between gap plasmon waveguides, D. K. Gramotnev, K. C. Vernon, Queensland Univ. of Technology (Australia); D. F. P. Pile, X. Zhang, Univ. of California/Berkeley . . . . . [6641-59]

Experimental study and analysis of passive plamonic nano-cavities, V. Sorger, R. F. Oulton, S. Han, Z. Liu, D. F. P. Pile, D. A. Genov, C. Sun, X. Zhang, Univ. of California/Berkeley . . . . . [6641-60]

Surface-plasmon enhancement of Brillouin light scattering from gold-nanodisk arrays on glass, Z. N. Utegulov, National Institute of Standards and Technology; B. T. Draine, Princeton Univ.; S. A. Kim, J. M. Shaw, W. L. Johnson, National Institute of Standards and Technology . . . . . [6641-61]

Comparisons of the surface plasmon sensitivities for nanohole and nanoslit arrays, P. Wei, Research Ctr. for Applied Sciences (Taiwan) . . . . . [6641-62]

SESSION 14 . . . . . Wed. 3:40 to 6:00 pm

New Developments in Nanoplasmonics

Chair: **David J. Bergman**, Tel Aviv Univ. (Israel)

Polarization-dependent dark-field microspectroscopy of individual plasmonic nanostructures, J. B. Lassiter, N. A. Mirin, H. Wang, D. W. Brandl, T. Park, C. L. Nehl, J. H. Hafner, P. J. Nordlander, N. J. Halas, Rice Univ. . . . . [6641-63]

Fabrication of gold nanoparticles using nanosphere lithography in combination with laser tailoring - a flexible approch for nanostructuring of surfaces, R. Morarescu, F. Hubenthal, F. Träger, Univ. Kassel (Germany) . . . . . [6641-64]

2D hexagonal arrays of Au nanoshells as integrated substrates for surface enhanced spectroscopies, F. Le, H. Wang, N. J. Halas, P. J. Nordlander, Rice Univ. . . . [6641-65]

Screening process of the quantum-confined Stark effect of an InGaN/GaN quantum well in its coupling with surface plasmon for light emission enhancement, C. Chen, Y. Lu, D. Yeh, C. Yang, National Taiwan Univ. (Taiwan) . . . . . [6641-66]

Bloch mode analysis of transmission through periodic slit arrays in finite thickness metallic slabs, Y. Xie, The Univ. of Arizona; A. R. Zakharian, College of Optical Sciences/The Univ. of Arizona; J. V. Moloney, The Univ. of Arizona; M. Mansuripur, College of Optical Sciences/The Univ. of Arizona . [6641-67]

Modeling of core-shell silver nanoparticles in nanostructured sol-gel thin films, G. Valverde-Aguilar, J. A. Garcia-Macedo, V. Rentería, Univ. Nacional Autónoma de México (Mexico) . . . . . [6641-68]

Design and fabrication of gold nanostructures with nanosphere lithography for LSPR applications, X. D. Zhou, W. Knoll, Institute of Materials Research and Engineering (Singapore); S. Virasawmy, National Univ. of Singapore (Singapore); S. S. Y. Oh, L. W. Yen, N. Zhang, Institute of Materials Research and Engineering (Singapore) . . [6641-69]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Bloch mode analysis of transmission through periodic slit arrays in finite thickness metallic slabs,** Y. Xie, A. R. Zakharian, J. V. Moloney, M. Mansuripur, College of Optical Sciences/The Univ. of Arizona . . . . . [6641-70]

✔ **Optical properties of platinum-coated gold nanorods,** J. Perez-Juste, M. Grzelczak, Univ. de Vigo (Spain); F. J. García de Abajo, Consejo Superior de Investigaciones Científicas (Spain); L. M. Liz-Marzán, Univ. de Vigo (Spain) . . [6641-71]

✔ **Synthesis, optical properties and modeling of silver core-silver oxide shell nanostructures in silica films,** V. Rentería, J. A. Garcia-Macedo, G. Valverde-Aguilar, Univ. Nacional Autónoma de México (Mexico) . . . . . [6641-72]

✔ **Surface enhanced Raman spectroscopy on the tip of a plastic optical fiber,** J. M. Taguenang, K. Aschalew, A. Sharma, Alabama A&M Univ.; D. E. Diggs, Air Force Research Lab. . . . . [6641-73]

✔ **Amorphous and crystallized alloys analysis by Kramers-Kronig method,** O. O. Fedosenko, National Taras Shevchenko Univ. of Kyiv (Ukraine); E. A. Loza, National Antarctic Scientific Ctr. (Ukraine); L. V. Poperenko, National Taras Shevchenko Univ. of Kyiv (Ukraine) . . . . . [6641-74]

✔ **Advanced Kramers-Kronig analysis method for ribbons of Fe-based amorphous and crystallized alloys,** O. O. Fedosenko, L. V. Poperenko, National Taras Shevchenko Univ. of Kyiv (Ukraine); E. A. Loza, National Antarctic Scientific Ctr. (Ukraine) . . . . . [6641-75]

✔ **Analysis of Bragg gratings for long-range surface plasmon polaritons using the bidirectional beam propagation method based on scattering operators,** H. Zhang, J. Mu, W. Huang, McMaster Univ. (Canada) [6641-76]

✔ **Light focusing with tip formed array of plasmon-polariton waveguides,** W. M. Saj, Univ. Warszawski (Poland) . . . . . [6641-77]

✔ **Finite difference time domain analysis and design of 2D silver nano-plasmonic waveguides,** M. Rasouli Disfani, K.N.Toosi Univ. of Technology (Iran) . . . . . [6641-78]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm
SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm
SC727 Nanoplasmonics (Stockman) Thursday 30, 8:30 am - 5:30 pm

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Conference 6642

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6642

Plasmonics: Nanoimaging, Nanofabrication, and Their Applications III

Conference Chairs: **Satoshi Kawata**, Osaka Univ. (Japan); **Vladimir M. Shalaev**, Purdue Univ.; **Din-Ping Tsai**, National Taiwan Univ. (Taiwan)

Program Committee: **David J. Bergman**, Tel Aviv Univ. (Israel); **Sergey I. Bozhevolnyi**, Aalborg Univ. (Denmark); **Che Ting Chan**, Hong Kong Univ. of Science and Technology (Hong Kong China); **Jochen Feldmann**, Ludwig-Maximilians-Univ. München (Germany); **Naomi J. Halas**, Rice Univ.; **Teruya Ishihara**, The Institute of Physical and Chemical Research (Japan); **Fritz Keilmann**, Max-Planck-Institut für Biochemie (Germany); **Victor I. Klimov**, Los Alamos National Lab.; **Aaron Lewis**, The Hebrew Univ. of Jerusalem (Israel); **Le-Wei J. Li**, National Univ. of Singapore (Singapore); **Olivier J. F. Martin**, École Polytechnique Fédérale de Lausanne (Switzerland); **Martin Moskovits**, Univ. of California/Santa Barbara; **Peter J. Nordlander**, Rice Univ.; **Masaya Notomi**, NTT Basic Research Labs. (Japan); **Lukas Novotny**, Univ. of Rochester; **Motoichi Ohtsu**, The Univ. of Tokyo (Japan); **John B. Pendry**, Imperial College London (United Kingdom); **Joseph W. Perry**, Georgia Institute of Technology; **Lewis J. Rothberg**, Univ. of Rochester; **Vahid Sandoghdar**, ETH Zürich (Switzerland); **George C. Schatz**, Northwestern Univ.; **Tigran V. Shahbazyan**, Jackson State Univ.; **Mark I. Stockman**, Georgia State Univ.; **Yung Doug Suh**, Korea Research Institute of Chemical Technology (South Korea); **Xiang Zhang**, Univ. of California/Berkeley; **Nikolay I. Zheludev**, Univ. of Southampton (United Kingdom)

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:30 to 10:10 am

Nano Fabrication and Lithography

Chair: **Thomas A. Klar**, Ludwig-Maximilians-Univ. München (Germany)

Fabrication and application of custom-designed arrays of nanoparticles and nanowires on anodic alumina templates *(Invited Paper)*, Y. Wang, Academia Sinica (Taiwan) [6642-01]

DNA-mediated patterning of gold nanoparticles into discrete structures: modularity, write/erase and structural switching *(Invited Paper)*, H. Sleiman, F. Aldaye, McGill Univ. (Canada) . . . . . [6642-02]

Surface-plasmons-assisted nanoscale photolithography, S. Chen, The Univ. of Texas at Austin . . . . . [6642-03]

Focusing and manipulation of surface plasmon polaritons by laser fabricated dielectric structures, C. Reinhardt, R. V. Kiyan, S. Passinger, A. Stepanov, B. N. Chichkov, Laser Zentrum Hannover e.V. (Germany) . . . . . [6642-04]

Coffee Break

SESSION 2 . . . . . Tues. 10:30 am to 3:10 pm

Nano Imaging

Chair: **Satoshi Kawata**, Osaka Univ. (Japan)

Hyperspectral cathodoluminescent imaging of plasmonic excitations with nanoscale resolution *(Invited Paper)*, N. I. Zheludev, M. Bashevoy, A. Denisyuk, F. Jonsson, Univ. of Southampton (United Kingdom) . . . . . [6642-05]

Tip-enhanced Raman scattering: regulating the tip-sample distance *(Invited Paper)*, P. Verma, T. Yano, T. Ichimura, Y. Inouye, S. Kawata, Osaka Univ. (Japan) . . . . . [6642-06]

Particle enhanced plasmonic NSOM, Y. Wang, Univ. of California/Berkeley; B. M. Reinhard, Boston Univ.; C. Sun, X. Zhang, Univ. of California/Berkeley . . . . . [6642-07]

Lunch/Exhibition Break

Near field imaging of subwavelength plasmonic structures *(Invited Paper)*, J. Wang, National Taiwan Univ. (Taiwan); J. Y. Chu, T. R. Wang, J. T. Yeh, M. Lin, Y. Chang, Industrial Technology Research Institute (Taiwan) . . . . . [6642-08]

Imaging of optical field distributions and plasmon wavefunctions in metal nanoparticles *(Invited Paper)*, H. Okamoto, K. Imura, Institute for Molecular Science (Japan) . . . . . [6642-09]

Infrared antennas for near-field microscopy, T. Taubner, J. A. Schuller, M. L. Brongersma, Stanford Univ. . . . . [6642-10]

A surface plasmon polariton phase microscope with a subwavelength grating structure, Y. Su, S. Chen, National Cheng Kung Univ. (Taiwan) . . . . . [6642-11]

Coffee Break

SESSION 3 . . . . . Tues. 3:30 to 5:50 pm

Plasmonics Spectroscopy

Chair: **Yuh-Lin Wang**, Academia Sinica (Taiwan)

Spectroscopy of Single Gold Nanoparticle Dimers *(Invited Paper)*, T. A. Klar, J. Feldmann, Ludwig-Maximilians-Univ. München (Germany) . . . . . [6642-12]

Nanoengineering of hotspots for surface enhanced spectroscopies *(Invited Paper)*, P. J. Nordlander, Rice Univ. . . . . [6642-13]

Tip-pressurized near-field Raman spectroscopy of carbon nanotubes, T. Yano, P. Verma, Y. Inouye, Osaka Univ. (Japan); S. Kawata, Osaka Univ. (Japan) and RIKEN (Japan) [6642-14]

Tip-enhanced near-field Raman spectroscopy applied to nano-composite materials, Y. Saito, Osaka Univ. (Japan); K. Yanagi, H. Kataura, National Institute of Advanced Industrial Science and Technology (Japan); N. Hayazawa, The Institute of Physical and Chemical Research (RIKEN) (Japan); S. Kawata, Osaka Univ. (Japan) . . . . . [6642-15]

An integrated plasmonic biosensor for pathogenic bacteria detection, L. Tay, J. Tanha, S. Ryan, National Research Council Canada (Canada) . . . . . [6642-16]

Investigating the secondary structures for long oligonucleotides using attenuated-total-reflection nanoplasmon-enhanced Raman scattering, K. Chiu, S. Chen, National Cheng Kung Univ. (Taiwan) . . . . . [6642-17]

Wednesday 29 August

SESSION 4 . . . . . Wed. 8:10 to 10:10 am

Nano Sensing

Chair: **Mark L. Brongersma**, Stanford Univ.

Localized surface plasmon sensing with gold nanorods and nanostars *(Invited Paper)*, K. M. Mayer, S. Lee, C. L. Nehl, J. H. Hafner, Rice Univ. . . . . [6642-18]

Localized surface plasmon sensing platform *(Invited Paper)*, K. Kajikawa, Tokyo Institute of Technology (Japan) . . . . . [6642-19]

Surface plasmon-enhanced photodetectors, J. White, Z. Yu, G. Veronis, S. L. Fan, M. L. Brongersma, Stanford Univ. . . . . [6642-20]

Effect of individual nanoparticles on the response of Si photodiodes, N. K. Grady, S. P. Sundararajan, N. J. Halas, Rice Univ. . . . . [6642-21]

Novel optical geometry for multi-analyte surface plasmon coupled emission (SPCE) based biosensors, F. T. O'Neill, S. O'Sullivan, S. K. Vashist, B. D. MacCraith, Dublin City Univ. (Ireland) . . . . . [6642-22]

Coffee Break

SESSION 5 . . . . . Wed. 10:30 am to 3:10 pm

Manipulation of Plasmonic Effect

Chair: **Vladimir M. Shalaev**, Purdue Univ.

Hierarchy and energy dissipation in optical near-fields and their system applications *(Invited Paper)*, M. Naruse, National Institute of Information and Communications Technology (Japan); M. Ohtsu, The Univ. of Tokyo (Japan) . . . . . [6642-23]

Plasmonic detection of local order in self-assembling metal nanoparticle materials *(Invited Paper)*, A. A. Lazarides, D. S. Sebba, Duke Univ. . . . . [6642-24]

Segmented metallic nanowires for optical antennas, E. S. Barnard, M. L. Brongersma, Stanford Univ. . . . . [6642-25]

Plasmonic nanostructures with depth-tuned grooves for beam shaping, X. Dong, C. Du, X. Luo, Institute of Optics and Electronics (China) . . . . . [6642-26]

Lunch/Exhibition Break

Surface plasmons on SNOM probes: optical nanofocusing and fluorescence dynamics *(Invited Paper)*, N. A. Issa, R. Guckenberger, Max-Planck-Institut für Biochemie (Germany); C. Bolwien, A. Brandenburg, Fraunhofer-Institut für Physikalische Messtechnik (Germany) . . . . . [6642-27]

Enhanced transmission efficiency of a nanoaperture in a designed complex *(Invited Paper)*, S. Zou, H. Wang, Univ. of Central Florida . . . . . [6642-28]

Optical properties of plasmonic nano-devices, C. Du, X. Luo, Institute of Optics and Electronics (China) . . . [6642-29]

Far-field imaging of surface plasmon resonance modes on single gold nanorod, H. J. Huang, National Taiwan Univ. (Taiwan) and Ctr. of Nanostorage Research (Taiwan); C. Yu, National Taiwan Univ. (Taiwan); K. Chiu, National Taiwan Univ. (Taiwan) and Ctr. of Nanostorage Research (Taiwan); H. Chang, R. S. Liu, National Taiwan Univ. (Taiwan); H. P. Chiang, National Taiwan Ocean Univ. (Taiwan); D. Tsai, National Taiwan Univ. (Taiwan) and Institute of Electro-optical Science and Technology (Taiwan) and Academia Sinica (Taiwan) [6642-30]

Coffee Break

SESSION 6 . . . . . Wed. 3:30 to 5:10 pm

Plasmonic Metamaterials I

Chair: **Xiang Zhang**, Univ. of California/Berkeley

Terahertz plasmonics: guiding and focusing of far-infrared radiation using a metamaterials approach *(Invited Paper)*, S. Maier, Univ. of Bath (United Kingdom) . . . . . [6642-31]

Size effects in plasmonic metamaterials for the visible range *(Invited Paper)*, V. P. Drachev, U. K. Chettiar, H. Yuan, W. Cai, A. V. Kildishev, V. M. Shalaev, Purdue Univ. . . . [6642-32]

Experimental demonstration of an optical hyperlens, Z. Liu, H. Lee, Y. Xiong, C. Sun, X. Zhang, Univ. of California/Berkeley [6642-33]

Plasmonic materials for cloaking structures, A. Alu, N. Engheta, Univ. of Pennsylvania . . . . . [6642-34]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Plasmonic nano-kaleidoscope,** S. Chen, Far East College (Taiwan); D. Tsai, National Taiwan Univ. (Taiwan) . . [6642-51]

✔ **Plasmonic optical fiber biosensor for small sample volume,** M. Inoue, M. Kimura, K. Kajikawa, Tokyo Institute of Technology (Japan) . . . . . [6642-52]

✔ **Variation of the confocal parameters of silver nano superlens,** K. Lee, K. Kim, J. Kim, H. Park, Yonsei Univ. (South Korea) . . . . . [6642-53]

Thursday 30 August

SESSION 7 . . . . . Thurs. 8:30 to 10:10 am

Plasmonic Metamaterials II

Chair: **Nader Engheta**, Univ. of Pennsylvania

Negative index materials based on plasmonic and polaritonic components *(Invited Paper)*, G. Shvets, Y. A. Urzhumov, The Univ. of Texas at Austin; V. Lomakin, Univ. of California/San Diego; M. I. Davanco, Univ. of California/Santa Barbara; S. Forrest, Univ. of Michigan . . . . . [6642-35]

Magnifying superlens based on surface plasmon optics *(Invited Paper)*, I. I. Smolyaninov, Univ. of Maryland/College Park . . . . . [6642-36]

Anomalous surface plasmon dispersion in metallodielectric multilayers, P. G. Kik, G. Webb-Wood, A. Ghoshal, College of Optics & Photonics/Univ. of Central Florida . . . . . [6642-37]

High directive antenna based on a metamaterial superstrate, Q. Deng, X. Luo, Institute of Optics and Electronics (China) . . . . . [6642-38]

Coffee Break

SESSION 8 . . . . . Thurs. 10:30 am to 3:00 pm

Plasmonics

Chairs: **Che Ting Chan**, Hong Kong Univ. of Science and Technology (Hong Kong China); **Hirokazu Hori**, Univ. of Yamanashi (Japan)

Multiple electric and magnetic resonances of nano spherical particles in light scattering *(Invited Paper)*, H. She, L. J. Li, S. J. Chua, National Univ. of Singapore (Singapore) . . . . . [6642-39]

Function and fundamental processes of nano-optoelectronics devices *(Invited Paper)*, H. Hori, Univ. of Yamanashi (Japan) . . . . . [6642-40]

FDTD studies of the optical properties of metallic tip/substrate systems, F. Le, P. J. Nordlander, Rice Univ. . . . . [6642-41]

Analysis of a long-range surface Plasmon polariton gratings using one dimensional finite difference mode matching method, J. Mu, H. Zhang, W. Huang, McMaster Univ. (Canada) . . . . . [6642-42]

Lunch Break

Plasmonic modes in periodic metal nanoparticle structures *(Invited Paper)*, C. T. Chan, K. H. Fung, Hong Kong Univ. of Science and Technology (Hong Kong China) . . . . . [6642-43]

Strong coupling between nanoshell plasmons and organic excitons, N. T. Fofang, N. J. Halas, Rice Univ. . . . [6642-44]

Surface plasmon resonances on metallic nano-antennas, nano-stars and nano-trimers, J. A. Sanchez-Gil, V. Giannini, J. V. Garcia-Ramos, Consejo Superior de Investigaciones Científicas (Spain); O. L. Muskens, J. Gomez Rivas, FOM Institute for Atomic and Molecular Physics (Netherlands) . . . . . [6642-45]

Efficient parameterization of the dielectric response of Au and Ag nanostructures, F. Hao, P. J. Nordlander, Rice Univ. . . . . [6642-46]

Coffee Break

SESSION 9 . . . . . Thurs. 3:20 to 4:50 pm

Nanoplasmonic Applications

Chair: **Din-Ping Tsai**, National Taiwan Univ. (Taiwan)

Compensation of loss by optical gain in localized and propagating surface plasmons *(Invited Paper)*, M. A. Noginov, G. Zhu, M. Bahoura, M. Mayy, B. A. Ritzo, Norfolk State Univ.; V. A. Podolskiy, Oregon State Univ.; V. P. Drachev, V. M. Shalaev, Purdue Univ. . . . . [6642-47]

Plasmonic modification of adjacent molecules and materials: routes to active plasmonic devices, R. Bardhan, S. P. Sundararajan, N. K. Grady, F. Tam, S. Grabtchak, N. J. Halas, Rice Univ. . . . . [6642-48]

Improvements of photo-thermal recording efficiency on phase-change optical recording media with metallic oxide nano thin film, T. S. Kao, National Taiwan Univ. (Taiwan) and Ctr. for Nanostorage Research (Taiwan); J. W. M. Chon, Swinburne Univ. of Technology (Australia); Y. Yan, H. Hsu, Y. H. Fu, National Taiwan Univ. (Taiwan) and Ctr. for Nanostorage Research (Taiwan); M. Gu, Swinburne Univ. of Technology (Australia); D. Tsai, National Taiwan Univ. (Taiwan) and Ctr. for Nanostorage Research (Taiwan) and Academia Sinica (Taiwan) . . . . . [6642-49]

Surface plasmon resonance enhanced electrooptic effect, Y. Uchiho, Y. Ohno, S. Abe, K. Kajikawa, Tokyo Institute of Technology (Japan) . . . . . [6642-50]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm
SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm
SC727 Nanoplasmonics (Stockman) Thursday 30, 8:30 am - 5:30 pm

Conference 6643

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6643

Physical Chemistry of Interfaces and Nanomaterials VI

Conference Chairs: **Piotr Piotrowiak**, Rutgers Univ.; **Garry Rumbles**, National Renewable Energy Lab.

Acknowledgement is made to the Donors of the **American Chemical Society Petrolieum Research Fund,** *for partial support of this conference. SPIE also wishes to thank the following sponsor for their generous support to this conference:* NREL National Renewable Energy Laboratory

Sunday 26 August

SESSION 1 . . . . . Sun. 1:30 to 3:00 pm

Session 1

Nanoscale excitons and energy transfer *(Invited Paper)*, G. D. Scholes, Univ. of Toronto (Canada) . . . . . [6643-01]

Characterization of SWNT thin film electrodes with optical and THz spectroscopies, and the correlation of spectroscopy with electrical and device performance, J. L. Blackburn, M. C. Beard, T. Barnes, T. McDonald, M. Heben, National Renewable Energy Lab. . . . . [6643-02]

Charge transfer studies of photosensitive ruthenium complexes with single walled carbon nanotubes, H. Chaturvedi, J. C. Poler, The Univ. of North Carolina at Charlotte . . . . . [6643-03]

Non-covalent functionalization of carbon nanotubes in polymer composites, A. A. Hofstra, J. L. Sample, Johns Hopkins Univ. . . . . [6643-04]

SESSION 2 . . . . . Sun. 3:30 to 4:50 pm

Session 2

Conducting polymer nanocomposites: interactions at interfaces *(Invited Paper)*, H. He, Rutgers Univ. . [6643-05]

Elucidating the influence of conducting polymer anodes by optical spectroscopy of devices, P. A. Lane, Naval Research Lab.; P. J. Brewer, Imperial College London (United Kingdom); G. P. Kushto, Naval Research Lab.; J. C. de Mello, Imperial College London (United Kingdom) . . . . . [6643-06]

Exciton diffusion and quenching in semiconducting polymers *(Invited Paper)*, I. D. W. Samuel, P. Shaw, A. Ruseckas, Univ. of St. Andrews (United Kingdom) . [6643-07]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Lunch/Exhibition Break

SESSION 3 . . . . . Mon. 1:30 to 2:50 pm

Session 3

Tools to study interface photophysics in excitonic solar cells *(Invited Paper)*, N. Kopidakis, J. Piris, A. J. Ferguson, W. L. Rance, D. C. Olson, D. Selmarten, S. E. Shaheen, D. S. Ginley, G. Rumbles, National Renewable Energy Lab.[6643-08]

Multiple exciton generation in films of chemically treated lead chalcogenide quantum dots, J. Luther, M. C. Beard, Q. Song, M. Law, A. J. Nozik, National Renewable Energy Lab. . . . . [6643-09]

Analysis of single-molecule emission dynamics using photon interarrival time recording *(Invited Paper)*, H. Fujiwara, S. Tamura, T. Chiba, S. Takeuchi, K. Sasaki, Hokkaido Univ. (Japan) . . . . . [6643-10]

SESSION 4 . . . . . Mon. 3:20 to 5:00 pm

Session 4

Interfacial structure and dynamics in molecular solar cells *(Invited Paper)*, O. L. A. Monti, M. L. Blumenfeld, J. M. Tyler, L. K. Schirra, B. S. Tackett, The Univ. of Arizona . . . . [6643-11]

Imaging of resonant quenching of surface plasmons by quantum dots using scanning tunneling luminescence *(Invited Paper)*, J. van de Lagemaat, M. J. Romero, National Renewable Energy Lab.; I. Mora-Sero, Univ. Jaume I (Spain); G. Rumbles, M. M. Al-Jassim, National Renewable Energy Lab. . . . . [6643-12]

Holographic imaging of nanostructures and interfaces with low energy electrons, L. Livadaru, Univ. of Alberta (Canada); R. A. Wolkow, National Institute for Nanotechnology (Canada) and Univ. of Alberta (Canada) . . . . . [6643-13]

Novel setup for time-resolved fluorescence microscopy, L. Gundlach, P. Piotrowiak, Rutgers Univ. . . . . [6643-14]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

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✔ **Effect of preparation on the growth mode and structure in laser MBE grown multilayer of SrTiO3 and YBa2Cu3Oy,** Z. Wu, J. L. Li, J. Hao, The Hong Kong Polytechnic Univ. (Hong Kong China) . . . . . [6643-22]

✔ **Laser assisted surface modification of AISI 304 SS with SiC-Ti-Zr,** P. Rajarajan, S. Dillibabu, National Institute of Technology/Tiruchirappalli (India); J. Jamal Mohamed, Jamal Mohamed College (India); R. Kaul, H. Kumar, N. Asish Kumar, Ctr. for Advanced Technology (India) . . . . . [6643-23]

✔ **Optical characterization of silicon quantum dots,** J. Choi, Univ. of Maryland/College Park and National Institute of Standards and Technology; M. Satterfield, H. G. Kang, J. Hwang, National Institute of Standards and Technology; N. S. Wang, Univ. of Maryland/College Park; V. Reipa, National Institute of Standards and Technology . . . . . [6643-24]

✔ **First-principles calculations of band structures in Ba- and Ti-terminated BaTiO3 (001) and Sr- and Ti-terminated SrTiO3 (001) surfaces with oxygen vacancy,** Z. Yin, M. Cai, M. Zhang, Nanjing Univ. (China) . . . [6643-25]

Tuesday 28 August

SESSION 5 . . . . . Tues. 8:30 to 10:00 am

Session 5

Photovoltaic energy conversion utilizing the different photon energies in the solar spectrum *(Invited Paper)*, F. Willig, Fritz-Haber-Institut der Max-Planck-Gesellschaft (Germany) . . . . . [6643-15]

Non-invasive directional diagnosis of surface/interface nanostructures via traceable x-ray diffraction procedures, G. G. Berti, Univ. di Pisa (Italy) . . . . . [6643-16]

Nano-scale manipulation of interface in engineered titanate heterostructure with temperature gradient modulation, J. L. Li, J. Hao, Z. Wu, The Hong Kong Polytechnic Univ. (Hong Kong China); Y. Li, Univ. of Electronic Science and Technology of China (China) . . . . . [6643-17]

Ultrafast interfacial electron transfer probed with two-photon-photoemission, L. Gundlach, Rutgers Univ.; R. Ernstorfer, Univ. of Toronto (Canada); F. Willig, Fritz-Haber-Institut der Max-Planck-Gesellschaft (Germany) . . [6643-18]

SESSION 6 . . . . . Tues. 10:30 to 11:50 am

Session 6

Femtosecond visible-to-IR spectroscopy of TiO2 nanocrystalline films: dynamics of UV-generated charge carrier relaxation and electron-injection from gold nano-dots *(Invited Paper)*, A. Furube, National Institute of Advanced Industrial Science and Technology (Japan); Y. Tamaki, Univ. of the Ryukyus (Japan); M. Murai, K. Hara, R. Katoh, M. Tachiya, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [6643-19]

Study on phase transitions and phonon characters of nanostructured oxides by Raman spectroscopy, M. Zhang, Y. Deng, K. Zhu, J. Zhou, Z. Yin, Nanjing Univ. (China)[6643-20]

Sensitization of defined metal oxide semiconductor electrode surfaces by cyanine dyes *(Invited Paper)*, M. T. Spitler, National Renewable Energy Lab.; B. A. Parkinson, Colorado State Univ. . . . . [6643-21]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm

SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

Conference 6644

Sunday-Wednesday 26-29 August 2007 • Proceedings of SPIE Vol. 6644

Optical Trapping and Optical Micromanipulation IV

Conference Chairs: **Kishan Dholakia**, Univ. of St. Andrews (United Kingdom); **Gabriel C. Spalding**, Illinois Wesleyan Univ.

Program Committee: **Elliot L. Botvinick**, Beckman Laser Institute; **Carlos L. César**, Univ. Estadual de Campinas (Brazil); **Arthur E. T. Chiou**, National Yang-Ming Univ. (Taiwan); **Eric R. Dufresne**, Yale Univ.; **Jesper Glückstad**, Risø National Lab. (Denmark); **Min Gu**, Swinburne Univ. of Technology (Australia); **Philippe J. Marchand**, Celula, Inc.; **Jens-Christian D. Meiners**, Univ. of Michigan; **Lene B. Oddershede**, Niels Bohr Institute (Denmark); **H. D. Ou-Yang**, Lehigh Univ.; **Rubén Ramos-García II**, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); **Alexander Rohrbach**, Albert-Ludwigs-Univ. Freiburg (Germany); **Halina H. Rubinsztein-Dunlop**, The Univ. of Queensland (Australia)

Sunday 26 August

SESSION 1 . . . . . Sun. 8:00 to 10:10 am

Optical Traps and DNA

Chair: **Justin E. Molloy,** National Institute for Medical Research (United Kingdom)

Visualizing single DNA-bound proteins using DNA as a scanning probe *(Invited Paper)*, G. J. L. Wuite, Vrije Univ. Amsterdam (Netherlands) . . . . . [6644-01]

Stretching sub-micron DNA fragments with optical tweezers *(Invited Paper)*, Y. Chen, G. A. Blab, J. D. Meiners, Univ. of Michigan . . . . . [6644-02]

Studies of viral DNA packaging motors with optical tweezers: a comparison of motor function in bacteriophages phi29, lambda, and T4, D. E. Smith, D. N. Fuller, D. Raymer, J. P. Rickgauer, Univ. of California/San Diego; S. Grimes, P. J. Jardine, D. L. Anderson, Univ. of Minnesota; C. Catalano, Univ. of Washington; V. Kottadiel, V. Rao, The Catholic Univ. of America . . . . . [6644-03]

Mechanisms of DNA binding determined in optical tweezers experiments, M. J. McCauley, M. C. Williams, Northeastern Univ. . . . . [6644-04]

High-resolution single-molecule optical trapping measurements of transcription with basepair accuracy *(Invited Paper)*, W. J. Greenleaf, E. A. Abbondanzieri, Stanford Univ.; M. T. Woodside, Stanford Univ. and National Research Council of Canada (Canada); R. Landick, Univ. of Wisconsin/ Madison; S. M. Block, Stanford Univ. . . . . [6644-05]

SESSION 2 . . . . . Sun. 10:30 am to 12:00 pm

Statistical Mechanics of Small Systems

Chair: **Kirstine Berg-Sørensen,** Danmarks Tekniske Univ. (Denmark)

Fluctuation and dissipation theorems: theory and experiment *(Invited Paper)*, D. J. Evans, E. M. Sevick, G. Wang, D. M. Carberry, J. C. Reid, The Australian National Univ. (Australia); D. J. Searles, Griffith Univ. (Australia) . . [6644-06]

An optical trap with colored noise, S. Perrone, Institut de Ciències Fotòniques (Spain); M. Rubi, Univ. de Barcelona (Spain); D. Petrov, Institut de Ciències Fotòniques (Spain) . . . . . [6644-07]

The determination of the second virial coefficient of colloidal particles by forced Rayleigh light scattering in the vicinity of a blinking optical trap, J. Junio, E. Blanton, H. D. Ou-Yang, Lehigh Univ. . . . . [6644-08]

Brownian motion in a non-homogeneous field of force, G. Volpe, G. Volpe, D. Petrov, Institut de Ciències Fotòniques (Spain) . . . . . [6644-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 3:10 pm

Single Molecule Studies

Chair: **Jens-Christian D. Meiners,** Univ. of Michigan

Optical trapping studies of acto-myosin motor proteins *(Invited Paper)*, J. E. Molloy, National Institute for Medical Research (United Kingdom) . . . . . [6644-10]

Direct measurement of the intermolecular forces confining a single entangled polymer, R. M. Robertson, D. E. Smith, Univ. of California/San Diego . . . . . [6644-11]

Optically trapped water droplets as nanocontainers *(Invited Paper)*, K. Helmerson, A. M. Jofre, J. Tang, R. B. Kishore, L. S. Goldner, National Institute of Standards and Technology . . . . . [6644-12]

Hydrosomes: optically trapped femtoliter containers for single molecule studies, A. M. Jofre, R. B. Kishore, National Institute of Standards and Technology; N. Hodas, California Institute of Technology; J. Tang, G. Lowman, L. S. Goldner, K. Helmerson, National Institute of Standards and Technology . . . . . [6644-13]

SESSION 4 . . . . . Sun. 3:30 to 5:10 pm

Triggered Events in Biological Systems

Chair: **Kishan Dholakia,** Univ. of St. Andrews (United Kingdom)

Forced shape deformations of interfaces and biopolymer networks, W. Losert, A. Pomerance, E. Rericha, Univ. of Maryland/College Park . . . . . [6644-14]

A laser microscope system for mechanotransduction studies on cells, S. K. Mohanty, Univ. of California/Irvine; H. H. Rubinsztein-Dunlop, The Univ. of Queensland; E. L. Botvinick, Univ. of California/Irvine . . . . . [6644-15]

Optical tweezers and multiphoton microscopies integrated photonic tool for mechanical and biochemical cell processes studies, A. A. de Thomaz, W. M. Faustino, Univ. Estadual de Campinas (Brazil); A. Fontes, Univ. Federal de Pernambuco (Brazil); H. P. Fernandes, M. d. L. Barjas-Castro, K. Metze, S. Giorgio, L. C. Barbosa, C. L. Cesar, Univ. Estadual de Campinas (Brazil) . . . . . [6644-16]

Optical tweezers guided control of neuronal cell growth: effect of beam asymmetry and power on different cell types, S. K. Mohanty, C. Sun, M. W. Berns, Univ. of California/ Irvine . . . . . [6644-17]

Optical tweezers for studying DNA repair and ageing, K. O. Greulich, Fritz Lipmann Institute (Germany); S. Monajembashi, Fritz Lipmann Institute (Germany) and Consultant (Germany); T. Keining, P. Grigaravicius, Fritz Lipmann Institute (Germany) . . . . . [6644-18]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

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Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Lunch Break

SESSION 5 . . . . . Mon. 1:30 to 3:20 pm

Optical Measurements of Viscosity/Rheology

Chair: **Elliot L. Botvinick,** Beckman Laser Institute

Quantitative force calibration in viscoelastic media and living cells, K. Berg-Sørensen, Danmarks Tekniske Univ. (Denmark); M. Fischer, Danmarks Tekniske Univ. (Denmark) and Univ. of Copenhagen (Denmark); A. C. Richardson, N. Reihani, L. B. Oddershede, Niels Bohr Institute (Denmark) . [6644-19]

Using optical traps to test materials by active microrheology *(Invited Paper)*, C. F. Schmidt, D. Mizuno, Georg-August-Univ. (Germany) . . . . . [6644-20]

Studying red blood cell agglutination by measuring membrane viscosity with optical tweezers, A. Fontes, H. P. Fernandes, A. A. de Thomaz, L. C. Barbosa, M. d. L. Barjas-Castro, C. L. César, Univ. Estadual de Campinas (Brazil) . . . . . [6644-21]

Mechanical inhomogeneity and anisotropy in mimetic microtubule networks, J. Wang, Lehigh Univ.; Y. Liu, J. X. Tang, Brown Univ.; H. D. Ou-Yang, Lehigh Univ. . . [6644-22]

Microrheology of microlitre samples, S. J. W. Parkin, G. G. Knoener, T. A. Nieminen, N. R. Heckenberg, H. H. Rubinsztein-Dunlop, The Univ. of Queensland (Australia) . . . . . [6644-23]

SESSION 6 . . . . . Mon. 3:30 to 5:50 pm

Towards Lab-on-a-Chip

Chair: **Jesper Glückstad,** Risø National Lab. (Denmark)

Micro-optics for optical trapping in microfluidics, F. Merenda, J. Rohner, J. R. Fournier, R. Salathé, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [6644-24]

Integrated optical manipulation within microfluidic systems, D. W. M. Marr, R. W. Applegate, Jr., J. A. Squier, Colorado School of Mines; T. Vestad, J. S. Oakey, Metafluidics, Inc. . . . . [6644-25]

Optically driven particle separation, W. Mu, Z. Li, L. Luan, Northwestern Univ.; G. Wang, Indiana Univ.-Purdue Univ. Fort Wayne; G. C. Spalding, Illinois Wesleyan Univ.; J. B. Ketterson, Northwestern Univ. . . . . [6644-26]

Transport and separation of microspheres with lensless imaging technique, Y. Sun, J. Bu, L. Ong, X. Yuan, Nanyang Technological Univ. (Singapore) . . . . . [6644-27]

Dispersion of carbon nanotubes and nanotube-assisted bubble formation using near infrared optical tweezers, K. S. Mohanty, S. K. Mohanty, Univ. of California/Irvine . [6644-28]

Optical microrotors: theory, design and fabrication, V. L. Y. Loke, T. Asavei, T. A. Nieminen, N. R. Heckenberg, H. H. Rubinsztein-Dunlop, The Univ. of Queensland (Australia) . . . . . [6644-29]

Optically trapping lithoparticles of complex shapes: colloidal alphabet soup, J. N. Wilking, C. Hernandez, T. G. Mason, Univ. of California/Los Angeles . . . . . [6644-30]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

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✔ **The use of laser tweezers to analyze sperm motility and mitochondrial respiration,** J. M. Nascimento, L. Z. Shi, C. Chandsawangbhuwana, Univ. of California/San Diego; B. S. Durrant, Conservation and Research for Endangered Species; E. L. Botivinick, M. W. Berns, Univ. of California/Irvine . . . . . [6644-73]

✔ **Improved measurement of the maximum transverse force applicable by OT, using the viscous drag method,** A. C. Richardson, N. Reihani, L. B. Oddershede, Niels Bohr Institute (Denmark) . . . . . [6644-74]

✔ **Improving axial optical trapping efficiency by compensating spherical aberrations,** N. Reihani, L. B. Oddershede, Niels Bohr Institute (Denmark) . . . . . [6644-75]

✔ **A holographic tweezers setup for force measurements on biological molecules,** A. van der Horst, N. R. Forde, Simon Fraser Univ. (Canada) . . . . . [6644-76]

✔ **Smooth-moving holographic optical-tweezers,** E. Eriksson, M. Goksor, Göteborg Univ. (Sweden); J. Leach, S. Keen, M. Padgett, Univ. of Glasgow (United Kingdom) . . . . . [6644-77]

✔ **Diffractive optical elements for laser tweezers appplications,** M. Nadasan, O. D. Iancu, Univ. Politehnica Bucuresti (Romania) . . . . . [6644-78]

✔ **Forming standing vortex modes in opposite directed laser beams,** V. G. Shvedov, N. V. Shostka, V. Mykhaylov, Vernadskiy Tavricheskiy National Univ. (Ukraine) . . [6644-79]

✔ **Optical forces on asymmetric particles,** K. D. Bonin, D. Bonessi, Wake Forest Univ.; T. G. Walker, Univ. of Wisconsin/Madison . . . . . [6644-80]

✔ **Laser cooling in flame synthesis of nanoparticles,** X. Liu, Rutgers Univ. . . . . [6644-81]

✔ **Flow-assisted collection of DNA molecules on silica beads,** R. Ramos-García, N. A. Korneev, J. C. Ramirez-San-Juan, E. Rodriguez-Aboytes, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); M. Cardenas-Garcia, Benemérita Univ. Autónoma de Puebla (Mexico) . . . . . [6644 82]

✔ **Optofluidic microscope with optical tweezer actuation,** X. Heng, E. Hsiao, California Institute of Technology; D. Psaltis, École Polytechnique Fédérale de Lausanne (Switzerland); C. Yang, California Institute of Technology . . . . . [6644-83]

✔ **Micro-kinetics of the trapping of medium-sized particles: angular momentum transfer and force calibration,** Y. Zhao, J. S. Edgar, G. D. M. Jeffries, D. McGloin, D. T. Chiu, Univ. of Washington . . . . . [6644-84]

Tuesday 28 August

SESSION 7 . . . . . Tues. 8:00 to 10:00 am

Phun with Phase

Chair: **Halina H. Rubinsztein-Dunlop,** The Univ. of Queensland (Australia)

Combining holographic optical tweezers with flexible image filtering *(Invited Paper)*, M. A. Ritsch-Marte, A. Jesacher, C. Maurer, S. Bernet, Innsbruck Medical Univ. (Austria) . . . . . [6644-31]

Encoding arbitrary grey-level optical landscapes for trapping and manipulation using GPC *(Invited Paper)*, C. A. C. Alonzo, P. J. L. Rodrigo, I. R. Perch-Nielsen, J. S. Dam, J. Glückstad, Risø National Lab. (Denmark) . . . . . [6644-32]

Optical coherence measurements of vortex light fields using optically manipulated micro-apertures, W. M. Lee, K. Dholakia, Univ. of St. Andrews (United Kingdom) . [6644-33]

Rotating matter with optical and acoustical wavefields: new aspects of angular momentum transfer, K. P. Volke-Sepulveda, A. Orozco-Santillán, A. Vásquez-Arzola, N. Hernández-Candia, R. Jauregui, Univ. Nacional Autónoma de México (Mexico); V. M. Arrizón, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6644-34]

Vortical laser tweezers with predetermined intensity structure, K. N. Afanasiev, E. G. Abramochkin, A. V. Korobtsov, S. P. Kotova, N. N. Losevsky, E. V. Razueva, V. G. Volostnikov, P.N. Lebedev Physical Institute (Russia) . . . . . [6644-35]

SESSION 8 . . . . . Tues. 10:30 am to 12:00 pm

Basic Science

Chair: **Kristian Helmerson,** National Institute of Standards and Technology

All-optical manipulation and control of neutral atomic ensembles, W. T. Hill III, I. A. Arakelyan, N. Chattrapiban, S. Mitra, Univ. of Maryland/College Park . . . . . [6644-36]

The world through a spinning window *(Invited Paper)*, J. Leach, L. Allen, Univ. of Glasgow (United Kingdom); A. J. Wright, J. M. Girkin, S. M. Barnett, Univ. of Strathclyde (United Kingdom); M. J. Padgett, Univ. of Glasgow (United Kingdom) . . . . . [6644-37]

Radiation pressure on submerged mirrors: implications for the momentum of light in dielectric media, M. Mansuripur, College of Optical Sciences/The Univ. of Arizona . [6644-38]

Theories of longitudinal optical binding, E. M. Wright, College of Optical Sciences/The Univ. of Arizona; K. Metzger, M. Mazilu, K. Dholakia, Univ. of St. Andrews (United Kingdom); V. Karàsek, P. Zemanek, Institute of Scientific Instruments (Czech Republic); P. Jakobsen, Univ. of Tromsø (Norway) . . . . . [6644-39]

Lunch/Exhibition Break

SESSION 9 . . . . . Tues. 1:30 to 3:10 pm

Optical Binding

Chair: **Gabriel C. Spalding,** Illinois Wesleyan Univ.

Nonlinear optics perspective of optical binding of particles, E. M. Wright, College of Optical Sciences/The Univ. of Arizona; P. J. Reece, K. Metzger, K. Dholakia, Univ. of St. Andrews (United Kingdom) . . . . . [6644-40]

Self-consistent collective dynamics and instability of an optically bound chain, H. Ritsch, Univ. Innsbruck (Austria) . . . . . [6644-41]

Effect of coherence on transverse optical binding studied using line optical tweezers, S. K. Mohanty, Univ. of California/Irvine . . . . . [6644-42]

Layer-by-layer optical assembly of colloidal particles, G. Wang, Indiana Univ.-Purdue Univ. Fort Wayne . . . . [6644-43]

A quantum electrodynamical understanding of optical binding, D. L. Andrews, R. G. Crisp, L. C. Dávila Romero, Univ. of East Anglia Norwich (United Kingdom) . . . . . [6644-44]

SESSION 10 . . . . . Tues. 3:30 to 6:00 pm

Plasmonics/Nano

Chair: **Carlos L. César,** Univ. Estadual de Campinas (Brazil)

Radiation forces and torques of surface plasmons excited by an optical beam with orbital angular momentum, G. Volpe, J. P. Staforelli, D. Petrov, Institut de Ciències Fotòniques (Spain) . . . . . [6644-45]

Gold nanoparticles: enhanced optical trapping yet significant heating, T. T. Perkins, Y. Seol, A. E. Carpenter, Univ. of Colorado/Boulder . . . . . [6644-46]

Thermal tweezers for nanomanipulation and nanofabrication on surfaces, D. K. Gramotnev, D. R. Mason, G. Gramotnev, Queensland Univ. of Technology (Australia) . . . . . [6644-47]

Blue-detuned trap for resonant confinement of metal nanoparticles, M. Dienerowitz, P. J. Reece, N. K. Metzger, T. F. Krauss, K. Dholakia, Univ. of St. Andrews (United Kingdom) . . . . . [6644-48]

Optical trapping of nanoshells, K. Helmerson, A. Crawford, B. Cranswick, R. B. Kishore, National Institute of Standards and Technology; N. J. Halas, C. Levin, Rice Univ. . [6644-49]

Optical forces in nanoplasmonic systems for SERS, B. Sepulveda, F. Svedberg, Chalmers Tekniska Högskola (Sweden); Z. Li, H. Xu, Institute of Physics (China); M. Käll, Chalmers Tekniska Högskola (Sweden) . . . . . [6644-50]

Plasmon-enhanced optical trapping of individual metal nanoparticles *(Invited Paper)*, M. A. Pelton, Argonne National Lab.; M. Liu, The Univ. of Chicago; K. C. Toussaint, Jr., Univ. of Chicago; H. Y. Kim, G. Smith, J. Pesic, P. Guyot-Sionnest, The Univ. of Chicago; N. F. Scherer, Argonne National Lab. and The Univ. of Chicago . . . . . [6644-51]

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Conference 6644

Wednesday 29 August

SESSION 11 . . . . . Wed. 8:10 to 10:10 am

Colloid Science with Optical Traps

Chair: **H. Daniel Ou-Yang,** Lehigh Univ.

Measuring many-body forces with many optical tweezers, S. Sainis, E. R. Dufresne, Yale Univ. . . . . [6644-52]

Multi-particle hydrodynamic interactions using a streaming high-speed video camera, J. Leach, Univ. of Glasgow (United Kingdom); R. Di Leonardo, G. Ruocco, Univ. degli Studi di Roma (Italy); C. Saunter, G. Love, Durham Univ. (United Kingdom); S. Keen, M. Padgett, Univ. of Glasgow (United Kingdom) . . . . . [6644-53]

Direct observation of capillary forces between colloidal particles confined in a liquid film, F. Saglimbeni, R. Di Leonardo, G. Ruocco, Univ. degli Studi di Roma (Italy)[6644-54]

Studies of droplet manipulation in optical traps *(Invited Paper)*, D. McGloin, D. R. Burnham, M. D. Summers, Univ. of St. Andrews (United Kingdom); N. Dewar, High School of Dundee (United Kingdom); J. Buchanan, D. Rudd, Univ. of St. Andrews (United Kingdom) . . . . . [6644-55]

Parametric resonance of optically trapped aerosols *(Invited Paper)*, R. Di Leonardo, G. Ruocco, Univ. degli Studi di Roma (Italy); J. Leach, M. J. Padgett, Univ. of Glasgow (United Kingdom); A. J. Wright, J. M. Girkin, Univ. of Strathclyde (United Kingdom); D. R. Burnham, D. McGloin, Univ. of St. Andrews (United Kingdom) . . . . . [6644-56]

SESSION 12 . . . . . Wed. 10:30 am to 12:10 pm

Optical Traps for Novel Sensors

Chair: **Eric R. Dufresne,** Yale Univ.

Circular motion control of an optically trapped microprobe for nano-position sensing, Y. Nagasaka, Y. Takaya, T. Hayashi, T. Miyoshi, Osaka Univ. (Japan) . . . . . [6644-57]

Specific interaction study between protein molecules using optical tweezers and atomic force microscope combined, H. Sehgal, T. De, M. V. Salapaka, Iowa State Univ. [6644-58]

11:10 am: **Cavitation induced by continuous wave laser,** J. C. Ramirez-San-Juan, E. Rodriguez-Aboytes, N. A. Korneev, R. Ramos-García, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6644-59]

Optical trapping on biological samples and its combination with other fields in optics, D. A. Cojoc, E. Ferrari, Lab. Nazionale TASC/INFM (Italy); V. Garbin, Univ. Twente (Netherlands); S. Cabrini, Lawrence Berkeley National Lab.; E. M. Di Fabrizio, Univ. degli studi Magna Græcia di Catanzaro (Italy) . . . . . [6644-60]

Azimuthal trapping and optical binding observed in single fiber optical tweezers, S. K. Mohanty, K. S. Mohanty, Univ. of California/Irvine . . . . . [6644-61]

Lunch/Exhibition Break

SESSION 13 . . . . . Wed. 1:30 to 3:10 pm

The Optics of Optical Trap Systems

Chair: **Rubén Ramos-García,** Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico)

Axial optical trapping for an arbitrary beam through a refractive index mismatch interface, A. Á. R. Neves, Istituto Nazionale per la Fisica della Materia (Italy); A. Fontes, Federal Univ. of Pernambuco (Brazil); L. C. Barbosa, Univ. Estadual de Campinas (Brazil); A. Camposeo, R. Cingolani, D. Pisignano, Istituto Nazionale per la Fisica della Materia (Italy); C. L. César, Univ. Estadual de Campinas (Brazil) . . . . . [6644-62]

Multiple counterpropagating-beam traps using MEMS-based spatial light modulation, P. J. L. Rodrigo, I. R. Perch-Nielsen, C. A. C. Alonzo, J. S. Dam, J. Glückstad, Risø National Lab. (Denmark) . . . . . [6644-63]

Assembly of novel nano and micro-structures, D. M. Carberry, L. Ikin, Univ. of Bristol (United Kingdom); G. M. Gibson, M. J. Padgett, Univ. of Glasgow (United Kingdom); M. J. Miles, Univ. of Bristol (United Kingdom) . . . . . [6644-64]

Operation of high resolution optically addressed spatial light modulators, D. Preece, E. Yao, G. M. Gibson, M. Padgett, Univ. of Glasgow (United Kingdom) . . . . . [6644-65]

Study on femtosecond optical tweezers induced kerr effect on rotation of microscopic objects, S. K. Mohanty, Univ. of California/Irvine; K. D. Rao, P. K. Gupta, Raja Ramanna Ctr. for Advanced Technology (India) . . . . . [6644-66]

SESSION 14 . . . . . Wed. 3:30 to 5:30 pm

Optical Control for Biological Studies

Chair: **David W. M. Marr,** Colorado School of Mines

Preparative separations using optical chromatography, A. V. Terray, J. Arnold, T. A. Leski, S. D. Sundbeck, S. J. Hart, Naval Research Lab. . . . . [6644-67]

Interrogating the impact of optical trapping on the bioluminescence of individual cells using the marine bacterium Vibrio harveyi, B. Koss, Naval Research Lab. . . . . [6644-68]

Elastic force measurement for Klebsiella pneumoniae type III pili by using optical tweezers, F. Chen, L. Hsu, National Chiao Tung Univ. (Taiwan) . . . . . [6644-69]

Stable manipulating of microscopic rods by line optical tweezers with haptic feedback, S. Lee, Y. Lee, Kwangju Institute of Science and Technology (South Korea) [6644-70]

Feedback control single particle tracking system, A. Chang, National Chiao Tung Univ. (Taiwan) . . . . . [6644-71]

Real-time control of optical tweezers, A. E. Wallin, R. Tuma, Univ. of Helsinki (Finland) . . . . . [6644-72]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm

SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

SC655 Introduction to Optical Tweezers and Optical Micromanipulation (Dholakia, Spalding) Thursday 30, 8:30 am - 12:30 pm

Conference 6645

Monday-Thursday 27-30 August 2007 • Proceedings of SPIE Vol. 6645

Nanoengineering: Fabrication, Properties, Optics, and Devices IV

Conference Chairs: **Elizabeth A. Dobisz**, Hitachi Global Storage Technologies; **Louay A. Eldada**, DuPont Photonics Technologies

Program Committee: **Luisa D. Bozano**, IBM Almaden Research Ctr.; **Gregory J. Exarhos**, Pacific Northwest National Lab.; **Cynthia Hanson**, Space and Naval Warfare Systems Command; **Daniel J. C. Herr**, Semiconductor Research Corp.; **Ghassan E. Jabbour**, Arizona State Univ.; **Miguel Levy**, Michigan Technological Univ.; **Robert Magnusson**, Univ. of Connecticut; **Juan R. Maldonado**, Stanford Univ.; **Jun Tanida**, Osaka Univ. (Japan); **Chee Wei Wong**, Columbia Univ.

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Lunch Break

SESSION 1 . . . . . Mon. 1:30 to 3:00 pm

Photonic Crystals

Chair: **Louay A. Eldada**, DuPont Photonics Technologies

Controlling light with photonic crystal nanostructures: dispersion, nonlinearities and quantum *(Invited Paper)*, C. W. Wong, Columbia Univ. . . . . [6645-01]

SiN photonic crystal cavities: promising tools for the manipulation of light in the visible, M. Barth, Humboldt-Univ. zu Berlin (Germany); J. Kouba, BESSY GmbH (Germany); O. Benson, Humboldt-Univ. zu Berlin (Germany) . . . . [6645-02]

Fabrication of large scale nanofocusing device based on negative refraction index photonic crystals, S. Cabrini, D. L. Olynick, Lawrence Berkeley National Lab.; V. Mocella, Istituto per la Microelettronica e Microsistemi (Italy) . . . . . [6645-03]

Fabrication and optical characterisation of Si_3N_4 2D-photonic crystals for applications in visible range, J. Kouba, BESSY GmbH (Germany); M. Barth, Humboldt-Univ. zu Berlin (Germany); W. Eberhardt, B. Loechel, BESSY GmbH (Germany) . . . . . [6645-04]

SESSION 2 . . . . . Mon. 3:20 to 5:30 pm

Nano-Biotechnology

Chair: **Cynthia Hanson**, Space and Naval Warfare Systems Command

Parallel optical tweezers with combining a diffractive optical element and a spatial light modulator for photonic DNA memory *(Invited Paper)*, M. Zheng, T. Naoya, O. Yusuke, T. Jun, Osaka Univ. (Japan) . . . . . [6645-05]

Nanopatterned hydrogels and their application as high-density nanoarrays, I. Saaem, Duke Univ.; M. R. Libera, Stevens Institute of Technology; J. Tian, Duke Univ. [6645-06]

Multi-layered organic light-emitting diode (OLED) based bio-sensors, S. Prasad, S. Devabhaktuni, S. K. Padigi, Portland State Univ. . . . . [6645-07]

Nano-scale patterning of phospholipid thin films by interferometric UV lithography, A. S. Kassu, J. M. Taguenang, A. Sharma, Alabama A&M Univ. . . . . [6645-08]

Biological fabrication of nanostructured silicon-germanium photonic crystals possessing unique photoluminescent and electroluminescent properties, G. L. Rorrer, C. Chang, C. Jeffryes, T. Qin, D. Lee, Oregon State Univ.; T. Gutu, J. Jiao, R. Solanki, Portland State Univ. . . . . [6645-09]

Development of ultra-low magnetic field sensor with magnetic tunneling junctions, W. T. Pong, The Univ. of Hong Kong (Hong Kong China); W. F. Egelhoff, Jr., National Institute of Standards and Technology . . . . . [6645-10]

✔ Posters-Monday

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✔ **Fabrication process optimization for magnetic tunnel junctions with magnetoelectronic applications,** W. T. Pong, The Univ. of Hong Kong (Hong Kong China); W. F. Egelhoff, Jr., National Institute of Standards and Technology . . . . . [6645-69]

✔ **Silver nano-particles floating gate effect of organic nonvolatile memories,** J. Seo, J. Kwon, S. Shin, Korea Univ. (South Korea); K. Suh, Electronics and Telecommunications Research Institute (South Korea); B. Ju, Korea Univ. (South Korea) . . . . . [6645-70]

✔ **Studying the nanostructured surface of single-crystal silicon by scanning tunnel spectroscopy method,** N. Nina, K. Sergey, M. Mykola, Taras Shevchenko National Univ. of Kyiv Chapter (Ukraine); S. Katerina, Institute of Semiconductor Physics (Ukraine) . . . . . [6645-71]

✔ **Flexible Bragg reflection waveguide devices fabricated on a plastic substrate,** K. Kim, J. Yi, M. Oh, Pusan National Univ. (South Korea); Y. Noh, H. Lee, ChemOptics Inc. (South Korea) . . . . . [6645-72]

✔ **Characterization of AlF3 thin film in the ultraviolet by magnetron sputtering of aluminum target,** B. H. Liao, M. Liu, C. Lee, National Central Univ. (Taiwan) . . . . . [6645-73]

✔ **The research of oblique deposition of lanthanum fluoride thin films at 193nm,** M. C. Liu, C. C. Lee, W. H. Cho, B. H. Liao, National Central Univ. (Taiwan) . . . . . [6645-74]

✔ **Dynamic force microscopy and x-ray photoemission spectroscopy studies of conducting polymer thin film on nanoscale structured Al surface,** H. Kato, S. Takemura, A. Ishii, Y. Takarai, Y. Watanabe, T. Sugiyama, T. Hiramatsu, N. Nanba, Kanto Gakuin Univ. (Japan); O. Nishikawa, M. Taniguchi, Kanazawa Institute of Technology (Japan) . . . . . [6645-75]

✔ **Optical properties of ZnSiOx nanocomposite films on Si substrates,** Y. Kim, W. Cho, S. Kim, Y. T. Kim, Korea Institute of Science and Technology (South Korea) [6645-76]

✔ **Photopolymerization of hybrid organic/inorganic materials based on nanostructured molecular units for photonic applications,** I. Fortunati, R. Signorini, R. Bozio, G. Brusatin, M. Guglielmi, Univ. degli Studi di Padova (Italy); S. Dirè, V. Tagliazucca, Univ. degli Studi di Trento (Italy); S. Licoccia, M. L. Di Vona, M. Trombetta, Univ. degli Studi di Roma/Tor Vergata (Italy); P. Innocenzi, Univ. degli Studi di Sassari (Italy); C. Andraud, Ecole normale superieure de Lyon (France) . . . . . [6645-77]

✔ **Theory and numerical design of CROW sections with bends,** S. V. Pishko, S. V. Boriskina, Kharkiv National Univ. (Ukraine) . . . . . [6645-78]

✔ **Compact MEMS switch and variable optical attenuator on high contrast silicon waveguides,** X. Wang, M. S. Nawrocka, A. Lavrenov, R. R. Panipucci, Florida International Univ. . . . . [6645-79]

✔ **Silicon nanoparticle conjugation to high molecular weight DNA,** J. Choi, National Institute of Standards and Technology; N. S. Wang, Univ. of Maryland/College Park; V. Reipa, National Institute of Standards and Technology . . . . . [6645-80]

✔ **Elasticity of bradied DNA measured with AFM force spectroscopy,** J. W. Strzelecki, Nicholas Copernicus Univ. Chapter (Poland) . . . . . [6645-81]

✔ **Micro-opto-electro-mechanical system (MOEMS) for microstructure manipulation and optical characterization,** J. A. Martinez, T. Liu, M. S. Nawrocka, R. R. Panepucci, Florida International Univ. . . . . [6645-82]

✔ **Comparison of the nonlinear optical response calculations for bulk semiconductors using length and transversal gauges,** M. A. Escobar Acevedo, J. L. Cabellos Quiroz, N. Arzate, B. S. Mendoza, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6645-83]

✔ **Structural modifications of carbon nanotubes by CO_2 gasification,** A. Collins, S. N. Sambandam, W. Lu, Fisk Univ. . . . . [6645-84]

✔ **The role of electro-osmosis and dielectrophoresis in collection of micro/nano size particles in low frequency AC electric field,** C. Wei, C. Hsu, Tatung Univ. (Taiwan) . . . . . [6645-85]

✔ **A sub-wavelength polarizer with high contract and high tolerance of incident ray's angle in the range of visible wavelength,** Y. Lo, K. Cheng, T. Teng, C. Sun, National Central Univ. (Taiwan) . . . . . [6645-86]

✔ **Dielectric constant trends in silicate spin on glasses,** N. Iwamoto, Honeywell Electronic Materials; T. Li, Honeywell International, Inc.; J. Sepa, A. Krishnamoorthy, Honeywell Electronic Materials . . . . . [6645-87]

Conference 6645

Tuesday 28 August

SESSION 3 . . . . . Tues. 8:10 to 10:00 am

Optical Interconnects

Chair: **El-Hang Lee**, Inha Univ. (South Korea)

Nanoengineered polymeric materials for ultra-short to ultra-long optical links *(Invited Paper)*, L. A. Eldada, DuPont Photonics Technologies . . . . . [6645-11]

Flexible optical wire-bonding for planar lightwave circuits packaging, R. R. Panepucci, A. J. Zakariya, T. Liu, Florida International Univ. . . . . [6645-12]

Nanotaper coupler for the horizontal slot-waveguide, A. M. P. Fievre, R. R. Panepucci, T. Liu, Florida International Univ. . . . . [6645-13]

Enhancement of light extraction efficiency in light-emitting diodes using prism type textured top surface, M. Chang, SAMSUNG Electro-Mechanics Co., Ltd. (South Korea) . . . . . [6645-14]

Enhancement of light extraction efficiency of light-emitting diode with hexagonal photonic crystal layer, H. L. Dang, H. Do, J. Park, I. Hoang, J. Lee, S. Ryu, Chonnam National Univ. (South Korea) . . . . . [6645-15]

SESSION 4 . . . . . Tues. 10:20 am to 12:00 pm

Nanofabricated Optical Devices

Chair: **Chee Wei Wong**, Columbia Univ.

Periodic-dielectric-waveguide beam-splitter, P. Luan, K. Chang, National Central Univ. (Taiwan) . . . . . [6645-16]

Polymer waveguide resonator with distributed Bragg reflectors, T. Liu, M. S. Nawrocka, R. R. Panepucci, Florida International Univ. . . . . [6645-17]

Wavelength reconfigurable photonic switching using thermally tuned micro-ring resonators fabricated on silicon substrate, M. R. Wang, H. Ng, Univ. of Miami; D. Li, New Span Opto-Technology, Inc.; X. Wang, J. Martinez, R. R. Panepucci, Florida International Univ. . . . . [6645-18]

Nanophotonic devices based on optical Kerr effect in ovonic chalcogenides, R. O. Miller, D. V. Tsu, D. A. Strand, Energy Conversion Devices, Inc. . . . . [6645-19]

Variable diffraction gratings using nanoporous electrodes and electrophoresis of dye ions, M. A. Martinuk, P. C. P. Hrudey, M. A. Mossman, The Univ. of British Columbia (Canada); A. C. van Popta, M. J. Brett, Univ. of Alberta (Canada); J. S. Huizinga, 3M Co.; L. A. Whitehead, The Univ. of British Columbia (Canada) . . . . . [6645-20]

Lunch/Exhibition Break

SESSION 5 . . . . . Tues. 1:10 to 3:00 pm

Quantum Dots and Wires

Chair: **Elizabeth A. Dobisz**, Hitachi Global Storage Technologies

Design and fabrication of functional nano-photonic devices for VLSI photonic circuit application *(Invited Paper)*, E. Lee, Inha Univ. (South Korea) . . . . . [6645-21]

Optical anisotropy, birefringence and light scattering by semiconductor nanowires, J. Gomez Rivas, S. Diedenhofen, O. L. Muskens, E. Bakkers, M. Borgstrom, FOM Institute for Atomic and Molecular Physics (Netherlands) . . . . . [6645-22]

Comparison of optical gain and a-factor in laser diodes having different quantum dot structures (in the vertical direction), K. C. Kim, Korea Univ. (South Korea) and Korea Institute of Science and Technology (South Korea); Y. C. Yoo, J. H. Jung, I. K. Han, J. I. Lee, Korea Institute of Science and Technology (South Korea); D. H. Kim, T. G. Kim, Korea Univ. (South Korea) . . . . . [6645-23]

Size dependence of confined photonic modes in opto-quantum dots prepared by conformal deposition method, K. Chen, S. Chen, B. Qian, X. Zhang, W. Li, J. Xu, X. Huang, Nanjing Univ. (China) . . . . . [6645-24]

Design, fabrication and testing of enhanced EO quantum dots for mmW detection, B. Redding, N. N. Faleev, T. Creazzo, D. W. Prather, Univ. of Delaware . . . . . [6645-25]

SESSION 6 . . . . . Tues. 3:20 to 5:30 pm

Nanostructure Engineering

Chair: **Jun Tanida**, Osaka Univ. (Japan)

Ultrafast pulsed laser ablation as a method for synthesis of nanocrystals *(Invited Paper)*, B. Liu, Z. Hu, IMRA America, Inc.; K. Sun, Y. Chen, X. Pan, Univ. of Michigan; Y. Che, IMRA America, Inc. . . . . [6645-26]

Fabrication of spintronic devices: etching endpoint detection by resistance measurement for magnetic tunnel junctions, W. T. Pong, The Univ. of Hong Kong (Hong Kong China); M. Schmoueli, W. F. Egelhoff, Jr., National Institute of Standards and Technology . . . . . [6645-27]

Designing electron beams for in-line holography of nanostructures, L. Livadaru, Univ. of Alberta (Canada); R. A. Wolkow, National Institute for Nanotechnology (Canada) and University of Alberta (Canada) . . . . . [6645-28]

Preliminary design and noise consideration of an ultrasensitive magnetic field, W. T. Pong, The Univ. of Hong Kong (Hong Kong China); R. D. McMichael, W. F. Egelhoff, Jr., National Institute of Standards and Technology . . . [6645-29]

Nanocoating stationary phase of MEMS-based preconcentrators and gas chromatography columns fabricated by layer-by-layer assembly of gold nanoparticles for high-speed chemical detection analysis, V. Jain, Virginia Polytechnic Institute and State Univ.; H. M. Yochum, Sweet Briar College; R. Montazami, J. R. Heflin, B. Alfeeli, S. A. Ali, M. Agah, L. T. Taylor, M. Ashraf-Khorassani, Virginia Polytechnic Institute and State Univ. . . . . [6645-30]

In situ Raman scattering in nanomaterial flame synthesis, X. Liu, Rutgers Univ. . . . . [6645-31]

Wednesday 29 August

SESSION 7 . . . . . Wed. 8:10 to 10:10 am

Thin Film Nanostructure Optics

Chair: **Gregory J. Exarhos**, Pacific Northwest National Lab.

Optics of thin-film silicon solar cells with efficient periodic light trapping texture, C. S. Haase, H. Stiebig, Forschungszentrum Jülich GmbH (Germany) . . . . . [6645-32]

Tailored circular Bragg phenomena in TiO_2 sculptured thin films through post-deposition processing, S. M. Pursel, M. W. Horn, The Pennsylvania State Univ. . . . . [6645-33]

Optoelectronic properties of ZnO/ZnMgO quantum well lasers with coupled self-consistent models, R. V. N. Melnik, Wilfrid Laurier Univ. (Canada); M. Willatzen, Syddansk Univ. (Denmark); D. R. Mahapatra, Indian Institute of Science (India); L. C. Lew Yan Voon, Wright State Univ. . . . . [6645-34]

Fabrication and characterization of silicon/silicon dioxide super lattices for silicon-based light-emitting devices, T. Creazzo, E. Marchena, B. Redding, T. R. Hodson, D. W. Prather, Univ. of Delaware . . . . . [6645-35]

Function of bubble pit during readout process in PtOx type super-RENS disk, Q. Liu, The National Ctr. for Nanoscience and Technology of China (China); T. Fukaya, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [6645-36]

Narrowband, linear-polarization rejection filter based on columnar thin film superlattice, F. Chiadini, Univ. degli Studi di Salerno (Italy); V. Fiumara, Univ. degli Studi della Basilicata (Italy); A. Scaglione, Univ. degli Studi di Salerno (Italy); A. Lakhtakia, The Pennsylvania State Univ. . . . . [6645-37]

SESSION 8 . . . . . Wed. 10:30 am to 12:00 pm

Organic Nanostructures

Chair: **Louay A. Eldada**, DuPont Photonics Technologies

Rational design of molecular self-assemblies for controlled surface patterning and molecular diffusion *(Invited Paper)*, D. Bléger, D. Kréher, F. Mathevet, A. Attias, Univ. Pierre et Marie Curie (France); G. Schull, L. Douillard, C. Fiorini-Debuisschert, F. Charra, Commissariat à l'Energie Atomique (France) . . . . . [6645-38]

Fabrication of sub-diffraction-limit molecular structures by scanning near-field photolithography, G. J. Leggett, The Univ. of Sheffield (United Kingdom) . . . . . [6645-39]

Elasticity of two-photon-fabricated nano-wires, S. Nakanishi, Osaka Univ. (Japan); H. Sun, Jinlin Univ. (China) and Osaka University (Japan); S. Kawata, Osaka Univ. (Japan) . . . . . [6645-40]

Current modulation of polymer/nanoparticle memory devices through nanoparticle engineering, J. Ouyang, National Univ. of Singapore (Singapore) . . . . . [6645-41]

Lunch/Exhibition Break

SESSION 9 . . . . . Wed. 1:10 to 3:10 pm

Nanotubes

Chair: **Elizabeth A. Dobisz**, Hitachi Global Storage Technologies

Optical polarizer made of mechanically aligned carbon nanotubes, S. Shoji, H. Suzuki, S. Kawata, Osaka Univ. (Japan) . . . . . [6645-42]

Optoelectronic transport studies of photosensitive ruthenium complexes with single walled carbon nanotubes, H. Chaturvedi, J. C. Poler, The Univ. of North Carolina at Charlotte . . . . . [6645-43]

Ambient formation of highly aligned carbon nanotube networks, M. D. Lay, P. Vichchulada, The Univ. of Georgia . . . . . [6645-44]

Analytical modeling of the current transport in carbon nanotube field effect transistors (CNT-FETs), J. M. Marulanda, Florida International Univ.; A. Srivastava, Louisiana State Univ. . . . . [6645-45]

Nano materials for efficiently lowering the freezing point of anti-freeze coolants, H. Hong, South Dakota School of Mines and Technology . . . . . [6645-46]

Light source with carbon nanotubes field emission cathode and rare-earth doped nanocrystalline phosphors, P. Psuja, W. Strek, Polska Akademia Nauk (Poland) . . . . . [6645-47]

SESSION 10 . . . . . Wed. 3:30 to 4:30 pm

Nanowires, Nanofibers, and Nanorods

Chair: **David Bléger**, Univ. Pierre et Marie Curie (France)

Ultrahigh sensitivity nanowire photodetectors, C. Soci, A. Zhang, B. Xiang, S. A. Dayeh, D. P. R. Aplin, X. Bao, Y. Lo, D. Wang, Univ. of California/San Diego . . . . . [6645-48]

Nano-structured metal-organic polymers for electronic devices, A. L. R. Vellaisamy, W. Lu, C. Che, A. Yuen, S. Chui, K. Low, L. hui, The Univ. of Hong Kong (Hong Kong China) . . . . . [6645-49]

Self-sensing of CNF and Ni nanowire/PVDF and cellulose composites using electro-micromechanical test, J. Park, Gyeongsang National Univ. (South Korea) and The Univ. of Utah; P. Kim, J. Jang, Gyeongsang National Univ. (South Korea); D. Yoon, Korea Research Institute of Standards and Science (South Korea); G. Hansen, Metal Matrix Composites Co.; L. K. DeVries, The Univ. of Utah . . . . . [6645-50]

Thursday 30 August

SESSION 11 . . . . . Thurs. 8:30 to 11:50 am

Optofluidics

Chairs: **Demetri Psaltis**, École Polytechnique Fédérale de Lausanne (Switzerland); **Yeshaiahu Fainman**, Univ. of California/San Diego

Diffusive and convective dye replenishment in optofluidic light sources, A. Kristensen, M. Gersborg-Hansen, N. A. Mortensen, Danmarks Tekniske Univ. (Denmark) . . [6645-51]

Fabrication of bicolour pixels from a single active molecule by surface-tension-driven technique, I. Viola, F. Della Sala, M. Piacenza, Univ. degli Studi di Lecce (Italy); L. Favaretto, M. Gazzano, Istituto per la Sintesi Organica e la Fotoreattività (Italy); M. Anni, Univ. degli Studi di Lecce (Italy); G. Barbarella, Istituto per la Sintesi Organica e la Fotoreattività (Italy); R. Cingolani, Istituto Nazionale per la Fisica della Materia (Italy); G. Gigli, Univ. degli Studi di Lecce (Italy) . . . . . [6645-52]

Holographic fabrication of photonic nanostructures for optofluidic integration, S. Yang, Korea Advanced Institute of Science and Technology (South Korea) . . . . . [6645-53]

Photonic crystal biosensor microplates with integrated fluid networks for high throughput applications in drug discovery, C. J. Choi, L. L. Chan, M. F. Pineda, J. T. Heeres, P. J. Hergenrother, B. T. Cunningham, Univ. of Illinois at Urbana-Champaign . . . . . [6645-54]

Capillary driven tunable optofluidic DFB dye lasers, M. Gersborg-Hansen, A. Kristensen, Danmarks Tekniske Univ. (Denmark) . . . . . [6645-55]

Nanoscale optofluidic sensor arrays for Dengue virus detection, S. Mandal, S. Nugen, R. Akhmechet, A. Baeumner, D. Erickson, Cornell Univ. . . . . [6645-56]

Microfluidic channel with built-in photonic crystal nanolaser, S. Kim, S. Lee, Y. Lee, S. Yang, Korea Advanced Institute of Science and Technology (South Korea) [6645-57]

Liquid-infiltrated photonic crystals for lab-on-a-chip applications, N. A. Mortensen, S. Xiao, Danmarks Tekniske Univ. (Denmark) . . . . . [6645-58]

Electroactive nanowells for spectrographic fluidic memory, B. Cordovez, Cornell Univ.; D. Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland); D. Erickson, Cornell Univ. . . . . [6645-59]

Lunch Break

SESSION 12 . . . . . Thurs. 1:30 to 4:50 pm

Nanoprocessing Technologies and Nanosystems for Medical Applications

Chair: **Frederic Zenhausern**, Arizona State Univ.

Emergent properties of nanostructured polymer films, M. C. Demirel, A. Lakhtakia, The Pennsylvania State Univ. . . . . [6645-60]

Enhancing the sensitivity of DNA-microarrays using shear-driven micro and nanoflows, K. Pappaert, F. Detobel, P. Van Hummelen, G. Desmet, Vrije Univ. Brussel (Belgium) [6645-61]

Organic electronics and nanodevices in monitoring and control of cardiovascular diseases and neurological disorders, V. K. Varadan, Univ. of Arkansas . . . . . [6645-62]

Electron microscopy characterization of iron oxide nanopowders (prepared by laser pyrolysis) for magnetic fluid applications, V. Ciupina, G. Prodan, Univ. Ovidius Constanta (Romania); I. G. Morjan, F. V. Dumitrache, R. Alexandrescu, Institutul National pentru Fizica Laserilor, Plasmei si Radiatiei (Romania); E. Vasile, METAV-CERCETARE DEZVOLTARE (Romania); L. Vekas, D. Bica, Politehnica Univ. of Timisoara (Romania) . . . . . [6645-63]

Cytotoxicity of silicon nanocrystals, J. Choi, National Institute of Standards and Technology; N. S. Wang, Univ. of Maryland/College Park; V. Reipa, National Institute of Standards and Technology . . . . . [6645-64]

Shear-driven flows through nano-channels uniformly packed with a micro-structured pillar region, D. Clicq, J. Vangelooven, W. De malsche, Vrije Univ. Brussel (Belgium); H. Gardeniers, Univ. Twente; G. Desmet, Vrije Univ. Brussel . . . . . [6645-65]

Verigene® system: a nanoparticle-based molecular diagnostic platform for enzyme-free direct detection of nucleic acids, S. S. Marla, Y. P. Bao, J. J. Storhoff, M. Huber, T. Patno, W. H. Cork, Nanosphere, Inc. . . . . [6645-66]

Seeing multifunctional nano and microparticles suitable for therapy and imaging by freeze-fracture electron microscopy, B. P. Sternberg, NanoAnalytical Lab. [6645-67]

Near-infrared laser photothermal therapy and photodynamic inactivation of cells by using gold nanoparticles and dyes, G. G. Akchurin, G. G. Akchurin, V. A. Bogatyrev, I. L. Maksimova, Saratov State Univ. (Russia); G. A. Seliverstov, Saratov State Medical Univ. (Russia); B. N. Khlebtsov, N. G. Khlebtsov, Institute of Biochemistry and Physiology of Plants and Microorganisms (Russia); G. S. Terentyuk, First Banian Hospital of Saratov (Russia); V. V. Tuchin, Saratov State Univ. (Russia) . . . . . [6645-68]

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Courses of Related Interest

See pages 162-187 for full course descriptions.

6645 (OP217)
Nanoengineering: Fabrication, Properties, Optics, and Devices IV
SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm
SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

Conference 6646

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6646

Nanobiotronics

Conference Chairs: **Emily M. Heckman**, Air Force Research Lab.; **Thokchom B. Singh**, Johannes Kepler Univ. Linz (Austria); **Junichi Yoshida**, Chitose Institute of Science and Technology (Japan)

Program Committee: **Liming Dai**, Univ. of Dayton; **Ananth Dodabalapur**, The Univ. of Texas/Austin; **James G. Grote**, Air Force Research Lab.; **Kuniharu Ijiro**, Hokkaido Univ. (Japan); **Jung-Il Jin**, Korea Academy of Science and Technology (South Korea); **Francois Kajzar**, Univ. d'Angers (France); **Norihisa Kobayashi**, Chiba Univ. (Japan); **Oksana Krupka,** Univ. d'Angers (France); **Charles Y. C. Lee**, Air Force Office of Scientific Research; **Misoon Mah**, Asian Office of Aerospace Research and Development (Japan); **Naoya Ogata**, Chitose Institute of Science and Technology (Japan); **Ileana Rău**, Univ. d'Angers (France); **Bruce H. Robinson**, Univ. of Washington; **Anna Samoc**, The Australian National Univ. (Australia); **Marek J. Samoc**, The Australian National Univ. (Australia); **Niyazi S. Sariciftci**, Johannes Kepler Univ. Linz (Austria); **Andrew J. Steckl**, Univ. of Cincinnati; **Morley O. Stone**, Air Force Research Lab.; **Perry P. Yaney**, Univ. of Dayton

Sunday 26 August

SESSION 1 . . . . . Sun. 8:40 to 9:50 am

Bio-Polymer Photonics

Chair: **James G. Grote**, Air Force Research Lab.

An overview of Air Force biomimetic electronics and photonics *(Keynote),* M. O. Stone, Air Force Research Lab. . . . . [6646-01]

DNA-hybrid materials for photonic applications *(Invited Paper),* N. Ogata, Y. Kagami, M. Wada, J. Yoshida, Chitose Institute of Science and Technology (Japan) . . . . . [6646-02]

SESSION 2 . . . . . Sun. 10:20 am to 12:00 pm

Investigation and Characterization Techniques of DNA Films

Chair: **Marec J. Samoc**, The Australian National Univ. (Australia)

Plasmid DNA structures for photonic devices, J. Akin, Air Force Research Lab. . . . . [6646-03]

Resistivity and electric-field poling behaviors of DNA-based polymers compared to selected non-DNA polymers, P. P. Yaney, Univ. of Dayton . . . . . [6646-04]

Structure and optoelectrical properties of photopolymerized PAn/DNA complex *(Invited Paper),* N. Kobayashi, Chiba Univ. (Japan) . . . . . [6646-05]

Prism coupler and microscopic investigations of DNA films *(Invited Paper),* A. Samoc, The Australian National Univ. (Australia); Z. Galewski, Univ. of Wroclaw (Poland); M. J. Samoc, The Australian National Univ. (Australia); J. G. Grote, Air Force Research Lab. . . . . [6646-06]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 3:10 pm

NLO Processes in Biomaterials

Chair: **Anna Samoc**, The Australian National Univ. (Australia)

Thin film dye-lasers based on DNA-lipid complex materials *(Invited Paper),* J. Yoshida, Chitose Institute of Science and Technology (Japan) . . . . . [6646-07]

Optical amplification and laser action in cyanine dyes doped in DNA complex, M. Honda, N. Nakai, M. Fukuda, Y. Kawabe, Chitose Institute of Science and Technology (Japan) . . . . . [6646-08]

Cubic nonlinear optical effects in deoxyribonucleic acid (DNA) based materials containing chromophores, M. J. Samoc, A. Samoc, The Australian National Univ. (Australia); A. Miniewicz, Politechnika Wroclawska (Poland); J. G. Grote, US Air Force Research Lab. . . . . [6646-09]

DNA-metal Schottky barriers and measurements *(Invited Paper),* D. Zang, IPITEK, Inc. . . . . [6646-10]

SESSION 4 . . . . . Sun. 3:30 to 5:00 pm

Application and Characterization of Bio/ Nanomaterials

Chair: **Junichi Yoshida**, Chitose Institute of Science and Technology (Japan)

DNA-metal hybrid nanomaterials *(Invited Paper),* K. Ijiro, M. Sato, K. Niikura, Y. Matsuo, Hokkaido Univ. (Japan) [6646-11]

Design of an all-optical spatial light modulator and logic gates with phototropin, S. Roy, K. Kulshrestha, Dayalbagh Educational Institute (India) . . . . . [6646-12]

Brilliant organic nanodots as an alternative to semiconductor quantum dots for in vivo imaging, M. H. Blanchard-Desce, CNRS (France); O. Mongin, Univ. de Rennes I (France); M. Werts, A. Caminade, J. Majoral, CNRS (France) . . . . . [6646-13]

Ambipolar devices based on DNA molecules, A. L. R. Vellaisamy, C. Che, The Univ. of Hong Kong (Hong Kong China) . . . . . [6646-14]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/ Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Lunch Break

SESSION 5 . . . . . Mon. 1:30 to 3:10 pm

Biological Systems and Applications

Chair: **Perry P. Yaney**, Univ. of Dayton

An integrated bionanosensing array for airborne toxin detection, M. Griep, C. R. Friedrich, D. Lueking, E. Winder, Michigan Technological Univ. . . . . [6646-15]

DNA base pair-controlled assembly of azobenzene at the air-water interface, O. Haruta, Y. Matsuo, K. Ijiro, Hokkaido Univ. (Japan) . . . . . [6646-16]

Magneto-compression of bio-nanoparticles with the formation of crystalline structures, S. B. Norina, M.V. Lomonosov Moscow State Univ. (Russia) . . . . . [6646-17]

The development of a nano-IMU using buoyancy-driven convection coupled with chemistry, M. E. Tanner, J. Protz, Duke Univ. . . . . [6646-18]

Experimental and Monte Carlo studies of diffraction grating inscription in DNA-based materials, A. C. Mitus, G. Pawlik, A. Kochalska, J. Mysliwiec, A. Miniewicz, Politechnika Wroclawska (Poland); F. Kajzar, Univ. d'Angers (France) . . . . . [6646-19]

SESSION 6 . . . . . Mon. 3:40 to 5:10 pm

Bio-Materials for Semiconductor and Sensor Applications

Chair: **Joe Akin**, Air Force Research Lab.

Bio-organic field effect transistors *(Invited Paper),* J. G. Grote, Air Force Research Lab. . . . . [6646-20]

Biopolymer-based semiconductor materials, C. M. Bartsch, AT&T Government Solutions, Inc.; G. Subramanyam, Univ. of Dayton; J. G. Grote, K. M. Singh, R. R. Naik, Air Force Research Lab.; T. B. Singh, N. S. Sariciftci, Johannes Kepler Univ. Linz (Austria) . . . . . [6646-21]

Scaling of nanoFET biosensors, Q. Wei, F. Zhou, Kent State Univ. . . . . [6646-22]

High sensitivity SERS detection in hollow core microstructured optical fibre for biosensing applications, F. M. Cox, M. C. J. Large, A. Argyros, The Univ. of Sydney (Australia); S. Kalluri, Ilumed, LLC . . . . . [6646 23]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm

SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

Conference 6647

Sunday 26 August 2007 • Proceedings of SPIE Vol. 6647

Nanocoatings

Conference Chairs: **Geoffrey B. Smith**, Univ. of Technology/Sydney (Australia); **Michael B. Cortie**, Univ. of Technology/Sydney (Australia)

Program Committee: **Richard J. Blaikie**, Univ. of Canterbury (New Zealand); **Michael J. Brett**, Univ. of Alberta (Canada); **Dentcho A. Genov**, Univ. of California/Berkeley; **Andreas Gombert**, Fraunhofer-Institut für Solare Energiesysteme (Germany); **Cläs-Göran Granqvist, Sr.**, Uppsala Univ. (Sweden); **Ruediger Iden**, BASF AG (Germany); **Cheng-Chung Lee**, National Central Univ. (Taiwan); **Andrey K. Sarychev**, Ethertronics Inc.; **Mark I. Stockman**, Georgia State Univ.; **Motofumi Suzuki**, Kyoto Univ. (Japan)

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:10 am

Plasmonics in Nanocoatings

Chair: **Geoffrey B. Smith**, Univ. of Technology/Sydney (Australia)

The use of metallo-dielectric coatings for super-resolution near-field imaging *(Invited Paper)*, R. J. Blaikie, Univ. of Canterbury (New Zealand) and The MacDiarmid Institute for Advanced Materials and Nanotechnology (New Zealand) . . . . . [6647-01]

The exciting world of surface plasmons: order vs. chaos *(Invited Paper)*, D. A. Genov, Univ. of California/Berkeley . . . . . [6647-02]

Active control of the optical properties of nanoscale coatings of gold and silver nanorods, M. B. Cortie, X. Xu, M. J. Ford, Univ. of Technology/Sydney (Australia) . . . [6647-03]

Co-existense of localized and delocalized surface plasmon modes, K. Seal, Oak Ridge National Lab. . . . . [6647-04]

SESSION 2 . . . . . Sun. 10:30 am to 12:20 pm

Devices and Optical Switching

Chair: **Richard J. Blaikie**, Univ. of Canterbury (New Zealand)

Photonic structures for high efficiency solar cells *(Invited Paper)*, K. R. Catchpole, S. Pillai, M. A. Green, Univ. of New South Wales (Australia) . . . . . [6647-05]

Plasmonic nanocoatings tailored for surface-enhanced Raman imaging in near-infrared region, M. Suzuki, Y. Wada, S. Li, K. Nakajima, K. Kimura, Kyoto Univ. (Japan); T. Fukuoka, Japan Science and Technology Agency (Japan); Y. Mori, Doshisha Univ. (Japan) . . . . . [6647-06]

Millisecond switching speed and high contrast of electrochromic self-assembled films for fast displays, V. Jain, R. Montazami, Virginia Polytechnic Institute and State Univ.; H. M. Yochum, Sweet Briar College; J. R. Heflin, Virginia Polytechnic Institute and State Univ. . . . . [6647-07]

Optical and electrical switching in nanostructured coatings of VO_2, A. R. Gentle, A. I. Maaroof, M. B. Cortie, G. B. Smith, Univ. of Technology/Sydney (Australia) . . . . . [6647-08]

Application of transparent nanostructured electrodes for modulation of total internal reflection, P. C. P. Hrudey, M. A. Martinuk, M. A. Mossman, The Univ. of British Columbia (Canada); A. C. van Popta, M. J. Brett, Univ. of Alberta (Canada); J. S. Huizinga, 3M Co.; L. A. Whitehead, The Univ. of British Columbia (Canada) . . . . . [6647-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 3:20 pm

Advanced Nano-materials I

Chair: **Motofumi Suzuki**, Kyoto Univ. (Japan)

Present status of research and development on visible-light photocatalysts *(Invited Paper)*, Y. Taga, Chubu Univ. (Japan) . . . . . [6647-10]

Nanodiamond particles in optical coatings, S. Hens, O. A. Shenderova, G. Cunningham, T. Tyler, G. E. McGuire, International Technology Ctr. . . . . [6647-11]

Nanocoating material with a high etching resistance for 193 nm lithography process, S. Matsumaru, T. Ogata, K. Isikawa, H. Hada, K. Ohmori, Tokyo Ohka Kogyo Co., Ltd. (Japan); S. Fujikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan); J. Onodera, Tokyo Ohka Kogyo Co., Ltd. (Japan) . . . . . [6647-12]

Thermal annealing of birefringent TiO_2 thin films formed by oblique-angle deposition, A. C. van Popta, J. Cheng, J. C. Sit, M. J. Brett, Univ. of Alberta (Canada) . . . . . [6647-13]

Nanoporous plasmonic coatings, A. I. Maaroof, A. R. Gentle, M. B. Cortie, G. B. Smith, Univ. of Technology/Sydney (Australia) . . . . . [6647-14]

SESSION 4 . . . . . Sun. 3:40 to 5:30 pm

Advanced Nano-materials II

Chair: **Michael B. Cortie**, Univ. of Technology/Sydney (Australia)

The business case for (and against) nanocoatings *(Invited Paper)*, M. Bunger, Lux Research, Inc. . . . . [6647-15]

Synthesis of polymer nanocomposites by UV-curing of silver nano particles-acrylic resins, L. Balan, École Nationale Supérieure de Chimie de Mulhouse (France) . . . . . [6647-16]

Study on the layer-by-layer electrostatic self-assembly method for biomolecule immobilization onto biosensor surface, X. Wang, Univ. of Massachusetts/Lowell; K. L. Cooper, A. Wang, Virginia Polytechnic Institute and State Univ. . . . . [6647-17]

Ellipsometric porosimetry: fast and non-destructive method of porosity characterization of porous thin films, A. Bondaz, L. Kitzinger, SOPRA, Inc. . . . . [6647-18]

Optical near-field patterning of photopolymer, O. Soppera, S. Jradi, C. Ecoffet, D. Lougnot, École Nationale Supérieure de Chimie de Mulhouse (France) . . . . . [6647-19]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

NanoScience and Engineering

8:30 am: **Optically Driven Mechanical Micro/Nanosystems in Classical and Quantum Realms,** Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia)

9:00 am: **Plastic Optoelectronics and Aligned Carbon Nanotube Nanodevices,** Liming Dai, Univ. of Dayton

9:30 am: **Brave New Nanoworld, Without Apologies to Auldus Huxley,** Akhlesh Lakhtakia, The Pennsylvania State Univ.

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **High Performance Organic Electronic Devices Based on Nano-Scale Engineering,** Yang Yang, Univ. of California/Los Angeles

11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **An approach to self-cleaning SERS sensors by arraying Au nanorods on TiO_2 layer,** S. Li, M. Suzuki, K. Nakajima, K. Kimura, Kyoto Univ. (Japan); T. Fukuoka, Japan Science and Technology Agency (Japan); Y. Mori, Doshisha Univ. (Japan) . . . . . [6647-20]

✔ **Thin films of zinc phthalocyanine (ZnPc) for optoelectronic devices,** M. Puri, Guru Nanak Dev Univ. (India) . . . . . [6647-21]

✔ **On the excess specific heat of single-wall carbon nanotube ropes due to the adsorption of helium atoms in the temperature range 2-20K,** S. Tewari, A. Saxena, S. Rana, Univ. of Delhi (India) . . . . . [6647-22]

✔ **Characterization of radio-frequency sputtered AlN films by spectroscopic ellipsometry,** D. Huang, K. Uppireddi, V. Pantojas, W. Otano-Rivera, B. R. Weiner, G. Morell, Univ. of Puerto Rico . . . . . [6647-23]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC496 Fabrication and Processing of Nanostructures (Cao) Sunday 26, 8:30 am - 5:30 pm

SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

Conference 6648

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6648

Instrumentation, Metrology, and Standards for Nanomanufacturing

Conference Chair: **Michael T. Postek**, National Institute of Standards and Technology

Cochair: **John A. Allgair**, SEMATECH, Inc. and Freescale Semiconductors, Inc.

Program Committee: **Haris Doumanidis**, National Science Foundation; **Daniel J. C. Herr**, Semiconductor Research Corp.; **Mark D. Hoover**, The National Institute for Occupational Safety and Health; **David C. Joy**, The Univ. of Tennessee and Oak Ridge National Lab.; **Kevin W. Lyons**, National Institute of Standards and Technology; **Ron L. Remke**, SEMATECH, Inc.; **Richard M. Silver**, National Institute of Standards and Technology; **Stephan J. Stranick**, National Institute of Standards and Technology

Monday 27 August

Plenary Session . . . . . Mon. 8:30 am to 12:00 pm

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11:00 am: **Nanotechnology: New Tool for Diagnostics and Treatment of Cancer,** Michael Heller, Univ. of California/San Diego

11:30 am: **Commercialization of Nanotechnology: A Business Perspective,** Sean Murdock, Nano Business Alliance

Wednesday 29 August

SESSION 1 . . . . . Wed. 1:30 to 3:10 pm

Instrumentation Metrology and Standards I

Chairs: **John A. Allgair**, International SEMATECH Manufacturing Initiative; **David C. Joy**, The Univ. of Tennessee

Instrumentation, metrology, and standards: key elements for the future of nanomanufacturing, M. T. Postek, K. W. Lyons, National Institute of Standards and Technology . . . . . [6648-01]

Recent advances in photon correlation spectroscopy (PCS), A. F. Rawle, Malvern Instruments Inc. . . . . [6648-02]

Infrared reflectivity spectroscopy of optical phonons in short-period AlGaN superlattices, J. B. Herzog, A. M. Mintairov, K. Sun, J. L. Merz, D. Jena, C. Yu, Univ. of Notre Dame . . . . . [6648-03]

Near-field birefringence response in thickness direction of liquid crystal thin film, J. Qin, N. Umeda, Tokyo Univ. of Agriculture and Technology (Japan) . . . . . [6648-04]

High-throughput maskless nanolithography, C. Sun, W. Srituravanich, L. Pan, X. Zhang, D. Bogy, Univ. of California/Berkeley . . . . . [6648-05]

SESSION 2 . . . . . Wed. 3:30 to 5:50 pm

Instrumentation and Metrology II

Chairs: **Richard M. Silver**, National Institute of Standards and Technology; **Stephan J. Stranick**, National Institute of Standards and Technology

Helium ion microscopy: a new tool for nanomanufacturing, M. T. Postek, A. E. Vladár, J. Kramar, National Institute of Standards and Technology; L. A. Stern, J. Notte, S. McVey, ALIS Corp. . . . . [6648-06]

Length calibration standards for nanomanufacturing, D. C. Joy, S. J. Deo, The Univ. of Tennessee . . . . . [6648-07]

Microstructure of 100 nm damascene copper overburden and lines, R. Geiss, D. T. Read, National Institute of Standards and Technology . . . . . [6648-08]

Robust and novel nanomanufacturing via laser-induced self-organization of metal nanostructures, C. Favazza, R. Sureshkumar, R. Kalyanaraman, Washington Univ. in St. Louis . . . . . [6648-09]

Elevated temperature QCM for nanotube quality control, S. A. Hooker, National Institute of Standards and Technology; R. Schilt, Univ. of Colorado/Boulder; A. Kar, R. Geiss, National Institute of Standards and Technology . . . . . [6648-10]

On-line monitoring of nanoparticles and agglomerates on a substrate, M. Francoeur, M. M. Aslan, P. M. Mengüç, Univ. of Kentucky . . . . . [6648-11]

Nanomonitors: electrical immunoassays for clinical diagnostics applications, S. Prasad, R. K. Reddy, Portland State Univ.; T. Barrett, Oregon Health & Science Univ.; J. Carruthers, Portland State Univ. . . . . [6648-12]

Courses of Related Interest

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✔ **Development of acoustic and vibration criteria for research instrumentation and microelectronics process tools,** T. A. Busch, Consultant . . . . . [6648-19]

✔ **Nanometrology device standards for scanning probe microscopes,** P. Moeck, Portland State Univ. . . . . [6648-24]

✔ **A novel low-cost high-throughput probe card analyzer for characterization of magnetic tunnel junctions,** W. T. Pong, M. Schmoueli, W. F. Egelhoff, Jr., National Institute of Standards and Technology . . . . . [6648-25]

✔ **High temperature acoustic wave gas sensors using nanostructured ZnO,** H. Cheng, L. Qin, Q. Wang, Univ. of Pittsburgh . . . . . [6648-26]

✔ **Silicon test object of the linewidth of the nanometer range for SEM and AFM,** Y. Novikov, V. Gavrilenko, General Physics Institute (Russia); Y. Ozerin, JSC Mikron (Russia); A. Rakov, General Physics Institute (Russia); P. Todua, Ctr. for Surface and Vacuum Research (Russia) . . . . . [6648-27]

✔ **Measurements of linear sizes of relief elements in the nanometer range using an atomic force microscope,** P. Todua, Ctr. for Surface and Vacuum Research (Russia); M. Filippov, N.S. Kurnakov Institute of General and Inorganic Chemistry (Russia); V. Gavrilenko, Ctr. for Surface and Vacuum Research (Russia); Y. Novikov, A. Rakov, General Physics Institute (Russia) . . . . . [6648-28]

✔ **Measurements of linear sizes of relief elements in the nanometer range using a scanning electron microscope,** V. Gavrilenko, Ctr. for Surface and Vacuum Research (Russia); M. Filippov, N.S. Kurnakov Institute of General and Inorganic Chemistry (Russia); Y. Novikov, A. Rakov, General Physics Institute (Russia); P. Todua, Ctr. for Surface and Vacuum Research (Russia) . . . . . [6648-29]

✔ **Effect of ambient temperature on nano-scale measurement precision,** J. Cui, S. Gao, H. Du, National Institute of Metrology (China); M. Lu, Tsinghua Univ. (China); Y. Shi, China Jiliang Univ. (China) . . . . . [6648-30]

✔ **Nano-electrokinetic focusing as a tool for nanomanufacturing,** D. Garcia, Univ. of California/Los Angeles; A. Silva, Instituto Tecnologico y de Estudios Superiores de Monterrey (Mexico); C. Ho, Univ. of California/Los Angeles . . . . . [6648-31]

✔ **Heterogeneous surface patterning by diffusion limited patterning and capillary force lithography,** M. Y. Dogan, C. Duan, Univ. of California/Berkeley; I. Wong, C. Ho, Univ. of California/Los Angeles; A. Majumdar, Univ. of California/Berkeley and Lawrence Berkeley National Lab. . . . [6648-32]

Thursday 30 August

SESSION 3 . . . . . Thurs. 8:10 to 10:10 am

Integration, Interoperability, and Information Management I

Chairs: **Kevin W. Lyons**, National Institute of Standards and Technology; **Haris Doumanidis**, Consultant

Integration, interoperability and information management for nanomanufacturing, K. W. Lyons, National Institute of Standards and Technology . . . . . [6648-13]

The National Nanomanufacturing Network: a vehicle for cooperative R&D and information dissemination in nanomanufacturing, M. T. Tuominen, Univ. of Massachusetts/ Amherst . . . . . [6648-33]

Modelling of angle-resolved x-ray photoelectron spectroscopy (ARXPS) intensity ratios for nanocharacterization of closely packed core-shell nanofibres and nanoparticles, J. Wang, P. J. Cumpson, National Physical Lab. (United Kingdom) . . . . . [6648-15]

Optimal architecture of a neural network for a high precision in ellipsometric scatterometry, I. Gereige, S. Robert, D. Jamon, Univ. Jean Monnet (France) . . . [6648-16]

Nano-precision dynamic motion control, T. Tsao, Univ. of California/Los Angeles . . . . . [6648-17]

Combining nanometrology and coordinate measurement for large-range nanoscale metrology, M. Gruhlke, H. Rothe, Helmut-Schmidt Univ. (Germany) . . . . . [6648-18]

SESSION 4 . . . . . Thurs. 10:30 am to 12:10 pm

Integration, Interoperability, and Information Management II

Chairs: **Daniel J. C. Herr**, Semiconductor Research Corp.; **Kevin W. Lyons**, National Institute of Standards and Technology

Control of relatively long wavelength acoustic "noise" within technology facilities, T. A. Busch, Consultant[6648-20]

Computational modeling of laser-induced self-organization in nanoscopic metal films for predictive nanomanufacturing, J. Trice, C. Favazza, R. Kalyanaraman, R. Sureshkumar, Washington Univ. in St. Louis . . . [6648-14]

Efficient design of complex optical nanocomposites: a broadband solar absorbing glass, J. Trice, Washington Univ. in St. Louis; H. Garcia, Southern Illinois Univ.; R. Sureshkumar, R. Kalyanaraman, Washington Univ. in St. Louis . . [6648-21]

VEDA: a virtual environment for dynamic atomic force microscopy, J. Melcher, S. Hu, A. Raman, Purdue Univ. . . . . [6648-22]

A CAD integration framework for designing devices with atomic scale resolution, Y. Chang, Stanford Univ.; K. Ramaswami, Indian Institute of Science (India); M. Pinilla, F. Prinz, Stanford Univ. . . . . [6648-23]

Lunch Break

Environmental, Health and Safety Monitoring and Metrology . . . . . 1:30 to 3:10 pm

Chairs: **Mark D. Hoover,** The National Institute for Occupational Safety and Health; **Ron L. Remke,** SEMATECH, Inc.

ESH Overview - Exposure Assessment and Control for Nanoparticles in the Workplace: Insights from the NIOSH Nanotechnology Research Program: . . . . . 1:30 to 2:30 pm

Mark D. Hoover, National Institute for Occupational Safety and Health

The National Institute for Occupational Safety and Health (NIOSH) is the US federal agency that conducts research and makes recommendations for preventing work-related injuries, illnesses, and deaths. This presentation provides an update on the coordinated program of laboratory, field, and information dissemination activities being conducted by the NIOSH Nanotechnology Research Center (NTRC). Activities of the NIOSH NTRC support the development of environment, safety, and health tools, practices, and recommendations, including the web-based "Approaches to Safe Nanotechnology" document, and the Nanotechnology Information Library. NIOSH has performed a number of field studies in nanoparticle research, development and production facilities to evaluate potential worker exposures; collect information on work practices; evaluate the presence and effectiveness of controls; and identify areas for improvement. A framework is developing for conducting a qualitative risk management approach to managing nanomaterials along the product life cycle, and for applying the associated logic to control exposures in the presence of uncertainty. The framework takes into account the potential routes of exposure and factors that may influence biological activity and potential toxicity of nanomaterials; incorporates primary approaches based on the traditional industrial hygiene hierarchy of controls involving elimination or substitution, engineering controls, administrative controls, and use of personal protective equipment; and includes valuable secondary approaches involving health surveillance and medical monitoring.

Panel Discussion . . . . . 2:30 to 3:10 pm

Environment, Health, and Safety Issues for Nanotechnology

Panel Moderator: **Mark D. Hoover,** National Institute for Occupational Safety and Health

Panel Members: **Ron L. Remke,** SEMATECH, Inc.; **Michael T. Postek,** National Institute of Standards and Technology; **Akhlesh Lakhtakia,** The Pennsylvania State Univ.

This panel discussion will provide participants with the opportunity to pose questions about potential worker exposures; work practices; engineering and administrative controls; and areas for information sharing and improvement.

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Solar Energy + Applications

Part of SPIE Optics+Photonics

Symposium Chair:

Ravi Durvasula,
Lightfleet Corp.

Technical Organizing Committee

Martha Symko-Davies, National Renewable Energy Lab.
Jinghua Guo, Lawrence Berkeley National Lab.
Bolko von Roedern, National Renewable Energy Lab.
Alan E. Delahoy, Energy Photovoltaics, Inc.
Daryl R. Myers, National Renewable Energy Lab.

Conference 6649

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6649

High and Low Concentration for Solar Electric Applications II

Conference Chair: **Martha Symko-Davies**, National Renewable Energy Lab.

Program Committee: **Allen M. Barnett**, Univ. of Delaware; **Timothy J. Coutts**, National Renewable Energy Lab.; **Ravi Durvasula**, Lightfleet Corp.; **Vahan Garboushian**, Amonix Inc.; **Sarah R. Kurtz**, National Renewable Energy Lab.; **Oliver Mayer**, GE Global Research (Germany); **Raed A. Sherif**, Spectrolab, Inc.

Sunday 26 August

SESSION 1 . . . . . Sun. 3:30 to 5:10 pm

CPV Characterization

Chair: **Fannie Posey-Eddy**, National Renewable Energy Lab.

XR: a high-performance photovoltaic concentrator, M. Hernández, Light Prescriptions Innovators Europe, S. L. (Spain); P. Benítez, Univ. of California/Merced and Univ. Politécnica de Madrid (Spain); J. C. Miñano, Univ. Politécnica de Madrid (Spain) and Light Prescriptions Innovators Europe, S. L. (Spain); A. Cvetkovic, Univ. of California/Merced; O. Dross, R. Mohedano-Arroyo, Light Prescriptions Innovators Europe, S. L. (Spain); R. Jones, The Boeing Co.; G. S. Kinsey, Spectrolab, Inc.; R. Alvarez, Light Prescriptions Innovators Europe, S. L. (Spain) . . . . . [6649-01]

Spectral matching issues for pulsed solar simulators, J. Kiehl, A. Andreas, National Renewable Energy Lab. [6649-02]

Ray-trace modeling of reflectors for quantum dot solar concentrators, M. R. Kennedy, S. McCormack, J. P. Doran, B. Norton, Dublin Institute of Technology (Ireland) . . . [6649-03]

Daily fill factor variation as a diagnostic probe of concentrator systems during outdoor operation, W. E. McMahon, K. E. Emery, D. J. Friedman, L. Ottoson, M. S. Young, J. S. Ward, C. M. Kramer, A. Duda, S. R. Kurtz, National Renewable Energy Lab. . . . . [6649-04]

High-flux characterization of ultra-efficient commercial 1 mm^2 multi-junction solar cells, O. Korech, B. Hirsch, E. A. Katz, J. M. Gordon, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6649-05]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 2 . . . . . Mon. 8:00 to 10:00 am

CPV Systems

Chair: **Timothy J. Coutts**, National Renewable Energy Lab.

A 30% efficient (>250 Watt) module using multijunction solar cells and their one-year on-sun field performance *(Keynote),* V. Garboushian, A. M. Slade, R. Gordon, Amonix Inc. . . . . [6649-06]

A high concentration rooftop photovoltaic system *(Keynote),* P. L. Gleckman, Energy Innovations . . . [6649-07]

The SunTrap PV receiver, E. G. Aylaian, Radiant Power, LLC . . . . . [6649-08]

Photocurrent enhancement in $In_{0.53}Ga_{0.47}$ as solar cells grown on InP/SiO_2/Si transferred epitaxial templates, J. M. Zahler, AONEX Technologies; K. Tanabe, California Institute of Technology; C. Ladous, T. Pinnington, AONEX Technologies; F. D. Newman, EMCORE Corp.; H. A. Atwater, California Institute of Technology . . . . . [6649-09]

Quantum dot solar concentrators: an investigation of various geometries, B. C. Rowan, Dublin Institute of Technology (Ireland) . . . . . [6649-10]

SESSION 3 . . . . . Mon. 10:30 am to 12:00 pm

CPV and Economics

Chair: **William E. McMahon**, National Renewable Energy Lab.

Concentrator optical design to minimize LCOE *(Invited Paper),* G. D. Conley, S. Horne, SolFocus, Inc. . . . [6649-11]

Concentrating solar energy for more cost effective use, B. E. Hines, Practical Instruments, Inc. . . . . [6649-12]

Design and development of a concentrator PV module utilizing Si cells, S. V. Vasylyev, V. Vasylyev, SVVTI, Inc. . . . . [6649-13]

InGaP/GaAs/Ge/Si multijunction solar cells fabricated on transferred epitaxial templates, M. J. Archer, California Institute of Technology; D. C. Law, R. R. King, Spectrolab, Inc.; A. C. Ackerman, C. Ladous, AONEX Technologies; H. A. Atwater, California Institute of Technology . . . . . [6649-14]

Lunch Break

Plenary Session . . . . . Mon. 1:30 to 5:30 pm

Solar Energy

1:30 pm: **The Solar-hydrogen Economy: An Analysis** *(Invited Paper),* W. Reynolds, CEO, Eco-Engineers, Inc.

2:00 pm: **Solar Hydrogen Production by Tandem Cell System Composed of Metal Oxide Semiconductor Film Photoelectrode and Dye-Sensitized Solar Cell** (Invited Paper, Presentation Only), H. Arakawa, Professor, Tokyo Univ. of Science (Japan); C. Shiraishi, M. Tatemoto, H. Kishida, D. Usui, A. Suma, A. Takamisawa, T. Yamaguchi, Tokyo Univ. of Science (Japan)

2:30 pm: **New Opportunities in Concentrator Photovoltaics with Low-cost 40% Efficient Multijunction III-V Solar Cells** *(Invited Paper, Presentation Only),* R. R. King, Principal Scientist, Photovoltaic Cell R&D, Spectrolab, Inc.; R. A. Sherif, G. S. Kinsey, D. C. Law, K. M. Edmondson, H. Yoon, H. L. Cotal, C. M. Fetzer, J. H. Ermer, P. Hebert, P. Pien, N. H. Karam, Spectrolab, Inc.

3:00 pm: **Module Design and Development: Progress and Opportunities** *(Invited Paper, Presentation Only),* D. Rose, Director of Module R&D, Sunpower Corp.

Coffee Break . . . . . 3:30 to 4:00 pm

4:00 pm: **Delivering Service at Scale: Old Requirements for the New Energy Industry** *(Invited Paper, Presentation Only),* M. Culpepper, VP/Strategic Marketing, SunEdison

4:30 pm: **PV Solar Electricity Market and Technology Development** *(Invited Paper, Presentation Only),* W. Hoffmann, CTO, Solar Business Group, Applied Materials, Inc.

5:00 pm: **The Solar Industry-DOE and NREL Programs to Accelerate Growth** *(Invited Paper, Presentation Only),* S. J. Eglash, Consultant to the National Renewable Energy Lab.

Tuesday 28 August

✔ Poster/Demo Session-Tuesday

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✔ **MOVPE growth of quantum well GaAs/In0.11GaAs for space solar cell applications,** P. Wu, Y. Su, National Cheng Kung Univ. (Taiwan); Y. C. Tzeng, Institute of Nuclear Energy Research (Taiwan) . . . . . [6649-15]

✔ **High concentration nonimaging Fresnel lens design with flat upper surface,** A. Akisawa, T. Sato, T. Miyazaki, T. Kashiwagi, Tokyo Univ. of Agriculture and Technology (Japan); M. Hiramatsu, Daido Steel Co., Ltd. (Japan) . . . . . [6649-16]

✔ **Design of lens system to power up the $100 computer using solar cells,** R. Manayil John, B. Thailampillai, National Institute of Technology/Tiruchirappalli (India) . . . . . [6649-17]

✔ **RF control system of a parabolic solar concentrator,** M. Tecpoyotl-Torres, Univ. Autónoma del Estado de Morelos (Mexico); J. Campos-Alvarez, F. Tellez-Alanis, Univ. Nacional Autónoma de México (Mexico); J. Sanchez-Mondragon, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6649-18]

✔ **Spectral-shifting compound parabolic concentrator to improve the performance of amorphous and multi-crystalline silicon solar cells,** R. K. Kostuk, J. E. Castillo, J. Manuel-Russo, The Univ. of Arizona . . . . . [6649-19]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC388 Non-Imaging Optics (Winston) Monday 27, 8:30 am - 12:30 pm

SC552 Aspheric Optics: Design, Fabrication, and Test (Fischer) Wednesday 29, 1:30 - 5:30 pm

SC659 Understanding Reflective Optical Design (Contreras) Monday 27, 8:30 am - 5:30 pm

SC797 The Science and Technology of Organic Solar Cells (Peumans) Tuesday 28, 1:30 - 5:30 pm

Conference 6650

Monday-Thursday 27-30 August 2007 • Proceedings of SPIE Vol. 6650

Solar Hydrogen and Nanotechnology II

Conference Chair: **Jinghua Guo**, Lawrence Berkeley National Lab.

Program Committee: **Hironori Arakawa**, Tokyo Univ. of Science (Japan); **Jan Augustynski**, Univ. de Genève (Switzerland); **Joe da Costa**, The Univ. of Queensland (Australia); **Maria L. Ghirardi**, National Renewable Energy Lab.; **Michael Graetzel**, École Polytechnique Fédérale de Lausanne (Switzerland); **Ting Guo**, Univ. of California/Davis; **Claude Levy-Clement**, Ctr. National de la Recherche Scientifique (France); **Yoshihiro Nakato**, Osaka Univ. (Japan); **Janusz Nowotny**, Univ. of New South Wales (Australia); **Ian C. Plumb**, Commonwealth Scientific and Industrial Research Organisation (Australia); **Pathiyamattom J. Sebastian**, Univ. Nacional Autónoma de México (Mexico); **John A. Turner**, National Renewable Energy Lab.; **Lionel Vayssieres**, National Institute for Materials Science (Japan); **T. Nejat Veziroglu**, The International Ctr. for Hydrogen Energy Technologies (Turkey); **Gunnar Westin**, Uppsala Univ. (Sweden); **Upul Wijayantha**, Loughborough Univ. (United Kingdom); **Jin Z. Zhang**, Univ. of California/Santa Cruz

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Monday 27 August

Plenary Session . . . . . Mon. 1:30 to 5:30 pm

Solar Energy

1:30 pm: **The Solar-hydrogen Economy: An Analysis** *(Invited Paper),* W. Reynolds, CEO, Eco-Engineers, Inc.

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Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Photocatalytic hydrogen production over CdS/titania-nanotube composite films,** S. Moon, J. Baeg, Korea Research Institute of Chemical Technology (South Korea) . . . . . [6650-31]

✔ **A solar photobioreactor for the production of biohydrogen from microlagae,** R. Patiño, L. Panti, P. Chávez, D. Robledo, Ctr. de Investigación y de Estudios Avanzados (Mexico) . . . . . [6650-32]

✔ **Visible light activated nanocrystalline photocatalysts for solar hydrogen production,** C. Huang, B. Illiassou, N. Muradov, A. T-Raissi, Univ. of Central Florida . . . . [6650-33]

✔ **Interaction of [FeFe] hydrogenases with single-walled carbon nanotubes,** D. Svedruzic, National Renewable Energy Lab.; T. J. McDonald, National Renewable Energy Lab. and Columbia Univ.; J. L. Blackburn, Y. Kim, M. J. Heben, P. W. King, National Renewable Energy Lab. . . . . [6650-34]

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:30 to 10:10 am

Synthesis of Advanced Nanostructures and Semiconductor I

Chair: **Jinghua Guo**, Lawrence Berkeley National Lab.

Novel visible light-active metal oxide semiconductor nanostructures for solar hydrogen generation *(Invited Paper),* L. Vayssieres, National Institute for Materials Science (Japan) . . . . . [6650-01]

Vertically-aligned highly-ordered TiFeOx nanotube arrays with enhanced visible spectrum photo-electrochemical properties *(Invited Paper),* C. A. Grimes, The Pennsylvania State Univ. . . . . [6650-02]

Copper gallium diselenide photocathodes for solar photoelectrolysis, B. Marsen, B. Cole, S. Dorn, R. E. Rocheleau, E. L. Miller, Univ. of Hawaii at Manoa . [6650-03]

Effect of 100 MeV Ni^{10+} swift heavy ion (SHI) irradiation on electrodeposited Cu_2O films for hydrogen generation by photoelectrochemical splitting of water, C. Tripathi, Dayalbagh Educational Institute (India); D. K. Avasthi, S. A. Khan, A. Tripathi, Inter Univ. Accelerator Ctr. (India); J. Shrivastav, M. Gupta, A. P. Singh, S. Kumari, V. R. Satsangi, R. Shrivastav, S. D. Kaura, Dayalbagh Educational Institute (India) . . . . . [6650-04]

SESSION 2 . . . . . Wed. 10:40 am to 12:30 pm

Synthesis of Advanced Nanostructures and Semiconductor II

Chair: **Lionel Vayssieres**, National Institute for Materials Science (Japan)

Effects of doping on the photocatalytic activity for water splitting of metal oxides and nitride *(Invited Paper),* Y. Inoue, Nagaoka Univ. of Technology (Japan) . . . . . [6650-05]

Photoelectrochemical properties of nanostructured zinc oxide electrodes *(Invited Paper),* T. Oekermann, Univ. Hannover (Germany) . . . . . [6650-06]

Electrodeposition of ZnO nanowire arrays with tailored dimensions: building blocks for photoelectrochemical devices *(Invited Paper),* R. Tena-Zaera, J. Elias, C. Lévy-Clément, Ctr. National de la Recherche Scientifique (France) . . . . . [6650-07]

Manufacture and investigation of thin film titanium oxide photoelectrodes for photoelectrochemical production of hydrogen, V. M. Aroutiounian, V. M. Arakelyan, G. E. Shahnazaryan, E. Khachaturyan, G. M. Stepanyan, Yerevan State Univ. (Armenia) . . . . . [6650-08]

Lunch/Exhibition Break

SESSION 3 . . . . . Wed. 1:50 to 3:20 pm

Solar Hydrogen and Water Splitting

Chair: **Jin Z. Zhang**, Univ. of California/Santa Cruz

Water-splitting *(Invited Paper),* D. G. Nocera, Massachusetts Institute of Technology . . . . . [6650-09]

Nanowires for solar energy and hydrogen production *(Invited Paper),* T. Guo, Univ. of California/Davis . [6650-10]

Metal oxide semiconductors in PEC splitting of water *(Invited Paper),* V. R. Satsangi, Dayalbagh Educational Institute (India) . . . . . [6650-11]

SESSION 4 . . . . . Wed. 3:50 to 5:30 pm

Bandgap Engineering of Solar Hydrogen Materials

Chair: **Gunnar Westin**, Uppsala Univ. (Sweden)

Hydrogen production using metal nanoparticle modified silicon thin film photoelectrode *(Invited Paper),* S. Yae, Univ. of Hyogo (Japan) and CREST-JST (Japan); M. Abe, N. Fukumuro, Univ. of Hyogo (Japan); S. Ogawa, Gifu Univ. (Japan); N. Yoshida, S. Nonomura, Gifu Univ. (Japan) and CREST (Japan); Y. Nakato, Kwansei Gakuin Univ. (Japan) and CREST (Japan); H. Matsuda, Univ. of Hyogo (Japan) [6650-12]

Electronic structure characterization and bandgap engineering of solar hydrogen materials *(Invited Paper),* J. Guo, Lawrence Berkeley National Lab. . . . . [6650-13]

Rapid synthesis of nanostructured metal-oxide films for solar energy applications by a flame aerosol reactor (FLAR), E. J. Thimsen, H. Song, C. Kirmaier, D. Holten, P. Biswas, Washington Univ. in St. Louis . . . . . [6650-14]

Bandgap reduction of ZnO for photoelectrochemical splitting of water, Y. Yan, K. Ahn, National Renewable Energy Lab.; T. Deutsch, Univ. of Colorado/Boulder; M. Huda, S. Wei, J. A. Turner, M. Al-Jassim, National Renewable Energy Lab. . . . . [6650-15]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:30 to 10:10 am

Solar Hydrogen at Biohybrid and Organic Catalysts

Chair: **Ting Guo**, Univ. of California/Davis

Merging (FeFe) hydrogenases with materials and nanomaterials as biohybrid catalysts for solar hydrogen production *(Invited Paper)*, P. W. King, D. Svedruzic, National Renewable Energy Lab.; M. Hambourger, M. Gervaldo, Arizona State Univ.; T. J. McDonald, J. L. Blackburn, M. J. Heben, National Renewable Energy Lab.; D. Gust, A. L. Moore, T. A. Moore, Arizona State Univ.; M. L. Ghirardi, National Renewable Energy Lab. . . . . [6650-16]

Sonoelectrochemical synthesis of low-band-gap titania nanotubes for photoelectrochemical generation of hydrogen *(Invited Paper)*, M. Misra, Y. S. Sohn, K. S. Raja, V. R. Subramanian, Univ. of Nevada/Reno . . . . . [6650-17]

Photocatalytic hydrogen production using surface-modified titania nanoparticles, W. Choi, Pohang Univ. of Science and Technology (South Korea) . . . . . [6650-18]

Porphyrin-based nanostructures for solar hydrogen production, Z. Wang, L. Evans, C. J. Medforth, J. E. Miller, Sandia National Labs.; J. A. Shelnutt, Sandia National Labs. and Univ. of Georgia . . . . . [6650-19]

SESSION 6 . . . . . Thurs. 10:40 am to 12:10 pm

Hydrogen Generation and Storage Materials

Chair: **Gunnar Westin**, Uppsala Univ. (Sweden)

Generation and storage of hydrogen using tandem PV-PEC devices based on nanomaterials *(Invited Paper)*, J. Z. Zhang, L. Seballos, T. Lopez-Luke, A. Wolcott, Univ. of California/Santa Cruz; Y. Zhao, W. Smith, Y. He, The Univ. of Georgia . . . . . [6650-20]

Hydrogen storage in microporous metal-organic frameworks with exposed metal sites *(Invited Paper, Presentation Only)*, J. R. Long, M. Dinca, S. S. Kaye, W. S. Han, Univ. of California/Berkeley . . . . . [6650-21]

Nanostructured catalysts for fuel cell reactions *(Invited Paper)*, C. Zhong, Binghamton Univ. . . . . [6650-22]

Lunch/Exhibition Break

SESSION 7 . . . . . Thurs. 1:40 to 3:20 pm

Solar Hydrogen Devices and Applications

Chair: **Lionel Vayssieres**, National Institute for Materials Science (Japan)

Nitride-based photoelectrochemical cells *(Invited Paper)*, W. Walukiewicz, Lawrence Berkeley National Lab.; R. E. Jones, K. Alberi, Univ. of California/Berkeley and Lawrence Berkeley National Lab. . . . . [6650-23]

Soft x-ray and electron spectroscopy studies of oxide semiconductors for photoelectrochemical hydrogen production *(Invited Paper)*, C. Heske, Univ. of Nevada/Las Vegas . . . . . [6650-24]

Progress toward 10% solar-to-hydrogen efficiency in a hybrid, thin-film silicon photoelectrochemical (PEC) cell, A. P. Stavrides II, A. Kunrath, J. Hu, R. Treglio, A. Feldman, MVSystems, Inc.; B. Marsen, B. Cole, E. L. Miller, Univ. of Hawaii at Manoa; A. Madan, MVSystems, Inc. . . . . [6650-25]

Photoelectrochemical and photocatalytic properties of nanocrystalline TiO_2 electrodes, H. G. Oliveira, D. C. Nery, M. P. Paschoalino, W. F. Jardim, C. Longo, Univ. Estadual de Campinas (Brazil) . . . . . [6650-26]

SESSION 8 . . . . . Thurs. 3:50 to 5:30 pm

Photo-Catalysis at Titanium Oxides

Chair: **Jinghua Guo**, Lawrence Berkeley National Lab.

Solution processing of complex large band-gap semiconductors for photo-catalysis *(Invited Paper)*, G. Westin, M. Leideborg, Uppsala Univ. (Sweden) . . . . . [6650-27]

Ultrafast structural dynamics of photoactive metal complexes in solar hydrogen generation *(Invited Paper)*, L. X. Chen, Argonne National Lab. . . . . [6650-28]

Slow photons in TiO2 inverse opals: optical amplification and effect of disorder on the photocatalytic efficiency, J. I. L. Chen, Univ. of Toronto (Canada); G. von Freymann, Forschungszentrum Karlsruhe (Germany); S. Y. Choi, Univ. of Toronto (Canada); V. Kitaev, Wilfrid Laurier Univ. (Canada); G. A. Ozin, Univ. of Toronto (Canada) . . . . . [6650-29]

Synthesis and characterization of phase-pure anatase, brookite, and rutile nanoparticles, G. Oskam, D. Reyes-Coronado, G. Rodriguez-Gattorno, Ctr. de Investigación y de Estudios Avanzados (Mexico) . . . . . [6650-30]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC797 The Science and Technology of Organic Solar Cells (Peumans) Tuesday 28, 1:30 - 5:30 pm

Conference 6651

Monday-Tuesday 27-28 August 2007 • Proceedings of SPIE Vol. 6651

Photovoltaic Cell and Module Technologies

Conference Chairs: **Bolko von Roedern**, National Renewable Energy Lab.; **Alan E. Delahoy**, Energy Photovoltaics, Inc.

Program Committee: **Robert W. Collins, Jr.**, Univ. of Toledo; **Ravi Durvasula**, Lightfleet Corp.; **Alan L. Fahrenbruch**, Stanford Univ.; **Sheyu Guo**, Energy Photovoltaics, Inc.; **Steven G. Hegedus**, Univ. of Delaware; **Martha C. Lux-Steiner**, Hahn-Meitner-Institut Berlin (Germany); **James R. Sites**, Colorado State Univ.

Monday 27 August

Plenary Session . . . . . Mon. 1:30 to 5:30 pm

Solar Energy

1:30 pm: **The Solar-hydrogen Economy: An Analysis** *(Invited Paper),* W. Reynolds, CEO, Eco-Engineers, Inc.

2:00 pm: **Solar Hydrogen Production by Tandem Cell System Composed of Metal Oxide Semiconductor Film Photoelectrode and Dye-Sensitized Solar Cell** (Invited Paper, Presentation Only), H. Arakawa, Professor, Tokyo Univ. of Science (Japan); C. Shiraishi, M. Tatemoto, H. Kishida, D. Usui, A. Suma, A. Takamisawa, T. Yamaguchi, Tokyo Univ. of Science (Japan)

2:30 pm: **New Opportunities in Concentrator Photovoltaics with Low-cost 40% Efficient Multijunction III-V Solar Cells** *(Invited Paper, Presentation Only),* R. R. King, Principal Scientist, Photovoltaic Cell R&D, Spectrolab, Inc.; R. A. Sherif, G. S. Kinsey, D. C. Law, K. M. Edmondson, H. Yoon, H. L. Cotal, C. M. Fetzer, J. H. Ermer, P. Hebert, P. Pien, N. H. Karam, Spectrolab, Inc.

3:00 pm: **Module Design and Development: Progress and Opportunities** *(Invited Paper, Presentation Only),* D. Rose, Director of Module R&D, Sunpower Corp.

Coffee Break . . . . . 3:30 to 4:00 pm

4:00 pm: **Delivering Service at Scale: Old Requirements for the New Energy Industry** *(Invited Paper, Presentation Only),* M. Culpepper, VP/Strategic Marketing, SunEdison

4:30 pm: **PV Solar Electricity Market and Technology Development** *(Invited Paper, Presentation Only),* W. Hoffmann, CTO, Solar Business Group, Applied Materials, Inc.

5:00 pm: **The Solar Industry-DOE and NREL Programs to Accelerate Growth** *(Invited Paper, Presentation Only),* S. J. Eglash, Consultant to the National Renewable Energy Lab.

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:30 to 10:20 am

Solar Cell Operation

Chair: **Alan E. Delahoy**, Energy Photovoltaics, Inc.

Detailed balance: lifetimes and efficiencies *(Invited Paper),* H. J. Queisser, Max-Planck-Institut für Festkörperforschung (Germany) . . . . . [6651-01]

Efficiency enhancement in concentrator solar cells by dielectric micro-concentrators, O. Korech, J. M. Gordon, E. A. Katz, D. Feuermann, Ben-Gurion Univ. of the Negev (Israel); N. P. Eisenberg, Jerusalem College of Technology (Israel) . . . . . [6651-02]

Performance analysis of $CIGS_2$ thin film solar cells based on semiconductor properties, N. G. Dhere, Univ. of Central Florida . . . . . [6651-03]

Temperature dependence of Si-based thin film solar cells near phase boundary, K. Sriprapha, I. A. Yunaz, S. Y. Myong, A. Yamada, M. Konagai, Tokyo Institute of Technology (Japan) . . . . . [6651-04]

Diffractive and energy selective photonic crystal for thin-film tandem solar cells, A. Bielawny, Martin-Luther Univ. Halle-Wittenberg (Germany); A. von Rhein, Univ. Paderborn (Germany); R. B. Wehrspohn, Fraunhofer Institut für Werkstoffmechanik Halle (Germany); C. Rockstuhl, Univ. de Neuchâtel (Switzerland); M. Lisca, F. L. Lederer, Friedrich-Schiller-Univ. Jena (Germany); B. Lange, R. Zentel, Johannes Gutenberg Univ. Mainz (Germany); R. Carius, Forschungszentrum Jülich GmbH (Germany) . . . . . [6651-05]

SESSION 2 . . . . . Tues. 10:50 am to 12:00 pm

Solar Cell (Material/Process) Characterization

Chair: **Bolko von Roedern**, National Renewable Energy Lab.

Analysis and optimization of thin film photovoltaic materials and device fabrication by real time spectroscopic ellipsometry *(Invited Paper),* R. W. Collins, Jr., J. Li, N. J. Podraza, J. A. Stoke, D. Sainju, Univ. of Toledo . . . [6651-06]

A reliable optical method for in-situ process control for deposition of $Cu(In,Ga)Se_2$ thin layers for photovoltaics, R. Hesse, A. Caballero-Mesa, D. Abou-Ras, T. Unold, C. A. Kaufmann, H. W. Schock, Hahn-Meitner-Institut Berlin GmbH (Germany) . . . . . [6651-07]

Structural, microelectrical and microluminescent characterization of crystallized Si films, M. Al-Jassim, M. J. Romero, F. Liu, National Renewable Energy Lab. . . [6651-08]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:20 to 3:30 pm

Solar Cell Material/Cell Processing

Chair: **Robert W. Collins, Jr.**, Univ. of Toledo

Design consideration for nanocrystalline silicon solar cells *(Invited Paper),* X. Deng, Univ. of Toledo . . . . . [6651-09]

Textured, doped, ZnO thin films produced by a new process for a-Si and CIGS solar cell application, S. Guo, A. Patel, J. Cambridge, L. Sahoo, A. E. Delahoy, Energy Photovoltaics, Inc. . . . . [6651-10]

Deposition of a-Si:H and μc-Si:H using a novel linear RF source, B. B. Van Aken, C. Devilee, M. Dörenkämper, M. Geusebroek, M. Heijna, J. Löffler, W. J. Soppe, ECN Solar Energy (Netherlands) . . . . . [6651-11]

Correlation between the photoconductivity and the nanostructure of hot-wire deposited silicon-germanium alloys analyzed by anomalous small-angle x-ray scattering, G. J. Goerigk, Deutsches Elektronen-Synchrotron (Germany); D. Williamson, Colorado School of Mines . . . . . [6651-12]

Optimum base carrier density for spherical silicon solar cell with reflector cup, T. Minemoto, S. Nishimura, H. Takakura, Ritsumeikan Univ. (Japan) . . . . . [6651-13]

Modeling of Si-based solar cells with v-grooved surface texture by crosslight APSYS, Y. Xiao, Crosslight Software Inc. (Canada); M. Lestrade, Ecole Polytechnique de Montréal (Canada); Z. L. Li, Z. M. S. Li, Crosslight Software Inc. (Canada) . . . . . [6651-14]

SESSION 4 . . . . . Tues. 4:00 to 5:00 pm

PV Module/Manufacturing Issues

Chair: **Neelkanth G. Dhere**, Univ. of Central Florida

Electrical and photovoltaic properties through a large multicrystalline silicon ingot, S. Martinuzzi, I. Perichaud, O. Palais, D. Barakel, I.U.T. de l'Universite de Provence (France); M. Gaultier, PHOTOWATT International S.A.S (France)[6651-15]

Influence of the laser parameters on the patterning quality of thin-film silicon modules, S. Haas, A. Gordijn, H. Stiebig, Forschungszentrum Jülich GmbH (Germany) . . . . . [6651-16]

Enhancing efficiency in PV systems: a new solar cooling module, M. Buchanan, G. M. Aas, Norsk Solkraft AS (Norway); B. Moshfegh, Högskolan i Gävle (Sweden) . . . . . [6651-17]

✔ Poster/Demo Session-Tuesday

Poster authors will begin displaying posters after 10:00 am Tuesday morning. A poster session and demo session, with authors present at their posters, will be held Tuesday evening from 8:00 to 10:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **High-rate preparation of poly-si film by atmospheric-pressure plasma enhanced chemical transport with high feedstock utilization efficiency,** H. Ohmi, K. Kishimoto, D. Kamada, H. Kakiuchi, K. Yasutake, Osaka Univ. (Japan) . . . . . [6651-18]

✔ **Si film preparation by atmospheric pressure plasma enhanced chemical transport in H_2/He or H_2/Ar mixture,** D. Kamada, H. Ohmi, K. Kishimoto, H. Kakiuchi, K. Yasutake, Osaka Univ. (Japan) . . . . . [6651-19]

✔ **Fabrication of $Cu(In,Al)Se_2$ solar cells by three stage evaporation process,** T. Hayashi, T. Minemoto, T. Araki, H. Takakura, Ritsumeikan Univ. (Japan) . . . . . [6651-20]

✔ **Heterojunctions on the basis of $A_2B_2C_6$ films, deposited from solution,** E. F. Nasirov, S. Mamedova, A. S. Abdinov, M. A. Jafarov, Baku State Univ. (Azerbaijan) . . . . . [6651-21]

✔ **Design maximum power tracking of solar array charge regulator with CPLD technology,** C. P. Liu, J. S. Wu, Yuan Ze Univ. (Taiwan) . . . . . [6651-22]

✔ **Summary of a-Si PVT system in Thailand,** T. Nualboonrueng, P. Sichanugrist, National Science and Technology Development Agency (Thailand) . . . . . [6651-23]

✔ **Solar radiation splitting technology for enhancing solar energy conversion efficiency,** J. Avaliani, I. I. Kordzakhia, Institute OPTICA (Georgia) . . . . . [6651-24]

✔ **III-V on Ge multijunction solar cells as an energy source for wireless sensor networks,** N. V. Yastrebova, K. Hinzer, Univ. of Ottawa (Canada); D. Mason, CYRIUM Technologies Inc. (Canada); S. Desgreniers, H. Schriemer, Univ. of Ottawa (Canada); B. Riel, S. Fafard, CYRIUM Technologies Inc. (Canada); T. Hall, Univ. of Ottawa (Canada) . . . . . [6651-25]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC797 The Science and Technology of Organic Solar Cells (Peumans) Tuesday 28, 1:30 - 5:30 pm

Conference 6652

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6652

Optical Modeling and Measurements for Solar Energy Systems

Conference Chair: **Daryl R. Myers**, National Renewable Energy Lab.

Program Committee: **Ravi Durvasula**, Light Fleet Corp.; **Christian A. Gueymard**, Solar Consulting Services; **Hanno Ohvril**, Tartu Ülikool (Estonia); **Benjamin K. Tsai**, National Institute of Standards and Technology; **Frank Vignola**, Univ. of Oregon

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:30 am

Solar Energy Systems and Components

Chair: **Benjamin K. Tsai**, National Institute of Standards and Technology

Fast in-line surface topography and stress metrology for solar cell manufacturing for throughput requirements in excess of 2000 WPH, W. J. Walecki, F. Szondy, Sunrise Optical LLC; M. Hilali, Advent Solar, Inc. . . . . [6652-01]

Antenna-coupled MIM diodes for efficient energy conversion, R. M. Osgood III, B. R. Kimball, J. B. Carlson, K. Gregorcyzk, U.S. Army Soldier Systems Ctr. . . . . [6652-02]

Design and analysis of optical mechanism for concentration photovoltaic module, C. Chen, H. Kuo, H. Hong, H. Shin, Institute of Nuclear Energy Research (Taiwan) . . . . . [6652-03]

Inverse illumination method for characterization of CPC concentrators, A. P. Parretta, ENEA (Italy) and Univ. degli Studi di Ferrara (Italy); A. Antonini, CPower S.r.l. (Italy) and Univ. degli Studi di Ferrara (Italy); M. Stefancich, CPower S.r.l. (Italy); G. Martinelli, Univ. degli Studi di Ferrara (Italy); M. Armani, EURAC research (Italy) . . . . . [6652-04]

PV optics: a software package for solar cell and module design, B. L. Sopori, National Renewable Energy Lab. . . . . [6652-05]

Characterization of CPC solar concentrators by a laser method, A. P. Parretta, ENEA (Italy) and Univ. degli Studi di Ferrara (Italy); A. Antonini, M. Stefancich, CPower S.r.l. (Italy) and Univ. degli Studi di Ferrara (Italy); V. Franceschini, G. Martinelli, Univ. degli Studi di Ferrara (Italy); M. Armani, EURAC research (Italy) . . . . . [6652-06]

SESSION 2 . . . . . Sun. 11:00 am to 12:20 pm

Solar Radiation Measurements and Modeling I

Chair: **Daryl R. Myers**, National Renewable Energy Lab.

General cloud cover modifier for clear sky solar radiation models, D. R. Myers, National Renewable Energy Lab. . . . . [6652-07]

Passive separation of global irradiance into direct normal and diffuse components, M. J. Brooks, Univ. of KwaZulu-Natal (South Africa); D. R. Myers, National Renewable Energy Lab. . . . . [6652-08]

Evaluation of methods to correct for IR loss in Eppley PSP diffuse measurements, F. Vignola, Univ. of Oregon; C. N. Long, Pacific Northwest National Lab.; I. Reda, National Renewable Energy Lab. . . . . [6652-09]

The assessment of four different correction models applied to the diffuse radiation measured with a shadow ring using global and normal beam radiation beasurements for Beer Sheva, Israel, A. I. Kudish, E. G. Evseev, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6652-10]

Lunch Break

SESSION 3 . . . . . Sun. 1:20 to 3:00 pm

Solar Radiation Measurements and Modeling II

Chair: **Daryl R. Myers**, National Renewable Energy Lab.

Multi-annual variability of atmospheric transparency at four European locations, H. Ohvril, Tartu Ülikool (Estonia); O. Okulov, Estonian Meteorological and Hydrological Institute (Estonia); H. Teral, L. Neiman, Tartu Ülikool (Estonia); V. Russak, Tartu Observatory (Estonia); A. Kallis, Estonian Meteorological and Hydrological Institute (Estonia); M. Tee, Tartu Ülikool (Estonia); G. M. Abakumova, M.V. Lomonosov Moscow State Univ. (Russia); E. I. Terez, G. K. Gushchin, G. A. Terez, Vernadskiy Tavricheskiy National Univ. (Ukraine); N. Laulainen, Pacific Northwest National Lab. . . . . [6652-11]

Spectral effects on latitude-tilt and vertical PV modules as affected by latitude, air mass and climate, C. A. Gueymard, Solar Consulting Services . . . . . [6652-12]

Aerosol columnar optical properties in Estonia: AERONET observations, 2002-2006, H. Ohvril, H. Teral, M. Uustare, Tartu Ülikool (Estonia); O. Okulov, Estonian Meteorological and Hydrological Institute (Estonia); N. Laulainen, Pacific Northwest National Lab. . . . . [6652-13]

A simple modeling of spectral aerosol optical depth, M. Kannel, H. Ohvril, Tartu Ülikool (Estonia); O. Okulov, Estonian Meteorological and Hydrological Institute (Estonia); H. Teral, Tartu Ülikool (Estonia) . . . . . [6652-14]

Optimizing concentrating solar collection systems considering integrated performance over time band and location, T. L. R. Davenport, Optical Research Associates . . . . . [6652-15]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Plenary Session . . . . . Mon. 1:30 to 5:30 pm

Solar Energy

1:30 pm: **The Solar-hydrogen Economy: An Analysis** *(Invited Paper),* W. Reynolds, CEO, Eco-Engineers, Inc.

2:00 pm: **Solar Hydrogen Production by Tandem Cell System Composed of Metal Oxide Semiconductor Film Photoelectrode and Dye-Sensitized Solar Cell** (Invited Paper, Presentation Only), H. Arakawa, Professor, Tokyo Univ. of Science (Japan); C. Shiraishi, M. Tatemoto, H. Kishida, D. Usui, A. Suma, A. Takamisawa, T. Yamaguchi, Tokyo Univ. of Science (Japan)

2:30 pm: **New Opportunities in Concentrator Photovoltaics with Low-cost 40% Efficient Multijunction III-V Solar Cells** *(Invited Paper, Presentation Only),* R. R. King, Principal Scientist, Photovoltaic Cell R&D, Spectrolab, Inc.; R. A. Sherif, G. S. Kinsey, D. C. Law, K. M. Edmondson, H. Yoon, H. L. Cotal, C. M. Fetzer, J. H. Ermer, P. Hebert, P. Pien, N. H. Karam, Spectrolab, Inc.

3:00 pm: **Module Design and Development: Progress and Opportunities** *(Invited Paper, Presentation Only),* D. Rose, Director of Module R&D, Sunpower Corp.

Coffee Break . . . . . 3:30 to 4:00 pm

4:00 pm: **Delivering Service at Scale: Old Requirements for the New Energy Industry** *(Invited Paper, Presentation Only),* M. Culpepper, VP/Strategic Marketing, SunEdison

4:30 pm: **PV Solar Electricity Market and Technology Development** *(Invited Paper, Presentation Only),* W. Hoffmann, CTO, Solar Business Group, Applied Materials, Inc.

5:00 pm: **The Solar Industry-DOE and NREL Programs to Accelerate Growth** *(Invited Paper, Presentation Only),* S. J. Eglash, Consultant to the National Renewable Energy Lab.

Tuesday 28 August

✔ Poster/Demo Session-Tuesday

Poster authors will begin displaying posters after 10:00 am Tuesday morning. A poster session and demo session, with authors present at their posters, will be held Tuesday evening from 8:00 to 10:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Design of a sun concentrator with hexagonal facets,** J. Herrera-Vazquez, S. Vazquez y Montiel, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6652-16]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC797 The Science and Technology of Organic Solar Cells (Peumans) Tuesday 28, 1:30 - 5:30 pm

Photonics Devices + Applications

Part of SPIE Optics+Photonics

Symposium Chair:

Zakya H. Kafafi,
Naval Research Lab.

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Organic Photonics and Electronics

Detectors and Imaging Devices

Applications

Conference 6653

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6653

Linear and Nonlinear Optics of Organic Materials VII

Conference Chair: **Jean-Michel Nunzi**, Queens Univ. (Canada)

Cochairs: **Rachel Jakubiak**, Air Force Research Lab.; **Theodore G. Goodson III**, Univ. of Michigan; **Manfred Eich**, Technische Univ. Hamburg-Harburg (Germany)

Program Committee: **Kevin D. Belfield**, Univ. of Central Florida; **Antao Chen**, Univ. of Washington; **Koen J. Clays**, Katholieke Univ. Leuven (Belgium); **Alain F. Fort**, Institut de Physique et Chimie des Matériaux de Strasbourg (France); **Francois Kajzar**, Univ. d'Angers (France); **Satoshi Kawata**, Osaka Univ. (Japan); **Mark G. Kuzyk**, Washington State Univ.; **Charles Y. C. Lee**, Air Force Office of Scientific Research; **Kwang-Sup Lee**, Hannam Univ. (South Korea); **Geoffrey A. Lindsay**, Naval Air Warfare Ctr.; **Aristides A. Marcano**, Instituto Venezolano de Investigaciones Científicas (Venezuela); **Robert A. Norwood**, College of Optical Sciences/The Univ. of Arizona; **André P. Persoons**, College of Optical Sciences/The Univ. of Arizona; **Jayan Thomas**, College of Optical Sciences/The Univ. of Arizona; **Tatsuo Wada**, The Institute of Physical and Chemical Research (Japan); **A. Todd Yeates**, Air Force Research Lab.

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✔ **Kinetic study of quenching mechanism of rose bengal triplet state involved in photosensitization of oxygen in water using thermal lens spectroscopy,** J. Hung, A. Gonzalez, Instituto Venezolano de Investigaciones Científicas (Venezuela); J. A. Castillo, Univ. Central de Venezuela (Venezuela) . . . . . [6653-35]

✔ **Unidirectional bulk growth of pure and doped KDP crystals,** B. Subramaniyan, R. Perumalsamy, SSN College of Engineering (India) . . . . . [6653-36]

✔ **Detection of alterations in human sperm using magnetic orientation techniques,** L. Sakhnini, M. Dairi, Univ. of Bahrain (Bahrain); H. Manaa, Kuwait Univ. (Kuwait) [6653-37]

✔ **Possibility of using Rhodamine B dye in diagnosis of some men's diseases,** G. Khodjaev, Z. F. Ismailov, E. N. Kurtaliev, F. U. Khaydarova, Samarkand State Univ. (Uzbekistan); Z. M. Hamidov, Special Medical Ctr. (Uzbekistan); D. P. Khakimova, Samarkand No. 3 Polyclinic (Uzbekistan) . . . . . [6653-38]

✔ **Low-contrast polymer nanocomposite waveguides,** J. E. Castillo, J. M. Russo, R. K. Kostuk, The Univ. of Arizona . . . . . [6653-39]

✔ **Hydrogen bond interaction in the Raman spectra of chloroform tret-butanol solutions,** T. Farit, J. A. Abduvaxid, T. N. Ulugbek, S. Alisher, Samarkand State Univ. (Uzbekistan) . . . . . [6653-40]

✔ **Structure of salient vibration ν(H-Hal) absorption band of B...H-Hal complex in gaseous and condensed systems,** M. Gulamxon, Samarkand State Univ. (Uzbekistan); K. G. Tokhadze, Saint-Petersburg State Univ. (Russia) . . [6653-41]

✔ **Completely passive nonlinear transmission system using nonlinear absorbing medium and azobenzene films,** C. S. Yelleswarapu, D. V. G. L. N. Rao, Univ. of Massachusetts/ Boston; B. R. Kimball, U.S. Army Soldier Systems Ctr. . . . . [6653-42]

✔ **Enhanced photoinduced birefringence in hydrogen-bonded guest-host polymers,** A. Priimagi, Helsinki Univ. of Technology (Finland); F. J. Rodriguez, M. Kauranen, Tampere Univ. of Technology (Finland); M. Kaivola, Helsinki Univ. of Technology (Finland) . . . . . [6653-43]

✔ **New sol-gel hybrid materials for high energy applications in nonlinear optics,** I. Fortunati, R. Signorini, R. Bozio, G. Brusatin, M. Guglielmi, Univ. degli Studi di Padova (Italy); S. Dirè, Univ. degli Studi di Trento (Italy) . . . . . [6653-44]

✔ **Control of refractive index distribution for realization of high-functional optical polymer,** M. Asai, Y. Koike, Keio Univ. (Japan) . . . . . [6653-45]

✔ **Growth, optical and microhardness studies of trimethoprim malate: an organic NLO crystal,** F. Savarimuthu, B. K. Periyasamy, B. Thailampillai, National Institute of Technology/Tiruchirappalli (India) . . . . . [6653-46]

✔ **Protein-based integrated optical devices,** A. Dér, S. Valkai, L. Fábián, Biological Research Ctr. (Hungary); E. K. Wolff, Univ. Witten/Herdecke (Germany); J. J. Ramsden, Cranfield Univ. (United Kingdom); P. Ormos, Biological Research Ctr. (Hungary) . . . . . [6653-47]

✔ **Ultrafast excitation dynamics in organic multicromophoric systems after two-photon excitation,** O. P. Varnavski, T. G. Goodson III, Univ. of Michigan . . . . . [6653-48]

✔ **Quantitative description two-photon absorption in dipolar molecules with two-level model,** N. S. Makarov, A. Rebane, M. A. Drobizhev, Z. Suo, Montana State Univ./ Bozeman; C. W. Spangler, Rasiris, Inc.; B. D. Spangler, Sensopath Technologies, Inc.; F. Meng, MPA Technologies, Inc.; H. L. Anderson, C. J. Wilson, Univ. of Oxford (United Kingdom) . . . . . [6653-49]

✔ **Observation of new strong high-frequency feature in two-photon absorption spectrum of GFP and its description within three-level model with resonance enhancement,** M. A. Drobizhev, N. S. Makarov, A. Rebane, T. E. Hughes, Montana State Univ./Bozeman . . . . [6653-50]

✔ **One step inscription of surface relief multigratings,** S. Ahmadi-Kadjani, Univ. d'Angers (France); S. H. Kucharski, Politechnika Wroclawska (Poland); R. Barille, Univ. d'Angers (France); J. Nunzi, Queens Univ. (Canada) . . . . . [6653-51]

✔ **Concentration and solvent effects on the two-photon absorption of diphenylaminofluorene chromophore adducts of [60] fullerene,** R. Jakubiak, Air Force Research Lab.; R. Anandakathir, Univ. of Massachusetts/Lowell; H. I. Elim, W. Ji, National Univ. of Singapore (Singapore); L. Tan, Air Force Research Lab.; L. Y. Chiang, Univ. of Massachusetts/Lowell . . . . . [6653-52]

✔ **Two-photon resonant Raman scattering in a quantum well in a quantizing magnetic field,** R. K. Turniyazov, Samarkand State Univ. (Uzbekistan); B. Eshpulatov, Tashkent Univ. of Information Technologies (Uzbekistan) . . . . . [6653-53]

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:30 to 10:10 am

Organic Lasers

Chair: **Manfred Eich**, Technische Univ. Hamburg-Harburg (Germany)

Photonic superlattices for photonic crystal laser *(Keynote)*, K. J. Clays, Katholieke Univ. Leuven (Belgium) and Washington State Univ.; K. Baert, M. Van der Auweraer, R. Vallée, Katholieke Univ. Leuven (Belgium) . . . . . [6653-01]

An all-plastic polymer laser, K. D. Singer, Y. Wu, T. Boatwright, H. Song, A. Hiltner, J. Lott, C. Weder, E. Baer, Case Western Reserve Univ. . . . . [6653-02]

First order distributed feedback dye laser effect in reflection pumping geometry for nonlinear optical measurements, F. Chen, Univ. d'Angers (France); D. Gindre, Institut de Physique et Chimie des Matériaux de Strasbourg (France); J. Nunzi, Queens Univ. (Canada) . . . . . [6653-03]

Generation of squeezed laser by squeezing in organic materials in Raman process *(Invited Paper)*, P. S. Gupta, Indian School of Mines (India) . . . . . [6653-04]

SESSION 2 . . . . . Wed. 10:40 am to 12:00 pm

Multiphoton Effects

Chair: **Jean-Michel Nunzi**, Queens Univ. (Canada)

Two-photon and excited-state absorption in asymmetric phthalocyanines, push-pull phthalocyanines, and phthalocyanine: electron-acceptor diads, M. A. Drobizhev, N. S. Makarov, A. Rebane, Montana State Univ./Bozeman; G. de la Torre, T. Torres, Univ. Autónoma de Madrid (Spain); H. Wolleb, H. Spahni, Ciba Specialty Chemicals Inc. (Switzerland) . . . . . [6653-05]

Broad bandwidth near-IR two-photon absorption in conjugated porphyrins core dendrimers, A. Rebane, M. A. Drobizhev, N. S. Makarov, Montana State Univ./Bozeman; C. W. Spangler, Rasiris, Inc.; A. Gong, MPA Technologies, Inc.; F. Meng, Montana State Univ./Bozeman . . . . . [6653-06]

High sensitivity photo-thermal lens method for measurement of two-photon absorption, A. Marcano, K. D. Williams, N. Melikechi, Delaware State Univ. . . . . [6653-07]

Pump-lasers-induced multiphotonic photoprocesses and nonlinear phenomena of the near-lying singlet and triplet excited states in the geterociclic molecules in aggregation of matter, A. E. Obukhov, Moscow Mining Institute (Russia) . . . . . [6653-08]

Lunch/Exhibition Break

PHOTONICS

Conference 6653

SESSION 3 . . . . . Wed. 1:20 to 3:00 pm

Microstructures

Chair: **Aristides A. Marcano**, Instituto Venezolano de Investigaciones Científicas (Venezuela)

Polymer microphotonic structures *(Invited Paper)*, M. Eich, Technische Univ. Hamburg-Harburg (Germany) . . . [6653-09]

Optical storage through second harmonic signals in organic films, A. F. Fort, A. Barsella, A. J. Boeglin, L. Mager, Institut de Physique et Chimie des Matériaux de Strasbourg (France); D. Gindre, Propriétés Optiques des Matériaux et Applications (France); K. D. Dorkenoo, Institut de Physique et Chimie des Matériaux de Strasbourg (France) . . . . [6653-10]

Infiltration characterization of 2D and 3D photonic crystals using laser scatterometry, L. Wang, R. A. Norwood, A. Kropachev, N. N. Peyghambarian, College of Optical Sciences/ The Univ. of Arizona . . . . . [6653-11]

Molecular orientation by two-and multi-photon photoselection and nanofabrication in azo-polymers *(Invited Paper)*, Z. Sekkat, Osaka Univ. (Japan) . . [6653-12]

SESSION 4 . . . . . Wed. 3:30 to 5:30 pm

Optical Components

Chair: **Alain F. Fort**, Institut de Physique et Chimie des Matériaux de Strasbourg (France)

Effect of silicon dioxide nanoparticles on the characteristics of PQ/PMMA holographic filters, J. M. Russo, R. K. Kostuk, The Univ. of Arizona . . . . . [6653-13]

Design of low-loss and thermally stable GI POF prepared by novel polymer, K. Koike, Keio Univ. (Japan); Y. Okamoto, Polytechnic Univ.; Y. Koike, Keio Univ. (Japan) and ERATO-SORST/JST (Japan); H. Teng, Polytechnic Univ. . . [6653-14]

Zero zero-birefringence polymers for photonics devices, A. Tagaya, Japan Science and Technology Agency (Japan) and Keio Univ. (Japan); Y. Koike, Keio Univ. (Japan) and Japan Science and Technology Agency (Japan) . . . . . [6653-15]

Fiber optic transmission of analog signals, R. Furukawa, Y. Koike, Keio Univ. (Japan) . . . . . [6653-16]

Modal analysis of organic-inorganic hybrid planar waveguides for integrated optics, L. P. Pellegrino, Siemens Networks GmbH & Co. KG (Portugal) and Univ. de Aveiro (Portugal); P. M. P. Monteiro, Siemens Networks GmbH & Co. KG (Portugal) and Instituto de Telecomunicações (Portugal) and Univ. de Aveiro (Portugal); R. S. Ferreira, C. Vicente, P. André, L. D. Carlos, Univ. de Aveiro (Portugal) . . . . [6653-17]

Design of zero-birefringence optical polymer and analysis of birefringence of molecule dopant and polymer, H. Takahashi, A. Tagaya, Keio Univ. (Japan); H. Teng, Y. Okamoto, Polytechnic Univ.; Y. Koike, Keio Univ. (Japan) and ERATO-SORST, Japan Science and Technology Agency (Japan) . . . . . [6653-18]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:30 to 10:10 am

Photo-Induced Effects

Chair: **Rachel Jakubiak**, Air Force Research Lab.

A new mechanism of relaxation in poled guest-host systems: Monte Carlo analysis of aggregation scenario *(Invited Paper)*, A. C. Mitus, G. Pawlik, Politechnika Wroclawska (Poland); I. Rau, Commissariat à l'Energie Atomique (France); F. Kajzar, Univ. d'Angers (France); C. Andraud, Ecole normale supérieure de Lyon (France)[6653-19]

Photoinduced twisting behavior of chiral cyclic compounds, M. Kawamoto, T. Aoki, T. Wada, The Institute of Physical and Chemical Research (RIKEN) (Japan) . [6653-20]

Stability of all-optical poling in hydrogen-bonded guest-host polymers, F. J. Rodriguez, I. Kettunen, Tampere Univ. of Technology (Finland); A. Priimagi, Helsinki Univ. of Technology (Finland); M. Kauranen, Tampere Univ. of Technology (Finland) . . . . . [6653-21]

Nonlinear optical effects induced in polymer optical fibres *(Invited Paper)*, A. Samoc, M. J. Samoc, B. Luther-Davies, The Australian National Univ. (Australia); R. Barille, Univ. d'Angers (France); J. Nunzi, Queens Univ. (Canada) . . . . . [6653-22]

SESSION 6 . . . . . Thurs. 10:40 am to 12:10 pm

Nonlinear Devices

Chair: **Theodore G. Goodson III**, Univ. of Michigan

Multifunctional polyimides for tailored high-performance polymer electro-optical devices *(Invited Paper)*, A. J. Guenthner, M. E. Wright, S. Fallis, G. A. Lindsay, J. Cash, Naval Air Warfare Ctr.; D. Zang, C. Gaeta, M. C. Zounes, IPITEK, Inc. . . . . [6653-23]

Oven aging of optical modulators made from CLD and FTC in guest-host polycarbonate and side-chain polyimides, G. A. Lindsay, A. J. Guenthner, M. E. Wright, Naval Air Warfare Ctr.; M. Sanghadasa, The AEgis Technologies Group, Inc.; P. R. Ashley, U.S. Army Aviation and Missile Command [6653-24]

Optical bistability of terchiophene/polymethylmethacrylate composite film, S. Ochiai, Aichi Institute of Technology (Japan); S. Mototani, Aichi Institute of Tchnology (Japan); K. Kojima, T. Mizutani, Aichi Institute of Technology (Japan) . . . . . [6653-25]

Very low half-wave voltage and high electro-optic effect in Mach-Zehnder modulators using nonlinear optical polymers, D. Jin, D. Huang, B. Chen, L. Zhang, H. Chen, D. Tolstedt, S. Condon, A. M. Barklund, G. Yu, E. Miller, Y. Fang, B. Li, R. Dinu, Lumera Corp. . . . . [6653-26]

Lunch/Exhibition Break

SESSION 7 . . . . . Thurs. 1:40 to 3:10 pm

Second Order Effects

Chair: **Robert A. Norwood**, College of Optical Sciences/The Univ. of Arizona

Structure-property relationship in organometallic compounds regarding SHG *(Invited Paper)*, J. Heck, M. H. Prosenc, Univ. Hamburg (Germany); T. Meyer-Friedrichsen, H.C. Starck GmbH & Co. KG (Germany); H. Kuball, G. Archetti, Univ. Kaiserslautern (Germany); Y. Luo, Kungliga Tekniska Högskolan (Sweden) . . . . . [6653-27]

Second-harmonic generation investigation of the interfacial charge-transfer-induced polarity of C_{60} thin film, S. W. Chan, Univ. d'Angers (France); J. Nunzi, Queens Univ. (Canada); M. A. Rutkis, I. Muzikante, Latvijas Univ. (Latvia) . . . . . [6653-28]

Plasmon enhanced second order nonlinear optical response of ionic self-assembled multilayer films, C. Durak, K. Chen, H. Robinson, A. Garg, R. M. Davis, J. R. Heflin, Virginia Polytechnic Institute and State Univ. . . . . [6653-29]

Optical absorption and SHG in PMMA: DR1 thin films as function of poling time, J. A. Garcia-Macedo, A. Franco, G. Valverde-Aguilar, C. Aguilar-Gutiérrez, Univ. Nacional Autónoma de México (Mexico) . . . . . [6653-30]

SESSION 8 . . . . . Thurs. 3:40 to 5:10 pm

Molecular Engineering

Chair: **Tatsuo Wada**, The Institute of Physical and Chemical Research (Japan)

Quantum two-photon absorption of an organic material by entangled photon pairs in spontaneous parametric down-conversion *(Invited Paper)*, D. Lee, T. G. Goodson III, Univ. of Michigan . . . . . [6653-31]

Modulated conjugation for record high intrinsic hyperpolarizabilities, K. J. Clays, Katholieke Univ. Leuven (Belgium) and Washington State Univ.; J. Pérez-Moreno, Katholieke Univ. Leuven (Belgium); M. G. Kuzyk, Washington State Univ.; Y. Zhao, Technical Institute of Physics and Chemistry (China) . . . . . [6653-32]

NLO properties of dithienothiophene-based chromophores: a comparison study between the donor/donor and donor/acceptor substitution patterns, M. C. Ruiz Delgado, J. Casado, V. Hernández, J. T. López Navarrete, Univ. de Málaga (Spain); O. Kim, H. Y. Woo, Naval Research Lab.; J. Orduna, J. Garín, B. Villacampa, Univ. de Zaragoza (Spain) . . [6653-33]

Third harmonic generation and luminescence of some rare earth doped thin layers based on ZnO nanostructures, E. M. Alaqui Lamrani, M. Addou, Z. Sofiani, Univ. Ibn Tofail (Morocco) . . . . . [6653-34]

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Conference 6654

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6654

Liquid Crystals XI

Conference Chair: **Iam Choon Khoo**, The Pennsylvania State Univ.

Program Committee: **Timothy J. Bunning**, Air Force Research Lab.; **Shaw H. Chen**, Univ. of Rochester; **Neil Collings**, Univ. of Cambridge (United Kingdom); **Jean-Pierre Huignard**, Thales Research & Technology (France); **Tomiki Ikeda**, Tokyo Institute of Technology (Japan); **Francesco F. Simoni**, Univ. Politecnica delle Marche (Italy); **David M. Walba**, Univ. of Colorado/Boulder

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:10 am

Electro-Optics LC and Polarized LED

Chair: **Iam Choon Khoo**, The Pennsylvania State Univ.

Polarized organic light-emitting diodes as energy-efficient backlight for liquid-crystal displays *(Invited Paper)*, A. C. Chen, S. H. Chen, Univ. of Rochester; C. W. Tang, Eastman Kodak Co. . . . . [6654-01]

Polarization dependent photoactuation in azobenzene LC polymers, T. J. White, General Dynamics Information Technology; V. P. Tondiglia, L. V. Natarajan, Science Applications International Corp.; N. V. Tabirian, S. V. Serak, V. A. Grozhik, BEAM Engineering for Advanced Measurements Co.; T. J. Bunning, R. A. Vaia, Air Force Research Lab. . . . . [6654-02]

Three-dimensional alignment of liquid crystals in nanostructured porous thin films *(Invited Paper)*, N. Wakefield, J. C. Sit, Univ. of Alberta (Canada) . . . . [6654-03]

Polarization-independent, tunable optical filters based on liquid-crystal polarization gratings, E. Nicolescu, M. J. Escuti, North Carolina State Univ. . . . . [6654-04]

SESSION 2 . . . . . Sun. 10:40 am to 12:20 pm

Electro- and Nonlinear-Optical LC and Devices

Chair: **Neil Collings**, Univ. of Cambridge (United Kingdom)

Nonlinear effects in a liquid-crystal optical oscillator *(Invited Paper)*, S. Residori, U. Bortolozzo, Institut Non Linéaire de Nice Sophia Antipolis (France); J. Huignard, Thales Research & Technology (France); A. Montina, T. F. Arecchi, Univ. degli Studi di Firenze (Italy) . . . . . [6654-05]

Toward low-threshold and high efficiency tunable chiral nematic and blue phase liquid crystal lasers *(Invited Paper)*, H. J. Coles, Univ. of Cambridge (United Kingdom) . . . . . [6654-06]

Polysilane 1xN optical splitters fabricated by UV laser direct drawing, S. Kobayashi, T. Suda, Y. Masuko, Chitose Institute of Science and Technology (Japan); K. Ogura, H. Tsushima, Nippon Paint Co.,Ltd. (Japan) . . . . . [6654-07]

Photo-alignment of glassy-nematic liquid crystals, A. Trajkovska, C. K. Kim, J. U. Wallace, S. H. Chen, Univ. of Rochester . . . . . [6654-08]

Lunch Break

SESSION 3 . . . . . Sun. 1:20 to 3:00 pm

Electro- and Nonlinear-Optical LC and Processes

Chair: **Timothy J. Bunning**, Air Force Research Lab.

Optical and thermal tuning of cholesteric liquid-crystal selective reflection wavelengths *(Invited Paper)*, L. V. Natarajan, R. L. Sutherland, V. P. Tondiglia, Science Applications International Corp.; J. M. Wofford, Air Force Research Lab.; S. A. Siwecki, Science Applications International Corp.; H. Koerner, R. A. Vaia, T. J. Bunning, Air Force Research Lab. . . . . [6654-09]

Enhanced photosensitivity and functionality of hybrid liquid-crystal structures *(Invited Paper)*, M. Kaczmarek, O. Buchnev, Univ. of Southampton (United Kingdom) [6654-10]

Implementation of colorless shutter-based free-space optical interconnections using ferroelectric liquid-crystal spatial light modulators, H. Chou, N. Collings, T. D. Wilkinson, Univ. of Cambridge (United Kingdom); F. Zhang, Univ. of Southampton (United Kingdom); W. A. Crossland, Univ. of Cambridge (United Kingdom) . . . . . [6654-11]

Computer simulation of liquid-crystal spatial light modulator based on surface plasmon resonance, P. Kogan, Ben Gurion University of the Negev (Israel); B. Apter, Holon Institute of Technology (Israel); U. Efron, Ben-Gurion Univ. of the Negev (Israel) and Holon Institute of Technology (Israel); I. Baal-Zedaka, Holon Institute of Technology (Israel) [6654-12]

SESSION 4 . . . . . Sun. 3:30 to 4:50 pm

Liquid-Crystal Optics

Chair: **Andres Diaz**, The Pennsylvania State Univ.

Super-structured smectics and their application *(Invited Paper)*, I. Nishiyama, Dainippon Ink and Chemicals, Inc. (Japan); T. Yamamoto, National Institute of Advanced Industrial Science and Technology (Japan); J. Yamamoto, Kyoto Univ. (Japan); H. Yokoyama, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [6654-13]

Using time-dependent density functional theory (TD-DFT) in the design and development of near-IR dopants for liquid-crystal device applications, K. L. Marshall, R. Wang, M. Coan, K. Leskow, R. Pauszek, A. Moore, Univ. of Rochester . . . . . [6654-14]

Optical aspects of inhomogeneous molecular order in confined NLC systems: Monte Carlo studies *(Invited Paper)*, A. C. Mitus, G. Pawlik, Politechnika Wroclawska (Poland); F. Kajzar, Univ. d'Angers (France) . . . . . [6654-15]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:30 to 10:30 am

LC Lasers and Optoelectronics

Chair: **Shaw H. Chen**, Univ. of Rochester

Electrically tunable laser based on dye-doped cholesteric liquid-crystal with negative dielectric anisotropy *(Invited Paper)*, A. Y. Fuh, T. Lin, H. Jau, National Cheng Kung Univ. (Taiwan); C. Chen, National Chia-Yi Univ. (Taiwan); T. Wei, National Chung Cheng Univ. (Taiwan) . . . . . [6654-16]

Mesophase semiconductors and the field effect transistors *(Invited Paper)*, Y. Shimizu, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [6654-17]

Electro-optical effect coupled with macroscopic deformation of swollen nematic elastomers *(Invited Paper)*, K. Urayama, A. Fukunaga, S. Honda, T. Takigawa, Kyoto Univ. (Japan); I. Kobayashi, Nissan Chemical Industries, Ltd. (Japan) . . . . . [6654-18]

Photochemical control of structural color of composite materials consisting of inverse opal structure and azo-polymer liquid crystals *(Invited Paper)*, S. Kurihara, M. Moritsugu, S. Kim, T. Ogata, T. Nonaka, Kumamoto Univ. (Japan) . . . . . [6654-19]

SESSION 6 . . . . . Mon. 11:00 am to 12:30 pm

Novel Index and Electro-Optical Liquid-Crystalline Materials

Chair: **Jeremy C. Sit**, Univ. of Alberta (Canada)

Studies of the fundamental limits of electro-optical modulation *(Invited Paper)*, U. Efron, R. Israeli, Ben-Gurion Univ. of the Negev (Israel); B. Apter, B. Lembrikov, Holon Institute of Technology (Israel) . . . . . [6654-20]

Optical properties of organic-based periodic structures *(Invited Paper)*, D. E. Lucchetta, F. Vita, R. Castagna, O. Francescangeli, F. F. Simoni, Univ. Politecnica delle Marche (Italy) and Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia (CNISM) (Italy) . . . . . [6654-21]

Nano-dispersed liquid-crystalline zero or negative-index frequency selective structures for filters and switch applications *(Invited Paper)*, I. C. Khoo, A. Diaz, S. Kubo, T. Mallouk, D. Kwon, J. H. Park, D. H. Werner, The Pennsylvania State Univ. . . . . [6654-22]

Lunch Break

SESSION 7 . . . . . Mon. 1:30 to 3:30 pm

Novel Liquid Crystals and Optoelectronics

Chair: **Iam Choon Khoo**, The Pennsylvania State Univ.

Unique optical and physical properties with stimuli-sensitivity in soft transparent nanocomposite gels *(Invited Paper)*, K. Haraguchi, Kawamura Institute of Chemical Research (Japan) . . . . . [6654-23]

Development of deVries SmA* materials for liquid-crystal wavequide applications *(Invited Paper)*, E. D. Korblova, D. M. Walba, Univ. of Colorado at Boulder; S. R. Davis, S. D. Rommel, Vescent Photonics Inc.; R. Shao, Univ. of Colorado at Boulder; M. Talarico, Univ. degli Studi della Calabria (Italy); M. Nakata, N. A. Clark, Univ. of Colorado at Boulder . [6654-24]

Multidomain liquid-crystal alignment properties on anchoring controllable polymer surface *(Invited Paper)*, R. Yamaguchi, S. Sato, Akita Univ. (Japan) . . . . . [6654-25]

Switching properties of VAN LCoS devices with ultra-microscale electrodes *(Invited Paper)*, R. Ghannam, Univ. of Cambridge (United Kingdom); R. W. James, Univ. College London (United Kingdom); N. Collings, W. A. Crossland, Univ. of Cambridge (United Kingdom); A. Fernandez, S. E. Day, Univ. College London (United Kingdom) . . . . . [6654-26]

Conference 6654

Tuesday 28 August

✔ Poster/Demo Session-Tuesday

Poster authors will begin displaying posters after 10:00 am Tuesday morning. A poster session and demo session, with authors present at their posters, will be held Tuesday evening from 8:00 to 10:00 pm. Light refreshments will be served.

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Conference 6655

Sunday-Wednesday 26-29 August 2007 • Proceedings of SPIE Vol. 6655

Organic Light Emitting Materials and Devices XI

Conference Chair: **Zakya H. Kafafi**, Naval Research Lab.

Cochair: **Franky So**, Univ. of Florida

Program Committee: **Chihaya Adachi**, Kyushu Univ. (Japan); **Alasdair J. Campbell**, Imperial College London (United Kingdom); **Brian W. D'Andrade**, Universal Display Corp.; **Anil R. Duggal**, GE Global Research; **Tukaram K. Hatwar**, Eastman Kodak Co.; **Andrew B. Holmes**, The Univ. of Melbourne (Australia); **Ghassan E. Jabbour**, Arizona State Univ.; **Junji Kido**, Yamagata Univ. (Japan); **Changhee Lee**, Seoul National Univ. (South Korea); **Chun S. Lee**, City Univ. of Hong Kong (Hong Kong China); **Michele Muccini**, Istituto per lo Studio dei Materiali Nanostrutturati (Italy); **Ifor D. W. Samuel**, Univ. of St. Andrews (United Kingdom); **Joseph Shinar**, Iowa State Univ.

Sunday 26 August

SESSION 1 . . . . . Sun. 1:00 to 3:05 pm

OLED Materials I

Chair: **Zakya H. Kafafi**, Naval Research Lab.

Synthesis and electroluminescent properties of poly(p-phenylenevinylene)s with 3',3'-diheptyl-3,4-propylenedioxythiophene pendant group for light-emitting diode applications *(Invited Paper)*, S. Jin, Pusan National Univ. (South Korea) . . . . . [6655-01]

Liquid crystalline semiconducting materials and nanostructures *(Invited Paper)*, K. D. Singer, V. Duzhko, Case Western Reserve Univ. . . . . [6655-02]

Origin of the different emission wavelengths in Alq_3 analyzed by solid-state NMR *(Invited Paper)*, H. Kaji, Kyoto Univ. (Japan) . . . . . [6655-03]

On the oxidation of fluorenes and the synthesis of low defect polyfluorenes *(Invited Paper)*, A. B. Holmes, S. Y. Cho, A. C. Grimsdale, S. E. Watkins, The Univ. of Melbourne (Australia) . . . . . [6655-04]

Recent progress in deep-blue phosphorescent OLEDs *(Invited Paper)*, C. D. Schildknecht, C. Lennartz, K. Kahle, O. Molt, E. Fuchs, J. Rudolph, P. Amrhein, J. Proelss, I. Muenster, BASF AG (Germany) . . . . . [6655-05]

SESSION 2 . . . . . Sun. 3:35 to 5:35 pm

OLED Materials II

Chair: **Franky So**, Univ. of Florida

Designing molecules using heteroaromatic building blocks *(Invited Paper)*, L. S. Sapochak, A. B. Padmaperuma, P. Vecchi, H. Qiao, P. E. Burrows, Pacific Northwest National Lab. . . . . [6655-06]

Molecular organization in organic thin films employed as active layers in light-emitting transistors *(Invited Paper)*, M. Muccini, Istituto per lo Studio dei Materiali Nanostrutturati (Italy) . . . . . [6655-07]

New charge-transporting and emitting amorphous molecular materials for organic electroluminescent devices *(Invited Paper)*, Y. Shirota, Fukui Univ. of Technology (Japan); K. Okumoto, K. Hashimoto, M. Maeda, T. Yamate, M. Tanaka, H. Kageyama, Osaka Univ. (Japan) . . . . . [6655-08]

Organic materials for blue emission organic electroluminescent devices *(Invited Paper)*, J. Shi, Army Research Lab. . . . . [6655-09]

Efficient blue organic light-emitting diodes with 4H-cyclopenta[def]phenanthrene, H. Suh, Y. Jin, S. Song, C. Yoo, J. Kim, Pusan National Univ. (South Korea) . . [6655-10]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 3 . . . . . Mon. 8:30 to 10:05 am

Triplet Emitters

Chair: **Linda S. Sapochak**, Pacific Northwest National Lab.

Spin-orbit coupling routes and OLED performance: studies of blue-light emitting Ir(III) and Pt(II) complexes *(Invited Paper)*, H. Yersin, A. F. Rausch, Univ. Regensburg (Germany); P. I. Djurovich, M. E. Thompson, Univ. of Southern California . . . . . [6655-11]

High efficiency phosphorescent organic light emitting diodes at high current density *(Invited Paper)*, J. Kim, J. Kang, W. Jung, Seoul National Univ. (South Korea) [6655-12]

Harvest of triplet excitons in fluorescence emission layer based on a wide band gap host of TcTa for efficient white organic light emitting diodes, J. Lee, H. Y. Chu, Y. S. Yang, L. M. Do, S. M. Chung, S. K. Park, C. Hwang, Electronics and Telecommunications Research Institute (South Korea)[6655-13]

Blue phosphorescent emitter microcavity OLED devices *(Invited Paper)*, P. B. Mackenzie, B. W. D'Andrade, V. I. Adamovich, M. S. Weaver, Universal Display Corp. [6655-14]

SESSION 4 . . . . . Mon. 10:35 am to 12:00 pm

Device Architectures

Chair: **Chihaya Adachi**, Kyushu Univ. (Japan)

Spectrally narrowed edge emission from organic light-emitting diodes *(Invited Paper)*, Y. Tian, Z. Gan, Z. Zhou, Iowa State Univ.; J. Kang, Q. Park, Korea Univ. (South Korea); D. W. Lynch, J. Shinar, Iowa State Univ. . . . . [6655-15]

Highly efficient fully transparent inverted OLED, J. Meyer, T. Winkler, S. Hamwi, M. Kröger, P. Görrn, H. Johannes, T. J. Riedl, W. Kowalsky, Technische Univ. Braunschweig (Germany); T. D. Dobbertin, D. Becker, E. Lang, OSRAM Opto Semiconductors GmbH (Germany) . . . . . [6655-16]

Fabrication of multi-layered polymer light emitting diodes by resonant infrared pulsed laser deposition, S. L. Johnson, Vanderbilt Univ.; H. K. Park, Appliflex LLC; R. F. Haglund, Jr., Vanderbilt Univ. . . . . [6655-17]

Technical issues of stainless steel foil substrates for OLED display applications, Y. Hong, Seoul National Univ. (South Korea) . . . . . [6655-18]

Lunch Break

SESSION 5 . . . . . Mon. 1:00 to 3:00 pm

Novel Devices

Chair: **Michele Muccini**, Istituto per lo Studio dei Materiali Nanostrutturati (Italy)

OLEDs from ionic transition metal complexes *(Invited Paper)*, G. G. Malliaras, Cornell Univ. . . . . [6655-19]

Electrospun light-emitting nanofibers, J. D. Slinker, J. Moran-Mirabal, J. A. DeFranco, H. D. Abruna, H. G. Craighead, G. G. Malliaras, Cornell Univ. . . . . [6655-20]

Organic light-emitting transistors containing laterally arranged heterojunction *(Invited Paper)*, Y. Liu, Institute of Chemistry (China) . . . . . [6655-21]

Novel non-planar and ITO-free organic light-emitting device architectures *(Invited Paper)*, M. Shtein, Univ. of Michigan . . . . . [6655-22]

Ambipolar organic field effect transistor aiming for efficient electroluminescence *(Invited Paper)*, C. Adachi, M. Yahiro, T. Sakanoue, H. Nakanotani, Kyushu Univ. (Japan) . . [6655-23]

SESSION 6 . . . . . Mon. 3:30 to 5:55 pm

Lasers

Chair: **Brian K. Crone**, Los Alamos National Lab.

Photonic feedback structures for organic lasers: modeling and experiment *(Invited Paper)*, R. F. Mahrt, T. Stoeferle, N. Moll, R. Harbers, IBM Zürich Research Lab. (Switzerland) . . . . . [6655-24]

Pump-laser-induced multiphotonic photoprocesses, A. E. Obukhov, Moscow Mining Institute (Russia) . . . . . [6655-25]

Loss processes in organic double-heterostructure laser diodes, C. Gaertner, C. Karnutsch, U. Lemmer, Univ. Karlsruhe (Germany) . . . . . [6655-26]

Towards an electrically driven organic laser, B. Wallikewitz, D. Hertel, K. Meerholz, Univ. zu Köln (Germany) . . [6655-27]

Optical gain in Coumarin 545T doped Tris (8-hydroxy-chinolinato)aluminium thin films, T. Rabe, P. Görrn, T. J. Riedl, W. Kowalsky, Technische Univ. Braunschweig (Germany) . . . . . [6655-28]

Polymer lasers: recent advances, T. J. Riedl, T. Rabe, P. Görrn, Technische Univ. Braunschweig (Germany); T. Weinmann, J. Wang, P. Hinze, Physikalisch-Technische Bundesanstalt (Germany); F. Galbrecht, U. Scherf, Bergische Univ. Wuppertal (Germany); W. Kowalsky, Technische Univ. Braunschweig (Germany) . . . . . [6655-29]

Diode-pumped polymer lasers, G. A. Turnbull, A. E. Vasdekis, G. Tsiminis, I. D. W. Samuel, Univ. of St. Andrews (United Kingdom) . . . . . [6655-30]

Tuesday 28 August

Plenary Session . . . . . Tues. 8:30 to 10:00 am

OLEDs/SSL

8:30 am: **Solid State Lighting: Illumination and Communication** *(Invited Paper, Presentation Only),* I. E. Ashdown, Senior Research Scientist for TIR Systems Ltd. (Canada) and Senior Software Engineer for Lighting Analysts Inc. and President of by.Heart Consultants Ltd. (Canada)

9:15 am: **Organic LEDs for Lighting Applications** *(Invited Paper, Presentation Only),* J. Kido, Professor, Yamagata Univ. (Japan) and General Director, Research Institute for Organic Electronics (Japan)

SESSION 7 . . . . . Tues. 10:30 am to 12:10 pm

OLEDs and Solid State Lighting

Joint session with Conference 6669: Seventh International Conference on Solid State Lighting

Chair: **Hideyuki Murata**, Japan Advanced Institute of Science and Technology (Japan)

Employing microcavity effects to enhance performances of white-emitting OLEDs *(Invited Paper)*, C. Wu, Y. Lu, T. Cho, National Taiwan Univ. (Taiwan) . . . . . [6655-31]

An overview of the DOE SSL program *(Invited Paper)*, P. M. Pattison, National Energy Technology Lab. . . . . [6669-20]

Low-cost manufacturing processes for OLEDs *(Invited Paper)*, J. Liu, C. Ye, L. N. Lewis, A. R. Duggal, GE Global Research . . . . . [6655-32]

Circadian photoreception and the use of physiologically adaptive LEDs (PALs) to treat dysfunctions of the circadian system *(Invited Paper)*, G. Tosini, Morehouse School of Medicine; I. T. Ferguson, Georgia Institute of Technology . . . . . [6669-21]

Lunch/Exhibition Break

SESSION 8 . . . . . Tues. 1:15 to 3:10 pm

OLED Lighting

Chair: **Jie Liu**, GE Global Research

Super-flexible electroluminescent systems for both white light and near-infrared illumination *(Invited Paper)*, E. A. Bruton, P. J. Kinlen, F. Doering, Crosslink . . . . . [6655-33]

Improving the light extraction efficiency of polymer LEDs using microcavities and photonic crystals *(Invited Paper)*, D. G. Lidzey, The Univ. of Sheffield (United Kingdom)[6655-34]

Concepts for high efficient white OLEDs for lighting applications *(Invited Paper)*, A. Hunze, S. Seidel, R. Krause, O. Weiss, C. Chiu, G. Schmid, F. Kozlowski, Siemens AG (Germany); W. Kowalsky, H. Johannes, J. Meyer, M. Kröger, Technische Univ. Braunschweig (Germany); T. D. Dobbertin, OSRAM Opto Semiconductors GmbH (Germany) . [6655-35]

White phosphorescent organic light emitting devices, B. W. D'Andrade, Universal Display Corp. . . . . [6655-36]

Light extraction for a doubly resonant cavity organic LED: the RC2LED, P. Vandersteegen, S. Mladenovski, Univ. Gent (Belgium); V. van Elsbergen, G. Gaertner, Philips Research Labs. (Germany); P. Bienstman, K. Neyts, R. G. Baets, Univ. Gent (Belgium) . . . . . [6655-37]

SESSION 9 . . . . . Tues. 3:40 to 5:40 pm

Device Physics

Chair: **Chung-Chih Wu**, National Taiwan Univ. (Taiwan)

Emission and degradation mechanism of PLED *(Invited Paper)*, M. Koden, Sharp Corp. (Japan) . . . . . [6655-38]

Where is the dipole?: measuring and optimizing the emissive dipole distribution in polymeric OLEDs, M. C. Gather, A. Köhnen, K. Meerholz, Univ. zu Köln (Germany) . . . . . [6655-39]

Exciton-photon coupling in optical microcavities and applications in organic optoelectronic devices *(Invited Paper)*, R. J. Holmes, Univ. of Minnesota . . . . . [6655-40]

Intrinsic degradation mechanism of organic light-emitting devices fabricated under ultra-high vacuum condition *(Invited Paper)*, H. Murata, Japan Advanced Institute of Science and Technology (Japan) . . . . . [6655-41]

Unraveling organic optoelectronic device function on the single molecule level *(Invited Paper)*, J. M. Lupton, The Univ. of Utah . . . . . [6655-42]

✔ Poster/Demo Session-Tuesday

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✔ **White light-emitting organic electroluminescent device base on a new orange organometallic iridium complexes,** T. Shieh, H. Huang, P. Liu, M. Tseng, J. Liu, Industrial Technology Research Institute (Taiwan) . [6655-46]

✔ **Highly efficient electrophosphorescent and electrofluorescent organic light-emitting diodes by sequential doping,** Y. Divayana, X. Sun, Nanyang Technological Univ. (Singapore) . . . . . [6655-47]

✔ **Frequency dependence in polymer light emitting diodes based on poly[(9,9-dioctylfluorenyl-2,7-diyl)-co-(1,4-phenylene)],** A. R. Mohd Yusoff, Johannes Kepler Univ. Linz (Austria) . . . . . [6655-48]

✔ **Optical characteristics of the OLED with microlens array film attachment,** H. Lin, J. Lee, National Taiwan Univ. (Taiwan); M. Wei, National Dong Hwa Univ. (Taiwan); K. Chen, S. Hsu, Y. Ho, C. Lin, National Taiwan Univ. (Taiwan) . . . . . [6655-49]

✔ **Oscillation method for uniform formation of solution-processed organic films and its application to organic light-emitting devices,** T. Kitano, S. Naka, M. Shibata, H. Okada, Univ. of Toyama (Japan) . . . . . [6655-50]

✔ **Influence of cavity effects on light out-coupling efficiency in organic light emitting devices,** J. Lee, K. Roy-Choudhury, F. So, Univ. of Florida . . . . . [6655-51]

✔ **Novel strategies for the fabrication of solution processed multilayer OLEDs: oxetane crosslinking without photoacid,** A. Köhnen, N. Riegel, D. C. Müller, K. Meerholz, Univ. zu Köln (Germany) . . . . . [6655-52]

✔ **Lasing characteristics of optically-pumped edge-emitting organic semiconductor laser,** H. Yamaoka, S. N. Takahashi, M. Shibamoto, Keio Univ. (Japan) . . . . [6655-53]

✔ **New conjugated polymer (PININE) with stability for LEDs,** S. Song, Y. Jin, K. Kim, J. Kim, S. Kim, Pusan National Univ. (South Korea); J. Kim, Univ. of California/ Santa Barbara and Pusan National Univ. (South Korea); S. Park, Pusan National Univ. (South Korea); K. Lee, Gwangju Institute of Science and Technology (South Korea); H. Suh, Pusan National Univ. (South Korea) . . . . . [6655-54]

✔ **Exclusive inkjet printed poly(3,4-ethylenedioxythiophene): polystyrenesulfonate as anode in polymer light-emitting diodes,** W. Chou, S. Lin, M. Chang, J. Horng, H. Cheng, National Cheng Kung Univ. (Taiwan) . . . . . [6655-55]

✔ **A gas barrier film composed of SiO_2/Al_2O_3 multilayers on flexible substrates,** J. Liao, P. Liu, Y. Yeh, M. Tseng, Industrial Technology Research Institute (Taiwan) . [6655-56]

✔ **Studies of blue organic electroluminescent devices using the polymer/dopant systems as light-emitting layer,** F. Wu, H. Cheng, W. Chou, National Cheng Kung Univ. (Taiwan) . . . . . [6655-57]

✔ **Carrier injection and bipolar transport in NPB for single-layer OLEDs,** S. Tse, K. Tsung, S. So, Hong Kong Baptist Univ. (Hong Kong China) . . . . . [6655-58]

✔ **Live and let die of polymeric oxonium ions in multi-layer OLEDs,** P. Zacharias, M. C. Gather, K. Meerholz, Univ. zu Köln (Germany) . . . . . [6655-59]

✔ **Numerical simulation of top-emitting organic light-emitting diodes with electron and hole blocking layers,** S. Chang, C. Yang, National Changhua Univ. of Education (Taiwan) . . . . . [6655-60]

✔ **Numerical simulation of bright white multilayer organic light-emitting diodes,** M. Chen, C. Yang, C. Wen, S. Chang, Y. Kuo, National Changhua Univ. of Education (Taiwan) . . . . . [6655-61]

✔ **Light emission optimization of europium based complex in multilayer organic light emitting diodes,** G. Santos, F. J. Fonseca, A. M. Andrade, Univ. de São Paulo (Brazil); M. Peres, T. Monteiro, W. Santos, L. R. Pereira, Univ. de Aveiro (Portugal) . . . . . [6655-62]

✔ **Electro-optical measurements, stability and physical carrier behavior of rare-earth based organic light emitting diodes,** G. Santos, F. J. Fonseca, A. M. Andrade, Univ. de São Paulo (Brazil); V. Deichmann, L. C. Ackcelrud, Univ. Federal do Parana (Brazil); M. Peres, T. Monteiro, W. Santos, L. R. Pereira, Univ. de Aveiro (Portugal) . . [6655-63]

✔ **Improved lifetime and efficiency of green organic light-emitting diodes with a fluorescent dye (C545T)doped hole transport layer,** H. Bang, J. Yun, C. Lee, Seoul National Univ. (South Korea) . . . . . [6655-64]

✔ **Tunable organic solid-state DFB laser utilizing molecular reorientation,** C. Wu, H. Cheng, H. Lin, K. Wong, C. Kuan, National Taiwan Univ. (Taiwan) . . . . . [6655-65]

✔ **Surface properties of indium-tin-oxide anode by plasma treated for organic light emitting diodes,** C. Tseng, National Sun Yat-Sen Univ. (Taiwan) . . . . . [6655-66]

✔ **Influence of thermal treatment on ITO surface and OLED performance,** C. Tseng, National Sun Yat-Sen Univ. (Taiwan) . . . . . [6655-67]

✔ **Out-coupling enhancement of OLED using a nano-imprinted diffractive resistance layer,** J. Jang, K. Kim, J. Kim, T. Yoon, J. Kim, M. Oh, Pusan National Univ. (South Korea) . . . . . [6655-68]

✔ **Transparent silver oxide anode by using oxygen plasma treatment for inverted top-emitting organic light-emitting diodes,** K. Hong, J. Lee, Pohang Univ. of Science and Technology (South Korea) . . . . . [6655-69]

Wednesday 29 August

SESSION 10 . . . . . Wed. 1:30 to 3:00 pm

Charge Transport and Recombination in Organic Opto-electronic Devices

Joint session with Conference 6656: Organic Photovoltaics VIII

Chair: **Kwanghee Lee**, Gwangju Institute of Science and Technology (South Korea)

The role of isoelectronic dopants in organic light emitting diodes *(Invited Paper)*, B. K. Crone, I. H. Campbell, D. L. Smith, Los Alamos National Lab. . . . . [6655-43]

Effect of mobile ions in heterojunction organic solar cells, H. Benmansour, R. Hany, F. A. Nüesch, EMPA (Switzerland) . . . . . [6656-08]

Carrier transport and photovoltaic properties of hybrid heterojunction polymer solar cells using GaN nanowire array, C. Lin, C. Lin, J. Lee, K. Chen, L. Chen, National Taiwan Univ. (Taiwan) . . . . . [6656-09]

Charge transport and recombination in dendrimer-fullerene blends studied by time resolved microwave conductivity, W. L. Rance, Colorado School of Mines; D. S. Ginley, N. Kopidakis, W. J. Mitchell, G. Rumbles, S. E. Shaheen, National Renewable Energy Lab. . . . . [6656-10]

SESSION 11 . . . . . Wed. 3:30 to 5:20 pm

Charge Injection in Organic Opto-electronic Devices

Joint session with Conference 6656: Organic Photovoltaics VIII

Chair: **Mark A. Baldo**, Massachusetts Institute of Technology

In-depth investigation of P3HT:PCBM solar cells *(Invited Paper)*, K. Meerholz, A. J. Moulé, J. Bonekamp, H. Lademann, Univ. zu Köln (Germany) . . . . . [6656-11]

Advances in Plexcore(tm) active layer technology systems for organic photovoltaics: a more efficient alternative to P3HT:PCBM, D. Laird, S. Williams, T. D. Hammond, M. Mathai, Plextronics Inc. . . . . [6656-12]

Improved electron injection and enhanced performance in organic light emitting devices by successful doping with LiF, K. Roy-Choudhury, J. Yoon, F. So, Univ. of Florida[6655-44]

Self-assembled monolayer modification of PEDOT: PSS interface to improve the device performance in polymer light-emitting diodes, Y. Lee, T. Park, W. Jeon, J. Park, J. Kwon, J. Jang, Kyunghee Univ. (South Korea) . . . . [6655-45]

Dye sensitized solar cells with a plastic counter electrode of poly(3,4-ethylene dioxythiophene)-poly(styrenesulfonate), A. Kanciurzewska, E. Dobruchowska, A. Baranzahi, E. Carlegrim, A. Fahlman, M. Fahlman, Linköpings Univ. (Sweden); M. A. Girtu, Univ. Ovidius Constanta (Romania) . . . . . [6656-13]

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Conference 6656

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6656

Organic Photovoltaics VIII

Conference Chair: **Zakya H. Kafafi**, Naval Research Lab.

Cochair: **Christoph J. Brabec**, Konarka Austria (Austria)

Program Committee: **Homer Antoniadis**, InnovaLight, Inc.; **Rene A. J. Janssen**, Technische Univ. Eindhoven (Netherlands); **Bernard Kippelen**, Georgia Institute of Technology; **Paul A. Lane**, Naval Research Lab.; **Kwanghee Lee**, Gwangju Institute of Science and Technology (South Korea); **Peter Peumans**, Stanford Univ.; **Niyazi S. Sariciftci**, Johannes Kepler Univ. Linz (Austria); **Sean E. Shaheen**, National Renewable Energy Lab.; **Yasuhiko Shirota**, Fukui Univ. of Technology (Japan); **Tetsuo Tsutsui**, Kyushu Univ. (Japan)

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Tuesday 28 August

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✔ **Dark and photovoltaic properties of p-CoPc/n-Si (Organic/Inorganic) heterojunction cells,** T. G. Abdel-Malik, Minia Univ. (Egypt); N. Abdel Aziz, Alexandria Univ. (Egypt) . . . . . [6656-29]

✔ **Electrical and photoelectrical properties of nickel phthalocyanine photovoltaic cells,** T. G. Abdel-Malik, Minia Univ. (Egypt); A. H. Elsayed, Alexandria Univ. (Egypt) . . . . . [6656-30]

✔ **New bio-inorganic photo-electronic devices based on photosynthetic proteins,** N. Lebedev, Naval Research Lab.; A. Spano, Univ. of Virginia; S. A. Trammell, Naval Research Lab.; I. Griva, George Mason Univ.; S. Tsoi, J. Schnur, Naval Research Lab. . . . . [6656-31]

✔ **Light intensity dependent recombination at the anode in bulk-heterojunction solar cells,** A. J. Moulé, K. Meerholz, Univ. zu Köln (Germany) . . . . . [6656-32]

✔ **Photovoltaic devices of polymer and alkanethiol modified ZnO,** T. C. Monson, D. C. Olson, N. C. Archuleta, J. W. P. Hsu, Sandia National Labs. . . . . [6656-33]

✔ **Titania nanotube array based photovoltaic cells,** C. Yip, K. Cheung, A. B. Djurisic, W. Chan, The Univ. of Hong Kong (Hong Kong China) . . . . . [6656-34]

✔ **High open-circuit-voltage organic solar cell based on two solution-processible triphenylamine-containing compounds,** Y. Li, Institute of Chemistry (China) . [6656-35]

✔ **CMOS color image sensor with overlaid organic photoelectric conversion layers having narrow absorption band: depression of dark current,** M. Ihama, M. Hayashi, Y. Maehara, T. Mitsui, S. Takada, Fuji Photo Film Co., Ltd. (Japan) . . . . . [6656-36]

✔ **Inorganic nanocrystal/conducting polymer bulk heterojunction solar cells,** P. E. Schwenn, The Univ. of Queensland (Australia); A. A. R. Watt, Univ. of Oxford (United Kingdom); H. H. Rubinsztein-Dunlop, P. Meredith, The Univ. of Queensland (Australia) . . . . . [6656-37]

✔ **Charge separation and transport in ZnO nanostructures/polymer:TiO_2 hybrid solar cell,** Y. Lin, T. Zeng, C. Chen, W. Su, National Taiwan Univ. (Taiwan) . . . . . [6656-38]

✔ **The effect of hydrophobic absorbent for reducing charge recombination to improve dye-sensitized solar cell performance,** S. Chaiyuth, H. Ekkachart, S. Porponth, National Science and Technology Development Agency (Thailand) . . . . . [6656-39]

✔ **Organic tandem solar cells comprising polymer and small-molecule subcells,** A. Colsmann, J. Silbereisen, J. Junge, C. Kayser, U. Lemmer, Univ. Karlsruhe (Germany) . . . . . [6656-40]

✔ **Efficiency improvement of polymer solar cells by electron transport layers,** A. Colsmann, J. Junge, D. Kohler, R. Webinger, C. Kayser, U. Lemmer, Univ. Karlsruhe (Germany) . . . . . [6656-41]

✔ **Elucidating the aspect of phase separation in organic blends by means of thermal analysis,** A. Swinnen, Univ. Hasselt (Belgium); J. Zhao, G. Van Assche, Vrije Univ. Brussel (Belgium); D. J. M. Vanderzande, M. D'Olieslaeger, J. V. Manca, Univ. Hasselt (Belgium); B. Van Mele, Vrije Univ. Brussel (Belgium) . . . . . [6656-42]

✔ **Cryscade(tm) n-peller based solar cells,** P. I. Lazarev, E. Morozov, B. Sanderson, Cryscade Solar Ltd. (Russia) . . . . . [6656-43]

✔ **Organic photovoltaics based on solution-processed benzoporphyrin,** Y. Sato, T. Niinomi, M. Hashiguchi, Y. Matsuo, E. Nakamura, The Univ. of Tokyo (Japan) [6656-44]

✔ **Efficient photovoltaic devices based on blends of fullerenes and radical salt-doped hole transporters,** S. Vaddiraju, M. K. Mathai, Univ. of Connecticut; E. Kymakis, Technological Education Institute-Crete (Greece); F. Papadimitrakopoulos, Univ. of Connecticut . . . . . [6656-45]

✔ **Integrated spectroscopic approach to study low-absorbing spectral features in thin film, organic D/A blends for next generation solar cells,** L. J. Goris, Stanford Univ.; A. Poruba, A. Purkrt, M. Vanecek, Fyzikální Ústav (Czech Republic); K. Haenen, J. V. Manca, D. J. M. Vanderzande, Univ. Hasselt (Belgium) . . . . . [6656-46]

✔ **Nanoscale control of donor/acceptor materials concentrations in polymeric photovoltaic devices,** M. Kaur, A. Gopal, R. M. Davis, Virginia Polytechnic Institute and State Univ.; M. Drees, B. Holloway, Luna Innovations, Inc.; J. R. Heflin, Virginia Polytechnic Institute and State Univ. . . . . [6656-47]

✔ **Alternating current induced by interference pattern for investigation of photoelectric properties of bulk heterojunction polymer structure,** M. Espinosa, S. Mansurova, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); K. Meerholz, H. Lademann, Univ. zu Köln (Germany) . . . . . [6656-48]

✔ **Fabrication of low band-gap polymer solar cells using chemical vapor deposition polymerization,** C. Lee, M. H. C. Jin, The Univ. of Texas at Arlington . . . . . [6656-49]

✔ **Hybrid ionic liquid and polymer electrolytes for nanocrystalline dye-sensitized TiO_2 solar cells,** A. F. Dalsin, M. De Paoli, A. F. Nogueira, Univ. Estadual de Campinas (Brazil); S. Passerini, W. Henderson, ENEA (Italy); C. Longo, Univ. Estadual de Campinas (Brazil) . . . [6656-50]

✔ **Molecular morphological effects to optoelectronics,** S. Sun, Norfolk State Univ. . . . . [6656-51]

✔ **Oriented P3HT crystals in P3HT: PCBM solar cells,** A. C. Mayer, S. R. Scully, Stanford Univ.; M. F. Toney, Stanford Linear Accelerator Ctr.; M. D. McGehee, Stanford Univ. . . . . [6656-52]

✔ **Integrated organic photovoltaic modules,** W. J. Potscavage, S. Yoo, B. Domercq, J. Kim, J. Holt, B. Kippelen, Georgia Institute of Technology . . . . . [6656-53]

✔ **DNA complex layer as a hole transport layer in P3HT/PCBM bulk heterojunction solar cells,** V. Kolachure, M. H. C. Jin, The Univ. of Texas at Arlington . . . . . [6656-54]

✔ **Plasmon enhanced photovoltaic conversion efficiency in organic bulk heterojunction devices,** A. J. Morfa, Univ. of Colorado at Boulder; J. van de Lagemaat, National Renewable Energy Lab.; K. L. Rowlen, Univ. of Colorado at Boulder . . . . . [6656-55]

✔ **Polymer optoelectronic devices with ion conductive layers,** J. Ouyang, National Univ. of Singapore (Singapore) . . . . . [6656-56]

✔ **Enhanced optical absorption of organic materials via surface plasmon resonance in gold nanoparticles,** G. J. Su, C. Sue, National Taiwan Univ. (Taiwan) . . . . . [6656-57]

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:30 to 10:00 am

Optimized Structures for Organic Photovoltaics

Chair: **Zakya H. Kafafi**, Naval Research Lab.

Air-stable, efficient polymer solar cells incorporating solution-processed titanium oxide layer *(Invited Paper)*, K. Lee, Gwangju Institute of Science and Technology (South Korea); J. Kim, A. J. Heeger, Univ. of California/Santa Barbara . . . . . [6656-01]

Ordered structures for photovoltaic devices *(Invited Paper)*, M. F. Durstock, T. Kang, Air Force Research Lab.; A. P. Smith, B. A. Minch, B. D. Pate, J. R. Deneault, B. E. Taylor, Universal Technology Corp. . . . . [6656-02]

Optical considerations in bulk-heterojunction solar cells *(Invited Paper)*, G. Dennler, K. Forberich, M. C. Scharber, C. J. Brabec, Konarka Austria (Austria); K. Hingerl, T. Fromherz, Johannes Kepler Univ. Linz (Austria) . . . . . [6656-03]

SESSION 2 . . . . . Wed. 10:30 am to 12:00 pm

Dye-sensitized Solar Cells

Chair: **Michael F. Durstock**, Air Force Research Lab.

Dye-sensitized solar cells with high efficiency *(Invited Paper)*, S. Hayase, T. Kado, T. Kato, Kyushu Institute of Technology (Japan) . . . . . [6656-04]

Umbrella concepts for mesoporous photogalvanic (voltaic) solar, M. T. Spitler, National Renewable Energy Lab. [6656-05]

All screen printed dye solar cell modules, T. B. Meyer, A. F. Meyer, A. Azam, Solaronix SA (Switzerland) . . . . . [6656-06]

Development of new efficient Ru dyes having β-diketonate and terpyridine ligands for solar cells, H. Arakawa, N. Shibayama, M. Nakade, T. Yamaguchi, Y. Abe, Tokyo Univ. of Science (Japan) . . . . . [6656-07]

Lunch/Exhibition Break

SESSION 3 . . . . . Wed. 1:30 to 3:00 pm

Charge Transport and Recombination in Organic Opto-electronic Devices

Joint Session with Conference 6655: Organic Light Emitting Materials and Devices XI

Chair: **Kwanghee Lee**, Gwangju Institute of Science and Technology (South Korea)

The role of isoelectronic dopants in organic light emitting diodes *(Invited Paper)*, B. K. Crone, I. H. Campbell, D. L. Smith, Los Alamos National Lab. . . . . [6655-43]

Effect of mobile ions in heterojunction organic solar cells, H. Benmansour, R. Hany, F. A. Nüesch, EMPA (Switzerland) . . . . . [6656-08]

Carrier transport and photovoltaic properties of hybrid heterojunction polymer solar cells using GaN nanowire array, C. Lin, C. Lin, J. Lee, K. Chen, L. Chen, National Taiwan Univ. (Taiwan) . . . . . [6656-09]

Charge transport and recombination in dendrimer-fullerene blends studied by time resolved microwave conductivity, W. L. Rance, Colorado School of Mines; D. S. Ginley, N. Kopidakis, W. J. Mitchell, G. Rumbles, S. E. Shaheen, National Renewable Energy Lab. . . . . [6656-10]

SESSION 4 . . . . . Wed. 3:30 to 5:20 pm

Charge Injection in Organic Opto-electronic Devices

Joint Session with Conference 6655: Organic Light Emitting Materials and Devices XI

Chair: **Mark A. Baldo**, Massachusetts Institute of Technology

In-depth investigation of P3HT:PCBM solar cells *(Invited Paper)*, K. Meerholz, A. J. Moulé, J. Bonekamp, H. Lademann, Univ. zu Köln (Germany) . . . . . [6656-11]

Advances in Plexcore™ active layer technology systems for organic photovoltaics: a more efficient alternative to P3HT:PCBM, D. Laird, S. Williams, T. D. Hammond, M. Mathai, Plextronics Inc. . . . . [6656-12]

Improved electron injection and enhanced performance in organic light emitting devices by successful doping with LiF, K. Roy-Choudhury, J. Yoon, F. So, Univ. of Florida[6655-44]

Self-assembled monolayer modification of PEDOT: PSS interface to improve the device performance in polymer light-emitting diodes, Y. Lee, T. Park, W. Jeon, J. Park, J. Kwon, J. Jang, Kyunghee Univ. (South Korea) . . . . [6655-45]

Dye sensitized solar cells with a plastic counter electrode of poly(3,4-ethylene dioxythiophene)-poly(styrenesulfonate), A. Kanciurzewska, E. Dobruchowska, A. Baranzahi, E. Carlegrim, A. Fahlman, M. Fahlman, Linköpings Univ. (Sweden); M. A. Girtu, Univ. Ovidius Constanta (Romania) . . . . . [6656-13]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:20 to 10:00 am

Physical Phenomena

Chair: **Christoph J. Brabec**, Konarka Austria (Austria)

Toward singlet fission for excitonic solar cells *(Invited Paper)*, J. Michl, Univ. of Colorado at Boulder; A. J. Nozik, National Renewable Energy Lab.; X. Chen, Univ. of Colorado at Boulder; J. C. Johnson, National Renewable Energy Lab.; G. Rana, A. Akdag, A. F. Schwerin, Univ. of Colorado at Boulder . . . . . [6656-14]

Time-resolved microwave conductivity studies of polymer: fullerene blends *(Invited Paper)*, G. Rumbles, A. Ferguson, X. Ai, N. Kopidakis, S. E. Shaheen, National Renewable Energy Lab.; J. Piris, Technische Univ. Delft (Netherlands); M. C. Beard, R. J. Ellingson, T. J. McDonald, M. J. Heben, National Renewable Energy Lab. . . . . [6656-15]

Electronic structure of CuPc-C_{60} co-evaporated films and their interface with metallic substrates, L. Lozzi, M. Simeoni, S. Picozzi, Univ. degli Studi dell'Aquila (Italy); S. La Rosa, Sincrotrone Trieste S.C.p.A. (Italy); S. Santucci, Univ. degli Studi dell'Aquila (Italy) . . . . . [6656-16]

Role of intrinsic band-gap states for the energy level alignment at an organic-conductor interface, N. Ueno, Chiba Univ. (Japan) . . . . . [6656-17]

SESSION 6 . . . . . Thurs. 10:30 am to 12:00 pm

Recombination and Energy Transfer

Chair: **Paul A. Lane**, Naval Research Lab.

Surface plasmon polariton mediated energy transfer in organic photovoltaic devices *(Invited Paper)*, M. Baldo, T. Heidel, J. Mapel, K. Celebi, M. Currie, Massachusetts Institute of Technology . . . . . [6656-18]

Efficient thin-film organic solar cells containing low band gap oligothiophenes: tailored heterojunctions with fullerene as studied by photoinduced absorption, R. Schueppel, Technische Univ. Dresden (Germany); K. Schmidt, Georgia Institute of Technology; C. L. Uhrich, K. Schulze, D. Wynands, Technische Univ. Dresden (Germany); J. Brédas, Georgia Institute of Technology; B. Maennig, Technische Univ. Dresden (Germany); M. P. Pfeiffer, Heliatek GmbH (Germany); K. Leo, Technische Univ. Dresden (Germany); E. Brier, E. Reinold, P. Baeuerle, Univ. Ulm (Germany) . . . . . [6656-19]

Polythiophene:fullerene solar cells: strongly carrier dependent bimolecular recombination rate constants measured by combined transient absorption and transient photovoltage experiments on complete cells under bias illumination, C. G. Shuttle, B. C. O'Regan, A. M. Ballantyne, J. C. de Mello, J. R. Durrant, Imperial College London (United Kingdom) . . . . . [6656-20]

Effects of geminate and bimolecular recombination on organic PV: limiting factors to the maximum efficiency, S. R. Scully, A. C. Mayer, Stanford Univ.; B. C. Thompson, J. M. J. Frechet, Univ. of California/Berkeley; M. D. McGehee, Stanford Univ. . . . . [6656-21]

Lunch/Exhibition Break

SESSION 7 . . . . . Thurs. 1:30 to 3:00 pm

Bulk Heterojunction Solar Cells

Chair: **Garry Rumbles**, National Renewable Energy Lab.

Formation of new bulk-heterojunction structure in organic thin film solar cells *(Invited Paper)*, M. Matsumura, Osaka Univ. (Japan) . . . . . [6656-22]

Improvement of low light efficiency of bulk heterojunction devices with respect to first applications, C. Waldauf, G. Dennler, C. J. Brabec, M. C. Scharber, M. F. Morana, M. Koppe, P. Denk, H. Egelhaaf, T. Ameri, K. Forberich, Konarka Austria (Austria) . . . . . [6656-23]

Interface control in heterojunction photovoltaic cells by polymer phase separation processes, J. Heier, EMPA (Switzerland); F. A. Castro, Univ. de São Paulo (Brazil); F. A. Nüesch, R. Hany, EMPA (Switzerland) . . . . . [6656-24]

Optimization of conjugated polymer/nanostrucutured ZnO photovoltaic devices, D. C. Olson, Y. Lee, E. D. Spoerke, Sandia National Labs.; M. S. White, S. E. Shaheen, D. S. Ginley, National Renewable Energy Lab.; J. A. Voigt, J. W. P. Hsu, Sandia National Labs. . . . . [6656-25]

SESSION 8 . . . . . Thurs. 3:30 to 4:40 pm

New Materials

Chair: **Yasuhiko Shirota**, Fukui Univ. of Technology (Japan)

Photovoltaic devices from water-soluble conjugated polymers *(Invited Paper)*, T. T. Nguyen, J. Yang, Univ. of California/Santa Barbara . . . . . [6656-26]

Solution processable small molecules with energy levels optimized for maximum open circuit voltage and absorption of the solar spectrum, M. T. Lloyd, Cornell Univ.; J. E. Anthony, Univ. of Kentucky; G. G. Malliaras, Cornell Univ. . . . . [6656-27]

Synthesis and properties of novel thiophene-based low band gap materials for organic solar cells, P. Baeuerle, Univ. Ulm (Germany) . . . . . [6656-28]

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Courses of Related Interest

See pages 162-187 for full course descriptions.

SC797 The Science and Technology of Organic Solar Cells (Peumans) Tuesday 28, 1:30 - 5:30 pm

Conference 6657

Tuesday 28 August 2007 • Proceedings of SPIE Vol. 6657

Organic 3D Photonics Materials and Devices

Conference Chair: **Susanna Orlic**, Technische Univ. Berlin (Germany)

Cochair: **Klaus Meerholz**, Univ. zu Köln (Germany)

Program Committee: **Eunkyoung Kim**, Yonsei Univ. (South Korea); **Robert R. McLeod**, Univ. of Colorado/Boulder; **David A. Waldman**, DCE Aprilis, Inc.; **William L. Wilson**, InPhase Technologies

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:30 to 10:00 am

Materials I

Chair: **Klaus Meerholz**, Univ. zu Köln (Germany)

Holographic assembly of nanoparticles in polymers for 3D recording and patterning *(Invited Paper)*, Y. Tomita, N. Suzuki, Y. Endoh, S. Kurozumi, M. Miki, Univ. of Electro-Communications (Japan); K. Chikama, Nissan Chemical Industries, Ltd. (Japan) . . . . . [6657-01]

Impact of inhibitor diffusion in holographic photopolymers, R. R. McLeod, Univ. of Colorado at Boulder . . . . . [6657-02]

New composite blue sensitive materials for high resolution optical data storage, L. Criante, F. Vita, R. Castagna, D. E. Lucchetta, Univ. Politecnica delle Marche (Italy) and CNISM (Italy); S. Frohmann, T. Feid, Technische Univ. Berlin (Germany); F. F. Simoni, Univ. Politecnica delle Marche (Italy); S. Orlic, Technische Univ. Berlin (Germany) . . . . . [6657-03]

Determination of the microstructure-defect concentration relationship by high sensitive optical spectroscopy, L. J. Goris, L. H. Jimison, A. Salleo, Stanford Univ. . . . . [6657-04]

SESSION 2 . . . . . Tues. 10:40 am to 12:10 pm

Applications I

Chair: **Susanna Orlic**, Technische Univ. Berlin (Germany)

Depth multiplexing of microgratings for multilayer optical disk *(Invited Paper)*, E. Dietz, T. Feid, S. Frohmann, J. Gortner, J. Rass, S. Orlic, Technische Univ. Berlin (Germany) [6657-05]

Non-volatile holographic data storage media based on dye-doped thermoplastic, C. Erben, X. Shi, E. P. Boden, K. L. Longley, B. L. Lawrence, GE Global Research . . . . [6657-06]

Material saturation effects on holographic data storage and content-addressable search, B. Das, J. Joseph, K. Singh, Indian Institute of Technology Delhi (India) . [6657-07]

Advanced imaging using photorefractive polymers, K. Meerholz, M. F. Salvador, S. Köber, J. Pauzner, Univ. zu Köln (Germany) . . . . . [6657-08]

Lunch Break

SESSION 3 . . . . . Tues. 1:30 to 3:00 pm

Materials II

Chair: **Robert R. McLeod**, Univ. of Colorado/Boulder

Rewritable FRET-based two-photon 3D optical data storage *(Invited Paper)*, K. D. Belfield, Z. Huang, C. C. Corredor, Univ. of Central Florida . . . . . [6657-09]

Chemical photostructuration in iodoform-doped carbazolic copolymers for holographic recording, B. Mailhot, A. Rivaton, Univ. Blaise Pascal (France); E. Chilat, S. V. Robu, State Univ. of Chisinau (Moldova); L. Frezet, M. Bolte, Univ. Blaise Pascal (France) . . . . . [6657-10]

Photopolymers containing photo functional dyes for holographic recording, E. Kim, H. Oh, Yonsei Univ. (South Korea) . . . . . [6657-11]

Characterization of photoelectric propeties of photorefractive PF6-TPD based composite by non-steady-state photo-EMF technique, M. Espinosa, S. Mansurova, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); S. Köber, K. Meerholz, Univ. zu Köln (Germany) . . . [6657-12]

SESSION 4 . . . . . Tues. 3:40 to 5:00 pm

Applications II

Chair: **Enrico Dietz**, Technische Univ. Berlin (Germany)

Improved outcoupling in OLEDs by direct holographic patterning, M. de la Rosa, K. Meerholz, Univ. zu Köln (Germany) . . . . . [6657-13]

3D nano and micro structurization of polymer nanocomposites for optical sensing and image processing, S. Orlic, H. Markötter, C. Mueller, C. Rauch, A. Schloesser, Technische Univ. Berlin (Germany) . . . . . [6657-14]

Towards the microstructuring of nonlinear and hybrid polymeric materials by two-photon polymerization, A. Ovsianikov, Laser Zentrum Hannover e.V. (Germany); M. Farsari, M. Vamvakaki, Foundation for Research and Technology-Hellas (Greece); B. N. Chichkov, Laser Zentrum Hannover e.V. (Germany) and Foundation for Research and Technology-Hellas (Greece); C. Fotakis, Foundation for Research and Technology-Hellas (Greece) . . . . . [6657-15]

3D waveguides with fiber couplers and 90 degree bends in holographic photopolymer, R. R. McLeod, Univ. of Colorado at Boulder . . . . . [6657-16]

✔ Poster/Demo Session-Tuesday

Poster authors will begin displaying posters after 10:00 am Tuesday morning. A poster session and demo session, with authors present at their posters, will be held Tuesday evening from 8:00 to 10:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Photopolymer composites containing s-triazine diepoxy monomers for holographic recording storage,** E. Kim, J. H. Kim, K. Rameshbabu, B. D. Sarwade, Yonsei Univ. (South Korea) . . . . . [6657-17]

✔ **Sugar holograms with artificial organic colorants,** N. Mejias Brizuela, A. Olivares-Pérez, M. d. l. P. Hernandez Garay, I. Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6657-18]

✔ **Sugar holograms with erioglaucine and tartrazine,** N. Mejias Brizuela, A. Olivares-Perez, G. P. Paez-Trujillo, I. Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6657-19]

✔ **Fluorescence modulation of photochromic diarylethene,** S. I. Yang, K. H. Ahn, Y. C. Jeong, S. Kim, Kyung Hee Univ. (South Korea) . . . . . [6657-20]

✔ **Synthesis and characterization of sulfur-oxidized diarylethenes,** K. H. Ahn, S. I. Yang, Kyung Hee Univ. (South Korea); Y. C. Jeong, Kyung Hee Univ (South Korea); S. Kim, Kyung Hee Univ. (South Korea) . . . . . [6657-21]

✔ **Adaptive detection of rough surface displacement using non-steady-state photo-EMF effect in photorefractive polymers,** P. Rodriguez, S. Mansurova, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); S. Köber, K. Meerholz, Univ. zu Köln (Germany) . . . . . [6657-22]

✔ **Holograms recorded in organic dye-sensitized dichromate gelatin,** G. P. Páez-Trujillo, A. Olivares-Pérez, N. Mejias-Brizuela, M. P. Hernández-Garay, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6657-23]

✔ **Hologram with dichromated polyvinyl alcohol and natural colorant,** G. P. Páez-Trujillo, A. Olivares-Pérez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); E. Amigón-de León, Instituto Tecnologico Superior de Atlixco (Mexico); M. P. Hernández-Garay, I. Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6657-24]

✔ **Electro-optical characteristics of holographic gratings in real time with voltage applied,** R. Fontanilla-Urdaneta, M. P. Hernández-Garay, A. Olivares-Pérez, G. P. Paéz-Trujillo, I. Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6657-25]

✔ **Diffraction efficiencies comparison of holographic gratings in PVA with metallic chlorides,** M. d. l. P. Hernández Garay, A. Olivares-Pérez, R. Baltasar-Arroyo, N. Mejias-Brizuela, I. Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6657-26]

✔ **Polarization analysis of holographic gratings recorded in organic conductive materials,** R. Fontanilla-Urdaneta, M. P. Hernández-Garay, A. Olivares-Pérez, G. P. Paéz-Trujillo, I. Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6657-27]

Conference 6658

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6658

Organic Field-Effect Transistors VI

Conference Chairs: **Zhenan Bao**, Stanford Univ.; **David J. Gundlach**, National Institute of Standards and Technology

Program Committee: **Kilwon Cho**, Pohang Univ. of Science and Technology (South Korea); **Dean M. DeLongchamp**, National Institute of Standards and Technology; **C. Daniel Frisbie**, Univ. of Minnesota; **Thomas N. Jackson**, The Pennsylvania State Univ.; **Hagen Klauk**, Max-Planck-Institut für Festkörperforschung (Germany); **Sang Yoon Lee**, SAMSUNG Advanced Institute of Technology (South Korea); **Iain A. McCulloch**, Merck Chemicals Ltd. (United Kingdom); **Alberto Salleo**, Stanford Univ.; **Takao Someya**, The Univ. of Tokyo (Japan)

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:10 am

Circuits and Displays

Chair: **Thokchom B. Singh**, Johannes Kepler Univ. Linz (Austria)

Organic transistors and associated building blocks for smart labels and active-matrix displays *(Invited Paper)*, G. H. Gelinck, TNO (Netherlands); J. Genoe, P. L. Heremans, IMEC (Belgium); D. M. De Leeuw, Philips Research Labs. (Netherlands) . . . . . [6658-01]

Organic thin-film transistor array for active-matrix organic light emitting diode *(Invited Paper)*, S. Y. Lee, SAMSUNG Advanced Institute of Technology (South Korea) . . [6658-02]

13.56MHz polymer rectifier by printing processes *(Invited Paper)*, J. Hou, C. Lin, Y. Chan, H. Cheng, C. Kung, M. Liang, Industrial Technology Research Institute (Taiwan) . [6658-03]

Contactless position sensing using printed organic transistors for power transmission sheets *(Invited Paper)*, T. Someya, The Univ. of Tokyo (Japan) . . . . . [6658-04]

SESSION 2 . . . . . Sun. 10:40 am to 12:00 pm

Gate Dielectrics and Contacts

Chair: **John E. Anthony**, Univ. of Kentucky

Microstructural mobility of the polymeric gate insulator affecting pentacene charge transport *(Invited Paper)*, A. F. Facchetti, C. Kim, M. J. Tobin, Northwestern Univ. [6658-05]

High performance organic field-effect transistors with fluoropolymer gate dielectric, W. L. Kalb, T. Mathis, S. Haas, A. F. Stassen, B. Batlogg, ETH Zürich (Switzerland) [6658-06]

Low-temperature inorganic dielectrics for thin-film transistors made with semiconducting polymers, M. L. Chabinyc, R. Lujan, F. Endicott, Palo Alto Research Ctr., Inc.; M. J. Heeney, I. A. McCulloch, Merck Chemicals Ltd. (United Kingdom) . . . . . [6658-07]

Metal interfaces in organic field effect transistors based on perylene derivatives *(Invited Paper)*, D. R. T. Zahn, Technische Univ. Chemnitz (Germany) . . . . . [6658-08]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 3:15 pm

Charge Transport

Chair: **David J. Gundlach**, National Institute of Standards and Technology

Microscopic charge transport mechanisms in high-mobility conjugated polymers *(Invited Paper)*, J. Chang, J. Clark, N. Zhao, H. Sirringhaus, Univ. of Cambridge (United Kingdom); D. W. Breiby, J. W. Andreasen, Risø National Lab. (Denmark); M. M. Nielsen, Københavns Univ. (Denmark); M. Giles, M. J. Heeney, I. A. McCulloch, Merck Chemicals Ltd. (United Kingdom) . . . . . [6658-09]

Insulator-to-metal transition in conjugated polymer field-effect transistors *(Invited Paper)*, D. A. Moses, Univ. of California/Santa Barbara . . . . . [6658-10]

Determination of the density of trap states in organic thin film transistors, F. Yan, The Hong Kong Polytechnic Univ. (Hong Kong China) . . . . . [6658-11]

Charge transport mechanisms in organic and microcrystalline silicon field-effect transistors *(Invited Paper)*, S. J. Konezny, École Polytechnique Fédérale de Lausanne (Switzerland); M. Bussac, École Polytechnique (France); L. Zuppiroli, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6658-12]

Current conduction in ambipolar organic field-effect transistor (OFET), H. L. Kwok, Univ. of Victoria (Canada) . . . . . [6658-13]

SESSION 4 . . . . . Sun. 3:45 to 5:30 pm

Organic Crystals

Chair: **Daniel A. Moses**, Univ. of California/Santa Barbara

High-mobility organic transistors *(Invited Paper)*, T. T. M. Palstra, Univ. of Groningen (Netherlands); O. D. Jurchescu, National Institute of Standards and Technology; A. Arkenbout, Univ. of Groningen (Netherlands) . . . . . [6658-14]

Modification of charge transport in single crystal rubrene *(Invited Paper)*, O. Mitrofanov, Lucent Technologies/Bell Labs.; D. V. Lang, Columbia Univ.; T. Siegrist, Lucent Technologies/ Bell Labs.; W. So, Columbia Univ.; C. Kloc, A. P. Ramirez, Lucent Technologies/Bell Labs. . . . . [6658-15]

Photo-induced phenomena in single-crystal organic field-effect transistors *(Invited Paper)*, M. Calhoun, C. Hsieh, M. E. Gershenson, V. Podzorov, Rutgers Univ. . . . . [6658-16]

Fabrication of single crystal transistor arrays, Z. Bao, Stanford Univ. . . . . [6658-17]

Cast assembly single crystalline nanoribbons of organic semiconductors for high performance field-effect transistors, W. Hu, Institute of Chemistry (China) . [6658-18]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:20 to 10:00 am

Molecular Design

Chair: **Antonio F. Facchetti**, Northwestern Univ.

Predicting the growth habit and properties of organic semiconducting thin films *(Invited Paper)*, P. Clancy, Cornell Univ.; M. Haran, Intel Corp.; J. Goose, Cornell Univ. [6658-19]

Crystal design for soluble organic semiconductors *(Invited Paper)*, J. E. Anthony, Univ. of Kentucky . . . . . [6658-20]

Semiconducting polythiophenes: synthesis and structure property relationships *(Invited Paper)*, M. J. Heeney, B. Clare, R. Hamilton, I. A. McCulloch, M. N. Shkunov, D. Sparrowe, S. Tierney, W. Zhang, Merck Chemicals Ltd. (United Kingdom); M. L. Chabinyc, Palo Alto Research Ctr., Inc.; D. M. DeLongchamp, R. J. Kline, National Institute of Standards and Technology . . . . . [6658-21]

High performance n-type FETs based on heterocyclic ring systems with trifluoromethylphenyl groups *(Invited Paper)*, Y. Yamashita, Tokyo Institute of Technology (Japan) [6658-22]

SESSION 6 . . . . . Mon. 10:30 am to 12:00 pm

OTFTs I

Chair: **Takao Someya**, The Univ. of Tokyo (Japan)

In-situ TEM study of pentacene film morphology, J. A. DeFranco, R. Ilic, G. G. Malliaras, Cornell Univ. . . . [6658-23]

Using contacts to induce order and high mobility in solution processed organic TFTs, D. J. Gundlach, J. Royer, B. H. Hamadani, L. C. Teague, C. A. Richter, J. G. Kushmerick, L. J. Richter, National Institute of Standards and Technology; S. Subramanian, J. E. Anthony, Univ. of Kentucky; S. K. Park, O. D. Jurchescu, T. N. Jackson, The Pennsylvania State Univ. . . . . [6658-24]

Fast response ion gel gated polymer thin-film transistors, J. Lee, J. H. Cho, B. Kim, Y. He, T. P. Lodge, C. D. Frisbie, Univ. of Minnesota . . . . . [6658-25]

Organic phototransistor behavior and light-accelerated bias stress, M. Debucquoy, S. Verlaak, K. Myny, S. Steudel, J. Genoe, P. L. Heremans, IMEC (Belgium) . . . . . [6658-26]

High mobility solution-processed n-channel organic thin film transistors, H. Yan, A. F. Facchetti, Polyera Corp. . . . . [6658-27]

High performance organic field-effect transistors (OFETs) using high-κ dielectrics grown by atomic layer deposition (ALD), X. Zhang, B. Domercq, S. Yoo, X. Wang, Z. Wang, B. Kippelen, Georgia Institute of Technology . . . . . [6658-28]

Lunch Break

PHOTONICS

SESSION 7 . . . . . Mon. 1:30 to 3:00 pm

OTFTs II

Chair: **Kilwon Cho**, Pohang Univ. of Science and Technology (South Korea)

N-channel field-effect transistors and ring oscillators based on epitaxially grown C_{60} fullerene films, T. B. Singh, N. S. Sariciftci, Johannes Kepler Univ. Linz (Austria); H. Yang, Rensselaer Polytechnic Institute; L. Yang, Brookhaven National Lab.; H. Sitter, B. Plockberger, Johannes Kepler Univ. Linz (Austria); T. Anthoupolos, Imperial College London (United Kingdom); M. Cölle, D. M. De Leeuw, Philips Research Labs. (Netherlands) . . . . . [6658-29]

Influence of source-drain electric field on mobility and charge transport in organic field-effect transistors, B. H. Hamadani, R. J. Kline, National Institute of Standards and Technology; I. A. McCulloch, M. J. Heeney, Merck Chemicals Ltd. (United Kingdom); C. A. Richter, D. J. Gundlach, National Institute of Standards and Technology . . . . . [6658-30]

Dielectric interface modification by UV irradiation: a novel method to control OFET charge carrier transport properties, N. J. Benson, M. Schidleja, Technische Univ. Darmstadt (Germany); C. Siol, University of Technology Darmstadt (Germany); C. Melzer, H. von Seggern, Technische Univ. Darmstadt (Germany) . . . . . [6658-31]

Effect of surface polarity of polymer gate dielectrics on hysteresis behavior of pentacene field-effect transistor, C. E. Park, S. H. Kim, S. Y. Yang, Pohang Univ. of Science and Technology (South Korea); H. Yang, Rensselaer Polytechnic Institute . . . . . [6658-32]

Transfer printing as a method for the fabrication of organic electronics on flexible substrates, D. R. Hines, A. E. Southard, A. Tunnell, E. D. Williams, Univ. of Maryland/College Park . . . . . [6658-33]

Microstructured thin films, OTFTs, and PFBT-treated Au electrodes, S. K. Park, D. Mourey, The Pennsylvania State Univ.; S. Subramanian, J. E. Anthony, Univ. of Kentucky; T. N. Jackson, The Pennsylvania State Univ. . . . . [6658-34]

SESSION 8 . . . . . Mon. 3:30 to 5:35 pm

Novel Processing of Soluble Organic Semiconductors

Chair: **Gerwin H. Gelinck**, TNO (Netherlands)

Mobility studies on new regioregular polythiophene block copolymers and other new structures *(Invited Paper),* R. D. McCullough, G. Sauve, Carnegie Mellon Univ. . . . . [6658-35]

Ink-jet printing of self-aligned soluble-pentacene crystals for high-performance organic field-effect transistors, K. Cho, J. A. Lim, W. H. Lee, Y. D. Park, H. S. Lee, Pohang Univ. of Science and Technology (South Korea) . . . . . [6658-36]

Solubility-driven high OFET performance thin film structures of thiophene derivatives using volatile solvents, S. W. LeFevre, H. Yang, Rensselaer Polytechnic Institute; Z. Bao, Stanford Univ.; C. Y. Ryu, Rensselaer Polytechnic Institute . . . . . [6658-37]

Simple patterning methodologies for functional organic thin-film transistors with solution-processed components *(Invited Paper),* Y. Loo, The Univ. of Texas at Austin [6658-38]

Fabrication of polymer thin film transistors by gravure contact printing, A. J. Campbell, M. Voigt, D. Chung, A. Guite, J. Huang, F. Meng, J. Steinke, D. D. C. Bradley, Imperial College London (United Kingdom) . . . . . [6658-39]

Tough, semiconducting bi-component systems, N. Stingelin-Stutzmann, Queen Mary Univ. of London (United Kingdom); C. Müller, P. Wolfer, P. Smith, ETH Zürich (Switzerland); C. P. Radano, Degussa RohMax; R. A. J. Janssen, Technische Univ. Eindhoven (Netherlands); S. Goffri, H. Sirringhaus, Univ. of Cambridge (United Kingdom); D. J. Gundlach, National Institute of Standards and Technology; A. Kumar, T. Kreouzis, Queen Mary Univ. of London (United Kingdom) . . . . . [6658-40]

Performance improvement and evaluation of an all-plastic organic field effect transistor, S. Ochiai, A. Ohashi, K. Kojima, T. Mizutani, Aichi Institute of Technology (Japan) . . . . . [6658-41]

Tuesday 28 August

✔ Poster/Demo Session-Tuesday

Poster authors will begin displaying posters after 10:00 am Tuesday morning. A poster session and demo session, with authors present at their posters, will be held Tuesday evening from 8:00 to 10:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session..

✔ **Low-voltage pentacene thin film transistors with ultra thin SiO_2 and SiON gate dielectrics,** S. W. Cho, D. S. Park, W. C. Chang, K. H. Yoo, K. Jeong, C. N. Whang, Yonsei Univ. (South Korea); Y. Yi, K. B. Chung, M. H. Cho, Korea Research Institute of Standards and Science (South Korea) [6658-42]

✔ **Deoxyribonucleic acid (DNA)-based bio-organic field-effect transistors and memory elements,** T. B. Singh, P. Stadler, K. Oppelt, N. S. Sariciftci, Johannes Kepler Univ. Linz (Austria); J. Grote, Air Force Research Lab.; R. Schwödiauer, S. Bauer, H. Piglmayer-Brezina, D. Bäuerle, Johannes Kepler Univ. Linz (Austria) . . . . . [6658-43]

✔ **High-performance organic field-effect transistors with the bottom contact configuration,** G. Yu, C. Di, Y. Liu, D. Zhu, Institute of Chemistry (China) . . . . . [6658-44]

✔ **Synthesis of bis-silylated oligothiophenes for solution-processable organic field-effect transistors,** J. H. Choi, U. C. Yoon, Pusan National Univ. (South Korea) . . [6658-45]

✔ **A novel structure of directly patterned isolating layer for organic thin-film transistors driven organic light emitting diodes,** Y. Wang, T. Lin, J. Yan, J. Wen, T. Lee, C. Kao, S. Yeh, M. Lin, Y. Shen, M. Tseng, T. Chen, P. Wu, J. Ho, Industrial Technology Research Institute (Taiwan) . [6658-46]

✔ **Organic field-effect transistors based on solution-processible thiophene/phenylene oligomer derivatives,** H. Yang, S. W. LeFevre, Rensselaer Polytechnic Institute; J. Locklin, Univ. of Georgia; Z. Bao, Stanford Univ. . . [6658-47]

✔ **Understanding the mechanisms of photodecarbonylation of the photoprecursors of higher poly(acene)s,** R. Mondal, A. N. Okhrimenko, B. K. Shah, D. C. Neckers, Bowling Green State Univ. . . . . [6658-48]

✔ **Highly sensitive thin film polymer phototransistors,** X. Wang, K. Wasapinyokul, A. J. Campbell, D. D. C. Bradley, Imperial College London (United Kingdom) . . . . . [6658-49]

✔ **High mobility pentacene-based OTFT with PMMA dielectric layer,** T. S. Huang, National Cheng Kung Univ. (Taiwan) . . . . . [6658-50]

✔ **Solution deposited liquid crystalline semiconducting materials on a photo alignment layer for organic thin-film transistors,** T. Fujiwara, J. Locklin, Z. Bao, Stanford Univ. . . . . [6658-51]

✔ **Surface modification with SAMs for patterning of organic semiconductors,** Y. Ito, Z. Bao, Stanford Univ. . . . . [6658-52]

✔ **Organic thin film transistor with suspended source/drain structure,** Y. U. Lee, Y. Kim, Korea Electronics Technology Institute (South Korea); M. Han, Seoul National Univ. (South Korea); J. Han, Korea Electronics Technology Institute (South Korea) . . . . . [6658-53]

✔ **Capacitance reconstruction from measured C-V and direct extraction of mobility in polymer PFETs using C-V and I-V measurements,** M. Fadlallah, Commissariat à l'Energie Atomique (France); G. Klink, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) . . [6658-54]

Conference 6659

Tuesday 28 August 2007 • Proceedings of SPIE Vol. 6659

Organic-based Chemical and Biological Sensors

Conference Chair: **Ruth Shinar**, Iowa State Univ.

Cochair: **George G. Malliaras**, Cornell Univ.

Program Committee: **Graciela B. Blanchet**, DuPont Electronic Polymers; **Emil J. W. List**, Technische Univ. Graz (Austria); **Roisin Owens**, Agave BioSystems; **Franky So**, Univ. of Florida; **Luisa Torsi**, Univ. degli Studi di Bari (Italy)

Tuesday 28 August

Plenary Session . . . . . Tues. 8:30 to 10:00 am

OLEDs/SSL

8:30 am: **Solid State Lighting: Illumination and Communication** *(Invited Paper, Presentation Only),* I. E. Ashdown, Senior Research Scientist for TIR Systems Ltd. (Canada) and Senior Software Engineer for Lighting Analysts Inc. and President of by.Heart Consultants Ltd. (Canada)

9:15 am: **Organic LEDs for Lighting Applications** *(Invited Paper, Presentation Only),* J. Kido, Professor, Yamagata Univ. (Japan) and General Director, Research Institute for Organic Electronics (Japan)

SESSION 1 . . . . . Tues. 10:30 am to 12:10 pm

Organic-Based Sensing Applications I

Chair: **Luisa Torsi**, Univ. degli Studi di Bari (Italy)

Sensitive four-terminal silicon/organic field-effect chemical vapor sensors *(Invited Paper),* A. Dodabalapur, The Univ. of Texas at Austin . . . . . [6659-01]

Organic electrochemical transistors in sensing applications, D. A. Bernards, G. G. Malliaras, Cornell Univ. . . . . [6659-02]

Organic field effect based sensors for physiological parameters monitoring *(Invited Paper),* A. Bonfiglio, I. Manunza, E. Orgiu, A. Caboni, W. Cambarau, M. Barbaro, Univ. degli Studi di Cagliari (Italy) . . . . . [6659-03]

Highly fluorescent bipyridazines for fluorogenic detector, E. Kim, J. Do, Y. Kim, Yonsei Univ. (South Korea); A. Attias, Univ. Pierre et Marie Curie (France) . . . . . [6659-04]

Lunch/Exhibition Break

SESSION 2 . . . . . Tues. 1:40 to 3:30 pm

Organic-Based Sensing Applications II

Chair: **George G. Malliaras**, Cornell Univ.

Recent developments in integrated OLED-based chemical and biological sensors *(Invited Paper),* J. Shinar, Z. Zhou, Y. Cai, R. Shinar, Iowa State Univ. . . . . [6659-05]

OLED-based sensor array for simultaneous monitoring of multiple analytes, Y. Cai, R. Shinar, Z. Zhou, J. Shinar, Iowa State Univ. . . . . [6659-06]

Polymer-based micro-array sensors, R. B. A. Sharpe, R. De Zwart, R. Houben, G. Van Heck, B. Allard, P. A. Rensing, S. J. F. Van Veen, M. M. Koetse, H. F. M. Schoo, TNO (Netherlands) . . . . . [6659-07]

Organic semiconductor lasers as integrated light sources for optical sensor systems, M. Punke, T. Woggon, M. Stroisch, B. Ebenhoch, U. Geyer, C. Karnutsch, M. Gerken, U. Lemmer, Univ. Karlsruhe (Germany); M. Bruendel, Forschungszentrum Karlsruhe (Germany); J. Wang, T. Weimann, Physikalisch-Technische Bundesanstalt (Germany) . . . . . [6659-08]

Immobilized polymeric pH, O_2 and glucose optical sensors for cell culture optimization, D. F. Leroux, S. E. Miller, BioProcessors . . . . . [6659-09]

SESSION 3 . . . . . Tues. 4:00 to 5:40 pm

Organic-Based Sensing Applications III

Chair: **Ananth Dodabalapur**, The Univ. of Texas/Austin

Chiral recognition with enhanced sensing bilayer organic thin-film transistors *(Invited Paper),* L. Torsi, G. M. Farinola, M. C. Tanese, O. Hassan Omar, Univ. degli Studi di Bari (Italy); L. Valli, Univ. degli Studi di Lecce (Italy); F. Babudri, F. Palmisano, P. G. Zambonin, F. Naso, Univ. degli Studi di Bari (Italy) . . . . . [6659-10]

Electrochemical sensors and actuators based PEDOT: PSS for bioelectronic applications *(Invited Paper),* M. Berggren, Linköpings Univ. (Sweden); P. Kjäll, Karolinska Institutet (Sweden); J. Isaksson, Linköpings Univ. (Sweden); D. Nilsson, Acreo AB (Sweden); K. Svennersten, Karolinska Institutet (Sweden); P. Svensson, Linköpings Univ. (Sweden); A. Richter-Dahlfors, Karolinska Institutet (Sweden); M. Bolin, E. Saindon, N. D. Robinson, Linköpings Univ. (Sweden) . . . . . [6659-11]

Enzymatic conducting polymer sensor arrays, J. A. DeFranco, D. A. Bernards, Y. Sylvester, D. Macaya, M. Nikolou, G. G. Malliaras, Cornell Univ. . . . . [6659-12]

Sensitivity control of optical fiber biosensors utilizing turnaround point long period gratings with self-assembled polymer coatings, E. Gifford, Virginia Polytechnic Institute and State Univ.; S. Ramachandran, OFS Fitel, LLC; J. R. Heflin, Virginia Polytechnic Institute and State Univ. . . . . [6659-13]

✔ Poster/Demo Session-Tuesday

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✔ **Integrated photoluminescence-based sensor arrays: OLED excitation source/sensor film/thin-film photodetector,** D. Ghosh, R. Shinar, Y. Cai, Z. Zhou, V. Dalal, J. Shinar, Iowa State Univ. . . . . [6659-14]

✔ **Multiphoton excited fluorescence quenching of organic materials for TNT detection,** A. Narayanan, O. P. Varnavski, T. G. Goodson III, Univ. of Michigan . . . [6659-15]

PHOTONICS

Conference 6660A

Monday-Tuesday 27-28 August 2007 • Proceedings of SPIE Vol. 6660: Infrared Systems and Photoelectronic Technology II

Infrared Detectors and Focal Plane Arrays IX

Conference Chairs: **Eustace L. Dereniak**, The Univ. of Arizona; **John P. Hartke**, U.S. Military Academy

Program Committee: **Sarath D. Gunapala**, Jet Propulsion Lab.; **John E. Hubbs**, Ball Aerospace & Technologies Corp.; **Paul D. LeVan**, Air Force Research Lab.; **Herbert K. Pollehn**, Army Research Lab.; **Robert E. Sampson**, I Technology Applications; **James A. Stobie**, BAE Systems; **William B. Weissbard**, Teledyne Scientific Co.

Monday 27 August

SESSION 1 . . . . . Mon. 8:30 to 10:00 am

Multi-Band Focal Planes

Chair: **John P. Hartke**, U.S. Military Academy

Foveating infrared image sensors *(Invited Paper)*, M. A. Massie, Nova Sensors . . . . . [6660A-01]

Multi-band large format infrared imaging arrays for spectrometer applications, S. V. Bandara, S. D. Gunapala, J. K. Liu, D. Z. Ting, C. J. Hill, J. M. Mumolo, S. K. Keo, Jet Propulsion Lab. . . . . [6660A-02]

Demonstration of a dual-band IR imaging spectrometer, B. P. Beecken, Bethel Univ.; P. D. LeVan, Air Force Research Lab.; B. D. Todt, Bethel Univ. . . . . [6660A-03]

Three dimensional simulation of detector parameters for backside illuminated InSb 2-D arrays, T. A. Fishman, V. Nahum, E. Saguy, Z. Calahora, I. Shtrichman, SemiConductor Devices (Israel) . . . . . [6660A-04]

SESSION 2 . . . . . Mon. 10:30 am to 12:00 pm

Infrared Polarimetry

Chair: **Paul D. LeVan**, Air Force Research Lab.

A review of thermal infrared polarization phenomenology in the outdoors *(Invited Paper)*, J. A. Shaw, Montana State Univ./Bozeman . . . . . [6660A-05]

Development of an MWIR polarimetric FPA, D. P. Forrai, J. W. Devitt, L-3 Communications Cincinnati Electronics, Inc.; A. M. Sarangan, Q. Zhan, Univ. of Dayton; R. T. Mack, J. S. Harris, Air Force Research Lab. . . . . [6660A-06]

A monolithically integrated longwave infrared polarimetric photodetector, X. Lu, Univ. of Massachusetts/ Lowell . . . . . [6660A-07]

Longwave infrared snapshot imaging spectropolarimeter, R. W. Aumiller, E. L. Dereniak, R. E. Sampson, R. S. McMillan, College of Optical Sciences/The Univ. of Arizona [6660A-08]

Lunch/Exhibition Break

SESSION 3 . . . . . Mon. 1:30 to 3:00 pm

Astronomical Application of 2D Arrays

Chair: **Sarath D. Gunapala**, Jet Propulsion Lab.

SOI-based back-illuminated imaging technology for scientific UV/visible/NIR applications *(Invited Paper)*, B. Pain, S. Seshadri, C. Sun, X. Zheng, C. J. Wrigley, T. J. Cunningham, Jet Propulsion Lab. . . . . [6660A-09]

High performance large infrared and visible astronomy arrays for low background applications: instruments performance data and future developments at Raytheon, E. J. Beuville, FLIR Systems; D. Acton, E. Corrales, A. Levy, Raytheon Vision Systems; M. Merrill, National Optical Astronomy Observatory . . . . . [6660A-10]

VIS/SWIR focal plane and detector development at Raytheon, D. Acton, B. Starr, N. J. Therrien, W. D. Ritchie, Raytheon Vision Systems; C. W. McMurtry, Univ. of Rochester; A. Hoffman, Raytheon Vision Systems . . . . . [6660A-11]

Optical thermal imaging for mass-market applications, M. Wagner, RedShift Systems Corp. . . . . [6660A-12]

SESSION 4 . . . . . Mon. 3:30 to 5:00 pm

QWIP Technology

Chair: **John E. Hubbs**, Air Force Research Lab.

Towards 16 megapixel focal plane arrays *(Invited Paper)*, S. D. Gunapala, Jet Propulsion Lab. . . . . [6660A-13]

Far infrared and terahertz quantum well intrasubband photodetector (QWISP), D. Z. Ting, Jet Propulsion Lab.; Y. Chang, Univ. of Illinois at Urbana-Champaign; S. V. Bandara, S. D. Gunapala, Jet Propulsion Lab. . . . . [6660A-14]

LWIR QWIP focal plane array mounting and single cryocooler thermal treatment for rigid optics packaging, W. R. Johnson, D. L. Johnson, J. M. Mumolo, S. D. Gunapala, Jet Propulsion Lab. . . . . [6660A-15]

MBE grown type-II superlattice photodiodes for MWIR and LWIR imaging applications, C. J. Hill, J. V. Li, J. M. Mumolo, S. D. Gunapala, Jet Propulsion Lab.; D. R. Rhiger, R. E. Kvaas, S. F. Harris, Raytheon Vision Systems . . . . . [6660A-16]

Tuesday 28 August

SESSION 5 . . . . . Tues. 8:10 to 10:10 am

Hyperspectral IR Imaging

Chair: **James A. Stobie**, BAE Systems, Inc.

Hyperspectral visible and infrared focal plane arrays for planetary science studies *(Invited Paper)*, W. B. Weissbard, J. Pan, T. Peihn, Teledyne Imaging Sensors . . . . . [6660A-17]

SWIR variable dispersion spectral imaging sensor, F. D. Shepherd, J. M. Mooney, T. D. Reeves, D. S. Franco, J. E. Murguia, Solid State Scientific Corp.; M. M. Weeks, D. J. Leahy, Air Force Research Lab. . . . . [6660A-18]

No moving parts imaging spectrometers, E. L. Dereniak, M. W. Kudenov, N. A. Hagen, C. J. Vandervlugt, College of Optical Sciences/The Univ. of Arizona . . . . . [6660A-19]

The spaceborne infrared atmospheric sounder for geosynchronous Earth orbit (SIRAS-G): pathfinder to space, T. U. Kampe, Ball Aerospace & Technologies Corp. . . . . [6660A-20]

Hyperspectral sensor development at the U.S. Army RDECOM CERDEC Night Vision and Electronic Sensors Directorate (NVESD) *(Invited Paper)*, J. G. Zeibel, U.S. Army Night Vision & Electronic Sensors Directorate . . . [6660A-21]

SESSION 6 . . . . . Tues. 10:30 am to 12:00 pm

Special IR System Cameras

Chair: **Herbert K. Pollehn**, Army Research Lab.

Very long wavelength infrared HgCdTe staring focal plane development *(Invited Paper)*, J. A. Stobie, S. P. Tobin, BAE Systems . . . . . [6660A-22]

Performance of new IR detectors for wide field camera 3 (WFC3), R. J. Hill, R. Foltz, E. M. Malumuth, N. R. Collins, A. Waczynski, Y. Wen, R. A. Kimble, NASA Goddard Space Flight Ctr.; M. Robberto, Space Telescope Science Institute . . . . . [6660A-23]

An overview of teledyne imaging sensors for the James Webb Space Telescope, J. D. Garnett, S. W. Anglin, P. Pettersson, T. Sprafke, M. Zandian, Teledyne Imaging Sensors; G. A. Luppino, GL Scientific . . . . . [6660A-24]

Mid-IR photon counting array using HgCdTe APDs and the Medipix2 ROIC, J. V. Vallerga, J. McPhate, Univ. of California/ Berkeley; M. G. Stapelbroek, DRS Sensors & Targeting Systems, Inc. . . . . [6660A-25]

Lunch/Exhibition Break

SESSION 7 . . . . . Tues. 1:30 to 3:00 pm

Silicon Technology

Chair: **William B. Weissbard**, Teledyne Imaging Sensors

Silicon: IBC detectors for space based imaging at 2-28μm *(Invited Paper)*, J. J. Drab, Raytheon Vision Systems . . . . . [6660A-26]

Signal management with FPA multiplicative background and noise, M. K. Rafailov, Defense Advanced Research Projects Agency Consultant . . . . . [6660A-27]

Development of Si: as blocked impurity band detector for far IR detection, D. S. Tezcan, J. Putzeys, K. De Munck, P. De Moor, P. J. Merken, P. Fiorini, C. A. van Hoof, IMEC (Belgium); T. Dartois, Alcatel Alenia Space (France); S. Birkmann, J. Stegmaier, U. Grozinger, O. Krause, Max-Planck-Institut für Astronomie (Germany) . . . . . [6660A-28]

Focal plane detectors for the WISE 12- and 24-μm bands, H. H. Hogue, M. Reed, M. G. Stapelbroek, S. A. Masterjohn, DRS Sensors & Targeting Systems, Inc.; M. F. Larsen, J. D. Elwell, Space Dynamics Lab. . . . . [6660A-29]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC152 Infrared Focal Plane Arrays (Dereniak, Hubbs)
Sunday 26, 1:30 - 5:30 pm

Conference 6660B

Sunday 26 August 2007 • Proceedings of SPIE Vol. 6660: Infrared Systems and Photoelectronic Technology II

Infrared and Photoelectronic Imagers and Detectors III

Conference Chairs: **Randolph E. Longshore**, Raytheon Missile Systems; **Ashok K. Sood**, Magnolia Optical Technologies, Inc.

Program Committee: **Alexander C. Childs**, Raytheon Vision Systems; **Meimei Z. Tidrow**, Missile Defense Agency

Sunday 26 August

SESSION 8 . . . . . Sun. 1:00 to 3:00 pm

Imagers

Chair: **Randolph E. Longshore**, Raytheon Missile Systems

CMOS pixel structures optimised for indirect detection of x-rays, T. A. Greig, A. D. Holland, Brunel Univ. (United Kingdom); D. J. Burt, A. Pike, e2v (United Kingdom)[6660B-30]

Nearsighted photodetector and camera, M. Matsumoto, Y. Buyo, S. Hashimoto, Waseda Univ. (Japan) . . . . . [6660B-31]

Dark current reduction of GaInAsSb based photodetectors by surface treatment with octadecylthiol, Y. Xiao, Crosslight Software Inc.; V. Bhagwat, I. B. Bhat, P. S. Dutta, Rensselaer Polytechnic Institute . . . . . [6660B-32]

Considerations concerning an image transceiver system design, N. S. Thirer, I. David, I. Baalb Zedaka, Holon Institute of Technology (Israel); U. Efron, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6660B-33]

High performance back-illuminated CMOS imaging sensors, M. E. Hoenk, T. J. Jones, M. R. Dickie, T. J. Cunningham, S. Nikzad, Jet Propulsion Lab. . . . . [6660B-34]

Large format silicon image sensors for high sensitivity UV/optical/NIR, soft x-ray and particle detection, S. Nikzad, J. Blacksberg, M. E. Hoenk, Jet Propulsion Lab.; S. Holland, Lawrence Berkeley National Lab. . . . . [6660B-35]

SESSION 9 . . . . . Sun. 3:30 to 4:50 pm

IR Systems

Chair: **Ashok K. Sood**, Magnolia Optical Technologies, Inc.

$Hg_{1-x}Cd_xTe$ mid-wavelength infrared (MWIR) avalanche photodiode (APD) grown on Si substrate, S. Mallick, Univ. of Illinois at Chicago . . . . . [6660B-36]

Implementation a new real-time structure for driving an IRFPA and image enhancement, A. Homaei, E. Koohestani, Rayan-Electronics . . . . . [6660B-37]

Study on the effective method to reduce the lens calibre of the un-cooled IR thermal imaging systems, L. Dong, Beijing Institute of Technology (China) . . . . . [6660B-38

Corrugated QWIP developments for tactical infrared imaging *(Invited Paper)*, D. P. Forrai, L-3 Communications Cincinnati Electronics, Inc.; K. Choi, Army Research Lab.; J. W. Devitt, L-3 Communications Cincinnati Electronics, Inc. . . . . [6660B-39]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Influence of distributed conductive coupling between MCP channels on transfer of the image contrast,** A. B. Berkin, Novosibirsk State Technical Univ. (Russia)[6660B-40]

✔ **Experimental data on the reflection and transmission spectral response of photocathodes,** R. J. Brooks, J. Howorth, Photek Ltd. (United Kingdom); C. Joseph, Rutgers Univ. . . . . [6660B-41]

✔ **Modeling of resonant cavity enhanced separate absorption charge and multiplication avalanche photodiodes by crosslight APSYS,** Y. Xiao, Z. L. Li, Z. M. S. Li, Crosslight Software Inc. (Canada) . . . . . [6660B-42]

✔ **Back-illuminated CMOS APS with low crosstalk level,** Y. David, Holon Institute of Technology (Israel); U. Efron, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6660B-43]

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Conference 6661

Tuesday-Wednesday 28-29 August 2007 • Proceedings of SPIE Vol. 6661

Imaging Spectrometry XII

Conference Chairs: **Sylvia S. Shen**, The Aerospace Corp.; **Paul E. Lewis**, National Geospatial-Intelligence Agency

Cochair: **Robert T. Kroutil**, Los Alamos National Lab.

Program Committee: **Christoph C. Borel**, Ball Aerospace & Technologies Corp.; **Chein-I Chang**, Univ. of Maryland/Baltimore County; **Thomas W. Cooley**, Air Force Research Lab.; **Eustace L. Dereniak**, The Univ. of Arizona; **Michael R. Descour**, The Univ. of Arizona; **David B. Gillis**, Naval Research Lab.; **Terrence S. Lomheim**, The Aerospace Corp.; **Anthony Ratowski**, Air Force Research Lab.; **Luc Rochette**, LR Tech (Canada); **John R. Schott**, Rochester Institute of Technology; **Winthrop Wadsworth**, D&P Instruments

Tuesday 28 August

SESSION 1 . . . . . Tues. 3:30 to 5:00 pm

Spectrometer Design and Development

Chair: **Paul E. Lewis**, National Geospatial-Intelligence Agency

Advanced responsive tactically effective military imaging spectrometer (ARTEMIS): system overview and objectives *(Invited Paper),* T. W. Cooley, R. B. Lockwood, Air Force Research Lab. . . . . [6661-01]

Fourier methods of improving reconstruction speed for CTIS imaging spectrometers, N. A. Hagen, E. L. Dereniak, College of Optical Sciences/The Univ. of Arizona . [6661-02]

Visible imaging spectro-polarimeter, C. J. Vandervlugt, N. A. Hagen, College of Optical Sciences/The Univ. of Arizona; R. E. Sampson, I Technology Applications; E. L. Dereniak, College of Optical Sciences/The Univ. of Arizona; G. R. Gerhart, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. . . . . [6661-03]

Portable spectrophotometer based on polarization independent tunable optical filters, E. Nicolescu, M. J. Escuti, North Carolina State Univ. . . . . [6661-04]

Wednesday 29 August

SESSION 2 . . . . . Wed. 8:30 to 10:20 am

Fourier Transform Spectrometer Design and Development

Chair: **Luc Rochette**, LR Tech (Canada)

State-of-the-art imaging FTS with CCD camera *(Invited Paper),* J. E. Genest, S. A. Roy, P. Dubois, S. Potvin, Univ. Laval (Canada) . . . . . [6661-05]

Long wave focal plane array detector: development and performance assessment of an 8X8 Stirling-cooled photovoltaic MCT detector module, L. Rochette, LR Tech (Canada); T. L. Smithson, Defence R&D Canada/Valcartier (Canada); F. J. Chateauneuf, Institut National d'Optique (Canada); R. H. K. Gurgenian, Fermionics Corp. . . [6661-06]

An interferometer for compact imaging spectrometers, L. M. Moreau, M. A. Soucy, C. Deutsch, ABB Inc. (Canada) . . . . . [6661-07]

FTIR-based airborne spectral imagery for target interrogation, T. L. Smithson, Defence R&D Canada/Valcartier (Canada) . . . . . [6661-08]

SHIELDS: a battlefield Fraunhofer line discrimination sensor, S. R. Watchorn, J. Noto, M. A. Migliozzi, Scientific Solutions, Inc. . . . . [6661-09]

SESSION 3 . . . . . Wed. 10:50 am to 12:10 pm

Imaging Systems and Components

Chair: **Robert T. Kroutil**, Los Alamos National Lab.

Development of mercurous halide crystals for acousto-optic devices, J. S. Kim, W. Palosz, J. I. Soos, S. B. Trivedi, Brimrose Corp. of America; N. Gupta, Army Research Lab. . . . . [6661-10]

A high-resolution 2D imaging laser radar for occluded hard target viewing and identification, R. J. Grasso, G. F. Dippel, K. D. Cecchetti, J. C. Wikman, D. P. Drouin, P. I. Egbert, BAE Systems . . . . . [6661-11]

Effect of light level and photon noise on hyperspectral target detection performance, T. Skauli, R. Ingebrigtsen, I. Kåsen, Norwegian Defense Research Establishment (Norway) . . . . . [6661-12]

Development of smearless high speed SPD-CCD camera employing a rotating shutter, F. Tsumuraya, M. Sakamoto, Hyogo Univ. (Japan); N. Baba, Hokkaido Univ. (Japan) . . . . . [6661-13]

Lunch/Exhibition Break

SESSION 4 . . . . . Wed. 1:30 to 3:10 pm

Spectral Data Analysis Techniques

Chair: **John R. Schott**, Rochester Institute of Technology

Linear unmixing using endmember subspaces and physics-based modeling, D. B. Gillis, J. H. Bowles, Naval Research Lab.; E. J. Ientilucci, D. W. Messinger, Rochester Insitute of Technology . . . . . [6661-14]

Statistics-based endmember extraction algorithms for hyperspectral imagery, S. Chu, C. Chang, Univ. of Maryland/ Baltimore County . . . . . [6661-15]

Synthetic data generation of high-resolution, hyperspectral data using DIRSIG, M. K. Jakubowski, Univ. of California/ Berkeley and Rochester Institute of Technology; D. W. Messinger, S. D. Brown, J. R. Schott, Rochester Institute of Technology . . . . . [6661-16]

Atmospheric inversion in the presence of clouds: an adaptive ELM approach, B. D. Bartlett, J. R. Schott, Rochester Institute of Technology . . . . . [6661-17]

Unsupervised hyperspectral image classification, X. Jiao, C. Chang, Univ. of Maryland/Baltimore County . . . [6661-18]

SESSION 5 . . . . . Wed. 3:40 to 5:20 pm

Spectral Methodologies and Applications

Chair: **Sylvia S. Shen**, The Aerospace Corp.

Use of lidar data to geometrically-constrain radiance subspaces for physics-based target detection, M. S. Foster, Rochester Institute of Technology and Air Force Institute of Technology; D. W. Messinger, J. R. Schott, Rochester Institute of Technology . . . . . [6661-19]

Airborne infrared spectroscopic analysis of emissions from swamps situated in the Southern Gulf Coast region of the United States, R. T. Kroutil, P. E. Lewis, Los Alamos National Lab.; M. J. Thomas, U.S. Environmental Protection Agency; D. P. Miller, Northrop Grumman Corp.; S. S. Shen, The Aerospace Corp.; T. Curry, U.S. Environmental Protection Agency . . . . . [6661-20]

Chemical agent detection and identification with a hyperspectral imaging infrared sensor, V. Farley, M. Chamberland, P. Lagueux, A. Vallières, A. J. Villemaire, J. Giroux, Telops, Inc. (Canada) . . . . . [6661-21]

Measuring the MTF of imaging spectrometers at infinite focus with roof-line images, P. W. Nugent, J. A. Shaw, Montana State Univ./Bozeman; M. Kehoe, C. Smith, T. S. Moon, R. Swanson, Resonon Inc. . . . . [6661-22]

Application of mid-infrared and x-ray diffraction spectrum analysis in tobacco quality sorting, X. Zhong, F. Yao, Chongqing Univ. . . . . [6661-23]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC194 Multispectral and Hyperspectral Image Sensors (Lomheim) Wednesday 29, 1:30 - 5:30 pm

Conference 6662

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6662

Optical Technologies for Arming, Safing, Fuzing, and Firing III

Conference Chairs: **William J. Thomes, Jr.**, Sandia National Labs.; **Fred M. Dickey**, Sandia National Labs.

Program Committee: **Adrian A. Akinci**, Los Alamos National Lab.; **Michael J. Barglowski**, Ensign-Bickford Aerospace & Defense Co.; **Dennis W. Baum**, Office of the Under Secretary of Defense; **Richard A. Beyer**, U.S. Army Research Lab.; **Mike D. Bowden**, AWE plc (United Kingdom); **Kevin R. Cochran**, Naval Surface Warfare Ctr.; **Andrew Forbes**, Council for Scientific and Industrial Research (South Africa); **Keren K. Hamilton**, AWE plc (United Kingdom); **Christopher R. Hardy**, Kigre, Inc.; **Stephen R. Lerner**, Laser Diode, Inc.; **Keith L. Lewis**, Electro-Magnetic Remote Sensing Defence Technology Ctr. (United Kingdom); **Robert V. McDaniel**, Kollsman, Inc.; **Thomas D. Milster**, The Univ. of Arizona; **Gregg L. Morelli**, Honeywell Technology; **Alex Rosiewicz**, EM4, Inc.; **Raymond J. Silva**, BAE Systems North America; **Kelly Simmons-Potter**, The Univ. of Arizona; **Bolesh J. Skutnik**, CeramOptec Industries, Inc.; **Gabriel L. Smith**, U.S. Army Research, Development and Engineering Command; **Donald R. Snyder**, Air Force Research Lab.; **John E. Spencer**, Photodigm Inc.; **Christian M. von der Lippe**, U.S. Army Research, Development and Engineering Command; **Louis S. Weichman**, Sandia National Labs.; **Eric J. Welle**, Sandia National Labs.; **Jan-Gustav Werthen**, JDS Uniphase Corp.; **James A. Wilder, Jr.**, Sandia National Labs.

Wednesday 29 August

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Practical internal combustion engine laser spark plug development,** M. J. Myers, J. D. Myers, B. Guo, C. Yang, C. R. Hardy, Kigre, Inc. . . . . [6662-13]

✔ **High-efficiency side diode pumped breech mount laser ignition,** C. R. Hardy, B. Guo, C. Yang, M. J. Myers, J. D. Myers, Kigre, Inc. . . . . [6662-14]

✔ **Optical fiber sensor based on thermo-responsive hydrogel,** J. C. Rueda, K. Contreras, C. Paragua, R. Coello Paria, G. Baldwin-Olguin, Pontificia Univ. Catolica del Peru (Peru); M. Lomer, Univ. de Cantabria (Spain); H. Komber, S. Zschoche, B. Voit, Leibniz-Institut für Polymerforschung Dresdene e.V. (Germany) . . . . . [6662-15]

✔ **Fiber-optic inclinometer for structural health monitoring,** Y. N. Kulchin, O. B. Vitrik, A. V. Dyshlyuk, Institute for Automation and Control Processes (Russia) . . . . . [6662-16]

✔ **The coupling loss between single-mode fibers and waveguides,** J. Yang, Tianjin Univ. . . . . [6662-17]

Thursday 30 August

SESSION 1 . . . . . Thurs. 8:10 to 10:10 am

Optical Firing and Fuzing Systems and Components

Chair: **Kelly Simmons-Potter**, The Univ. of Arizona

Assembly and characterization of packaged laser-optical firing system, G. L. Morelli, Honeywell Technology [6662-01]

Challenges in high-intensity laser injection into multiple optical fibers, R. E. Setchell, D. M. Berry, Sandia National Labs. . . . . [6662-02]

Impact of ionizing radiation on the optical properties, K. Simmons-Potter, The Univ. of Arizona; D. C. Meister, Sandia National Labs. . . . . [6662-03]

Characterization of laser-optical systems packaged for use in harsh environments, M. R. Bright, Honeywell Technology . . . . . [6662-04]

High-voltage optical power conversion with a series connected photovoltaic array, J. W. Shelton, W. J. Thomes, Jr., F. M. Dickey, Sandia National Labs. . . . . [6662-05]

Design and developmental aspects of holographic sight for rifles and carbine, S. Kamineni, National Institute of Technology/Warangal (India); R. K. Palukuri, Bharat Electronics Ltd. (India) . . . . . [6662-06]

SESSION 2 . . . . . Thurs. 10:30 am to 12:30 pm

Explosives and Optical Diagnostics

Chair: **Gregg L. Morelli**, Honeywell Technology

Laser initiation of energetic materials: a historical overview, M. D. Bowden, AWE plc (United Kingdom); J. Akhavan, Cranfield Univ.; R. C. Drake, AWE plc (United Kingdom) . . . . . [6662-07]

Development of a portable non-contact optical diagnostic system for the detection of delta-HMX, A. J. Dale, M. W. Wright, C. T. Hughes, M. D. Bowden, AWE plc (United Kingdom) . . . . . [6662-08]

Optically based velocity and topographic measurement systems in the nano-scale for developing optical initiation, A. R. Valenzuela, G. Rodriguez, S. A. Clarke, K. A. Thomas, Los Alamos National Lab. . . . . [6662-09]

The development of a heterodyne velocimeter system for use in sub-microsecond time regimes, M. D. Bowden, M. P. Maisey, AWE plc (United Kingdom); J. Akhavan, Cranfield Univ. (United Kingdom); R. C. Drake, AWE plc (United Kingdom) . . . . . [6662-10]

High-speed laser Schlieren movies for visualization of explosive events, S. A. Clarke, K. A. Thomas, M. E. Martinez, A. A. Akinci, Los Alamos National Lab.; M. J. Murphy, R. J. Adrian, Arizona State Univ. . . . . [6662-11]

The initiation of high surface area pentaerythritol tetranitrate using fiber-coupled laser-driven flyer plates, M. D. Bowden, M. P. Maisey, AWE plc (United Kingdom); J. Akhavan, Cranfield Univ. (United Kingdom); R. C. Drake, AWE plc (United Kingdom) . . . . . [6662-12]

Conference 6663

Tuesday-Wednesday 28-29 August 2007 • Proceedings of SPIE Vol. 6663

Laser Beam Shaping VIII

Conference Chairs: **Fred M. Dickey**, Sandia National Labs.; **David L. Shealy**, The Univ. of Alabama/Birmingham

Program Committee: **Daniel M. Brown**, Optosensors Technology, Inc.; **Michael R. Duparré**, Friedrich-Schiller-Univ. Jena (Germany); **Andrew Forbes**, Council for Scientific and Industrial Research (South Africa); **Julio C. Gutierrez-Vega**, Instituto Tecnológico y de Estudios Superiores de Monterrey (Mexico); **John A. Hoffnagle**, IBM Almaden Research Ctr.; **Kurt J. Kanzler**, Diffractive Laser Solutions; **R. John Koshel**, Lambda Research Corp.; **Alexis V. Kudryashov**, Moscow State Open Univ. (Russia); **Andrew F. Kurtz**, Eastman Kodak Co.; **Zsolt J. Laczik**, Univ. of Oxford (United Kingdom); **William P. Latham**, Air Force Research Lab.; **Todd E. Lizotte**, Hitachi Via Mechanics USA, Inc.; **Günter Luepke**, The College of William & Mary; **Olivier Magnin**, C2 Diagnostics (France); **Paul F. Michaloski**, Corning Tropel Corp.; **Thomas D. Milster**, The Univ. of Arizona; **Tasso R. M. Sales**, RPC Photonics, Inc.; **José M. Sasian**, The Univ. of Arizona; **Kenneth J. Weible**, SUSS MicroOptics SA (Switzerland); **Uwe-Detlef Zeitner**, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); **Shuyan Zhang**, The College of William & Mary

Tuesday 28 August

SESSION 1 . . . . . Tues. 1:00 to 3:10 pm

Theory

Chair: **John A. Hoffnagle**, IBM Almaden Research Ctr.

Microlens laser beam homogenizer: from theory to application *(Invited Paper)*, M. Zimmermann, Bayerisches Laserzentrum gGmbH (Germany); N. Lindlein, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); R. Voelkel, K. J. Weible, SUSS MicroOptics SA (Switzerland) . . . . . [6663-01]

Impact of phase errors at the conjugate step on the propagation of intensity and phase shaped beams, A. Forbes, I. A. Litvin, Council for Scientific and Industrial Research (South Africa) . . . . . [6663-02]

Irradiance distributions within refractive laser beam shapers, J. A. Hoffnagle, IBM Almaden Research Ctr.; D. L. Shealy, The Univ. of Alabama/Birmingham . . . . . [6663-03]

A model of the transverse modes of stable and unstable porro-prism resonators using symmetry considerations, L. Burger, Council for Scientific and Industrial Research (South Africa) and Univ. of KwaZulu-Natal (South Africa); A. Forbes, Council for Scientific and Industrial Research (South Africa) . . . . . [6663-04]

Unwound vortex beams for axial beam shaping, C. López-Mariscal, J. C. Gutiérrez-Vega, Instituto Tecnológico y de Estudios Superiores de Monterrey (Mexico) . . . . . [6663-05]

Helical Hermite-Gaussian beams, C. López-Mariscal, J. C. Gutiérrez-Vega, Instituto Tecnológico y de Estudios Superiores de Monterrey (Mexico) . . . . . [6663-06]

Panel Discussion . . . . . Tues. 3:40 to 5:20 pm

State-of-the-Art of Laser Beam Shaping

Moderator:

Andrew Forbes, Council for Scientific and Industrial Research (South Africa)

Panelists:

Theory: **Fred M. Dickey,** Sandia National Labs.

Design: **John G. Smith,** MEMS Optical

Fabrication: **Ken J. Weible,** SUSS MicroOptics SA (Switzerland)

Application: **Todd E. Lizotte,** Hitachi Via Mechanics USA

Wednesday 29 August

SESSION 2 . . . . . Wed. 8:00 to 10:00 am

Design

Chair: **Andrew Forbes**, Council for Scientific and Industrial Research (South Africa)

Beam shaping based on lenslet arrays with the help of diffraction and interference effects, Y. Miklyaev, D. Hauschild, M. Darscht, A. Mikhailov, V. Lissotschenko, LIMO-Lissotschenko Mikrooptik GmbH (Germany) . . . . . [6663-07]

Fly's eye condenser based on chirped microlens arrays, F. C. Wippermann, U. Zeitner, P. Dannberg, A. Bräuer, Fraunhofer Institut Angewandte Optik und Feinmechanik (Germany); S. Sinzinger, Technische Univ. Ilmenau (Germany) . . . [6663-08]

Laser profile uniformity at the image plane: comparing hard and digital apertures illuminated by a diffractive optical beam shaper, T. E. Lizotte, Hitachi Via Mechanics USA, Inc. . . . . [6663-09]

Remapping diffractive beam shaping of a fiber laser for focused tophat profiles, K. J. Kanzler, Lambda Research Optics, Inc.; A. P. Hoult, SPI Lasers plc; V. Thorosian, Lambda Research Optics, Inc. . . . . [6663-10]

Designing beam shaping systems basing on spherical catalog lenses, H. Schimmel, LightTrans GmbH (Germany); F. Wyrowski, Friedrich Schiller Univ. (Germany) . . . . . [6663-11]

Spatial spectrum optimization of diffractive optical element used with the smoothing by spectral dispersion technique, Y. Li, W. Zhang, F. Shu, X. Zhang, R. Wu, Univ. of Science and Technology of China (China) . . . . . [6663-12]

SESSION 3 . . . . . Wed. 10:30 am to 12:00 pm

Fabrication and Techniques I

Chair: **Todd E. Lizotte**, Hitachi Via Mechanics USA, Inc.

Refractive beam shaping: from the solution of the Maxwell equations to products and its applications in laser material processing *(Invited Paper)*, O. Homburg, D. Hauschild, L. Aschke, LIMO-Lissotschenko Mikrooptik GmbH (Germany); V. Lissotschenko, LIMO-Lissotschenko Mikrooptik GmbH . . . . . [6663-13]

Vacuum isostatic micro molding of diffractive structures into PTFE materials, T. E. Lizotte, O. P. Ohar, Hitachi Via Mechanics USA, Inc. . . . . [6663-14]

Methods of designing and fabricating: an equilateral triangle beam splitter, J. G. Smith, A. Stockham, MEMS Optical, Inc. . . . . [6663-15]

Analysis of application properties of diffractive optical element fabricated by ion-beam rotation etching technology, Y. Li, X. Zhang, W. Zhang, F. Shu, R. Wu, Univ. of Science and Technology of China (China) . . . . . [6663-16]

Lunch/Exhibition Break

SESSION 4 . . . . . Wed. 1:20 to 2:20 pm

Fabrication and Techniques II

Chair: **Todd E. Lizotte**, Hitachi Via Mechanics USA, Inc.

High-power holographic masks for beam shaping, W. P. Parker, Creative Microsystems Corp. . . . . [6663-17]

Characterization of a spinning pipe gas lens using a Shack-Hartmann wavefront sensor, C. Mafusire, A. Forbes, Council for Scientific and Industrial Research (South Africa); M. M. Michaelis, Univ. of KwaZulu-Natal (South Africa); G. Snedden, Council for Scientific and Industrial Research (South Africa) . . . . . [6663-18]

New approaches for manufacturing refractive beam shapers, S. R. Kiontke, asphericon GmbH (Germany); H. Schimmel, LightTrans GmbH (Germany) . . . . . [6663-19]

SESSION 5 . . . . . Wed. 2:20 to 5:40 pm

Applications

Chair: **David L. Shealy**, The Univ. of Alabama/Birmingham

Innovative optical techniques increase LED wafer scribing production *(Invited Paper)*, L. Chen, R. Y. L. Hsu, R. J. Z. Lee, Uni-Via Technology Inc. (Taiwan); T. E. Lizotte, Hitachi Via Mechanics USA, Inc. . . . . [6663-20]

Beam shaping for cosmetic hair removal, T. E. Lizotte, T. Tuttle, Hitachi Via Mechanics USA, Inc. . . . . [6663-21]

Wafer dicing utilizing unique beam shapes, T. E. Lizotte, O. P. Ohar, Hitachi Via Mechanics USA, Inc. . . . . [6663-22]

Advances in MEMS deformable mirror technology and applications in laser beam shaping, S. Menn, Boston Micromachines Corp. . . . . [6663-23]

Increased efficiency and performance in laser pump chambers through use of diffuse highly reflective materials, B. Y. Chang, C. M. Chase, Labsphere, Inc. . . . . [6663-24]

The main peculiarities of arranging the optical scheme of acousto-optical spectrometer for the Mexican large millimeter telescope, A. S. Shcherbakov, S. E. Balderas Mata, E. Tepichín-Rodriguez, A. Luna Castellanos, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); J. Maximov, Molecular Technology GmbH (Germany) . . . . . [6663-25]

Laser plasma waveguide for SHF radiation, A. E. Dormidonov, V. P. Kandidov, M.V. Lomonosov Moscow State Univ. Chapter (Russia); V. V. Valuev, State Unitary Enterprise (Russia) . . . . . [6663-26]

A design of optical resonator for donut mode generation, S. Chu, National Cheng Kung Univ. (Taiwan) . . . . . [6663-27]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

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Special Program

Wednesday 29 August 2007

Tribute to Joseph W. Goodman

Conference Chair: **Masud Mansuripur,** College of Optical Sciences/The Univ. of Arizona

Joseph W. Goodman, Stanford Univ.

Professor Joseph W. Goodman is the recipient of SPIE's Gold Medal in 2007. Dr. Goodman was affiliated with Stanford University from 1963 until his retirement in 2000, serving in various academic and administrative positions including the William E. Ayer Professor of Electrical Engineering, the Chairman of the Electrical Engineering Department, and Senior Associate Dean of the School of Engineering. Dr. Goodman is the author of Introduction to Fourier Optics (1968, second edition 1996, third edition 2005), Statistical Optics (1985), Speckle Phenomena in Optics (2006), and (with R. M. Gray) Fourier Transforms: An Introduction for Engineers (1995). Professor Goodman has been the primary research supervisor for 49 Ph.D.s; he is the author of more than 220 scientific and technical papers, and has received numerous awards from the IEEE, the OSA, the SPIE and the ASEE.

Dr. Goodman has contributed to many areas of physical optics including holography, synthetic aperture optics, image processing, optical computing, and speckle theory. His first full-length publication (Proc. IEEE, Vol. 53, 168 (1965)) was named a "Citation Classic" by the Institute for Scientific Information. Professor Goodman is a member of the National Academy of Engineering and a Fellow of the American Academy of Arts and Sciences. He is the founder (or co-founder) of Optivision,Inc., ONI Systems, and Nanoprecision Products, Inc., and has served as the director, board member, or chairman of the board of several corporations.

SPIE is proud to announce that a special program honoring Professor Joseph W. Goodman will be held on Wednesday, August 29, 2007 at SPIE's Optics + Photonics meeting in San Diego, California. Many of Prof. Goodman's former students and colleagues will attend the event and give presentations (reminiscences or technical) to commemorate the event. The organizers invite all SPIE attendees to participate in the ceremonies and attend the symposium honoring one of the giants of 20th century optics.

Preliminary list of Speakers:

Jack Gaskill, College of Optical Sciences/ The Univ. of Arizona

Raymond K. Kostuk, The Univ. of Arizona

Anthony E. Siegman, Stanford Univ.

James R. Fineup, Univ. of Rochester

Kristina Johnson, Duke Univ.

Jehoshua Bruck, California Institute of Technology

John Walkup, Consultant

Alexander A. Sawchuk, Univ. of Southern California

Albert Macovski, Stanford Univ.

James C. Wyant, College of Optical Sciences/The Univ. of Arizona

Lambertus Hesselink, Stanford Univ.

Antonio Dias, College of Optical Sciences/ The Univ. of Arizona

Gordon R. Knight, Nanochip, Inc.

Yoshito Tsunoda, Maxell (Japan)

Barry Shoop, Joint IED Defeat Organization

Connie Chang-Hasnain, Univ. of California/Berkeley

Eric W. Hansen, Dartmouth College

Harrison Barrett, College of Optical Sciences/The Univ. of Arizona

David A. B. Miller, Stanford Univ.

Masud Mansuripur, College of Optical Sciences/The Univ. of Arizona

Conference 6664

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6664 • On-Site Proceedings

The Nature of Light: What are photons?

Conference Chairs: **Chandrasekhar Roychoudhuri**, Univ. of Connecticut; **Al F. Kracklauer**, Consultant (Germany); **Katherine Creath**, Optineering and Univ. of Arizona

Program Committee: **Shahriar S. Afshar**, Rowan Univ.; **Robert W. Boyd**, Univ. of Rochester; **Benjamin J. Eggleton**, The Univ. of Sydney (Australia); **Margaret H. Hawton**, Lakehead Univ. (Canada); **Subhash C. Kak**, Louisiana State Univ.; **Andrei Y. Khrennikov**, Växjö Univ. (Sweden); **Thomas F. Krauss**, Univ. of St. Andrews (United Kingdom); **Akhlesh Lakhtakia**, The Pennsylvania State Univ.; **Ashok Muthukrishnan**, Texas A&M Univ.; **John M. Myers**, Harvard Univ.; **Narasimha S. Prasad**, NASA Langley Research Ctr.; **Michael G. Raymer**, Univ. of Oregon; **Wolfgang P. Schleich**, Univ. Ulm (Germany); **Marlan O. Scully**, Texas A&M Univ. and Princeton Univ.; **Weilong She**, Sun Yat-Sen Univ. (China); **C. S. Unnikrishnan**, Tata Institute of Fundamental Research (India); **Ian A. Walmsley**, Univ. of Oxford (United Kingdom); **Herbert G. Winful**, Univ. of Michigan; **Ewan M. Wright**, Optical Sciences Ctr./Univ. of Arizona

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Sunday 26 August

Opening Remarks . . . . . Sun. 9:50 to 10:00 am

Chandrasekhar Roychoudhuri, Univ. of Connecticut; **Al F. Kracklauer**, Consultant (Germany); **Katherine Creath**, Optineering and Univ. of Arizona

SESSION 1 . . . . . Sun. 10:00 am to 11:50 pm

Information and Wave-Particle Duality

Chairs: **Al F. Kracklauer**, Bauhaus Univ. Weimar (Germany); **Chandrasekhar Roychoudhuri**, Univ. of Connecticut

What is the information in a photon? *(Invited Paper),* S. C. Kak, Louisiana State Univ. . . . . [6664-01]

Can a deeper understanding of the nature of light remove the wave-particle duality?, C. Roychoudhuri, Univ. of Connecticut . . . . . [6664-02]

Can we get any new information about the nature of light by comparative study of the radio and light wave communication processes?, C. Roychoudhuri, Univ. of Connecticut; P. Poulos, Manchester Community College . . . . . [6664-12]

Photons as beat frequency envelopes, D. J. Maker, Photon Research Associates, Inc. . . . . [6664-03]

A self-consistent picture of wave-particle duality of light, Y. Gan, Hubei Univ. (China); W. Wang, Vrije Univ. Brussel (Netherlands) . . . . . [6664-04]

Lunch Break

SESSION 2 . . . . . Sun. 1:10 to 3:10 pm

Theoretical Formulations

Chairs: **Herbert G. Winful**, Univ. of Michigan; **Margaret H. Hawton**, Lakehead Univ. (Canada)

Photon position eigenvectors lead to Dirac-like wave mechanics *(Invited Paper),* M. H. Hawton, Lakehead Univ. (Canada) . . . . . [6664-05]

Einstein's dream *(Invited Paper),* A. Y. Khrennikov, Växjö Univ. (Sweden) and International Center for Mathematical Modeling in Physics, Engineering, Economy and Cognitive Sc. (Sweden) . . . . . [6664-06]

Light quantum from classical electromagnetic theory, W. She, Sun Yat-Sen Univ. (China) . . . . . [6664-07]

Single photons cannot be extracted from the light of multi-atom light sources *(Invited Paper),* K. O. Greulich, Fritz Lipmann Institute (Germany) . . . . . [6664-08]

SESSION 3 . . . . . Sun. 3:30 to 5:30 pm

Fundamental Properties of Photons

Chairs: **Wolfgang P. Schleich**, Univ. Ulm (Germany); **Narasimha S. Prasad**, NASA Langley Research Ctr.

Do single photons travel faster than light? *(Invited Paper),* H. G. Winful, Univ. of Michigan . . . . . [6664-09]

Do Abraham or Minkowski care about translating fringe patterns? *(Invited Paper),* M. J. Padgett, J. Leach, Univ. of Glasgow (United Kingdom); S. Franke-Arnold, L. Allen, A. J. Wright, J. M. Girkin, S. M. Barnett, Univ. of Strathclyde (United Kingdom) . . . . . [6664-10]

Experimental detection of photons emitted during inhibited spontaneous emission *(Invited Paper),* D. A. Branning, Trinity College; A. L. Migdall, National Institute of Standards and Technology . . . . . [6664-11]

The orthodox view of a photon and its problems *(Invited Paper)*, W. P. Schleich, Univ. Ulm (Germany) . . . . . [6664-32]

Reception . . . . . 5:30 to 6:00 pm
Authors and Friends of "What are Photons?"

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 4 . . . . . Mon. 8:30 to 10:20 am

Entanglement and EPR

Chairs: **Andrei Y. Khrennikov**, Växjö Univ. (Sweden); **Philip Walther**, Harvard Univ.

Multi-photon entanglement: from quantum curiosity to linear optics quantum computing *(Invited Paper),* P. Walther, Harvard Univ. . . . . [6664-13]

Multi-photon interference with and without entanglement: beating the diffraction limit with classical pulses *(Invited Paper),* A. Pe'er, Univ. of Colorado/Boulder; B. Dayan, California Institute of Technology; A. A. Friesem, Y. Silberberg, Weizmann Institute of Science (Israel) . . . . . [6664-14]

What EPR correlations tell us about light *(Invited Paper),* A. F. Kracklauer, Bauhaus Univ. Weimar (Germany) . . [6664-15]

Is the fair sampling assumption supported by EPR experiments?, G. Adenier, A. Y. Khrennikov, Växjö Univ. (Sweden) . . . . . [6664-16]

SESSION 5 . . . . . Mon. 11:00 am to 12:30 pm

Experimental Measurements

Chairs: **John M. Myers**, Harvard Univ.; **C. S. Unnikrishnan**, Tata Institute of Fundamental Research (India)

Modifications of the Sagnac effect to detect the chirality of space time *(Invited Paper),* R. M. Kiehn, Univ. of Houston (France) . . . . . [6664-17]

Coherence vortex with orbital angular coherence momentum and wave-particle duality in correlation function, W. Wang, M. Takeda, The Univ. of Electro-Communications (Japan) . . . . . [6664-18]

New tests and clarification of some conceptual issues in the superposition of monochromatic light fields, A. Gilra, V. Gokhroo, C. S. Unnikrishnan, Tata Institute of Fundamental Research (India) . . . . . [6664-19]

Why Kastner analysis does not apply to a modified Afshar experiment, E. Flores, E. Knoesel, Rowan Univ. . . [6664-20]

Lunch Break

SESSION 6 . . . . . Mon. 2:00 to 3:40 pm

Reconciling Theory and Measurement

Chairs: **Katherine Creath**, The Univ. of Arizona; **Weilong She**, Sun Yat-Sen Univ. (China)

Photons as elements in models of light-based experiments *(Invited Paper),* J. M. Myers, Harvard Univ. . . . . [6664-21]

Theory and practice: how do we teach our students about light?, K. Creath, The Univ. of Arizona . . . . . [6664-22]

Light and the observer: new experiments and a critique of our common beliefs *(Invited Paper),* C. S. Unnikrishnan, Tata Institute of Fundamental Research (India) . . . . . [6664-23]

Can the hypothesis 'photon interferes only with itself' be reconciled with heterodyne mixing of various sources and the consequent temporal correlations?, C. Roychoudhuri, Univ. of Connecticut; N. S. Prasad, NASA Langley Research Ctr. . . . . [6664-24]

Panel Discussion . . . . . 4:00 to 5:00 pm
Can a photon be both localized within a laser pulse and non-localized when in an interferometer?

Reception, Networking, and Discussion . . . . . 5:00 to 6:00 pm
Authors and Friends of "What are Photons?"

OPTICS

Conference 6664

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

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✔ **A complete description and applications for a photon,** Z. Yao, J. Zhong, B. Pan, Zhejiang Univ. (China) . . . . [6664-25]

✔ **Probing a nonlinear nature of a photon in single photon echo,** S. A. Moiseev, Kazan Physical-Technical Institute (Russia) . . . . . [6664-26]

✔ **What is the shortest pulse duration of light?,** Q. Lin, Zhejiang Univ. (China) . . . . . [6664-27]

✔ **Nonlocality as consequence of PDE type,** D. J. Maker, Photon Research Associates, Inc. . . . . [6664-28]

✔ **The natural philosophy of fundamental particles,** R. C. Storti, Delta Group Engineering, P/L (Australia) . . . [6664-29]

✔ **The nature of light: towards overcoming of the wave-particle duality,** F. T. Valishin, N. T. Valishin, Tatarstan Academy of Sciences (Russia) . . . . . [6664-30]

✔ **The principle of frequency interaction and photo-electronic conversion of the mass wave,** C. Dayong, Beijing Natural Providence Science & Technology [6664-31]

Conference 6665

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6665

New Developments in Optomechanics

Conference Chair: **Alson E. Hatheway**, Alson E. Hatheway, Inc.

Program Committee: **Anees Ahmad**, Raytheon Co.; **Joseph Antebi**, Simpson Gumpertz & Heger Inc.; **Patrick A. Bournes**, MicroMeasure, Inc.; **John M. Casstevens**, Dallas Optical Systems, Inc.; **Robert G. Chave**, RCAP Inc.; **Patrick A. Coronato**, Raytheon Co.; **John G. Daly**, Vector Engineering; **Keith B. Doyle**, Sigmadyne, Inc.; **Robert C. Guyer**, BAE Systems; **Mark J. Hegge**, Ball Aerospace & Technologies Corp.; **Tony B. Hull**, L3 Communications Tinsley; **William J. Lees**, Johns Hopkins Univ.; **Ann F. Shipley**, Univ. of Colorado/Boulder; **Deming Shu**, Argonne National Lab.; **David M. Stubbs**, Lockheed Martin Advanced Technology Ctr.; **Daniel Vukobratovich**, Raytheon Co.; **Paul R. Yoder, Jr.**, Optical Engineering Consultant; **Carl H. Zweben**, Composites Consultant

Tuesday 28 August

Optomechanical/Instrument Technical Event . . . . . Tues. 8:00 to 10:00 pm

Chair: **Alson E. Hatheway,** Alson E. Hatheway Inc.

This is the annual meeting of the premier group of optomechanical engineers that design and analyze the world's optical instruments and systems. Our feature speaker will be Larry Stepp who will discuss, **Optomechanical Challenges of the Thirty Meter Telescope**

The Thirty Meter Telescope (TMT) will be an extremely large, ground-based segmented-mirror optical-infrared telescope. Although similar in concept to the Keck Observatory 10-meter telescopes, each Keck telescope has just 36 hexagonal segments, while TMT will have 492! TMT faces new technical challenges because of its size and complexity and new programmatic challenges because of the strong pressure to limit its cost and complete its construction as quickly as possible. Larry Stepp is the TMT Telescope Department Head. His department is responsible for the telescope structure, optics and controls.

This gathering is open to all attendants to the Optics and Photonics Symposium. Anyone who wishes to put an item on the agenda should contact the Chair [Al Hatheway: aeh@aehinc.com]. One agenda item will certainly be the advance planning of our biennial conference on Optomechanics for year-after-next's (2009's) Optics and Photonics Symposium.

Following the speakers and other agenda items the floor will be open for our traditional 'Problems and Solutions Workshop' session so bring some challenges for the group.

Wednesday 29 August

SESSION 1 . . . . . Wed. 1:30 to 3:10 pm

Design I

Chair: **Alson E. Hatheway**, Alson E. Hatheway, Inc.

Design and test of an airborne IR countermeasures hyper-hemispherical silicon dome, M. J. Bender, R. C. Guyer, BAE Systems; T. E. Fenton, Exotic Electro-Optics, Inc. . [6665-01]

Athermal bonded mounts, C. L. Monti, Raytheon Missile Systems . . . . . [6665-02]

Designing elastomeric mirror mountings, A. E. Hatheway, Alson E. Hatheway, Inc. . . . . [6665-03]

Design and analysis of the composite spider structure within the Kepler Schmidt telescope, M. J. Hegge, R. G. Wendland, C. D. Miller, Ball Aerospace & Technologies Corp. . . . . [6665-04]

An integrated LED luminance-uniform device for light guide plate applications, Z. Chen, C. Chien, Tatung Univ. (Taiwan) . . . . . [6665-05]

SESSION 2 . . . . . Wed. 3:40 to 5:40 pm

Adhesives and Composites

Chair: **John G. Daly**, Vector Engineering

A survey of technical literature on adhesive applications for optics, K. S. Prabhu, Univ. of Florida; J. G. Daly, Vector Engineering; T. L. Schmitz, P. G. Ifju, Univ. of Florida [6665-06]

Index matching silicone for optoelectronic applications, B. Riegler, R. Thomaier, R. Elgiin, NuSil Technology LLC[6665-07]

Advances in adhesive-free bonding technologies for precision optics, T. Turner, J. A. Aust, D. C. Ness, A. Woolverton, Research Electro-Optics, Inc. . . . . [6665-08]

Lightweight optical telescope structures fabricated from CFRP composites, R. N. Martin, R. C. Romeo, Composite Mirror Applications, Inc. . . . . [6665-09]

Calculation of the elastic properties of a triangular cell core for lightweight composite mirrors, F. E. Penado, Northern Arizona Univ.; J. H. Clark III, J. P. Walton, Naval Research Lab.; R. C. Romeo, R. N. Martin, Composite Mirror Applications, Inc. . . . . [6665-10]

Final assembly of the ULTRA 1-m carbon fiber optical telescope, R. C. Romeo, R. N. Martin, Composite Mirror Applications, Inc.; P. B. Etzel, San Diego State Univ.; B. Twarog, Univ. of Kansas . . . . . [6665-11]

✔ Posters-Wednesday

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✔ **Design and performance of a compact collimator at GM/CA-CAT,** S. Xu, R. Fischetti, Argonne National Lab.[6665-33]

✔ **A novel structural health monitoring system based on optical fibers for intelligent structures,** L. Guo, Z. Zhao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [6665-34]

✔ **MIRI telescope simulator (MTS) current status,** F. J. Herrada, Instituto Nacional de Técnica Aeroespacial (Spain) . . . . . [6665-35]

✔ **Mechanical support system of some laser megajoule large-dimension optical components,** S. Noailles, T. Bart, P. Schmitz, A. Hugget, R. Ferbos, S. Bouillet, C. Leymarie, S. Martin, Commissariat à l'Energie Atomique (France) . . . . . [6665-36]

✔ **Novel optomechanical techniques for a custom laser in a rugged environment,** W. C. Welch, Welch Mechanical Designs, LLC; G. A. Rines, Q-Peak, Inc. . . . . [6665-37]

✔ **Analysis and design of an optical spherometer with an adaptive lens,** A. Santiago-Alvarado, Univ. Technologica de la Mixteca (Mexico); S. Vazquez-Montiel, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); J. Gonzalez-Garcia, Univ. Technologica de la Mixteca (Mexico) [6665-38]

✔ **Current techniques and tools for aligning an optical array at the Navy prototype optical interferometer,** J. H. Clark III, Naval Research Lab.; J. P. Walton, Interferometrics Inc. . . . . [6665-39]

✔ **Optical mount modifications for increased articulation at the Navy prototype optical interferometer,** J. H. Clark III, Naval Research Lab.; J. P. Walton, Interferometrics Inc.; F. E. Penado, D. L. Smith, Northern Arizona Univ. . . . . [6665-40]

✔ **Design of asymmetrically-loaded end-plates with vacuum seal surfaces for the Navy prototype optical interferometer,** J. P. Walton, Interferometrics Inc.; J. H. Clark III, Naval Reserach Lab.; F. E. Penado, Northern Arizona Univ. . . . . [6665-41]

Thursday 30 August

SESSION 3 . . . . . Thurs. 8:30 to 10:10 am

Design II

Chair: **Alson E. Hatheway**, Alson E. Hatheway, Inc.

Fine steering mirror for the James Webb space telescope, M. A. Ostaszewski, W. Vremeer, Ball Aerospace & Technologies Corp. . . . . [6665-12]

Design of a flex pivot protection device and a stress-free beamsplitter mount for GOSAT FTS, D. Duquette, N. Etienne, H. L. Buijs, ABB Inc. (Canada) . . . . . [6665-13]

Active tangent link system for transverse support of large thin meniscus mirrors, D. R. Neill, V. L. Krabbendam, J. R. Andrew, National Optical Astronomy Observatory; S. R. Heathcote, Cerro Tololo Inter-American Observatory (Chile); M. Warner, B. Gregory, G. Schumacher, NOAO/Cerro Tololo (Chile) . . . . . [6665-14]

Design optimization of a multi-axis passive isolation configuration for MLCD, K. B. Doyle, Sigmadyne, Inc. . . . . [6665-15]

A study on the optomechanical tolerance model for lens assembly, C. C. Cheng, National Chaio Tung Univ. (Taiwan); T. Y. Lin, Chung Cheng Institute of Technology (Taiwan); R. H. Chen, National Chaio Tung Univ. (Taiwan) . . . . . [6665-16]

SESSION 4 . . . . . Thurs. 10:40 am to 12:20 pm

System Analysis

Chair: **Deming Shu**, Argonne National Lab.

Line-of-sight jitter analysis for MLCD, K. B. Doyle, Sigmadyne, Inc. . . . . [6665-17]

Design and analysis of a low vibration floor for a telescope enclosure, P. G. Wood, F. E. Penado, Northern Arizona Univ.; J. H. Clark III, J. P. Walton, Naval Research Lab. . . [6665-18]

Analysis of thermal stress and deformation in elastically bonded optics, V. M. Ryaboy, Newport Corp. . . . . [6665-19]

Pier vibration isolation for lightweight interferometry telescopes, P. G. Wood, F. E. Penado, Northern Arizona Univ.; J. H. Clark III, J. P. Walton, Naval Research Lab. . . [6665-20]

Ivory optomechanical tools for controlling random vibration effects, A. E. Hatheway, Alson E. Hatheway, Inc. . . . . [6665-21]

Lunch/Exhibition Break

OPTICS

Conference 6665

SESSION 5 . . . . . Thurs. 1:40 to 3:20 pm

Design III

Chair: **Anees Ahmad**, Raytheon Co.

Mechanical design of a high-resolution x-ray powder diffractometer at the advanced photon source, D. Shu, P. L. Lee, C. A. Preissner, M. Ramanathan, M. A. Beno, R. Von Dreele, R. Ranay, L. Ribaud, C. Kurtz, J. Xuesong, P. R. Jemian, B. Toby, Argonne National Lab. . . . . [6665-22]

Precision mechanical design of an UHV-compatible artificial channel-cut x-ray monochromator, D. Shu, S. Narayanan, A. R. Sandy, M. S. Sprung, C. A. Preissner, J. Sullivan, Argonne National Lab. . . . . [6665-23]

Experimental investigation and model development, C. A. Preissner, D. Shu, Argonne National Lab.; T. J. Royston, Univ. of Illinois/Chicago . . . . . [6665-24]

Performance evaluations of the ATST secondary mirror, M. K. Cho, J. R. DeVries, National Optical Astronomy Observatory; E. R. Hansen, National Solar Observatory . . . . . [6665-25]

Cryogenic Fabry-Perot interferometer reinvented, E. Ruiz, E. Sohn, Y. Padilla, Univ. Nacional Autónoma de México (Mexico) . . . . . [6665-26]

SESSION 6 . . . . . Thurs. 3:50 to 5:50 pm

Design of Systems

Chair: **Alson E. Hatheway**, Alson E. Hatheway, Inc.

Shroud Debris Modeling Techniques for IR Sensors in Space, A. Ahmad, A. VanderWyst, D. G. Jenkins, Raytheon Missile Systems . . . . . [6665-27]

Design and tolerancing of a dual-zoom optical sensor head, A. E. Hatheway, Alson E. Hatheway, Inc. . . . [6665-28]

Optomechanical design for the SCUBA-2 polarimeter, S. Bernier, Institut National d'Optique (Canada); P. Bastien, Univ. de Montreal (Canada); M. R. Leclerc, Institut National d'Optique (Canada); É. Bissonnette, Univ. de Montréal (Canada) . . . . . [6665-29]

New design of the laser megajoule final optics assembly, A. Hugget, E. Journot, R. Ferbos, F. Macias, P. Fayollas, Commissariat à l'Energie Atomique (France) . . . . . [6665-30]

Optomechanical design of a field-deployable thermal weapon sight, M. Boucher, N. J. Desnoyers, S. Bernier, A. Bergeron, M. Doucet, F. Lagacé, Institut National d'Optique (Canada); P. Laou, Defence Research and Development Canada (Canada) . . . . . [6665-31]

Three-dimensional MCAD parametric solid modeling as a tool for conceptual opto-mechanical hardware development programs, R. M. Friedman, DTCI . . [6665-32]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC014 Introduction to Optomechanical Design (Vukobratovich) Sunday/Monday 26-27, 8:30 am - 5:30 pm
SC015 Structural Adhesives for Optical Bonding (Daly) Wednesday 29, 8:30 am - 12:30 pm
SC218 Advanced Composite Materials for Optomechanical Systems (Zweben) Tuesday 28, 8:30 am - 5:30 pm
SC219 Materials: Properties and Fabrication for Stable Optical Systems (Paquin) Wednesday 29, 8:30 am - 5:30 pm
SC254 Integrated Opto-Mechanical Analysis (Genberg, Michels, Doyle) Wednesday 29, 8:30 am - 5:30 pm
SC447 Principles for Mounting Optical Components (Yoder) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm
SC561 Optomechanics for Space Applications (Shipley) Tuesday 28, 8:30 am - 5:30 pm
SC781 Optomechanical Analysis (Hatheway) Tuesday 28, 8:30 am - 5:30 pm

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Conference 6666

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6666

Optical Materials and Structures Technologies III

Conference Chair: **William A. Goodman**, Schafer Corp.

Cochair: **Joseph L. Robichaud**, L-3 SSG-Tinsley

Program Committee: **Ray Boucarut**, NASA Goddard Space Flight Ctr.; **Carol A. Click**, SCHOTT North America, Inc.; **David A. Content**, NASA Goddard Space Flight Ctr.; **Brett J. de Blonk**, Air Force Research Lab.; **Douglas Deason**, U.S. Army Space and Missile Defense Command; **Marc T. Jacoby**, Schafer Corp.; **Matthias R. Krödel**, ECM GmbH (Germany); **Thomas B. Parsonage**, Brush Wellman Inc.; **John W. Pepi**, L-3 SSG-Tinsley; **David N. Strafford**, ITT Industries, Inc.; **Marc Tricard**, QED Technologies Inc.; **David V. Wick**, Sandia National Labs.

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 9:50 am

Glass and Glass-Ceramics

Chair: **Carol A. Click**, SCHOTT North America, Inc.

Manufacturing of lightweighted ZERODUR components at SCHOTT, T. Doehring, R. Jedamzik, H. Kohlmann, A. Thomas, P. Hartmann, SCHOTT AG (Germany) . . . . . [6666-01]

Strength aspects for the design of ZERODUR glass ceramics structures, P. Hartmann, K. Nattermann, T. Doehring, SCHOTT AG (Germany) . . . . . [6666-02]

Athermal glass by design, W. A. Goodman, Schafer Corp. . . . . [6666-03]

Optimization of spectralon through numerical modeling and improved processes, B. Y. Chang, R. M. Huppe, Jr., D. P. D'Amato, Labsphere, Inc. . . . . [6666-04]

SESSION 2 . . . . . Sun. 9:50 am to 12:00 pm

SiC Processing and Characterization I

Chair: **Brett J. de Blonk**, Air Force Research Lab.

Chemical vapor composite silicon carbide fabrication methods and techniques, K. Webb, C. T. Tanaka, Kauai Advanced Materials . . . . . [6666-05]

Development of lightweight SiC mirrors for the space infrared telescope for cosmology and astrophysics (SPICA) mission, H. Kaneda, T. Nakagawa, K. Enya, H. Kataza, S. Makiuti, H. Matsuhara, H. Murakami, Y. Y. Yui, Japan Aerospace Exploration Agency (Japan); T. Onaka, The Univ. of Tokyo (Japan) . . . . . [6666-06]

Development of a systematic approach to space qualification of SiC for mirror applications, I. A. Palusinski, The Aerospace Corp. . . . . [6666-07]

Metrology guided laser micromachining of SiC for mirrors, R. L. Jacobsen, M. B. Scott, J. Pitz, Mound Laser & Photonics Ctr., Inc.; A. A. Goshtasby, D. Smith, Wright State Univ. . . . . [6666-08]

Rapid fabrication of lightweight SiC aspheres using reactive atom plasma (RAP) processing, P. Fiske, G. J. Gardopee, Y. Verma, N. Li, P. K. Subrahmanyan, T. H. Yu, P. R. Sommer, T. E. Kyler, RAPT Industries, Inc. . . . . [6666-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:00 to 1:40 pm

SiC Processing and Characterization II

Chair: **Brett J. de Blonk**, Air Force Research Lab.

Characterization of hydrogenated silicon carbide produced by plasma enhanced chemical vapor deposition at low temperature, G. Taglioni, Galileo Avionica SpA (Italy)[6666-10]

Ultrasonic nondestructive evaluation of silicon carbide lightweight mirror systems, R. A. Haber, Rutgers Univ. . . . . [6666-11]

SESSION 4 . . . . . Sun. 1:40 to 3:00 pm

Silicon + Carbon = Silicon Carbide I

Chair: **John W. Pepi**, L-3 SSG-Tinsley

SiC-SiC composite optics for UV applications, W. Kowbel, Materials and Electrochemical Research Corp. . . . [6666-12]

HBCesicâ composites for space optics and structures, M. R. Krödel, ECM GmbH (Germany); T. Ozaki, Mitsubishi Electric Corp. (Japan) . . . . . [6666-13]

Design and fabrication of a single crystal silicon (SCSi) telescope: a success story, D. R. McCarter, R. A. Paquin, E. T. McCarter, McCarter Machine, Inc. . . . . [6666-14]

Investigation of bonding methods for single crystal silicon (SCSi): to itself and to other materials, R. A. Paquin, D. R. McCarter, E. T. McCarter, McCarter Machine, Inc. . [6666-15]

SESSION 5 . . . . . Sun. 3:30 to 4:50 pm

Silicon + Carbon = Silicon Carbide II

Chair: **Matthias R. Krödel**, ECM GmbH (Germany)

Carbon-carbon mirrors for exoatmospheric and space applications, D. E. Krumweide, San Diego Composites LLC . . . . . [6666-16]

Converted silicon carbide technology developments for optics, C. J. Duston, K. M. Woestman, H. Vargus, Poco Graphite, Inc.; B. J. de Blonk, Air Force Research Lab. . . . . [6666-17]

NTSIC: progress in recent two years, K. Tsuno, H. Irikado, K. Ono, NEC TOSHIBA Space Systems, Ltd. (Japan); Y. Itoh, S. Suyama, Toshiba Corp. (Japan) . . . . . [6666-18]

NT-SiC(r) mirror for space application: new advances in manufacture of high-strength reaction-sintered silicon carbide, S. Suyama, Y. Itoh, Toshiba Corp. (Japan); K. Tsuno, K. Ohno, H. Irikado, NEC TOSHIBA Space Systems, Ltd. (Japan) . . . . . [6666-19]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 6 . . . . . Mon. 8:30 to 10:30 am

Silicon + Carbon = Silicon Carbide III

Chair: **Joseph L. Robichaud**, L-3 SSG-Tinsley

Fabrication and optical characterization of a segmented and brazed mirror assembly, D. A. Bath, S. C. Williams, CoorsTek, Inc.; M. Bougoin, BOOSTEC S.A. (France); G. J. Gardopee, RAPT Industries, Inc. . . . . [6666-20]

Cesic(r) and silicon: a perfect combination for high-performance applications, M. R. Krödel, ECM GmbH (Germany); R. Graue, Kayser-Threde GmbH (Germany); M. J. Collon, cosine Research B.V. (Netherlands) . . . . . [6666-21]

Manufacturing of a 3D complex hyperstable Cesic(r) structure, M. R. Krödel, ECM GmbH (Germany) . . [6666-22]

Polishability and thermal stability of reaction bonded silicon carbide, J. L. Robichaud, S. E. Mason, M. Peters, G. Deveau, A. Akerstrom, D. Landry, B. Cozzens, L-3 SSG-Tinsley . . . . . [6666-23]

Lightweight optical assembly using graphite composite structure, C/SiC interface, and silicon mirrors, T. G. Stern, DR Technologies Inc. . . . . [6666-24]

SLMS(tm) athermal technology for high-quality wavefront control of HEL tactical airborne and relay mirror beam control applications, W. A. Goodman, M. T. Jacoby, Schafer Corp. . . . . [6666-25]

SESSION 7 . . . . . Mon. 11:00 am to 12:00 pm

Beryllium and Metals I

Chair: **Thomas B. Parsonage**, Brush Wellman Inc.

Laser produced Fe-TiC composite coatings on Al-Si alloy, A. Viswanathan, D. Sastikumar, National Institute of Technology (India); K. Harish, N. Ashish Kumar, Raja Ramanna Ctr. for Advanced Technology (India) . . . . . [6666-26]

Cryogenic design and predicted performance of the James Webb space telescope beryllium aft optics subsystem optical bench, K. L. Martinez, J. F. Sullivan, A. A. Barto, J. A. Lewis, R. A. Franck, T. E. Dreher, B. A. Shogrin, J. T. Sokol, Ball Aerospace & Technologies Corp. . . . . [6666-27]

Beryllium optics and beryllium-aluminum structures for reconnaissance applications, M. J. Russo, J. Bernabeo, B. Coon, M. Engelhardt, W. Pinzon, BAE Systems . . . [6666-28]

Lunch Break

SESSION 8 . . . . . Mon. 1:30 to 2:30 pm

Beryllium and Metals II

Chair: **Thomas B. Parsonage**, Brush Wellman Inc.

Mirrors from light-weight sintered micro-spheres combined with replication techniques, M. P. Ulmer, Northwestern Univ.; D. Baker, Advanced Powder Solutions; A. J. Davis, S. R. Ehlert, Northwestern Univ.; T. Kaye, Spectrashift.com; M. E. Graham, S. Vaynman, Northwestern Univ. . . . . [6666-29]

The limits of classical beam theory for bent strip residual stress measurements in plated metals, T. M. Sanderson, Raytheon Missile Systems and The Univ. of Arizona [6666-30]

AlBe shaped blank technology, J. Knapp, Brush Wellman Inc. . . . . [6666-31]

SESSION 9 . . . . . Mon. 2:30 to 5:40 pm

MASTER's Session

Chair: **William A. Goodman**, Schafer Corp.

Telescope materials (r)evolution: a historical perspective *(Invited Paper)*, R. A. Paquin, Advanced Materials Consultant . . . . . [6666-32]

The evolution of thin surface films for space optical systems *(Invited Paper)*, J. B. Heaney, Swales Aerospace . . . . . [6666-33]

Materials for high-energy laser windows: how thermal lensing and thermal stresses control the performance *(Invited Paper)*, C. A. Klein, C.A.K. Analytics, Inc. [6666-34]

Optomechanical design, engineering, and fabrication: 60 years of evolution *(Invited Paper)*, P. R. Yoder, Jr., Optical Engineering Consultant . . . . . [6666-35]

History of the development of hot-pressed and chemical-vapor-deposited zinc sulfide and zinc selenide in the United States *(Invited Paper)*, D. C. Harris, Naval Air Warfare Ctr. . . . . [6666-36]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Porous-nanostructured and multi-layer left-handed material slab at optical frequencies,** P. Chen, S. Wu, Y. Chen, J. Tsai, National Nano Device Labs. (Taiwan) [6666-37]

✔ **Theoretical analysis for double-liquid variable focus lens,** R. Peng, J. Chen, S. Zhuang, Shanghai Univ. of Science and Technology (China) . . . . . [6666-38]

✔ **Monitoring and analysis of optical fiber intelligent structures,** Z. Zhao, L. Guo, Y. Song, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [6666-39]

✔ **Research on the design and performance assess of a photoelectric detecting system,** C. Ma, Z. Zhao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . [6666-40]

✔ **Characteristic and application of shortwave curing materials,** X. Hong, Z. Zhao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [6666-41]

Courses of Related Interest

See pages 162-187 for full course descriptions.

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SC561 Optomechanics for Space Applications (Shipley) Tuesday 28, 8:30 am - 5:30 pm
SC781 Optomechanical Analysis (Hatheway) Tuesday 28, 8:30 am - 5:30 pm

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Conference 6667

Monday 27 August 2007 • Proceedings of SPIE Vol. 6667

Current Developments in Lens Design and Optical Engineering VIII

Conference Chairs: **Pantazis Z. Mouroulis**, Jet Propulsion Lab.; **Warren J. Smith**, Rockwell Collins Optronics; **R. Barry Johnson**, PanTechne Corp.

Program Committee: **Florian Bociort**, Technische Univ. Delft (Netherlands); **Apostolos Deslis**, InPhase Technologies; **Robert E. Fischer**, OPTICS 1, Inc.; **Virendra N. Mahajan**, The Aerospace Corp.; **Simon Thibault**, ImmerVision (Canada); **Daniel W. Wilson**, Jet Propulsion Lab.; **Andrew P. Wood**, QIOPTIQ (United Kingdom); **James M. Zavislan**, Univ. of Rochester

Monday 27 August

SESSION 1 . . . . . Mon. 8:00 to 10:10 am

Lens Design and Applications

Chair: **Virendra N. Mahajan**, The Aerospace Corp.

Advances in tuneable imaging technologies: electrically variable lens *(Invited Paper)*, T. V. Galstian, V. V. Presniakov, K. E. Asatryan, A. Tork, A. V. Zohrabyan, A. Bagramyan, Univ. Laval (Canada) . . . . . [6667-01]

New generation of high-resolution panoramic lenses, S. Thibault, ImmerVision (Canada) . . . . . [6667-02]

Design and analysis of a diffractive astigmatic lens for DVD pickup, W. Chen, Univ. of Minnesota/Twin Cities; C. Chen, National Tsing Hua Univ. (Taiwan) . . . . . [6667-03]

Large-format telecentric lens, H. Bai, S. P. Sadoulet, Edmund Optics Inc. . . . . [6667-04]

Rear landscape on steroids, P. Z. Mouroulis, Jet Propulsion Lab. . . . . [6667-05]

Optical encoder based on a nondiffractive beam, A. Lutenberg, F. L. Perez-Quintian, M. A. Rebollo, Univ. de Buenos Aires (Argentina) . . . . . [6667-06]

SESSION 2 . . . . . Mon. 10:40 am to 12:10 pm

Aberration Theory and Deisgn

Chair: **Simon Thibault**, ImmerVision (Canada)

Practical guide to saddle-point construction in lens design *(Invited Paper)*, F. Bociort, M. van Turnhout, O. Marinescu, Technische Univ. Delft (Netherlands) . . . . . [6667-07]

Predictability and unpredictability in optical system optimization, M. van Turnhout, F. Bociort, Technische Univ. Delft (Netherlands) . . . . . [6667-08]

Some properties of Mertz type aspheric surfaces, T. B. Andersen, Lockheed Martin Corp. . . . . [6667-09]

Third order aberration solution using aberration polynomials for a general zoom lens design, H. K. F. An, The Univ. of Alabama in Huntsville . . . . . [6667-10]

Lunch Break

SESSION 3 . . . . . Mon. 1:30 to 3:00 pm

System Modeling I

Chair: **R. Barry Johnson**, PanTechne Corp.

Vision multiplexing: an optical engineering concept for low-vision aid *(Invited Paper)*, E. Peli, Schepens Eye Research Institute . . . . . [6667-11]

Modeling of polychromatic MTF losses due to sub-aperturing a diffractive element in zoom lenses, M. D. Thorpe, R. P. Jonas, S. Szapiel, ELCAN Optical Technologies (Canada) . . . . . [6667-12]

Scene-based sensor modeling using optical design software, J. Fisher, Brandywine Optics, Inc. . . . . [6667-13]

Spectral response evaluation and computation for pushbroom imaging spectrometers, P. Z. Mouroulis, Jet Propulsion Lab.; R. O. Green, Jet Propulsion Lab. and California Institute of Technology . . . . . [6667-14]

SESSION 4 . . . . . Mon. 3:30 to 5:10 pm

System Modeling II

Chair: **James M. Zavislan**, Univ. of Rochester

Space-variant polarization in optical design *(Invited Paper)*, T. G. Brown, Univ. of Rochester . . . . . [6667-15]

Stress-induced focal splitting, A. K. Spilman, T. G. Brown, Institute of Optics . . . . . [6667-16]

Analysis of stray light in most complex situations, J. Perrin, Consultant (France) . . . . . [6667-17]

Bi-centenary celebration of successes of Fourier theorem: not a principle and yet a principal tool for optical system designs *(Invited Paper)*, C. Roychoudhuri, Univ. of Connecticut . . . . . [6667-18]

✔ Posters-Monday

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✔ **Aplanatic hybrid lenses,** S. Vazquez-Montiel, O. García-Liévanos, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6667-19]

✔ **Mechanical design and analysis of a variable focal length lens,** J. Gonzalez-Garcia, V. M. Cruz-Martínez, A. Santiago-Alvarado, Univ. Technologica de la Mixteca (Mexico); S. Vazquez-Montiel, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); J. A. Rayas-Alvarez, Ctr. de Investigaciones en Óptica, A.C. (Mexico); A. J. Mendoza-Jasso, Univ. Technologica de la Mixteca (Mexico) . . . . . [6667-20]

✔ **Estimating the factors restricting potential dynamic range in the optical scheme of acousto-optical spectrometer for the Mexican large millimeter telescope,** A. S. Shcherbakov, S. E. Balderas-Mata, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6667-21]

✔ **A compact camera/handlens/microscope with laser spectroscopy for lunar in-situ resource prospecting,** C. A. Sepulveda, G. S. Mungas, K. R. Johnson, G. Olarte, J. L. Lambert, C. C. La Baw, J. E. Feldman, M. S. Anderson, J. Boynton, Jet Propulsion Lab. . . . . [6667-22]

✔ **Studies of the manufacturability of the HOE included in objective of BD/DVD combined optical pick-up head according to the objective lens glass type,** N. V. Lisitsyna, Bauman Moscow State Technical Univ. (Russia) . . [6667-23]

✔ **Polarization-holographic correctors of laser radiation on the basis of the phenomenon of the wave front reversal,** V. I. Tarasashvili, A. L. Purtseladze, Institute of Cybernetics (Georgia) . . . . . [6667-24]

✔ **A compact and cost effective design for cell phone zoom lens,** C. Chang, Industrial Technology Research Institute (Taiwan); C. Wu, EFUN Technology (Taiwan) . . . . . [6667-25]

Tuesday 28 August

Lens Design Technical Event . Tues. 8:00 to 10:00 pm

Chairs: **Mary Turner,** Breault Research Organization, Inc.; **Steve Johnston,** Photon Engineering, LLC; **Rich Pfisterer,** Photon Engineering, LLC

"Let's Give 'Em Something to Talk About!"

We are in the process of inviting a panel of experienced, "recognized" professional lens designers to come and talk about...lens design! We want to hear about what they're designing, how they're going about doing it (what materials, software, techniques, etc.), and what problems they're encountering. We want to hear about technical and commercial trends in the marketplace. We want to hear who's making the optics! We want them to give us something to talk about!

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC003 Practical Optical System Design - EXPANDED 2 Day Format (Fischer) Sunday/Monday 26-27, 8:30 am - 5:30 pm

SC006 Modern Lens Design (Smith) Monday/Tuesday 27-28, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

SC134 Optical Design Fundamentals for Infrared Systems (Riedl) Sunday 26, 8:30 am - 5:30 pm

SC384 The Design of Plastic Optical Systems (Schaub) Monday 27, 1:30 - 5:30 pm

SC552 Aspheric Optics: Design, Fabrication, and Test (Fischer) Wednesday 29, 1:30 - 5:30 pm

SC560 Exploring Optical Aberrations (Mahajan) Sunday 26, 8:30 am - 5:30 pm

SC659 Understanding Reflective Optical Design (Contreras) Monday 27, 8:30 am - 5:30 pm

SC720 Cost-Conscious Tolerancing of Optical Systems (Youngworth) Monday 27, 1:30 - 5:30 pm

SC792 Polarization in Optical Design (Chipman) Sunday 26, 8:30 am - 12:30 pm

SC835 Infrared Systems - Technology & Design (Daniels) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

Conference 6668

Tuesday-Wednesday 28-29 August 2007 • Proceedings of SPIE Vol. 6668

Novel Optical Systems Design and Optimization X

Conference Chairs: **R. John Koshel**, Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona; **G. Groot Gregory**, Optical Research Associates

Program Committee: **Jyh-Long Chern**, National Chiao Tung Univ. (Taiwan); **Alexander Epple**, Carl Zeiss AG (Germany); **Joseph M. Howard**, NASA Goddard Space Flight Ctr.; **Richard C. Juergens**, Raytheon Missile Systems; **Scott A. Lerner**, Hewlett-Packard Co.; **Rongguang Liang**, Eastman Kodak Co.; **Andrew B. Locke**, ZEMAX Development Corp.; **Paul K. Manhart**, ASML; **Richard N. Pfisterer**, Photon Engineering, LLC; **Andrew Rakich**, EOS Space Systems Pty. Ltd. (Australia); **Jannick P. Rolland**, College of Optics & Photonics/Univ. of Central Florida; **José M. Sasian**, The Univ. of Arizona; **David L. Shealy**, The Univ. of Alabama/Birmingham; **Donn M. Silberman**, PI Physik Instrumente L.P. and Optics Institute of Southern California; **Marija Strojnik-Scholl**, Ctr. de Investigaciones en Óptica, A.C.; **Kevin P. Thompson**, Optical Research Associates; **Mary G. Turner**, Breault Research Organization, Inc.

Tuesday 28 August

Novel Introduction . . . . . Tues. 8:00 to 8:10 am

Chair: **R. John Koshel,** Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona

SESSION 1 . . . . . Tues. 8:10 to 10:20 am

Optical Design

Chair: **Scott A. Lerner**, Hewlett-Packard Co.

Optical design and tolerance analysis of the infrared survey telescope for remote sensor, J. Chang, Beijing Institute of Technology (China); X. Cong, Changchun Institute of Optics, Fine Mechanics and Physics (China); H. Jiang, Changchun Univ. of Science and Technology (China); Z. Weng, Changchun Institute of Optics, Fine Mechanics and Physics (China); Y. Wang, Beijing Institute of Technology (China) . . . . [6668-01]

Direct methods for freeform surface design *(Invited Paper)*, R. A. Hicks, Drexel Univ. . . . . [6668-02]

Automated transfer of opto-mechanical tolerances from CAD programs to optical codes, M. S. Boren, R. C. Juergens, Raytheon Missile Systems . . . . . [6668-03]

Optical modeling activities for NASA's James Webb Space Telescope (JWST): IV. overview and introduction of Matlab based toolkits used to interface with optical design software, J. M. Howard, NASA Goddard Space Flight Ctr. . . . . [6668-04]

Evaluation of the wavefront and caustic surfaces within refractive laser beam shapers, D. L. Shealy, The Univ. of Alabama at Birmingham; J. A. Hoffnagle, IBM Almaden Research Ctr. . . . . [6668-05]

The high efficiency collimator for HD-DVD optical pickup head application, W. Sun, National Central Univ. (Taiwan) . . . . . [6668-06]

SESSION 2 . . . . . Tues. 10:50 am to 12:00 pm

'Reduced' Optics

Chair: **Joseph M. Howard**, NASA Goddard Space Flight Ctr.

Broadband endoscopic imaging through a single fiberoptic channel, A. L. Kano, A. Gmitro, College of Optical Sciences/ The Univ. of Arizona; R. J. Koshel, Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona[6668-07]

Arc-sectioned annular folded imagers *(Invited Paper)*, E. J. Tremblay, Univ. of California/San Diego; R. A. Stack, R. L. Morrison, Distant Focus Corp.; J. Ford, Univ. of California/San Diego . . . . . [6668-08]

A study of LED light-linear device for light guide plate applications, Z. Chen, C. Chien, Tatung Univ. (Taiwan) . . . . . [6668-09]

Lunch Break

SESSION 3 . . . . . Tues. 1:30 to 2:20 pm

Optics Education I

Chair: **Donn M. Silberman**, PI Physik Instrumente L.P. and Optics Institute of Southern California

Creating scientific and technical talent through educational outreach, D. E. Diggs, J. G. Grote, Air Force Research Lab.; K. W. Jones, L. C. Jenkins, U.S. Air Force; I. L. Turner, Freescale Semiconductor, Inc. . . . . [6668-10]

Professional development in photonics: the advanced technology education projects of the New England board of education *(Invited Paper)*, J. F. Donnelly, Three Rivers Community College; F. D. Hanes, New England Board of Higher Education; N. M. Massa, Central Connecticut State Univ. . . . . [6668-11]

Break

SESSION 4 . . . . . Tues. 2:30 to 3:30 pm

Historical Perspectives in Optical Design

Chair: **G. Groot Gregory**, Optical Research Associates

Evidence supporting the primacy of Joseph Petzval in the development of aberration coefficients and their application to lens design *(Invited Paper)*, A. Rakich, EOS Space Systems Pty. Ltd. (Australia); R. N. Wilson, European Southern Observatory (Germany) . . . . . [6668-12]

The earliest history of computer-aided optical design on large computers: the previously classified work by James G. Baker 1945-1954 *(Invited Paper)*, K. P. Thompson, Optical Research Associates . . . . . [6668-13]

SESSION 5 . . . . . Tues. 4:00 to 5:40 pm

Optics Education II

Chair: **José M. Sasian**, College of Optical Sciences/ The Univ. of Arizona

Hands-on optics: an informal science education initiative, A. M. Johnson, Univ. of Maryland/Baltimore County; S. M. Pompea, National Optical Astronomy Observatory; E. G. Arthurs, SPIE; C. E. Walker, R. T. Sparks, National Optical Astronomy Observatory . . . . . [6668-14]

Teaching lens, optical systems and opto-mechanical systems design at the Irvine Center for Applied Competitive Technologies (CACT), V. V. Doushkina, MetroLaser, Inc.; D. M. Silberman, PI Physik Instrumente L.P. and Optics Institute of Southern California . . . . . [6668-15]

A course in illumination engineering, R. J. Koshel, Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona . . . . . [6668-16]

Art + technology in optics educational outreach programs, D. M. Silberman, Optics Institute of Southern California . . . . . [6668-17]

Finding science is fun in a 'Magic Show of Light' from optical demonstrations on an overhead projector for elementary school students, J. J. Lones, Adroit Engineering, Inc.; N. K. Maltseva, St. Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russia) and Adroit Engineering, Inc.; K. N. Peterson, Ford Motor Co. and Clarenceville School District Board of Education . . [6668-18]

Tuesday 28 August

Lens Design Technical Event . Tues. 8:00 to 10:00 pm

Chairs: **Mary Turner,** Breault Research Organization, Inc.; **Steve Johnston,** Photon Engineering, LLC; **Rich Pfisterer,** Photon Engineering, LLC

"Let's Give 'Em Something to Talk About!"

We are in the process of inviting a panel of experienced, "recognized" professional lens designers to come and talk about...lens design! We want to hear about what they're designing, how they're going about doing it (what materials, software, techniques, etc.), and what problems they're encountering. We want to hear about technical and commercial trends in the marketplace. We want to hear who's making the optics! We want them to give us something to talk about!

Wednesday 29 August

SESSION 6 . . . . . Wed. 8:00 to 10:00 am

Optical Systems and Applications

Chair: **Andrew Rakich**, EOS Space Systems Pty. Ltd. (Australia)

High NA line scanning system, R. Liang, Eastman Kodak Co. . . . . [6668-19]

Space imaging optical guidance for ground vehicle, A. Akiyama, Kanazawa Technical College (Japan); N. Kobayashi, Kanazawa Institute of Technology (Japan); E. Mutoh, Kawasaki Heavy Industries, Ltd. (Japan); H. Kumagai, Tamagawa Seiki Co., Ltd. (Japan); H. Yamada, Kanazawa Technical College (Japan); H. Ishii, Nihon Univ. (Japan) . . . . . [6668-20]

Volume holographic beam splitter for hyperspectral imaging applications, J. D. Matchett, R. I. Billmers, E. J. Billmers, M. E. Ludwig, RL Associates Inc. . . . . [6668-21]

A dual channel lens for simultaneous VIS and SWIR imaging in harsh radiation environments, S. M. Dets, Mattson Technology Canada (Canada) . . . . . [6668-22]

Optical deformation sensor based on morphology dependent resonances, A. M. Rahman, R. Eze, S. Kumar, Polytechnic Univ. . . . . [6668-23]

Design of diffraction optical element applied to resonant cavity LED, S. Chang, Far East College (Taiwan); T. Liang, National Kaohsiung First Univ. of Science and Technology (Taiwan) . . . . . [6668-24]

SESSION 7 . . . . . Wed. 10:30 to 11:50 am

Optics for Mobile Systems

Chair: **Rongguang Liang**, Eastman Kodak Co.

Design issues for semi-passive optical communication devices, I. Glaser, Holon Institute of Technology (Israel) . . . . . [6668-25]

Micro-Lens (ML) maker equation of a CMOS image sensor, Y. Wu, OmniVision Technologies, Inc. . . . . [6668-26]

3X zoom lens system for cell phone cameras, D. J. Reiley, Y. Lo, R. Jenkin, Rhevision Technology, Inc. . . . . [6668-27]

Zoom lens design of mobilephone camera with global-explorer optimization, C. Hung, J. Chern, National Chiao Tung Univ. (Taiwan) . . . . . [6668-28]

Closing Remarks . . . . . Wed. 11:50 am to 12:00 pm

Chair: **R. John Koshel,** Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Design and manufacture of non-coaxial grazing reflective x-ray microscope,** J. Hu, Dalian Univ. of Technology (China); Y. Bai, Changchun Institute of Optics, Fine Mechanics and Physics (China) . . . . . [6668-29]

✔ **Variable focus photographic lens without mechanical movements,** J. Chen, R. Peng, S. Zhuang, Univ. of Shanghai for Science and Technology (China) . . . . [6668-30]

✔ **Optical zoom system design for compact digital camera using lens modules,** S. C. Park, Dankook Univ. (South Korea) . . . . . [6668-31]

✔ **Structural design of a lens component,** S. Chatterjee, L. N. Hazra, Univ. of Calcutta (India) . . . . . [6668-32]

✔ **Novel microscopy in arbitrary step digital holography,** C. Lin, National Central Univ. (Taiwan); G. L. Chen, M. K. Kuo, National Defense Univ. (Taiwan); C. C. Chang, Ming Dao Univ. (Taiwan) . . . . . [6668-33]

✔ **The design of a Noble VCSEL with DOE,** T. Liang, National Kaohsiung First Univ. of Science and Technology (Taiwan); S. Chang, Far East College (Taiwan) . . . . . [6668-34]

✔ **Innovative global approach for high-performance low-cost integral field unit (IFU),** S. Vivès, E. Prieto, Observatoire Astronomique de Marseille Provence (France); Y. Salaun, Winlight Optics (France) . . . . . [6668-35]

✔ **Optical design of near diffraction limited HUD (heads-up-display),** M. Negarchi, Univ. of Isfahan (Iran) . . [6668-36]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC003 Practical Optical System Design - EXPANDED 2 Day Format (Fischer) Sunday/Monday 26-27, 8:30 am - 5:30 pm

SC006 Modern Lens Design (Smith) Monday/Tuesday 27-28, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

SC134 Optical Design Fundamentals for Infrared Systems (Riedl) Sunday 26, 8:30 am - 5:30 pm

SC384 The Design of Plastic Optical Systems (Schaub) Monday 27, 1:30 - 5:30 pm

SC552 Aspheric Optics: Design, Fabrication, and Test (Fischer) Wednesday 29, 1:30 - 5:30 pm

SC560 Exploring Optical Aberrations (Mahajan) Sunday 26, 8:30 am - 5:30 pm

SC659 Understanding Reflective Optical Design (Contreras) Monday 27, 8:30 am - 5:30 pm

SC720 Cost-Conscious Tolerancing of Optical Systems (Youngworth) Monday 27, 1:30 - 5:30 pm

SC792 Polarization in Optical Design (Chipman) Sunday 26, 8:30 am - 12:30 pm

SC835 Infrared Systems - Technology & Design (Daniels) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

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Conference 6669

Monday-Wednesday 27-29 August 2007 • Proceedings of SPIE Vol. 6669

Seventh International Conference on Solid State Lighting

Conference Chairs: **Ian T. Ferguson**, Georgia Institute of Technology; **Nadarajah Narendran**, Rensselaer Polytechnic Institute; **Tsunemasa Taguchi**, Yamaguchi Univ. (Japan); **Ian E. Ashdown**, TIR Systems Ltd. (Canada)

Program Committee: **Srinath K. Aanegola**, GELcore LLC; **Andrew A. Allerman**, Sandia National Labs.; **William J. Cassarly**, Optical Research Associates; **Lianghui Chen**, Institute of Semiconductors (China); **Makarand H. Chipalkatti**, OSRAM Opto Semiconductors Inc.; **Steven P. DenBaars**, Univ. of California/Santa Barbara; **Kevin J. Dowling**, Color Kinetics Inc.; **Ivan Eliashevich**, IQE RF; **Volker K. Härle**, OSRAM Opto Semiconductors GmbH (Germany); **Asif W. Khan**, Univ. of South Carolina; **Michael R. Krames**, Philips Lumileds Lighting Co.; **Yung-Sheng Liu**, National Tsing Hua Univ. (Taiwan); **Shuji Nakamura**, Univ. of California/Santa Barbara; **Eun-Hyun Park**, Epivalley Co., Ltd. (South Korea); **Seong-Ju Park**, Gwangju Institute of Science and Technology (South Korea); **Yoon-Soo Park**, Rensselaer Polytechnic Institute; **Robert V. Steele**, Strategies Unlimited; **Brent K. Wagner**, Georgia Institute of Technology; **Chih-Chung Yang**, National Taiwan Univ. (Taiwan)

Monday 27 August

SESSION 1 . . . . . Mon. 8:30 to 10:00 am

LED I

Chair: **Ian T. Ferguson**, Georgia Institute of Technology

History of high-power light emitting diodes *(Invited Paper)*, N. F. Gardner, Philips Lumileds Lighting Co. . . . . [6669-01]

Vertical GaN based light emitting diodes on metal alloy substrate boosts high power LED performance, T. Doan, C. Tran, C. Chu, C. Cheng, W. Liu, J. Chu, J. Yen, H. Cheng, F. Fan, Semi-Photonics Co., Ltd. (Taiwan) . . . . . [6669-02]

Enhancement of light-output and reliability of GaN-based high power green light-emitting diodes using gallium-doped ZnO electrode grown by oxygen plasma enhance PLD, M. Oh, D. Hwang, J. Lim, J. Kim, Y. Choi, S. Park, Kwangju Institute of Science and Technology (South Korea) . . . . . [6669-03]

Light enhancement by the formation of a ceramic honeycomb nano-structure on the n-GaN surface of thin-GaN LEDs, C. Lin, C. Liu, National Central Univ. (Taiwan) . . . . . [6669-04]

Surface plasmon coupling with the InGaN/GaN quantum well in a single-quantum-well blue light-emitting diode, D. Yeh, C. Huang, T. Tang, Y. Lu, C. Chen, C. Yang, National Taiwan Univ. (Taiwan) . . . . . [6669-05]

SESSION 2 . . . . . Mon. 11:00 am to 12:00 pm

Application

Chair: **Nathan F. Gardner**, Philips Lumileds Lighting Co.

Efficient calculation of luminance variation of a luminaire using LED light sources, P. Goldstein, Dialight Corp.[6669-06]

Solid state lighting applications for volumetric diffusers, T. L. Kelly, Z. A. Coleman, K. Osborn, M. Chu, Fusion Optix, Inc. . . . . [6669-07]

Direct RGB LED backlight for large area LCD tv, S. Chung, C. Hsieh, National Central Univ. (Taiwan); I. Moreno, National Central Univ. (Taiwan) and Univ. Autonoma de Zacatecas (Mexico); W. Chien, T. Lee, C. Sun, National Central Univ. (Taiwan) . . . . . [6669-08]

Design and development of a new method for enhancing LED beam pattern to wider angles, A. Rahmani Nejad, Civil Aviation Organization (Iran) . . . . . [6669-09]

Lunch Break

SESSION 3 . . . . . Mon. 1:30 to 3:00 pm

Source Performance I

Chair: **Eun-Hyun Park**, Georgia Institute of Technology

Recent progress on n-UV chip *(Invited Paper)*, T. Taguchi, Yamaguchi Univ. (Japan) . . . . . [6669-10]

Performance and trends of high luminance light emitting diodes, S. J. Bierhuizen, G. Harbers, Philips Lumileds Lighting Co. . . . . [6669-11]

Peak wavelength shifts and opponent-colors theory, I. E. Ashdown, M. Salsbury, TIR Systems Ltd. (Canada) [6669-12]

Uniform color space based on color matching, S. Liao, C. Lee, T. Yang, National Central Univ. (Taiwan) . . . . . [6669-13]

Achieving high CRI from warm to super white, E. Bailey, Transducin Optics LLC and Lamina Ceramics Inc. [6669-14]

SESSION 4 . . . . . Mon. 3:30 to 5:00 pm

LED II

Chair: **Tsunemasa Taguchi**, Yamaguchi Univ. (Japan)

InGaN based high effiency light emitting diode *(Invited Paper)*, E. Park, S. Jeon, C. Kim, D. Kim, J. Park, Epivalley Co., Ltd. (South Korea) . . . . . [6669-15]

Design of high-efficient large area GaN-based LEDs, T. Lee, C. Chien, C. Hu, C. Sun, National Central Univ. (Taiwan) . . . . . [6669-16]

Improved electrostatic discharge withstand capability and optical output power of GaN-based LEDs by wet chemical etching of p-GaN, T. Park, K. Lee, J. Kim, S. Park, Kwangju Institute of Science and Technology (South Korea); K. Min, SAMSUNG Electro-Mechanics Co., Ltd. (South Korea) . . . . . [6669-17]

Photoluminescence dynamics investigation of InGaN/GaN multiple quantum well light-emitting diodes grown by metalorganic chemical vapor deposition, T. W. Kuo, Z. S. Lee, S. .. Hung, Z. Feng, National Taiwan Univ. (Taiwan); A. G. Li, ShenZhen Fangda GuoKe Optronics Technical Co. Ltd. (China); N. Li, I. T. Ferguson, Georgia Institute of Technology; T. Y. Lin, National Taiwan Ocean Univ. (Taiwan); Y. F. Chen, National Taiwan Univ. (Taiwan) . . . . . [6669-18]

High-pressure chemical vapor deposition: an enabling technology for the fabrication of embedded indium rich In1-xGaxN heterostructures, N. Dietz, M. Alevli, G. Durkaya, R. Atalay, Georgia State Univ.; W. Fenwick, I. T. Ferguson, Georgia Institute of Technology . . . . . [6669-19]

Illumination Technical Event . Mon. 8:00 to 10:00 pm

Chair: **R. John Koshel,** Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona

We will present two topics: étendue and state-of-the-art concepts for displays. For the former, speakers from display manufacturers, such as Philips, will be on hand to discuss such display topics as:

- LED displays,
- Visual experience of viewing displays, and
- Future trends in displays.

For the étendue topic, a panel with a moderator will be convened to discuss this very important topic of illumination system design. Étendue describes the geometrical propagation characteristics of optical systems, and for illumination systems it provides a metric for design analysis and limitations. This provides a physical limit analogous to that of the diffraction limit of imaging/lens design. For both topics, each presenter will give a short overview, followed by questions from the audience. If you would like to participate as a presenter in either of these areas, or possibly in another area, please contact John Koshel (john.koshel@osa.org). At the conclusion of the planned agenda the floor will be open to impromptu presentations and questions. Light refreshments will be served. We look forward to your participation.

Tuesday 28 August

Plenary Session . . . . . Tues. 8:30 to 10:00 am

OLED/SSL

8:30 am: **Solid State Lighting: Illumination and Communication** *(Invited Paper, Presentation Only),* I. E. Ashdown, Senior Research Scientist for TIR Systems Ltd. (Canada) and Senior Software Engineer for Lighting Analysts Inc. and President of by.Heart Consultants Ltd. (Canada)

9:15 am: **Organic LEDs for Lighting Applications** *(Invited Paper, Presentation Only),* J. Kido, Professor, Yamagata Univ. (Japan) and General Director, Research Institute for Organic Electronics (Japan)

SESSION 5 . . . . . Tues. 10:30 am to 12:10 pm

OLEDs and Solid State Lighting

Joint Session with Conference 6655: Organic Light Emitting Materials and Devices XI

Chair: **Ian T. Ferguson**, Georgia Institute of Technology

Employing microcavity effects to enhance performances of white-emitting OLEDs *(Invited Paper)*, C. Wu, Y. Lu, T. Cho, National Taiwan Univ. (Taiwan) . . . . . [6655-31]

An overview of the DOE SSL program *(Invited Paper)*, P. M. Pattison, National Energy Technology Lab. . . . . [6669-20]

Low-cost manufacturing processes for OLEDs *(Invited Paper)*, J. Liu, C. Ye, L. N. Lewis, A. R. Duggal, GE Global Research . . . . . [6655-32]

Circadian photoreception and the use of physiologically adaptive LEDs (PALs) to treat dysfunctions of the circadian system *(Invited Paper)*, G. Tosini, Morehouse School of Medicine; I. T. Ferguson, Georgia Institute of Technology . . . . . [6669-21]

Lunch/Exhibition Break

SESSION 6 . . . . . Tues. 1:30 to 3:00 pm

Phosphors

Chair: **P. Morgan Pattison**, National Energy Technology Lab.

Enhanced performance of solid state lighting phosphors *(Invited Paper)*, H. Menkara, B. K. Wagner, C. J. Summers, Phosphor Technology Ctr. of Excellence . . . . . [6669-22]

Study of rare-earth-doped borate phosphor thin films prepared by pulsed laser deposition, J. Hao, The Hong Kong Polytechnic Univ. (Hong Kong China); G. He, Huazhong Univ. of Science and Technology (China) . . . . . [6669-23]

A precise optical model of phosphor-based multi-chip LEDs, W. Chien, C. Tsai, H. Ho, C. Sun, S. Ma, National Central Univ. (Taiwan); C. Chen, NeoPac Lighting, Inc. (Taiwan) . . . . . [6669-24]

Silicate phosphors and white LED technology - improvements and opportunities, P. Hartmann, Tridonic Optoelectronics GmbH (Austria); F. Wenzl, JOANNEUM RESEARCH GmbH (Austria); D. Strarick, Leuchtstoffwerk Breitungen GmbH (Germany) . . . . . [6669-25]

Materials design and properties of nitride phosphors for LEDs, P. J. Schmidt, A. Tuecks, J. Meyer, H. Bechtel, D. U. Wiechert, Philips Research Labs. (Germany); R. Mueller-Mach, G. O. Mueller, Lumileds Lighting, LLC; W. Schnick, Ludwig-Maximilians-Univ. München (Germany) . . . . . [6669-26]

SESSION 7 . . . . . Tues. 3:30 to 5:00 pm

Source Performance II

Chair: **Wang N. Wang**, Univ. of Bath (United Kingdom)

Lighting with diodes *(Invited Paper)*, J. Nause, B. Nemeth, V. Rengarajan, M. Pan, Cermet, Inc.; N. Li, S. Wang, Z. C. Feng, I. T. Ferguson, Georgia Institute of Technology . . . . . [6669-27]

Efficiency improvements of white-light CdSe nanocrystal-based LEDs, J. D. Gosnell, M. A. Schreuder, S. J. Rosenthal, S. M. Weiss, Vanderbilt Univ. . . . . [6669-28]

An improved method for measuring LED intensity distribution from a single CCD image, I. Moreno, National Central Univ. (Taiwan) and Univ. Autonoma de Zacatecas (Mexico); M. Han, W. Jian, T. Lee, C. Sun, National Central Univ. (Taiwan) . . . . . [6669-29]

Large, thin, flexible and low-cost light emitting surfaces, B. A. Salters, M. C. P. M. Krijn, Philips Research Labs. (Netherlands) . . . . . [6669-30]

Investigation of thermal management techniques in blue LED airport taxiway fixtures, Y. Gu, N. Narendran, A. Baker, M. Overington, Rensselaer Polytechnic Institute . . [6669-31]

✔ Poster/Demo Session-Tuesday

Poster authors will begin displaying posters after 10:00 am Tuesday morning. A poster session and demo session, with authors present at their posters, will be held Tuesday evening from 8:00 to 10:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session..

✔ **Study on tunnel diode as an electro-optic modulator,** R. Beig Agha, M. Roostaie, Iran Univ. of Science and Technology (Iran) . . . . . [6669-51]

✔ **Description of caustic structures in non-linear media: envelope of characteristic trajectories for the non-linear Schrodinger equation,** J. C. Juárez-Morales, J. L. Munoz-Lopez, G. C. Martinez-Niconoff, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6669-52]

✔ **Structural and optical properties of Si/β-$FeSi_2$/Si heterostructures fabricated by ion implantation and Si MBE,** N. G. Galkin, E. A. Chusovitin, D. L. Goroshko, Institute for Automation and Control Processes (Russia); R. I. Batalov, R. M. Bayzitov, Kazan Physical-Technical Institute (Russia); T. S. Shamirzaev, K. S. Zhuravlev, Institute of Semiconductor Physics (Russia) . . . . . [6669-53]

✔ **Investigation of material properties for zincblende AlGaN alloys applied in UV LEDs,** B. Liou, Hsiuping Institute of Technology (Taiwan); C. Liu, Soochow Univ. (Taiwan); Y. Kuo, National Changhua Univ. of Education (Taiwan) . . . . . [6669-54]

✔ **Effect of spontaneous and piezoelectric polarization on the optical characteristics of blue light-emitting diodes,** B. Liou, Hsiuping Institute of Technology (Taiwan); S. Yen, M. Tsai, Y. Kuo, National Changhua Univ. of Education (Taiwan) . . . . . [6669-55]

✔ **Simulation of deep ultraviolet light-emitting diodes,** Y. Kuo, S. Yen, National Changhua Univ. of Education (Taiwan) . . . . . [6669-56]

✔ **GaN-based flip-chip light-emitting diode with photonic crystal,** K. Lee, J. Kim, T. Park, S. Park, Kwangju Institute of Science and Technology (South Korea); S. Kim, K. Lee, LG Electronics Institute of Technology (South Korea) . [6669-57]

Wednesday 29 August

SESSION 8 . . . . . Wed. 8:30 to 10:00 am

LED III

Chair: **Ian E. Ashdown**, TIR Systems Ltd. (Canada)

Study and issues of thin-GaN LED *(Invited Paper)*, C. Liu, C. Lin, P. H. Chen, C. Chang, Y. C. Lin, National Central Univ. (Taiwan) . . . . . [6669-32]

All-InGaN white-light light-emitting diode of stable spectrum with prestrained growth of InGaN/GaN quantum wells, C. Huang, C. Lu, T. Tang, J. Huang, C. Yang, National Taiwan Univ. (Taiwan) . . . . . [6669-33]

MOCVD growth of high in content in InGaN on ZnO substrates, N. Li, S. Wang, E. Park, Z. Feng, Georgia Institute of Technology; A. Valencia, J. Nause, Cermet, Inc.; I. T. Ferguson, Georgia Institute of Technology . . . . . [6669-34]

III-nitride LEDs with high quality InGaN/GaN MQWs grown with different growth conditions, S. J. Leem, Y. C. Shin, C. M. Kim, S. J. Kim, Korea Univ. (South Korea); Y. Moon, Seoul National Univ. of Technology (South Korea); T. G. Kim, Korea Univ. (South Korea) . . . . . [6669-35]

Highly efficient light emitting diode involved photonic crystal and tunnel junctions, B. Zhang, L. Rao, Huazhong Univ. of Science and Technology (China) . . . . . [6669-36]

SESSION 9 . . . . . Wed. 10:30 am to 12:00 pm

Characterization

Chair: **Jeff Nause**, Cermet, Inc.

Thermal management methods for compact high power LED *(Invited Paper)*, T. Martin, M. Ha, S. Graham, Georgia Institute of Technology . . . . . [6669-37]

EpiEL: electroluminescence directly on LED epi-wafers, M. X. Ma, H. J. Jia, MaxMile Technologies, LLC . . . . . [6669-38]

Is the thermal resistance coefficient from junction to board for a high-power LED a constant?, L. Jayasinghe, N. Narendran, Rensselaer Polytechnic Institute . . . . . [6669-39]

Application of least squares regression to LED color management, M. Salsbury, I. E. Ashdown, TIR Systems Ltd. (Canada) . . . . . [6669-40]

Thermal stability analysis of high brightness LEDs during high temperature and electrical aging, L. R. Trevisanello, M. Meneghini, C. Sanna, S. Buso, G. Spiazzi, G. Meneghesso, E. Zanoni, Univ. degli Studi di Padova (Italy) . . . . . [6669-41]

Lunch/Exhibition Break

SESSION 10 . . . . . Wed. 1:30 to 3:00 pm

Source Performance III

Chair: **Cheng-Yi Liu**, National Central Univ. (Taiwan)

High brightness directional photonic quasicrystal LEDs *(Invited Paper)*, W. N. Wang, P. Shields, Univ. of Bath (United Kingdom); M. E. Zoorob, T. D. M. Lee, Mesophotonics Ltd. (United Kingdom) . . . . . [6669-42]

Modulated the light pattern and enhanced light extraction in photonic-crystal light-emitting diodes, J. Chang, M. Wu, Y. Lee, P. Lee, National Central Univ. (Taiwan) . . . . [6669-43]

Photoluminescent nanofibers for solid-state lighting, L. Davis, H. Walls, L. Han, T. Walker, A. L. Andrady, D. S. Ensor, RTI International . . . . . [6669-44]

Narrow beam RGB array optic, E. Bailey, Transducin Optics LLC and Lamina Ceramics Inc. . . . . [6669-45]

Pseudorandom pulse code modulation of LEDs, I. Toma, B. Bjeljac, I. E. Ashdown, TIR Systems Ltd. (Canada) [6669-46]

SESSION 11 . . . . . Wed. 4:00 to 5:00 pm

Modeling

Chair: **Nadarajah Narendran**, Rensselaer Polytechnic Institute

A comprehensive model to predict solid state lighting performance, M. Salsbury, I. E. Ashdown, TIR Systems Ltd. (Canada) . . . . . [6669-47]

Modelling of non-Lambertian LED sources in lighting applications, M. Bennahmias, Physical Optics Corp.; E. Arik, K. Yu, E. Poliakov, Luminit LLC; K. Chua, R. D. Pradhan, T. C. Forrester, Physical Optics Corp. . . . . [6669-48]

Algorithm to illustrate context using dynamic lighting effects, R. Manayil John, T. Balasubramanian, National Institute of Technology/Tiruchirappalli (India) . . . . . [6669-49]

An electrical model of InGaN based high power light emitting diodes with self-heating effect, B. Li, Foshan Univ. (China); Y. Feng, Shenzhen Univ. (China); Y. Liu, Foshan Univ. (China) . . . . . [6669-50]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC011 Design of Efficient Illumination Systems (Cassarly) Monday 27, 1:30 - 5:30 pm

SC388 Non-Imaging Optics (Winston) Monday 27, 8:30 am - 12:30 pm

SC490 Solid State Lighting I (Ferguson) Sunday 26, 1:30 - 5:30 pm

SC657 Accurate Measurement of LED Optical Properties (Tirpak) Tuesday 28, 8:30 am - 12:30 pm

SC799 Solid State Lighting Phosphors (Summers) Sunday 26, 8:30 am - 12:30 pm

Conference 6670

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6670

Nonimaging Optics and Efficient Illumination Systems IV

Conference Chairs: **Roland Winston**, Univ. of California/Merced; **R. John Koshel**, Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona

Program Committee: **Pablo Benítez**, Univ. Politécnica de Madrid and Light Prescriptions Innovators LLC; **William J. Cassarly**, Optical Research Associates; **Philip L. Gleckman**, Idealab Capital Partners; **Jeffrey M. Gordon**, Ben-Gurion Univ. of the Negev (Israel); **Anurag Gupta**, Optical Research Associates; **Douglas A. Kirkpatrick**, Defense Advanced Research Projects Agency; **Kenneth K. Li**, Wavien, Inc.; **Juan C. Miñano**, Univ. Politécnica de Madrid (Spain) and Light Prescriptions Innovators LLC; **Holger Moench**, Philips Research Labs. (Germany); **Narkis E. Shatz**, Science Applications International Corp.; **John F. Van Derlofske**, 3M Co.

Sunday 26 August

SESSION 1 . . . . . Sun. 8:00 to 8:10 am

Introduction

Chair: **R. John Koshel**, Lambda Research Corp.

Why illumination engineering?, R. J. Koshel, Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona . . . . . [6670-01]

SESSION 2 . . . . . Sun. 8:10 to 10:00 am

Solar and Energy Applications

Chair: **Jeffrey M. Gordon**, Ben-Gurion Univ. of the Negev (Israel)

Opportunities for fiber optics *(Invited Paper)*, J. M. Davenport, Fiberstars, Inc. . . . . [6670-02]

Optimal integration of daylighting and electric lighting systems by the way of nonimaging optics, J. Scartezzini, E. Kaegi-Kolisnychenko, F. Linhart, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6670-03]

The XR nonimaging photovoltaic concentrator, M. M. Hernandez, Light Prescriptions Innovators Europe, S. L. (Spain); P. Benítez, J. C. Miñano, Light Prescriptions Innovators, LLC and Univ. Politécnica de Madrid (Spain); A. Cvetkovic, Univ. Politécnica de Madrid (Spain); O. Dross, R. Mohedano Arroyo, Light Prescriptions Innovators Europe, S. L. (Spain); R. Jones, The Boeing Co.; G. S. Kinsey, Spectrolab, Inc.; R. Alvarez, Light Prescriptions Innovators, LLC [6670-04]

Field results from concentrating photovoltaic system using Kohler integration, L. D. Reed, R. Winston, A. Ritschel, Univ. of California/Merced . . . . . [6670-05]

Light-loss when measuring transmittance of thick scattering samples with an integrating sphere, J. C. Jonsson, M. D. Rubin, Lawrence Berkeley National Lab. . . . . [6670-06]

SESSION 3 . . . . . Sun. 10:30 am to 12:20 pm

Theory and Design

Chair: **Roland Winston**, Univ. of California/Merced

Elliptical reflector: efficiency gain by defocusing, H. Rehn, OSRAM GmbH (Germany) . . . . . [6670-07]

An analytical approach to the design of efficient reflectors *(Invited Paper)*, G. Kloos, Hella KGaA Hueck & Co. (Germany) . . . . . [6670-08]

Recursive generalized functional method of nonimaging optical design, J. C. Bortz, N. E. Shatz, Science Applications International Corp. . . . . [6670-09]

Aberrations of asymmetric reflector design, F. Zhao, Zumtobel Staff Lighting, Inc. . . . . [6670-10]

Electromagentic modelling of non-paraxial propagation and illumination, H. Schimmel, LightTrans GmbH (Germany); J. P. Turunen, P. Vahimaa, Joensuu Yliopisto (Finland); M. Kuhn, LightTrans GmbH (Germany); F. Wyrowski, Friedrich Schiller Univ. (Germany) . . . . . [6670-11]

Lunch Break

SESSION 4 . . . . . Sun. 1:20 to 3:10 pm

Sources: Characterization, Mixing, and Recycling

Chair: **R. John Koshel**, Lambda Research Corp.

A compact LED color mixing scheme with the etendue of a single chip, G. X. Ouyang, K. K. Li, Wavien, Inc. . . [6670-12]

Etendue conserved color mixing *(Invited Paper)*, R. P. Van Gorkom, Philips Research Eindhoven (Netherlands); M. A. Van As, Philips Lighting B.V. (Netherlands); G. M. Verbeek, Philips Research Eindhoven (Netherlands); C. G. A. Hoelen, Philips Lighting B.V. (Netherlands); R. G. Alferink, Philips LumiLEDs (Netherlands); K. A. Mutsears, Philips Research Eindhoven (Netherlands); H. Cooijmans, Philips Lighting B.V. (Netherlands) . . . . . [6670-13]

Light recycling characteristics of ultra-bright lamps, A. Malul, D. Nakar, D. Feuermann, J. M. Gordon, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6670-14]

Radiometric characterization of ultra-bright xenon short-arc discharge lamps for novel applications, D. Nakar, A. Malul, D. Feuermann, J. M. Gordon, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6670-15]

An analytic model for the radiation pattern of LEDs, I. Moreno, Univ. Autónoma de Zacatecas (Mexico) and National Central Univ. (Taiwan); C. Tsai, National Central Univ. (Taiwan); D. Bermúdez, Univ. Autónoma de Zacatecas (Mexico); C. Sun, National Central Univ. (Taiwan) . . . . . [6670-16]

SESSION 5 . . . . . Sun. 3:40 to 5:40 pm

Design and Application

Chair: **Narkis E. Shatz**, Science Applications International Corp.

Beyond NURBS: enhancement of local refinement through T-splines, E. Bailey, S. Carayon, Transducin Optics LLC . . . . . [6670-17]

Illumination merit functions, W. J. Cassarly, Optical Research Associates . . . . . [6670-18]

Optical design of LED-based automotive tail lamps, A. Domhardt, Univ. Karlsruhe (Germany); U. Rohlfing, Hochschule Darmstadt (Germany); K. D. Klinger, D. Kooß, K. Manz, U. Lemmer, Univ. Karlsruhe (Germany) . . . . . [6670-19]

High-efficiency reflector optics for LED forward lighting, J. Jiao, B. Wang, North American Lighting, Inc. . . . . [6670-20]

Light sources and output couplers for a backlight with switchable emission angles, I. Fujieda, K. Imai, Y. Takagi, Ritsumeikan Univ. (Japan) . . . . . [6670-21]

Lightweight CFRP spherical mirrors for the LHCb RICH-1 detector, R. N. Martin, R. C. Romeo, Composite Mirror Applications, Inc.; G. Barber, Imperial College London (United Kingdom); A. Braem, CERN (Switzerland); N. Brook, Univ of Bristol (United Kingdom); B. Cameron, Imperial College London (United Kingdom); C. D'Ambrosio, CERN (Switzerland); N. Harnew, Univ. of Oxford (United Kingdom); K. Lessnoff, F. Metlica, Univ. of Bristol (United Kingdom); D. Websdale, Imperial College London (United Kingdom) . . . . . [6670-22]

Closing Remarks . . . . . Sun. 5:40 to 5:45 pm

Chair: **Roland Winston**, Univ. of California/Merced

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

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Monday 27 August

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Illuminators for high numerical aperture lithography tools: components, aberrations and performance,** L. Ryzhikov, Y. Vladimirsky, ASML Wilton . . . . . [6670-23]

✔ **Shape and illumination as a function of path length,** S. Mulder, Optical Research Associates . . . . . [6670-24]

✔ **Diffuser array for a light-emitting diode backlight system,** J. Lee, Y. Hu, Y. Wu, Y. Wang, Northern Taiwan Institute of Science and Technology (Taiwan) . . . . . [6670-25]

✔ **The generation of random non-overlapping dot patterns for light guides using molecular dynamics simulations with variable r-cut and reflective boundary techniques,** J. Chang, Y. Fang, National Ctr. for High-Performance Computing (Taiwan) . . . . . [6670-26]

✔ **The application of toroidal surface and free shape surface for pillow optics,** V. K. Berger, Mark IV Industries, Inc. . . . . [6670-27]

✔ **Multi-element secondary concentrator for lasers pumped by concentrated solar flux of big solar furnace,** S. Payziyev, ACADEMPRIBOR Scientific and Production Association (Uzbekistan); S. A. Bakhramov, NPO Akadempribor (Uzbekistan); S. Klychev, A. Kasimov, ACADEMPRIBOR Scientific and Production Association (Uzbekistan); A. Abdurakhmanov, Academy of Sciences of Uzbekistan (Uzbekistan); A. Fazilov, ACADEMPRIBOR Scientific and Production Association (Uzbekistan) [6670-28]

✔ **Power characteristics of two-stage concentrating systems for solar furnaces,** S. Klichev, Consultant (Uzbekistan); S. A. Bakhramov, NPO Akadempribor (Uzbekistan); Y. Dudko, Z. Klichev, Consultant (Uzbekistan); A. Abdurakhmanov, Academy of Sciences of Uzbekistan (Uzbekistan); A. Fazilov, ACADEMPRIBOR Scientific and Production Association (Uzbekistan) . . . . . [6670-29]

Illumination Technical Event . Mon. 8:00 to 10:00 pm

Chair: **R. John Koshel,** Lambda Research Corp. and College of Optical Sciences/The Univ. of Arizona

We will present two topics: étendue and state-of-the-art concepts for displays. For the former, speakers from display manufacturers, such as Philips, will be on hand to discuss such display topics as:

- LED displays,
- Visual experience of viewing displays, and
- Future trends in displays.

For the étendue topic, a panel with a moderator will be convened to discuss this very important topic of illumination system design. Étendue describes the geometrical propagation characteristics of optical systems, and for illumination systems it provides a metric for design analysis and limitations. This provides a physical limit analogous to that of the diffraction limit of imaging/lens design. For both topics, each presenter will give a short overview, followed by questions from the audience. If you would like to participate as a presenter in either of these areas, or possibly in another area, please contact John Koshel (john.koshel@osa.org). At the conclusion of the planned agenda the floor will be open to impromptu presentations and questions. Light refreshments will be served. We look forward to your participation.

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC011 Design of Efficient Illumination Systems (Cassarly) Monday 27, 1:30 - 5:30 pm

SC388 Non-Imaging Optics (Winston) Monday 27, 8:30 am - 12:30 pm

Conference 6671

Tuesday-Wednesday 28-29 August 2007 • Proceedings of SPIE Vol. 6671

Optical Manufacturing and Testing VII

Conference Chairs: **James H. Burge**, The Univ. of Arizona/Steward Observatory; **Oliver W. Faehnle**, FISBA OPTIK AG (Switzerland); **Ray Williamson**, Ray Williamson Consulting

Program Committee: **Dave Baiocchi**, Sandia National Labs.; **Michael Bray**, MB Optique SARL (France); **Andrew R. Clarkson**, L-3 Brashear; **Glen C. Cole**, L3 Communications Tinsley; **David A. Content**, NASA Goddard Space Flight Ctr.; **Peter J. de Groot**, Zygo Corp.; **Roland Geyl**, SAGEM SA (France); **John E. Greivenkamp**, College of Optical Sciences/The Univ. of Arizona; **Stephen D. Jacobs**, Univ. of Rochester; **Stephen E. Kendrick**, Ball Aerospace & Technologies Corp.; **Stephen J. Martinek**, 4D Technology Corp.; **Gary Matthews**, ITT Industries, Inc.; **Robert E. Parks**, Optical Perspective Group, LLC; **Joseph L. Robichaud**, L-3 SSG-Tinsley; **Joanna Schmit**, Veeco Instruments Inc.; **Peter Z. Takacs**, Brookhaven National Lab.; **Martin J. Valente**, College of Optical Sciences/The Univ. of Arizona; **David D. Walker**, Univ. College London (United Kingdom); **Xuejun Zhang**, Changchun Institute of Optics, Fine Mechanics and Physics (China)

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:00 to 10:00 am

Mirrors

Chair: **James H. Burge**, The Univ. of Arizona/Steward Observatory

JWST mirror technology development results, H. P. Stahl, NASA Marshall Space Flight Ctr. . . . . [6671-01]

Production status of the JWST primary mirror segments at Tinsley, G. C. Cole, T. B. Hull, R. S. Garfield, T. Peters, A. Lee, R. J. Bernier, A. N. Zertuche, P. J. Johnson, C. D. Kiikka, J. M. Kincade, L3 Communications Tinsley; B. B. Gallagher, R. J. Brown, Ball Aerospace & Technologies Corp.; A. G. McKay, Northrop Grumman Space Technology; L. M. Cohen, Smithsonian Astrophysical Observatory . . . . . [6671-02]

JWST primary mirror segment metrology, R. J. Bernier, L. R. Dettmann, C. D. Kiikka, A. N. Zertuche, P. J. Johnson, G. C. Cole, T. B. Hull, R. S. Garfield, J. M. Kincade, J. Daniel, L3 Communications Tinsley; R. J. Brown, B. B. Gallagher, Ball Aerospace & Technologies Corp.; L. M. Cohen, Smithsonian Astrophysical Observatory; D. M. Chaney, Ball Aerospace & Technologies Corp.; A. G. McKay, Northrop Grumman Space Technology . . . . . [6671-03]

Comparison of metrology to FEA predictions for the Kepler primary mirror assembly, J. W. Zinn, G. W. Jones, L-3 Brashear . . . . . [6671-04]

Manufacturing meter-scale aspheric optics, W. J. Messner, P. Dumas, R. W. Hallock, C. A. Hall, M. Tricard, QED Technologies Inc.; S. M. Miller, The Univ. of Arizona/Steward Observatory . . . . . [6671-05]

Fabrication and testing of large flats, J. Yellowhair, M. Novak, P. Su, J. H. Burge, College of Optical Sciences/The Univ. of Arizona . . . . . [6671-06]

SESSION 2 . . . . . Tues. 10:30 to 11:50 am

Systems

Chair: **Oliver W. Fähnle**, FISBA OPTIK AG (Switzerland)

Cryogenic in-vacuum vertically configured collimator system for testing of meter scale optical systems, D. S. Sabatke, S. Meyer, N. J. Siegel, P. D. Atcheson, M. A. Martella, Ball Aerospace & Technologies Corp. . . . . [6671-07]

Manufacturing development of visor for binocular helmet mounted display, D. H. Krevor, T. J. Edwards, E. W. Larkin, Kaiser Electronics; R. Speirs, Ferris State Univ.; J. Skubon, MXL Industries, Inc.; T. M. Sowden, Contour Metrological Manufacturing, Inc. . . . . [6671-08]

Structure function analysis of mirror fabrication and support errors, S. Hvisc, J. H. Burge, College of Optical Sciences/The Univ. of Arizona . . . . . [6671-09]

Zernike-like orthogonal basis functions for wavefront characterization over sampled, irregular apertures, D. L. Aronstein, B. H. Dean, S. Smith, NASA Goddard Space Flight Ctr.; H. Schreiber, T. Tienvieri, Corning Tropel Corp. [6671-10]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:00 to 3:00 pm

New Measurement Methods

Chair: **Ray Williamson**, Ray Williamson Consulting

Flexible and accurate metrology of aspheric surfaces, S. D. O'Donohue, P. E. Murphy, G. M. DeVries, J. F. Fleig, QED Technologies Inc. . . . . [6671-11]

The JWST infrared scanning Shack Hartman system: a new in-process way to measure large mirrors during optical fabrication at Tinsley, C. D. Kiikka, L3 Communications Tinsley; D. R. Neal, Wavefront Sciences, Inc.; R. J. Bernier, J. M. Kincade, T. B. Hull, L3 Communications Tinsley; D. M. Chaney, B. B. Gallagher, Ball Aerospace & Technologies Corp. . . . . [6671-12]

Three Gaussian beam heterodyne interferometer for surface profiling, L. Juárez, M. Cywiak, B. Barrientos, J. M. Flores Moreno, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6671-13]

New null tests for convex surfaces, R. F. Royce, R.F. Royce-Precision Optical Components; R. C. Romeo, R. N. Martin, Composite Mirror Applications, Inc. . . . . [6671-14]

Piston measurement and segmented mirror alignment, Q. Gong, Swales Aerospace; D. A. Kubalak, W. L. Eichhorn, B. W. Greeley, B. J. Frey, NASA Goddard Space Flight Ctr. [6671-15]

Measuring a precise ultra-lightweight spaceflight mirror on Earth: the analysis of SHARPI PM mirror figure data during mirror processing at GSFC, S. R. Antonille, D. A. Content, D. M. Rabin, T. E. Wallace, S. Wake, NASA Goddard Space Flight Ctr. . . . . [6671-16]

SESSION 4 . . . . . Tues. 3:30 to 5:10 pm

Materials, Forming

Chair: **James H. Burge**, The Univ. of Arizona/Steward Observatory

Thermal shock testing of lapped optical glass, J. C. Lambropoulos, Univ. of Rochester . . . . . [6671-17]

In-process non-destructive subsurface damage measurements and correlations to both laser damage and surface roughness, K. C. Robinson, A. Ghanbari, J. J. Nelson, T. Kamprath, VLOC . . . . . [6671-18]

Removal mechanism and subsurface damage in hard optical ceramics, S. N. Shafrir, J. C. Lambropoulos, S. D. Jacobs, Univ. of Rochester . . . . . [6671-19]

Moore's law and mold making: staying in the megapixel race, K. Renkema, Philips High Tech Plastics Inc. (Netherlands) . . . . . [6671-20]

High-precision aspheres for professional cine lenses: design and manufacturing, T. Koehler, Carl Zeiss Jena GmbH (Germany); C. Beder, Carl Zeiss AG (Germany) . . . [6671-21]

Panel Discussion I . . . . . Tues. 5:10 to 6:30 pm

Optical Testing and Alignment in Cryo/ Vacuum

Wednesday 29 August

SESSION 5 . . . . . Wed. 8:00 to 10:00 am

Interferometry I

Chair: **Oliver W. Fähnle**, FISBA OPTIK AG (Switzerland)

Surface reconstruction based on transmission interferometric testing, K. Seong, G. A. Williby, J. E. Greivenkamp, College of Optical Sciences/The Univ. of Arizona . . . . . [6671-22]

New interferometric technique to measure the length (thickness) of opaque objects using a commercial interferometer, A. R. Suratkar, A. Davies, The Univ. of North Carolina at Charlotte . . . . . [6671-23]

A fast demodulation method for single fringe patterns with closed fringes by using local quadrature filters, J. C. Estrada Rico, M. Servín, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6671-24]

Segmented wave-front measurements by lateral shearing interferometry, B. Toulon, J. Primot, N. Guérineau, ONERA (France); S. Velgue, PHASICS SA (France); R. Haïdar, ONERA (France) . . . . . [6671-25]

Stitching interferometry and absolute calibration: progress, M. Bray, MB Optique SARL (France) . . . . . [6671-26]

Shear test of the off-axis surface with axis-symmetric parent, P. Su, J. H. Burge, J. M. Sasian, College of Optical Sciences/The Univ. of Arizona . . . . . [6671-27]

SESSION 6 . . . . . Wed. 10:30 am to 12:30 pm

Interferometry II

Chair: **Ray Williamson**, Ray Williamson Consulting

Full surface mapping and calibration of large interferometer flats, F. Tinker, Flemming Tinker, LLC; M. Bray, MB Optique SARL (France); D. Smith, Plymouth Grating Lab Inc.; T. Takahashi, Okamoto Optics Works, Inc. (Japan) . . . . . [6671-28]

Weighted least-square approach for simultaneous measurement of multiple reflective surfaces, S. Tang, R. E. Bills, K. R. Freischlad, ADE Phase Shift . . . . . [6671-29]

Nondestructive evaluation (NDE) using multiaperture DSPI system and fast Fourier transform method, B. Bhaduri, N. Krishna Mohan, M. P. Kothiyal, Indian Institute of Technology Madras (India) . . . . . [6671-30]

Speckle metrology based study on the effect of chatter on machined surface, P. A. Cheriyan, U. Nair, V. Kas, V. N. N. Namboothiri, N. P. N. Vadakedathu, Cochin Univ. of Science & Technology (India) . . . . . [6671-31]

Design of partial nulls for testing of fast aspheric surfaces, J. J. Sullivan, J. E. Greivenkamp, College of Optical Sciences/ The Univ. of Arizona . . . . . [6671-32]

3D-measurement of grinded optical surfaces by means of short coherence interferometry, T. Hellmuth, R. Boerret, K. Khrennikov, Hochschule Aalen (Germany) . . . . . [6671-33]

Lunch/Exhibition Break

SESSION 7 . . . . . Wed. 1:30 to 4:20 pm

Novel Finishing

Chair: **James H. Burge**, The Univ. of Arizona/Steward Observatory

Calculation of MRF influence functions, M. Schinhaerl, Fachhochschule Deggendorf (Germany); G. Smith, Univ. of the West of England (United Kingdom); A. Geiss, Fachhochschule Deggendorf (Germany); L. N. Smith, Univ. of the West of England (United Kingdom); R. Rascher, P. Sperber, Fachhochschule Deggendorf (Germany); R. J. Stamp, Univ. of the West of England (United Kingdom); E. G. Pitschke, Fachhochschule Deggendorf (Germany) . . . . . [6671-34]

Modeling the optical glass material removal rate for magnetorheological finishing (MRF) with nanodiamond MR fluids, J. E. DeGroote, A. E. Marino, J. P. Wilson, A. L. Bishop, S. D. Jacobs, Univ. of Rochester . . . . . [6671-35]

Magnetorheological fluid template for basic studies of mechanical-chemical effects during polishing, C. Miao, Univ. of Rochester; K. M. Bristol, U.S. Army ARDEC; A. E. Marino, S. N. Shafrir, J. E. DeGroote, S. D. Jacobs, Univ. of Rochester . . . . . [6671-36]

Complete pre-polishing and finishing solution to improve speed and determinism in asphere manufacture, P. Dumas, R. W. Hallock, C. A. Hall, A. Price, QED Technologies Inc. . . . . [6671-37]

Deterministic shape correction with fluid jet polishing using a sub-aperture footprint, W. A. C. M. Messelink, O. W. Faehnle, M. Forrer, FISBA OPTIK AG (Switzerland) [6671-38]

High-speed form preserving polishing of precision aspheres, R. Boerret, A. Kelm, Hochschule Aalen (Germany); H. Thiess, Carl Zeiss AG (Germany) . . . . . [6671-39]

Correction of high spatial frequencies errors on optical surfaces by means of ion beam figuring, M. Ghigo, R. Canestrari, Osservatorio Astronomico di Brera (Italy); A. Novi, SELEX Sensors and Airborne Systems SpA (Italy) . [6671-40]

Panel Discussion II . . . . . Tues. 4:20 to 5:30 pm

Non-traditional Optical Figuring

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

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✔ **An analytical method for measuring the decentration of lens module,** C. Chang, Industrial Technology Research Institute (Taiwan) . . . . . [6671-41]

✔ **Optical tests of a space mechanism under an adverse environment: GAIA secondary mirror mechanism under pressure and thermal controlled conditions,** T. Belenguer, Instituto Nacional de Técnica Aeroespacial (Spain) [6671-42]

✔ **3D profile measurement of large-scale curvature plates using structured light source,** B. Kim, S. H. Kim, E. Heo, Kyungnam Univ. (South Korea); H. Lee, J. M. Han, DSME Co. Ltd. (South Korea) . . . . . [6671-43]

✔ **Aspheric measurement based on the curvature sensing method,** B. Kim, Y. Kwon, D. H. Wang, Kyungnam Univ. (South Korea); Y. Lee, H. Yang, H. Rhee, Korea Research Institute of Standards and Science (South Korea) . [6671-44]

✔ **Stimulated and uncertainty analysis for Hartmann-Shack wavefront sensor,** C. Chang, Industrial Technology Research Institute (Taiwan); C. Lee, National Central Univ. (Taiwan) . . . . . [6671-45]

✔ **Three-dimensional imaging with acousto-optic fringe projector and piecewise temporal phase unwrapping,** J. D. Tian, X. B. Zhao, X. L. Liu, X. Peng, Shenzhen Univ. (China) . . . . . [6671-46]

✔ **A new design of furnace for modern fiber draw based on computational thermal fluid model,** X. Wang, Shanghai Institute of Optics and Fine Mechanics (China); Q. Nie, Ningbo Univ. (China); L. Liu, Shanghai Institute of Optics and Fine Mechanics (China); T. Xu, C. Xu, Ningbo Univ. (China); D. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6671-47]

✔ **Statistical detection of fatigue lifetime using a simple optical setup,** C. M. García Becerril, Instituto Tecnológico y de Estudios de Monterrey - León Campus (Mexico); A. Dávila, G. Garnica, Ctr. de Investigaciones en Óptica, A.C. (Mexico); A. López, Secretaria de Comunicaciones y Transporte (Mexico) . . . . . [6671-48]

✔ **Phase detection from two phase-shifting interferograms,** Y. Zhu, L. Liu, Z. Luan, J. Sun, Shanghai Institute of Optics and Fine Mechanics (China) . . . [6671-49]

✔ **Fourier analysis of two-run-times-two-frame phase shift algorithm,** X. Zhong, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6671-50]

✔ **Fiber Bragg gratings for laser interferometry with VCSEL diode at 760 nm wavelength,** B. Mikel, R. Helan, O. Cip, Institute of Scientific Instruments (Czech Republic) [6671-51]

✔ **Noise removal for fringe patterns in optical metrology,** N. H. Le Tran, K. Qian, Nanyang Technological Univ. (Singapore) . . . . . [6671-52]

✔ **Extended range interferometry based on wavefront shaping,** M. L. Szczupak, L. A. Salbut, R. Sitnik, Politechnika Warszawska (Poland) . . . . . [6671-53]

✔ **Demodulation of a closed fringe pattern guided by local frequencies,** K. Qian, Nanyang Technological Univ. (Singapore) . . . . . [6671-54]

✔ **Corrective polishing with HyDra,** L. Salas, E. Ruiz, E. Luna-Aguilar, E. Sohn, I. Cruz-González, M. Nuñez, Univ. Nacional Autónoma de México (Mexico) . . . . . [6671-55]

✔ **A quantitative comparison of three grolishing techniques for the precessions process,** D. D. Walker, OpTIC Technium (United Kingdom) and Zeeko Ltd. (United Kingdom); R. Evans, G. Yu, OpTIC Technium (United Kingdom); S. Wei, R. R. Freeman, Zeeko Ltd. (United Kingdom) . . . . . [6671-56]

✔ **Fabrication of axicons by laser evaporation,** J. M. Gonzalez-Leal, J. A. Angel, Univ. de Cádiz (Spain) [6671-57]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC020 Optical Scattering: Measurement and Analysis (Stover) Sunday 26, 1:30 - 5:30 pm

SC492 Predicting, Modeling, and Interpreting Light Scattered by Surfaces (Germer) Monday 27, 8:30 am - 12:30 pm

SC848 Fundamentals of Single Point Diamond Turning (Schaefer) Monday 27, 1:30 - 5:30 pm

Conference 6672

Tuesday-Wednesday 28-29 August 2007 • Proceedings of SPIE Vol. 6672

Advanced Characterization Techniques for Optics, Semiconductors, and Nanotechnologies III

Conference Chairs: **Angela Duparré**, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); **Bhanwar Singh**, Advanced Micro Devices, Inc.; **Zu-Han Gu**, Surface Optics Corp.

Program Committee: **Lionel R. Baker**, Consultant (United Kingdom); **Salvador Bosch Puig**, Univ. de Barcelona (Spain); **Russell A. Chipman**, The Univ. of Arizona; **Iraj Emami**, Advanced Micro Devices, Inc.; **Thomas A. Germer**, National Institute of Standards and Technology; **Daniel J. C. Herr**, Semiconductor Research Corp.; **Alexei A. Maradudin**, Univ. of California/Irvine; **Akira Matsumoto**, Nikon Corp. (Japan); **Eugenio R. Méndez**, Ctr. de Investigación Científica y de Educación Superior de Ensenada; **Soe-Mie F. Nee**, Naval Air Warfare Ctr.; **Hendrik Rothe**, Helmut-Schmidt Univ. (Germany); **Michael Schulz**, Physikalisch-Technische Bundesanstalt (Germany); **Costas J. Spanos**, Univ. of California/Berkeley; **John C. Stover**, The Scatter Works Inc.; **John F. Valley**, Raytex USA Corp.; **Alexander V. Vinogradov**, P.N. Lebedev Physical Institute (Russia)

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:30 to 10:20 am

Interferometry and 3D Techniques I

Chairs: **Angela Duparré**, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); **Bhanwar Singh**, Advanced Micro Devices, Inc.

Interferometry for wafer dimensional metrology *(Invited Paper)*, K. R. Freischlad, S. Tang, J. Grenfell, ADE Phase Shift . . . . . [6672-01]

Warpage of thin wafers using computer aided reflection moire method, C. S. Ng, Infineon Technolgies (M) Sdn. Bhd (Malaysia) and Nanyang Technological Univ. (Singapore); K. Y. Chua, M. T. Ong, Y. C. Goh, S. F. Loo, Infineon Technolgies (M) Sdn. Bhd (Malaysia); T. Y. Khoo, A. K. Asundi, Nanyang Technological Univ. (Singapore) . . . . . [6672-02]

Auto-scanning white-light interferometer, J. Chen, C. C. Chang, C. Tung, Industrial Technology Research Institute (Taiwan); C. Kao, MingDao Univ. (Taiwan) . . . . . [6672-03]

Radio-frequency controlled synthetic wavelength sweep for absolute distance measurement by optical interferometry, S. Le Floch, Y. Salvadé, Haute Ecole Arc Ingénierie Siège (Switzerland) . . . . . [6672-04]

Use of light-emitting diode (LED) in interference microscopy, M. Jobin, R. Foschia, Ecole d'ingènieurs de Genève (Switzerland) . . . . . [6672-05]

SESSION 2 . . . . . Tues. 10:40 am to 12:20 pm

Interferometry and 3D Techniques II

Chair: **Klaus R. Freischlad**, KLA-Tencor Corp.

Optical system for investigations of low-cost diffraction gratings, P. Czapski, L. Platos, M. Józwik, Politechnika Warszawska (Poland) . . . . . [6672-06]

Calibration of a reversed wavefront interferometer for polarization coherence metrology, D. P. Brown, A. K. Spilman, T. G. Brown, M. A. Alonso, Univ. of Rochester; R. Borghi, M. Santarsiero, Univ. degli Studi di Roma Tre (Italy) . . . . . [6672-07]

High resolution interferometric metrology for patterned wafers, S. Tang, K. R. Freischlad, P. Yam, KLA-Tencor Corp. . . . . [6672-08]

Measuring height variation over entire wafer surface with high lateral resolution, S. Tang, B. C. Clendenin, KLA-Tencor Corp. . . . . [6672-09]

Three-dimensional phase microobject studies by means of digital holography tomography supported by algebraic reconstruction technique, B. J. Bilski, A. Jozwicka, M. Kujawinska, Politechnika Warszawska (Poland) . . . [6672-10]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:30 to 3:10 pm

Scatter and Diffraction I

Chairs: **Angela Duparré**, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); **Marc Jobin**, Ecole d'Ingenieurs (Switzerland)

Limitations of Rayleigh Rice perturbation theory for describing surface scatter *(Invited Paper)*, J. C. Stover, The Scatter Works Inc.; J. E. Harvey, College of Optics & Photonics/Univ. of Central Florida . . . . . [6672-11]

Unified scatter model for rough surfaces at large incident and scatter angles *(Invited Paper)*, J. E. Harvey, A. Krywonos, College of Optics & Photonics/Univ. of Central Florida; J. C. Stover, The Scatter Works Inc. . . . . [6672-12]

Applications in the optical characterization of grating roughness, L. Arnaud, C. Deumié-Raviol, C. Amra, Institut Fresnel (France); E. Roisin, P. Maillot, STMicroelectronics (France) . . . . . [6672-13]

Inverse scattering simulation for a 1D surface reconstruction, A. Wang, Z. Gu, Surface Optics Corp. and Univ. of California/San Diego . . . . . [6672-14]

SESSION 4 . . . . . Tues. 3:30 to 5:10 pm

Scatter and Diffraction II

Chair: **James E. Harvey**, College of Optics & Photonics/Univ. of Central Florida

BRDF and MBR of a retro-reflected tag for free-space optical communication, Z. Gu, Surface Optics Corp.[6672-15]

A structure that more than doubles the intensity of an enhanced backscattering peak, T. A. Leskova, A. A. Maradudin, Univ. of California/Irvine; E. R. Mendez, Ctr. de Investigación Científica y de Educación Superior de Ensenada (Mexico); Z. Gu, Surface Optics Corp. . . . . [6672-16]

Experimental reconstruction for inverse scattering of one-dimensional surfaces, Z. Gu, A. Wang, Surface Optics Corp. and Univ. of California/San Diego . . . . . [6672-17]

Generation of partially coherent light in rough surface scattering and suppression of the speckle it produces, T. A. Leskova, A. A. Maradudin, Univ. of California/Irvine; E. R. Méndez, Ctr. de Investigación Científica y de Educación Superior de Ensenada (Mexico); A. Wang, Z. Gu, Surface Optics Corp. . . . . [6672-18]

Polarization of grating diffraction simulated by a vector Kirchhoff model, S. F. Nee, T. Nee, National Yang-Ming Univ. (Taiwan) . . . . . [6672-19]

Wednesday 29 August

SESSION 5 . . . . . Wed. 8:30 to 9:50 am

Roughness and Structure

Chairs: **Laurent Arnaud**, Institut Fresnel (France); **Zu-Han Gu**, Surface Optics Corp.

Progress towards traceable nanoscale optical critical dimension metrology for semiconductors, H. J. Patrick, T. A. Germer, National Institute of Standards and Technology . . . . . [6672-20]

A novel parameter proposed for 2D and 3D topography comparisons and measurements, J. Song, T. Vorbueger, National Institute of Standards and Technology . . . [6672-21]

Metrology and application of precision optical surfaces and laser mirrors, V. V. Azarova, M.F. Stelmakh Polyus Research and Development Institute (Russia); V. E. Asadchikov, Institute of Crystallography (Russia); Y. D. Golyaev, M.F. Stelmakh Polyus Research and Development Institute (Russia); M. L. Zanaveskin, Institute of Crystallography (Russia) . . [6672-22]

Roughness correction in optical calibration of gauge blocks by using an integrating sphere, C. Kang, J. W. Kim, J. Kim, T. B. Eom, Korea Research Institute of Standards and Science (South Korea) . . . . . [6672-23]

SESSION 6 . . . . . Wed. 10:20 to 11:20 am

Thin Fim Analysis

Chair: **Bhanwar Singh**, Advanced Micro Devices, Inc.

Measurement of ultra low film stress, local stress distribution and flatness by imaging nanotopography based on low coherence phase shifting interferometry in conjunction with wafer and film thickness metrology, A. Pravdivtsev, U. M. Wielsch, M. Santos II, A. Koo, Frontier Semiconductor, Inc. . . . . [6672-24]

Ellipsometric porosimetry: fast and non destructive method of porosity characterization of solid oxide fuel cell material based on YSZ thin film, A. Bondaz, L. Kitzinger, SOPRA, Inc. . . . . [6672-25]

Nano-meter measurement of oxide barrier (compacted) film thickness of aluminum by electrochemical impedance spectroscopy (EIS), K. J. Habib, Kuwait Institute for Scientific Research (Kuwait) . . . . . [6672-26]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **A hybrid phase unwrapping method for correction the error,** Y. Zou, C. Tung, Industrial Technology Research Institute (Taiwan) . . . . . [6672-27]

✔ **Development of a precision dual level stage system for the dimensional metrology of large range surface topography,** J. Kim, J. W. Kim, T. B. Eom, C. Kang, Korea Research Institute of Standards and Science (South Korea) . . . . . [6672-28]

✔ **Three-dimensional phase object measurement using an off-axis Fresnel hologram,** C. Lin, National Central Univ. (Taiwan); G. L. Chen, M. K. Kuo, National Defense Univ. (Taiwan); C. Chang, Ming Dao Univ. (Taiwan) . . . . . [6672-29]

✔ **Vibration insensitive measurement of variation in thickness of glass plates by using optical interferometry,** J. W. Kim, J. Kim, C. Kang, T. B. Eom, Korea Research Institute of Standards and Science (South Korea) . [6672-30]

✔ **Coherent control and spectroscopy of excitonic states in semiconductor nanostructures,** O. K. Khasanov, Institute of Solid State and Semiconductor Physics (Belarus); L. Dementsova, Belarusian State Univ. (Belarus); O. M. Fedotova, G. V. Rusetsky, Institute of Solid State and Semiconductor Physics (Belarus); N. N. Rubtsova, Institute of Semiconductor Physics (Russia) . . . . . [6672-31]

✔ **Precision measurement of LED angular intensity distribution,** O. Muzychko, National Technical Univ. of Ukraine (Ukraine) . . . . . [6672-32]

OPTICS

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC020 Optical Scattering: Measurement and Analysis (Stover) Sunday 26, 1:30 - 5:30 pm
SC211 Practical Interferometry and Fringe Analysis (Creath) Wednesday 29, 8:30 am - 12:30 pm
SC213 Introduction to Interferometric Optical Testing (Wyant) Monday 27, 8:30 am - 12:30 pm
SC492 Predicting, Modeling, and Interpreting Light Scattered by Surfaces (Germer) Monday 27, 8:30 am - 12:30 pm
SC850 Metrology for Modern Optical Manufacturing (Murphy) Monday 27, 8:30 am - 12:30 pm

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Conference 6673

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6673

Time and Frequency Metrology

Conference Chair: **R. Jason Jones**, College of Optical Sciences/The Univ. of Arizona

Program Committee: **James C. Bergquist**, National Institute of Standards and Technology; **Andre Clairon**, Observatoire de Paris (France); **Peter J. Delfyett, Jr.**, College of Optics & Photonics/Univ. of Central Florida; **Patrick Gill**, National Physical Lab. (United Kingdom); **Feng-Lei Hong**, National Institute of Advanced Industrial Science and Technology (Japan); **Tetsuya Ido**, National Institute of Information and Communications Technology (Japan); **David J. Jones**, The Univ. of British Columbia (Canada); **Ekkehard Peik**, Physikalisch-Technische Bundesanstalt (Germany); **John D. Prestage**, Jet Propulsion Lab.; **Thomas Udem**, Max-Planck-Institut für Quantenoptik (Germany); **Jun Ye**, Univ. of Colorado/Boulder

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:10 to 10:10 am

Optical Clocks I: Ions

Chair: **John D. Prestage**, Jet Propulsion Lab.

A single trapped strontium ion optical frequency standard with application as an optical clock *(Invited Paper)*, P. Gill, G. P. Barwood, G. Huang, H. A. Klein, National Physical Lab. (United Kingdom) . . . . . [6673-01]

Optical frequency standards based on mercury and aluminum ions *(Invited Paper)*, W. M. Itano, J. C. Bergquist, A. Brusch, S. A. Diddams, T. M. Fortier, T. P. Heavner, L. W. Hollberg, D. B. Hume, S. R. Jefferts, L. Lorini, T. E. Parker, T. Rosenband, J. E. Stalnaker, National Institute of Standards and Technology . . . . . [6673-02]

Ultra-stable local oscillator and optical frequency standard based on the $2S_{1/2}$ - $2F_{7/2}$ transition in $^{171}Yb+$ *(Invited Paper)*, S. A. Webster, M. Oxborrow, K. Hosaka, A. Stannard, B. Walton, P. Gill, National Physical Lab. (United Kingdom) . . . . . [6673-03]

High-resolution spectroscopy of the $^{88}Sr+$ single ion optical frequency standard *(Invited Paper)*, P. Dubé, A. A. Madej, J. E. Bernard, A. D. Shiner, National Research Council Canada (Canada) . . . . . [6673-04]

SESSION 2 . . . . . Wed. 10:30 am to 12:00 pm

Portable Clocks and Standards

Chair: **Patrick Gill**, National Physical Lab. (United Kingdom)

Hg ion atomic clock for deep space navigation and science *(Invited Paper)*, J. D. Prestage, Jet Propulsion Lab. [6673-05]

Advances in chip-scale atomic frequency references at NIST *(Invited Paper)*, S. A. Knappe, National Institute of Standards and Technology; V. Shah, A. Brannon, Univ. of Colorado/Boulder; V. P. Gerginov, Univ. of Notre Dame; H. G. Robinson, National Institute of Standards and Technology; Z. Popovic, Univ. of Colorado/Boulder; L. W. Hollberg, J. E. Kitching, National Institute of Standards and Technology . . . . . [6673-06]

The space program PHARAO/ACES *(Invited Paper)*, P. Laurent, Observatoire de Paris (France); M. Abgrall, ALTEN SUD-OUEST (France); A. Clairon, P. Lemonde, G. Santarelli, Observatoire de Paris (France); C. Salomon, Lab. Kastler Brossel (France); C. Sirmain, Ctr. National d'Études Spatiales (France); L. Cacciapuoti, European Space Agency (France) . . . . . [6673-07]

Lunch/Exhibition Break

SESSION 3 . . . . . Wed. 1:30 to 3:00 pm

Atomic Fountain Clocks

Chair: **Nathan R. Newbury**, National Institute of Standards and Technology

NIST cesium fountains current status and future prospects *(Invited Paper)*, S. R. Jefferts, T. P. Heavner, T. E. Parker, J. Shirley, National Institute of Standards and Technology . . . . . [6673-08]

Operation of a caesium fountain standard at zero collisional frequency shift *(Invited Paper)*, K. Szymaniec, W. Chalupczak, National Physical Lab. (United Kingdom); S. Weyers, R. Wynands, Physikalisch-Technische Bundesanstalt (Germany); E. Tiesinga, C. J. Williams, National Institute of Standards and Technology . . . . . [6673-09]

Comparisons between atomic fountains at LNE-SYRTE *(Invited Paper)*, S. Bize, Observatoire de Paris (France) . . . . . [6673-10]

SESSION 4 . . . . . Wed. 3:30 to 5:20 pm

Optical Clocks II: Neutrals

Chair: **Chad W. Hoyt**, Bethel Univ.

Ultra-high resolution spectroscopy with a ^{87}Sr optical lattice clock *(Invited Paper)*, G. K. Campbell, M. M. Boyd, A. D. Ludlow, T. Zelevinsky, S. Blatt, S. M. Foreman, T. Zanon, J. Ye, Univ. of Colorado/Boulder . . . . . [6673-11]

A light source for ytterbium optical lattice clocks, F. Hong, M. Yasuda, T. Kohno, A. Onae, National Institute of Advanced Industrial Science and Technology (Japan) and Japan Science and Technology Agency (Japan) . . . . . [6673-12]

Lattice-based optical clock using an even isotope of Yb *(Invited Paper)*, Z. W. Barber, National Institute of Standards and Technology and Univ. of Colororado; C. W. Hoyt, Bethel Univ.; J. E. Stalnaker, C. W. Oates, L. W. Hollberg, National Institute of Standards and Technology . . . . . [6673-13]

Towards compact strontium optical lattice clock *(Invited Paper)*, N. Poli, R. E. Drullinger, G. Ferrari, Univ. degli Studi di Firenze (Italy); M. Prevedelli, Univ. degli Studi di Bologna (Italy); F. Sorrentino, M. G. Tarallo, G. M. Tino, Univ. degli Studi di Firenze (Italy) . . . . . [6673-14]

✔ Posters-Wednesday

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✔ **precise length etalon generator controlled by femtosecond mode-lock laser,** R. Smid, O. Cip, J. Lazar, Institute of Scientific Instruments (Czech Republic) [6673-23]

✔ **Absolute frequency shifts of iodine cells for laser stabilization,** J. Lazar, J. Hrabina, F. Petru, P. Jedlicka, O. Cip, R. Smid, Institute of Scientific Instruments (Czech Republic) . . . . . [6673-24]

✔ **A compact and efficient hyper coherent light source of visible violet laser diode based on Pound-Drever-Hall technique,** W. Sasaki, H. Yashiro, Y. Miura, K. Mizutani, J. Nakajima, Doshisha Univ. (Japan) . . . . . [6673-25]

✔ **High precision thermal expansion measurements using small Fabry-Perot etalons,** M. J. Davis, J. S. Hayden, SCHOTT North America, Inc.; D. L. Farber, Lawrence Livermore National Lab. . . . . [6673-26]

✔ **Measurements of the spectral response of loudspeakers using speckle photo-EMF technique,** K. Contreras, Pontificia Univ. Catolica del Peru (Peru); L. Mosquera, Univ. Nacional de Ingenieria (Peru); G. Baldwin-Olguin, Pontificia Univ. Catolica del Peru (Peru) . . . . . [6673-27]

✔ **Compact and inexpensive frequency stabilization technique for 850nm vertical cavity surface emitting lasers based on Fabry-Perrot resonator,** Y. Miura, J. Nakajima, K. Mizutani, W. Sasaki, Doshisha Univ. (Japan) [6673-28]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:10 to 10:10 am

FS Combs and Frequency Transfer

Chair: **David J. Jones**, The Univ. of British Columbia (Canada)

Precise time and frequency transfer link used for the uncertainty evaluation of Sr. optical lattice clock *(Invited Paper)*, M. Imae, Y. Fujii, F. Hong, National Institute of Advanced Industrial Science and Technology (Japan); M. Takamoto, R. Higashi, H. Katori, The Univ. of Tokyo (Japan) . . . . . [6673-15]

Coherent fiber-based frequency combs and CW lasers at 1550 nm *(Invited Paper)*, N. R. Newbury, W. C. Swann, National Institute of Standards and Technology . . . [6673-16]

Frequency and timing transfer for an ^{87}Sr optical clock *(Invited Paper)*, S. M. Foreman, A. D. Ludlow, M. M. Boyd, S. Blatt, T. Zelevinsky, G. K. Campbell, J. Ye, Univ. of Colorado/ Boulder; J. E. Stalnaker, S. A. Diddams, National Institute of Standards and Technology . . . . . [6673-17]

Erbium fiber laser-based frequency combs from THz to VIS *(Invited Paper)*, F. Tauser, A. Zach, F. Lison, TOPTICA Photonics AG (Germany) . . . . . [6673-18]

SESSION 6 . . . . . Thurs. 10:30 am to 12:20 pm

FS Combs and Precision Spectroscopy

Chair: **Feng-Lei Hong**, National Institute of Advanced Industrial Science and Technology (Japan)

High-precision spectroscopy of antiprotonic helium atoms using femtosecond frequency comb, and related topics in low-energy antiproton physics *(Invited Paper)*, H. A. Torii, The Univ. of Tokyo (Japan) . . . . . [6673-19]

Cavity enhanced modulation transfer using double modulation frequencies *(Invited Paper)*, Y. Jian, Z. Bi, X. Xu, L. Ma, East China Normal Univ. (China) . . . . . [6673-20]

Sub-transit-time limited saturated absorption in hollow-core photonic bandgap fibers, J. Hald, Dansk Fundamental Metrologi A/S (Denmark); J. Henningsen, Niels Bohr Institute (Denmark); J. C. Petersen, Dansk Fundamental Metrologi A/S (Denmark) . . . . . [6673-21]

Generation of an octave-spanning Raman comb with carrier-envelope-offset control *(Invited Paper)*, M. Katsuragawa, T. Suzuki, T. Onose, The Univ. of Electro-Communications (Japan); K. Misawa, Tokyo Univ. of Agriculture and Technology (Japan); F. Hong, A. Onae, National Institute of Advanced Industrial Science and Technology (Japan)[6673-22]

OPTICS

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Conference 6674

Monday-Thursday 27-30 August 2007 • Proceedings of SPIE Vol. 6674

Thin-Film Coatings for Optical Applications IV

Conference Chair: **Michael J. Ellison**, Alpine Research Optics Corp.

Monday 27 August

Plenary Session . . . . . Mon. 1:30 to 5:30 pm

Solar Energy

1:30 pm: **The Solar-hydrogen Economy: An Analysis** *(Invited Paper),* W. Reynolds, CEO, Eco-Engineers, Inc.

2:00 pm: **Solar Hydrogen Production by Tandem Cell System Composed of Metal Oxide Semiconductor Film Photoelectrode and Dye-Sensitized Solar Cell** (Invited Paper, Presentation Only), H. Arakawa, Professor, Tokyo Univ. of Science (Japan); C. Shiraishi, M. Tatemoto, H. Kishida, D. Usui, A. Suma, A. Takamisawa, T. Yamaguchi, Tokyo Univ. of Science (Japan)

2:30 pm: **New Opportunities in Concentrator Photovoltaics with Low-cost 40% Efficient Multijunction III-V Solar Cells** *(Invited Paper, Presentation Only),* R. R. King, Principal Scientist, Photovoltaic Cell R&D, Spectrolab, Inc.; R. A. Sherif, G. S. Kinsey, D. C. Law, K. M. Edmondson, H. Yoon, H. L. Cotal, C. M. Fetzer, J. H. Ermer, P. Hebert, P. Pien, N. H. Karam, Spectrolab, Inc.

3:00 pm: **Module Design and Development: Progress and Opportunities** *(Invited Paper, Presentation Only),* D. Rose, Director of Module R&D, Sunpower Corp.

Coffee Break . . . . . 3:30 to 4:00 pm

4:00 pm: **Delivering Service at Scale: Old Requirements for the New Energy Industry** *(Invited Paper, Presentation Only),* M. Culpepper, VP/Strategic Marketing, SunEdison

4:30 pm: **PV Solar Electricity Market and Technology Development** *(Invited Paper, Presentation Only),* W. Hoffmann, CTO, Solar Business Group, Applied Materials, Inc.

5:00 pm: **The Solar Industry-DOE and NREL Programs to Accelerate Growth** *(Invited Paper, Presentation Only),* S. J. Eglash, Consultant to the National Renewable Energy Lab.

Wednesday 29 August

✔ Posters-Wednesday

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✔ **Novel monitor system for optical thin film growth,** K. Wu, C. Lee, S. Ma, National Central Univ. (Taiwan) . . . . [6674-13]

✔ **ZnO based diluted magnetic semiconductor thin films by RF magnetron sputtering for spin photonic devices,** J. Elanchezhiyan, B. K. Periyasamy, G. Nammalvar, T. Balasubramanian, National Institute of Technology/ Tiruchirappalli (India) . . . . . [6674-14]

✔ **Effect of hydrogen in aluminum-doped zinc oxide thin films,** W. Liu, O. D. Crisalle, P. Holloway, M. R. Davidson, Univ. of Florida . . . . . [6674-15]

Thursday 30 August

SESSION 1 . . . . . Thurs. 8:40 to 10:00 am

Innovative Film Structures and Measurements

Chair: **Michael J. Ellison**, Alpine Research Optics Corp.

Simultaneous measurements of thin-film thickness and refractive index by dispersive white-light interferometry, Y. Ghim, S. Kim, Korea Advanced Institute of Science and Technology (South Korea) . . . . . [6674-01]

Conductive distributed Bragg reflector fabricated by oblique angle deposition from a single material, M. F. Schubert, J. K. Kim, S. Chhajed, E. F. Schubert, Rensselaer Polytechnic Institute . . . . . [6674-02]

Aperiodic metal-dielectric optical filters, C. Fuentes-Hernandez, The Univ. of Arizona; D. Owens, S. Randhawa, B. Kippelen, Georgia Institute of Technology . . . . . [6674-03]

Analyses of structural films using effective refractive index model, T. Chang, Y. Yeh, S. Chen, C. Lee, National Central Univ. (Taiwan) . . . . . [6674-04]

SESSION 2 . . . . . Thurs. 10:30 am to 12:00 pm

Novel Deposition Techniques

Chair: **Michael J. Ellison**, Alpine Research Optics Corp.

Printable thin birefringent film retarders for LCD *(Invited Paper),* P. I. Lazarev, I. Kasianova, E. Kharatiyan, Kontrakt Technology Ltd. (Russia); A. P. Lazarev, Crysoptix Ltd. (Russia) . . . . . [6674-05]

Robust antireflection coatings By UV cross-linking of silica nanoparticles and diazo-resin polycation, J. Ridley, K. Papavasiliou, A. L. Ritter, J. R. Heflin, Virginia Polytechnic Institute and State Univ. . . . . [6674-06]

Vapor-phase deposited organosilane coatings as hardening agents for high peak power laser optics, K. L. Marshall, Z. Culakova, B. Ashe, C. Giacofei, A. L. Rigatti, T. J. Kessler, A. W. Schmid, J. B. Oliver, A. Kozlov, Univ. of Rochester . . . . . [6674-07]

Fabrication of indium tin oxide (ITO) thin films by spin-coating deposition method, P. Psuja, W. Strek, Polska Akademia Nauk (Poland) . . . . . [6674-08]

Lunch/Exhibition Break

SESSION 3 . . . . . Thurs. 1:30 to 3:00 pm

Thin-Films for Solar Applications

Chair: **Michael J. Ellison**, Alpine Research Optics Corp.

FASST(tm) CIGS printing technology for low-cost integration of thin film photovoltaics into buildings *(Invited Paper),* B. J. Stanbery, HelioVolt Corp. . . . . [6674-09]

Single wall carbon nanotube networks as transparent contacts for photovoltaics, T. M. Barnes, J. van de Lagemaat, M. Contraras, X. Wu, J. Zhou, G. Rumbles, S. E. Shaheen, T. J. Coutts, National Renewable Energy Lab.; C. Weeks, D. Britz, J. A. Peltola, P. J. Glatkowski, Eikos Inc. . . . . [6674-10]

Graded silicon based PECVD thin film for solar cell applications, M. Gharghi, S. Sivoththaman, Univ. of Waterloo (Canada) . . . . . [6674-11]

Fabrication of hydrogenated microcrystalline silicon thin films using RF magnetron sputtering, S. Wang, W. Su, C. Han, S. Chen, C. Lee, National Central Univ. (Taiwan)[6674-12]

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Courses of Related Interest

See pages 162-187 for full course descriptions.

SC321 Thin Film Optical Coatings (Macleod) Tuesday 28, 8:30 am - 5:30 pm

Conference 6675

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6675

Optical Modeling and Performance Predictions III

Conference Chair: **Mark A. Kahan**, Optical Research Associates

Program Committee: **James W. Bilbro**, NASA Marshall Space Flight Ctr.; **Robert P. Breault**, Breault Research Organization, Inc.; **Gail J. Brown**, Air Force Research Lab.; **Thomas G. Brown**, Univ. of Rochester; **William J. Cassarly**, Optical Research Associates; **H. John Caulfield**, Diversified Research Corp.; **Helen J. Cole**, NASA Marshall Space Flight Ctr.; **Keith B. Doyle**, Sigmadyne, Inc.; **Peter G. Eliseev**, The Univ. of New Mexico; **G. Groot Gregory**, Optical Research Associates; **James B. Hadaway**, The Univ. of Alabama/Huntsville; **Claus C. Hoff**, Jet Propulsion Lab.; **George N. Lawrence**, Applied Optics Research; **Marie B. Levine**, Jet Propulsion Lab.; **Steven P. Levitan**, Univ. of Pittsburgh; **H. Angus Macleod**, Thin Film Ctr., Inc.; **Jack L. May**, Northrop Grumman Corp.; **Gregory J. Moore**, Jet Propulsion Lab.; **James D. Moore, Jr.**, SRS Technologies; **Steven R. Murrill**, Army Research Lab.; **Sean O'Brien**, Army Research Lab.; **Jefferson E. Odhner**, BAE Systems; **David C. Redding**, Jet Propulsion Lab.; **James C. Wyant**, College of Optical Sciences/The Univ. of Arizona; **Richard N. Youngworth**, Ball Aerospace & Technologies Corp.; **Feng Zhao**, Jet Propulsion Lab.

Wednesday 29 August

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Laser line scan performance prediction,** K. L. Mahoney, Naval Oceanographic Office; O. Schofield, J. Kerfoot, Rutgers Univ.; J. Shirron, T. Giddings, Metron, Inc.; M. S. Twardowski, WET Labs., Inc. . . . . [6675-24]

✔ **Folded holographic imager,** N. Ghanbari, R. K. Kostuk, M. A. Neifeld, M. D. Stenner, The Univ. of Arizona . . . [6675-25]

✔ **Ghost image modeling in the STEREO-B HI-2 camera using ASAP,** A. G. Richards, Rutherford Appleton Lab. (United Kingdom) . . . . . [6675-26]

✔ **PROPER: a physical optical propagation library for IDL,** J. E. Krist, Jet Propulsion Lab. . . . . [6675-27]

✔ **Finite element analysis of the LOLA receiver telescope lens,** E. A. Matzinger, NASA Goddard Space Flight Ctr. . . . . [6675-28]

✔ **Closed form design equations for CTE distribution in optical structures,** E. Rassi, C. H. M. Jenkins, Montana State Univ. . . . . [6675-29]

✔ **Efficient finite element modeling methods across optical length scales,** J. A. Harwood, C. H. M. Jenkins, Montana State Univ.; P. A. Gierow, GATR Technologies; B. G. Patrick, G. Poe, SRS Technologies, Inc. . . . . [6675-30]

✔ **A linear equation system to obtain a quadrature filter for temporal fringe pattern demodulation,** J. C. Estrada Rico, D. A. Arroyo, M. Servin, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6675-31]

✔ **Compare the fiber MOPA and Q-switch,** B. Cai, A & P Instrument Co., Ltd. (China) . . . . . [6675-32]

✔ **Presentation, design and application of a real-time demosaicing generic model based on a multiple channel CMOS image sampling system,** B. Shan, T. Shen, Beijing Institute of Technology (China); D. T. W. Chan, The Hong Kong Polytechnic Univ. (Hong Kong China) . . . . . [6675-33]

Thursday 30 August

SESSION 1 . . . . . Thurs. 8:00 to 9:00 am

Optical Modeling on JWST

Chair: **James B. Hadaway**, The Univ. of Alabama/ Huntsville

Optical modeling in support of the JWST test program, J. Marzouk, Sigma Space Corp. . . . . [6675-01]

Optical modeling activities for NASA's James Webb Space Telescope (JWST): III. wavefront aberrations due to alignment and figure compensation, J. M. Howard, NASA Goddard Space Flight Ctr. . . . . [6675-02]

Investigating the use of mutually uncorrelated acceleration spectrums to predict line of sight for JWST optical testing, C. L. Buttaccio, K. M. Patterson, K. A. Sweitzer, ITT Space Systems LLC . . . . . [6675-03]

SESSION 2 . . . . . Thurs. 9:00 to 10:20 am

Optical Modeling on SIM

Chair: **Marie B. Levine**, Jet Propulsion Lab.

Centroiding estimates of SIM angle tracker camera in presence of a crowded field, N. Fathpour, Jet Propulsion Lab. and California Institute of Technology . . . . . [6675-04]

Star confusion effect on SIM PlanetQuest astrometric performance, C. Zhai, J. W. Yu, M. H. Milman, N. Fathpour, M. J. Morales, B. Nemati, M. W. Regehr, M. Heflin, L. Sievers, Jet Propulsion Lab. . . . . [6675-05]

SIM-PlanetQuest interferometer realtime control system architecture, B. H. Kang, D. S. Bayard, G. A. Macala, Jet Propulsion Lab. . . . . [6675-06]

A covariance analysis tool for assessing fundamental limits to SIM pointing performance, D. S. Bayard, B. H. Kang, Jet Propulsion Lab. . . . . [6675-07]

The instrument model: performance prediction simulator for SIM PlanetQuest, M. J. Morales, N. Fathpour, Jet Propulsion Lab. . . . . [6675-08]

SESSION 3 . . . . . Thurs. 10:40 to 11:20 am

Models for a Near Earth Object Observatory and for Fabrication and Test of Diamond Turned Aspheres and/or DOEs

Chair: **Richard N. Youngworth**, Ball Aerospace & Technologies Corp.

System modeling to support a space-based mission for discovery of near-earth objects, M. D. Lieber, J. Van Cleve, R. Arentz, H. J. Reitsema, J. Pullen, Ball Aerospace & Technologies Corp. . . . . [6675-09]

Optical design to manufacturing convergence, designing infrared optical systems with aspheric/diffractive surfaces for maximum success in the diamond point turning manufacturing environment, M. S. Conlon, J. P. Schaefer, J. A. Spangler, R. Chipper, J. McKay, Raytheon-ELCAN Optical Technologies . . . . . [6675-10]

SESSION 4 . . . . . Thurs. 11:20 am to 12:00 pm

Modeling Stray Light

Chair: **G. Groot Gregory**, Optical Research Associates

Stay light computations: Has nothing changed since the 1970's?, A. W. Greynolds, Ruda and Associates, Inc.[6675-11]

Stray light design and analysis of the SNAP Observatory, M. J. Sholl, Univ. of California/Berkeley; J. C. Fleming, Ball Aerospace & Technologies Corp.; P. N. Jelinsky, M. L. Lampton, Univ. of California/Berkeley . . . . . [6675-12]

Lunch/Exhibition Break

SESSION 5 . . . . . Thurs. 1:30 to 2:30 pm

Structural/Thermal/Optical (STOP) Modeling and Models of Electrostatic Stress

Chair: **Claus C. Hoff**, MSC.Software Corp.

Advancements in integrated structural/thermal/optical (STOP) analysis of optical systems, G. Stoeckel, D. Crompton, G. Perron, L-3 SSG-Tinsley . . . . . [6675-13]

Random image motion analysis with Ivory 2.0 FE models, A. E. Hatheway, Alson E. Hatheway, Inc. . . . . [6675-14]

On the prediction of electrostatic stresses in devices, G. Kloos, Hella KGaA Hueck & Co. (Germany) . . . . . [6675-15]

SESSION 6 . . . . . Thurs. 2:30 to 3:30 pm

Wave-optics and Blaze Profile Models

Chair: **George N. Lawrence**, Applied Optics Research

Algorithm for implementing an ABCD ray matrix wave-optics propagator, J. D. Mansell, R. Praus, L. Xu, A. J. Seward, S. Coy, MZA Associates Corp. . . . . [6675-16]

Determining wave-optics mesh parameters for complex optical systems, J. D. Mansell, S. Coy, R. Praus, MZA Associates Corp. . . . . [6675-17]

Rigorous modeling of various blaze-type profiles and incidence geometries in the intermediate structure regime, O. Sandfuchs, A. Pesch, R. Brunner, Carl Zeiss Jena GmbH (Germany) . . . . . [6675-18]

SESSION 7 . . . . . Thurs. 3:50 to 4:30 pm

Modeling of Polarization Beamsplitters and a Novel Polarization Detector

Chair: **Thomas G. Brown**, Univ. of Rochester

Advances in polymeric Cartesian polarizing beamsplitters and light engines employing them, S. Magarill, 3M Precision Optics, Inc.; C. L. Bruzzone, 3M Co. . . . . [6675-19]

Design and analysis of a novel micro polarization detector, K. Zhao, Dalian Univ. of Technology (China) . . . . . [6675-20]

SESSION 8 . . . . . Thurs. 4:30 to 5:30 pm

Models Used in Fiber Communications and a Fiber Interferometer

Chair: **Feng Zhao**, Jet Propulsion Lab.

Design of Tb/s capacity quadruply cladded optical fiber for WDM systems, A. Goel, Maulana Azad National Institute of Technology (India) . . . . . [6675-21]

Design of wideband erbium doped fiber amplifier for WDM systems, A. Goel, R. K. Baghel, Maulana Azad National Institute of Technology (India) . . . . . [6675-22]

Processing of the signals of the single-fiber intermode interferometer with a small number of excited modes by using an electronic correlation method, O. B. Vitrik, Far Eastern State Technical Univ. (Russia); Y. N. Kul'chin, A. D. Lantsov, Institute of Automation and Control Processes (Russia) . . . . . [6675-23]

OPTICS

Conference 6676

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6676

Optical System Alignment and Tolerancing

Conference Chairs: **José M. Sasian**, The Univ. of Arizona; **Mitchell C. Ruda**, Ruda & Associates

Program Committee: **Sen Han**, Veeco Tucson Inc.; **Chao-Wen Liang**, National Central Univ. (Taiwan); **Robert E. Parks**, Optical Perspective Group, LLC; **David V. Wick**, Sandia National Labs.; **Richard N. Youngworth**, Ball Aerospace & Technologies Corp.

Sunday 26 August

Introduction . . . . . Sun. 8:00 to 8:05 am

Chair: **José M. Sasian,** The Univ. of Arizona

SESSION 1 . . . . . Sun. 8:05 to 10:05 am

Tolerancing and Component Considerations

Chairs: **José M. Sasian**, College of Optical Sciences/ The Univ. of Arizona; **Richard N. Youngworth**, Ball Aerospace & Technologies Corp.

Comparison of three methods for tolerancing opto-mechanical systems, J. Perrin, Consultant (France) [6676-01]

Precision centering of lenses *(Invited Paper)*, R. E. Parks, Optical Perspectives Group, LLC . . . . . [6676-02]

Illumination system tolerancing, R. J. Koshel, Lambda Research Corp. and The Univ. of Arizona . . . . . [6676-03]

Random thoughts on Monte Carlo tolerancing *(Invited Paper)*, R. C. Juergens, H. J. Wood, Raytheon Missile Systems . . . . . [6676-04]

Tolerancing and compensation of microlithographic optics, D. G. Smith, Nikon Research Corp. of America . . . [6676-05]

SESSION 2 . . . . . Sun. 10:35 am to 12:15 pm

Alignment of Laser and Electro-Optical Systems

Chairs: **David V. Wick**, Sandia National Labs.; **Sen Han**, Veeco Instruments, Inc.

Design, construction, alignment, and calibration of a compact velocimetry experiment, M. I. Kaufman, R. M. Malone, B. C. Frogget, V. T. Romero, D. L. Esquibel, A. J. Iverson, G. A. Lare, B. Briggs, D. DeVore, B. Cata, K. McGillivray, M. J. Palagi, National Security Technologies, LLC; M. E. Briggs, M. R. Furlanetto, D. B. Holtkamp, N. S. P. King, M. D. Wilke, Los Alamos National Lab.; M. D. Furnish, Sandia National Labs. . . . . [6676-06]

Optical alignment techniques for line-imaging velocity interferometry and line-imaging self-emission of targets at the National Ignition Facility (NIF) *(Invited Paper)*, R. M. Malone, B. C. Frogget, M. I. Kaufman, T. W. Tunnell, R. L. Guyton, I. P. Reinbachs, P. W. Watts, National Security Technologies, LLC; J. R. Celeste, P. M. Celliers, T. L. Lee, B. J. MacGowan, E. W. Ng, R. B. Robinson, Lawrence Livermore National Lab. . . . . [6676-07]

Nanoalignment *(Invited Paper)*, S. Pau, College of Optical Sciences/The Univ. of Arizona . . . . . [6676-08]

Tolerance analysis of a phase space beam analyzer, G. Kloos, Hella KGaA Hueck & Co. (Germany) . . . . . [6676-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:15 to 3:05 pm

Alignment in Optical Metrology

Chair: **Mitchell C. Ruda**, Ruda and Associates, Inc.

Interferometer alignment, S. Han, Veeco Instruments Inc. . . . . [6676-10]

Optical alignment with computer-generated holograms *(Invited Paper)*, J. H. Burge, R. Zehnder, College of Optical Sciences/The Univ. of Arizona . . . . . [6676-11]

A snapshot distortion test using Moire fringes, E. M. E. Sabatke, Ball Aerospace & Technologies Corp.; L. R. Dettmann, The Univ. of Arizona/Steward Observatory; A. Pierce, D. S. Sabatke, Ball Aerospace & Technologies Corp. . . . . [6676-12]

Use of a commercial laser tracker for optical alignment, J. H. Burge, The Univ. of Arizona/Steward Observatory; C. Zhao, P. Su, College of Optical Sciences/The Univ. of Arizona . . . . . [6676-13]

A simple tool for alignment and wavefront testing, W. P. Kuhn, William P. Kuhn, Ph.D., LLC . . . . . [6676-14]

SESSION 4 . . . . . Sun. 3:25 to 5:55 pm

Alignment in High Performance Optical Systems

Chair: **Robert E. Parks**, Optical Perspectives Group, LLC

A scanning Hartmann focus test for the EUVI telescopes aboard STEREO, R. G. Ohl IV, S. R. Antonille, D. L. Aronstein, B. H. Dean, M. Delmont, NASA Goddard Space Flight Ctr.; J. P. d'Entremont, Lenox Laser; W. L. Eichhorn, B. J. Frey, NASA Goddard Space Flight Ctr.; S. J. Hynes, Swales Aerospace; D. Janssen, Lenox Laser; D. A. Kubalak, Orbital Sciences Corp.; K. W. Redman, ManTech International Corp.; S. Shiri, J. S. Smith, NASA Goddard Space Flight Ctr.; P. L. Thompson, The Johns Hopkins Univ. Applied Physics Lab.; M. E. Wilson, NASA Goddard Space Flight Ctr. . . . . [6676-15]

Minimizing angst during optical alignment *(Invited Paper)*, M. C. Ruda, Ruda and Associates, Inc. . . . . [6676-16]

Alignment of a three-mirror off-axis telescope, A. Mahler, R. A. Chipman, College of Optical Sciences/The Univ. of Arizona . . . . . [6676-17]

JWST-MIRI spectrometer main optics alignment and tolerancing philosophy, M. Meijers, G. Kroes, ASTRON (Netherlands) . . . . . [6676-18]

Cryogenic alignment of an infrared hyperspectral imager, T. A. Mitchell, Wavefront Research, Inc.; J. G. Zeibel, U.S. Army Night Vision & Electronic Sensors Directorate . . . . [6676-19]

Design, tolerancing, and alignment of a dark field condenser, S. M. Prince, W. G. McGuigan, OPTICS 1, Inc. . . . . [6676-20]

A new approach to align the off-axis TMA telescopes, X. Zhang, Z. Zhang, Z. Li, Changchun Institute of Optics, Fine Mechanics and Physics (China) . . . . . [6676-21]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Using a co-ordinate measuring machine to align multiple element large optical systems,** E. F. Howick, D. Cochrane, D. Meier, Industrial Research Ltd. (New Zealand) . [6676-22]

✔ **Error analysis and alignment in the optical head of near field recording system,** J. Lee, Korea Institute of Machinery and Materials (South Korea); D. Gweon, Korea Advanced Institute of Science and Technology (South Korea); W. Kim, Korea Institute of Machinery and Materials (South Korea) . . . . . [6676-23]

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Conference 6677

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6677

Earth Observing Systems XII

Conference Chairs: **James J. Butler**, NASA Goddard Space Flight Ctr.; **Jack Xiong**, NASA Goddard Space Flight Ctr.

Program Committee: **Philip E. Ardanuy**, Raytheon Co.; **Robert A. Barnes**, Science Applications International Corp.; **Stuart F. Biggar**, Optical Sciences Ctr./The Univ. of Arizona; **Armin W. Doerry**, Sandia National Labs.; **Thomas S. Pagano,** Jet Propulsion Lab.; **Carl F. Schueler**, Consultant

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:10 am

Prelaunch Calibration I

Chair: **Thomas S. Pagano**, Jet Propulsion Lab.

Application of SSULI ground calibration methods to retrieval of spectral emissions on flight instruments, P. W. Walker II, Computational Physics, Inc.; S. A. Budzien, S. E. Thonnard, A. C. Nicholas, K. F. Dymond, Naval Research Lab. . . . . [6677-01]

Spectral features, effects and cures, H. H. van Brug, G. Bazalgette Courrèges-Lacoste, TNO TPD (Netherlands) . . . . . [6677-02]

System level pre-launch calibration of onboard solar diffusers, R. A. Barnes, Science Applications International Corp.; S. W. Brown, National Institute of Standards and Technology; J. J. Butler, NASA Goddard Space Flight Ctr. . . . . [6677-03]

Characterization of Earth-observing satellite instruments for response to spectrally and spatially variable scenes, S. W. Brown, J. P. Rice, National Institute of Standards and Technology; R. A. Barnes, NASA Goddard Space Flight Ctr. . . . . [6677-04]

Design and characterization of a large area uniform radiance source for calibration of a remote sensing imaging system, G. A. McKee, Labsphere, Inc. and Indian Space Research Organization (India); S. Pal, H. Seth, A. Bhardwaj, H. S. Sahoo, Indian Space Research Organisation (India) . . . . . [6677-05]

SESSION 2 . . . . . Sun. 10:40 am to 12:40 pm

Prelaunch Calibration II

Chair: **Stuart F. Biggar**, College of Optical Sciences/ The Univ. of Arizona

Validation of radiometric standards for the laboratory calibration of reflected-solar Earth-observing satellite instruments, J. J. Butler, NASA Goddard Space Flight Ctr.; S. W. Brown, National Institute of Standards and Technology; R. A. Barnes, NASA Goddard Space Flight Ctr. . . . . [6677-06]

Comparison of area measurements of apertures for exo-atmospheric solar irradiance between NIST and JPL, M. Litorja, J. B. Fowler, B. C. Johnson, National Institute of Standards and Technology . . . . . [6677-07]

The TSI radiometer facility: absolute calibrations for total solar irradiance instruments, G. A. Kopp, V. A. Drake, N. Farber, D. M. Harber, K. F. Heuerman, Univ. of Colorado/ Boulder . . . . . [6677-08]

VIIRS ZEMAX and FORTRAN polarization models, E. Waluschka, NASA Goddard Space Flight Ctr.; G. Meister, FutureTech Corp.; D. Moyer, Science Systems and Applications, Inc.; K. J. Voss, Univ. of Miami . . . . . [6677-09]

Vacuum focus testing of large telescopes, J. J. Lumia, Ball Aerospace & Technologies Corp. . . . . [6677-10]

Linearity improvement in a high dark-current near-infrared array spectrometer, D. P. D'Amato, D. Griffiths, J. E. Leland, Labsphere, Inc. . . . . [6677-11]

Lunch Break

SESSION 3 . . . . . Sun. 1:40 to 3:00 pm

On-orbit Calibration I

Chair: **Jack Xiong**, NASA Goddard Space Flight Ctr.

Absolute ultraviolet irradiance of the Moon from SORCE SOLSTICE, M. Snow, G. Holsclaw, W. E. McClintock, T. N. Woods, Univ. of Colorado/Boulder . . . . . [6677-12]

The on-orbit calibration of SeaWiFS: revised temperature and gain corrections, R. E. Eplee, Science Applications International Corp.; F. S. Patt, NASA Goddard Space Flight Ctr.; G. Meister, FutureTech Corp.; B. A. Franz, S. W. Bailey, C. R. McClain, NASA Goddard Space Flight Ctr. . . . . [6677-13]

Consistency of L4 ™ absolute calibration with respect to the L5 ™ sensor based on near simultaneous image acquisition, G. Chander, U.S. Geological Survey; D. L. Helder, South Dakota State Univ.; E. Micijevic, U.S. Geological Survey; C. J. Mettler, R. Malla, South Dakota State Univ. . . [6677-14]

Comparison of the outgassing models for the Landsat thematic mapper sensors, E. Micijevic, G. Chander, U.S. Geological Survey . . . . . [6677-15]

SESSION 4 . . . . . Sun. 3:30 to 4:50 pm

On-orbit Calibration II

Chair: **Carl F. Schueler**, Consultant

Radiometric performance of the CERES Earth radiation budget climate record sensors on the EOS Aqua and Terra spacecraft: launch through 2006, K. J. Priestley, NASA Langley Research Ctr.; G. M. Matthews, Analytical Services and Materials, Inc.; S. Thomas, Science Applications International Corp. . . . . [6677-17]

Transfer of radiometric standards between multiple LEO Earth-observing broadband radiometers: application to CERES, G. M. Matthews, Analytical Services and Materials, Inc.; K. J. Priestley, NASA Langley Research Ctr.; S. Thomas, Science Applications International Corp. . . . . [6677-18]

A method for jointly estimating the noise and bias of AIRS and TES over ocean scenes, L. J. Scharenbroich, H. H. G. Aumann, Jet Propulsion Lab. . . . . [6677-19]

RADARSAT ScanSAR wind retrieval under hurricane conditions, C. Nie, D. G. Long, Brigham Young Univ.[6677-20]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:30 to 11:20 am

MODIS

Chair: **Robert A. Barnes**, NASA Goddard Space Flight Ctr.

Detector noise characterization and performance of MODIS thermal emissive bands, J. Xiong, NASA Goddard Space Flight Ctr.; A. Wu, Science Systems and Applications, Inc.; W. L. Barnes, Univ. of Maryland/Baltimore County . . . . . [6677-21]

Monitoring MODIS thermal emissive band stability through brightness temperature trending of a ground target, B. N. Wenny, Science Systems and Applications, Inc.; J. Xiong, NASA Goddard Space Flight Ctr. . . . . [6677-22]

Aqua MODIS L1B radiometric accuracy update for TIR bands: Tahoe 2006 field data from the NASA ER-2, C. C. Moeller, Univ. of Wisconsin/Madison; S. J. Hook, Jet Propulsion Lab.; R. O. Knuteson, D. C. Tobin, Univ. of Wisconsin/Madison . . . . . [6677-23]

Characterization of MODIS solar diffuser on-orbit degradation, J. Xiong, NASA Goddard Space Flight Ctr.; X. Xie, Science Systems and Applications, Inc. . . . . [6677-24]

Correction of subframe striping in high-resolution MODIS ocean color products, G. Meister, FutureTech Corp.; C. Pan, Science Systems and Applications, Inc.; F. S. Patt, B. A. Franz, J. Xiong, C. R. McClain, NASA Goddard Space Flight Ctr. . . . . [6677-25]

Utility of MODIS-Terra for ocean color applications, B. A. Franz, E. J. Kwiatkowska, Science Applications International Corp.; G. Meister, FutureTech Corp.; C. R. McClain, NASA Goddard Space Flight Ctr. . . . . [6677-26]

MODIS pre-launch characterization of reflective solar band response vs. scan angle, C. Pan, Science Systems and Applications, Inc.; J. Xiong, NASA Goddard Space Flight Ctr.; N. Che, Science Systems and Applications, Inc. . . [6677-27]

SESSION 6 . . . . . Mon. 11:20 am to 12:40 pm

Vicarious Calibration I

Chair: **James J. Butler**, NASA Goddard Space Flight Ctr.

Prime candidate Earth targets for the post-launch radiometric calibration of space-based optical imaging instruments, P. M. Teillet, Univ. of Lethbridge (Canada); J. A. Barsi, NASA Goddard Space Flight Ctr.; G. Chander, U.S. Geological Survey; K. J. Thome, College of Optical Sciences/ The Univ. of Arizona . . . . . [6677-28]

Retrieval of surface BRDF for reflectance-based calibration, K. J. Thome, J. S. Czapla-Myers, College of Optical Sciences/The Univ. of Arizona . . . . . [6677-29]

Implication of spatial uniformity on vicarious calibration using automated test sites, J. S. Czapla-Myers, K. J. Thome, N. P. Leisso, College of Optical Sciences/The Univ. of Arizona . . . . . [6677-30]

LSpec at Frenchman Flat, Nevada test site: an automatic VNIR vicarious calibration facility, M. C. Helmlinger, Northrop Grumman Space Technology; C. J. Bruegge, Jet Propulsion Lab.; H. N. Gross, Integrity Applications, Inc. . . . . [6677-31]

Lunch Break

SESSION 7 . . . . . Mon. 1:40 to 3:00 pm

Vicarious Calibration II

Chair: **Armin W. Doerry**, Sandia National Labs.

VNIR transfer radiometer for validation of calibration sources for hyperspectral sensors, S. F. Biggar, K. J. Thome, College of Optical Sciences/The Univ. of Arizona; R. B. Lockwood, S. M. Miller, Air Force Research Lab. . . [6677-32]

Solar radiation-based calibration of laboratory grade Radiometers, N. J. Anderson, S. F. Biggar, K. J. Thome, N. P. Leisso, College of Optical Sciences/The Univ. of Arizona . . . . . [6677-33]

Cross-calibration of the Terra MODIS, Landsat-7 ETM+ and EO-1 ALI sensors using near simultaneous surface observation over Railroad Valley Playa, Nevada test site, G. Chander, U.S. Geological Survey; A. Angal, T. Choi, Science Systems and Applications, Inc.; D. J. Meyer, U.S. Geological Survey; X. Xiong, NASA Goddard Space Flight Ctr.; P. M. Teillet, Univ. of Lethbridge (Canada) . . . . . [6677-34]

Operational calibration of Metop AVHRR solar reflectance channels using the desert target, F. Yu, Earth Resources Technology, Inc.; X. F. Wu, National Oceanic and Atmospheric Administration . . . . . [6677-35]

SESSION 8 . . . . . Mon. 3:30 to 5:10 pm

Vicarious Calibration III

Chair: **Jack Xiong**, NASA Goddard Space Flight Ctr.

Airborne prototype instrument suite test flight of a low light-high dynamic range imager and visible spectrometer over the Great Salt Lake region, M. A. Kuester, B. R. Johnson, W. S. Good, P. B. Johnson, P. Kaptchen, J. Lasnik, T. Lin, T. Ramond, Ball Aerospace & Technologies Corp.[6677-36]

Vicarious calibration of GOES imager visible channel using star measurements: recent improvements, X. F. Wu, National Oceanic and Atmospheric Administration; I. Chang, American Univ.; C. Dean, QSS Group, Inc.; M. P. Weinreb, General Dynamics Advanced Information Systems; D. S. Crosby, QSS Group, Inc.; D. Han, Integral Systems, Inc. . . . . [6677-37]

Seasonal and interannual variations in Antarctic backscatter signature from 1999 to 2006 as observed by QuikSCAT, B. R. Lambert, D. G. Long, Brigham Young Univ. . . . . [6677-38]

Accuracy assessment of satellite DEM mosaic, C. V. Rao, S. Saiveena, D. S. Jain, A. S. Manjunath, K. M. M. Rao, National Remote Sensing Agency (India) . . . . . [6677-39]

Research on land sandy desertification with remote sensing, J. Jian, Chengdu Univ. of Information Technology (China) . . . . . [6677-40]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Improvement of low-temperature estimation in MODIS thermal bands by adjusting calibration offset and non-linear terms,** A. Wu, Science Systems and Applications, Inc.; J. Xiong, NASA Goddard Space Flight Ctr.; B. N. Wenny, N. Chen, K. Chiang, Science Systems and Applications, Inc. . . . . [6677-55]

✔ **WindSat passive microwave polarimetric observations of soil moisture and land variables,** T. J. Jackson, R. Bindlish, U.S. Dept. of Agriculture; L. Li, Naval Research Lab.; J. Du, Institute of Remote Sensing Applications (China) . . . . . [6677-56]

✔ **Pre-launch characterization of aqua MODIS scan mirror response versus scan angle for thermal emissive bands,** K. Chiang, Science Systems and Applications, Inc.; J. Xiong, NASA Goddard Space Flight Ctr. . . . . [6677-57]

✔ **MODIS reflective solar bands unscheduled lunar observations,** J. Sun, Science Systems and Applications, Inc.; X. Xiong, NASA Goddard Space Flight Ctr. . . [6677-58]

✔ **The simulator of the photon counting planetary altimeter,** J. Blazej, I. Prochazka, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6677-59]

✔ **The design of integrated aerial camera system with convertible film and CCD image sensor,** S. Zhao, Peking Univ. (China) . . . . . [6677-60]

✔ **Scene identification and clear-sky compositing algorithms for generating North America coverage at 250m spatial resolution from MODIS land channels for landcover and change detection applications,** Y. Luo, A. P. Trishchenko, K. V. Khlopenkov, B. Park, Canada Ctr. for Remote Sensing (Canada) . . . . . [6677-61]

Tuesday 28 August

SESSION 9 . . . . . Tues. 8:30 to 10:30 am

On-orbit Data Analysis

Chair: **James J. Butler**, NASA Goddard Space Flight Ctr.

Distributed database schema, A. Mousessian, J. Burke, J. Ericson, Jet Propulsion Lab. . . . . [6677-41]

Contributions to climate studies from four years of hyperspectral data from the atmospheric infrared sounder (AIRS), D. A. Elliott, H. H. G. Aumann, Jet Propulsion Lab.; L. L. Strow, Univ. of Maryland/Baltimore County; D. T. Gregorich, Jet Propulsion Lab. . . . . [6677-42]

Analysis of clouds and the Earth's radiant energy system (CERES)lunar measurements, S. Thomas, Science Applications International Corp.; K. J. Priestley, NASA Langley Research Ctr.; G. M. Matthews, Analytical Services and Materials, Inc. . . . . [6677-43]

ENVISAT-ASAR single polarized SLC data analysis for the study of snow pack characteristics, G. Singh, V. Kumar, G. Venkataraman, Y. S. Rao II, Indian Institute of Technology Bombay (India) . . . . . [6677-44]

Investigating snow wetness using dual polarization advanced synthetic aperture radar imagery, G. Venkataraman, G. Singh, V. Kumar, Y. S. Rao II, Indian Institute of Technology Bombay (India) . . . . . [6677-45]

Snow grain size estimation in Himalayan snow-covered region using ASAR data, G. Venkataraman, G. Singh, V. Kumar, Indian Institute of Technology Bombay (India)[6677-46]

SESSION 10 . . . . . Tues. 11:00 am to 12:20 pm

Future Instruments and Developments I

Chair: **Philip E. Ardanuy**, Raytheon Co.

Development of dual imaging optical sensor (DIOS) for small satellites, Y. Choi, M. Kang, S. Jeong, J. Yun, S. Yang, J. Kim, E. Kim, Satrec Initiative Co., Ltd. (South Korea) [6677-47]

Development of high-performance optical system for small satellite, Y. Choi, S. Yang, M. Kang, E. Kim, Satrec Initiative Co., Ltd. (South Korea) . . . . . [6677-48]

GeoSTAR: a geostationary microwave sounder for the future, B. H. Lambrigtsen, T. C. Gaier, P. P. Kangaslahti, A. B. Tanner, Jet Propulsion Lab. . . . . [6677-49]

Passive A-band Wind Sounder (PAWS) for measurement of tropospheric wind velocity profile, G. Miecznik, R. Pierce, P. Huang, P. A. Slaymaker, P. Kaptchen, S. Roark, B. R. Johnson, D. F. Heath, Ball Aerospace & Technologies Corp. . [6677-50]

Lunch/Exhibition Break

SESSION 11 . . . . . Tues. 1:50 to 3:10 pm

Future Instruments and Developments II

Chair: **Jack Xiong**, NASA Goddard Space Flight Ctr.

VENμS (vegetation and environment monitoring on a new micro satellite) image quality, A. Meygret, O. Hagolle, Ctr. National d'Études Spatiales (France); E. Hillairet, Magellium (France); G. Dedieu, P. Crebassol, Ctr. National d'Études Spatiales (France) . . . . . [6677-51]

ASSIST - Atmospheric Sounder Spectrometer for Infrared Spectral Technology: latest development and improvement in the atmospheric sounding technology, L. Rochette, LR Tech (Canada); M. E. Howard, National Security Technologies, LLC; M. Wang, Institut National d'Optique (Canada); T. Bratcher, Ionetrics, Inc. . . . . [6677-52]

Improving GLM design capabilities with high fidelity analytical and simulation tools, D. M. Down, S. P. Hagerty, T. F. Updike, Ball Aerospace & Technologies Corp. . . [6677-53]

Modeling and optimal design of optical remote sensing payloads, R. W. Tarde, E. M. Donley, Ball Aerospace & Technologies Corp.; J. L. Carr, Carr Astronautics, Inc.[6677-54]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC194 Multispectral and Hyperspectral Image Sensors (Lomheim) Wednesday 29, 1:30 - 5:30 pm

Conference 6678

Monday-Thursday 27-30 August 2007 • Proceedings of SPIE Vol. 6678

Infrared Spaceborne Remote Sensing and Instrumentation XV

Conference Chair: **Marija Strojnik**, Ctr. de Investigaciones en Óptica, A.C. (Mexico)

Program Committee: **John A. Antoniades**, BAE Systems North America; **Gail E. Bingham**, Utah State Univ.; **David A. Cardimona**, Air Force Research Lab.; **Catherine J. Cesarsky**, European Southern Observatory (Germany); **Jam Farhoomand**, TechnoScience Corp.; **Gerald T. Fraser**, National Institute of Standards and Technology; **John C. Gille**, National Ctr. for Atmospheric Research; **Dietrich Lemke**, Max-Planck-Institut für Astronomie (Germany); **Jan L. Williams**, e-Systems Management Consultants; **Juergen Wolf**, NASA Ames Research Ctr.

Monday 27 August

SESSION 1 . . . . . Mon. 1:00 to 3:20 pm

Calibration of Infrared Instruments I

Chairs: **Gerald T. Fraser**, National Institute of Standards and Technology; **Sergey N. Mekhontsev**, National Institute of Standards and Technology

MWIR imaging spectrometer with digital time delay tntegration for remote sensing and characterization of planetary satellites, S. E. Kendrick, A. Harwit, M. L. Kaplan, Ball Aerospace & Technologies Corp.; W. D. Smythe, Jet Propulsion Lab. . . . . [6678-01]

Infrared standards in space, J. A. Dykema, Harvard Univ. . . . . [6678-02]

Navy primary standards capability for spectral radiometric calibration of blackbodies, T. H. Uzzell, W. S. Schlotte, Navy Primary Standards Lab.; S. N. Mekhontsev, V. B. Khromchenko, L. M. Hanssen, National Institute of Standards and Technology . . . . . [6678-03]

NIST-calibrated SI-traceable stars, G. T. Fraser, S. W. Brown, B. C. Johnson, K. R. Lykke, H. W. Yoon, National Institute of Standards and Technology; R. W. Russell, The Aerospace Corp. . . . . [6678-04]

Direct measurements of angle and temperature-dependent IR emissivity of targets, S. N. Mekhontsev, V. B. Khromchenko, L. M. Hanssen, G. T. Fraser, National Institute of Standards and Technology . . . . . [6678-05]

Tunable filter comparator for spectral calibration of near-ambient temperature blackbodies, V. B. Khromchenko, S. N. Mekhontsev, L. M. Hanssen, National Institute of Standards and Technology . . . . . [6678-06]

Cs and Na heat pipe blackbodies as standards of infrared spectral radiance and radiance temperature in the temperature range 300 to 1100 degrees C, J. Envall, S. N. Mekhontsev, V. B. Khromchenko, L. M. Hanssen, National Institute of Standards and Technology . . . . . [6678-07]

SESSION 2 . . . . . Mon. 3:50 to 4:50 pm

Infrared Instruments

Chairs: **Dietrich Lemke**, Max-Planck-Institut für Astronomie (Germany); **Marija Strojnik**, Ctr. de Investigaciones en Óptica, A.C. (Mexico)

Interferometry on stars at mid-infrared wavelengths, K. Tatebe, C. H. Townes, Univ. of California/Berkeley [6678-08]

Spectral balancing of a broadband Earth-observing radiometer with co-aligned SW channel to ensure accuracy and stability of broadband daytime OLR measurements: application to CERES, G. M. Matthews, Analytical Services and Materials, Inc.; K. J. Priestley, NASA Langley Research Ctr.; S. Thomas, Science Applications International Corp. . . . . [6678-09]

A comprehensive radiometric validation protocol for the CERES Earth radiation budget climate record sensors, K. J. Priestley, NASA Langley Research Ctr.; G. M. Matthews, Analytical Services and Materials, Inc.; S. Thomas, Science Systems and Applications, Inc. . . . . [6678-10]

Tuesday 28 August

SESSION 3 . . . . . Tues. 9:00 to 9:50 am

SOFIE Global Warming and Climate Change Instrument

Chair: **Jan L. Williams**, e-Systems Management Consultants

Sounding the upper mesosphere using broadband solar occultation: initial results from the SOFIE experiment *(Invited Paper)*, L. L. Gordley, M. E. Hervig, GATS, Inc.; J. M. Russell III, Hampton Univ.; G. J. Paxton, L. E. Deaver, J. C. Burton, R. E. Thompson, C. W. Brown, B. E. Magill, M. J. McHugh, GATS, Inc. . . . . [6678-11]

SOFIE jitter analysis, S. R. Wassom, C. Fish, Utah State Univ.; L. L. Gordley, J. C. Burton, GATS, Inc. . . . . [6678-12]

AIRES, an airborne infrared Echelle spectrometer for SOFIA, E. F. Erickson, M. R. Haas, NASA Ames Research Ctr. . . . . [6678-13]

SESSION 4 . . . . . Tues. 10:30 am to 12:40 pm

Global Warming and Climate Change Instruments

Chair: **Jan L. Williams**, e-Systems Management Consultants

SOFIE instrument ground calibration update, S. M. Hansen, C. Fish, A. L. Shumway, Utah State Univ.; L. L. Gordley, M. E. Hervig, GATS, Inc. . . . . [6678-14]

HIRDLS complete correction algorithm for optical train blockage and resulting data *(Invited Paper)*, J. C. Gille, C. Hartsough, B. Nardi, H. Lee, National Ctr. for Atmospheric Research . . . . . [6678-15]

ACE-FTS instrument: after four years on-orbit, M. A. Soucy, H. L. Buijs, S. Y. Fortin, C. J. Deutsch, ABB Inc. (Canada) . . . . . [6678-16]

Lessons learned: fabrication and assembly integration of the orbiting carbon observatory instrument, R. E. Haring, R. Pollock, B. M. Sutin, R. D. Blakley, Hamilton Sundstrand; L. M. Scherr, D. Crisp, Jet Propulsion Lab. . . . . [6678-17]

Design of the SAC-D/NIRST camera module, J. Gauvin, F. J. Chateauneuf, Institut National d'Optique (Canada); H. G. Marraco, Comisión Nacional de Actividades Espaciales (Argentina); L. Ngo-Phong, Canadian Space Agency (Canada) . . . . . [6678-18]

The performance test results for engineering model (EM) of thermal and near infrared sensor for carbon observation (TANSO) on GOSAT, H. Suto, Japan Aerospace Exploration Agency (Japan); T. Kawashima, NEC TOSHIBA Space Systems, Ltd. (Japan); K. Shiomi, T. Kina, A. Kuze, T. Urabe, S. Kawakami, Y. Kaneko, T. Hamazaki, Japan Aerospace Exploration Agency (Japan) . . . . . [6678-19]

Lunch/Exhibition Break

SESSION 5 . . . . . Tues. 2:40 to 3:20 pm

Global Warming & Climate Change Instruments II

Chair: **Jan L. Williams**, e-Systems Management Consultants

Development of airborne SWIR FTS for GOSAT validation and calibration, H. Suto, A. Kuze, Y. Kaneko, T. Hamazaki, Japan Aerospace Exploration Agency (Japan); I. Morino, H. Oguma, T. Yokota, National Institute for Environmental Studies (Japan); G. Inoue, Nagoya Univ. (Japan) . . . . . [6678-20]

The test results from contamination control activity for GOSAT, T. Urabe, A. Kuze, H. Suto, T. Hamazaki, Japan Aerospace Exploration Agency (Japan) . . . . . [6678-21]

SESSION 6 . . . . . Tues. 3:50 to 4:40 pm

Weather and Climate Change Instruments

Chair: **Jan L. Williams**, e-Systems Management Consultants

The performance of the AVHRR, HIRS and AMSU-A instruments on board Metop-A *(Invited Paper)*, A. Perez-Albiñana, EUMETSAT (Germany); D. Battles, EADS Astrium (Germany); D. Monteiro, EADS Astrium S.A.S. (France); R. W. Lambeck, QSS Group, Inc.; R. M. Aleman, NASA Goddard Space Flight Ctr.; C. Jackson, National Oceanic and Atmospheric Administration . . . . . [6678-22]

In orbit checkout feedback from the infrared imaging radiometer for the CALIPSO mission, F. Tinto, T. Tremas, Ctr. National d'Études Spatiales (France) . . . . . [6678-23]

Wednesday 29 August

SESSION 7 . . . . . Wed. 9:00 to 11:50 am

Advanced Detectors and Technologies

Chairs: **Paul M. Alsing**, Air Force Research Lab.; **David A. Cardimona**, Air Force Research Lab.

Quantum well and quantum dot based detector arrays for infrared imaging applications *(Invited Paper)*, S. D. Gunapala, Jet Propulsion Lab. . . . . [6678-24]

Dual band HEIWIP detectors with nitride materials, A. G. Unil-Perera, G. Ariyawansa, M. Alevli, N. Dietz, S. G. Matsik, Georgia State Univ.; I. T. Ferguson, Georgia Institute of Technology; H. Luo, A. Bezinger, H. C. Liu, National Research Council Canada (Canada) . . . . . [6678-25]

Demonstration of a two-color 320 x 256 quantum dots-in-a-well focal plane array, E. S. Varley, S. Krishna, D. A. Ramirez, J. S. Brown, S. J. Lee, A. Stintz, M. C. Lenz, The Univ. of New Mexico; A. Riesinger, M. Sundaram, QmagiQ, LLC . . . . . [6678-26]

Current status of type II InAs/GaSb superlattices MWIR-LWIR photodiodes and FPA at the Center for Quantum Devices *(Invited Paper)*, M. Razeghi, M. B. Nguyen, P. Delaunay, D. M. Hoffman, A. D. Hood, Y. Wei, J. Nguyen, Northwestern Univ. . . . . [6678-27]

New materials and advanced detectors technologies, A. M. Fathimulla, H. S. Hier, L. A. Aina, D. Johnson, M. Lecates, Epitaxial Technologies, LLC . . . . . [6678-28]

Characterization of very large format 1Kx1K LWIR QWIP focal plane array, S. B. Rafol, E. Cho, W. Lim, QWIP Technologies, Inc. . . . . [6678-29]

Lunch/Exhibition Break

OPTICS

Conference 6678

SESSION 8 . . . . . Wed. 1:50 to 5:40 pm

Infrared and Submillimeter Technology

Chairs: **Jam Farhoomand**, TechnoScience Corp.; **Juergen Wolf**, NASA Ames Research Ctr.

Hot-electron direct detectors for THz astronomy, B. S. Karasik, J. H. Kawamura, W. R. McGrath, Jet Propulsion Lab.; M. E. Gershenson, D. Olaya, Rutgers Univ. . . . . [6678-30]

Sensitivity of hot electron bolometer heterodyne receiver at 4.3 THz, P. Khosropanah, SRON Nationaal Instituut voor Ruimteonderzoek (Netherlands); J. Gao, M. Hajenius, J. N. Hovenier, T. M. Klapwijk, Technische Univ. Delft (Netherlands) . . . . . [6678-31]

Tunable far-IR detectors/filters based on surface plasmon polaritons in two dimensional electron gases, W. R. Buchwald, Air Force Research Lab.; R. E. Peale, Univ. of Central Florida . . . . . [6678-32]

Technologies for cooling of large, distributed and deployable loads, A. Kashani, J. Maddocks, Atlas Scientific Technologies Inc.; G. F. Nellis, Univ. of Wisconsin/Madison; Y. B. Gianchandani, Univ. of Michigan . . . . . [6678-33]

The first look at SB349, a 32x32 CTIA readout multiplexer for far IR focal-plane arrays, J. Farhoomand, TechnoScience Corp.; D. T. Hoang, NASA Ames Research Ctr.; B. Y. Shiroyama, TechnoScience Corp. . . . . [6678-34]

A microshutter-based field selector for JWST's near infrared spectrograph, R. F. Silverberg, R. G. Arendt, D. E. Franz, M. D. Jhabvala, G. Kletetschka, A. S. Kutyrev, M. J. Li, S. H. Moseley, D. A. Rapchun, S. J. Snodgrass, D. W. Sohl, L. M. Sparr, NASA Goddard Space Flight Ctr. . . . . [6678-35]

Backshort-under-grid bolometer arrays for far-infrared airborne and spaceborne instrumentation, C. A. Allen, D. J. Benford, D. T. Chuss, T. M. Miller, S. H. Moseley, J. G. Staguhn, E. J. Wollack, NASA Goddard Space Flight Ctr. . . . [6678-36]

Sensitive detectors of terahertz radiation based on Pb1-xSnxTe(In), D. R. Khokhlov, M.V. Lomonosov Moscow State Univ. (Russia) . . . . . [6678-37]

Transients in stressed Ge:Ga photoconductors, J. M. Stegmaier, U. Grözinger, Max-Planck-Institut für Astronomie (Germany); N. M. Haegel, Naval Postgraduate School; S. M. Birkmann, D. Lemke, O. Krause, Max-Planck-Institut für Astronomie (Germany) . . . . . [6678-38]

Germanium far-IR detector development, H. H. Hogue, M. L. Guptill, J. C. Monson, J. Stewart, DRS Sensors & Targeting Systems, Inc. . . . . [6678-39]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Feasibility study of IR-to-visible converter based on EuTTA's fluorescence,** M. Alfaro Gómez, G. Paez, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-54]

✔ **The radiometric results using two-wavelength differential thermometry for microscopic extended source confirm the stablishment of a microcavity in tungsten source,** J. A. Aranda Ruiz, G. Paez, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-55]

✔ **Development of misalignment conditions of a rotational shearing interferometer to detect extra-solar planets,** M. Galan, M. Strojnik-Scholl, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-56]

✔ **Misalignment study for a Dove prism employing exact ray trace,** E. Gutierrez-Herrera, M. Strojnik, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-57]

✔ **Wide-field OCT using micro lens arrays,** A. Ortega, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-58]

✔ **Noise-immune oximetry employing logarithmic filtering,** G. Paez, Ctr. de Investigaciones en Optica, A.C. (Mexico) . . . . . [6678-59]

✔ **Determination of the degree of asphericity of a transparent reference sphere with a vectorial shearing interferometer,** C. N. Ramirez, M. Strojnik, G. Paez, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-60]

✔ **Mathematical model to enhance the spatial resolution of the pulsed phase thermography technique,** J. Ramirez-Granados, G. Paez, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-61]

✔ **Scaling thermal, temporal and geometrical tooth response to laser pulse irradiation,** M. Strojnik, Ctr. de Investigaciones en Optica, A.C. (Mexico) . . . . . [6678-62]

✔ **Optimal source bandwidth for transillumination interferometry,** P. Vacas-Jacques, M. Strojnik, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6678-63]

✔ **Prediction of cryogenic temperature impact on the performance of space-borne IR sensors,** X. Xu, X. Shi, Beihang Univ. (China) . . . . . [6678-64]

Thursday 30 August

SESSION 9 . . . . . Thurs. 9:00 to 10:50 am

Image Prossessing and Technologies

Chairs: **John A. Antoniades**, BAE Systems North America; **Gonzalo Paez**, Ctr. de Investigaciones en Óptica, A.C. (Mexico)

Detection of shadowed objects in hyperspectral imagery *(Invited Paper)*, R. R. Mayer, J. A. Antoniades, M. M. Baumback, D. Chester, J. Edwards, A. Goldstein, D. Haas, S. Henderson, BAE Systems Advanced Information Technologies . . . . . [6678-40]

Pyroelectric linear arrays and their applications, V. Norkus, G. Gerlach, Technische Univ. Dresden (Germany); R. Köhler, G. Hofmann, DIAS Infrared GmbH (Germany) . . . . . [6678-41]

Multi-channel LWIR acousto-optic tunable devices, N. B. Singh, M. S. Gottlieb, D. R. Suhre, D. J. Knuteson, D. A. Kahler, A. Berghmans, B. Wagner, S. McLaughlin, J. J. Hawkins, Northrop Grumman Corp. . . . . [6678-42]

Optomechanical design and analysis considerations on the lunar orbiter laser altimeter, S. M. Schmidt, W. Mamakos, E. A. Matzinger, S. M. Wall, NASA Goddard Space Flight Ctr. . . . . [6678-43]

Integration of subsystems for optimal performance, M. Schless, N. A. Thompson, Raytheon Space and Airborne Systems . . . . . [6678-44]

Coffee Break

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC134 Optical Design Fundamentals for Infrared Systems (Riedl) Sunday 26, 8:30 am - 5:30 pm

SC152 Infrared Focal Plane Arrays (Dereniak, Hubbs) Sunday 26, 1:30 - 5:30 pm

SC194 Multispectral and Hyperspectral Image Sensors (Lomheim) Wednesday 29, 1:30 - 5:30 pm

SC835 Infrared Systems - Technology & Design (Daniels) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

SESSION 10 . . . . . Thurs. 11:20 am to 12:40 pm

SOFIA Instrumentation

Chairs: **Jam Farhoomand**, TechnoScience Corp.; **Juergen Wolf**, NASA Ames Research Ctr.

SOFIA science instrument development, S. C. Casey, M. L. Savage, Universities Space Research Association [6678-45]

SOFIA: stratospheric observatory for infrared astronomy, E. E. Becklin, NASA Ames Research Ctr. . . . . [6678-46]

The SOFIA data cycle system, today and tomorrow: system design and user perspective, R. S. Krzaczek, Rochester Institute of Technology; R. Y. Shuping, NASA Ames Research Ctr. . . . . [6678-47]

A polarimetric upgrade for the far-infrared camera HAWC on SOFIA, J. E. Vaillancourt, California Institute of Technology; D. T. Chuss, NASA Goddard Space Flight Ctr.; J. L. Dotson, NASA Ames Research Ctr.; C. D. Dowell, Jet Propulsion Lab.; D. A. Harper, R. H. Hildebrand, The Univ. of Chicago; T. J. Jones, Univ. of Minnesota/Twin Cities; G. Novak, Northwestern Univ.; M. W. Werner, Jet Propulsion Lab. . . . . [6678-48]

Lunch/Exhibition Break

SESSION 11 . . . . . Thurs. 2:40 to 4:20 pm

SOFIA Instrumentation II

Chairs: **Jam Farhoomand**, TechnoScience Corp.; **Juergen Wolf**, NASA Ames Research Ctr.

THIS: a tuneable heterodyne infrared spectrometer for SOFIA, R. T. Schieder, G. Sonnabend, M. Sornig, P. J. Kroetz, D. Stupar, Univ. zu Köln (Germany) . . . . . [6678-49]

Mid-IR polarimetry: new vistas for SOFIA, C. C. Packham, Univ. of Florida; D. Axon, Rochester Institute of Technology; J. H. Hough, Univ. of Hertfordshire (United Kingdom); T. J. Jones, Univ. of Minnesota/Twin Cities; P. F. Roche, Univ. of Oxford (United Kingdom); C. M. Telesco, Univ. of Florida; M. Tamura, National Astronomical Observatory of Japan (Japan) [6678-50]

Development of sensitive SIS mixers for terahertz spectroscopy at SOFIA, A. Karpov, D. A. Miller, California Institute of Technology; J. A. Stern, H. G. LeDuc, Jet Propulsion Lab.; J. Zmuinzinas, California Institute of Technology . . . . . [6678-51]

A far-IR/submillimeter integral field spectrograph for SOFIA, T. Nikola, G. J. Stacey, Cornell Univ. . . . . [6678-52]

SPICA: a concept for a second generation SOFIA instrument, J. Wolf, Univ. Stuttgart (Germany); A. Krabbe, Univ. zu Köln (Germany) . . . . . [6678-53]

Conference 6679

Tuesday-Wednesday 28-29 August 2007 • Proceedings of SPIE Vol. 6679

Remote Sensing and Modeling of Ecosystems for Sustainability IV

Conference Chairs: **Wei Gao**, Colorado State Univ.; **Susan L. Ustin**, Univ. of California/Davis

Program Committee: **Gregory P. Asner**, Stanford Univ.; **Xiuwan Chen**, Peking Univ. (China); **Wenjie Dong**, Chinese Meteorological Administration (China); **John A. Gamon**, California State Univ./Los Angeles; **E. Raymond Hunt, Jr.**, USDA Agricultural Research Service; **Xin-Zhong Liang**, Univ. of Illinois at Urbana-Champaign and Illinois State Water Survey; **John M. Melack**, Univ. of California/Santa Barbara; **Dennis Ojima**, Colorado State Univ.; **Jeffrey L. Privette**, NASA Goddard Space Flight Ctr.; **Jiaguo Qi**, Michigan State Univ.; **John J. Qu**, George Mason Univ.; **Dar A. Roberts**, Univ. of California/Santa Barbara; **Daniel L. Schmoldt**, U.S. Dept. of Agriculture; **James R. Slusser**, Colorado State Univ.; **Yegang Wu**, E2 Consulting Engineers, Inc.; **Xiaoxiong Xiong**, NASA Goddard Space Flight Ctr.; **Xiusheng H. Yang**, Univ. of Connecticut; **Hamid Yimit**, Xinjiang Univ. (China); **Hua Zhang**, National Climate Ctr. (China)

Cooperating Organizations: **UV-B Monitoring and Research Program of U.S. Dept. of Agriculture, Natural Resource Ecology Lab., Colorado State Univ.; The Ctr. for Spatial Technologies and Remote Sensing; International Ctr. for Desert Affairs—Research for Sustainable Development in Arid and Semi-Arid Land; PKU-CSU Joint Lab. for Remote Sensing of Ecological Environments**

Tuesday 28 August

Welcome and Opening Remarks Tues. 8:00 to 8:10 am

SESSION 1 . . . . . Tues. 8:10 to 10:00 am

Remote Sensing and Modeling Theory, Techniques, and Applications I

Remote sensing of vegetation water content using shortwave infrared reflectances *(Invited Paper)*, E. R. Hunt, Jr., M. T. Yilmaz, USDA Agricultural Research Service[6679-01]

Spatial distribution and seasonal variation of UV-B radiation in the United States, X. Wang, W. Gao, B. Olson, J. M. Davis, J. R. Slusser, Colorado State Univ. . . . . [6679-02]

Characterization of land cover change by multi-temporal biophysical variables in fused images, A. A. López-Caloca, F. Mora, Ctr. de Investigación en Geografía y Geomática (Mexico); B. Escalante-Ramírez, Univ. Nacional Autónoma de México (Mexico) . . . . . [6679-03]

Two-band enhanced vegetation index without a blue band and its conversion from AVHRR to MODIS sensors, Z. Jiang, A. R. Huete, Y. Kim, K. Didan, The Univ. of Arizona . . . . . [6679-04]

Multisensor reflectance and vegetation index comparisons of Amazon tropical forest phenology with hyperspectral Hyperion data, Y. Kim, A. R. Huete, Z. Jiang, The Univ. of Arizona; T. Miura, Univ. of Hawai'i at Manoa . . . . . [6679-05]

SESSION 2 . . . . . Tues. 10:20 am to 12:10 pm

Remote Sensing and Modeling Theory, Techniques, and Applications II

Comparison of the NASA EOS AIRS and NOAA SBUV2 ozone measurements *(Invited Paper)*, J. J. Qu, George Mason Univ. . . . . [6679-06]

Characteristics of spatial distribution and temporal variation of ultraviolet radiation and their affecting factors in Henan Province of China, R. Liu, H. Tian, Z. Du, Henan Institute of Meteorological Science (China) . . . . . [6679-07]

Vine variety discrimination with airborne imaging spectroscopy, J. Martín-Herrero, M. Ferreiro-Armán, J. L. Alba Castro, Univ. de Vigo (Spain); S. Homayouni, J. Da Costa, Univ. Bordeaux I (France) . . . . . [6679-08]

High-performance spectroradiograph for 250-400 solar UV band, C. Rafanelli, I. Di Menno, S. De Simone, M. Di Menno, Istituto di Scienze dell'Atmosfera e del Clima (Italy) [6679-09]

Monitoring the intensity of locust damage to vegetation using hyper-spectra data obtained at ground surface, S. Ni, T. Wu, Nanjing Normal Univ. (China) . . . . . [6679-10]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:30 to 5:20 pm

Remote Sensing and Modeling Theory, Techniques, and Applications III

A regional climate simulation study with land cover dynamics in northern China *(Invited Paper)*, H. Wang, Y. Ju, Regional Ctr. for Temperate East Asia (China) . . . . [6679-11]

Study on the regional difference of built up area expansion and its determinants in China, L. Zhu, Chongqing Technology and Business Univ. (China) . . . . . [6679-12]

Vegetation cover change in semi-arid northeast China using SPOT VEGETATION data, X. Liu, China Univ. of Geosciences (China); F. Huang, P. Wang, Northeast Normal Univ. (China) . . . . . [6679-13]

Wetlands dynamic in West Songnen plain, China, since the 1950s, F. Huang, P. Wang, Northeast Normal Univ. (China); Y. Zhang, Northeast Institute of Geography and Agricultural Ecology (China) . . . . . [6679-14]

A comprehensive method based on dempster-shafer theory to extract the land use/land cover information from digital remotely sensed images:a case study of Poyang Lake region in Jiangxi Province, R. Shen, Nanjing Univ. of Information Science & Technology (China); R. Wang, Zhejiang Univ. (China); X. Zhao, Jiangxi Agricultural Univ. (China); X. Li, Nanjing Univ. of Information Science & Technology (China) . . . . . [6679-15]

Sensitivity analysis of MODIS band-to-band registration characterization and its impact on science data products, Y. Xie, George Mason Univ.; X. Xiong, NASA Goddard Space Flight Ctr.; J. J. Qu, George Mason Univ.; N. Che, Science Systems and Applications, Inc.; L. Wang, George Mason Univ. . . . . [6679-16]

Temporal comparison of land surface albedo for three different land use cover types in the Beijing area, W. Liu, Institute of Urban Meteorology (China) . . . . . [6679-17]

Response characteristic analysis of climate change of vegetation activity in Huang-Huai-Hai area based on NOAA NDVI data set, H. Chen, Z. Du, Henan Institute of Meteorological Science (China) . . . . . [6679-18]

Geometric correction and evaluation of accuracy using rational functional model on QuickBird stereo imagery in metropolitan area, G. Qiao, W. Wang, Tongji Univ. (China) . . . . . [6679-19]

Study on RS and GIS-based ecological capital assessment in arid areas, Z. Qing, X. Chen, X. Zhang, Peking Univ. (China) . . . . . [6679-20]

Wednesday 29 August

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Study on the process of snowmelt based on the 3S technology,** S. Fang, Z. Liu, Xinjiang Univ. (China) [6679-21]

✔ **A study of retrieval land surface temperature and evapotranspiration in response to LUCC based on remote sensing data,** C. Liu, Institute of Geographical Sciences and Natural Resources Research (China); W. Gao, Colorado State Univ.; Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China) [6679-54]

✔ **Extracting valley impervious surfaces and its change information using satellite remote sensing data,** X. Ma, Liaocheng Univ. (China) . . . . . [6679-50]

✔ **The study trend of UVB coupling TOMS data and USDA stations,** Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-48]

✔ **Technique comparisons of land cover classifications based on RS images,** X. Zhou, Institute of Geographical Sciences and Natural Resources Research (China) [6679-47]

✔ **Retrieving land surface temperature and land use/cover change,** F. Zhang, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-46]

✔ **Comparison of seasonal and spatial variations of albedos from moderate-resolution imaging spectroradiometer (MODIS) and common land model,** Q. Lu, Institute of Geographical Sciences and Natural Resources Research (China); W. Gao, Colorado State Univ.; Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China); W. Wu, National Ctr. for Atmospheric Research . . . . . [6679-43]

✔ **Seasonal relationship between temperature and precipitation with snow retrieved from SSM/I over China,** Q. Lu, Institute of Geographical Sciences and Natural Resources Research (China); W. Gao, Colorado State Univ.; W. Wu, National Ctr. for Atmospheric Research; Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-41]

✔ **Construction of land data assimilation system based on EnKF technology and community land model,** Q. Lu, Institute of Geographical Sciences and Natural Resources Research (China); W. Gao, Colorado State Univ.; Z. Gao, Institute of Geographical Sciences and Natural Resources Research; W. Wu, National Ctr. for Atmospheric Research [6679-39]

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- ✔ **Relations between albedos and emissivities from MODIS and ASTER data over China,** W. Gao, Colorado State Univ.; Q. Lu, Institute of Geographical Sciences and Natural Resources Research (China); W. Wu, National Ctr. for Atmospheric Research; Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China) [6679-33]
- ✔ **Propagation characters of baroclinic waves in the upper troposphere during the period of rainstorm in Yangtze and Huaihe Valley,** M. Shilong, Z. Guan, Nanjing Univ. of Information Science & Technology (China) . . . . . [6679-31]
- ✔ **Investigation of soil organic carbon and nitrogen spatial distribution in Huolin River wetland with MODIS satellite data,** G. Z. Wang, U.S.D.A. Forest Service; M. Zhou, Inner Mongolia Normal Univ. (China); G. Guo, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-26]
- ✔ **Influence of land use/cover change on land surface temperature of Laizhou Bay plain,** J. Ning, Shandong Normal Univ. (China) . . . . . [6679-24]
- ✔ **Variation of solar radiation and simulation of its effect on crop growth,** X. Zhang, Henan Institute of Meteorological Science (China); C. Wang, W. Zhai, D. Chen, Chinese Meteorological Society (China); X. Fu, Henan Institute of Meteorological Science (China); L. Bai, Mengjin Meteorological Bureau (China) . . . . . [6679-22]
- ✔ **Distribution of soil dryness indices of fields as ecoregions during winter wheat growth in the Huang-Huai plains,** Z. Ren, Chinese Meteorological Administration (China); Z. Sun, Nanjing Univ. of Information Science & Technology (China) . . . . . [6679-68]
- ✔ **Spatial and temporal distributions of lightning activities in northeast China from satellite observation,** G. Z. Wang, U.S.D.A. Forest Service; J. Zhao, Beijing Forestry Univ. (China) . . . . . [6679-23]
- ✔ **A remote sensing-based integrated approach for monitoring of grassland degradation: case study on the representative grassland near the middle and upper reaches of Heihe River basin, western China,** Z. Du, Cold and Arid Regions Environmental and Engineering Research Institute (China); Y. Shen, Huazhong Univ. of Science and Technology (China); J. Wang, X. Shen, Cold and Arid Regions Environmental and Engineering Research Institute (China) . . . . . [6679-25]
- ✔ **Cultivated land changes and driving force analysis by satellite remote sensing in the Yellow River delta of China,** X. Zhang, P. Wang, Nanjing Univ. of Information Science & Technology (China); G. Zhao, Shandong Agricultural Univ. (China) . . . . . [6679-27]
- ✔ **A method to compute solar radiation at surface in any time interval based on NCEP reanalysis,** L. Zou, Nanjing Univ. of Information Science & Technology (China); T. Wu, X. Xu, Chinese Meteorological Administration (China); W. Gao, Colorado State Univ. . . . . [6679-28]
- ✔ **A three-dimensional variational data assimilation system for a climate model: basic scheme and idea experiments,** Y. Guan, Nanjing Univ. of Science & Technology (China); G. Zhou II, Institute of Atmospheric Physics (China); W. Lu, Nanjing Univ. of Information Science & Technology (China) . . . . . [6679-29]
- ✔ **Spatial heterogeneity analysis for the remote sensing of regional water and heat fluxes of land surface,** W. Zhang, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-30]
- ✔ **The relationship between the intensity of east Asian summer monsoon in Yangtze and sea surface temperature anomalies in pre-winter,** X. Lu, X. Zhang, Beijing Climate Ctr. (China); J. Chen, Institute of Oceanology (China) . . . . . [6679-32]
- ✔ **Preliminary study on the evolution features of historical floods/droughts for the northeast of China,** N. Xu, Heilongjiang Provincial Meteorological Bureau (China); M. Yuan, Nanjing Univ. of Information Science & Technology (China) . . . . . [6679-34]
- ✔ **Study on an abrupt rainstorm in northeast China from remote sensings,** M. Yuan, Nanjing Univ. of Information Science & Technology (China) . . . . . [6679-35]
- ✔ **Assessing the impact of climate change on the crop potential productivity in Huang-Huai-Hai Plain in China based on crop model and GIS technique,** Z. Tian, X. T. Lei, Shanghai Meteorological Bureau (China); Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-36]
- ✔ **Impacts of climate change and urbanization on carbon cycle in the Yangtze River delta, China,** J. Shi, Shanghai Meteorological Bureau (China); Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-37]
- ✔ **The dynamic of terrestrial carbon storage in eastern China,** L. Cui, Shanghai Meteorological Bureau (China); Z. Gao, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6679-38]
- ✔ **The regional climate effects of large-scale agricultural irrigation related to south-to-north water transfer engineering in China,** H. Wang, J. Li, Y. Ju, Regional Ctr. for Temperate East Asia (China) . . . . . [6679-40]
- ✔ **Research on Cleistogenes squarrosa's histocytic changing and determine method in the course of restoring succession in degradation community of the typical steppe,** Z. Tao, Inner Mongolia Agricultural Univ. (China) . . . . . [6679-42]
- ✔ **Impact assessment on ecosystem to climate change in Heihe River basin in northwest China,** S. Landong, Cold and Arid Regions Environmental and Engineering Research Institute (China) and Lanzhou Regional Climate Ctr. Gansu Province (China) . . . . . [6679-44]
- ✔ **Water quality analysis of Aksu-Tarim River based on remote sensing data,** J. Ding, T. Tiyip, F. Zhang, Xinjiang Univ. (China) . . . . . [6679-45]
- ✔ **Analysis of temporal variation regulation and source of urban aerosol in middle China,** D. Chen, Chinese Academy of Meteorological Sciences (China); W. Deng, Z. Du, Henan Institute of Meteorological Science (China) . . . . . [6679-49]
- ✔ **EOS/MODIS data-based estimation of the daily snowmelt in Juntanghu Watershed, northern slope of Tianshan Mountain,** Q. Zhao, Z. Liu, S. Fang, Z. Lu, Xinjiang Univ. (China) . . . . . [6679-51]
- ✔ **Landscape ecological risk assessment study in Bosten Lake,** L. Gong, A. Amut, G. Lu, Xinjiang Univ. (China); X. Liang, Univ. of Illinois at Urbana-Champaign . . . . . [6679-52]
- ✔ **Research on spatial differentiation of landscape and ecological construction in arid land oasis,** H. Wang, L. Gong, J. Ding, Z. Liu, Xinjiang Univ. (China) . . . . . [6679-53]
- ✔ **Application of hyperspectral remote sensing in soil salinization,** W. Chen, H. Xu, X. Liao, Tongji Univ. (China) . . . . . [6679-55]
- ✔ **The inter-decadal correlation between summer arctic oscillation and summer drought and moist characteristic of northwest China,** P. Wang, Nanjing Univ. of Information Science & Technology (China) and Lanzhou Institute of Arid Meteorology (China); Y. Zheng, Nanjing Univ. of Information Science & Technology (China); B. Wang, Lanzhou Institute of Arid Meteorology (China); J. He, Nanjing Univ. of Information Science & Technology (China) . . . . . [6679-56]
- ✔ **The response of water resources to climate change and its influence on ecological environment in Shiyang River basin,** B. Wang, Lanzhou Institute of Arid Meteorology (China) . . . . . [6679-57]
- ✔ **The analysis of land cover and landscape patternsbased on RS and GIS,** R. Mao, Institute of Genetics and Developmental Biology (China) . . . . . [6679-58]
- ✔ **Land use/land cover change in Yellow River Delta, China during fast development period,** W. Zhou, Y. Tian, Southwest China Normal Univ. (China) . . . . . [6679-59]
- ✔ **On the study of water vapor transport in the Yangtze River basin under global warming background,** Z. Zhang, Nanjing Forestry Univ. (China); L. Zou, Nanjing Univ. of Information Science & Technology (China); X. Liang, Beijing Normal Univ. (China) . . . . . [6679-60]
- ✔ **Mapping wetlands cover types with directional polarization signatures,** V. C. Vanderbilt, NASA Ames Research Ctr.; J. Greenberg, Univ. of California/Davis; G. P. Livingston, Altos Imaging; S. Khanna, S. L. Ustin, Univ. of California/Davis; U. Boettger, DLR Berlin-Adlershof (Germany) . . . . . [6679-61]
- ✔ **Monitoring and trend simulation of sediment yield of Jialingjiang River,** Y. Tian, Southwest China Normal Univ. (China); Y. Gao, Institute of Meteorological Science (China); L. Zhu, Chongqing Technology and Business Univ. (China) . . . . . [6679-62]
- ✔ **Land cover dynamic monitoring and assessment of Three-gorge areas,** Y. Gao, Institute of Meteorological Science (China); Y. Tian, J. Yi, R. Wang, Southwest China Normal Univ. (China) . . . . . [6679-63]
- ✔ **Validate classification precision of low spatial resolution data by using high spatial resolution data,** S. Qingdong, I. Guanghui, Xinjiang Univ. (China); J. Qi, Michigan State Univ. . . . . [6679-64]
- ✔ **Analysis on spatial differences of surface albedo using remote sensing technique in arid oasis**, A. Amut, L. Gong, Z. Yuan, Xinjiang Univ. (China) . . . . . [6679 65]
- ✔ **Characteristic analysis on temporal-spatial features of accumulated temperature in southeastern China in 1961-2006**, W. Hu, Anhui Meteorological Institute (China) [6679 66]
- ✔ **Relationship between interdecadal variability of north China summer rainfall, east Asia summer monsoon, and atmospheric circulation anomaly**, Q. Gao, Nanjing Univ. of Science & Technology (China); L. Hao, Meteorological Institute of Hebei Province (China); J. Min, Nanjing Univ. of Information Science and Technology (China) . . . . . [6679 67]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC194 Multispectral and Hyperspectral Image Sensors (Lomheim) Wednesday 29, 1:30 - 5:30 pm

Conference 6680

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6680

Coastal Ocean Remote Sensing

Conference Chair: **Robert J. Frouin**, Scripps Institution of Oceanography

Cochair: **ZhongPing Lee**, Naval Research Lab.

Program Committee: **Robert A. Arnone**, Naval Research Lab.; **Ichio Asanuma**, Tokyo Univ. of Information Sciences (Japan); **Christopher W. Brown**, CICS ESSIC - NOAA; **Curtiss O. Davis**, Oregon State Univ.; **Arnold G. Dekker**, Commonwealth Scientific and Industrial Research Organisation (Australia); **Roland Doerffer**, GKSS-Research Crt/ Institute for Coastal Research (Germany); **Milton Kampel**, Instituto Nacional de Pesquisas Espaciais (Brazil); **Samantha Lavender**, Univ. of Plymouth (United Kingdom); **Mervyn J. Lynch**, Curtin Univ. of Technology (Australia); **Richard L. Miller**, NASA Stennis Space Ctr.; **Frank E. Muller-Karger**, Univ. of South Florida; **Richard P. Santer**, Univ. du Littoral Côte d'Opale (France)

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:10 am

Inversion of the Electromagnetic Signal: Atmospheric Correction Schemes

Chair: **Robert J. Frouin**, Scripps Institution of Oceanography

A general ocean color atmospheric correction scheme based on principal components analysis: part I, performance on Case 1 and Case 2 waters, L. S. Gross, Capgemini (France); S. Colzy, Magellium (France); R. J. Frouin, Scripps Institution of Oceanography; P. J. Henry, Ctr. National d'Études Spatiales (France) . . . . . [6680-01]

A general ocean color atmospheric correction scheme based on principal components analysis: part II, level 4 merging capabilities, L. S. Gross, Capgemini (France); S. Colzy, Magellium (France); R. J. Frouin, Scripps Institution of Oceanography; P. J. Henry, Ctr. National d'Études Spatiales (France) . . . . . [6680-02]

Constrained linear inversion of satellite ocean-color data, R. J. Frouin, Scripps Institution of Oceanography; B. Pelletier, Univ. Montpellier II (France) . . . . . [6680-03]

Regularization strategies for inferring aerosol vertical distribution from light scattering measurements, B. Pelletier, Univ. Montpellier II (France); R. J. Frouin, Scripps Institution of Oceanography; P. Dubuisson, Univ. du Littoral Côte d'Opale (France) . . . . . [6680-04]

Optimization of Cox and Munk sun-glint model using ADEOS/II GLI data and SeaWinds data, L. Li, H. Fukushima, K. Suzuki, Tokai Univ. (Japan); N. Suzuki, Kyoto Univ. (Japan) . . . . . [6680-05]

SESSION 2 . . . . . Sun. 10:30 am to 12:50 pm

Inversion of the Electromagnetic Signal: Retrieval of Water Properties

Chair: **ZhongPing Lee**, Naval Research Lab.

Spectral separation of photosynthetic pigments in coastal waters with hyperspectral reflectance data, K. H. Szekielda, The City Univ. of New York . . . . . [6680-06]

Improving the accuracy of water and bottom properties derived from remote sensing reflectance via artificial neural network, M. ZHang, Winona State Univ.; Z. Lee, Naval Research Lab.; J. Guan, Winona State Univ. . . . . [6680-07]

Backscattering coefficient model of bio-optical in the coastal ocean, Z. Mao, Second Institute of Oceanography (China) . . . . . [6680-08]

Utility of hyperspectral imagery for seagrass mapping in Tampa Bay, Florida (US), P. R. Carlson, Fish and Wildlife Research Institute . . . . . [6680-09]

Reconstruction of vertical profiles of chlorophyll concentration, R. P. Souto, Univ. Federal do Rio Grande do Sul (Brazil); M. Kampel, H. F. Campos Velho, S. Stephany, Instituto Nacional de Pesquisas Espaciais (Brazil) . [6680-10]

Fluorescence contribution to reflectance spectra for a variety of coastal waters, A. Gilerson, J. Zhou, S. Hlaing, I. Ioannou, B. M. Gross, F. Moshary, S. A. Ahmed, City College/ CUNY . . . . . [6680-11]

Determination of primary bands for global ocean-color remote sensing, Z. Lee, R. A. Arnone, Naval Research Lab.; K. L. Carder, Univ. of South Florida; M. He, Ocean Univ. of China (China) . . . . . [6680-12]

Lunch Break

SESSION 3 . . . . . Sun. 1:50 to 4:10 pm

Evaluation of Algorithms and Products

Chair: **Milton Kampel**, Instituto Nacional de Pesquisas Espaciais (Brazil)

Automated validation of satellite derived coastal optical products, P. E. Lyon, R. A. Arnone, R. W. Gould, Jr., Z. Lee, P. M. Martinolich, S. D. Ladner, B. Casey, Naval Research Lab.; H. M. Sosik, Woods Hole Oceanographic Institution; D. Vandemark, Univ. of New Hampshire . . . . . [6680-13]

Atmospheric correction for MERIS over coastal waters: validation of the MERIS standard aerosol models, O. Aznay, R. P. Santer, F. Zagolski, Univ. du Littoral Côte d'Opale (France) . . . . . [6680-14]

Approach for the long-term spatial and temporal evaluation of ocean color satellite data products in a coastal environment, P. J. Werdell, Science Systems and Applications, Inc.; B. A. Franz, NASA Goddard Space Flight Ctr.; S. W. Bailey, FutureTech Corp.; L. W. Harding, Jr., Univ. of Maryland Ctr. for Environmental Science; G. C. Feldman, NASA Goddard Space Flight Ctr. . . . . [6680-15]

Measurement of oceanic chlorophyll by LIDAR, MODIS, fluorometry and above-water radiometry, M. Kampel, J. A. Lorenzzetti, Instituto Nacional de Pesquisas Espaciais (Brazil); C. M. Bentz, Petrobras-Petróleo Brasileiro (Brazil); R. A. Nunes, Pontifícia Univ. Católica do Rio de Janeiro (Brazil); R. Paranhos, Univ. Federal do Rio de Janeiro (Brazil); F. d. M. Rudorff, Instituto Nacional de Pesquisas Espaciais (Brazil); A. T. Politano, Petrobras-Petróleo Brasileiro (Brazil) . . . . [6680-16]

Results in coastal waters with high-resolution in-situ spectral radiometry: the MOS ROV, M. Yarbrough, M. Feinholz, S. Flora, T. Houlihan, Moss Landing Marine Labs.; B. C. Johnson, National Institute of Standards and Technology; Y. S. Kim, National Oceanic and Atmospheric Administration; D. K. Clark, Marine Optical Consulting . . . . . [6680-17]

Simultaneous measurement of up-welling spectral radiance using a fiber-coupled CCD spectrograph, M. Yarbrough, Moss Landing Marine Labs.; S. W. Brown, National Institute of Standards and Technology; M. Feinholz, S. Flora, T. Houlihan, Moss Landing Marine Labs.; B. C. Johnson, National Institute of Standards and Technology; Y. S. Kim, National Oceanic and Atmospheric Administration; K. J. Voss, Univ. of Miami; D. K. Clark, Marine Optical Consulting . . . . [6680-18]

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SESSION 4 . . . . . Sun. 4:10 to 5:50 pm

Characterization and Variability of the Coastal Ocean: Composition and Bio-Optical Properties I

Chair: **Arnold G. Dekker**, Commonwealth Scientific and Industrial Research Organisation (Australia)

Satellite-based water quality (compliance) monitoring in the Great Barrier Reef world heritage area coastal and reef waters, V. E. Brando, A. G. Dekker, D. Blondeau-Patissier, T. Schroeder, L. Clementson, Commonwealth Scientific and Industrial Research Organisation (Australia) . . . . . [6680-19]

Optical characterization and age estimates of river plumes on the US west coast, R. M. Kudela, S. L. Palacios, Univ. of California/Santa Cruz . . . . . [6680-20]

Phytoplankton distribution on the east China Sea determined by the interaction between the Yangtze River runoff and the Kuroshio, M. Fukuda, I. Asanuma, Tokyo Univ. of Information Sciences (Japan) . . . . . [6680-21]

Particulate beam attenuation coefficient, bacteria abundance and production in marine waters, M. A. Montes-Hugo, M. Vernet, R. Reynolds, D. Stramski, V. M. Wright, Univ. of California/San Diego . . . . . [6680-22]

Bio-optical variability in coastal waters of southeast Brazil, M. Kampel, Instituto Nacional de Pesquisas Espaciais (Brazil); S. A. Gaeta, M. Pompeu, Univ. de São Paulo (Brazil); J. A. Lorenzzetti, F. d. M. Rudorff, Instituto Nacional de Pesquisas Espaciais (Brazil); R. J. Frouin, Scripps Institution of Oceanography . . . . . [6680-23]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:30 to 9:30 am

Characterization and Variability of the Coastal Ocean: Composition and Bio-Optical Properties II

Chair: **Arnold G. Dekker**, Commonwealth Scientific and Industrial Research Organisation (Australia)

Coral reefs change detection using Landsat data, N. S. Adi, Agency for Marine and Fisheries Research (Indonesia)[6680-24]

Spatial and spectral resolution considerations for imaging coastal waters, C. O. Davis, M. Kavanaugh, R. M. Letelier, Oregon State Univ.; W. P. Bissett, Florida Environmental Research Institute . . . . . [6680-25]

Possible satellite oceanography on the coastal water in NPP stage, J. Zhu, I. Asanuma, Tokyo Univ. of Information Sciences (Japan) . . . . . [6680-26]

Conference 6680

SESSION 6 . . . . . Mon. 9:30 am to 12:30 pm

Characterization and Variability of the Coastal Ocean: Processes, Interactions, and Modeling

Chair: **Ichio Asanuma**, Tokyo Univ. of Information Sciences (Japan)

Influence of improved underwater optical climate on biogeochemical models: a case study in tropical coastal environment, Fitzroy Estuary and Keppel Bay, Australia, N. R. C. Cherukuru, V. E. Brando, B. Robson, A. G. Dekker, Commonwealth Scientific and Industrial Research Organisation (Australia) . . . . . [6680-27]

Forecasting coastal optical properties using ocean color and coastal circulation models, R. A. Arnone, B. Casey, D. S. Ko, P. Flynn, Naval Research Lab. . . . . [6680-28]

MODIS imagery as a tool for water quality assessments in southern California coastal ocean, N. P. Nezlin, Southern California Coastal Water Research Project . . . . . [6680-29]

Ocean color remote sensing of turbid plumes in the southern California coastal waters during storm events, F. C. Lahet, D. Stramski, Univ. of California/San Diego [6680-30]

Multiparametric observation of biological contribution to surface structure of the water in archipelago, I. Asanuma, Tokyo Univ. of Information Sciences (Japan); Y. Arvelyna, Tokyo Univ. of Marine Science and Technology (Japan); D. Hasegawa, Tokyo Univ. of Information Sciences (Japan) . . . . . [6680-31]

Investigation on ballast water exchangeable area in the Bay of Bengal using MODIS/Aqua, K. Kozai, H. Ishida, Kobe Univ. (Japan); K. Okamoto, Y. Fukuyo, The Univ. of Tokyo (Japan) . . . . . [6680-32]

Submerged turbulence detection from optical satellites, R. N. Keeler, Directed Technologies, Inc.; V. Bondur, Aerocosmos Scientific Ctr. of Aerospace Monitoring (Russia); C. Gibson, The Scripps Research Institute; P. Leung, Texas A&M Univ.; H. Prandke, ISW Wassermesstechnik (Germany); D. Vithanage, Oceanit Labs., Inc. . . . . [6680-33]

Evaluation of offshore wind energy potential using SAR and MM5, K. Kozai, T. Ohsawa, Kobe Univ. (Japan) . . . [6680-34]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Optical characterization of runoff in the Chesapeake Bay,** M. E. Ondrusek, C. Kinkade, E. Stengel, National Oceanic and Atmospheric Administration . . . . . [6680-35]

✔ **Assessing dynamics micro-regions in the Great Islands of the Gulf of California based on MODIS aqua imagery products,** F. J. Flores de Santiago, E. Santamaria del Angel, A. Gonzalez-Silvera, A. Martinez Diaz de Leon, R. Millan Nuñez, Univ. Nacional Autónoma de México (Mexico) . . . . . [6680-36]

✔ **Ultra-high-resolution near coastal wind retrieval for QuikSCAT,** M. P. Owen, K. Stuart, D. G. Long, Brigham Young Univ. . . . . [6680-37]

✔ **A new aerosol climatology for aerosol remote sensing over ocean,** O. Aznay, F. Zagolski, R. P. Santer, Univ. du Littoral Côte d'Opale (France) . . . . . [6680-38]

✔ **Iterative process to derive aerosol phase function from CIMEL measurements,** F. Zagolski, R. P. Santer, O. Aznay, Univ. du Littoral Côte d'Opale (France) . . . . . [6680-39]

✔ **A new climatology for atmospheric correction based on the aerosol inherent optical properties,** F. Zagolski, O. Aznay, R. P. Santer, Univ. du Littoral Côte d'Opale (France) . . . . . [6680-40]

✔ **Satellite estimates of chlorophyll-a concentration in the Brazilian southeastern continental shelf and slope, southwestern Atlantic,** M. Kampel, Instituto Nacional de Pesquisas Espaciais (Brazil); S. A. Gaeta, M. Pompeu, Univ. de São Paulo (Brazil); J. A. Lorenzzetti, Instituto Nacional de Pesquisas Espaciais (Brazil) . . . . . [6680-41]

✔ **Development of finer spatial resolution optical properties from MODIS,** S. D. Ladner, R. A. Arnone, R. W. Gould, Jr., Z. Lee, P. E. Lyon, P. M. Martinolich, J. C. Sandidge, Naval Research Lab. . . . . [6680-42]

✔ **Simple and efficient technique for spatial/temporal composite imagery,** B. Casey, Planning Systems, Inc.; R. A. Arnone, Naval Research Lab. . . . . [6680-43]

✔ **Influence of solar radiation absorbed by phytoplankton on the thermal structure and circulation of the tropical Atlantic Ocean,** R. J. Frouin, K. Ueyoshi, Scripps Institution of Oceanography; M. Kampel, Instituto Nacional de Pesquisas Espaciais (Brazil) . . . . . [6680-44]

✔ **Analysis of SeaWiFS imagery over the southwestern Atlantic Ocean during the March 2002 R/V IOFFE cruise,** F. d. M. Rudorff, Instituto Nacional de Pesquisas Espaciais (Brazil); R. J. Frouin, Scripps Institution of Oceanography; M. Kampel, Instituto Nacional de Pesquisas Espaciais (Brazil); O. V. Kopelevich, P.P. Shirshov Institute of Oceanology (Russia); V. Lutz, Instituto Nacional de Investigación y Desarrollo Pesquero (Argentina) . . . . . [6680-45]

✔ **Assessment of the lidar green laser bottom tracking ability and waveform characterization in algae contaminated areas,** P. Kuus, Univ. of New Brunswick (Canada) . . . . . [6680-46]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC194 Multispectral and Hyperspectral Image Sensors (Lomheim) Wednesday 29, 1:30 - 5:30 pm

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Conference 6681

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6681

Lidar Remote Sensing for Environmental Monitoring VIII

Conference Chair: **Upendra N. Singh**, NASA Langley Research Ctr.

Program Committee: **Kazuhiro Asai**, Tohoku Institute of Technology (Japan); **Andreas Behrendt**, Univ. Hohenheim (Germany); **Edwin W. Eloranta**, Univ. of Wisconsin/Madison; **Tetsuo Fukuchi**, Central Research Institute of Electric Power Industry (Japan); **Bruce M. Gentry**, NASA Goddard Space Flight Ctr.; **Robert M. Hardesty**, National Oceanic and Atmospheric Administration; **Floyd E. Hovis**, Fibertek, Inc.; **Syed Ismail**, NASA Langley Research Ctr.; **Toshikazu Itabe**, National Institute of Information and Communications Technology (Japan); **Gary W. Kamerman**, FastMetrix, Inc.; **Philippe L. Keckhut**, Service d'aeronomie (France); **Kohei Mizutani**, National Institute of Information and Communications Technology (Japan); **D. Narayana Rao**, National Atmospheric Research Lab. (India); **Shiv K. Sharma**, Univ. of Hawaii at Manoa; **Randhir K. Sinha**, LS College (India); **William R. Stabnow**, NASA Headquarters; **David M. Tratt**, The Aerospace Corp.; **Jinxue Wang**, Raytheon Santa Barbara Remote Sensing; **Jirong Yu**, NASA Langley Research Ctr.; **Jun Zhou**, Anhui Institute of Optics and Fine Mechanics (China)

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:30 to 8:40 am

Welcome and Introductions

Chair: **Upendra N. Singh**, NASA Langley Research Ctr.

SESSION 2 . . . . . Wed. 8:40 to 10:30 am

Aerosol and Cloud Measurements I

Chairs: **Upendra N. Singh**, NASA Langley Research Ctr.; **William R. Stabnow,** NASA Headquarters

Eye-safe aerosol lidar at 1.5 mircons *(Invited Paper)*, S. M. Spuler, National Ctr. for Atmospheric Research . . . [6681-01]

Ultraviolet high-spectral resolution lidar with polarization detection for accurate measurement of optical properties of aerosol and clouds, H. Kawai, T. Kobayashi, Univ. of Fukui (Japan) . . . . . [6681-02]

Balloon-borne lidar experiment for the study of aerosol and clouds from a low latitude urban environment at Hyderabad, India, M. V. Satyanarayana, B. Presennakumar, D. Rama Krishna Rao, S. R. Radhakrishnan, Vikram Sarabhai Space Ctr. (India) . . . . . [6681-03]

Two wavelength (532 nm/1064 nm) depolarization lidar measurements of aerosol and dust at Suwon, Korea, C. B. Park, C. H. Lee, Kyung Hee Univ. (South Korea); S. Nobuo, National Institute for Environmental Studies (Japan) [6681-04]

Lidar/photometry studies at Sao Paulo, Brazil, E. Landulfo, P. Sawamura, S. T. Uehara, W. M. Nakaema, A. S. Torres, F. J. d. S. Lopes, C. A. Matos, W. C. Jesus, Instituto de Pesquisas Energéticas e Nucleares (Brazil) . . . . . [6681-05]

SESSION 3 . . . . . Wed. 11:00 am to 12:30 pm

Wind Lidar I

Chairs: **Bruce M. Gentry**, NASA Goddard Space Flight Ctr.; **Jinxue Wang**, Raytheon Santa Barbara Remote Sensing

Requirements and technology advances for global wind measurement with a coherent lidar: a shrinking gap *(Invited Paper)*, M. J. Kavaya, J. Yu, G. J. Koch, F. Amzajerdian, U. N. Singh, NASA Langley Research Ctr.; G. D. Emmitt, Simpson Weather Associates, Inc. . . . . [6681-06]

Development and testing of a risk reduction high-energy laser transmitter for spaceborne high-spectral resolution lidar and Doppler winds lidar, J. Wang, Raytheon Santa Barbara Remote Sensing; F. E. Hovis, Fibertek, Inc. [6681-07]

A Q-switched Ho:YLF laser pumped by Tm:fiber laser, J. Yu, NASA Langley Research Ctr.; Y. Bai, Analytical Services and Materials, Inc.; M. Petros, NASA Langley Research Ctr.; P. J. Petzar, Science Applications International Corp.; B. C. Trieu, U. N. Singh, NASA Langley Research Ctr. . . . . [6681-08]

Parameter trade studies for coherent lidar measurement of wind from space, M. J. Kavaya, NASA Langley Research Ctr.; R. G. Frehlich, Univ. of Colorado/Boulder . . . . . [6681-09]

Lunch/Exhibition Break

SESSION 4 . . . . . Wed. 1:50 to 3:40 pm

Wind Lidar II

Chairs: **Bruce M. Gentry**, NASA Goddard Space Flight Ctr.; **Jinxue Wang**, Raytheon Santa Barbara Remote Sensing

Airborne wind lidar for atmospheric boundary layer research *(Invited Paper)*, G. D. Emmitt, Simpson Weather Associates, Inc. . . . . [6681-10]

Development of an airborne molecular direct detection Doppler lidar for tropospheric wind profiling, B. M. Gentry, M. J. McGill, NASA Goddard Space Flight Ctr.; G. K. Schwemmer, Science and Engineering Services, Inc.; R. M. Hardesty, National Oceanic and Atmospheric Administration; T. D. Wilkerson, Space Dynamics Lab.; M. Sirota, Sigma Space Corp.; S. K. Lindemann, Michigan Aerospace Corp.; F. E. Hovis, Fibertek, Inc. . . . . [6681-11]

A simpler lidar approach to wind profiling from space, C. J. Grund, M. Stephens, C. S. Weimer, Ball Aerospace & Technologies Corp. . . . . [6681-12]

Simulation studies on aerosols and clouds from a high altitude balloon borne lidar, M. V. Satyanarayana, S. R. Radhakrishnan, B. Presennakumar, Vikram Sarabhai Space Ctr. (India) . . . . . [6681-13]

Development of single-frequency laser for direct-detection wind lidar, J. Zhou, H. Zang, T. Yu, J. Liu, W. Chen, Shanghai Institute of Optics and Fine Mechanics (China) . . . [6681-14]

SESSION 5 . . . . . Wed. 4:10 to 5:20 pm

Raman Lidar

Chairs: **Malladi V. Satyanarayana**, Vikram Sarabhai Space Ctr. (India); **D. Narayana Rao,** National Atmospheric Research Lab. (India)

Daytime rapid detection of minerals and organics from 50m distance using remote Raman system *(Invited Paper)*, A. K. Misra, S. K. Sharma, P. G. Lucey, R. C. F. Lentz, C. H. Chio, Univ. of Hawai'i at Manoa . . . . . [6681-15]

An accurate modeling, simulation, and analysis tool for predicting and estimating Raman lidar system performance, R. J. Grasso, L. E. Russo, J. L. Barrett, J. E. Odhner, P. I. Egbert, BAE Systems . . . . . [6681-16]

Properties of aerosols hygroscopicity using a combined multiwavelength elastic: Raman lidar, GPS and nephelometer, D. V. Vladutescu, Y. Wu, L. A. M. Charles, B. M. Gross, F. Moshary, S. A. Ahmed, City College/CUNY [6681-17]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

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✔ **Remote location of the effects of SHF radiation on the stratosphere via radiation of atomic hydrogen at 1420 MHz,** G. A. Kolotkov, S. T. Penin, Institute of Atmospheric Optics (Russia) . . . . . [6681-32]

✔ **Raman-Mie lidar measurements of low and optically thin cloud,** Y. Wu, S. Chaw, B. M. Gross, D. V. Vladutescu, L. A. M. Charles, F. Moshary, S. A. Ahmed, City College/CUNY . . . . . [6681-33]

✔ **The relationships between the zonal temperature variation and ozone distribution in the northern hemisphere winter stratosphere,** C. Shi, Nanjing Univ. of Information Science & Technology (China) . . . . . [6681-34]

✔ **Filamentation of femtosecond laser pulse upon coherent scattering by atmospheric aerosol,** E. P. Kachan, M.V. Lomonosov Moscow State Univ. (Russia) . . . . . [6681-35]

✔ **Automation of a lidar system for high-speed internet operation,** E. Landulfo, N. D. Vieira, Jr., G. E. C. Nogueira, J. T. Vidal, A. M. Carrilo, Instituto de Pesquisas Energéticas e Nucleares (Brazil) . . . . . [6681-36]

✔ **Change of plant's fluorescence signals at nitric and oil pollution of ground,** A. V. Klimkin, Institute of Atmospheric Optics (Russia); L. Fiorani, ENEA (Italy); N. L. Fateyeva, V. M. Klimkin, G. G. Matvienko, Institute of Atmospheric Optics (Russia); A. Palucci, ENEA (Italy) . . . . . [6681-37]

✔ **Sounding of the environment by means of the un-impulse of the low-power continuous source,** J. Polkanov, B.I. Stepanov Institute of Physics (Belarus) . . . . . [6681-38]

✔ **Unlinsing methods of small angular displacement transformation of a laser beam in circular scanning and reception of radiation by the small-sized receiver within the limits of a spatial hemisphere,** J. Polkanov, B.I. Stepanov Institute of Physics (Belarus) . . . . . [6681-39]

✔ **Lidar profiles and cluster analysis of back-trajectories of air arriving at the Otlica, Slovenia,** M. Colovic Daul, B. Forte, K. Bergant, D. Zavrtanik, Univ. of Nova Gorica (Slovenia) . . . . . [6681-40]

✔ **Rayleigh lidar investigation of stratospheric sudden warming over a low latitude station, Gadanki (13.5°N; 79.2°E): a statistical study,** V. D. Acharyulu, Univ. de La Réunion (France); S. Venkataraman, Council for Scientific and Industrial Research (South Africa); H. Bencherif, Univ. de La Réunion (France); D. N. Rao, National Atmospheric Research Lab. (India) . . . . . [6681-41]

OPTICS

✔ **Short-term predictions of Doppler measurements in planetary boundary layer,** A. P. Shelekhov, Institute of Atmospheric Optics (Russia); A. V. Starchenko, D. A. Belikov, Tomsk State Univ. (Russia) . . . . . [6681-42]

✔ **High-reliability pump module for non-planar ring oscillator laser,** D. T. Liu, Y. Qiu, D. W. Wilson, S. Dubovitsky, S. Forouhar, Jet Propulsion Lab. . . . . [6681-43]

Thursday 30 August

SESSION 6 . . . . . Thurs. 8:30 to 10:10 am

Space-Borne Lidar

Chairs: **Jirong Yu**, NASA Langley Research Ctr.; **Michael J. Kavaya,** NASA Langley Research Ctr.

Development of a validated end-to-end model for space-based lidar systems *(Invited Paper),* M. D. Lieber, C. S. Weimer, M. Stephens, R. R. Demara, Ball Aerospace & Technologies Corp. . . . . [6681-18]

Design and development of space-borne lidar system for global measurement in the Earth's atmosphere *(Invited Paper),* M. V. Satyanarayana, Vikram Sarabhai Space Ctr. (India) . . . . . [6681-19]

Modeling spaceborne lidar returns from vegetation canopies, B. Hu, York Univ. (Canada); A. E. Dudelzak, A. S. Koujelev, Canadian Space Agency (Canada); J. R. Miller, H. Pan, York Univ. (Canada); I. Tcherniavski, Canadian Space Agency (Canada) . . . . . [6681-20]

Aerosol remote sensing from passive and active sensors, J. Leon, D. Tanre, F. Ducos, Univ. des Sciences et Technologies de Lille (France) . . . . . [6681-21]

SESSION 7 . . . . . Thurs. 10:40 to 11:50 am

Differential Absorption Lidar

Chairs: **Scott M. Spuler**, National Ctr. for Atmospheric Research; **Shiv K. Sharma,** Univ. of Hawaii at Manoa

Development of a frequency stabilized seed laser system for the water vapor lidar experiment in space (WALES) *(Invited Paper),* H. H. Schwarzer, A. Boerner, A. Fix, B. Günther, H. Huebers, M. Raugust, F. Schrandt, M. Wirth, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [6681-22]

Initial results from a water vapor differential absorption lidar (DIAL) using a widely tunable amplified diode laser source, M. D. Obland, K. S. Repasky, A. R. Nehrir, J. A. Shaw, J. L. Carlsten, Montana State Univ./Bozeman . . . . [6681-23]

Man-made structures influence on ozone behavior revealed by lidar, J. M. Moreno, Univ. Politécnica de Cartagena (Spain) . . . . . [6681-24]

Lunch/Exhibition Break

SESSION 8 . . . . . Thurs. 1:10 to 3:30 pm

Aerosol and Cloud Measurements II

Chairs: **Jun Zhou**, Anhui Institute of Optics and Fine Mechanics (China); **Huanling Hu**, Anhui Institute of Optics and Fine Mechanics (China)

Atmospheric transport of smoke and dust particulates and their interaction with the PBL as observed by multi-wavelength lidar and supporting instrumentation, L. A. M. Charles, S. Chaw, D. V. Vladutescu, Y. Wu, F. Moshary, B. M. Gross, S. A. Ahmed, City College/CUNY . . . . . [6681-25]

Novel applications of an affordable short-range digital lidar, D. Cantin, F. Babin, Y. Champagne, M. Allard, Institut National d'Optique (Canada) . . . . . [6681-26]

Micro lidar studies at IIT Madras, V. S. Murty, Indian Institute of Technology Madras (India) . . . . . [6681-27]

Measurements of PM10 profiles in ABL with lidar and DA-OPC at Beijing, H. Hu, Anhui Institute of Optics and Fine Mechanics (China) . . . . . [6681-28]

De-noising lidar signal using wavelet technique, V. Sivakumar, Council for Scientific and Industrial Research (South Africa) . . . . . [6681-29]

Ground-based lidar combined with CALIPSO for aerosol optical depth retrieval, W. Gong, Z. Zhu, P. Li, L. Zhang, Q. Qin, Y. Ma, S. Song, M. Liu, Z. Hao, J. Li, Wuhan Univ. (China) . . . . . [6681-30]

Performance tests of polarization-Mie scattering lidar, J. Zhou, Anhui Institute of Optics and Fine Mechanics (China) . . . . . [6681-31]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC194 Multispectral and Hyperspectral Image Sensors (Lomheim) Wednesday 29, 1:30 - 5:30 pm

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Conference 6682

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6682

Polarization Science and Remote Sensing III

Conference Chairs: **Joseph A. Shaw**, Montana State Univ./Bozeman; **J. Scott Tyo**, The Univ. of Arizona

Program Committee: **Alan J. Ames**, Ball Aerospace & Technologies Corp.; **David B. Chenault**, Polaris Sensor Technologies, Inc.; **Russell A. Chipman**, College of Optical Sciences/The Univ. of Arizona; **Aristide C. Dogariu**, College of Optics & Photonics/Univ. of Central Florida; **Michael J. Duggin**, Air Force Research Lab.; **Dennis H. Goldstein**, Air Force Research Lab.; **Brian G. Hoover**, Advanced Optical Technologies; **Yoav Y. Schechner**, Technion-Israel Institute of Technology (Israel)

Wednesday 29 August

Welcome and Introduction . . . . . Wed. 8:00 to 8:10am

Chairs: **Joseph A. Shaw,** Montana State Univ./Bozeman; **J. Scott Tyo,** College of Optical Sciences/The Univ. of Arizona

SESSION 1 . . . . . Wed. 8:10 to 9:50 am

Polarimetric and Spectropolarimetric Imaging I

Chair: **Michael J. Duggin**, Air Force Research Lab.

Polarization: nomenclature and background *(Keynote)*, D. B. Chenault, Polaris Sensor Technologies, Inc. [6682-01]

Channeled spectroscopic polarization state generator (CSPSG) and its application to spectroscopic measurement of Mueller matrix *(Invited Paper)*, K. Oka, S. Endo, A. Taniguchi, Hokkaido Univ. (Japan); H. Okabe, Omron Corp. (Japan) . . . . . [6682-02]

All-sky polarization imaging, N. J. Pust, J. A. Shaw, Montana State Univ./Bozeman . . . . . [6682-03]

High-speed portable polarimeter using a ferroelectric liquid crystal modulator, L. Bigué, N. Cheney, Univ. de Haute Alsace (France) . . . . . [6682-04]

SESSION 2 . . . . . Wed. 9:50 to 11:50 am

Polarimetric and Spectropolarimetric Imaging II

Chair: **David B. Chenault**, Polaris Sensor Technologies, Inc.

Image segmentation from multi-look passive polarimetric imagery *(Invited Paper)*, V. Thilak, D. G. Voelz, C. D. Creusere, New Mexico State Univ. . . . . [6682-05]

Snapshot Mueller matrix spectropolarimetry, N. A. Hagen, E. L. Dereniak, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-06]

Performance predictions for imaging polarimeters, M. W. Jones, C. M. Persons, Digital Fusion Inc. . . . . [6682-07]

Mitigation of image artifacts in LWIR microgrid polarimeter images, B. M. Ratliff, Applied Technology Associates; J. S. Tyo, College of Optical Sciences/The Univ. of Arizona; J. K. Boger, W. T. Black, D. L. Bowers, Applied Technology Associates; R. Kumar, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-08]

Lunch/Exhibition Break

Polarization Technical Event

(No-Host Lunch)

Wednesday 29 August . . . . . 11:50 am to 1:20 pm

Chair: **Art Lompado,** Polaris Sensor Technologies, Inc.

Cochair: **Derek Sabatke,** Ball Aerospace & Technologies Corp.

This event is focused on research, development, engineering, and applications in fields of optics where polarization and its measurement are key issues.

SESSION 3 . . . . . Wed. 1:20 to 2:30 pm

Polarimetric and Spectropolarimetric Imaging III

Chair: **Yoav Y. Schechner**, Technion-Israel Institute of Technology (Israel)

Information enhancement in polarimetric images of natural scenes *(Invited Paper)*, M. J. Duggin, E. R. Cabot, W. R. Glass, Air Force Research Lab. . . . . [6682-09]

Design of a dual use imager incorporating polarimetric capabilities, S. Moultrie, M. Roche, A. Lompado, D. B. Chenault, Polaris Sensor Technologies, Inc. . . . . [6682-10]

Polarimetric scene modeling in the thermal infrared, M. G. Gartley, S. D. Brown, A. A. Goodenough, N. J. Sanders, J. R. Schott, Rochester Institute of Technology . . . . . [6682-11]

SESSION 4 . . . . . Wed. 2:30 to 5:20 pm

Scattering: Coherence and Polarization

Chair: **Brian G. Hoover**, Advanced Optical Technologies

Non-goniometric scatterometry: a review *(Invited Paper)*, C. F. Hahlweg, H. Rothe, Helmut-Schmidt Univ. (Germany) . . . . . [6682-12]

Measurements of the coherent backscatter BRDF peak exhibited by surfaces relevant to ladar applications *(Invited Paper)*, T. J. Papetti, W. E. Walker, C. E. Keffer, CAS, Inc.; B. E. Johnson, U.S. Army Space and Missile Defense Command . . . . . [6682-13]

Using polarized variable coherence tomography to estimate polarimetric BRDF from monostatic data, J. S. Tyo, T. S. Turner, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-14]

Vector electromagnetic scattering from random surfaces with infinite slopes using the Kirchhoff approximation *(Invited Paper)*, N. C. Bruce, Univ. Nacional Autónoma de México (Mexico) . . . . . [6682-15]

Coherence versus radiance formulations of surface scattering *(Invited Paper)*, B. G. Hoover, Advanced Optical Technologies; V. L. Gamiz, Air Force Research Lab. [6682-16]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Methods and means of polarization parameter control in biotissue imaging polarimetry,** S. Y. Tuzhanskyy, Vinnitsa State Technical Univ. (Ukraine) . . . . . [6682-38]

✔ **Design of a hybrid division of aperture/division of focal plane polarimeter,** H. Wei, T. S. Turner, J. S. Tyo, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-39]

✔ **A preliminary study on multiangle polarized reflection hyperspectra of rocks,** Y. Xiang, L. Yan, Peking Univ. (China) . . . . . [6682-40]

✔ **Analysis of generalized polarimetric measurement equation,** S. N. Savenkov, National Taras Shevchenko Univ. of Kyiv (Ukraine) . . . . . [6682-41]

✔ **Initial results of a simultaneous Stokes imaging polarimeter,** E. E. de Leon, R. K. Brandt, A. M. Phenis, M. Virgen, Lockheed Martin Advanced Technology Ctr. . . . . [6682-42]

✔ **Hyperspectral polarized light remote sensing and its application on artificial target detection,** L. Zhang, L. Yan, Y. Xiang, T. Wu, Peking Univ. (China) . . . . . [6682-43]

✔ **Design of optical threshold gates using the polarization optical processor architecture,** Y. A. Zaghloul, A. R. M. Zaghloul, ITR Technologies Inc. . . . . [6682-44]

✔ **Motion-based superresolution in DoFP polarimeters,** R. Kumar, J. S. Tyo, College of Optical Sciences/The Univ. of Arizona; B. M. Ratliff, Applied Technology Associates . . . . . [6682-45]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:00 to 9:50 am

Polarimetric Calibration and Mathematics

Chair: **James K. Boger**, Applied Technology Associates

Degrees of freedom in depolarizing Mueller matrices *(Invited Paper)*, R. A. Chipman, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-17]

Transmission ellipsometry on unsupported film/pellicle: closed-form inversion, A. R. M. Zaghloul, Georgia Institute of Technology and ITR Technologies Inc.; M. Elshazly-Zaghloul, Y. A. Zaghloul, ITR Technologies Inc. . . . . [6682-18]

A proposed standard method for polarimetric calibration and calibration verification, C. M. Persons, M. W. Jones, C. A. Farlow, L. D. Morell, M. G. Gulley, K. D. Spradley, Digital Fusion Inc. . . . . [6682-19

Demonstrations of noise and error-reduction algorithms in a rotating-quartz laser polarimeter, I. J. Vaughn, B. G. Hoover, Advanced Optical Technologies . . . . . [6682-20]

Out-of-plane spectro-polarimetric imaging system: calibration and applications in dermatology, B. B. B. Boulbry, T. A. Germer, National Institute of Standards and Technology; J. C. Ramella-Roman, The Catholic Univ. of America . . . . . [6682-21]

Conference 6682

SESSION 6 . . . . . Thurs. 9:50 am to 12:00 pm

Polarimetric Interaction with Media, Materials, and Surfaces

Chair: **Alan J. Ames**, Ball Aerospace & Technologies Corp.

Characterizing dielectric tensor from angle-of-incidence Mueller matrix images, P. K. Smith, R. A. Chipman, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-22]

Estimation of index of refraction and surface orientation from multi-look passive polarimetric imagery: extension to out-of-plane scattering, A. Pamba, V. Thilak, D. G. Voelz, C. D. Creusere, New Mexico State Univ. . . . . [6682-23]

Polarization-dependent light flow in diffraction grating based on thin opal film, A. V. Baryshev, A. Khanikaev, R. Fujikawa, H. Uchida, M. Inoue, Toyohashi Univ. of Technology (Japan) . . . . . [6682-24]

Characterization of thermobonded nonwovens by polarimetric imaging, M. Tourlonias, L. Bigué, M. Bueno, Univ. de Haute Alsace (France) . . . . . [6682-25]

Polarization dependence of THz transmission through periodic array of sub-wavelength rectanglar holes, G. Zhao, Y. Wang, C. Zhang, G. Yang, Capital Normal Univ. (China) . . . . . [6682-26]

Lunch/Exhibition Break

SESSION 7 . . . . . Thurs. 1:00 to 2:30 pm

Active Polarimetry

Chair: **Dennis H. Goldstein**, Air Force Research Lab.

Laser polarimeter as an invariant monitor *(Invited Paper)*, B. G. Hoover, Advanced Optical Technologies; J. S. Tyo, College of Optical Sciences/The Univ. of Arizona . [6682-27]

Development of a pulse laser source-operated achromatic dual-rotating-retarder polarimeter designed for Hyper-Rayleigh scattering measurements, P. Lemaillet, S. Rivet, F. Pellen, B. Le Jeune, J. Cariou, Univ. de Bretagne Occidentale (France) . . . . . [6682-28]

Polarimetric lidar signatures for remote detection of biological warfare agents, J. M. Richardson, J. C. Aldridge, MIT Lincoln Lab. . . . . [6682-29]

Polarization imaging light scattering facility, H. Noble, G. A. Smith, T. Lam, R. A. Chipman, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-30]

SESSION 8 . . . . . Thurs. 2:30 to 5:20 pm

Polarization-Sensitive Optical Components and Systems

Chair: **Russell A. Chipman**, College of Optical Sciences/The Univ. of Arizona

Low-polarization optical system design, A. Mahler, P. K. Smith, R. A. Chipman, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-31]

Polarization measurements on SUMI's TVLS gratings, K. Kobayashi, E. A. West, J. M. Davis, A. Gary, NASA Marshall Space Flight Ctr. . . . . [6682-32]

A polarization modulator for the far infrared (terhahertz waves), T. C. Oakberg, Hinds Instruments, Inc.; T. Akiyama, National Institute for Fusion Science (Japan); K. Nakayama, Chubu Univ. (Japan) . . . . . [6682-33]

Spatially inhomogeneous polarization in laser beam shaping, B. Hao, J. R. Leger, Univ. of Minnesota/Twin Cities . . . . . [6682-34]

Properties of the polarization ray tracing matrix, G. Yun, K. Crabtree, R. A. Chipman, College of Optical Sciences/The Univ. of Arizona . . . . . [6682-35]

Study of CaF2 samples using DUV birefringence and x-ray diffraction techniques, B. B. Wang, Hinds Instruments, Inc. . . . . [6682-36]

Achromatic polarization gratings as highly efficient thin-film polarizing beamsplitters for broadband light, C. Oh, M. J. Escuti, North Carolina State Univ. . . . . [6682-37]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC194 Multispectral and Hyperspectral Image Sensors (Lomheim) Wednesday 29, 1:30 - 5:30 pm

SC206 Polarized Light: A Practical Hands-on Introduction (Fisher) Tuesday 28, 8:30 am - 5:30 pm

SC792 Polarization in Optical Design (Chipman) Sunday 26, 8:30 am - 12:30 pm

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Conference 6683

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6683

Satellite Data Compression, Communications, and Archiving III

Conference Chairs: **Roger W. Heymann**, NOAA NESDIS Office of Systems Development; **Bormin Huang**, CIMSS, Univ. of Wisconsin/Madison; **Irina Gladkova**, CREST, City College/CUNY

Program Committee: **Faliang Ao**, Guilin Univ. of Electronic Technology (China); **John J. Bates**, NOAA NESDIS NCDC; **Richard Fulton**, NOAA NESDIS Office of Systems Development; **Xinbo Gao**, Xidian Univ. (China); **Shila Ghosh**, B. P. Poddar Inst. of Management & Technology (India); **Shuxu Guo**, Jilin Univ. (China); **Allen H. Huang**, CIMSS, Univ. of Wisconsin/Madison; **Valliappa Lakshmanan**, Univ. of Oklahoma; **Qiwei Lin**, Hua Qiao Univ. (China); **Daniel J. Mandl**, NASA Goddard Space Flight Ctr.; **Donald P. Olsen**, The Aerospace Corp.; **Jeffery J. Puschell**, Raytheon Space and Airborne Systems; **Shen-En Qian**, Canadian Space Agency (Canada); **Ana M. C. Ruedin**, Univ. de Buenos Aires (Argentina); **Timothy J. Schmit**, NOAA NESDIS ORA; **Michael S. Seablom**, NASA Goddard Space Flight Ctr.; **Joan Serra-Sagristá**, Univ. Autónoma de Barcelona (Spain); **Ryan C. Shoup**, MIT Lincoln Lab.; **Carole Thiebaut**, Ctr. National d'Etudes Spatiales (France); **Charles C. Wang**, The Aerospace Corp.; **Shih-Chieh Wei**, Tamkang Univ. (Taiwan)

Wednesday 29 August

Opening Remarks . . . . . Wed. 8:30 to 8:50 am

Chairs: **Roger W. Heymann,** National Oceanic and Atmospheric Administration; **Bormin Huang,** Univ. of Wisconsin/Madison; **Irina Gladkova,** City College/CUNY

SESSION 1 . . . . . Wed. 8:50 to 10:30 am

Data Compression I

Chair: **Ryan C. Shoup**, MIT Lincoln Lab.

Prediction over wavelet transform coefficients using neural networks applied to lossless compression of multispectral images, D. G. Acevedo, A. M. C. Ruedin, Univ. de Buenos Aires (Argentina) . . . . . [6683-01]

Modifying file syntax for interactive decoding the recommendation (CCSDS-122-B-1), F. Garcia-Vilchez, F. Aulí Llinàs, J. Serra-Sagristà, Univ. Autònoma de Barcelona (Spain) . . . . . [6683-02]

Current status of satellite data compression in Canadian Space Agency *(Invited Paper)*, S. Qian, A. B. Hollinger, Canadian Space Agency (Canada) . . . . . [6683-03]

CNES studies of on-board compression for multispectral and hyperspectral images *(Invited Paper)*, C. Thiebaut, E. Christophe, Ctr. National d'Études Spatiales (France); D. Lebedeff, Alcatel Alenia Space (France); C. Latry, Ctr. National d'Études Spatiales (France) . . . . . [6683-04]

SESSION 2 . . . . . Wed. 11:00 am to 12:20 pm

Data Compression II

Chairs: **Jeffery J. Puschell**, Raytheon Space and Airborne Systems; **Ana M. C. Ruedin**, Univ. de Buenos Aires (Argentina)

Lossless data compression studies for the geostationary imaging Fourier transform spectrometer (GIFTS) with the bias-adjusted reordering (BAR) preprocessing, B. Huang, A. H. Huang, R. O. Knuteson, M. Smuga-Otto, W. L. Smith, Sr., Univ. of Wisconsin/Madison . . . . . [6683-05]

A new lossless compression algorithm for satellite earth science multispectral imagers, I. Gladkova, S. Gottipati, M. D. Grossberg, City College/CUNY . . . . . [6683-06]

An overview of radar data compression, V. Lakshmanan, Univ. of Oklahoma . . . . . [6683-07]

Use of independent component analysis for lossless compression of ultraspectral sounder data, S. Wei, Tamkang Univ. (Taiwan); B. Huang, Univ. of Wisconsin/Madison[6683-08]

Lunch/Exhibition Break

SESSION 3 . . . . . Wed. 2:00 to 3:40 pm

Communications Engineering

Chairs: **Shen-En Qian**, Canadian Space Agency (Canada); **Joan Serra-Sagristà**, Univ. Autònoma de Barcelona (Spain)

GEONETCast Americas: vision and plans, R. Fulton, H. Wood, National Oceanic and Atmospheric Administration . . . . . [6683-09]

Controlling satellite communication system unwanted emissions in congested RF spectrum, R. W. Heymann, National Oceanic and Atmospheric Administration; D. P. Olsen, The Aerospace Corp. . . . . [6683-10]

The application of near capacity low density parity check (LDPC) codes in a satellite communications channel, R. C. Shoup, MIT Lincoln Lab. . . . . [6683-11]

Concatenated space-time block coding with asymmetric MPSK TCM for fading channels, J. Ao, G. Liao, Xidian Univ. (China), F. Ao, Guilin Univ. of Electronic Technology (China) . . . . . [6683-12]

Theoretical study of use of optical orthogonal codes for compressed video transmission in optical code division multiple access (OCDMA) system, S. Ghosh, B. N. Chatterji, B.P. Poddar Institute of Management & Technology (India) . . . . . [6683-13]

SESSION 4 . . . . . Wed. 4:10 to 5:30 pm

Data Compression III

Chair: **Carole Thiebaut**, Ctr. National de la Recherche Scientifique (France)

Lossless compression of the geostationary imaging Fourier transform spectrometer (GIFTS) data via adaptive vector quantization with linear prediction, B. Huang, A. H. Huang, W. L. Smith, Sr., Univ. of Wisconsin/Madison . . . . . [6683-14]

A comparative study of lossless compression algorithms on MODIS data, S. Gottipati, J. Goddard, M. D. Grossberg, I. Gladkova, L. M. Roytman, City College/CUNY . . . [6683-15]

Ultraspectral sounder data compression using the Tungstall coding, S. Wei, Tamkang Univ. (Taiwan); B. Huang, Univ. of Wisconsin/Madison . . . . . [6683-16]

Fast minimum-redundancy prefix coding for real-time space data compression, B. Huang, Univ. of Wisconsin/Madison . . . . . [6683-17]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:40 am to 12:10 pm

Joint Session with Conference 6684: Atmospheric and Environmental Remote Sensing Data Processing and Utilization: Readiness for GEOSS

Remote Sensing Data Archiving, Management, and Distribution

Chairs: **Philip E. Ardanuy**, Raytheon Co.; **Valliappa Lakshmanan**, Univ. of Oklahoma

Operational environmental satellite archives in the 21st century *(Invited Paper)*, J. J. Bates, B. Barkstrom, J. L. Privette, National Climatic Data Ctr.; R. Vizbulis, National Environmental Satellite, Data, and Information Service[6683-18]

The telesupervised adaptive ocean sensor fleet, A. Elfes, Jet Propulsion Lab.; G. W. Podnar, J. M. Dolan, S. B. Stancliff, E. Lin, Carnegie Mellon Univ.; J. C. Hosler, T. J. Ames, J. Moisan, T. A. Moisan, NASA Goddard Space Flight Ctr.; J. Higinbotham, Emergent Space Technologies . . . . . [6684-37]

Sensor networks and netcentric operations perspectives of civil government *(Invited Paper)*, G. Mandt, National Oceanic and Atmospheric Administration; T. L. Howard, The Boeing Co. . . . . [6684-38]

Simulation for the design of next-generation global earth observing systems *(Invited Paper)*, M. S. Seablom, S. Talabac, NASA Goddard Space Flight Ctr. . . . . [6684-39]

Sensor webs with a service oriented architecture for on-demand science *(Invited Paper)*, D. Mandl, NASA Goddard Space Flight Ctr. . . . . [6684-40]

A prototype land information sensor web (LISW), H. Su, P. Houser, Institute of Global Environment and Society; Y. Tian, S. Kuma, Univ. of Maryland/Baltimore County; J. Geiger, NASA Goddard Space Flight Ctr.; D. Belvedere, Institute of Global Environment and Society . . . . . [6684-41]

An SWS-based remote sensing information and knowledge sharing system, C. Wang, Institute of Remote Sensing Applications (China) . . . . . [6684-19]

Lunch/Exhibition Break

SESSION 6 . . . . . Thurs. 2:00 to 3:40 pm

Data Compression IV

Chairs: **Shila Ghosh**, B.P. Poddar Institute of Management & Technology (India); **Shih-Chieh Wei**, Tamkang Univ. (Taiwan)

Fast inter-frames pattern chosen algorithm based on H.264, Q. Lin, Hua Qiao Univ. (China) . . . . . [6683-20]

A novel framework of FGS video coding, Z. J. Long, X. Gao, Xidian Univ. (China) . . . . . [6683-21]

The impact of striping artifacts on compression, M. D. Grossberg, S. Gottipati, I. Gladkova, City College/CUNY; T. J. Schmit, National Oceanic and Atmospheric Administration . . . . . [6683-22]

A fast pattern chosen algorithm for intra-frames prediction, Q. Lin, Hua Qiao Univ. (China) . . . . . [6683-23]

The compression algorithm of target image based on ROI, L. Gu, S. Guo, Jilin Univ. (China) . . . . . [6683-24]

Panel Discussion . . . . . Thurs. 4:10 to 4:40 pm

Panelists: **Jeffery J. Puschell,** Raytheon Space and Airborne Systems; **Shen-En Qian,** Canadian Space Agency (Canada); **Carole Thiebaut,** Ctr. National de la Recherche Scientifique (France); **Valliappa Lakshmanan,** Univ. of Oklahoma

OPTICS

Conference 6684

Monday-Tuesday 27-28, and Thursday 30 August 2007 • Proceedings of SPIE Vol. 6684

Atmospheric and Environmental Remote Sensing Data Processing and Utilization III: Readiness for GEOSS

Conference Chairs: **Mitchell D. Goldberg**, NOAA, Office of Research and Applications; **Hal J. Bloom**, NOAA, NPOESS Integrated Program Office

Cochairs: **Allen H. Huang**, Univ. of Wisconsin/Madison; **Philip E. Ardanuy**, Raytheon Information Solutions

Program Committee: **John J. Bates**, National Oceanic and Atmospheric Administration; **James J. Butler**, NASA Goddard Space Flight Ctr.; **Changyong Cao**, National Oceanic and Atmospheric Administration; **Gerald J. Dittberner**, National Oceanic and Atmospheric Administration; **Wei Gao**, Colorado State Univ.; **John F. Le Marshall**, Bureau of Meteorology; **Stephen A. Mango**, NPOESS Integrated Program Office; **Johannes Schmetz**, EUMETSAT (Germany); **William L. Smith, Jr.**, NASA Langley Research Ctr.

Monday 27 August

SESSION 1 . . . . . Mon. 8:30 to 10:10 am

Preparing for GEOSS I

Chair: **Thomas H. Achtor**, Univ. of Wisconsin/Madison

The global space-based inter-calibration system (GSICS) program *(Invited Paper)*, M. D. Goldberg, National Oceanic and Atmospheric Administration . . . . . [6684-01]

Intercalibration and reprocessing of MSU/AMSU measurements in support of GEOSS, C. Zou, National Oceanic and Atmospheric Administration . . . . . [6684-02]

Validation of the on-board radiometric calibration of the GOES I-M visible channel by reflectance-based vicarious methods, N. P. Leisso, K. J. Thome, J. S. Czapla-Myers, College of Optical Sciences/The Univ. of Arizona . [6684-03]

Developing a solar channel calibration algorithm for the Korean geostationary satellite *(Invited Paper)*, B. Sohn, H. Chun, J. Kim, Seoul National Univ. of Technology (South Korea) . . . . . [6684-04]

SESSION 2 . . . . . Mon. 10:40 am to 12:40 pm

Preparing for GEOSS II

Chair: **Xiangqian Wu**, Harbin Institute of Technology (China)

Back to the future: transition from operations to research *(Invited Paper)*, P. E. Ardanuy, Raytheon Co.; D. Santek, Univ. of Wisconsin/Madison; A. Tarro, J. Wegiel, Raytheon Co. . . . . [6684-05]

Calibration of AVHRR sensors using the reflectance-based method, J. S. Czapla-Myers, K. J. Thome, N. P. Leisso, College of Optical Sciences/The Univ. of Arizona . [6684-06]

Improving the SNO accuracy for the inter-calibration of the reflective solar bands of MetOP/AVHRR and Aqua/MODIS, C. Cao, X. F. Wu, National Oceanic and Atmospheric Administration; A. Wu, Science Systems and Applications, Inc.; X. Xiong, NASA Goddard Space Flight Ctr. . . . . [6684-07]

The calibration of AVHRR visible dual gain using Meteosat-8 for NOAA-16 to 18, D. R. Doelling, Analytical Services and Materials, Inc.; P. Minnis, L. Nguyen, NASA Langley Research Ctr.; V. Chakrapani, D. Spangenberg, Analytical Services and Materials, Inc. . . . . [6684-08]

Report on the first meeting of global space-based inter-calibration system (GSICS) research working group *(Invited Paper)*, X. F. Wu, National Oceanic and Atmospheric Administration . . . . . [6684-09]

Lunch Break

SESSION 3 . . . . . Mon. 1:40 to 3:20 pm

Remote Sensing Program, System and Sensor I

Chair: **Thierry Phulpin**, Ctr. National d'Etudes Spatiales (France)

A geostationary microwave sounder mission: science and applications, B. H. Lambrigtsen, Jet Propulsion Lab.[6684-10]

Overview of NOAA next generation geostationary operational environmental system *(Invited Paper)*, T. Walsh, Swales Aerospace . . . . . [6684-11]

The national polar-orbiting operational environmental satellite system (NPOESS) sensor suite *(Invited Paper)*, H. J. Bloom, NPOESS Integrated Program Office . . . [6684-12]

In preparation for NPOESS processing package: AMSR-E direct broadcast processing implementation and products evaluation, J. Huang, Univ. of Wisconsin/Madison [6684-13]

SESSION 4 . . . . . Mon. 3:50 to 5:40 pm

Remote Sensing Program, System and Sensor II

Chair: **Dieter Klaes**, EUMETSAT (Germany)

The EUMETSAT polar system: status and first results *(Invited Paper)*, D. Klaes, J. Schmetz, EUMETSAT (Germany) . . . . . [6684-14]

Applications of IASI on MetOp A: first results and illustration of potential use for meteorology, climate monitoring and atmospheric chemistry *(Invited Paper)*, T. Phulpin, Ctr. National d'Études Spatiales (France) . [6684-15]

An end-to-end processing package for polar orbiting satellite direct broadcast users *(Invited Paper)*, A. H. Huang, Univ. of Wisconsin/Madison . . . . . [6684-16]

In-flight performance of the infrared atmospheric sounding interferometer (IASI) on METOP-A, D. Blumstein, Ctr. National d'Études Spatiales (France); B. Tournier, Noveltis SA (France); F. R. Cayla, SISCLE (France); T. Phulpin, R. Fjortoft, C. Buil, G. Ponce, Ctr. National d'Études Spatiales (France) . . . . . [6684-17]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

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✔ **Relationships between SSTA in Kurishio region and windfield in the equatorial mid-Pacific as well as ENSO,** M. Shilong, J. Min, Z. Guan, Nanjing Univ. of Information Science & Technology (China) . . . . . [6684-42]

✔ **Radiance comparison of Metop-A AVHRR with AIRS and IASI,** L. Wang, C. Cao, National Oceanic and Atmospheric Administration . . . . . [6684-43]

✔ **Active-passive optical remote sensing for weather and climate research,** Z. Zhu, W. Gong, L. Zhang, P. Li, Q. Qin, Y. Ma, S. Song, M. Liu, Z. Hao, Wuhan Univ. (China) . . . . . [6684-44]

✔ **Helicity: Q vector and its effect,** Z. F. Zhengfeng, H. Xu, Nanjing Univ. of Information Science & Technology (China); Y. Ding, Beijing Climate Ctr. (China) . . . . . [6684-45]

✔ **Study on effects of the intensity of east Asian monsoon trough upon the genesis of tropical cyclones in the western North Pacific,** J. Gao, Fujian Specialized Meteorological Observatory (China) . . . . . [6684-46]

✔ **Study on impacts of an exceptionally intense sandstorm upon Gansu Region in summer,** X. Wang, Lanzhou Institute of Arid Meteorology (China) . . . . . [6684-47]

✔ **A synchronization scheme of low-duty-cycle MAC protocol of wireless sensor networks,** X. Zhong, J. Shi, Chongqing Univ. (China) . . . . . [6684-48]

✔ **Characteristic of surface water resources and response to climate change in northwest China,** J. Feng, N. Guo, X. Wang, Lanzhou Institute of Arid Meteorology (China) . . . . . [6684-49]

✔ **Study on fractal dimension of remote sensing image based on scaling bias,** L. Ma, Institute of Remote Sensing Applications (China) and Graduate School of Chinese Academy of Science (China) and The Academy of Opto-Electronics (China); L. Tang, The Academy of Opto-Electronics (China); Z. Li, Institute of Geographical Sciences and Natural Resources Research (China) . . . . . [6684-50]

✔ **The trends of water vapor and methane in the stratosphere in China,** C. Shi, Y. Chen, Univ. of Science and Technology of China (China) . . . . . [6684-51]

✔ **Hyperspectral data research application (HYDRA),** T. D. Rink, T. H. Achtor, T. M. Whittaker, Univ. of Wisconsin/Madison; W. P. Menzel, National Oceanic and Atmospheric Administration . . . . . [6684-52]

✔ **Improved processing of multifilter rotating shadowband radiometer network for distributed monitoring of atmospheric aerosols,** B. M. Gross, M. Bustamante, F. Moshary, R. Aspey, S. A. Ahmed, City College/CUNY . . . . . [6684-53]

✔ **A new concept: double ridges process of West Pacific subtropical high,** J. He, L. Qi, Nanjing Univ. of Information Science & Technology (China); Z. Zhang, Beijing Climate Ctr. (China) . . . . . [6684-54]

✔ **A robotic airship for atmospheric and environmental research and monitoring,** A. Elfes, Jet Propulsion Lab.; M. Bergerman, G. W. Podnar, Carnegie Mellon Univ.; J. L. Hall, Jet Propulsion Lab. . . . . [6684-55]

✔ **Intercalibrating geostationary imagers via polar orbiting high spectral resolution data,** M. M. Gunshor, Univ. of Wisconsin/Madison; T. J. Schmit, National Oceanic and Atmospheric Administration; D. C. Tobin, Univ. of Wisconsin/Madison; W. P. Menzel, National Oceanic and Atmospheric Administration . . . . . [6684-56]

✔ **Lidar measurements,** J. Polkanov, B.I. Stepanov Institute of Physics (Russia) . . . . . [6684-57]

Tuesday 28 August

SESSION 5 . . . . . Tues. 8:30 to 10:20 am

Remote Sensing Algorithm and Data Analysis I

Chair: **Jun Li**, Univ. of Wisconsin/Madison

Simulation of atmospheric profile retrieval from hyperspectral infrared data under cloudy condition, L. Guan, Nanjing Univ. of Information Science & Technology (China); A. H. Huang, Univ. of Wisconsin/Madison . [6684-18]

A study on the accuracies of ozone data observed with ground-based and satellite-borne instruments *(Invited Paper),* Z. Wang, J. Zhang, Nanjing Univ. of Information Science & Technology (China); H. Chen, Institute of Atmospheric Physics (China); Z. Zhang, Z. He, Nanjing Univ. of Information Science & Technology (China) . . . . . [6684-19]

An improved atmospheric profile retrieval system for GOES sounder and SEVIRI data, X. Jin, J. Li, J. P. Nelson III, C. C. Schmidt, Z. Li, Univ. of Wisconsin/Madison; T. J. Schmit, M. D. Goldberg, National Oceanic and Atmospheric Administration . . . . . [6684-20]

Simultaneous retrieval of hyperspectral IR emissivity spectrum along with temperature and moisture profiles from AIRS, J. Li, J. Li, E. Weisz, Univ. of Wisconsin/Madison; T. J. Schmit, M. D. Goldberg, National Oceanic and Atmospheric Administration; D. K. Zhou, NASA Langley Research Ctr. . . . . [6684-21]

Improved atmospheric soundings and error estimates from analysis of AIRS/AMSU data, J. Susskind, NASA Goddard Space Flight Ctr. . . . . [6684-22]

SESSION 6 . . . . . Tues. 10:40 am to 12:20 pm

Remote Sensing Algorithm and Data Analysis II

Chair: **Fuzhong Weng**, National Oceanic and Atmospheric Administration

Interactive processing of multi- and hyper-spectral environmental satellite data: the next generation of McIDAS *(Invited Paper),* T. H. Achtor, T. D. Rink, T. M. Whittaker, Univ. of Wisconsin/Madison . . . . . [6684-23]

All sky sounding retrievals from hyperspectral infrared radiances alone *(Invited Paper),* J. Li, J. Li, E. Weisz, X. Jin, C. Liu, Univ. of Wisconsin/Madison; T. J. Schmit, National Oceanic and Atmospheric Administration; A. H. Huang, Univ. of Wisconsin/Madison; M. D. Goldberg, National Oceanic and Atmospheric Administration . . . . . [6684-24]

Evaluation of data thinning strategies for climate applications using the first four years of AIRS hyperspectral data, H. H. G. Aumann, Jet Propulsion Lab. . . . . [6684-25]

Improved MODIS aerosol retrieval over urban areas, B. M. Gross, M. M. Oo, E. Hernandez, F. Moshary, S. A. Ahmed, City College/CUNY . . . . . [6684-26]

Lunch/Exhibition Break

SESSION 7 . . . . . Tues. 1:40 to 3:30 pm

Remote Sensing Weather: Climate and Environmental Applications I

Chair: **Zhenhui Wang**, Nanjing Univ. of Information Science and Technology (China)

The interdecadal variations of the onset and advance of the east Asian summer monsoon, X. Lu, Beijing Climate Ctr. (China) and Graduate School of the Chinese Academy of Sciences (China); X. Zhang, Beijing Climate Ctr. (China) . . . . . [6684-27]

JCSDA progress in satellite data assimilation *(Invited Paper),* F. Weng, National Oceanic and Atmospheric Administration . . . . . [6684-28]

The moisture structure of ISO in western North Pacific revealed by AIRS, L. Tao, Nanjing Univ. of Information Science & Technology (China); X. Fu, B. Wang, Univ. of Hawai'i at Manoa . . . . . [6684-29]

Characteristics of Tibetan Plateau topographic trough and Bay of Bengal trough and their relationship with the South China Sea summer monsoon onset, J. Wei, J. He, S. Zhong, X. Zhu, Nanjing Univ. of Information Science & Technology (China) . . . . . [6684-30]

Possible mechanism of the south-born-south-persisting West Pacific subtropical high double ridges process, L. Qi, J. He, Nanjing Univ. of Information Science & Technology (China); Z. Zhang, Beijing Climate Ctr. (China) . . . . [6684-31]

SESSION 8 . . . . . Tues. 3:50 to 5:30 pm

Remote Sensing Weather: Climate and Environmental Applications II

Chair: **Byung-Ju Sohn**, Seoul National Univ. of Technology (South Korea)

Zonal thermal difference between East-Asia and West Pacific and its relationship with East Asian subtropical southerly onset, J. He, L. Qi, Nanjing Univ. of Information Science & Technology (China); Z. Zhang, Beijing Climate Ctr. (China); Z. Guan, Nanjing Univ. of Information Science & Technology (China) . . . . . [6684-32]

Techniques for assessing risks of droughts in winter wheat production, R. Liu, Z. Zhu, W. Fang, Y. Wang, Henan Institute of Meteorological Science (China) . . . . . [6684-33]

Climatic mechanisms of droughts and their patterns during winter wheat growing season in Henan Province of China, L. Chen, S. Shen, Nanjing Univ. of Information Science & Technology (China); R. Liu, Henan Institute of Meteorological Science (China) . . . . . [6684-34]

Climatic characteristics of atmospheric heat source in Qinghai-Tibetan Plateau over the last 44 years, S. Zhong, J. He, Nanjing Univ. of Information Science & Technology (China) . . . . . [6684-35]

Observations of deep convective clouds as stable reflected light standard for climate research: AIRS evaluation, H. H. G. Aumann, T. S. Pagano, D. A. Elliott, M. D. Hofstadter, S. Licata, Jet Propulsion Lab. . . . . [6684-36]

Thursday 30 August

SESSION 9 . . . . . Thurs. 8:40 am to 12:10 pm

Joint Session with Conference 6683: Satellite Data Compression, Communications, and Archiving III

Remote Sensing Data Archiving, Management and Distribution

Chairs: **Philip E. Ardanuy**, Raytheon Co.; **Valliappa Lakshmanan**, Univ. of Oklahoma

Operational environmental satellite archives in the 21st century *(Invited Paper),* J. J. Bates, B. Barkstrom, J. L. Privette, National Climatic Data Ctr.; R. Vizbulis, National Environmental Satellite, Data, and Information Service[6683-18]

The telesupervised adaptive ocean sensor fleet, A. Elfes, Jet Propulsion Lab.; G. W. Podnar, J. M. Dolan, S. B. Stancliff, E. Lin, Carnegie Mellon Univ.; J. C. Hosler, T. J. Ames, J. Moisan, T. A. Moisan, NASA Goddard Space Flight Ctr.; J. Higinbotham, Emergent Space Technologies . . . . . [6684-37]

Sensor networks and netcentric operations perspectives of civil government *(Invited Paper),* G. Mandt, National Oceanic and Atmospheric Administration; T. L. Howard, The Boeing Co. . . . . [6684-38]

Simulation for the design of next-generation global earth observing systems *(Invited Paper),* M. S. Seablom, S. Talabac, NASA Goddard Space Flight Ctr. . . . . [6684-39]

Sensor webs with a service oriented architecture for on-demand science *(Invited Paper),* D. Mandl, NASA Goddard Space Flight Ctr. . . . . [6684-40]

A prototype land information sensor web (LISW), H. Su, P. Houser, Institute of Global Environment and Society; Y. Tian, S. Kuma, Univ. of Maryland/Baltimore County; J. Geiger, NASA Goddard Space Flight Ctr.; D. Belvedere, Institute of Global Environment and Society . . . . . [6684-41]

An SWS-based remote sensing information and knowledge sharing system, C. Wang, Institute of Remote Sensing Applications (China) . . . . . [6683-19]

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Conference 6685

Sunday 26 August 2007 • Proceedings of SPIE Vol. 6685

Assimilation of Remote Sensing and In Situ Data in Modern Numerical Weather and Environmental Prediction Models

Conference Chair: **Xiaolei Zou**, Florida State Univ.

Cochairs: **Dale Barker**, National Ctr. for Atmospheric Research; **Francois-Xavier Le Dimet**, Univ. Joseph Fourier (France)

Program Committee: **Kayo Ide**, Univ. of California/Los Angeles; **John R. Mecikalski**, The Univ. of Alabama/Huntsville; **Michael Navon**, Florida State Univ.; **Zhaoxia Pu**, The Univ. of Utah; **Qingnong Xiao**, National Ctr. for Atmospheric Research

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:20 am

Data Assimilation Systems and New Methodologies

Chair: **Zhijin Li**, Jet Propulsion Lab.

Development of a unified community data assimilation for WRF *(Invited Paper)*, D. Barker, National Ctr. for Atmospheric Research . . . . . [6685-01]

Image assimilation: a new paradigm, F. Le Dimet, Univ. Joseph Fourier (France) and INRIA (France) . . . . . [6685-02]

Impact of HSV and TESV for adaptive observations targeting in a 4D VAR framework with a finite volume S-W model, I. M. Navon, Florida State Univ. . . . . [6685-03]

A lower bound for predicting uncertainty in forecasting models, C. Kerce, Propagation Research Associates, Inc.; F. C. Vandenberghe, National Ctr. for Atmospheric Research . . . . . [6685-04]

A satellite-based thermal infrared retrieval of soil moisture: implementation within a numerical mesoscale model, C. R. Hain, J. R. Mecikalski, The Univ. of Alabama in Huntsville; M. Anderson, U.S. Dept. of Agriculture . . . . . [6685-05]

SESSION 2 . . . . . Sun. 10:50 am to 12:40 pm

Assimilation of Satellite Observations of the Atmosphere

Chair: **John R. Mecikalski**, The Univ. of Alabama/Huntsville

What would it take to assimilate full spectrum of satellite observations in all weather conditions? *(Invited Paper)*, T. Vukicevic, Colorado State Univ. . . . . [6685-06]

Assimilation of AIRS data using a mesoscale model, M. J. Carrier, X. Zou, Florida State Univ. . . . . [6685-07]

Impact of COSMIC radio occultation refractivity measurements on analyses and forecasts over the tropical Atlantic Ocean, H. Liu, J. Anderson, Y. Kuo, Y. Chen, C. Snyder, National Ctr. for Atmospheric Research . . [6685-08]

Assimilation of angle of arrival measurements from an antenna of GPS receivers in the WRF model, F. C. Vandenberghe, National Ctr. for Atmospheric Research; C. Kerce, R. Bock, Propagation Research Associates, Inc. . . . . [6685-09]

Bias correction and observation error tuning in satellite data variational assimilation, W. Han, J. Xue, Chinese Academy of Meteorological Sciences (China) . . . . [6685-10]

Lunch Break

SESSION 3 . . . . . Sun. 1:40 to 3:20 pm

Assimilation of Satellite Observations of the Ocean

Chair: **Francois C. Vandenberghe**, National Ctr. for Atmospheric Research

A three-dimensional variational data assimilation in support of coastal ocean observing systems, Z. Li, Jet Propulsion Lab. . . . . [6685-11]

Assimilation of the high-frequency radar measurements for coastal currents using ROMS, K. Park, Z. Li, Jet Propulsion Lab.; J. Farrara, Raytheon Technical Services; Y. Chao, Jet Propulsion Lab. . . . . [6685-12]

Application of 4D-Var in storm surge simulation by adjusting the initial conditions and surface wind stress in an ocean model, S. Peng, L. Xie, L. J. Pietrafesa, North Carolina State Univ. . . . . [6685-13]

Towards assimilation of ocean color satellite observation into coastal ocean biogeochemical models: the tropical Fitzroy River Estuary case study, V. E. Brando, N. R. C. Cherukuru, A. G. Dekker, B. Robson, I. Webster, Commonwealth Scientific and Industrial Research Organisation (Australia) . . . . . [6685-14]

Pacific Ocean deep sea surface height fluctuation, T. Holden, P. J. Marchese, G. Tremberger, Jr., D. Cotten, T. D. Cheung, J. Roman, Queensborough Community College/CUNY . . . . . [6685-15]

SESSION 4 . . . . . Sun. 3:50 to 5:10 pm

Hurricane Data Assimilation

Chair: **Tomislava Vukicevic**, Colorado State Univ.

Diabatic initialization based on radar and satellite data assimilation for short-range QPF, Q. Xiao, National Ctr. for Atmospheric Research . . . . . [6685-16]

Mesoscale assimilation of rain-affected observations, C. M. Amerault, Naval Research Lab.; X. Zou, Florida State Univ.; J. Doyle, Naval Research Lab. . . . . [6685-17]

Study of the tropical cyclone intensity change with assimilation of multisensor remote sensing and in-situ observations in high-resolution numerical simulations, Z. Pu, X. Li, The Univ. of Utah . . . . . [6685-18]

Targeted observation and data assimilation for typhoon track predictions in DOTSTAR, C. Wu, J. Chen, P. Lin, K. Chou, National Taiwan Univ. (Taiwan) . . . . . [6685-19]

SESSION 5 . . . . . Sun. 5:10 to 5:50 pm

Data Assimilation Research and Education at Universities

Chair: **Francois-Xavier Le Dimet**, Univ. Joseph Fourier (France)

Data assimilation research and education at universities, X. Zou, Florida State Univ.; F. Le Dimet, Univ. Joseph Fourier (France) . . . . . [6685-20]

Promises and challenges of ensemble Kalman filter in research and operational applications, K. Ide, Univ. of California/Los Angeles . . . . . [6685-21]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Orographic effects on South China Sea summer climate,** H. Xu, Nanjing Univ. of Information Science & Technology (China); S. Xie, Y. Wang, Univ. of Hawaii at Manoa; W. Zhuang, D. Wang, South China Sea Institute of Oceanology (China) . . . . . [6685-22]

✔ **Relationship between the intensity and SW stream of the sub-tropical high over West Pacific Ocean and Fujian May-June rainfall,** Y. Zou, J. He, Z. Qiu, Fujian Meteorological Observatory (China) . . . . . [6685-23]

✔ **Assimilation and simulation of typhoon Bilis (2006) using global and regional assimilation prediction system (GRAPES),** Y. Liu, National Ctr. for Atmospheric Research; J. Xue, Chinese Academy of Meteorological Sciences (China) . . . . . [6685-24]

✔ **The delimitation and forecasting technique study of Meiyu season in Chinese Yangtze-Huaihe river basin,** G. H. Han, Nanjing Institute of Meteorology (China) . . [6685-25]

✔ **Ocean color data in case II waters: a different approach in support of ecosystem models,** V. Sanjuan-Calzado, I. S. Robinson, National Oceanography Ctr., Southampton (United Kingdom) . . . . . [6685-26]

✔ **Comparing in-cloud vertical profiles of the atmospheric state determined from GPS RO data with dropsondes and large-scale analysis,** X. Zou, L. Lin, J. O'Connor, Florida State Univ.; J. Chang, L. Chu, Chinese Culture Univ. (Taiwan) . . . . . [6685-27]

✔ **A retrieval of soil moisture using a satellite-based estimate of evaporative fraction,** C. R. Hain, J. R. Mecikalski, The Univ. of Alabama in Huntsville . . . [6685-28]

Conference 6686

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6686

UV, X-Ray, and Gamma-Ray Space Instrumentation for Astronomy XV

Conference Chair: **Oswald H. W. Siegmund**, Univ. of California/Berkeley

Program Committee: **James C. Green**, Univ. of Colorado/Boulder; **Michael P. Kowalski**, Naval Research Lab.; **Barry Y. Welsh**, Univ. of California/Berkeley

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:10 am

Novel Detectors and Techniques I

Chair: **Melville P. Ulmer**, Northwestern Univ.

Hybrid CMOS x-ray detectors: the next generation for focused x-ray telescopes, A. D. Falcone, D. N. Burrows, The Pennsylvania State Univ.; Y. Bai, M. C. Farris, Teledyne Imaging Sensors; R. Cook, The Pennsylvania State Univ. . . [6686-01]

Managing radiation degradation of CCDs on the Chandra X-ray Observatory III, S. L. O'Dell, NASA Marshall Space Flight Ctr.; T. L. Aldcroft, Harvard-Smithsonian Ctr. for Astrophysics; W. C. Blackwell, Jacobs Sverdrup; S. L. Bucher, J. H. Chappell, J. M. DePasquale, Harvard-Smithsonian Ctr. for Astrophysics; C. E. Grant, Massachusetts Institute of Technology; M. Juda, Harvard-Smithsonian Ctr. for Astrophysics; E. R. Martin, Northrop Grumman Space Technology; J. I. Minow, NASA Marshall Space Flight Ctr.; S. S. Murray, P. P. Plucinsky, D. A. Schwartz, Harvard-Smithsonian Ctr. for Astrophysics; D. P. Shropshire, Northrop Grumman Space Technology; B. D. Spitzbart, Harvard-Smithsonian Ctr. for Astrophysics; P. R. Viens, Northrop Grumman Space Technology; S. J. Wolk, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6686-02]

Radiation-hard charge-coupled devices for the Extreme-Ultraviolet Variability experiment, R. C. Westhoff, M. K. Rose, J. A. Gregory, G. D. Berthiaume, MIT Lincoln Lab.; J. F. Seely, Naval Research Lab.; T. N. Woods, G. J. Ucker, Univ. of Colorado/Boulder . . . . . [6686-03]

Advances in APDs for UV astronomy, M. P. Ulmer, M. Razeghi, Northwestern Univ. . . . . [6686-04]

Uniform high-spectral resolution demonstrated in arrays of TES x-ray microcalorimeters, S. R. Bandler, A. D. Brown, J. A. Chervenak, F. M. Finkbeiner, N. Iyomoto, R. L. Kelley, C. A. Kilbourne, F. S. Porter, S. J. Smith, NASA Goddard Space Flight Ctr. . . . . [6686-05]

SESSION 2 . . . . . Sun. 10:40 am to 12:00 pm

SWIFT Mission

Swift XRT status and performance, D. N. Burrows, The Pennsylvania State Univ. . . . . [6686-06]

The operation and evolution of the Swift X-ray Telescope, J. A. Kennea, The Pennsylvania State Univ. . . . . [6686-07]

Characterization of the Swift X-ray Telescope instrumental background, C. Pagani, The Pennsylvania State Univ. . . . . [6686-08]

The in-flight spectroscopic performance of the Swift XRT CCD camera, O. Godet, Univ. of Leicester (United Kingdom) . . . . . [6686-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:10 to 3:10 pm

Current and Future Missions

Chair: **Oswald H. W. Siegmund**, Univ. of California/Berkeley

Status of the Constellation-X Mission, R. Petre, N. E. White, NASA Goddard Space Flight Ctr.; H. D. Tananbaum, Harvard-Smithsonian Ctr. for Astrophysics; A. E. Hornschemeier, NASA Goddard Space Flight Ctr.; J. A. Bookbinder, M. R. Garcia, Harvard-Smithsonian Ctr. for Astrophysics; J. Grady, NASA Goddard Space Flight Ctr. . . . . [6686-10]

Pharos: GRB/WHIM science to mission design flowdown, M. Elvis, Harvard-Smithsonian Ctr. for Astrophysics; F. Nicastro, F. Fiore, Osservatorio Astronomico di Roma (Italy); L. A. Phillips, Amherst College; S. S. Murray, Harvard-Smithsonian Ctr. for Astrophysics; K. A. Flanagan, Massachusetts Institute of Technology; B. D. Ramsey, NASA Marshall Space Flight Ctr. . . . . [6686-11]

The Lunar Occultation Observer (LOCO) mission concept, R. S. Miller, The Univ. of Alabama in Huntsville . . . [6686-12]

SIMBOL-X: extending the field of x-rays astrophysics with the help of the formation flight concept, O. La Marle, Ctr. National d'Études Spatiales (France) . . . . . [6686-13]

Simbol-X, a formation flying mission for hard x-ray astrophysics, F. Fiore, Osservatorio Astronomico di Roma (Italy); P. R. Ferrando, Commissariat à l'Energie Atomique (France); P. Giommi, Agenzia Spaziale Italiana (Italy); G. Pareschi, Osservatorio Astronomico di Brera (Italy); P. Laurent, Commissariat à l'Energie Atomique (France); P. Malaguti, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy)[6686-14]

HXMT: the hard x-ray modulation telescope mission, T. Li, Institute of High Energy Physics (China) and Tsinghua Univ. (China) . . . . . [6686-15]

SESSION 4 . . . . . Sun. 3:40 to 5:20 pm

Novel Detectors and Techniques II

Chair: **Richard S. Miller**, The Univ. of Alabama/Huntsville

Fast large-area spectroscopic and imaging CCD detectors for x-ray astronomy with eROSITA and for exploration of the nanocosmos, N. Meidinger, R. Andritschke, Max-Planck-Institut für extraterrestrische Physik (Germany); R. Hartmann, PNSensor GmbH (Germany); G. Hasinger, S. Herrmann, Max-Planck-Institut für extraterrestrische Physik (Germany); P. Holl, PNSensor GmbH (Germany); P. Predehl, Max-Planck-Institut für extraterrestrische Physik (Germany); H. Soltau, PNSensor GmbH (Germany); L. W. Strueder, Max-Planck-Institut für extraterrestrische Physik (Germany) . . . . . [6686-16]

Characterization of swept-charge devices for the Chandrayaan-1 x-ray spectrometer (C1XS) instrument, J. P. Gow, D. R. Smith, A. D. Holland, Brunel Univ. (United Kingdom); B. Maddison, C. Howe, Rutherford Appleton Lab. (United Kingdom) . . . . . [6686-17]

Modeling instrument background for CCD x-ray spectrometers in Space, D. J. Hall, A. D. Holland, Brunel Univ. (United Kingdom); M. J. L. Turner, Univ. of Leicester (United Kingdom) . . . . . [6686-18]

Development of a gamma-ray burst detector based on silicon drift detector and scintillator, K. Yamaoka, S. Asano, K. Yoshida, Y. Arai, Aoyama Gakuin Univ. (Japan); A. Pahlke, KETEK GmbH (Germany); H. Ikeda, Japan Aerospace Exploration Agency (Japan); K. Mori, Clear Pulse Ltd. (Japan); A. Tsutsui, T. Doshida, A. Yoshida, Aoyama Gakuin Univ. (Japan); T. Takahashi, Japan Aerospace Exploration Agency (Japan); H. Kato, The Institute of Physical and Chemical Research (RIKEN) (Japan) . . . . . [6686-19]

Development of an ASIC employing delta-sigma digitization for readout of x-ray CCDs, D. Matsuura, H. Ozawa, E. Miyata, H. Tsunemi, Osaka Univ. (Japan); J. P. Doty, Noqsi Aerospace, Ltd.; H. Ikeda, Japan Aerospace Exploration Agency (Japan) . . . . . [6686-20]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:30 to 9:30 am

Suzaku Instruments

Ground bakeout experiment of the optical blocking filter (OBF) for the Suzaku XIS, H. Mori, T. G. Tsuru, H. Matsumoto, H. Uchiyama, M. Ozawa, Y. Takikawa, M. Nobukawa, K. Koyama, Kyoto Univ. (Japan); K. Torii, N. Tawa, Osaka Univ. (Japan); S. Kitamoto, K. Sudoh, Rikkyo Univ. (Japan); T. Kohmura, Kogakuin Univ. (Japan) . . . . . [6686-21]

The onboard calibration for the spaced raw charge injection of Suzaku XIS, H. Uchiyama, Y. Hyodo, H. Yamaguchi, H. Nakajima, H. Mori, H. Matsumoto, T. G. Tsuru, K. Koyama, Kyoto Univ. (Japan); K. Torii, K. Hasuike, S. Katsuda, K. Hayashida, H. Tsunemi, Osaka Univ. (Japan); T. Dotani, H. Murakami, Japan Aerospace Exploration Agency (Japan); G. Y. Prigozhin, S. E. Kissel, E. Miller, B. J. LaMarr, M. W. Bautz, Massachusetts Institute of Technology . [6686-22]

Mitigating CCD radiation damage with charge injection: first flight results from Suzaku, M. W. Bautz, S. E. Kissel, G. Y. Prigozhin, B. J. LaMarr, E. Miller, B. Burke, J. A. Gregory, Massachusetts Institute of Technology; H. Uchiyama, Y. Hyodo, H. Yamaguchi, H. Nakajima, H. Mori, T. G. Tsuru, H. Matsumoto, K. Koyama, Kyoto Univ. (Japan); K. Torii, S. Katsuda, K. Hasuike, K. Hayashida, H. Tsunemi, Osaka Univ. (Japan); H. Murakami, T. Dotani, Japan Aerospace Exploration Agency (Japan) . . . . . [6686-23]

SESSION 6 . . . . . Mon. 9:30 to 10:30 am

CZT Instruments

Spectroscopic CZT detectors development for x and gamma-ray imaging instruments, E. M. Quadrini, M. C. A. Uslenghi, M. Alderighi, P. Ubertini, L. Natalucci, E. Caroli, N. Auricchio, G. La Rosa, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); A. Zappettini, Consiglio Nazionale delle Ricerche (Italy); G. M. Guadalupi, Venezia Tecnologie S.p.A (Italy) . . . . . [6686-24]

Numerical study of the response of a CZT stack detector used as Laue lens focal plane, E. Caroli, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); R. M. Curado da Silva, Univ. de Coimbra (Portugal) and Univ. de Louvain (Belgium); A. Pisa, Univ. degli Studi di Ferrara (Italy); J. B. Stephen, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); A. J. Bird, A. J. Dean, Univ. of Southampton (United Kingdom); L. Natalucci, S. Del Sordo, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy) . . . . . [6686-25]

Design of a wide-field CZT gamma-camera for gamma-ray burst and fast transient detection with narrow field instrument follow-up, L. Natalucci, E. M. Quadrini, P. Ubertini, L. Amati, E. Caroli, M. Feroci, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); J. A. den Herder, SRON Nationaal Instituut voor Ruimteonderzoek (Netherlands); L. Piro, M. Frutti, G. La Rosa, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy) . . . . . [6686-26]

SESSION 7 . . . . . Mon. 11:00 am to 12:00 pm

Microchannel Plate Detectors

Chair: **Melville P. Ulmer**, Northwestern Univ.

Very-high-resolution microchannel plates at Lyman-alpha wavelength, J. Mutz, R. Fairbend, J. Seguy, Photonis S.A.S. (France); A. Penquer, Ctr. National d'Études Spatiales (France) . . . . . [6686-27]

HRC-I gain correction, J. Posson-Brown, V. L. Kashyap, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6686-28]

Microchannel plates: recent advances in performance, O. H. W. Siegmund, Univ. of California/Berkeley . . . . . [6686-29]

Lunch Break

SESSION 8 . . . . . Mon. 1:10 to 2:30 pm

Polarimetry

Narrow band x-ray polarizing filters, A. Martindale, N. P. Bannister, Univ. of Leicester (United Kingdom); S. P. Collins, Diamond Light Source Ltd. (United Kingdom); K. D. Harris, Cardiff Univ. (United Kingdom); G. A. Solan, Univ. of Leicester (United Kingdom); V. K. Muppidi, Cardiff Univ. (United Kingdom); Y. Champouret, G. W. Fraser, S. J. Gurman, M. Roy, P. S. Monks, Univ. of Leicester (United Kingdom) . [6686-30]

A burst chasing x-ray polarimeter, J. E. Hill, R. G. Baker, NASA Goddard Space Flight Ctr.; J. K. Black, Forbin Scientific; P. Deines-Jones, K. Jahoda, NASA Goddard Space Flight Ctr. . . . . [6686-31]

An x-ray polarimeter for HXMT mission, E. Costa, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); R. Bellazzini, Istituto Nazionale di Fisica Nucleare (Italy); G. Tagliaferri, Osservatorio Astronomico di Brera (Italy) . . . . . [6686-32]

A very compact polarizer for an x-ray polarimeter calibration, F. Muleri, P. Soffitta, E. Costa, M. Frutti, A. Rubini, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); R. Bellazzini, M. Minuti, G. Spandre, Istituto Nazionale di Fisica Nucleare (Italy) . . . . . [6686-33]

SESSION 9 . . . . . Mon. 2:30 to 4:20 pm

Current and Future Instruments I

An overview of MAXI onboard Kibo of ISS, M. Matsuoka, K. Kawasaki, S. Ueno, H. Tomida, N. Kuramata, M. Ishikawa, Japan Aerospace Exploration Agency (Japan); M. Suzuki, Tokyo Institute of Technology (Japan); T. Mihara, M. Kohama, N. Isobe, The Institute of Physical and Chemical Research (RIKEN) (Japan); H. Tsunemi, E. Miyata, Osaka Univ. (Japan); H. Negoro, Nihon Univ. (Japan); M. Nakajima, The Institute of Physical and Chemical Research (RIKEN) (Japan); A. Yoshida, T. Miyakawa, Aoyama Gakuin Univ. (Japan); N. Kawai, J. Kataoka, Tokyo Institute of Technology (Japan) . . . [6686-34]

High-resolution soft x-ray spectroscopy for Constellation X, C. F. Lillie, Northrop Grumman Space Technology; W. C. Cash, Jr., Univ. of Colorado/Boulder . . . . . [6686-35]

X-ray spectroscopy of the Cygnus Loop, R. L. McEntaffer, W. C. Cash, Jr., Univ. of Colorado/Boulder . . . . . [6686-36]

Integration, testing, and calibration of HST/wide field camera 3, J. W. MacKenty, Space Telescope Science Institute; R. A. Kimble, NASA Goddard Space Flight Ctr.; R. W. O'Connell, Univ. of Virginia; J. M. Townsend, NASA Goddard Space Flight Ctr. . . . . [6686-37]

SESSION 10 . . . . . Mon. 4:20 to 5:40 pm

Current and Future Instruments II

Chair: **Oswald H. W. Siegmund**, Univ. of California/Berkeley

A sub-arcmin coded mask imager for high-sensitivity deep studies of cosmic x-gamma/ray sources, L. Natalucci, P. Ubertini, E. M. Quadrini, S. Di Cosimo, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy) . . . . . [6686-38]

The ground calibrations of SuperAGILE, L. Pacciani, E. Costa, E. Del Monte, I. Donnarumma, Y. Evangelista, M. Feroci, F. Lazzarotto, I. Lapshov, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); M. Rapisarda, ENEA (Italy); P. Soffitta, A. Argan, G. Di Persio, M. Mastropietro, E. Morelli, A. Rubini, T. Alessio, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); A. Lo Bue, P. Rossi, L. Semeraro, ENEA (Italy); A. Bulgarelli, G. Fulvio, M. Trifoglio, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy) . . . . . [6686-39]

eROSITA, P. Predehl, G. Hasinger, H. Böhringer, U. G. Briel, H. Brunner, Max-Planck-Institut für extraterrestrische Physik (Germany); E. Churazov, Max-Planck-Institut für Astrophysik (Germany); M. J. Freyberg, P. Friedrich, Max-Planck-Institut für extraterrestrische Physik (Germany); E. Kendziorra, Univ. Tübingen (Germany); D. Lutz, N. Meidinger, Max-Planck-Institut für extraterrestrische Physik (Germany); M. N. Pavlinsky, Space Research Institute (Russia); E. Pfeffermann, Max-Planck-Institut für extraterrestrische Physik (Germany); A. E. Santangelo, Univ. Tübingen (Germany); J. H. M. M. Schmitt, Univ. Hamburg (Germany); A. Schwope, M. Steinmetz, Astrophysikalisches Institut Potsdam (Germany); L. W. Strueder, Max-Planck-Institut für extraterrestrische Physik (Germany); R. Sunyaev, Max-Planck-Institut für Astrophysik (Germany); J. Wilms, Univ. Erlangen-Nürnberg (Germany) . . . . . [6686-40]

Observation of Crab Nebula with hard x-ray polarimeter: PHENEX, S. Gunji, H. Sakurai, F. Tokanai, Y. Kishimoto, M. Kanno, Y. Ishikawa, Yamagata Univ. (Japan); K. Hayashida, N. Anabuki, H. Tsunemi, Osaka Univ. (Japan); T. Mihara, M. Kohama, M. Suzuki, The Institute of Physical and Chemical Research (RIKEN) (Japan); Y. Saito, T. Yamagami, Japan Aerospace Exploration Agency (Japan) . . . . . [6686-41]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Radiation damage and recovery properties in three kinds of polymer optical fiber exposed x-ray irradiation,** W. Ge, Xinjiang Univ. (China) and Xi'an Institute of Optics and Precision Mechanics (China) . . . . . [6686-42]

Tuesday 28 August

X-Ray/UV Optics Technical Event . 8:00 to 10:00 pm

Please see page 14 for details.

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Conference 6687

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6687

UV/Optical/IR Space Telescopes: Innovative Technologies and Concepts III

Conference Chairs: **Howard A. MacEwen**, SRS Technologies; **James B. Breckinridge**, Jet Propulsion Lab.

Program Committee: **Webster C. Cash, Jr.**, Univ. of Colorado/Boulder; **Alan L. Duncan**, Lockheed Martin Advanced Technology Ctr.; **Lee D. Feinberg**, NASA Goddard Space Flight Ctr.; **David T. Leisawitz**, NASA Goddard Space Flight Ctr.; **Daniel F. Lester**, The Univ. of Texas/Austin; **Gary Matthews**, ITT Industries, Inc.; **David W. Miller**, Massachusetts Institute of Technology; **Ronald S. Polidan**, Northrop Grumman Space Technology; **Wesley A. Traub**, Jet Propulsion Lab.; **Simon P. Worden**, NASA Ames Research Ctr.

Sunday 26 August

SESSION 1 . . . . . Sun. 9:00 am to 12:10 pm

JWST

Chair: **Lee D. Feinberg**, NASA Goddard Space Flight Ctr.

Architecture and design of the James Webb Space Telescope, J. W. Arenberg, Northrop Grumman Space Technology . . . . . [6687-01]

Technology demonstration of large stable cryogenic composite structures for JWST, C. B. Atkinson, J. W. Arenberg, L. Gilman, Northrop Grumman Space Technology; T. Messer, P. May, D. Moon, K. Patton, J. York, S. Backovsky, J. Tucker, M. Bluth, Alliant Techsystems Inc.; B. Eegholm, B. H. Eegholm, Swales Aerospace; B. N. Saif, Space Telescope Science Institute; R. A. M. Keski-Kuha, Goddard Space Flight Ctr.; J. R. Kegley, Marshall Space Flight Ctr. . . . . [6687-02]

Development of electronic speckle pattern interferometry for testing JWST composite structures, R. A. M. Keski-Kuha, NASA Goddard Space Flight Ctr.; B. N. Saif, Space Telescope Science Institute; M. Bluth, Alliant Techsystems Inc.; B. H. Eegholm, Swales Aerospace; P. N. Blake, NASA Goddard Space Flight Ctr. . . . . [6687-03]

Testing the James Webb Space Telescope's backplane stability article: lessons learned and relearned, J. W. Arenberg, Northrop Grumman Space Technology . [6687-04]

End-to-end commissioning demonstration of the James Webb Space Telescope on the JWST testbed telescope, D. S. Acton, T. C. Towell, J. P. Schwenker, D. M. Shields, Ball Aerospace & Technologies Corp. . . . . [6687-05]

Using multifield measurements to eliminate alignment degeneracies in the JWST testbed telescope, E. M. E. Sabatke, D. S. Acton, J. P. Schwenker, T. C. Towell, L. B. Carey, Ball Aerospace & Technologies Corp. . . . . [6687-06]

TRL-6 for JWST wavefront sensing and control, B. H. Dean, L. D. Feinberg, D. L. Aronstein, C. W. Bowers, W. L. Hayden, R. G. Lyon, S. Shiri, J. S. Smith, NASA Goddard Space Flight Ctr.; D. S. Acton, L. B. Carey, A. R. Contos, E. M. E. Sabatke, J. P. Schwenker, D. M. Shields, T. C. Towell, Ball Aerospace & Technologies Corp.; F. Shi, Jet Propulsion Lab.; L. Meza, Northrop Grumman Space Technology . . . . . [6687-07]

Microshutter array system for James Webb Space Telescope, M. J. Li, NASA Goddard Space Flight Ctr.[6687-08]

Lunch Break

SESSION 2 . . . . . Sun. 1:40 to 3:00 pm

Interferometry I

Chair: **Webster C. Cash, Jr.**, Univ. of Colorado/Boulder

System engineering the space infrared interferometric telescope (SPIRIT), T. T. Hyde, D. T. Leisawitz, S. A. Rinehart, NASA Goddard Space Flight Ctr. . . . . [6687-09]

The space infrared interferometric telescope (SPIRIT): optical system design considerations, M. E. Wilson, D. T. Leisawitz, A. J. Martino, S. A. Rinehart, NASA Goddard Space Flight Ctr.; J. A. Crooke, NASA Headquarters; J. L. Tveekrem, J. G. Budinoff, M. A. Quijada, T. T. Hyde, NASA Goddard Space Flight Ctr. . . . . [6687-10]

Mechanical design of the space infrared interferometric telescope (SPIRIT), J. G. Budinoff, D. T. Leisawitz, S. A. Rinehart, M. J. DiPirro, D. L. Jones, T. T. Hyde, B. Taylor, NASA Goddard Space Flight Ctr. . . . . [6687-11]

The SPIRIT thermal system, M. J. DiPirro, C. Cottingham, R. F. Boyle, S. Ollendorf, D. T. Leisawitz, NASA Goddard Space Flight Ctr. . . . . [6687-12]

SESSION 3 . . . . . Sun. 3:30 to 4:50 pm

Interferometry II

Chair: **David T. Leisawitz**, NASA Goddard Space Flight Ctr.

Wide-field imaging interferometry: an enabling technique for high-angular-resolution astronomy, S. A. Rinehart, NASA Goddard Space Flight Ctr.; T. Armstrong, Naval Research Lab.; B. J. Frey, J. Jung, NASA Goddard Space Flight Ctr.; J. Kirk, Orbital Sciences Corp.; D. T. Leisawitz, D. B. Leviton, R. G. Lyon, A. J. Martino, NASA Goddard Space Flight Ctr.; L. G. Mundy, Univ. of Maryland/College Park; T. A. Pauls, Naval Research Lab.; S. Schurr, Univ. of Waterloo (Canada)[6687-13]

Direct UV/optical imaging of stellar surfaces: the Stellar Imager Vision Mission, K. G. Carpenter, R. G. Lyon, NASA Goddard Space Flight Ctr.; C. J. Schrijver, Lockheed Martin Advanced Technology Ctr.; M. Karovska Neily, Harvard-Smithsonian Ctr. for Astrophysics; D. Mozurkewich, Seabrook Engineering . . . . . [6687-14]

Wavefront sensing and closed-loop control for the Fizeau interferometry testbed, R. G. Lyon, K. G. Carpenter, A. Liu, NASA Goddard Space Flight Ctr.; P. Petrone III, P. Dogoda, D. Reed, Sigma Space Corp.; D. Mozurkewich, Seabrook Engineering . . . . . [6687-15]

Fresnel interferometric arrays for space imaging: testbed results, D. Serre, L. Koechlin, P. Deba, Observatoire Midi-Pyrénées (France) . . . . . [6687-16]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 4 . . . . . Mon. 8:30 to 10:30 am

Systems and Concepts

Chair: **James B. Breckinridge**, Jet Propulsion Lab.

Ares V launch capability enables future space telescopes, H. P. Stahl, NASA Marshall Space Flight Ctr. . . . . [6687-17]

Large infrared telescopes in the exploration era: SAFIR, D. F. Lester, The Univ. of Texas at Austin; C. F. Lillie, Northrop Grumman Space Technology . . . . . [6687-18]

Decision making framework to determine the value of servicing space telescopes, M. Baldesarra, D. W. Miller, Massachusetts Institute of Technology . . . . . [6687-19]

Instrumentation for the next-generation cryogenic spaceborne far-IR observatories, C. M. Bradford, M. E. Kenyon, W. A. Holmes, C. G. Paine, P. F. Goldsmith, H. W. Yorke, M. W. Dragovan, Jet Propulsion Lab. . . . . [6687-20]

CALISTO: a cryogenic far-infrared/submillimeter observatory, P. F. Goldsmith, C. M. Bradford, M. W. Dragovan, B. Khayatian, H. W. Yorke, Jet Propulsion Lab.; J. Zmuidzinas, California Institute of Technology; C. G. Paine, C. M. Satter, R. A. Lee, Jet Propulsion Lab. . . . . [6687-21]

DESTINY: the dark energy space telescope, B. A. Pasquale, NASA Goddard Space Flight Ctr.; R. A. Woodruff, Lockheed Martin Space Co.; T. R. Lauer, National Optical Astronomy Observatory; D. J. Benford, NASA Goddard Space Flight Ctr. . . . . [6687-22]

SESSION 5 . . . . . Mon. 11:00 am to 12:00 pm

Telescopes and Mirrors I

Chair: **Alan L. Duncan**, Lockheed Martin Advanced Technology Ctr.

Comparison of on-axis three-mirror-anastigmat telescopes, M. L. Lampton, M. J. Sholl, Univ. of California/Berkeley . . . . . [6687-23]

Manufacturing and control of the aspherical mirrors for the Korsch telescope of the French satellite Pleiades, D. Fappani, H. Ducollet, Société Européenne de Systèmes Optiques (France) . . . . . [6687-24]

Unique space telescope concepts using CFRP composite thin-shelled mirrors and structures, R. C. Romeo, R. N. Martin, Composite Mirror Applications, Inc. . . . . [6687-25]

Lunch Break

SESSION 6 . . . . . Mon. 1:30 to 2:30 pm

Telescopes and Mirrors II

Chair: **Alan L. Duncan**, Lockheed Martin Advanced Technology Ctr.

Novel concept deformable membrane mirror to correct large amplitude aberrations, J. D. Moore, Jr., SRS Technologies, Inc. . . . . [6687-26]

Primary mirror shape control for athermalization using embedded sensors, E. O. Jordan, D. W. Miller, Massachusetts Institute of Technology . . . . . [6687-27]

Integrated modeling of point-spread function stability of the SNAP telescope, R. Besuner, Lawrence Berkeley National Lab.; M. J. Sholl, Univ. of California/Berkeley; M. D. Lieber, M. L. Kaplan, Ball Aerospace & Technologies Corp. . . [6687-28]

SESSION 7 . . . . . Mon. 2:30 to 3:10 pm

Wavefront Sensing and Control (WFSC)

Chair: **Alan L. Duncan**, Lockheed Martin Advanced Technology Ctr.

Dynamic wavefront control for lightweight mirrors in space telescopes, L. E. Cohan, D. W. Miller, Massachusetts Institute of Technology . . . . . [6687-29]

Adaptive cross-correlation algorithm and experiment of extended scene Shack-Hartmann wavefront sensing, E. Sidick, R. M. Morgan, J. J. Green, C. M. Ohara, D. C. Redding, Jet Propulsion Lab. . . . . [6687-30]

Conference 6687

Tuesday 28 August

SESSION 8 . . . . . Tues. 8:00 to 9:50 am

Joint Session with Conference 6693: Techniques and Instrumentation for Detection of Exoplanets III

TPF-External Occulter I

Chair: **Wesley A. Traub**, Jet Propulsion Lab.

External occulters for direct observation of exoplanets: an overview *(Invited Paper)*, W. C. Cash, Jr., E. R. Schindhelm, Univ. of Colorado/Boulder; J. W. Arenberg, A. S. Lo, R. S. Polidan, Northrop Grumman Space Technology; N. J. Kasdin, R. J. Vanderbei, Princeton Univ.; S. R. Heap, M. J. Kuchner, NASA Goddard Space Flight Ctr.; S. Kilston, M. C. Noecker, Ball Aerospace & Technologies Corp.; S. Seager, Massachusetts Institute of Technology . . . . . [6687-31]

The TPF-O science program *(Invited Paper)*, S. R. Heap, NASA Goddard Space Flight Ctr. . . . . [6687-32]

New Worlds Observer: system and mission architecture *(Invited Paper)*, J. W. Arenberg, Northrop Grumman Space Technology . . . . . [6693-01]

TPF-O design reference mission, D. J. Lindler, Sigma Space Corp. . . . . [6687-33]

SESSION 9 . . . . . Tues. 10:20 am to 12:00 pm

Joint Session with Conference 6693: Techniques and Instrumentation for Detection of Exoplanets III

TPF-External Occulter II

Chair: **Wesley A. Traub**, Jet Propulsion Lab.

New Worlds Observer optical performance, A. S. Lo, T. Glassman, C. F. Lillie, Northrop Grumman Space Technology . . . . . [6687-34]

A UV/optical telescope for the New Worlds Observer mission, C. F. Lillie, D. R. Dailey, A. S. Lo, R. S. Polidan, Northrop Grumman Space Technology . . . . . [6687-35]

Conceptual design of the TPF-O SC bus, L. R. Purves, NASA Goddard Space Flight Ctr. . . . . [6687-36]

Detecting and characterizing extra-solar Earth-like planets with two external occulters, S. L. Hunyadi, Jet Propulsion Lab.; A. S. Lo, Northrop Grumman Space Technology[6693-02]

Externally occulted terrestrial planet finder coronagraph: simulations and sensitivities, R. G. Lyon, S. R. Heap, NASA Goddard Space Flight Ctr.; A. S. Lo, Northrop Grumman Space Technology; W. C. Cash, Jr., Univ. of Colorado/Boulder; G. D. Starkman, Case Western Reserve Univ.; R. J. Vanderbei, N. J. Kasdin, Princeton Univ.; C. J. Copi, Case Western Reserve Univ. . . . . [6687-37]

Lunch/Exhibition Break

SESSION 10 . . . . . Tues. 1:30 to 2:50 pm

Joint Session with Conference 6693: Techniques and Instrumentation for Detection of Exoplanets III

TPF-External Occulter III

Chair: **Daniel R. Coulter**, Jet Propulsion Lab.

Optimal design of petal-shaped occulters for extra-solar planet detection, E. J. Cady, N. J. Kasdin, R. J. Vanderbei, R. Belikov, Princeton Univ. . . . . [6693-03]

Laboratory studies of petal-shaped occulters, E. R. Schindhelm, W. C. Cash, Jr., A. F. Shipley, P. Oakley, Univ. of Colorado/Boulder; D. B. Leviton, Ball Aerospace & Technologies Corp. . . . . [6693-04]

Alignment of a terrestrial planet finder occulter at 20-100 megameters, M. C. Noecker, Ball Aerospace & Technologies Corp. . . . . [6693-05]

Dynamics and control of a space based extra-solar planet imaging mission consisting of a telescope and multiple occulters, E. Kolemen, N. J. Kasdin, Princeton Univ.[6687-38]

SESSION 11 . . . . . Tues. 3:20 to 4:40 pm

Joint Session with Conference 6693: Techniques and Instrumentation for Detection of Exoplanets III

Formation Flying

Chair: **David W. Miller**, Massachusetts Institute of Technology

Formation flying system design for a planet-finding telescope occulter system, J. A. Leitner, NASA Goddard Space Flight Ctr. . . . . [6687-39]

Flight-like ground demonstration of precision formation flying spacecraft, D. P. Scharf, J. A. Keim, F. Y. Hadaegh, E. G. Benowitz, P. R. Lawson, Jet Propulsion Lab. . . . . [6693-06]

Formation control and reconfiguration through synthetic imaging formation flying testbed (SIFFT), S. Mohan, H. Sakamoto, D. W. Miller, Massachusetts Institute of Technology . . . . . [6687-40]

Satellite formation flight and realignment maneuver demonstration aboard the International Space Station, C. P. Mandy, A. Saenz-Otero, D. W. Miller, Massachusetts Institute of Technology . . . . . [6687-41]

SESSION 12 . . . . . Tues. 4:40 to 5:50 pm

Joint Session with Conference 6693: Techniques and Instrumentation for Detection of Exoplanets III

TPF-Interferometer

Chair: **Daniel R. Coulter**, Jet Propulsion Lab.

Terrestrial planet finder interferometer: 2006-2007 progress and plans, P. R. Lawson, O. P. Lay, R. O. Gappinger, A. Ksendzov, S. R. Martin, R. D. Peters, D. P. Scharf, C. A. Beichman, S. C. Unwin, Jet Propulsion Lab. . . . . [6693-07]

TPF-Emma: concept study of a planet finding space interferometer, S. R. Martin, Jet Propulsion Lab. . [6693-08]

Planet-finding performance of the TPF-I Emma architecture, O. P. Lay, S. R. Martin, S. L. Hunyadi, Jet Propulsion Lab. . . . . [6693-09]

X-Ray/UV Optics Technical Event . 8:00 to 10:00 pm

Please see page 14 for details.

Wednesday 29 August

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **New Worlds Observer: future mission architecture and technology roadmaps,** R. S. Polidan, Northrop Grumman Space Technology; W. C. Cash, Jr., Univ. of Colorado/Boulder; C. F. Lillie, A. S. Lo, J. W. Arenberg, Northrop Grumman Space Technology . . . . . [6687-42]

✔ **An optical model of the wide-field imaging interferometry testbed,** A. J. Martino, D. T. Leisawitz, NASA Goddard Space Flight Ctr.; A. K. Thompson, Swales Aerospace; S. A. Rinehart, B. J. Frey, NASA Goddard Space Flight Ctr. . . . . [6687-43]

✔ **Cryogenic far-infrared detectors for the space infrared interferometric telescope (SPIRIT),** D. J. Benford, S. A. Rinehart, T. T. Hyde, D. T. Leisawitz, NASA Goddard Space Flight Ctr. . . . . [6687-44]

✔ **Beam combination for stellar imager,** D. Mozurkewich, Seabrook Engineering; K. G. Carpenter, R. G. Lyon, NASA Goddard Space Flight Ctr. . . . . [6687-45]

✔ **New Worlds Observer tolerance overview,** A. F. Shipley, W. C. Cash, Jr., Univ. of Colorado/Boulder; J. W. Arenberg, A. S. Lo, Northrop Grumman Space Technology . . [6687-46]

✔ **Development update for the Orion MIDEX star formation survey mission,** P. A. Scowen, Arizona State Univ.; S. Nikzad, Jet Propulsion Lab.; T. J. Veach, Arizona State Univ.; M. N. Beasley, Univ. of Colorado/Boulder . . . . . [6687-47]

✔ **Thermal calculation and structure analysis of space main optical telescope,** Z. Chen, Hangzhou Dianzi Univ. (China); Z. Chen, S. Yang, H. Shi, National Astronomical Observatories (China) . . . . . [6687-48]

✔ **Coadding techniques for image-based wavefront sensing for segmented-mirror telescopes,** J. S. Smith, D. L. Aronstein, B. H. Dean, NASA Goddard Space Flight Ctr.; D. S. Acton, Ball Aerospace & Technologies Corp. [6687-49]

✔ **White-light demonstration of one hundred parts per billion irradiance suppression in air by new starshade occulters,** D. B. Leviton, NASA Goddard Space Flight Ctr.; W. C. Cash, Jr., B. T. Gleeson, M. J. Kaiser, S. A. Levine, Univ. of Colorado/Boulder; A. S. Lo, Northrop Grumman Space Technology; E. R. Schindhelm, A. F. Shipley, Univ. of Colorado/Boulder . . . . . [6687-50]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC134 Optical Design Fundamentals for Infrared Systems (Riedl) Sunday 26, 8:30 am - 5:30 pm

SC152 Infrared Focal Plane Arrays (Dereniak, Hubbs) Sunday 26, 1:30 - 5:30 pm

SC835 Infrared Systems - Technology & Design (Daniels) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

SC659 Understanding Reflective Optical Design (Contreras) Monday 27, 8:30 am - 5:30 pm

Conference 6688

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6688

Optics for EUV, X-Ray, and Gamma-Ray Astronomy III

Conference Chairs: **Stephen L. O'Dell**, NASA Marshall Space Flight Ctr.; **Giovanni Pareschi**, Osservatorio Astronomico di Brera

Program Committee: **Bernd E. Aschenbach**, Max-Planck-Institut für extraterrestrische Physik (Germany); **Marcos Bavdaz**, European Space Agency (Netherlands); **Webster C. Cash, Jr.**, Univ. of Colorado/Boulder; **Finn E. Christensen**, Danish National Space Ctr. (Denmark); **Oberto Citterio**, Osservatorio Astronomico di Brera (Italy); **Peter Friedrich**, Max-Planck-Institut für extraterrestrische Physik (Germany); **Paul Gorenstein**, Harvard-Smithsonian Ctr. for Astrophysics; **Fiona A. Harrison**, California Institute of Technology; **René Hudec**, Astronomical Institute (Czech Republic); **Hideyo Kunieda**, Japan Aerospace Exploration Agency (Japan); **Mikhail N. Pavlinsky**, Space Research Institute (Russia); **Robert Petre**, NASA Goddard Space Flight Ctr.; **Brian D. Ramsey**, NASA Marshall Space Flight Ctr.; **Paul B. Reid**, Harvard-Smithsonian Ctr. for Astrophysics; **Suzanne E. Romaine**, Harvard-Smithsonian Ctr. for Astrophysics; **John F. Seely**, Naval Research Lab.; **Gerald K. Skinner**, Ctr. d'Etude Spatiale des Rayonnements (France); **Yuzuru Tawara**, Nagoya Univ. (Japan); **Peter von Ballmoos**, Ctr. d'Etude Spatiale des Rayonnements (France); **Richard Willingale**, Univ. of Leicester (United Kingdom); **David L. Windt**, X-Ray Optics LLC; **William W. Zhang**, NASA Goddard Space Flight Ctr.

Tuesday 28 August

X-Ray/UV Optics Technical Event . 8:00 to 10:00 pm

Please see page 14 for details.

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:20 to 10:20 am

Telescope Systems

Chairs: **Yasushi Ogasaka**, Nagoya Univ. (Japan); **Robert Petre**, NASA Goddard Space Flight Ctr.

Constellation-X mirror technology development status and plan, W. W. Zhang, NASA Goddard Space Flight Ctr.; K. Chan, Univ. of Maryland/Baltimore County; D. A. Content, NASA Goddard Space Flight Ctr.; T. J. Hadjimichael, C. C. He, M. Hong, Swales Aerospace; J. P. Lehan, Univ. of Maryland/ Baltimore County; J. M. Mazzarella, Swales Aerospace; D. Nguyen, NASA Goddard Space Flight Ctr.; L. Olsen, Swales Aerospace; S. M. Owens, R. Petre, T. T. Saha, NASA Goddard Space Flight Ctr.; M. Sharpe, Swales Aerospace; G. Sneiderman, J. Sturm, T. E. Wallace, NASA Goddard Space Flight Ctr.; M. V. Gubarev, Universities Space Research Association; W. D. Jones, S. L. O'Dell, NASA Marshall Space Flight Ctr.; P. B. Reid, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6688-01]

Thin-foil multilayer-supermirror hard x-ray telescopes for InFOCuS/SUMIT balloon experiments and NeXT satellite program, Y. Ogasaka, H. Kunieda, K. Tamura, T. Miyazawa, Y. Fukaya, T. Iwahara, N. Sasaki, A. Furuzawa, Y. Haba, Y. Kanou, D. Ueno, K. Yamashita, Nagoya Univ. (Japan); T. Okajima, J. Tueller, P. J. Serlemitsos, Y. Soong, K. Chan, NASA Goddard Space Flight Ctr.; E. Miyata, H. Tsunemi, Osaka Univ. (Japan); R. Shibata, Nikon Corp. (Japan) . . . . . [6688-02]

Development of a hard x-ray telescope for the Constellation-X mission, S. E. Romaine, Harvard-Smithsonian Ctr. for Astrophysics; S. Basso, Osservatorio Astronomico di Brera (Italy); R. J. Bruni, Harvard-Smithsonian Ctr. for Astrophysics; W. Burkert, Max-Planck-Institut für extraterrestrische Physik (Germany); O. Citterio, V. Cotroneo, Osservatorio Astronomico di Brera (Italy); D. E. Engelhaupt, The Univ. of Alabama in Huntsville; M. J. Freyberg, Max-Planck-Institut für extraterrestrische Physik (Germany); P. Gorenstein, Harvard-Smithsonian Ctr. for Astrophysics; M. V. Gubarev, Universities Space Research Association; G. D. Hartner, Max-Planck-Institut für extraterrestrische Physik (Germany); F. Mazzoleni, Osservatorio Astronomico di Brera (Italy); S. L. O'Dell, NASA Marshall Space Flight Ctr.; G. Pareschi, Osservatorio Astronomico di Brera (Italy); B. D. Ramsey, NASA Marshall Space Flight Ctr.; C. O. Speegle, Raytheon-ITSS; D. Spiga, Osservatorio Astronomico di Brera (Italy) . . . . . [6688-03]

Explorer of diffuse structures and gamma-ray burst explosions: EDGE, J. A. den Herder, SRON Nationaal Instituut voor Ruimteonderzoek (Netherlands); L. Piro, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); T. Ohashi, Tokyo Metropolitan Univ. (Japan) . . . . . [6688-04]

GRI: focusing on the evolving violent universe, J. Knödlseder, Ctr. d'Etude Spatiale des Rayonnements (France) . . . . . [6688-05]

A wide-field hybrid X-ray telescope for a lunar-based gamma-ray burst observatory, P. Gorenstein, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6688-06]

SESSION 2 . . . . . Wed. 10:50 am to 12:10 pm

Telescope Design and Optimization

Chairs: **Bernd E. Aschenbach**, Max-Planck-Institut für extraterrestrische Physik (Germany); **Paul Gorenstein**, Harvard-Smithsonian Ctr. for Astrophysics

Design and optimization of the wide-field spectrometer for EDGE mission, Y. Tawara, I. Sakurai, Nagoya Univ. (Japan); J. A. den Herder, SRON Nationaal Instituut voor Ruimteonderzoek (Netherlands); G. Cusumano, T. Mineo, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); M. Barbera, Univ. degli Studi di Palermo (Italy) and Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); E. G. Perinati, Osservatorio Astronomico di Palermo G.S. Vaiana (Italy) . . . . . [6688-07]

New design for the Constellation-X spectroscopy x-ray telescope (SXT), P. B. Reid, Harvard-Smithsonian Ctr. for Astrophysics; M. Freeman, Smithsonian Astrophysical Observatory; T. T. Saha, NASA Goddard Space Flight Ctr. . . . . [6688-08]

An alternative optical design for x-ray telescopes, F. E. Zocchi, D. Vernani, Media Lario S.r.l. (Italy) . . . . . [6688-09]

SIMBOL-X: x-ray baffle for stray light reduction, G. Cusumano, M. Artale, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); V. Cotroneo, Osservatorio Astronomico di Brera (Italy); T. Mineo, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); G. Pareschi, Osservatorio Astronomico di Brera (Italy) . . . . . [6688-10]

Lunch/Exhibition Break

SESSION 3 . . . . . Wed. 1:40 to 3:00 pm

Performance Prediction and Calibration

Chairs: **Oberto Citterio**, Osservatorio Astronomico di Brera (Italy); **Paul B. Reid**, Harvard-Smithsonian Ctr. for Astrophysics

Establishing the response function of the x-ray telescopes onboard the Suzaku satellite, S. Okada, Institute of Space and Astronautical Science (Japan); H. Mori, Kyoto Univ. (Japan); R. Iizuka, A. Itoh, H. Inoue, Y. Yokoyama, M. Ebara, Y. Maeda, M. Ishida, Institute of Space and Astronautical Science (Japan); T. Hayashi, Y. Ishisaki, Tokyo Metropolitan Univ. (Japan); A. Furuzawa, H. Kunieda, Nagoya Univ. (Japan) . . . . . [6688-11]

What we learned from the first 2.5 years of the Swift XRT experiment, A. Moretti, Osservatorio Astronomico di Brera (Italy) . . . . . [6688-12]

HEW simulations and quantification of the microroughness requirements for the soft and hard x-ray telescopes SIMBOL-X and EDGE, D. Spiga, Osservatorio Astronomico di Brera (Italy); G. Cusumano, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); G. Pareschi, Osservatorio Astronomico di Brera (Italy) . . . . . [6688-13]

Grazing incidence of MeV protons, B. E. Aschenbach, Max-Planck-Institut für extraterrestrische Physik (Germany) . . . . . [6688-14]

SESSION 4 . . . . . Wed. 3:30 to 5:10 pm

Hard X-Ray and Gamma-Ray Imaging

Chairs: **Jürgen Knödlseder**, Ctr. d'Etude Spatiale des Rayonnements (France); **Mikhail N. Pavlinsky**, Space Research Institute (Russia)

Hard x-ray telescope concentrator for astrophysical mission Spectrum-X-Gamma, M. N. Pavlinsky, V. A. Arefiev, Space Research Institute (Russia); M. Revnivtsev, E. Churazov, M. Gilfanov, Space Research Institute (Russia) and Max-Planck-Institute for Astrophysics (Germany); S. Grigorovich, D. N. Litvin, RFNC-VNIIEF (Russia); I. Lapchov, V. A. Levin, V. V. Akimov, N. Semena, A. Tkachenko, Space Research Institute (Russia); A. Vikhlinin, Space Research Institute (Russia) and Harvard-Smithsonian Ctr. for Astrophysics; R. Sunyaev, Space Research Institute (Russia) and Max-Planck-Institute for Astrophysics (Germany) . . . . . [6688-15]

Gamma-ray waveguides for astronomy, D. Tournear, R. Epstein, M. A. Hoffbauer, S. J. Pendleton, Los Alamos National Lab. . . . . [6688-16]

Development status of a Laue lens project for gamma-ray astronomy, F. Frontera, V. Carassiti, F. Evangelisti, G. Loffredo, A. Pisa, Univ. degli Studi di Ferrara (Italy); E. Caroli, G. Landini, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); K. H. Andersen, P. Courtois, Institut Laue-Langevin (France)[6688-17]

R and D progress on second-generation crystals for Laue lens applications, N. Barriere, P. von Ballmoos, Ctr. d'Etude Spatiale des Rayonnements (France); P. Bastie, Univ. Joseph Fourier (France); P. Courtois, Institut Laue-Langevin (France); N. V. Abrosimov, Institut für Kristallzüchtung (Germany); K. H. Andersen, Institut Laue-Langevin (France); T. Buslaps, European Synchrotron Radiation Facility (France); T. Camus, Ctr. d'Etude Spatiale des Rayonnements (France); H. Halloin, Collège de France (France); J. Knödlseder, G. Roudil, Ctr. d'Etude Spatiale des Rayonnements (France); D. Serre, Observatoire Midi-Pyrénées (France); G. K. Skinner, NASA Goddard Space Flight Ctr. . . . . [6688-18]

Adaptive lobster-eye hard x-ray telescope with high-angular resolution and wide field of view, V. Grubsky, M. Gertsenshteyn, K. Shoemaker, T. P. Jannson, Physical Optics Corp. . . . . [6688-19]

Conference 6688

Poster Previews . . . . . 5:10 to 5:30 pm

Poster authors will give a 1-2 minute preview of their poster presentation.

✔ Posters-Wednesday

Chairs: ***Stephen L. O'Dell****, NASA Marshall Space Flight Ctr.;* ***Giovanni Pareschi****, Osservatorio Astronomico di Brera (Italy)*

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **A hard x-ray telescope science enhancement package for the Constellation-X mission,** B. D. Ramsey, NASA Marshall Space Flight Ctr.; P. Gorenstein, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6688-40]

✔ **A diffraction limited dual-band x-ray telescope,** C. Braig, P. Predehl, Max-Planck-Institut für extraterrestrische Physik (Germany) . . . . . [6688-41]

✔ **The problem of the calibration of SIMBOL-X x-ray telescope,** S. Basso, G. Pareschi, D. Spiga, Osservatorio Astronomico di Brera (Italy) . . . . . [6688-42]

✔ **Simulations of the HEW of multishell x-ray optical modules in soft and hard x-rays,** D. Spiga, Osservatorio Astronomico di Brera (Italy) . . . . . [6688-43]

✔ **Salient features of MACA and CMACA systems and their applications,** C. Ratnam, Osmania Univ. (India) . . [6688-44]

✔ **Optical constants in the hard x-ray/soft gamma-ray range of selected materials for ML reflectors,** C. P. Jensen, Danish National Space Ctr. (Denmark); S. E. Romaine, R. J. Bruni, Smithsonian Astrophysical Observatory; F. E. Christensen, Danish National Space Ctr.; Z. Zhong, Brookhaven National Lab. . . . . [6688-45]

✔ **A new fabrication method of mirror substrate with multistage closed shell for high-throughput x-ray telescope,** Y. Tawara, I. Sakurai, T. Masuda, T. Torii, Nagoya Univ. (Japan) . . . . . [6688-46]

✔ **Experimental results on slumped glass x-ray mirror segments,** P. Friedrich, H. W. Bräuninger, M. Fürmetz, A. Mazur, M. Vongehr, Max-Planck-Institut für extraterrestrische Physik (Germany) . . . . . [6688-47]

✔ **Characterization of thin plastic foils for applications in x-ray optics technology,** A. Taibi, Univ. degli Studi di Ferrara (Italy) and Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); M. Barbera, Univ. degli Studi di Palermo (Italy) and Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); G. Pareschi, Osservatorio Astronomico di Brera (Italy); H. W. Schnopper, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6688-48]

✔ **Mounting and alignment of full-shell replicated x-ray optics,** M. V. Gubarev, Universities Space Research Association; W. Arnold, Jacobs Engineering Group Inc.; T. J. Kester, B. D. Ramsey, M. E. Smithers, NASA Marshall Space Flight Ctr. . . . . [6688-49]

✔ **Thermal shielding of the SIMBOL-X mirror assembly,** A. Collura, Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); P. Attinà, Alcatel Alenia Space (Italy); M. Barbera, Univ. degli Studi di Palermo (Italy) and Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); A. Ferri, Alcatel Alenia Space (Italy); G. Pareschi, Osservatorio Astronomico di Brera (Italy); E. G. Perinati, Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); F. R. Powell, Luxel Corp. . . . . [6688-50]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:20 to 10:00 am

Multilayer Coatings

Chairs: **Suzanne E. Romaine**, Harvard-Smithsonian Ctr. for Astrophysics; **David L. Windt**, X-Ray Optics LLC

Multilayer deposition techniques for improved performance, D. L. Windt, Reflective X-ray Optics LLC . . . . . [6688-20]

Characterization of Pt/C multilayer at 200-keV soft gamma-ray, Y. Ogasaka, T. Iwahara, T. Miyazawa, Y. Fukaya, N. Sasaki, K. Tamura, Y. Kanou, H. Kunieda, K. Yamashita, Nagoya Univ. (Japan) . . . . . [6688-21]

Stacked depth graded multilayer for hard x-ray measured up to 140 keV, C. P. Jensen, F. E. Christensen, Danish National Space Ctr. (Denmark); S. E. Romaine, R. J. Bruni, Smithsonian Astrophysical Observatory; Z. Zhong, Brookhaven National Lab. . . . . [6688-22]

Over-coatings on depth-graded multilayer for better low-energy response, C. P. Jensen, F. E. Christensen, Danish National Space Ctr. (Denmark); D. H. Lumb, European Space Agency (Netherlands); M. K. Krumrey, Physikalisch-Technische Bundesanstalt (Germany) . . . . . [6688-23]

Light material coatings for soft x-ray reflectivity enhancement, V. Cotroneo, G. Pareschi, D. Spiga, Osservatorio Astronomico di Brera (Italy); M. Barbera, Univ. degli Studi di Palermo (Italy) and Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); S. E. Romaine, R. J. Bruni, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6688-24]

SESSION 6 . . . . . Thurs. 10:30 to 11:30 am

Spectroscopy

Chair: **John F. Seely**, Naval Research Lab.

Comparison of solar spectra from the Hinode extreme ultraviolet imaging spectrometer to preflight calibrations, J. F. Seely, Naval Research Lab.; U. Feldman, Artep Inc.; C. M. Brown, Naval Research Lab. . . . . [6688-25]

Fabrication and characterization of blazed transmission gratings for x-ray astronomy, R. K. Heilmann, M. Ahn, K. A. Flanagan, M. L. Schattenburg, Massachusetts Institute of Technology . . . . . [6688-26]

Spectrometer concept and design using a blazed transmission grating for x-ray astronomy, K. A. Flanagan, J. E. Davis, R. K. Heilmann, D. P. Huenemoerder, A. M. Levine, H. L. Marshall, G. Y. Prigozhin, G. R. Ricker, Jr., M. L. Schattenburg, N. S. Schulz, Massachusetts Institute of Technology; A. P. Rasmussen, Stanford Linear Accelerator Ctr. . . . . [6688-27]

Lunch/Exhibition Break

SESSION 7 . . . . . Thurs. 1:00 to 3:00 pm

Mirror Fabrication and Characterization I

Chairs: **Finn E. Christensen**, Danish National Space Ctr. (Denmark); **William W. Zhang**, NASA Goddard Space Flight Ctr.

Progress in x-ray optics development with formed glass and Si wafers, R. Hudec, Astronomical Institute (Czech Republic); L. Pina, Czech Technical Univ. in Prague (Czech Republic); V. Semencova, REFLEX s.r.o. (Czech Republic); M. Skulinova, Astronomical Institute (Czech Republic); L. Sveda, Czech Technical Univ. in Prague (Czech Republic); A. J. Inneman, REFLEX s.r.o. (Czech Republic); M. Mika, Institute of Chemical Technology (Czech Republic); J. Sik, ON Semiconductor Czech Republic (Czech Republic) . [6688-28]

Fabrication of mirror segments for the Constellation-X mission, W. W. Zhang, NASA Goddard Space Flight Ctr.; M. Hong, J. M. Mazzarella, M. Sharpe, Swales Aerospace; T. T. Saha, NASA Goddard Space Flight Ctr.; M. V. Gubarev, Universities Space Research Association; W. D. Jones, S. L. O'Dell, NASA Marshall Space Flight Ctr. . . . . [6688-29]

X-ray imaging glass micro-pore optics, M. J. Collon, M. W. Beijersbergen, cosine Research B.V. (Netherlands); K. Wallace, M. Bavdaz, European Space Agency (Netherlands); R. Fairbend, J. Séguy, D. Lacheze, E. Schyns, Photonis S.A.S. (France); M. K. Krumrey, Physikalisch-Technische Bundesanstalt (Germany); M. J. Freyberg, Max-Planck-Institut für extraterrestrische Physik (Germany) . . . . . [6688-30]

Silicon pore optics for astrophysical x-ray missions, M. W. Beijersbergen, M. J. Collon, R. Günther, S. Kraft, cosine Research B.V. (Netherlands); M. Bavdaz, K. Wallace, European Space Agency (Netherlands); M. K. Krumrey, Physikalisch-Technische Bundesanstalt (Germany); M. J. Freyberg, Max-Planck-Institut fuer extraterrestrische Physik (Germany) . . . . . [6688-31]

The first light of a single-stage MEMS x-ray optic, M. Koshiiishi, Y. Ezoe, M. Mita, K. Mitsuda, Japan Aerospace Exploration Agency (Japan); A. Hoshino, Y. Ishisaki, Tokyo Metropolitan Univ. (Japan); T. Takano, R. Maeda, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [6688-32]

Thin plastic foil x-ray optics with spiral geometry, M. Barbera, Univ. degli Studi di Palermo (Italy) and Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); T. Mineo, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); E. G. Perinati, Osservatorio Astronomico di Palermo G.S. Vaiana (Italy); A. Taibi, Univ. degli Studi di Ferrara (Italy); H. W. Schnopper, Harvard-Smithsonian Ctr. for Astrophysics . . . . . [6688-33]

SESSION 8 . . . . . Thurs. 3:30 to 4:30 pm

Mirror Fabrication and Characterization II

Chair: **Webster C. Cash, Jr.**, Univ. of Colorado/Boulder

X-ray imaging and adaptive optics system for a 13.5-nm telescope, S. Kitamoto, Y. Ohkubo, M. Tsujimoto, T. Ogita, K. Saitoh, M. Morii, Rikkyo Univ. (Japan) . . . . . [6688-34]

Toward a complete metrologic solution for the mirrors for the Constellation-X Spectroscopy X-ray Telescope, J. P. Lehan, K. Chan, Univ. of Maryland/Baltimore County; T. J. Hadjimichael, Swales Aerospace; S. M. Owens, NASA Goddard Space Flight Ctr.; M. Hong, Swales Aerospace; W. W. Zhang, NASA Goddard Space Flight Ctr. . . . . [6688-35]

Testing of the mirrors for the Constellation-X Spectroscopy X-ray Telescope with a refractive null, J. P. Lehan, Univ. of Maryland/Baltimore County; T. J. Hadjimichael, Swales Aerospace; C. Skocik, Mantech International Corp.; D. A. Content, W. W. Zhang, NASA Goddard Space Flight Ctr. . . . . [6688-36]

SESSION 9 . . . . . Thurs. 4:30 to 5:30 pm

Alignment and Mounting

Chair: **Brian D. Ramsey**, NASA Marshall Space Flight Ctr.

Breadboard micro-pore optic development for x-ray imaging, K. Wallace, M. Bavdaz, European Space Agency (Netherlands); M. J. Collon, M. W. Beijersbergen, cosine Research B.V. (Netherlands); R. Fairbend, J. Séguy, E. Schyns, Photonis S.A.S. (France) . . . . . [6688-37]

Alignment and integration techniques for mirror segment pairs on the Constellation-X telescope, T. J. Hadjimichael, Swales Aerospace; J. P. Lehan, Univ. of Maryland/Baltimore County; L. Olsen, Swales Aerospace; S. M. Owens, T. T. Saha, NASA Goddard Space Flight Ctr.; K. Chan, Univ. of Maryland/Baltimore County; T. E. Wallace, W. W. Zhang, NASA Goddard Space Flight Ctr. . . . . [6688-38]

Mechanical and thermal analysis of the spectroscopy x-ray telescopes for the Constellation-X mission, K. Chan, Univ. of Maryland/Baltimore County; V. Marquez, J. Sturm, W. W. Zhang, NASA Goddard Space Flight Ctr. . . . . [6688-39]

Conference 6689

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6689

Solar Physics and Space Weather Instrumentation II

Conference Chairs: **Silvano Fineschi**, Osservatorio Astronomico di Torino (Italy); **Rodney A. Viereck**, National Oceanic and Atmospheric Administration

Program Committee: **Jean-Marc Defise**, Ctr. Spatial de Liège (Belgium); **Leon Golub**, Harvard-Smithsonian Ctr. for Astrophysics; **Bernard V. Jackson**, Univ. of California/San Diego; **John D. Moses**, Naval Research Lab.; **Pierre L. P. M. Rochus**, Ctr. Spatial de Liège (Belgium)

Sunday 26 August

SESSION 1 . . . . . Sun. 8:50 am to 12:20 pm

Observing the Solar Corona

SMEI observations in the STEREO era, B. V. Jackson, A. Buffington, P. P. Hick, M. M. Bisi, E. A. Jensen, Univ. of California/San Diego . . . . . [6689-01]

STEREO: heliospheric imager design, pre-flight and in-flight response comparison, J. A. L. Halain, E. Mazy, J. Defise, Univ. de Liège (Belgium); J. D. Moses, J. S. Newmark, C. M. Korendyke, Naval Research Lab.; C. J. Eyles, The Univ. of Birmingham (United Kingdom); R. A. Harrison, C. J. Davis, Rutherford Appleton Lab. (United Kingdom) . . . . . [6689-02]

In-orbit verification, calibration, and performance of the heliospheric imager on the STEREO mission, C. J. Eyles, The Univ. of Birmingham (United Kingdom) and Rutherford Appleton Lab. (United Kingdom); C. J. Davis, R. A. Harrison, N. R. Waltham, Rutherford Appleton Lab. (United Kingdom); J. A. L. Halain, Univ. de Liège (Belgium); R. A. Howard, D. J. Moses, J. S. Newmark, S. P. Plunkett, Naval Research Lab. [6689-03]

Design, development, and performance of the STEREO SECCHI CCD cameras, N. R. Waltham, Rutherford Appleton Lab. (United Kingdom); C. J. Eyles, The Univ. of Birmingham (United Kingdom) and Rutherford Appleton Lab. (United Kingdom) . . . . . [6689-04]

UV-capped multilayer coatings for multiwavelength observations of the solar corona in the EUV/UV and visible-light, S. Fineschi, Osservatorio Astronomico di Torino (Italy) . . . . . [6689-05]

The solar ultraviolet magnetograph investigation, E. A. West, K. Kobayashi, J. M. Davis, A. Gary, NASA Marshall Space Flight Ctr. . . . . [6689-06]

A large coronagraph for coronal magnetic field studies, S. Tomczyk, P. G. Nelson, D. F. Elmore, National Ctr. for Atmospheric Research . . . . . [6689-07]

Optical design of a giant externally occulted coronagraph for the ASPIICS formation flying mission, S. Vivès, Observatoire Astronomique de Marseille Provence (France); P. L. Lamy, Lab. d'Astrophysique de Marseille (France); M. Saisse, Observatoire Astronomique de Marseille-Provence (France); P. Levacher, J. Boit, Lab. d'Astrophysique de Marseille (France); S. L. Koutchmy, Institut d'Astrophysique de Paris (France) . . . . . [6689-08]

Measuring the plane of polarization in a strongly circular signal, E. A. Jensen, Ctr. for Astrophysics & Space Sciences; C. T. Russell, Univ. of California/Los Angeles . . . . . [6689-09]

Lunch Break

SESSION 2 . . . . . Sun. 1:40 to 4:50 pm

Observing the Sun from GOES

Initial GOES 13 SXI on-orbit performance results, S. M. Hill, V. J. Pizzo, D. Biesecker, A. Reinard, National Oceanic and Atmospheric Administration; J. R. Lemen, M. D. Morrison, R. A. Stern, P. R. Catura, D. Sabolish, T. Rink, Lockheed Martin Corp. . . . . [6689-10]

The solar x-ray imager on GOES-13: design, analysis and on-orbit performance, J. E. Harvey, College of Optics & Photonics/Univ. of Central Florida; A. Krywonos, Florida Space Institute; M. Atanassova, Agfa-Gevaert Group (Belgium); P. L. Thompson, The Johns Hopkins Univ. Applied Physics Lab. . . . . [6689-11]

Early on-orbit observations from the GOES-13 SXI, J. R. Lemen, R. A. Stern, N. Nitta, L. Shing, G. L. Slater, Lockheed Martin Advanced Technology Ctr. . . . . [6689-12]

Report on GOES SXI/XRS calibration effort, A. Reinard, Univ. of Colorado/Boulder and National Oceanic and Atmospheric Administration; S. M. Hill, National Oceanic and Atmospheric Administration; S. Bailey, Virginia Polytechnic Institute and State Univ.; V. J. Pizzo, R. A. Viereck, National Oceanic and Atmospheric Administration . . . . . [6689-13]

Solar extreme ultraviolet irradiance observations from GOES, R. A. Viereck, National Oceanic and Atmospheric Administration . . . . . [6689-14]

Analyses of GOES-13 EUV 5-channel spectra, S. Guha, Swales Aerospace . . . . . [6689-15]

EXIS: The next generation of solar EUV and x-ray sensors for GOES-R, F. G. Eparvier, T. N. Woods, W. E. McClintock, P. C. Chamberlin, A. R. Jones, Univ. of Colorado/Boulder; R. A. Viereck, National Oceanic and Atmospheric Administration . . . . . [6689-16]

The SUVI for the GOES-R mission, J. R. Lemen, P. F. Boerner, N. Nitta, M. D. Morrison, Lockheed Martin Advanced Technology Ctr. . . . . [6689-17]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 3 . . . . . Mon. 8:30 am to 12:00 pm

Solar EUV Observing Systems

SDO EVE EUV spectrograph optical design and performance, D. A. Crotser, T. N. Woods, F. G. Eparvier, G. J. Ucker, R. A. Kohnert, M. A. Triplett, Univ. of Colorado/Boulder . . . . . [6689-18]

SDO EVE MEGS radiometric calibrations and results, P. C. Chamberlin, T. N. Woods, F. G. Eparvier, D. A. Crotser, D. L. Woodraska, R. Hock, Univ. of Colorado/Boulder . . [6689-19]

SDO EVE CCD and thin foil filter characterization and selection, M. A. Triplett, D. A. Crotser, T. N. Woods, F. G. Eparvier, G. J. Ucker, R. A. Kohnert, Univ. of Colorado/Boulder; G. D. Berthiaume, D. M. Weitz, MIT Lincoln Lab.; R. E. Vest, National Institute of Standards and Technology . . . [6689-20]

SDO EVE ESP radiometric calibration and results, L. V. Didkovsky, D. L. Judge, S. R. Wieman, M. Harmon, Univ. of Southern California; T. N. Woods, A. R. Jones, P. C. Chamberlin, D. L. Woodraska, B. Templeman, J. Harano, R. A. Kohnert, M. A. Triplett, F. G. Eparvier, Univ. of Colorado/Boulder; D. McMullin, Naval Research Lab.; M. L. Furst, R. E. Vest, National Institute of Standards and Technology[6689-21]

A lightweight optics-free EUV spectrometer with substantially improved efficiency and spectral resolution, L. V. Didkovsky, D. L. Judge, S. R. Wieman, Univ. of Southern California . . . . . [6689-22]

Development and testing of a dual grating filter-free spectrometer for photometric solar EUV measurements, S. R. Wieman, L. V. Didkovsky, D. L. Judge, M. Harmon, Univ. of Southern California; A. R. Jones, Univ. of Colorado/Boulder . . . . . [6689-23]

SWAP, a novel EUV telescope for space weather, J. Defise, J. A. L. Halain, Univ. de Liège (Belgium); D. Berghmans, Royal Observatory of Belgium (Belgium); F. Denis, Univ. de Liège; E. Mazy, P. L. P. M. Rochus, T. Thibert, Univ. de Liège (Belgium); B. Nicula, Royal Observatory of Belgium (Belgium); A. De Groof, Katholieke Univ. Leuven (Belgium); J. Hochedez, Royal Observatory of Belgium (Belgium); U. H. Schühle, Max-Planck-Institut für Sonnensystemforschung (Germany); M. Ravet-Krill, Univ. Paris-Sud II (France) . . . . . [6689-24]

$AlxGa^{1-x}N$ photo-detectors for focal plane arrays in the extreme ultraviolet (EUV) wavelength range, J. John, P. Malinowski, A. Lorenz, G. Hellings, K. Cheng, M. Germain, IMEC (Belgium); F. Semond, J. Duboz, Ctr. National de la Recherche Scientifique (France); A. Ben Moussa, J. Hochedez, Royal Observatory of Belgium (Belgium) . . . . . [6689-25]

Silicon photodiodes for absolute soft x-ray radiometry, J. Keister, SFA, Inc. . . . . [6689-26]

Lunch Break

SESSION 4 . . . . . Mon. 1:40 to 3:00 pm

Ground-based Solar Observing Systems

Development of a hybrid imaging system for Udaipur Solar Observatory, A. R. Bayanna, R. E. Louis, B. Kumar, S. K. Mathew, P. Venkatakrishnan, Udaipur Solar Observatory (India) . . . . . [6689-27]

Mirrors for solar telescopes made from ZERODUR glass ceramics, T. Doehring, R. Jedamzik, P. Hartmann, SCHOTT AG (Germany) . . . . . [6689-28]

The thermal environment of the fiber glass dome for the new solar telescope at Big Bear Solar Observatory, A. P. Verdoni, New Jersey Institute of Technology; C. J. Denker, New Jersey Institute of Technology and Astrophysikalisches Institut Potsdam (Germany); J. R. Varsik, S. Shumko, J. Nenow, Big Bear Solar Observatory . . . . . [6689-29]

An image stabilization system for solar observations, S. Rengaswamy, R. B. Ankala, R. E. Louis, B. Kumar, S. K. Mathew, V. Prameshvaran, Udaipur Solar Observatory (India) [6689-30]

SESSION 5 . . . . . Mon. 3:30 to 4:30 pm

Solar Wind and Space Weather

Combined STELab, EISCAT, ESR, and MERLIN IPS observations of the solar wind, M. M. Bisi, B. V. Jackson, Univ. of California/San Diego; R. A. Fallows, A. R. Breen, Univ. of Wales/Aberystwyth (United Kingdom); P. P. Hick, Univ. of California/San Diego; G. Wannberg, EISCAT Scientific Association (Sweden); P. Thomasson, C. A. Jordan, The Univ. of Manchester (United Kingdom); G. D. Dorrian, Univ. of Wales/Aberystwyth (United Kingdom) . . . . . [6689-31]

Performance of a prototype solar wind plasma analyzer for future solar and heliophysics missions, D. O. Kataria, G. Collinson, A. J. Coates, A. F. Fazakerley, C. J. Owen, B. Talyor, L. Bradley, Mullard Space Science Lab. (United Kingdom) . . . . . [6689-32]

Development of the spatial heterodyne spectrometer to detect thermospheric neutral oxygen density via Bowen fluorescence at 844 nm, S. R. Watchorn, Scientific Solutions, Inc. and Univ. of Illinois Urbana-Champaign; J. Noto, M. A. Migliozzi, Scientific Solutions, Inc.; L. Waldrop, Univ. of Illinois at Urbana-Champaign . . . . . [6689-33]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Analysis of the comparative responses of SMEI and LASCO,** A. Buffington, Univ. of California/San Diego; J. S. Morrill, Naval Research Lab.; P. P. Hick, Univ. of California/San Diego; R. A. Howard, Naval Research Lab.; B. V. Jackson, Univ. of California/San Diego; D. F. Webb, Boston College . . . . . [6689-34]

✔ **A procedure for fitting point sources in SMEI white-light full-sky maps,** P. P. Hick, A. Buffington, B. V. Jackson, Univ. of California/San Diego . . . . . [6689-35]

✔ **A soft x-ray polarimeter designed for broadband x-ray telescopes,** H. L. Marshall, Massachusetts Institute of Technology . . . . . [6689-36]

OPTICS

Conference 6690

Monday-Tuesday 27-28 August 2007 • Proceedings of SPIE Vol. 6690

Focal Plane Arrays for Space Telescopes III

Conference Chairs: **Thomas J. Grycewicz**, The Aerospace Corp.; **Cheryl J. Marshall**, NASA Goddard Space Flight Ctr.; **Penny G. Warren**, Ball Aerospace & Technologies Corp.

Program Committee: **Sachi Babu**, NASA Goddard Space Flight Ctr.; **James W. Beletic**, Teledyne Imaging Sensors; **Richard A. Bredthauer**, Semiconductor Technology Associates Inc.; **Mark C. Clampin**, NASA Goddard Space Flight Ctr.; **Michael P. Lesser**, The Univ. of Arizona; **Terrence S. Lomheim**, The Aerospace Corp.; **Kyle B. Miller**, Ball Aerospace & Technologies Corp.; **Peter J. Pool**, e2v technologies ltd. (United Kingdom); **John Traylor**, Naval Research Lab.

Monday 27 August

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Radiometric and noise characteristics of SI-19210 cameras built from the AlatSens ProCamHD 3560 FPA,** R. A. Kessel, Naval Research Lab.; D. M. Huber, C. Rollins, Research Support Instruments, Inc.; B. N. Dorland, G. Hennessy, U.S. Naval Observatory; B. E. Plourde, Assurance Technology Corp. . . . . [6690-18]

✔ **Astrometric and photometric sky testing results for the TIS 5-micron 3T-class CMOS detector,** B. N. Dorland, G. Hennessy, N. Zacharias, U.S. Naval Observatory; C. Rollins, D. M. Huber, Research Support Instruments, Inc. . [6690-19]

✔ **Laboratory and radiation performance testing results for the e2v model 212 CCD,** B. N. Dorland, U.S. Naval Observatory; A. Waczynski, G. Delo, NASA Goddard Space Flight Ctr.; R. Foltz, Sigma Space, Inc. . . . . [6690-20]

✔ **Characterization of the detector subsystem for near-infrared spectrograph (NIRSpec) on the James Webb Space Telescope,** D. B. Mott, NASA Goddard Space Flight Ctr.; A. Waczynski, Global Science & Technology, Inc.; Y. Wen, MEI Technologies, Inc.; W. Xia-Serafino, Global Science & Technology, Inc.; B. J. Rauscher, NASA Goddard Space Flight Ctr.; R. J. Hill, Science Systems and Applications, Inc.; G. Delo, R. Foltz, E. Kan, Global Science & Technology, Inc.; M. Chiao, MEI Technologies, Inc.; O. Fox, Univ. of Virginia; C. A. Cabelli, J. D. Garnett, M. Loose, S. Wong-Anglin, M. Zandian, Teledyne Imaging Sensors; D. Alexander, Northrop Grumman Technical Services; C. K. Brambora, R. J. Derro, NASA Goddard Space Flight Ctr.; T. Ellis, ITT Space Systems LLC; M. B. Garrison, NASA Goddard Space Flight Ctr.; B. Howe, ITT Space Systems LLC; T. E. Johnson, NASA Goddard Space Flight Ctr.; M. Jurado, ITT Space Systems LLC; S. S. Manthripragada, J. M. Marsh, C. J. Marshall, R. J. Martineau, NASA Goddard Space Flight Ctr.; J. Nieznanski, ITT Space Systems LLC; K. Novo-Gradac, Swales Aerospace; W. D. Roher, Northrop Grumman Technical Services; K. B. Shakoorzadeh, MEI Technologies, Inc.; M. T. Smith, D. Wilson, NASA Goddard Space Flight Ctr.; P. Wallis, ITT Space Systems LLC . . . . . [6690-21]

✔ **Detectors for the James Webb Space Telescope near-infrared spectrograph (NIRSpec),** B. J. Rauscher, NASA Goddard Space Flight Ctr. . . . . [6690-22]

✔ **Characterization of Raytheon 1.7-micron HgCdTe detector arrays,** C. W. McMurtry, J. L. Pipher, W. J. Forrest, Univ. of Rochester . . . . . [6690-23]

✔ **Characterization of a thinned Si PIN detector array,** C. W. McMurtry, T. S. Allen, J. L. Pipher, W. J. Forrest, Univ. of Rochester; Z. Ninkov, Rochester Institute of Technology; A. C. Moore, Univ. of Rochester . . . . . [6690-24]

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:00 to 11:50 am

New Developments in Satellite FPAs I

Readout integrated circuit (ROIC) design for spaceflight focal plane arrays *(Invited Paper)*, J. W. Beletic, A. B. Joshi, Teledyne Imaging Sensors . . . . . [6690-01]

Fundamental performance differences between CMOS and CCD imagers, part II *(Invited Paper)*, J. R. Janesick, J. T. Andrews, J. R. Tower, Sarnoff Corp.; T. S. Elliott, Jet Propulsion Lab.; J. Cheng, J. Bishop, Chronicle Technology Inc.[6690-02]

Inter-pixel capacitance in fully-depleted silicon hybrid CMOS focal plane arrays, Y. Bai, M. C. Farris, A. K. Petersen, J. W. Beletic, Teledyne Imaging Sensors . . . . . [6690-03]

Conversion gain nonlinearity and its correction in hybridized near-infrared detectors, N. N. Bezawada, D. J. Ives, D. Atkinson, UK Astronomy Technology Ctr. (United Kingdom) . . . . . [6690-04]

Comparing the low temperature performance of megapixel NIR InGaAs and HgCdTe imager arrays, S. Seshadri, D. M. Cole, B. R. Hancock, P. G. Ringold, C. Peay, C. J. Wrigley, Jet Propulsion Lab.; R. M. Smith, M. Bonati, G. Rahmer, California Institute of Technology; G. Tarlé, M. S. Schubnell, M. G. Brown, Univ. of Michigan; D. F. Figer, Rochester Institute of Technology; C. J. Bebek, Lawrence Berkeley National Lab. . . . . [6690-05]

Development of a thinned back-illuminated CMOS active pixel sensor for extreme ultraviolet spectroscopy and imaging in Space science *(Invited Paper)*, N. R. Waltham, M. L. Prydderch, H. C. A. Mapson-Menard, Rutherford Appleton Lab. (United Kingdom); A. Harris, P. J. Pool, e2v (United Kingdom) . . . . . [6690-06]

Sparse bumped back-illuminated active pixel hybrid FPA *(Invited Paper)*, D. Kingrey, DRS Sensors & Targeting Systems, Inc.; J. R. Janesick, Sarnoff Corp. . . . . [6690-07]

111-million pixel detector camera: realization, performance, and applications, N. Zacharias, B. N. Dorland, U.S. Naval Observatory; R. A. Bredthauer, K. L. Boggs, G. Bredthauer, Semiconductor Technology Associates Inc.; M. P. Lesser, The Univ. of Arizona/Steward Observatory [6690-08]

Lunch/Exhibition Break

SESSION 2 . . . . . Tues. 1:30 to 2:50 pm

New Developments in Satellite FPAs II

Back-illuminated 3D integrated CMOS image sensor for scientific applications *(Invited Paper)*, V. Suntharalingam, MIT Lincoln Lab. . . . . [6690-09]

The Gaia focal plane, A. A. Laborie, R. Davancens, P. Pouny, C. Vetel, F. Chassat, P. Charvet, EADS Astrium (France); P. Gare, G. Sarri, European Space Research and Technology Ctr. (Netherlands) . . . . . [6690-10]

Mission to Mars: the HiRISE camera on-board MRO *(Invited Paper)*, T. H. Ebben, J. W. Bergstrom, Ball Aerospace & Technologies Corp. . . . . [6690-11]

SESSION 3 . . . . . Tues. 3:20 to 5:40 pm

FPA Characterization and Test

High-performance focal plane arrays based on the HAWAII-2RG/4RG and the SIDECAR ASIC *(Invited Paper)*, M. Loose, J. W. Beletic, J. D. Garnett, M. Xu, Teledyne Imaging Sensors . . . . . [6690-12]

Laboratory and sky testing results for the TIS H4RG-10 4k x 4k 10-micron visible CMOS-hybrid detector *(Invited Paper)*, B. N. Dorland, G. Hennessy, N. Zacharias, U.S. Naval Observatory; C. Rollins, Research Support Instruments, Inc.; P. K. Shu, L. Miko, D. B. Mott, A. Waczynski, NASA Goddard Space Flight Ctr. . . . . [6690-13]

Radiation effects in two InGaAs focal plane arrays, F. K. Knight, M. Waldon, MIT Lincoln Lab. . . . . [6690-14]

Cryogenic testing of a 1024x1024 Si:As array for WISE, J. L. Dotson, M. E. McKelvey, R. E. McMurray, Jr., J. H. Goebel, NASA Ames Research Ctr.; A. K. Mainzer, Jet Propulsion Lab. . . . . [6690-15]

Characterization of blocked-impurity-band Si:As detectors, S. M. Birkmann, J. M. Stegmaier, U. Grözinger, O. Krause, Max-Planck-Institut für Astronomie (Germany); J. Putzeys, D. Sabuncuoglu Tezcan, P. J. Merken, P. de Moor, IMEC (Belgium) . . . . . [6690-16]

First results with a 4K^2 SiPIN array detector on a telescope, L. M. Simms, Stanford Linear Accelerator Ctr.; D. F. Figer, Rochester Institute of Technology; J. A. Tyson, Univ. of California/Davis; D. K. Gilmore, Stanford Linear Accelerator Ctr.; B. J. Hanold, Rochester Institute of Technology [6690-17]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC152 Infrared Focal Plane Arrays (Dereniak, Hubbs) Sunday 26, 1:30 - 5:30 pm

SC504 Introduction to CCD and CMOS Imaging Sensors and Applications (Janesick) Monday 27, 8:30 am - 5:30 pm

Conference 6691

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6691

Astronomical Adaptive Optics Systems and Applications III

Conference Chairs: **Robert K. Tyson**, Univ. of North Carolina/Charlotte; **Michael Lloyd-Hart**, The Univ. of Arizona/Steward Observatory

Program Committee: **Guido Brusa Zappellini**, The Univ. of Arizona/Steward Observatory; **Brent L. Ellerbroek**, California Institute of Technology; **Mark E. Furber**, Schafer Corp.; **Edward J. Kibblewhite**, The Univ. of Chicago; **Miska Le Louarn**, European Southern Observatory (Germany); **Carl Paterson**, Imperial College London (United Kingdom); **Gérard Rousset**, Observatoire de Paris à Meudon (France)

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:30 to 11:20 am

System Testing and Operations

Chair: **Michael Lloyd-Hart**, The Univ. of Arizona/ Steward Observatory

Test stand for the adaptive secondary at the MMT Observatory, T. E. Stalcup, Jr., O. Durney, P. M. Hinz, T. Connors, The Univ. of Arizona/Steward Observatory [6691-01]

FPGA developments for the SPARTA project: part 3, S. J. Goodsell, D. Geng, E. Younger, N. A. Dipper, R. M. Myers, Univ. of Durham (United Kingdom); E. Fedrigo, R. Donaldson, C. Soenke, European Southern Observatory (Germany) [6691-02]

ASSIST: development of a test-infrastructure for the VLT AO facility, R. Stuik, Leiden Univ. (Netherlands); R. Arsenault, European Southern Observatory (Germany); A. Deep, IUCAA (India); B. Delabre, European Southern Observatory (Germany); P. Hallibert, Leiden Univ. (Netherlands); L. Jolissaint, National Research Council Canada (Canada); N. N. Hubin, European Southern Observatory (Germany); S. Kendrew, Univ. College London (United Kingdom); P. Madec, J. Paufique, S. Stroebele, European Southern Observatory (Germany) . . . . . [6691-03]

EAGLE: a multiobject AO instrument for the European Extremely Large Telescope, G. Moretto, INSU (France); J. G. Cuby, Observatoire Astronomique de Marseille-Provence (France); J. Hammer, G. Rousset, Observatoire de Paris à Meudon (France); T. Fusco, ONERA (France); J. Devriendt, Observatoire de Lyon (France) . . . . . [6691-29]

A target selection system for ELTs multiobject instruments: system and trade-off analysis, E. Prieto, F. Madec, Observatoire Astronomique de Marseille Provence (France); P. Vola, Observatoire Astronomique de Marseille-Provence (France); E. Hugot, M. Ferrari, Observatoire Astronomique de Marseille Provence (France); J. G. Cuby, Observatoire Astronomique de Marseille-Provence (France) . . . . [6691-04]

The necessity of linearity calibrations for open-loop wavefront sensing, S. M. Ammons, D. T. Gavel, E. A. Laag, R. Kupke, C. E. Max, Univ. of California/Santa Cruz . . [6691-05]

An automated airplane detection system for the safeguard against airplane illumination from the laser guide star beacons at the MMT, M. Snyder, M. Lloyd-Hart, The Univ. of Arizona/Steward Observatory . . . . . [6691-06]

Lunch/Exhibition Break

SESSION 2 . . . . . Wed. 1:00 to 3:00 pm

Wavefront Sensing Algorithms and Simulations I

Chair: **Brent L. Ellerbroek**, California Institute of Technology

Broadband wavefront correction algorithm, A. Give'on, Princeton Univ.; S. B. Shaklan, Jet Propulsion Lab. [6691-07]

Real-time atmospheric turbulence profile estimation using modal covariance measurements from multiple guide stars, N. M. Milton, M. Lloyd-Hart, J. A. Bernier, C. J. Baranec, The Univ. of Arizona/Steward Observatory . . . . . [6691-08]

Energy-minimization-based wavefront correction algorithm for high-contrast imaging systems: experimental results, A. Give'on, Princeton Univ.; B. D. Kern, S. B. Shaklan, Jet Propulsion Lab. . . . . [6691-09]

Demonstration of wavefront correction in a shaped-pupil coronagraph using a Gerchberg-Saxton-based estimation scheme, J. D. Kay, R. Belikov, N. J. Kasdin, Princeton Univ. . . . . [6691-10]

Application of adaptive wavelets for laser beam compensation in astronomical adaptive optics, K. J. Jones, Rice Univ. . . . . [6691-11]

Wavefront sensor based on phase knife, A. V. Larichev, A. S. Goncharov, M.V. Lomonosov Moscow State Univ. (Russia) . . . . . [6691-12]

SESSION 3 . . . . . Wed. 3:30 to 4:50 pm

Wavefront Sensing Algorithms and Simulations II

Chair: **Miska Le Louarn**, European Southern Observatory (Germany)

High performance curvature wavefront sensing for extreme-AO, O. Guyon, National Astronomical Observatory of Japan/Subaru Telescope . . . . . [6691-13]

Effects of phase shifting error upon the self-referencing interferometer, R. A. Vincent, Air Force Research Lab.; D. Oesch, Air Force Research Lab. and Starfire Optical Range, Asalt Lab.; D. J. Sanchez, The Univ. of New Mexico [6691-14]

Phase calculation and tolerances in a self-referenced interferometer (SRI) spatial phase shifter, D. Oesch, Air Force Research Lab.; T. A. Rhoadarmer, Science Applications International Corp.; L. M. Klein, R. A. Vincent, Air Force Research Lab.; D. J. Sanchez, The Univ. of New Mexico . . . . . [6691-15]

Fast and accurate wavefront sensing algorithm of Shack-Hartmann sensor for adaptive optics, J. Yoo, Korea Advanced Institute of Science and Technology (South Korea) . . . . . [6691-16]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **A study on Shack-Hartmann sensors for adaptive optics,** J. Kim, T. Uhm, K. Park, S. Youn, Korea Advanced Institute of Science and Technology (South Korea) . . . . . [6691-25]

✔ **Loki: a ground-layer adaptive optics high-resolution near-infrared survey camera,** C. J. Baranec, M. Lloyd-Hart, M. R. Meyer, M. J. Rieke, The Univ. of Arizona/Steward Observatory . . . . . [6691-26]

✔ **Space variant point spread function modeling for astronomical image data processing,** M. Rerabek, P. Pata, K. Fliegel, J. Svihlik II, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6691-27]

✔ **Status of the production of the thin shells for the LBT adaptive secondaries,** G. Brusa Zappellini, H. M. Martin, S. M. Miller, B. Cuerden, The Univ. of Arizona/Steward Observatory; A. Riccardi, Osservatorio Astrofisico di Arcetri (Italy); B. K. Smith, The Univ. of Arizona/Steward Observatory . . . . . [6691-28]

Thursday 30 August

SESSION 4 . . . . . Thurs. 9:20 to 10:00 am

Wavefront Correction Optics

Chair: **Mark E. Furber**, Schafer Corp.

Development of lightweight segments for adaptive optics, M. Ghigo, S. Basso, R. Canestrari, G. Pareschi, Osservatorio Astronomico di Brera (Italy) . . . . . [6691-17]

Fast and compact tip-tilt/low order deformable mirror, F. P. Wildi, G. Muehlebach, T. Maulaz, Ecole d'Ingénieurs du Canton de Vaud (Switzerland) . . . . . [6691-18]

SESSION 5 . . . . . Thurs. 10:30 am to 12:30 pm

Laser Guide Stars

Chair: **Robert K. Tyson**, The Univ. of North Carolina at Charlotte

Status of the MMT Observatory multiple laser beacon projector, T. E. Stalcup, Jr., R. Angel, M. Lloyd-Hart, M. J. Rademacher, The Univ. of Arizona/Steward Observatory . . . . . [6691-19]

Astronomical imaging using ground-layer adaptive optics, C. J. Baranec, M. Lloyd-Hart, N. M. Milton, T. E. Stalcup, Jr., M. Snyder, V. Vaitheeswaran, D. W. McCarthy, Jr., P. M. Hinz, R. Angel, The Univ. of Arizona/Steward Observatory . [6691-20]

Multilaser guide star adaptive optics for the large binocular telescope, M. Lloyd-Hart, R. Angel, The Univ. of Arizona/ Steward Observatory; R. F. Green, The Univ. of Arizona . . . . . [6691-21]

Dynamic refocus optical design for a LBT Rayleigh laser guidestar, T. E. Stalcup, Jr., R. Angel, M. J. Rademacher, The Univ. of Arizona/Steward Observatory . . . . . [6691-22]

The European LGS test facility, R. M. Myers, Univ. of Durham (United Kingdom); D. Bonaccini Calia, European Southern Observatory (Germany); M. N. Devaney, National Univ. of Ireland/Galway (Ireland); S. Esposito, Osservatorio Astrofisico di Arcetri (Italy); S. J. Goodsell, Univ. of Durham (United Kingdom); A. V. Goncharov, National Univ. of Ireland/Galway (Ireland); J. C. Guerra, Isaac Newton Group of Telescopes (Spain); H. Guillet de Chatellus, Univ. Joseph Fourier (France); M. A. Harrison, Univ. of Durham (United Kingdom); R. Holzloehner, E. Marchetti, European Southern Observatory (Germany); T. J. Morris, Univ. of Durham (United Kingdom); E. Pinna, Osservatorio Astrofisico di Arcetri (Italy); J. Pique, Univ. Joseph Fourier (France); S. Rabien, Max-Planck-Institut für extraterrestrische Physik (Germany); M. Reyes Garcia-Talavera, Instituto de Astrofísica de Canarias (Spain); E. Ribak, Technion—Israel Institute of Technology (Israel); R. G. M. Rutten, Isaac Newton Group of Telescopes (Spain); H. Schnetler, M. Strachan, UK Astronomy Technology Ctr. (United Kingdom); R. Stuik, Leiden Univ. (Netherlands); G. Talbot, S. M. Tulloch, Isaac Newton Group of Telescopes (Spain) [6691-23]

The polychromatic laser guide star for the tilt measurement: progress report of the demonstrator at Observatoire de Haute Provence, R. Foy, Observatoire de Lyon (France); A. Le Van Suu, Observatoire de Haute Provence (France); J. Girard, Univ. Nacional Autónoma de México (Mexico); X. Rondeau, Observatoire de Lyon (France)[6691-24]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC135 Adaptive Optics (Tyson) Tuesday 28, 8:30 am - 5:30 pm

OPTICS

Conference 6692

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6692

Cryogenic Optical Systems and Instruments XII

Conference Chairs: **James B. Heaney**, Swales Aerospace; **Lawrence G. Burriesci**, Lockheed Martin Advanced Technology Ctr.

Program Committee: **David M. Chaney**, Ball Aerospace & Technologies Corp.; **Eric T. Kvamme**, Lockheed Martin Advanced Technology Ctr.; **Raymond G. Ohl IV**, NASA Goddard Space Flight Ctr.; **Leigh A. Ryder**, Lockheed Martin Corp.; **Mark T. Stier**, Goodrich Corp.; **Theodore D. Swanson**, NASA Goddard Space Flight Ctr.

Sunday 26 August

Introduction . . . . . 1:00 to 1:10 pm

Chair: **James B. Heaney,** Swales Aerospace

SESSION 1 . . . . . Sun. 1:10 to 2:50 pm

Cryogenic Optical Properties and Instrument Technology I

Chair: **Raymond G. Ohl IV**, NASA Goddard Space Flight Ctr.

High-fidelity cryothermal test of a subscale large space telescope cooling system, M. J. DiPirro, J. G. Tuttle, S. Ollendorf, A. N. Mattern, D. T. Leisawitz, M. L. Jackson, J. J. Francis, T. Hait, NASA Goddard Space Flight Ctr.; P. Cleveland, Energy Solutions International, LLC; D. Muheim, NASA Goddard Space Flight Ctr.; A. J. Mastropietro, NASA Goddard Space Flight Ctr. and Jet Propulsion Lab. . . . . [6692-01]

The high-spatial frequency cut-off in the cryogenic deformation of various lightweight mirrors, J. B. Hadaway, The Univ. of Alabama in Huntsville; R. Eng, D. E. Zissa, M. E. Smithers, NASA Marshall Space Flight Ctr. . . . . [6692-02]

Cryogenic temperature-dependent refractive index measurements of CaF_2 and Infrasil 301, B. J. Frey, T. J. Madison, NASA Goddard Space Flight Ctr. . . . . [6692-03]

Cryogenic temperature-dependent refractive index measurements of N-BK_7, $BaLKN_3$, SF_{15}, and E-$SF0_3$, B. J. Frey, D. B. Leviton, T. J. Madison, NASA Goddard Space Flight Ctr. . . . . [6692-04]

Temperature evolution in excitonic absorptions of $Cd_{0.96}Zn_{0.04}$ materials, M. A. Quijada, R. M. Henry, NASA Goddard Space Flight Ctr. . . . . [6692-05]

SESSION 2 . . . . . Sun. 3:40 to 5:20 pm

Cryogenic Optical Properties and Instrument Technology II

Chair: **David M. Chaney**, Ball Aerospace & Technologies Corp.

Cryogenic system for interferometric measurement of dimensional changes at 40 K, P. N. Blake, E. R. Canavan, NASA Goddard Space Flight Ctr.; J. A. Crane, Swales Aerospace; T. J. Madison, F. Miller, NASA Goddard Space Flight Ctr.; D. O. Miller, Bastion Technologies, Inc.; T. J. Zukowski, Research Support Instruments, Inc. . . . [6692-06]

Cryogenic tunable Fabry-Perot interferometer for astronomical observations, J. K. Chow, Lockheed Martin Space Systems Co.; L. A. Ryder, I. Chapman, Lockheed Martin Corp.; S. D. Horner, P. D. Dean, Lockheed Martin Advanced Technology Ctr. . . . . [6692-07]

Development and performance of a cryogenic Michelson interferometer, P. Lagueux, M. Chamberland, F. Marcotte, M. Duval, Telops, Inc. (Canada); A. C. Carter, National Institute of Standards and Technology . . . . . [6692-08]

The development of a breadboard cryogenic optical delay line for DARWIN, T. C. van den Dool, W. L. M. Gielesen, F. Kamphues, B. C. B. Braam, TNO TPD (Netherlands); N. Loix, Micromega Dynamics sa (Belgium); P. P. Kooijman, SRON Nationaal Instituut voor Ruimteonderzoek (Netherlands); G. Velsink, Dutch Space B.V. (Netherlands); Y. Stockman, Univ. de Liège (Belgium); J. Benoit, Alcatel Alenia Space (France); F. Sève, SAGEIS-CSO (France) . . . . . [6692-09]

Mid-infrared instrumentation for the European Extremely Large Telescope, S. Kendrew, B. R. Brandl, Leiden Observatory (Netherlands); R. Lenzen, Max-Planck-Institut für Astronomie (Germany); R. Stuik, Leiden Observatory (Netherlands); L. B. Venema, ASTRON (Netherlands); H. Kaeufl, G. Finger, European Southern Observatory (Germany); A. C. H. Glasse, UK Astronomy Technology Ctr. (United Kingdom) . . . . . [6692-10]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Introduction . . . . . 8:30 to 8:40 am

Chair: **Lawrence G. Burriesci**, Lockheed Martin Advanced Technology Ctr.

SESSION 3 . . . . . Mon. 8:40 to 9:40 am

Cryogenic Mechanisms and Refrigeration Technology

Chair: **Theodore D. Swanson**, NASA Goddard Space Flight Ctr.

Dual-mode DTE cryogenic thermal switch for NOTES, D. C. Bugby, M. Beres, Swales Aerospace . . . . . [6692-11]

A cryogen free ultralow temperature cooling system for STJ optical detectors for use in space and aerospace applications, J. Bartlett, I. D. Hepburn, Univ. College London (United Kingdom) . . . . . [6692-12]

Fiber optic microsensor hydrogen leak detection system on launch vehicle applications, A. A. Kazemi, J. W. Goepp, The Boeing Co.; D. B. Larson, Poly-Optical Products Inc.; M. D. Wuestling, The Boeing Co. . . . . [6692-13]

SESSION 4 . . . . . Mon. 10:30 to 11:50 am

Space Cryogenic Systems I

Chair: **Eric T. Kvamme**, Lockheed Martin Advanced Technology Ctr.

James Webb Space Telescope primary mirror segment assembly architecture overview, J. A. Lewis, Ball Aerospace & Technologies Corp. . . . . [6692-14]

An overview of integration and test of the James Webb Space Telescope integrated science instrument module, M. Drury, N. Becker, ManTech International Corp.; B. J. Bos, P. S. Davila, B. J. Frey, J. E. Hylan, J. M. Marsh, NASA Goddard Space Flight Ctr.; D. B. McGuffey, Swales Aerospace; M. D. Nowak, R. G. Ohl IV, NASA Goddard Space Flight Ctr.; K. W. Redman, ManTech International Corp.; H. P. Sampler, NASA Goddard Space Flight Ctr.; J. F. Sullivan, Ball Aerospace & Technologies Corp.; I. Walker, ManTech International Corp.; G. A. Wright, NASA Goddard Space Flight Ctr.; P. Young, Young Engineering Services . . . . . [6692-15]

NIRCam fold mirror design, A. A. Nordt, M. Jacoby, B. Biggs, E. T. Kvamme, T. Cahoon, Lockheed Martin Advanced Technology Ctr. . . . . [6692-16]

Cryo-test results of NIRCam optical elements, L. W. Huff, Lockheed Martin Advanced Technology Ctr.; L. A. Ryder, Lockheed Martin Corp. . . . . [6692-17]

Lunch Break

SESSION 5 . . . . . Mon. 1:30 to 2:30 pm

Space Cryogenic Systems II

Chair: **Mark T. Stier**, Goodrich Corp.

Cryogenic measurements of the dichroic beam splitter for the NIRCam instrument, Y. Mao, Lockheed Martin Advanced Technology Ctr. . . . . [6692-18]

A low-stress cryogenic mount for spaceborne lithium fluoride optics, E. T. Kvamme, Lockheed Martin Advanced Technology Ctr. . . . . [6692-19]

NIRCam thermal subsystem, L. Osborne, Lockheed Martin Advanced Technology Ctr. . . . . [6692-20]

SESSION 6 . . . . . Mon. 3:30 to 4:50 pm

Space Cryogenic Systems III

Chair: **Leigh A. Ryder**, Lockheed Martin Corp.

JWST-MIRI spectrometer main optics verification and qualification, M. Meijers, A. Oudenhuysen, A. A. Schoenmaker, ASTRON (Netherlands) . . . . . [6692-21]

MIRI telescope simulator folding mirrors, J. Serrano, A. Moral, E. Pedrosa, J. Moreno, L. Diez, J. Allo, LIDAX (Spain) . . . . . [6692-22]

The near-infrared spectrograph (NIRSpec) instrument on board the James Webb Space Telescope: an instrument overview, G. Bagnasco, European Space Agency (Netherlands); M. Kolm, EADS Astrium GmbH (Germany); M. B. J. te Plate, P. Rumler, J. Salvignol, P. Strada, European Space Agency (Netherlands); M. Melf, G. Noyer, K. Honnen, R. Lemke, EADS Astrium GmbH (Germany) . . . . . [6692-23]

Physical optics model for simulating the optical performance of the NIRSpec, M. B. J. te Plate, European Space Agency (Netherlands); P. Marenaci, EADS Astrium GmbH (Germany); J. Lorenzo Alvarez, P. Frugier, European Space Agency (Netherlands) . . . . . [6692-24]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **A low emissivity window for cryogenic testing of large optics,** B. W. Greeley, NASA Goddard Space Flight Ctr.; Q. Gong, D. C. Bugby, Swales Aerospace; D. A. Kubalak, NASA Goddard Space Flight Ctr. . . . . [6692-25]

✔ **Photogrammetric metrology for the James Webb Space Telescope integrated science instrument module,** M. D. Nowak, NASA Goddard Space Flight Ctr.; J. A. Crane, Swales Aerospace; P. S. Davila, W. L. Eichhorn, NASA Goddard Space Flight Ctr.; J. E. Gill, ManTech International Corp.; A. A. Herrera, Swales Aerospace; M. D. Hill, J. E. Hylan, NASA Goddard Space Flight Ctr.; M. Jetten, Northrop Grumman Space Technology; J. M. Marsh, R. G. Ohl IV, NASA Goddard Space Flight Ctr.; R. Quigley, Swales Aerospace; K. W. Redman, ManTech International Corp.; H. P. Sampler, G. A. Wright, NASA Goddard Space Flight Ctr.; P. Young, Young Engineering Services . . . . . [6692-26]

✔ **Thermal analysis and seeing improvement of LAMOST enclosure,** Z. Chen, Hangzhou Dianzi Univ. (China); H. Shi, R. Li, Z. Yao, National Astronomical Observatories (China) . . . . . [6692-27]

✔ **NIRCam optical telescope element stimulator (NOTES),** D. A. Kubalak, C. F. Hakun, B. W. Greeley, W. L. Eichhorn, C. Guishard, NASA Goddard Space Flight Ctr.; D. C. Bugby, Q. Gong, T. Warner, Swales Aerospace; J. Kirk, M. S. Garza, D. W. Robinson, P. Lansing, Orbital Sciences Corp.; D. B. Leviton, NASA Goddard Space Flight Ctr. . . . . [6692-28]

✔ **Optical alignment of the JWST ISIM to the OTE simulator (OSIM): current concept and design studies,** B. J. Frey, P. S. Davila, J. G. Hagopian, J. M. Marsh, R. G. Ohl IV, NASA Goddard Space Flight Ctr.; J. F. Sullivan, Ball Aerospace & Technologies Corp.; G. A. Wright, NASA Goddard Space Flight Ctr. . . . . [6692-29]

✔ **Effects of ice on the James Webb Space Telescope,** J. W. Arenberg, Northrop Grumman Space Technology . . . . . [6692-30]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC134 Optical Design Fundamentals for Infrared Systems (Riedl) Sunday 26, 8:30 am - 5:30 pm

SC835 Infrared Systems - Technology & Design (Daniels) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

Conference 6693

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6693

Techniques and Instrumentation for Detection of Exoplanets III

Conference Chair: **Daniel R. Coulter**, Jet Propulsion Lab.

Program Committee: **Charles A. Beichman**, California Institute of Technology; **James B. Breckinridge**, Jet Propulsion Lab.; **Tristram T. Hyde**, NASA Goddard Space Flight Ctr.; **David C. Hyland**, Texas A&M Univ.; **Peter R. Lawson**, Jet Propulsion Lab.; **Marie B. Levine**, Jet Propulsion Lab.; **Martin C. Noecker**, Ball Aerospace & Technologies Corp.; **John T. Trauger**, Jet Propulsion Lab.

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:00 to 9:50 am

Joint Session with Conference 6687: UV/Optical/IR Space Telescopes: Innovative Tehcnologies and Concepts III

TPF-External Occulter I

Chair: **Wesley A. Traub**, Jet Propulsion Lab.

External occulters for direct observation of exoplanets: an overview *(Invited Paper)*, W. C. Cash, Jr., E. R. Schindhelm, Univ. of Colorado/Boulder; J. W. Arenberg, A. S. Lo, R. S. Polidan, Northrop Grumman Space Technology; N. J. Kasdin, R. J. Vanderbei, Princeton Univ.; S. R. Heap, M. J. Kuchner, NASA Goddard Space Flight Ctr.; S. Kilston, M. C. Noecker, Ball Aerospace & Technologies Corp.; S. Seager, Massachusetts Institute of Technology . . . . . [6687-31]

The TPF-O science program *(Invited Paper)*, S. R. Heap, NASA Goddard Space Flight Ctr. . . . . [6687-32]

New Worlds Observer: system and mission architecture *(Invited Paper)*, J. W. Arenberg, Northrop Grumman Space Technology . . . . . [6693-01]

TPF-O design reference mission, D. J. Lindler, Sigma Space Corp. . . . . [6687-33]

SESSION 2 . . . . . Tues. 10:20 am to 12:00 pm

Joint Session with Conference 6687: UV/Optical/IR Space Telescopes: Innovative Tehcnologies and Concepts III

TPF-External Occulter II

Chair: **Wesley A. Traub**, Jet Propulsion Lab.

New Worlds Observer optical performance, A. S. Lo, T. Glassman, C. F. Lillie, Northrop Grumman Space Technology . . . . . [6687-34]

A UV/optical telescope for the New Worlds Observer mission, C. F. Lillie, D. R. Dailey, A. S. Lo, R. S. Polidan, Northrop Grumman Space Technology . . . . . [6687-35]

Conceptual design of the TPF-O SC bus, L. R. Purves, NASA Goddard Space Flight Ctr. . . . . [6687-36]

Detecting and characterizing extra-solar Earth-like planets with two external occulters, S. L. Hunyadi, Jet Propulsion Lab.; A. S. Lo, Northrop Grumman Space Technology[6693-02]

Externally occulted terrestrial planet finder coronagraph: simulations and sensitivities, R. G. Lyon, S. R. Heap, NASA Goddard Space Flight Ctr.; A. S. Lo, Northrop Grumman Space Technology; W. C. Cash, Jr., Univ. of Colorado/Boulder; G. D. Starkman, Case Western Reserve Univ.; R. J. Vanderbei, N. J. Kasdin, Princeton Univ.; C. J. Copi, Case Western Reserve Univ. . . . . [6687-37]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:30 to 2:50 pm

Joint Session with Conference 6687: UV/Optical/IR Space Telescopes: Innovative Tehcnologies and Concepts III

TPF-External Occulter III

Chair: **Daniel R. Coulter**, Jet Propulsion Lab.

Optimal design of petal-shaped occulters for extra-solar planet detection, E. J. Cady, N. J. Kasdin, R. J. Vanderbei, R. Belikov, Princeton Univ. . . . . [6693-03]

Laboratory studies of petal-shaped occulters, E. R. Schindhelm, W. C. Cash, Jr., A. F. Shipley, P. Oakley, Univ. of Colorado/Boulder; D. B. Leviton, Ball Aerospace & Technologies Corp. . . . . [6693-04]

Alignment of a terrestrial planet finder occulter at 20-100 megameters, M. C. Noecker, Ball Aerospace & Technologies Corp. . . . . [6693-05]

Dynamics and control of a space based extra-solar planet imaging mission consisting of a telescope and multiple occulters, E. Kolemen, N. J. Kasdin, Princeton Univ.[6687-38]

SESSION 4 . . . . . Tues. 3:20 to 4:40 pm

Joint Session with Conference 6687: UV/Optical/IR Space Telescopes: Innovative Tehcnologies and Concepts III

Formation Flying

Chair: **David W. Miller**, Massachusetts Institute of Technology

Formation flying system design for a planet-finding telescope occulter system, J. A. Leitner, NASA Goddard Space Flight Ctr. . . . . [6687-39]

Flight-like ground demonstration of precision formation flying spacecraft, D. P. Scharf, J. A. Keim, F. Y. Hadaegh, E. G. Benowitz, P. R. Lawson, Jet Propulsion Lab. . . . . [6693-06]

Formation control and reconfiguration through synthetic imaging formation flying testbed (SIFFT), S. Mohan, H. Sakamoto, D. W. Miller, Massachusetts Institute of Technology . . . . . [6687-40]

Satellite formation flight and realignment maneuver demonstration aboard the International Space Station, C. P. Mandy, A. Saenz-Otero, D. W. Miller, Massachusetts Institute of Technology . . . . . [6687-41]

SESSION 5 . . . . . Tues. 4:40 to 5:50 pm

Joint Session with Conference 6687: UV/Optical/IR Space Telescopes: Innovative Tehcnologies and Concepts III

TPF-Interferometer

Chair: **Daniel R. Coulter**, Jet Propulsion Lab.

Terrestrial planet finder interferometer: 2006-2007 progress and plans, P. R. Lawson, O. P. Lay, R. O. Gappinger, A. Ksendzov, S. R. Martin, R. D. Peters, D. P. Scharf, C. A. Beichman, S. C. Unwin, Jet Propulsion Lab. . . . . [6693-07]

TPF-Emma: concept study of a planet finding space interferometer, S. R. Martin, Jet Propulsion Lab. . [6693-08]

Planet-finding performance of the TPF-I Emma architecture, O. P. Lay, S. R. Martin, S. L. Hunyadi, Jet Propulsion Lab. . . . . [6693-09]

Wednesday 29 August

SESSION 6 . . . . . Wed. 8:00 to 10:00 am

Missions and Instruments I

Chair: **Charles A. Beichman**, Jet Propulsion Lab.

COROTEL: the Corot Telescope *(Invited Paper)*, V. Thierry, Alcatel Alenia Space (France) . . . . . [6693-10]

Finding Earth clones with SIM *(Invited Paper)*, M. Shao, J. C. Marr IV, Jet Propulsion Lab. . . . . [6693-11]

SIM PlanetQuest science and technology: a status report, S. J. Edberg, R. A. Laskin, J. C. Marr IV, S. C. Unwin, M. Shao, Jet Propulsion Lab. . . . . [6693-12]

SIM PlanetQuest precision white light interferometry, M. H. Milman, M. W. Regehr, Jet Propulsion Lab. . . . . [6693-13]

The microlensing planet finder: completing the census of extrasolar planets, D. P. Bennett, Univ. of Notre Dame; E. S. Cheng, Conceptual Analytics, LLC; A. J. Anderson, Rice Univ.; J. Beaulieu, Institut d'Astrophysique (France); I. Bond, Massey Univ. (New Zealand); M. E. Brown, California Institute of Technology; K. H. Cook, Lawrence Livermore National Lab.; S. D. Friedman, Space Telescope Science Institute; B. S. Gaudi, The Ohio State Univ.; R. L. Gilliland, Space Telescope Science Institute; A. Gould, The Ohio State Univ.; J. M. Jenkins, SETI Institute; R. A. Kimble, NASA Goddard Space Flight Ctr.; J. I. Lunine, The Univ. of Arizona; J. C. Mather, NASA Goddard Space Flight Ctr.; D. Minniti, Pontificia Univ. Católica de Chile (Chile); R. M. Rich, Univ. of California/Los Angeles; K. Sahu, Space Telescope Science Institute; M. Shao, Jet Propulsion Lab.; D. J. Tenerelli, Lockheed Martin Space Systems Co.; A. Udalski, Univ. Warszawski (Poland); P. Yock, The Univ. of Auckland (New Zealand) . . . . . [6693-14]

SESSION 7 . . . . . Wed. 10:30 am to 12:20 pm

Missions and Instruments II

Chair: **James B. Breckinridge**, Jet Propulsion Lab.

Observing exoplanets with the long-wave grism on JWST NIRCam *(Invited Paper)*, T. P. Greene, NASA Ames Research Ctr.; C. A. Beichman, California Institute of Technology; D. Eisenstein, The Univ. of Arizona/Steward Observatory; K. Hodapp, Univ. of Hawaii at Hilo; S. D. Horner, Y. Mao, Lockheed Martin Advanced Technology Ctr.; M. R. Meyer, M. J. Rieke, The Univ. of Arizona/Steward Observatory; F. Shi, Jet Propulsion Lab. . . . . [6693-15]

Hunting planets and observing disks with the JWST NIRCam coronagraph, J. E. Krist, C. A. Beichman, J. T. Trauger, Jet Propulsion Lab.; M. J. Rieke, The Univ. of Arizona/Steward Observatory; S. D. Horner, Lockheed Martin Advanced Technology Ctr.; F. Shi, K. R. Stapelfeldt, Jet Propulsion Lab.; J. A. Stansberry, The Univ. of Arizona/Steward Observatory; T. L. Roellig, NASA Ames Research Ctr.[6693-16]

The coronagrah project with the SPICA mission, K. Enya, Japan Aerospace Exploration Agency (Japan); L. Abe, National Astronomical Observatory of Japan (Japan); S. Tanaka, T. Nakagawa, H. Kataza, Japan Aerospace Exploration Agency (Japan); M. Tamura, J. Nishikawa, N. Murakami, National Astronomical Observatory of Japan (Japan); Y. Itoh, K. Fujita, Kobe Univ. (Japan); O. Guyon, National Astronomical Observatory of Japan/Subaru Telescope (Japan); M. Venet, Univ. de Provence (France) . . . . . [6693-17]

TOPS: direct imaging and characterization of rocky and giant planets with a small-size telescope, O. Guyon, National Astronomical Observatory of Japan/Subaru Telescope (Japan); R. Angel, The Univ. of Arizona/Steward Observatory; C. W. Bowers, NASA Goddard Space Flight Ctr.; J. H. Burge, The Univ. of Arizona/Steward Observatory; A. S. Burrows, The Univ. of Arizona; J. L. Codona, The Univ. of Arizona/Steward Observatory; T. P. Greene, NASA Ames Research Ctr.; M. Iye, National Astronomical Observatory of Japan (Japan); J. Kasting, The Pennsylvania State Univ.; H. M. Martin, D. W. McCarthy, Jr., The Univ. of Arizona/Steward Observatory; V. Meadows, California Institute of Technology; M. R. Meyer, The Univ. of Arizona/Steward Observatory; N. Sleep, Stanford Univ.; M. Tamura, National Astronomical Observatory of Japan (Japan); R. J. Vanderbei, Princeton Univ.; B. E. Woodgate, NASA Goddard Space Flight Ctr.; R. A. Woodruff, Lockheed Martin Space Systems Co.; N. J. Woolf, The Univ. of Arizona/Steward Observatory . . . . . [6693-18]

A conceptual design for an exoplanet imager, D. C. Hyland, R. Mosher, A. Momin, G. Iglesias, Q. Donnellan, Texas A&M Univ. . . . . [6693-19]

Lunch/Exhibition Break

SESSION 8 . . . . . Wed. 1:50 to 3:10 pm

Missions and Instruments III

Chair: **Tristram T. Hyde**, NASA Goddard Space Flight Ctr.

A new mission concept THESIS: the Transiting Habitable-zone Exoplanet Spectroscopy Infrared Spacecraft, M. R. Swain, Jet Propulsion Lab. . . . . [6693-20]

Developments in polarization nulling interferometry for exoplanet detection, J. Spronck, S. F. Pereira, J. J. M. Braat, Technische Univ. Delft (Netherlands) . . . . . [6693-21]

Analytic treatment of instrumental defects in exoplanet imaging with particular reference to the pupil-replication method, A. H. Greenaway, G. N. Craik, A. N. Johnson, R. J. Eastwood, F. H. P. Spaan, Heriot-Watt Univ. (United Kingdom) . . . . . [6693-22]

Calculation of signal-to-noise ratio for image formation using multispectral intensity correlation, D. C. Hyland, Texas A&M Univ. . . . . [6693-23]

SESSION 9 . . . . . Wed. 3:40 to 5:30 pm

TPF-Coronagraph

Chair: **Martin C. Noecker**, Ball Aerospace & Technologies Corp.

Recent developments in visible terrestrial planet finder mission design and technology *(Invited Paper)*, M. B. Levine, S. B. Shaklan, W. A. Traub, Jet Propulsion Lab. . . . . [6693-24]

The astrometric accuracy required for investigating planets in the habitable zones of nearby stars, R. A. Brown, Space Telescope Science Institute . . . . . [6693-25]

The lighter side of TPF-C: evaluating the scientific gain from a smaller mission concept, S. L. Hunyadi, S. B. Shaklan, Jet Propulsion Lab. . . . . [6693-26]

Broad band wave front control in a pupil remapping coronagraph, O. Guyon, National Astronomical Observatory of Japan/Subaru Telescope; S. B. Shaklan, Jet Propulsion Lab. . . . . [6693-27]

A holographic vortex coronagraph for high contrast imaging, D. M. Palacios, Jet Propulsion Lab. . . . . [6693-28]

✔ Posters-Wednesday

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Poster Setup

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✔ **Optimizing the broadband performance of TPF's high-contrast imaging testbed through modeling and simulations,** E. Sidick, B. D. Kern, A. C. Kuhnet, J. T. Trauger, Jet Propulsion Lab. . . . . [6693-49]

✔ **Effects of optical-density and phase dispersion of an imperfect band-limited occulting mask on the broadband performance of a TPF coronagraph,** E. Sidick, K. Balasubramanian, Jet Propulsion Lab. . . . . [6693-50]

✔ **Fractal analysis of noise buried time series signals with application to exoplanet spectroscopy,** G. Tremberger, Jr., T. Holden, E. Cheung, J. Boteju, F. Garcia, P. S. Schneider, H. Yao, A. Flamholz, P. J. Marchese, D. H. Lieberman, T. D. Cheung, Queensborough Community College/CUNY . . . . . [6693-51]

✔ **Light scattering from the New Worlds Observer occulter,** J. W. Arenberg, Northrop Grumman Space Technology . . . . . [6693-52]

✔ **Wavelength-dependent complex transmission profiles of band-limited coronagraph occulting masks measured in-situ,** B. D. Kern, D. W. Wilson, Jet Propulsion Lab. . . . . [6693-53]

✔ **A proposed laser frequency comb based wavelength reference for high-resolution spectroscopy,** S. N. Osterman, C. S. Froning, M. Beasly, Univ. of Colorado/Boulder; S. A. Diddams, National Institute of Standards and Technology; P. J. MacQueen, The Univ. of Texas at Austin . . . . . [6693-54]

✔ **A technique for measuring modal filtering properties in infrared fibers,** A. Ksendzov, O. P. Lay, S. R. Martin, Jet Propulsion Lab. . . . . [6693-55]

✔ **Estimation of confusion in SIM targets with a detailed focal plane model,** S. Rengaswamy, R. J. Allen, Space Telescope Science Institute . . . . . [6693-56]

✔ **The use of amplitude and phase in the design of hybrid Lyot coronagraph masks,** D. C. Moody, Jr., J. T. Trauger, Jet Propulsion Lab. . . . . [6693-57]

✔ **Detection of synthetic exoplanets and exo-zodiacal light in the lab with the shaped pupil coronagraph,** R. Belikov, L. A. Pueyo, Princeton Univ.; A. Give'on, Jet Propulsion Lab.; N. J. Kasdin, Princeton Univ. . . . . [6693-58]

✔ **Lithographically defined silicon high-resolution shaped pupil masks for TPF coronagraph,** V. E. White, M. R. Dickie, P. M. Echternach, K. Balasubramanian, Jet Propulsion Lab.; R. Belikov, Princeton Univ. . . . . [6693-59]

✔ **High contrast coronagraph designs for extremely large telescopes,** P. Martinez, A. Boccaletti, C. Cavarroc, Observatoire de Paris à Meudon (France) . . . . . [6693-60]

✔ **Principle and simulations of the self-coherent camera,** R. Galicher, Observatoire de Paris à Meudon (France) . . . . . [6693-61]

Thursday 30 August

SESSION 10 . . . . . Thurs. 8:20 to 10:00 am

Missions and Instruments IV

Chair: **David C. Hyland**, Texas A&M Univ.

System assessment study of the ESA Darwin Mission: concepts trade-off and first iteration design on novel Emma arrangement, C. Ruilier, R. Krawczyk, M. Sghedoni, O. Chanal, C. Degrelle, L. Pirson, O. Simane, E. Thomas, Alcatel Alenia Space (France) . . . . . [6693-30]

X-array aperture configuration in planar or non-planar spacecraft formation for DARWIN/TPF-I candidate architectures, O. Wallner, K. Ergenzinger, R. Flatscher II, U. A. Johann, EADS Astrium GmbH (Germany) . . . . . [6693-31]

GEDI: the Gemini Exoplanet Discovery Instrument, J. P. Lloyd, Cornell Univ.; T. S. Barman, Lowell Observatory; D. B. Charbonneau, Harvard-Smithsonian Ctr. for Astrophysics; R. T. Duck, J. Edelstein, D. J. Erskine, W. M. Feuerstein, Univ. of California/Berkeley; G. E. Gull, C. P. Henderson, T. L. Herter, Cornell Univ.; M. S. Marley, NASA Ames Research Ctr.; A. M. Moore, California Institute of Technology; M. W. Muterspaugh, Univ. of California/Berkeley; S. C. Parshley, B. E. Pirger, Cornell Univ.; I. N. Reid, Space Telescope Science Institute; D. Saumon, Los Alamos National Lab.; H. R. Schember, J. Schoenwald, G. W. Stasavage, Cornell Univ.; J. M. Wheatley, Univ. of California/Berkeley; R. J. White, The Univ. of Alabama in Huntsville; E. H. Wishnow, Univ. of California/Berkeley . . . . . [6693-32]

TEDI: the TripleSpec Exoplanet Discovery Instrument, J. Edelstein, Univ. of California/Berkeley; D. J. Erskine, Lawrence Berkeley National Lab.; W. M. Feuerstein, M. R. Marckwordt, M. W. Muterspaugh, E. Wishnow, Univ. of California/Berkeley; J. P. Lloyd, T. L. Herter, C. P. Henderson, S. C. Parshley, Cornell Univ. . . . . [6693-33]

Optimization of apodized pupil Lyot coronagraph for planet finder instruments, P. Martinez, A. Boccaletti, Observatoire de Paris à Meudon (France); M. E. Kasper, European Southern Observatory (Germany); P. Baudoz, C. Cavarroc, Observatoire de Paris à Meudon (France) . . . . . [6693-34]

SESSION 11 . . . . . Thurs. 10:30 am to 12:00 pm

Coronagraph Technology I

Chair: **Marie B. Levine**, Jet Propulsion Lab.

Laboratory demonstration of high-contrast imaging technologies and algorithms for Space coronagraphy *(Invited Paper)*, J. T. Trauger, B. Gordon, B. D. Kern, A. C. Kuhnert, D. C. Moody, Jr., A. F. Niessner, F. Shi, D. W. Wilson, Jet Propulsion Lab.; C. J. Burrows, Metajiva . . . . . [6693-35]

Demonstration of high contrast in broadband light with the shaped pupil coronagraph, R. Belikov, Princeton Univ.; A. Give'on, Jet Propulsion Lab.; E. J. Cady, J. D. Kay, N. J. Kasdin, Princeton Univ.; S. B. Shaklan, J. T. Trauger, Jet Propulsion Lab. . . . . [6693-36]

Thickness-dependent optical properties of metals and alloys applicable to TPF coronagraph image masks, K. Balasubramanian, D. W. Wilson, B. D. Kern, E. Sidick, Jet Propulsion Lab. . . . . [6693-37]

Contrast enhancement of a high Strehl PSF using wavelength diversity, L. A. Pueyo, R. Belikov, N. J. Kasdin, Princeton Univ. . . . . [6693-38]

Lunch/Exhibition Break

SESSION 12 . . . . . Thurs. 1:40 to 3:00 pm

Coronagraph Technology II

Chair: **John T. Trauger**, Jet Propulsion Lab.

Advancements of the optical vortex coronagraph, G. A. Swartzlander, E. Ford, R. S. Abdul-Malik, J. Kim, College of Optical Sciences/The Univ. of Arizona; L. M. Close, M. A. Peters, The Univ. of Arizona/Steward Observatory; D. M. Palacios, D. W. Wilson, Jet Propulsion Lab. . . . . [6693-39]

Amplitude variations on the ExAO testbed, J. W. Evans, Lawrence Livermore National Lab.; S. Thomas, Univ. of California/Santa Cruz; D. W. Phillion, Lawrence Livermore National Lab.; D. T. Gavel, D. R. Dillon, Univ. of California/ Santa Cruz; B. A. Macintosh, Lawrence Livermore National Lab. . . . . [6693-40]

Active thermal figure control for the TOPS II primary mirror, J. R. P. Angel, T. Kang, B. Cuerden, The Univ. of Arizona/ Steward Observatory; H. P. Stahl, NASA Marshall Space Flight Ctr.; O. Guyon, National Astronomical Observatory of Japan/ Subaru Telescope . . . . . [6693-41]

Broadband effects in hybrid pupil mapping shaped pupil designs, L. A. Pueyo, R. J. Vanderbei, N. J. Kasdin, Princeton Univ. . . . . [6693-42]

SESSION 13 . . . . . Thurs. 3:30 to 5:30 pm

Interferometer Technology

Chair: **Peter R. Lawson**, Jet Propulsion Lab.

Adaptive nulling in the mid-IR for the terrestrial planet finder interferometer, R. D. Peters, O. P. Lay, M. Jeganathan, Jet Propulsion Lab.; A. Hirai, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [6693-43]

Achromatic phase shifter, D. Rouan, D. Pelat, Observatoire de Paris à Meudon (France) . . . . . [6693-44]

Deep nulling in unpolarized light, C. Buisset, Observatoire de la Côte d'Azur (France); X. Rejeaunier, Alcatel Alenia Space (France); Y. Rabbia, Observatoire de la Côte d'Azur (France); M. Barillot, Alcatel Alenia Space (France) . . . . . [6693-45]

Current progress on TPF-I achromatic nulling at the Jet Propulsion Laboratory, R. O. Gappinger, R. T. Diaz, S. R. Martin, F. M. Loya, P. R. Lawson, Jet Propulsion Lab.[6693-46]

Single-mode nulling coronagraphy: first IR results, B. P. Mennesson, E. Serabyn, Jet Propulsion Lab. . . . . [6693-47]

Vectorial analysis of polarization issues in multi-axial nulling interferometers for exoplanet detection, J. Spronck, S. F. Pereira, J. J. M. Braat, Technische Univ. Delft (Netherlands) . . . . . [6693-48]

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Conference 6694

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6694

Instruments, Methods, and Missions for Astrobiology X

Conference Chairs: **Richard B. Hoover**, NASA Marshall Space Flight Ctr.; **Gilbert V. Levin**, Spherix Inc.; **Alexei Y. Rozanov**, Paleontological Institute (Russia); **Paul C. W. Davies**, Arizona State Univ.

Program Committee: **Mian M. Abbas**, NASA Marshall Space Flight Ctr.; **Sabit S. Abyzov**, Institute of Microbiology (Russia); **Marina M. Astafieva**, Paleontological Institute (Russia); **Stanley M. Awramik**, Univ. of California/Santa Barbara; **William B. Banerdt**, Jet Propulsion Lab.; **Bonnie K. Baxter**, Westminster College; **Lee Bebout**, NASA Ames Research Ctr.; **Kathleen C. Benison**, Central Michigan Univ.; **Adrian J. Brown**, SETI Institute; **Donald E. Brownlee**, Univ. of Washington; **Mark A. Bullock**, Southwest Research Institute; **Mark J. Burchell**, Univ. of Kent (United Kingdom); **Nathalie A. Cabrol**, NASA Ames Research Ctr.; **Francisco J. Carrapico**, Univ. de Lisboa (Portugal); **Bin Chen**, SETI Institute; **Max L. Coleman**, Jet Propulsion Lab.; **David W. Deamer**, Univ. of California/Santa Cruz; **Michael H. Engel**, Univ. of Oklahoma; **Sabrina Feldman**, Jet Propulsion Lab.; **Eric M. Galimov**, V.I. Verdansky Institute (Russia); **David H. Grinspoon**, Denver Museum of Art and Science; **J. Patrick Kociolek**, California Academy of Sciences; **Vera M. Kolb**, Univ. of Wisconsin/Parkside; **Jere H. Lipps**, Univ. of California/Berkeley; **Gene D. McDonald**, The Univ. of Texas at Austin; **David S. McKay**, NASA Johnson Space Ctr.; **Uwe Meierhenrich**, Univ. de Nice Sophia Antipolis (France); **Melanie R. Mormile**, Univ. of Missouri/Rolla; **David J. Mossman**, Mount Allison Univ. (Canada); **Roland R. Paepe**, Geobound International Ltd. (Netherlands); **Randall S. Perry**, Imperial College London (United Kingdom); **Elena V. Pikuta**, NASA Marshall Space Flight Ctr.; **Holly C. Pinkart**, Central Washington Univ.; **Malcom Potts**, Virginia Polytechnic Institute and State Univ.; **Lisa M. Pratt**, Indiana Univ.; **Francois C. Raulin**, Univ. Paris 12 Val-de-Marne (France); **Birgit I. Sattler**, Leopold-Franzens-Univ. Innsbruck (Austria); **Joseph Seckbach**, The Hebrew Univ. of Jerusalem (Israel); **Zdenek Sekanina**, Jet Propulsion Lab.; **Mark A. Sephton**, Imperial College London (United Kingdom); **Alexandre S. Simionovici**, Ecole normale supérieure de Lyon (France); **Paul P. Sipiera**, Harper College; **Peter Smith**, The Univ. of Arizona; **Michael C. Storrie-Lombardi**, Kinohi Institute; **Vitaly J. Vodyanoy**, Auburn Univ.; **Milton Wainwright**, The Univ. of Sheffield (United Kingdom); **Max K. Wallis**, Cardiff Univ. (United Kingdom); **Nalin C. Wickramasinghe**, Cardiff Univ. (United Kingdom); **Andreja Zalar**, Institut National de la Recherche Agronomique (France); **Georgi A. Zavarzin**, Institute of Microbiology (Russia)

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:05 to 10:20 am

The Origin of Life

Chairs: **David S. McKay**, NASA Johnson Space Ctr.; **David W. Deamer**, Univ. of California/Santa Cruz

Keynote

Reduced condition on early Earth and ATP-related mechanism of prebiological evolution *(Invited Paper)*, E. M. Galimov, V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry (Russia) . . . . . [6694-01]

Search for the origin of life homochirality: asymmetric photon-induced processes on amino acids with far-UV circularly polarized synchrotron radiation *(Invited Paper)*, L. F. Nahon, G. Garcia, Synchrotron SOLEIL (France); I. Powis, The Univ. of Nottingham (United Kingdom); U. Meierhenrich, Univ. de Nice Sophia Antipolis (France); A. Brack, Ctr. National de la Recherche Scientifique (France) . . . . . [6694-02]

Could there have been a single origin of life in a big bang universe?, R. Gordon, Univ. of Manitoba (Canada); R. B. Hoover, NASA Marshall Space Flight Ctr. . . . . [6694-03]

Importance of the interaction between sodium silicate and organic materials to astrobiology: examples from our laboratory, V. M. Kolb, P. J. Liesch, Univ. of Wisconsin/Parkside . . . . . [6694-04]

Contribution for a simbiogenic approach in astrobiology, F. J. Carrapico, L. Pereira, T. Rodrigues, Univ. de Lisboa (Portugal) . . . . . [6694-05]

SESSION 2 . . . . . Tues. 10:40 am to 12:20 pm

Microfossils in Ancient Rocks and Meteorites

Chairs: **Eric M. Galimov**, V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry (Russia); **Vera M. Kolb**, Univ. of Wisconsin/Parkside

Recent investigations of the Mars meteorites *(Invited Paper)*, D. S. McKay, NASA Johnson Space Ctr. . . [6694-06]

Fossil cyanobacteria in carbonaceous meteorites, R. B. Hoover, NASA Marshall Space Flight Ctr. . . . . [6694-07]

Early Proterozoic (2.0 GA) phosphorites from Pechenga Greenstone Belt and their origin *(Invited Paper)*, A. Y. Rozanov, M. M. Astafieva, Paleontological Institute (Russia); R. B. Hoover, NASA Marshall Space Flight Ctr. . . . . [6694-08]

Distribution, ecology and adaptations of stromatolite forming cyanobacteria from evaporating altiplanic lakes: Potosi region, Bolivia, L. E. Bebout, E. Fleming, L. Jahnke, NASA Ames Research Ctr.; S. Green, SETI Institute; N. A. Cabrol, NASA Ames Research Ctr. . . . . [6694-09]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:40 to 3:20 pm

Chemical and Mineral Biomarkers

Chairs: **Mark J. Burchell**, Univ. of Kent at Canterbury (United Kingdom); **Zdenek Sekanina**, Jet Propulsion Lab.

Stable sulfur isotopes as probes for ancient life in the solar system *(Invited Paper)*, M. H. Engel, Univ. of Oklahoma . . . . . [6694-10]

The case for vestiges of early solar system biota in carbonaceous chondrites: petroleum geochemical snapshots and possible future petroleum prospects on Mars expedition *(Invited Paper)*, P. K. Mukhopadhyay, Global Geoenergy Research Ltd. (Canada); D. J. Mossman, J. M. Ehrman, Mt. Allison Univ. (Canada); M. A. Kruge, Montclair State Univ. . . . . [6694-11]

Ratios of biogenic elements for distinguishing recent from fossil microorganisms, R. B. Hoover, NASA Marshall Space Flight Ctr. . . . . [6694-12]

An integrated strategy for detecting present or former life on other planets: the case for mineral biosignatures *(Invited Paper)*, M. L. Coleman, Jet Propulsion Lab. [6694-13]

SESSION 4 . . . . . Tues. 3:50 to 5:50 pm

Comets, Meteorites, and the Biosphere

Chairs: **Gilbert V. Levin**, Spherix Inc.; **Max L. Coleman**, Jet Propulsion Lab.

Stardust and comets *(Invited Paper)*, M. J. Burchell, Univ. of Kent at Canterbury (United Kingdom) . . . . . [6694-14]

The cometary biosphere *(Invited Paper)*, R. B. Sheldon, R. B. Hoover, NASA Marshall Space Flight Ctr. . . . . [6694-15]

Dust jets, outbursts, and fragmentation of comets *(Invited Paper)*, Z. Sekanina, Jet Propulsion Lab. . . . . [6694-16]

Probabilistic classification of elemental abundance distributions in Nakhla and Apollo 17 lunar dust samples, M. C. Storrie-Lombardi, Kinohi Institute; R. B. Hoover, NASA Marshall Space Flight Ctr. . . . . [6694-17]

Inventory, history, and scientific importance of the James M. DuPont meteorite collection, P. P. Sipiera, Harper College; K. R. Butler, J. R. Schwade, Planetary Studies Foundation . . . . . [6694-18]

Panel Discussion . . . . . Tues. 3:50 to 5:50 pm

Life in the Cosmos

Panel Moderators:

Paul C. W. Davies, BEYOND - Ctr. for Fundamental Concepts in Science, Arizona State Univ.

Richard B. Hoover, NASA/National Space Science and Technology Ctr.

Panel Members:

Erik M. Galimov, V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry (Russia)

Francois C. Raulin, GDR CNRS Exobio (France)

Alexei Yu. Rozanov, Institute of Paleontology (Russia)

David S. McKay, NASA Johnson Space Ctr.

Gilbert V. Levin, Spherix, Inc.

Michael Storrie-Lombardi, Kinohi Institute

Jere H. Lipps, Univ. of California/Berkeley

David Deamer, Univ. California/Santa Cruz

Joseph Seckbach, The Hebrew Univ. of Jerusalem (Israel)

Wednesday 29 August

Session 5 . . . . . 8:00 to 8:50 am

Life as We Do Not Know It

Chair: **Richard B. Hoover,** NASA Marshall Space Flight Ctr.

Keynote Presentation

Searching for an alternative form of life on Earth, P. C. W. Davies, Arizona State Univ. . . . . [6694-19]

SESSION 6 . . . . . Wed. 8:50 am to 12:30 pm

Astrobiology of Venus, Mars, and Icy Moons

Chairs: **Jere H. Lipps**, Univ. of California/Berkeley; **Peter Smith**, The Univ. of Arizona

Keynote

Titan: an astrobiological laboratory in the solar system, F. C. Raulin, P. Coll, M. Nguyen, Univ. Paris 12 Val-de-Marne (France) . . . . . [6694-20]

The revival of life on Mars *(Invited Paper)*, G. V. Levin, Spherix Inc. . . . . [6694-21]

Biogenic hydrogen peroxide: reinterpretation of the Viking results and properties of possible life on Mars, J. M. Houtkooper, Justus-Liebig-Univ. Giessen (Germany); D. Schulze-Makuch, Washington State Univ. . . . . [6694-22]

The biological oxidant and life detection (BOLD) mission: a new proposal for a mission to Mars, D. Schulze-Makuch, Washington State Univ.; J. M. Houtkooper, Justus-Liebig-Univ. Giessen (Germany) . . . . . [6694-23]

The Phoenix mission to Mars *(Invited Paper)*, P. Smith, The Univ. of Arizona . . . . . [6694-24]

Astrobiology on the surface of Venus *(Invited Paper)*, M. A. Bullock, D. H. Grinspoon, Southwest Research Institute . . . . . [6694-25]

Origin and early evolution of life on icy worlds *(Invited Paper)*, J. H. Lipps, Univ. of California/Berkeley; D. Schulze-Makuch, Washington State Univ. . . . . [6694-26]

Lunch/Exhibition Break

SESSION 7 . . . . . Wed. 1:40 to 3:30 pm

Distribution of Life

Chairs: **Francois C. Raulin**, Univ. Paris 12 Val-de-Marne (France); **Melanie R. Mormile**, Univ. of Missouri/Rolla

Diatoms: unique eukaryotic extremophiles providing insights into planetary change *(Invited Paper)*, J. P. Kociolek, California Academy of Sciences . . . . . [6694-27]

Plant seeds as biological instruments for dispersing life through the universe, D. A. Tepfer, A. Zalar, Institut National de la Recherche Agronomique (France); S. V. Hoffmann, F. Folkmann, Åarhus Univ. (Denmark); M. J. Burchell, Univ. of Kent at Canterbury (United Kingdom); S. Leach, Observatoire de Paris à Meudon (France) . . . . . [6694-28]

How do bacteria reach the stratosphere?, M. Wainwright, A. Laswd, J. Gilmour, F. Alshammari, The Univ. of Sheffield (United Kingdom) . . . . . [6694-29]

UV-VUV absorption spectroscopy of DNA and UV screens suggests strategies for UV resistance during evolution and space travel *(Invited Paper)*, A. Zalar, D. A. Tepfer, Institut National de la Recherche Agronomique (France); S. V. Hoffmann, Åarhus Univ. (Denmark); A. Kollmann, Institut National de la Recherche Agronomique (France); S. Leach, Observatoire de Paris à Meudon (France) . . . . . [6694-30]

Testing prospects for reliable diatom nanotechnology in microgravity, R. Gordon, Univ. of Manitoba (Canada); R. B. Hoover, NASA Marshall Space Flight Ctr.; J. A. Tuszynski, Univ. of Alberta (Canada) . . . . . [6694-31]

SESSION 8 . . . . . Wed. 3:50 to 5:40 pm

Microbial Extemophiles

Chairs: **Mark A. Bullock**, Southwest Research Institute; **J. Patrick Kociolek**, California Academy of Sciences

Extremophilic candidates to astrobiology *(Invited Paper)*, J. Seckbach, The Hebrew Univ. of Jerusalem (Israel) [6694-32]

Characterization of a moderately halo-acidophilic bacterium isolated from Lake Brown, Western Australia, M. R. Mormile, B. Hong, N. Adams, Univ. of Missouri/Rolla; K. C. Benison, Central Michigan Univ.; F. Oboh-Ikuenobe, Univ. of Missouri/Rolla . . . . . [6694-33]

Diversity, evolution, and horizontal gene transfer in Soda Lakes, H. C. Pinkart, Central Washington Univ.; M. C. Storrie-Lombardi, Kinohi Institute . . . . . [6694-34]

Investigating microbial diversity and UV radiation impact at the high-altitude Lake Aguas Calientes, Chile, C. S. Demergasso, L. E. González, Univ. Católica del Norte (Chile); E. O-Casamayor, Ctr. d'Estudis Avançats de Blanes (Spain); M. E. Farias, Consejo Superior de Investigaciones Científicas (Spain); N. A. Cabrol, E. A. Grin, NASA Ames Research Ctr.; E. Minkley, Jr., Y. Yu, Carnegie Mellon Univ. . . . . [6694-35]

2006 HLP diving expedition in the highest volcanic lake on Earth and characterization of its ecosystem *(Invited Paper)*, N. A. Cabrol, NASA Ames Research Ctr.; E. Minkley, Jr., Y. Yu, Carnegie Mellon Univ.; E. A. Grin, C. Woosley, R. L. Morris, NASA Ames Research Ctr. . . . . [6694-36]

Thursday 30 August

SESSION 9 . . . . . Thurs. 8:00 to 10:00 am

Instruments and Methods for Astrobiology

Chairs: **Holly C. Pinkart**, Central Washington Univ.; **Michael C. Storrie-Lombardi**, Kinohi Institute

Nanopore biosensors and the search for biosignatures, D. W. Deamer, Univ. of California/Santa Cruz . . . . . [6694-37]

Evidence regarding ancient environments on Mars from the Mars exploration rovers, W. B. Banerdt, Jet Propulsion Lab. . . . . [6694-38]

Carboxylic acid detection system for in situ astrobiological investigations, S. M. Feldman, R. Kidd, Jet Propulsion Lab.; D. Summers, NASA Ames Research Ctr. . . . . [6694-39]

MR PRISM: a software suite for CRISM data analysis, A. J. Brown, SETI Institute; M. C. Storrie-Lombardi, Kinohi Institute . . . . . [6694-40]

High-resolution light microscopy of nanoforms, V. J. Vodyanoy, O. M. Pustovyy, A. Vainrub, Auburn Univ. [6694-41]

In situ search for life traces in extraterrestrial samples by synchrotron x-ray fluorescence 2D and 3D imaging, L. Lemelle, A. S. Simionovici, Ecole normale supérieure de Lyon (France); M. Salome, P. Bleuet, J. Susini, European Synchrotron Radiation Facility (France); P. Gillet, Ecole normale supérieure de Lyon (France) . . . . . [6694-42]

SESSION 10 . . . . . Thurs. 10:50 am to 12:10 pm

Survivability to Radiation, Dessication, and Shock

Chairs: **Nathalie A. Cabrol**, NASA Ames Research Ctr.; **Lee Bebout**, NASA Ames Research Ctr.

Great Salt Lake halophilic archaea as models for astrobiology: evidence for ultraviolet irradiation and desiccation resistance, B. K. Baxter, B. Eddington, M. R. Riddle, T. Webster, B. J. Avery, Westminster College [6694-43]

Survival of microbial life under shock compression: implications for panspermia, M. J. Burchell, Univ. of Kent at Canterbury (United Kingdom) . . . . . [6694-44]

ATCG nucleotide fluctuation of Deinococcus radiodurans radiation genes, T. Holden, R. Subramaniam, R. Sullivan, E. Cheung, C. Schneider, G. Tremberger, Jr., A. Flamholz, D. H. Lieberman, T. D. Cheung, Queensborough Community College/CUNY . . . . . [6694-45]

Radiotolerance of microorganisms isolated from radiation fields on a university campus: implications for shallow subsurface growth of microorganisms on Mars, M. R. Mormile, J. J. Elmer, S. J. Spychala, Univ. of Missouri-Rolla . . . . . [6694-46]

Lunch/Exhibition Break

SESSION 11 . . . . . Thurs. 2:10 to 5:20 pm

Chirality and Astrobiology

Chairs: **Joseph Seckbach**, The Hebrew Univ. of Jerusalem (Israel); **Milton Wainwright**, The Univ. of Sheffield (United Kingdom)

Astrobiological polarimeter, N. Kothari, A. Jafarpour, R. P. Trebino, T. L. Thaler, A. S. Bommarius, Georgia Institute of Technology . . . . . [6694-47]

Living strategies of unusual life forms on Earth and the relevance to astrobiology *(Invited Paper)*, V. M. Kolb, P. J. Liesch, Univ. of Wisconsin/Parkside . . . . . [6694-48]

The importance of the Maillard-metal complexes and their silicates in astrobiology, V. M. Kolb, P. J. Liesch, Univ. of Wisconsin/Parkside . . . . . [6694-49]

Apparent biotic micromorphologies of abiotic origins, G. A. Konesky, SGK Nanostructures, Inc. . . . . [6694-50]

The red soil on Mars as a proof for water and vegetation!, R. R. Paepe, Geobound International Ltd. (Netherlands) . . . . . [6694-51]

Limits of life and microbial extremophiles, E. V. Pikuta, National Space Science and Technology Ctr.; R. B. Hoover, NASA Marshall Space Flight Ctr. . . . . [6694-52]

Raman spectra identifications of mineral and organic constituents, B. Chen, C. R. Stoker, N. A. Cabrol, C. P. McKay, NASA Ames Research Ctr. . . . . [6694-53]

Co-evolution of cyanophage and cyanobacteria in Antarctic lakes: adaptive responses to high-UV flux and global warming, M. C. Storrie-Lombardi, Kinohi Institute . . . . . [6694-54]

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Conference 6695

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Optics and Photonics for Information Processing

Conference Chairs: **Abdul A. S. Awwal**, Lawrence Livermore National Lab.; **Khan M. Iftekharuddin**, Univ. of Memphis; **Bahram Javidi**, Univ. of Connecticut

Program Committee: **Henri H. Arsenault**, Univ. Laval (Canada); **George Barbastathis**, Massachusetts Institute of Technology; **Fred R. Beyette, Jr.**, Univ. of Cincinnati; **David P. Casasent**, Carnegie Mellon Univ.; **H. John Caulfield**, Diversified Research Corp.; **Yeshaiahu Fainman**, Univ. of California/San Diego; **Pietro Ferraro**, Istituto Nazionale di Ottica Applicata (Italy); **James G. Grote**, Air Force Research Lab.; **Laurence G. Hassebrook**, Univ. of Kentucky; **Kazuyoshi Itoh**, Osaka Univ. (Japan); **Mohammad A. Karim**, Old Dominion Univ.; **Yao Li**, Alliance Fiber Optic Products Inc.; **Robert Magnusson**, Univ. of Connecticut; **Abhijit Mahalanobis**, Lockheed Martin Missiles and Fire Control; **Manuel Martínez-Corral**, Univ. de València (Spain); **Osamu Matoba**, Kobe Univ. (Japan); **Alastair D. McAulay**, Lehigh Univ.; **Maria S. Millán García-Varela**, Univ. Politècnica de Catalunya (Spain); **Nasser M. Nasrabadi**, Army Research Lab.; **Thomas J. Naughton**, National Univ. of Ireland/Maynooth (Ireland); **Takanori Nomura**, Wakayama Univ. (Japan); **Elisabet Pérez-Cabré**, Univ. Politècnica de Catalunya (Spain); **Ting-Chung Poon**, Virginia Polytechnic Institute and State Univ.; **Philippe Réfrégier**, Institut Fresnel (France); **Nabeel A. Riza**, College of Optics & Photonics/Univ. of Central Florida; **Joseph Rosen**, Ben-Gurion Univ. of the Negev (Israel); **Firooz A. Sadjadi**, Lockheed Martin Corp.; **John T. Sheridan**, National Univ. of Ireland/Dublin (Ireland); **Jung-Young Son**, Hanyang Univ. (South Korea); **Clay J. Stanek**, DataPath, Inc.; **Enrique Tajahuerce**, Univ. Jaume I (Spain); **Jun Tanida**, Osaka Univ. (Japan); **Shyh-Lin Tsao**, National Taiwan Normal Univ. (Taiwan); **Kelvin H. Wagner**, Univ. of Colorado/Boulder; **Cardinal Warde**, Massachusetts Institute of Technology; **Frank Wyrowski**, Friedrich-Schiller-Univ. Jena (Germany); **Toyohiko Yatagai**, Univ. of Tsukuba (Japan); **Francis T. S. Yu**, The Pennsylvania State Univ.; **Maria J. Yzuel**, Univ. Autònoma de Barcelona (Spain)

Tuesday 28 August

SESSION 1 . . . . . Tues. 1:30 to 3:20 pm

Switching and Interconnects

Chair: **Guoqiang Li**, College of Optical Sciences/The Univ. of Arizona

New active device design: routing wavelength switch based on 2x2 micro-ring resonators *(Invited Paper)*, S. Tsao, H. Chang, C. Chu, National Taiwan Normal Univ. (Taiwan) . . . . . [6695-01]

All-optical switching triode based on negative feedback optical amplification effect in semiconductor optical amplifiers, J. Huh, Toyota Technological Institute (Japan) . . . . . [6695-02]

Active linear phase bandpass filter for DWDM systems with slanted gratings, B. Stelzig, U. Barabas, Univ. der Bundeswehr München (Germany) . . . . . [6695-03]

Optimization of optical switching with a ferroelectric liquid crystal modulator, I. S. Moreno, M. M. Sanchez-Lopez, P. Velásquez, Univ. Miguel Hernández de Elche (Spain) [6695-04]

Surface plasmon resonance based optical sensor design using spatial filtering, A. K. Ghosh, Univ. of Oklahoma; V. Siddharth, Indian Institute of Technology Kanpur (India) . . . . . [6695-05]

SESSION 2 . . . . . Tues. 3:50 to 5:20 pm

Digital Optical Computing I

Chair: **Shyh-Lin Tsao**, National Taiwan Normal Univ. (Taiwan)

All optical delay of images using slow light *(Invited Paper)*, J. C. Howell, R. M. Camacho, C. Broadbent, I. Ali Khan, Univ. of Rochester . . . . . [6695-06]

Optoelectronic logic gates based on synthesized diffracting phase gratings, R. L. Kobzarenko, H. L. Lysenko, Vinnytsia National Technical Univ. (Ukraine) . . . . . [6695-07]

Optronic quantum-size structure for the decision of the systems of linear algebraic equalizations of high orders, N. I. Zabolotna, S. V. Kostyuk, Vinnytsia National Technical Univ. (Ukraine) . . . . . [6695-08]

Design of half and full optical binary adders using the polarization optical processor architecture, Y. A. Zaghloul, ITR Technologies Inc.; A. R. M. Zaghloul, Georgia Institute of Technology . . . . . [6695-09]

Wednesday 29 August

Plenary Presentation . . . . . Wed. 8:30 to 9:15 am

Image and Signal Processing

3D Home Theatre Systems

Kristina M. Johnson, Duke Univ.

See pg. 13 for details.

SESSION 3 . . . . . Wed. 9:30 to 11:50 am

Digital Optical Computing II

Chair: **Mohammad A. Matin**, Univ. of Denver

Polarization optical processor, binary optical gates, wave polarization, thin films, and ellipsometry *(Invited Paper)*, A. R. M. Zaghloul, Georgia Institute of Technology; Y. A. Zaghloul, ITR Technologies Inc. . . . . [6695-10]

A method for factorization by means of digital optical computing and image compression, K. Nitta, Y. Tado, O. Matoba, T. Yoshimura, Kobe Univ. (Japan) . . . . . [6695-11]

Optical coherence photorefractive holographic imaging at 1.03-μm wavelength, G. Li, J. Thomas, N. N. Peyghambarian, College of Optical Sciences/The Univ. of Arizona . [6695-12]

Simulation of long-haul DWDM optical communication systems using dispersion-compensating Raman/EDFA hybrid amplifiers, M. A. P. M. de Andrade, J. M. M. M. de Almeida, Univ. de Trás-os-Montes (Portugal) . . . . . [6695-13]

The study of the elongation of pili with the aid of a dark-field microscope, T. Cheliang, H. Long, National Chiao Tung Univ. (Taiwan); K. Huang, Hsiuping Institute of Technology (Taiwan); K. Y. Hsu, National Chiao Tung Univ. (Taiwan) . . . . . [6695-14]

Lunch/Exhibition Break

SESSION 4 . . . . . Wed. 1:30 to 3:10 pm

3D Display

Chair: **Kouichi Nitta**, Kobe Univ. (Japan)

3D image acquisition with novel time-of-flight range camera and real time processing of the 3D data, B. Koenig, P. Mengel, L. Listl, Siemens AG (Germany); B. Hosticka, Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme (Germany) . . . . . [6695-15]

Multiviewing angle display and touch-panel interface system for collaborative task surrounding round table, K. Sakamoto, A. Tanaka, M. Adachi, Shimane Univ. (Japan) . . . . . [6695-16]

3D information acquisition using a compound imaging system, R. Horisaki, S. Irie, Y. Ogura, J. Tanida, Osaka Univ. (Japan) . . . . . [6695-17]

Virtual display: mirror image of dual-views display and interface system for extension of screen region, H. Morimoto, A. Tanaka, K. Sakamoto, Shimane Univ. (Japan) . . . . . [6695-18]

Light refraction modeling for computational Schlieren imaging in symmetrical flows, I. V. Ershov, Y. D. Babichev, Central Research Institute of Machine Building (Russia) . . . . . [6695-19]

SESSION 5 . . . . . Wed. 3:40 to 5:30 pm

Fourier Optics

Chair: **Abdul R. Alsamman**, Univ. of New Orleans

Using Matlab to help teach Fourier optics *(Invited Paper)*, S. M. Schultz, Brigham Young Univ. . . . . [6695-20]

Estimation bias from using nonlinear Fourier plane correlators for subpixel image shift measurement and implications for the binary joint transform correlator, T. J. Grycewicz, C. J. Florio, B. E. Evans, The Aerospace Corp. . . . . [6695-21]

Reduction of multipath interference in a few mode fibers using spatial filters, H. Wang, S. Kumar, McMaster Univ. (Canada) . . . . . [6695-22]

Fast computation of computer-generated holography using reduced look-up table, E. S. Kim, S. Kim, Kwangwoon Univ. (South Korea) . . . . . [6695-23]

Fractional representation of generalized ambiguity function and its application in optical systems, Y. M. Kozlovskii, Institute for Condensed Matter Physics (Ukraine) . [6695-24]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

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✔ **Example of a holographic multigate array (HMGA),** E. Rodriguez-Vázquez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6695-40]

✔ **Polarization beam splitter for two-dimensional photonic crystal self-collimation devices,** R. Chen, H. Wei, Lunghwa Univ. of Science and Technology (Taiwan) . . . . . [6695-41]

✔ **Using optical properties of semiconductor structures for transparents realization,** I. V. Mialkivska, H. L. Lysenko, Vinnytsia National Technical Univ. (Ukraine) . . . . . [6695-42]

✔ **Revolving lantern display using holographic 3D images with 1/f fluctuation,** K. Sakamoto, K. Uchida, H. Fukuda, Shimane Univ. (Japan) . . . . . [6695-43]

✔ **Three-dimensional reconstruction using integral imaging technique of captured images by holographic method,** E. S. Kim, S. Kim, P. Shukhbat, Kwangwoon Univ. (South Korea) . . . . . [6695-44]

✔ **Electroholographic display with SLM,** C. Dai, Shanghai Univ. (China) . . . . . [6695-45]

- ✔ **Optical encryption in single shot digital holography,** C. Lin, National Central Univ. (Taiwan); G. L. Chen, M. K. Kuo, National Defense Univ. (Taiwan); C. C. Chang, Ming Dao Univ. (Taiwan) . . . . . [6695-46]
- ✔ **A whole smart scheme in adaptive target detection for complex practical application,** H. Jia, Univ. of Electronic Science and Technology of China (China) . . . . . [6695-47]
- ✔ **Application of digital signal processing in interferometry,** X. Ding, Z. Zhao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [6695-48]
- ✔ **Micro-lens array design and interactive simulation technique for practical integral imaging system,** E. S. Kim, S. Kim, J. Lee, Kwangwoon Univ. (South Korea) . . . . . [6695-49]
- ✔ **Generation of diffracted free fields and dark hollow beams using spatial filtering,** G. C. Martinez-Niconoff, J. L. Munoz-Lopez, G. Hernandez-Orduna, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6695-50]
- ✔ **Illumination-invariant adaptive joint transform correlator,** V. H. Diaz, V. Kober, Ctr. de Investigación Científica y de Educación Superior de Ensenada (Mexico) . . . . . [6695-51]
- ✔ **Recording multiple holograms by one beam in $LiNbO_3$ crystal,** C. Lin, National Central Univ. (Taiwan); W. Yang, W. Wu, L. Tang, National Defense Univ. (Taiwan); C. Chang, Ming Dao Univ. (Taiwan) . . . . . [6695-52]
- ✔ **Performance comparisons of amplitude object and phase object recording in $LiNbO_3$ crystal,** C. Lin, M. Wu, National Central Univ. (Taiwan); J. Liu, Feng-Chia Univ. (Taiwan); H. Yau, National Central Univ. (Taiwan) . . [6695-53]
- ✔ **An improved quantum key distribution protocol,** T. Wu, G. Wu, South China Univ. of Technology (China) . . [6695-54]
- ✔ **Identification of THz absorption spectra of chemicals,** J. Shen, Y. Jia, Capital Normal Univ. (China) . . . . . [6695-55]
- ✔ **Based on the CMOS image sensor image gathering system design,** Y. Hou, Z. Zhao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [6695-56]
- ✔ **A model of a perceptron, based on optoelectronic elements,** T. B. Martyniuk, I. V. Moroz, R. L. Kobzarenko, Vinnytsia National Technical Univ. (Ukraine) . . . . . [6695-57]
- ✔ **Study of photorefractive recording in Ce:Cu:$LiNbO_3$ on the wavelengths dependence,** W. Liu, Shanghai Univ. (China) . . . . . [6695-58]
- ✔ **Effect of geometry on thermoelastic damping in MEMS,** H. Tang, Y. Yi, M. A. Matin, Univ. of Denver . . . . . [6695-60]
- ✔ **MEMS sensors for hearing aid application,** H. Tang, Y. Yi, Univ. of Denver . . . . . [6695-59]

Thursday 30 August

SESSION 6 . . . . . Thurs. 8:30 to 10:00 am

Algorithms for Image Processing I

Chair: **Abhijit Mahalanobis**, Lockheed Martin Missiles and Fire Control

Optics inspection for the National Ignition Facility *(Invited Paper)*, S. G. Azevedo, A. D. Conder, J. J. Chang, W. H. Williams, M. L. Spaeth, J. A. Liebman, P. K. Whitman, M. C. Nostrand, L. M. Kegelmeyer, S. M. Glenn, Lawrence Livermore National Lab. . . . . [6695-25]

Multi-reference pseudo-random phase-encoded, A. R. Alsamman, Univ. of New Orleans . . . . . [6695-26]

A biologically inspired neural network model to transformation invariant object recognition, K. M. Iftekharuddin, Y. Li, F. Siddiqui, The Univ. of Memphis[6695-27]

Optical electronic systems for face recognition on the base of adaptive image moments features, V. L. Perju, Technical Univ. of Moldova (Moldova); D. P. Casasent, Carnegie Mellon Univ.; A. Crivat, Technical Univ. of Moldova (Moldova)[6695-28]

SESSION 7 . . . . . Thurs. 10:30 am to 12:20 pm

Algorithms for Image Processing II

Chair: **Yusuke Ogura**, Osaka Univ. (Japan)

Key-space analysis of double random phase encryption algorithm *(Invited Paper)*, D. S. Monaghan, G. Situ, J. P. Ryle, U. Gopinathan, National Univ. of Ireland/Dublin (Ireland); T. J. Naughton, National Univ. of Ireland/Maynooth (Ireland); J. T. Sheridan, National Univ. of Ireland/Dublin (Ireland) [6695-29]

Uncertainty detection for NIF normal pointing images, A. A. S. Awwal, C. Law, S. W. Ferguson, Lawrence Livermore National Lab. . . . . [6695-30]

Color digital holography using wavelength-tunable three-color lasers, Y. Ishii, J. Sato, Tokyo Univ. of Science (Japan); T. Takahashi, R. Onodera, Univ. of Industrial Technology (Japan) . . . . . [6695-31]

Pattern recognition of multiple objects using adaptive filters, M. I. Pinedo, V. I. Kober, Ctr. de Investigación Científica y de Educación Superior de Ensenada (Mexico) . . [6695-32]

Failure prediction in monitoring and control systems using Bayesian networks, S. Bottone, DataPath, Inc.; C. J. Stanek, Datapath, Inc. . . . . [6695-33]

Lunch/Exhibition Break

SESSION 8 . . . . . Thurs. 1:40 to 3:40 pm

EO Devices

Chair: **James G. Grote**, Air Force Research Lab.

Pulse amplitude equalization of RHMLFL with nonlinear parameter consideration, S. Tsao, N. Liu, L. Hu, National Taiwan Normal Univ. (Taiwan) . . . . . [6695-34]

Applying a two-phonon light scattering in crystals to the spectrum analysis of radio signals, A. S. Shcherbakov, S. E. Balderas-Mata, E. Tepichin-Rodriguez, A. Luna Castellanos, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); J. Maximov, Molecular Technology GmbH (Germany)[6695-35]

Adaptive single crystal holographic interferometer and applications, G. E. Dovgalenko, ITT Technical Institute; A. Dagdanova, Eastern Virginia Medical School . . . . . [6695-36]

A CPW-fed broadband two-way electro-optic probe, S. Tsao, Y. Kuo, National Taiwan Normal Univ. (Taiwan) [6695-37]

Verification of interferometric synthetic aperture microscopy with optical coherence microscopy, T. S. Ralston, D. L. Marks, S. A. Boppart, P. S. Carney, Univ. of Illinois at Urbana-Champaign . . . . . [6695-38]

Optoisolators simplify amplifier design, J. W. Ting, Institute of Atomic and Molecular Sciences (Taiwan) . . . . . [6695-39]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC017 Principles of Fourier Optics and Diffraction (Gaskill) Tuesday 28, 8:30 am - 5:30 pm

Conference 6696

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6696

Applications of Digital Image Processing XXX

Conference Chair: **Andrew G. Tescher**, AGT Associates

Program Committee: **Bernard V. Brower**, Eastman Kodak Co.; **Wo L. Chang**, National Institute of Standards and Technology; **Touradj Ebrahimi**, École Polytechnique Fédérale de Lausanne (Switzerland) and Emitall S.A. (Switzerland); **Ali Habibi**, The Aerospace Corp.; **T. Russell Hsing**, Telcordia Technologies, Inc.; **Chun-Chien J. Kuo**, Univ. of Southern California; **Catherine Lambert-Nebout**, Ctr. National d'Études Spatiales (France); **Andre J. Oosterlinck**, Katholieke Univ. Leuven (Belgium); **Sethuraman Panchanathan**, Arizona State Univ.; **John A. Saghri**, California Polytechnic State Univ.; **Peter Schelkens**, Vrije Univ. Brussel (Belgium); **Pankaj Topiwala**, FastVDO LLC; **Mihaela van der Schaar**, Univ. of California/Los Angeles; **Bhaskaran Vasudev**, Marvell Semiconductor, Inc.

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:40 to 11:50 am

Video and Image Technologies

Chair: **Andrew G. Tescher**, AGT Associates

A comparative study of JPEG2000, H.264/AVC and HD photo, T. Ebrahimi, École Polytechnique Fédérale de Lausanne (Switzerland) and Emitall S.A. (Switzerland), A.G. Tescher, AGT Associates, Frédéric Dufaux, École Polytechnique Fédérale de Lausanne (Switzerland) and Emitall S.A. (Switzerland), Mourad Ouaret, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6696-01]

Complexity modeling for context-based adaptive binary arithmetic coding (CABAC) in H.264/AVC decoder, S. Lee, C. C. J. Kuo, Univ. of Southern California . . . . . [6696-02]

Low-complexity MPEG-2 to H.264 transcoding, J. Lievens, Vrije Univ. Brussel (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); D. Van de Walle, J. De Cock, Univ. Gent (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); J. Barbarien, Vrije Univ. Brussel (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); R. Van de Walle, Univ. Gent (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); P. Schelkens, Vrije Univ. Brussel (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium) . . . . . [6696-03]

PixonVision real-time video processor, R. C. Puetter, Pixon LLC; R. G. Hier, DigiVision, Inc. . . . . [6696-04]

Performance evaluation of H.264/AVC decoders using the GPU, B. Pieters, D. Van Rijsselbergen, W. M. De Neve, R. Van de Walle, Univ. Gent (Belgium) . . . . . [6696-05]

Performance analysis of outer and inner boundary matching algorithm in H.264 video coding, T. Thaipanich, P. Wu, C. C. J. Kuo, Univ. of Southern California . . . . [6696-06]

Quality metrics for image rescaling, H. Kim, The Pennsylvania State Univ. . . . . [6696-07]

Compressed-domain motion detection for efficient and error-resilient MPEG-2 to H.264 transcoding, J. Lievens, Vrije Univ. Brussel (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); P. Lambert, D. Van de Walle, Univ. Gent (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); F. Dawoud, J. Barbarien, Vrije Univ. Brussel (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); R. Van de Walle, Univ. Gent (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium); P. Schelkens, Vrije Univ. Brussel (Belgium) and Interdisciplinary Institute for Broadband Technology (Belgium) . . . . . [6696-08]

Lunch/Exhibition Break

SESSION 2 . . . . . Tues. 1:20 to 5:50 pm

Processing and Implementation Technologies I

Chair: **Touradj Ebrahimi**, Ecole Polytechnique Fédérale de Lausanne (Switzerland) and Emitall S.A. (Switzerland)

An EO surveillance system for harbor security, K. Thyagarajan, R. Patterson, Micro USA, Inc. . . . . [6696-09]

Image analysis for the identification of coherent structures in plasma, N. S. Love, C. Kamath, Lawrence Livermore National Lab. . . . . [6696-10]

Real-time detection of targets in hyperspectral images using radial basis neural network filtering, T. G. Thomas, Univ. of South Alabama . . . . . [6696-11]

PixonVision real-time deblurring, anisoplanaticism corrector (DAC), R. G. Hier, DigiVision, Inc.; R. C. Puetter, Pixon LLC . . . . . [6696-12]

ATR for 3D medical imaging, T. P. Jannson, A. A. Kostrzewski, P. Paki-Amouzou, Physical Optics Corp.[6696-13]

Studies of image enhancement methods for the visually impaired, O. Bogillo, U. Efron, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6696-14]

An efficient method of noise suppression in security systems, K. Fliegel, J. Svihlik II, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6696-15]

Toward a tongue-based task triggering interface for computer interaction, L. R. Sapaico, S. Saito, Tokyo Institute of Technology (Japan); M. Nakajima, Tokyo Institute of Technology (Japan) and National Institute of Informatics (Japan) . . . . . [6696-16]

Iris recognition using directional energy, R. W. Ives, L. Kennell, R. Broussard, D. Soldan, U.S. Naval Academy . . . . . [6696-17]

APE phasing signal analysis, I. Surdej, N. Yaitskova, European Southern Observatory (Germany) . . . . . [6696-18]

Exploitation of hyperspectral imagery using adaptive resonance theory methods, R. S. Rand, U.S. Army Engineer Research and Development Ctr. . . . . [6696-19]

Forest species classification using hyperspectral remote sensing data and singular spectrum analysis, B. Hu, Q. Li, York Univ. (Canada) . . . . . [6696-20]

Wednesday 29 August

Plenary Presentation . . . . . Wed. 8:30 to 9:15 am

Image and Signal Processing 3D Home Theatre Systems

Kristina M. Johnson, Duke Univ.

See pg. 13 for details.

SESSION 3 . . . . . Wed. 9:30 am to 12:05 pm

Interaction Between Image Processing, Optics, and Photonics

Chair: **Peter Schelkens**, Vrije Univ. Brussel (Belgium)

Wavelet-based denoising for 3D OCT images, V. Zlokolica, L. Jovanov, A. Pizurica, W. Philips, Univ. Gent (Belgium) . . . . . [6696-21]

Improved invariant optical correlations for 3D target detection, P. García-Martínez, J. J. Vallés, J. García-Monreal, C. Ferreira, Univ. de València (Spain) . . . . . [6696-22]

Optical resources for highly secure remote object authentication, M. S. Millán García-Varela, E. Pérez-Cabré, Univ. Politècnica de Catalunya (Spain); B. Javidi, Univ. of Connecticut . . . . . [6696-23]

Multidimensional illumination and image processing techniques in the W-band for recognition of concealed objects, J. Stiens, L. Zhang, A. Elhawil, I. Jaeger, G. Koers, H. Sahli, P. Schelkens, Vrije Univ. Brussel (Belgium) . . [6696-24]

Object specific compressed sensing, A. Mahalanobis, R. R. Muise, Lockheed Martin Missiles and Fire Control . [6696-25]

Lunch/Exhibition Break

SESSION 4 . . . . . Wed. 1:30 to 5:45 pm

Mobile Video

Chair: **Bhaskaran Vasudev**, Marvell Semiconductor, Inc.

Sparse directional transforms for superresolution reconstruction of mobile video, S. Kanumuri, O. G. Guleryuz, DoCoMo Communications Labs. USA, Inc. . . . . [6696-26]

Superresolution mobile video based on fractal theory and post-processing techniques, J. J. Young, C. J. Kuo, Univ. of Southern California . . . . . [6696-27]

Stochastic classification/regression framework for single-image superresolution, K. Ni, T. Q. Nguyen, Univ. of California/San Diego . . . . . [6696-28]

The intensity reduction of ground shadow to deliver better viewing experiences of soccer videos, J. Ko, J. Lee, C. Kim, Information and Communications Univ. (South Korea); B. Vasudev, Marvell Semiconductor, Inc. . . . . [6696-29]

Real-time H.264 HD video decode on the graphics processing unit, W. Chen, J. C. Arevalo Baeza, D. Dinu, Microsoft Corp. . . . . [6696-30]

Document processing for mobile imaging, C. Liu, Epson Research & Development, Inc. . . . . [6696-31]

A cross-layer adaptive handoff algorithm in wireless multimedia environments, T. N. Lin, L. Chen, C. Wang, National Taiwan Univ. (Taiwan) . . . . . [6696-32]

Improving error resilience of wireless streaming through transcoding, W. Tan, A. J. Patti, B. Shen, Hewlett-Packard Labs. . . . . [6696-33]

Coding and optimization of a fully scalable motion model, M. Kao, T. Q. Nguyen, Univ. of California/San Diego [6696-34]

✔ Posters-Wednesday

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✔ **Automatic segmentation of brain CT image based on multiplicate features and decision tree,** Y. Hu, Univ. of Electronic Science and Technology of China (China) . . . . . [6696-53]

✔ **Morphology based iris localization scheme,** F. Gui, Hua Qiao Univ. (China) . . . . . [6696-54]

✔ **Automatic segmentation of moving objects in video sequences based on spatio-temporal information,** L. Mao, X. Mei, J. Li, Univ. of Electronic Science and Technology of China (China) . . . . . [6696-55]

✔ **Segmentation of moving target based on double displacement block matching,** T. Liu, X. Mei, Univ. of Electronic Science and Technology of China (China) . . . . . [6696-56]

✔ **Bayesian approach to the thermally generated charge elimination,** J. Svihlik II, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6696-57]

✔ **Make it easy: automatic pictogram generation system enables everybody to design illustrations by computer-aided technology,** K. Sakamoto, M. Adachi, T. Ishihara, Shimane Univ. (Japan) . . . . . [6696-58]

✔ **Development of air touch interface for floating 3D image in the air,** K. Sakamoto, H. Fukuda, H. Morimoto, Shimane Univ. (Japan) . . . . . [6696-59]

✔ **Video viewing browser enables to playback movie contents reproduced by using scene scenario in real-time,** K. Sakamoto, T. Ishihara, K. Uchida, Shimane Univ. (Japan) . . . . . [6696-60]

✔ **Pattern recognition with an adaptive generalized SDF filter,** E. M. Ramos Michel, V. I. Kober, Ctr. de Investigación Científica y de Educación Superior de Ensenada (Mexico) . . . . . [6696-61]

✔ **Research of the camera calibration based on digital image processing,** L. Gu, S. Guo, R. Ren, Jilin Univ. (China) . . . . . [6696-62]

✔ **Ideas for monitoring and evaluating environmental status at mining areas by remote sensing and GIS techniques,** Y. Liu, Chinese Academy of Surveying and Mapping (China); J. Zhang, China Institute of Geo-Environment Monitoring (China) . . . . . [6696-63]

✔ **Research of the application of ESPI in NDT of small components,** H. Chen, Z. Zhao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [6696-64]

✔ **The new methods for registration and integration of range images,** X. L. Liu, A. M. Li, P. D. Gao, J. D. Tian, X. Peng, Shenzhen Univ. (China) . . . . . [6696-65]

✔ **Pattern recognition with adaptive nonlinear filters,** S. Martinez-Diaz, V. Kober, Ctr. de Investigación Científica y de Educación Superior de Ensenada (Mexico) . . . . . [6696-66]

✔ **Color component cross-talk pixel SNR correction method for color imagers,** B. McCleary, Raytheon Co. . . . . [6696-67]

✔ **Holographic projection system for 3D shape reconstruction using temporal phase unwrapping,** C. A. Gonzalez, A. Davila, G. Garnica, Ctr. de Investigaciones en Óptica (Mexico) . . . . . [6696-68]

✔ **Image derived modulation transfer function and its applications for underwater imaging,** W. Hou, A. D. Weidemann, D. J. Gray, Naval Research Lab.; G. R. Fournier, Defence R&D Canada/Valcartier (Canada) . . . . . [6696-69]

✔ **Local adaptive image processing in a sliding transform domain,** J. Gomez-Agis, V. Kober, Ctr. de Investigación Científica y de Educación Superior de Ensenada (Mexico) . . . . . [6696-70]

✔ **Compressed domain statistical snake segmentation for real-time tracking of objects in airborne videos,** S. Zhang, College of Staten Island/CUNY; M. Chen, Binghamton Univ. . . . . [6696-71]

✔ **Hyperspectral end-member detection based on strong lattice independence,** J. C. Valdiviezo-Navarro, G. Urcid-Serrano, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6696-72]

✔ **A study of image quality analysis for a cutaneous capillary imaging system,** C. Wu, Chung Yuan Christian Univ. (Taiwan) . . . . . [6696-73]

✔ **Removing foreground objects by using depth information in multiview camera system,** J. Lee, C. Kim, Information and Communications Univ. (South Korea) . . . . . [6696-74]

✔ **Still image compression using cubic spline interpolation with bit-plane compensation,** T. Lin, I-Shou Univ. (Taiwan); S. Chen, Shu-Te Univ. (Taiwan); T. Truong, I-Shou Univ. (Taiwan) . . . . . [6696-75]

✔ **Blind image quality assessment considering blur, noise, and JPEG compression distortions,** E. Cohen, Y. Yitzhaky, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6696-76]

✔ **2D to 3D stereoscopic conversion: depth-map estimation in a 2D single-view image,** J. Ko, Information and Communications Univ. (South Korea); M. Kim, Kangwon National Univ. (South Korea); C. Kim, Information and Communications Univ. (South Korea) . . . . . [6696-77]

✔ **Contribution of image analysis to the definition of explosibility of fine particles resulting from waste recycling process,** F. La Marca, V. Gente, Univ. degli Studi di Roma La Sapienza (Italy) . . . . . [6696-78]

✔ **Watershed data aggregation for mean-shift video segmentation,** N. I. Petrovic, J. De Bock, A. Pizurica, W. Philips, Univ. Gent (Belgium) . . . . . [6696-79]

✔ **Evaluation of pork bellies using color image processing,** F. Cheng, Y. Ying, Zhejiang Univ. (China) . . . . . [6696-80]

✔ **Image blur analysis for the subpixel-level measurement of in-plane vibration parameters of MEMS resonators,** H. V. Le, Vietnam National Univ. (Vietnam) and Univ. Paris-Sud II (France); B. Zavidovique, A. Bosseboeuf, M. Gouiffes, F. Parrain, Univ. Paris-Sud II (France) . . . . . [6696-81]

✔ **Image segmentation based on fractal features extracting and neural network,** F. Gui, Hua Qiao Univ. (China) . . . . . [6696-82]

✔ **Validation of training set approaches to hyperparameter estimation for Bayesian tomography,** S. Lee, Paichai Univ. (South Korea) . . . . . [6696-83]

✔ **Local bivariate Cauchy distribution for video denoising in 3D complex wavelet domain,** H. Rabbani, Amirkabir Univ. of Technology (Iran) . . . . . [6696-84]

✔ **Local area signal-to-noise ratio (LASNR) algorithm for image segmentation,** L. M. Kegelmeyer, P. Fong, S. M. Glenn, J. A. Liebman, Lawrence Livermore National Lab. . . . . [6696-85]

✔ **Recovery of data from damaged CD/DVD,** D. E. Tamir, W. P. Davis, Texas State Univ. San Marcos; R. McNiece, L. Wolfe, Lucere Data Inc. . . . . [6696-86]

✔ **New quality metrics for digital image resizing,** H. Kim, S. Kumara, The Pennsylvania State Univ. . . . . [6696-87]

✔ **Application of digital image processing method for fish age estimation,** T. Wu, J. Hong, South China Univ. of Technology (China) . . . . . [6696-88]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:40 am to 12:10 pm

Special Session: IDCT

Chair: **Pankaj Topiwala**, FastVDO LLC

Standardization of IDCT approximation behavior for video compression: the history and the new MPEG-C parts 1 and 2 standards, G. J. Sullivan, Microsoft Corp. . . . . [6696-35]

From 16-bits to high accuracy: fruits of single-architecture affiliation, T. Tran, L. Liu, P. Topiwala, FastVDO LLC [6696-36]

Analysis of accuracy and drift in low-complexity IDCT solutions, G. J. Sullivan, Microsoft Corp. . . . . [6696-37]

Drift analyses for integer IDCT, Z. Ni, L. Yu, Zhejiang Univ. (China) . . . . . [6696-38]

Multiplierless approximation of the IDCT/DCT with low complexity and high accuracy, C. Zhang, Zhejiang Univ. (China) and Tampere Univ. of Technology (Finland); L. Yu, Zhejiang Univ. (China) . . . . . [6696-39]

An accurate fixed-point 8x8 IDCT algorithm based on 2D, I. Amer, W. Badawy, V. S. Dimitrov, G. A. Jullien, Univ. of Calgary (Canada) . . . . . [6696-40]

Efficient fixed-point approximation of 8x8 inverse discrete cosine transform, Y. A. Reznik, Qualcomm, Inc.; A. T. Hinds, IBM Corp.; C. Zhang, L. Yu, Z. Ni, Zhejiang Univ. (China) . . . . . [6696-41]

A full 2D IDCT with extremely low complexity, A. Navarro, A. Silva, Univ. de Aveiro (Portugal); Y. A. Reznik, Qualcomm, Inc. . . . . [6696-42]

A low-complexity 16-bit architecture, L. M. Bivolarski, Bright Scale . . . . . [6696-43]

Lunch/Exhibition Break

SESSION 6 . . . . . Thurs. 1:40 to 5:10 pm

Processing and Implementation Technologies II

Chair: **John A. Saghri**, California Polytechnic State Univ.

Regularization for designing spectral matched filter target detectors, N. M. Nasrabadi, Army Research Lab. . [6696-44]

Improving the accuracy of digital reconstruction of in-line point-source (Fresnel) holograms, L. Livadaru, Univ. of Alberta (Canada); R. A. Wolkow, National Institute for Nanotechnology (Canada) and Univ. of Alberta (Canada) . . . . . [6696-45]

SAR ATR using least squared rectangular box fit and Bayesian multifeature fusion/matching, J. A. Saghri, D. A. Cary, California Polytechnic State Univ. . . . . [6696-46]

Identification of degraded fingerprints using PCA and ICA-based features, M. Mehrübeoglu, Texas A&M Univ.-Corpus Christi; L. McLauchlan, Texas A&M Univ. . . . . [6696-47]

Using human body gestures as inputs for gaming through depth analysis, Y. Wang, L. Shi, Z. Li, Motorola, Inc.; T. Yu, Univ. of Illinois at Urbana-Champaign . . . . . [6696-48]

Building verification from geometrical and photometric cues, C. Beumier, Royal Belgian Military Academy (Belgium) . . . . . [6696-49]

Automatic license plate identification, M. S. Alam, M. M. Islam, Univ. of South Alabama . . . . . [6696-50]

Exploiting sub-pixel edge detection methods with high density sampling to provide .001 pixels rigid target localization, J. F. Gray, Univ. of New Orleans . . . . [6696-51]

Speckle removal from digital holograms by simulating temporal incoherence, B. M. Hennelly, J. Maycock IV, J. McDonald, T. J. Naughton, National Univ. of Ireland/Maynooth (Ireland); D. P. Kelly, Jr., Technische Univ. Wien (Austria) . . . . . [6696-52]

OPTICS

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC017 Principles of Fourier Optics and Diffraction (Gaskill) Tuesday 28, 8:30 am - 5:30 pm

SC661 Advanced Image Processing and Applications (Iftekharuddin) Monday 27, 8:30 am - 5:30 pm

SC728 Network Centric Target Tracking and Classification (Drummond) Monday 27, 8:30 am - 5:30 pm

Conference 6697

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6697

Advanced Signal Processing Algorithms, Architectures, and Implementations XVII

Conference Chair: **Franklin T. Luk**, Hong Kong Baptist Univ. (Hong Kong China)

Program Committee: **Daniela Calvetti**, Case Western Reserve Univ.; **Leon Cohen**, Hunter College/CUNY; **W. Randolph Franklin**, Rensselaer Polytechnic Institute; **Graham A. Jullien**, Univ. of Calgary (Canada); **Patrick J. Loughlin**, Univ. of Pittsburgh; **Alexandre F. Tenca**, Synopsys, Inc.; **William J. Williams**, Univ. of Michigan; **Kung Yao**, Univ. of California/Los Angeles

Sunday 26 August

SESSION 1 . . . . . Sun. 1:30 to 3:10 pm

Scientific Computing

Chair: **Daniela Calvetti**, Case Western Reserve Univ.

On matrix-vector product based subquadratic arithmetic complexity schemes for field multiplication, A. Hasan, Univ. of Waterloo (Canada) . . . . . [6697-01]

The processing of white -ight interferograms by the S transform, Z. Sarac, Zonguldak Karaelmas Üniv. (Turkey) . . . . . [6697-02]

Numerical properties of the LLL method, F. T. Luk, Hong Kong Baptist Univ. (Hong Kong China); S. Qiao, McMaster Univ. (Canada) . . . . . [6697-03]

Hyperpriors, Bayesian learning, and prior conditioners for signal and image processing, D. Calvetti, Case Western Reserve Univ.; E. Somersalo, Helsinki Univ. of Technology (Finland) . . . . . [6697-04]

Face recognition algorithm in hyperspectral imagery by employing the K-means clustering method and the Mahalanobis distance, M. I. Elbakary, M. S. Alam, M. S. Aslan, Univ. of South Alabama . . . . . [6697-05]

SESSION 2 . . . . . Sun. 3:40 to 5:40 pm

Time Frequency

Chair: **Leon Cohen**, Hunter College/CUNY

Rapid transient superresolution frequency tracking via generalized ESPRIT, R. M. Nickel, The Pennsylvania State Univ. . . . . [6697-06]

An exact time-varying noise model, L. Cohen, Hunter College/CUNY . . . . . [6697-07]

A scale cross-ambiguity function for Doppler and delay estimation, D. C. Smith, U.S. Dept. of Defense; D. J. Nelson, National Security Agency . . . . . [6697-08]

High-resolution correlation, D. J. Nelson, National Security Agency . . . . . [6697-09]

Time-varying spectral analysis in exercise and sport science, B. A. Frishberg, South Carolina State Univ.; L. Galleani, Politecnico di Torino (Italy); L. Cohen, Hunter College/CUNY . . . . . [6697-10]

Construction of time-frequency representations from moments, P. J. Loughlin, Univ. of Pittsburgh; K. L. Davidson, Univ. of Washington; L. Cohen, Hunter College/CUNY[6697-11]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 3 . . . . . Mon. 8:30 to 10:10 am

Imaging

Chair: **W. Randolph Franklin**, Rensselaer Polytechnic Institute

High-resolution imaging through strong turbulence, D. A. Hope, S. M. Jefferies, C. Giebienk, Univ. of Hawaii [6697-12]

Refocusing of defocused images using SAR2 algorithm, J. Burki, C. F. Barnes, Georgia Institute of Technology [6697-13]

A comparative evaluation of image background subtraction techniques, A. K. Jain, D. V. Rabinkin, MIT Lincoln Lab. . . . . [6697-14]

Surface compression using over-determined Laplacian approximation, Z. Xie, W. R. Franklin, M. Inanc, Rensselaer Polytechnic Institute . . . . . [6697-15]

Path planning on lossily compressed terrain, D. Tracy, W. R. Franklin, Rensselaer Polytechnic Institute . . . . . [6697-16]

SESSION 4 . . . . . Mon. 10:40 am to 12:20 pm

Sensor Networks

Chair: **Kung Yao**, Univ. of California/Los Angeles

Seismic-array signal processing for moving source localization, J. Stafsudd, R. E. Hudson, E. Taciroglu, K. Yao, Univ. of California/Los Angeles . . . . . [6697-17]

Theoretical and experimental study of DOA estimation using AML algorithm for an isotropic and non-isotropic 3D array, S. Asgari, A. Ali, T. C. Collier, Y. Yao, R. E. Hudson, K. Yao, C. E. Taylor, Univ. of California/Los Angeles . . [6697-18]

Optimal location of feedback handler under receiver contention schemes for routing in wireless networks, P. Huang, B. Krishnamachari, Univ. of Southern California . . . . . [6697-19]

Joint design of scheduling and routing based on connected coverage for optimal sensor network lifetime, T. Zhao, Q. Zhao, Univ. of California/Davis . . . . . [6697-20]

Optical infrared flame detection with neural networks, J. J. Huseynov, Univ. of California/Irvine; S. B. Baliga, General Monitors, Inc. . . . . [6697-21]

Lunch Break

SESSION 5 . . . . . Mon. 1:30 to 3:10 pm

Computer Arithmetic

Chair: **Graham A. Jullien**, Univ. of Calgary (Canada)

An improved reciprocal approximation algorithm for a Newton Raphson divider, G. Agrawal, A. Khandelwal, E. E. Swartzlander, Jr., The Univ. of Texas at Austin . . . . [6697-22]

A library for prototyping the computer arithmetic level in elliptic curve cryptography, L. Imbert, A. Peirera, A. Tisserand, Univ. Montpellier II (France) . . . . . [6697-23]

Pairing in cryptography: an arithmetic point of view, J. Bajard, N. El Mrabet, Univ. Montpellier II (France) . [6697-24]

Double base numbers in computer arithmetic optimization, A. J. Zakaluzny, Univ. of Calgary (Canada) . . . . . [6697-25]

Fast numerical algorithm for ultrashort THz pulse diffraction, D. P. Kelly, Jr., Technische Univ. Wien (Austria); B. M. Hennelly, National Univ. of Ireland/Maynooth (Ireland); J. Darmo, K. Unterrainer, Technische Univ. Wien (Austria) . . . . . [6697-26]

SESSION 6 . . . . . Mon. 3:40 to 5:20 pm

Computer Arithmetic II

Chair: **Alexandre F. Tenca**, Synopsys, Inc.

FPGA implementation of limited precision soft-decision LDPC decoding, R. Moberly, M. O'Sullivan, K. Waheed, San Diego State Univ. . . . . [6697-27]

Complex multiply add and other related operators, M. D. Ercegovac, Univ. of California/Los Angeles; J. Muller, Ecole normale supérieure de Lyon (France) . . . . . [6697-28]

ISA extensions for high-radix online floating-point addition, P. Dormiani, M. D. Ercegovac, Univ. of California/Los Angeles; O. Colavin, STMicroelectronics . . . . . [6697-29]

Carry length distribution analysis for self-timed asynchronous adders, A. A. Liddicoat, L. A. Slivovsky, A. Clarkson, California Polytechnic State Univ. . . . . [6697-30]

Decimal floating-point arithmetic units, M. J. Schulte, L. Wang, S. C. Tsen, Jr., Univ. of Wisconsin/Madison; S. G. Navarro, Univ. de Malaga (Spain) . . . . . [6697-31]

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Conference 6698

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6698

Photonic Fiber and Crystal Devices: Advances in Materials and Innovations in Device Applications

Conference Chairs: **Ruyan Guo**, The Pennsylvania State Univ.; **Shizhuo S. Yin**, The Pennsylvania State Univ.; **Francis T. S. Yu**, The Pennsylvania State Univ.

Program Committee: **Partha P. Banerjee**, Univ. of Dayton; **Kung-Li Deng**, GE Global Research; **Joseph Grant**, NASA Stennis Space Ctr.; **Ken Y. Hsu**, National Chiao Tung Univ. (Taiwan); **Tracy D. Hudson**, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Suganda Jutamulia**, Consultant (China); **Eckhard Kratzig**, Univ. Osnabrück (Germany); **John S. Kruger**, U.S. Army Research Office; **Nickolai V. Kukhtarev**, Alabama A&M Univ.; **Ravindra B. Lal**, Alabama A&M Univ.; **Byoungho Lee**, Seoul National Univ. (South Korea); **Sergei F. Lyuksyutov**, Univ. of Akron; **Karl M. Reichard**, The Pennsylvania State Univ.; **Gérald Roosen**, Institut d'Optique (France); **Paul B. Ruffin**, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Ching-Cherng Sun**, National Central Univ. (Taiwan)

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:20 am

Advances in Materials Synthesis, Property, and Characterization I

Chair: **Ruyan Guo**, The Pennsylvania State Univ.

Pyroelectric and ferroelectric semiconductors: dynamic holographic grating recording and x-ray and neutron generation *(Invited Paper)*, N. V. Kukhtarev, T. V. Kukhtareva, P. P. Land, J. Wang, Alabama A&M Univ. . . . . [6698-01]

Evaluation and control of the dopant distribution in a Nd:$LiNbO_3$ fiber grown from the melt by the edge-defined film-fed growth (EFG) method, L. Braescu, West Univ. of Timisoara (Romania); T. F. George, Univ. of Missouri-St. Louis; S. Balint, West Univ. of Timisoara (Romania) . . . . . [6698-02]

Mechanism of light-induced domain nucleation in $LiNbO_3$ crystals, D. Liu, Y. Zhi, Z. Luan, A. Yan, L. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . [6698-03]

Photo-EPR studies of photorefractive $BaTiO_3$ heavily doped with Cr^{3+}: evidence of photoinduced dissociation of Cr^{3+} dimers, S. R. R. A. Bairavarasu, M. E. Edwards, T. V. Kukhtareva, M. D. Sastry, Alabama A&M Univ.; D. D. Lianos, U.S. Army Space and Missile Defense Command; R. H. Hawrami, M. D. Aggarwal, Alabama A&M Univ. . . . [6698-04]

Photoluminescence, FTIR and laser-Raman spectroscopic studies of PMN-PT containing iron, S. R. R. A. Bairavarasu, M. E. Edwards, M. D. Sastry, Alabama A&M Univ.; D. D. Lianos, U.S. Army Space and Missile Defense Command; P. R. Kommidi, B. R. Reddy, M. D. Aggarwal, Alabama A&M Univ. . . . . [6698-05]

SESSION 2 . . . . . Sun. 10:40 am to 12:10 pm

Advances in Materials Synthesis, Property, and Characterization II

Chair: **Ravindra B. Lal**, Alabama A&M Univ.

Photopolymer materials for holographic data storage applications *(Invited Paper)*, J. T. Sheridan, M. R. Gleeson, C. E. Close, D. Sabol, National Univ. of Ireland/Dublin (Ireland) . . . . . [6698-06]

High-power nonlinear optical materials: growth and characterization, N. B. Singh, D. J. Knuteson, A. Berghmans, D. A. Kahler, B. Wagner, G. S. Kanner, M. L. Marable, K. A. Green, J. J. Hawkins, Northrop Grumman Corp. . . [6698-07]

Femtosecond laser ablation of PbTe thin films, E. Rodriguez, D. Silva, W. A. Pippo, L. C. Barbosa, C. L. César, A. Schrank, C. R. d. S. Filho, E. P. De Oliveira, Univ. Estadual de Campinas (Brazil) . . . . . [6698-08]

Nonlinear optical and electronic properties of PMMA:Fe:Ge waveguide for device applications, A. M. Darwish, Dillard Univ.; B. D. Koplitz, Tulane Univ.; N. V. Kukhtarev, Alabama A&M Univ.; R. Robet Combs, Tulane Univ. . . . . [6698-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 3:30 pm

Development in Component and Integrative Photonic Devices

Chair: **Abdalla M. Darwish**, Dillard Univ.

Gas sensitive colloid cladding on fused silica fiber for high-temperature CO gas sensing *(Invited Paper)*, K. Deng, GE Global Research . . . . . [6698-10]

Distributed feedback lasers from organic photonic crystals *(Invited Paper)*, R. Jakubiak, Air Force Research Lab.; V. P. Tondiglia, L. V. Natarajan, R. L. Sutherland, Science Applications International Corp.; P. F. Lloyd, UES, Inc.; R. A. Vaia, T. J. Bunning, Air Force Research Lab. . . . . [6698-11]

Soft glass photonic crystal fiber for high current sensor, E. F. Chillcce, E. Rodriguez, C. L. César, L. C. Barbosa, Univ. Estadual de Campinas (Brazil) . . . . . [6698-12]

Fiber optic photo-acoustic spectroscopy sensor for harsh environment gas detection, J. Wu, General Electric Co. . . . . [6698-13]

Ultrafast pulsed laser inscribed large polarization mode separated fiber Bragg gratings and their applications, C. Zhan, J. H. Kim, The Pennsylvania State Univ.; P. B. Ruffin, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; S. S. Yin, The Pennsylvania State Univ. . . . . [6698-14]

SESSION 4 . . . . . Sun. 3:50 to 5:50 pm

Development in Component and Integrative Photonic Devices II

Chair: **Narsingh B. Singh**, Northrop Grumman Corp.

A review of random phase encoding in volume holography and applications *(Invited Paper)*, C. Sun, S. Ma, Y. Yu, National Central Univ. (Taiwan) . . . . . [6698-15]

Development and testing of a packaged crossover free fiber optic gyroscope coil *(Invited Paper)*, L. C. Heaton, Stanley Associates; A. Lompado, Polaris Sensor Technologies, Inc.; P. B. Ruffin, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; J. L. Williams, S. D. Kwon, Stanley Associates . . . . . [6698-16]

Using an optimized high-index ITO overlay on a single resonant band LPG to enhance the tunable range while maintaining the resonant peak depth, J. E. Lee, Q. Chen, Q. Zhang, K. M. Reichard, D. H. Ditto, J. S. Mazurowski, The Pennsylvania State Univ.; M. Hackert, Naval Air Systems Command; S. S. Yin, The Pennsylvania State Univ. [6698-17]

Optimal design of Fresnel lens for a lighting system with multiple LEDs, C. Uang, I-Shou Univ. (Taiwan) . . . [6698-18]

Speckles removal from 3D images by empirical mode decomposition, W. Su, G. Chen, C. Kuo, National Sun Yat-Sen Univ. (Taiwan) . . . . . [6698-19]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:30 to 10:10 am

Novel Materials and Devices: Theoretical and Experimental Approaches I

Chair: **Shizhuo S. Yin**, The Pennsylvania State Univ.

Metamaterials for integrated optoelectronic devices and sensing systems *(Invited Paper)*, P. B. Catrysse, Stanford Univ. . . . . [6698-20]

Dispersion relations for negative index materials and slow light *(Invited Paper)*, P. P. Banerjee, G. T. Nehmetallah, P. Buranasiri, Univ. of Dayton . . . . . [6698-21]

Design and usage of non-zero dispersion wideband transport (NZDWT) fiber, S. Dutta, S. Kant, Sterlite Optical Technologies Ltd. (India) . . . . . [6698-22]

Nanophotonic applications toward photonic microchip, C. Chen, National Central Univ. (Taiwan) . . . . . [6698-23]

SESSION 6 . . . . . Mon. 10:30 am to 12:20 pm

Novel Materials and Devices: Theoretical and Experimental Approaches II

Chair: **Sergei F. Lyuksyutov**, Univ. of Akron

RGB generation by four-wave mixing in small-core holey fibers *(Invited Paper)*, P. Horak, P. Dupriez, F. Poletti, M. N. Petrovich, Y. Jeong, J. Nilsson, D. J. Richardson, D. N. Payne, Univ. of Southampton (United Kingdom) . . . . . [6698-24]

Structural study of superprism phenomena in photonic crystals, A. D. Varshney, R. K. Sinha, Delhi College of Engineering (India) . . . . . [6698-25]

Temporal evolution of holographic grating formation, M. R. Gleeson, J. T. Sheridan, D. Sabol, C. E. Close, National Univ. of Ireland/Dublin (Ireland) . . . . . [6698-26]

The paraxial solution for the collinear holographic storage systems, Y. Yu, S. Hsieh, M. Tsai, T. Teng, C. Sun, National Central Univ. (Taiwan) . . . . . [6698-27]

Study of elastic nonlinearity of the crystals used to control optical beams, S. V. Kulakov, V. V. Kludzin, St. Petersburg State Univ. of Aerospace Instrumentation (Russia); O. V. Shakin, A.F. Ioffe Physico-Technical Institute (Russia)[6698-28]

Lunch Break

SESSION 7 . . . . . Mon. 1:30 to 3:30 pm

Innovations in Optic and Photonic Applications I

Chair: **Karl M. Reichard**, The Pennsylvania State Univ.

Development of fiber biosensors based on surface enhanced Raman scattering *(Invited Paper)*, C. Gu, Y. Zhang, C. Shi, L. Seballos, J. Z. Zhang, Univ. of California/Santa Cruz . . . . . [6698-29]

A pyroelectric infrared biometric system for walker recognition, K. Y. Hsu, J. Fang, National Chiao Tung Univ. (Taiwan); Q. Hao, D. J. Brady, B. D. Guenther, Duke Univ. . . . . [6698-30]

Time resolved profile measurements for ultra-fast vibrating objects *(Invited Paper)*, W. Su, C. Kuo, National Sun Yat-Sen Univ. (Taiwan) . . . . . [6698-31]

Efficient red-shifted supercontinuum generation in GeO_2 doping fiber, Y. Liu, M. T. Cicerone, National Institute of Standards and Technology . . . . . [6698-32]

Planar monolithic integrated acoustooptic 1x4 waveguide switch, J. Zhu, Oklahoma State Univ. . . . . [6698-33]

SESSION 8 . . . . . Mon. 3:50 to 5:20 pm

Innovations in Optic and Photonic Applications II

Chair: **Paul B. Ruffin**, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.

Beam steering employing a phased array technique using coherent supercontinuum light source *(Invited Paper)*, J. H. Kim, J. W. An, J. E. Lee, S. S. Yin, The Pennsylvania State Univ.; P. B. Ruffin, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; C. Luo, General Opto Solutions, LLC . . . . . [6698-34]

Assembly of a nonmechanical optical beam steering using plano-convex MLAs in a triplet configuration, L. C. Heaton, Stanley Associates; P. B. Ruffin, J. C. Holt, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. . . . . [6698-35]

3D shape reconstruction using multiple projections: a method to eliminate shadowing for projected fringe profilometry, W. Su, C. Kuo, National Sun Yat-Sen Univ. (Taiwan) . . . . . [6698-36]

3D shape reconstruction using projected fringe profilometry for an image blurred by linear motion, C. Kuo, C. Lee, W. Su, National Sun Yat-Sen Univ. (Taiwan) [6698-37]

✔ Posters-Monday

Chair: ***Shizhuo S. Yin**, The Pennsylvania State Univ.*

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Theoretical analysis on splice loss of photonic crystal fibers,** G. Fu, W. Bi, Yanshan Univ. (China) . . . . . [6698-38]

✔ **Near infrared nonvolatile holographic recording in doubly doped $LiNbO_3$:Fe crystals,** D. Li, D. Liu, Y. Zhi, W. Lu, L. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6698-39]

✔ **Quasi-nonvolatile holographic storage in doubly-doped $LiNb_3$ crystals,** Z. Chai, East China Normal Univ. (China); D. Liu, L. Liu, Y. Zhi, D. Li, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6698-40]

✔ **Study of wavelength-dependent diffraction properties of photorefractive volume holographic lenses for optical beams conversion,** Z. Hu, Shanghai Normal Univ. (China); A. Yan, D. Liu, L. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6698-41]

✔ **The design of software for new fiber intelligent structure health monitoring,** W. Li, Z. Zhao, L. Guo, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [6698-42]

✔ **Mode confinement of light wave propagation in a new polymeric waveguide studied by the m-lines technique,** K. Sathiyamoorthy, P. A. Kurian, C. Vijayan, M. P. Kothiyal, Indian Institute of Technology Madras (India) . . . . [6698-43]

✔ **Laser-induced fluorescence based optical fiber probe for analyzing bacillus smithii and escherichia coli,** S. Menon, S. M. Nambiar, N. P. N. Vadakedathu, Cochin Univ. of Science & Technology (India) . . . . . [6698-44]

✔ **Crosstalk noise in speckle-based volume holographic multiplexing,** H. Liu, The Pennsylvania State Univ. [6698-45]

✔ **Laser heated pedestal growth and development of doped single-crystal ferroelectric fibers and devices,** M. Gu, H. Liu, Y. Lee, Z. Zhou, A. S. Bhalla, R. Guo, The Pennsylvania State Univ. . . . . [6698-46]

✔ **Optical interferometric evaluation of semiconducting piezoelectric zinc oxide microtubular crystals,** J. Y. Fu, P. Y. Liu, J. Cheng, R. Guo, The Pennsylvania State Univ. . . . . [6698-47]

✔ **Stoichiometric lithium niobate thin films preparation by sol-gel method,** A. R. Poghosyan, Institute for Physical Research (Armenia); R. Guo, The Pennsylvania State Univ.; A. Manukyan, S. Grigoryan, Institute for Physical Research (Armenia) . . . . . [6698-48]

✔ **Sol-gel method of p-type zinc oxide films preparation,** A. R. Poghosyan, Institute for Physical Research (Armenia); X. Li, National Renewable Energy Lab.; A. Manukyan, S. Grigoryan, E. S. Vardanyan, Institute for Physical Research (Armenia) . . . . . [6698-49]

✔ **Design of single-mode polarization splitter with a configuration of asymmetric Y-junction in two-dimensional honeycomb photonic crystal,** R. Chen, H. Wei, Lunghwa Univ. of Science and Technology (Taiwan) . . . . . [6698-50]

✔ **Mid-infrared fibers, analysis of the features due to high level of propagated optical power,** T. V. Tulaikova, Institute of Geosphere's Dynamics (Russia); I. Khmyrova, Univ. of Aizu (Japan); S. Artijushenko, General Physics Institute (Russia) . . . . . [6698-51]

✔ **Analysis of slanted transmission and reflection gratings,** D. Sabol, C. E. Close, M. R. Gleeson, J. T. Sheridan, National Univ. of Ireland/Dublin (Ireland) . . . . . [6698-52]

✔ **Optical and magnetooptical properties of $Bi_{1.8}Y_{1.2}Fe_4Ga_1O_{12}$ nanoparticles,** S. Kang, C. Yang, M. Chen, S. S. Yin, The Pennsylvania State Univ. . . . . [6698-53]

✔ **Investigation of domain inversion and internal field in congruent lithium niobate by digital holographic interferometry,** Y. Zhi, D. Liu, W. Qu, Y. Zhou, Z. Luan, L. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6698-54]

✔ **Realization of broadband source by overlapping two separate supercontinuum sources pumped at two different wavelengths,** J. H. Kim, C. Zhan, S. S. Yin, The Pennsylvania State Univ. . . . . [6698-55]

✔ **Holographic fixing with modulated light in two-center holographic recording,** Y. Zhou, L. Liu, D. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . [6698-56]

✔ **The preparation of optical substrate of silica glasses under 10-nm particle size,** M. S. Hsu, National Cheng Kung Univ. (Taiwan); S. Cheng, Chinese Military Academy (Taiwan); S. Sheu, Nan Jeon Institute of Technology (Taiwan); Y. Ouyang, Chinese Military Academy (Taiwan); F. Yen, National Cheng Kung Univ. (Taiwan) . . . . . [6698-57]

✔ **Implementation of optical WDM by anisotropic Bragg diffraction in photorefractive $LiNbO_3$ crystal,** X. Yan, Shanghai Univ. (China) . . . . . [6698-58]

✔ **Fabrication micro-Bragg grating in glass by femtosecond laser irradiation,** X. Yan, Shanghai Univ. (China) . . . . . [6698-59]

✔ **Laser emission from dye mixture doped polymer optical fiber,** S. M. Nambiar, T. Kannampuzha Jhony, R. Mandamparambil, N. Kumar, P. A. Cheriyan, N. P. N. Vadakedathu, P. Radhakrishnan, Cochin Univ. of Science & Technology (India) . . . . . [6698-61]

✔ **Acousto-optically tunable laser,** S. V. Kulakov, St. Petersburg State Univ. of Aerospace Instrumentation (Russia); Y. M. Mokrushin, Y. G. Gradoboev, St.-Petersburg State Polytechnical Univ. (Russia); O. V. Shakin, A.F. Ioffe Physico-Technical Institute (Russia); V. V. Kludzin, St. Petersburg State Univ. of Aerospace Instrumentation (Russia) . . . . . [6698-60]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC608 Photonic Crystals: A Crash Course, from Bandgaps to Fibers (Johnson) Tuesday 28, 1:30 - 5:30 pm

Conference 6699

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6699

Signal and Data Processing of Small Targets 2007

Conference Chair: **Oliver E. Drummond**, Consulting Engineer

Cochair: **Richard D. Teichgraeber**, Lockheed Martin Aeronautics Co.

Program Committee: **Liyi Dai**, U.S. Army Research Office; **John R. Edwards**, SRS Technologies; **Lawrence E. Hoff**, Hoff Engineering; **Cornelius T. Leondes**, Univ. of California/Los Angeles; **Rabinder N. Madan**, Office of Naval Research; **Kachesh M. Pathak**, U.S. Army Space and Missile Defense Command; **Albert J. Perrella, Jr.**, Institute for Defense Analyses; **Juan R. Vasquez**, Air Force Institute of Technology; **Steven Waugh**, Missile Defense Agency

Luncheon Dialogues

Lunch breaks on Tuesday, Wednesday, and Thursday will provide an opportunity to meet in a small group with one or two distinguished individuals who will lead discussions on a topic of signal and data processing algorithms. Tables will be reserved for a no-host lunch. Make reservations at the entrance to the main conference room beginning Tuesday morning, 28 August.

Conference Location Will Alternate Each Year

In the year 2007, this conference is located in San Diego. Thereafter, it will alternate between San Diego in the Summer in odd years and Orlando in the Spring in even years.

Internet Web Posting

Program changes, workshop announcements, and the latest information about this conference will be posted on the Internet World Wide Web at:http://home.att.net/~drummond/

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:30 am to 12:00 pm

Small Target Signal Processing

Chairs: **Lawrence E. Hoff**, Hoff Engineering; **Richard D. Teichgraeber**, Lockheed Martin Aeronautics Co.

Beyond the resolution limit: subpixel resolution in animals and now in silicon, M. J. Wilcox III, U.S. Air Force Academy . . . . . [6699-01]

Target detection in hyperspectral imagery using one-dimensional extended maximum average correlation height filter, M. S. Alam, Univ. of South Alabama . . . . . [6699-02]

Performance analysis of nonlinear detectors in generalized Rayleigh environment for space-time adaptive processing (STAP), X. Xu, Intelligent Automation, Inc.; R. Zheng, Univ. of Missouri-Rolla; G. Chen, Intelligent Automation, Inc.; E. Blasch, Air Force Research Lab. . . . . [6699-03]

Tracking dim targets using integrated clutter estimation, E. F. Brekke, Norwegian Univ. of Science and Technology (Norway) and Unik (Norway) and McMaster Univ. (Canada); R. Tharmarasa, T. Kirubarajan, McMaster Univ. (Canada)[6699-04]

Recognition of hidden pattern with background, L. Kovacs, T. Szirányi, Computer and Automation Research Institute (Hungary) . . . . . [6699-05]

Detection and tracking of low SNR divers in a noisy background in the presence of an interfering sonar, A. Rødningsby, Norwegian Univ. of Science and Technology (Norway); Y. Bar-Shalom, Univ. of Connecticut . . . [6699-06]

An efficient and effective low observable radar tracking system, Y. Rong, H. C. Lai, G. W. Ng, DSO National Labs. (Singapore) . . . . . [6699-07]

Lunch/Exhibition Break

SESSION 2 . . . . . Tues. 1:30 to 5:25 pm

Target Track Processing

Chairs: **John R. Edwards**, SRS Technologies; **Albert J. Perrella, Jr.**, Institute for Defense Analyses

Modeling ballistic target motion during boost for tracking, V. P. Jilkov, X. Li, J. Ru, Univ. of New Orleans . . . . . [6699-08]

Theory and practical application of out of sequence measurements with results for multi-static tracking, D. R. Iny, Northrop Grumman Corp. . . . . [6699-09]

The effect of various filters on covariance consistency in the presence of a nonlinear tracking problem, L. J. Ritter, B. Weir, G. Silberman, The Johns Hopkins Univ. Applied Physics Lab. . . . . [6699-10]

Differential geometry measures of nonlinearity for filtering with nonlinear dynamic and linear measurement models, B. F. La Scala, The Univ. of Melbourne (Australia); M. K. Mallick, Toyon Research Corp.; S. Arulampalam, Defence Science and Technology Organisation (Australia) . . . . . [6699-11]

Monitoring of sensor covariance consistency, S. S. Krigman, M. L. Smith, B. E. Tipton, MIT Lincoln Lab. [6699-12]

Future prospects for algorithm development of tracker related processing, O. E. Drummond, CyberRnD, Inc. . . . . [6699-13]

Map integration in tracking, D. D. Sworder, Univ. of California/San Diego; J. E. Boyd, Cubic Defense Systems, Inc.; G. Hutchins, Naval Postgraduate School . . . . . [6699-14]

Robust tracking for very long range radars, X. Tian, Y. Bar-Shalom, Univ. of Connecticut . . . . . [6699-15]

Demonstrations and Open Discussion . . . . . Tues. 8:00 to 10:00 pm

Signal and Data Processing

Wednesday 29 August

SESSION 3 . . . . . Wed. 8:30 am to 12:00 pm

Multiple-Frame Data Association

Chairs: **Liyi Dai**, U.S. Army Research Office; **Juan R. Vasquez**, Air Force Institute of Technology

Conference Overview *(Presentation Only),* O. E. Drummond, Consulting Engineer . . . . . [6699-100]

Consistent covariance estimation for PMHT, W. R. Blanding, P. K. Willett, Univ. of Connecticut; R. L. Streit, Metron, Inc.; D. T. Dunham, Vectraxx . . . . . [6699-17]

Multiple hypotheses feature-aided tracking of highly maneuvering air targets with multiframe data association, M. K. Mallick, R. M. Wilkerson, P. Stieber, Toyon Research Corp. . . . . [6699-18]

Computationally efficient assignment-based algorithms for data association for tracking with angle-only sensors, T. Sathyan, A. Sinha, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-19]

Evaluation of a posteriori probabilities of multi-frame data association hypotheses, S. Mori, C. Chong, BAE Systems Advanced Information Technologies . . . . . [6699-20]

Improved multitarget tracking using fixed-lag probability hypothesis density smoothing, N. Nandakumaran, K. Punithakumar, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-21]

Probability hypothesis density filtering for multitarget tracking using splines, K. Punithakumar, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-22]

Lunch/Exhibition Break

SESSION 4 . . . . . Wed. 1:30 to 5:25 pm

Multiple Sensors Data Processing

Chairs: **Cornelius T. Leondes**, Univ. of California/Los Angeles; **Oliver E. Drummond**, Consulting Engineer

Track-to-track association with informative prior associations, D. G. Danu, McMaster Univ. (Canada) and Array Systems Computing Inc. (Canada); A. Sinha, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-23]

Centralized multiple-hypothesis correlation and feedback with applications to video data, K. M. Tarplee, D. J. Trawick, S. M. Herman, Numerica Corp. . . . . [6699-24]

Mitigation of biases using the Schmidt-Kalman filter, R. C. Paffenroth, R. Y. Novoselov, S. Danford, M. Teixeira, S. Chan, A. Poore, Numerica Corp. . . . . [6699-25]

Flow-rate control for managing communications in tracking and surveillance networks, S. A. Miller, Numerica Corp.; E. K. P. Chong, Colorado State Univ. . . . . [6699-26]

Comparing optical flow to a Kalman filter to remove the effects of parallax for multitarget tracking in persistent video, B. R. Secrest, J. R. Vasquez, Air Force Institute of Technology . . . . . [6699-27]

Comparison of bias removal algorithms in track-to-track association, C. Chong, S. Mori, BAE Systems Advanced Information Technologies . . . . . [6699-28]

Improved observable operator model for target classification, S. Sutharsan, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-29]

Adaptive horizon sensor management with application to UAV trajectory planning, M. L. Hernandez, QinetiQ Ltd. (United Kingdom) . . . . . [6699-30]

✔ Posters/Oral Standby Presentations-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Posted presented poster papers will be included in the conference Proceedings and may also be presented orally if circumstances permit.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Spectral unmixing of agents on surface for the Joint Contaminated Surface Detector (JCSD),** M. M. Slamani, T. H. Chyba, H. LaValley, ITT Industries, Inc.; D. K. Emge, U.S. Army Edgewood Chemical Biological Ctr. . . . . [6699-46]

✔ **MHT tracking for crossing sonar targets,** P. K. Willett, Univ. of Connecticut; T. E. Luginbuhl, E. H. Giannopoulos, Naval Undersea Warfare Ctr. . . . . [6699-47]

✔ **Simulation assessment of RCS-aided multiple target tracking,** D. T. Dunham, Vectraxx; L. M. Ehrman, W. D. Blair, Georgia Tech Research Institute; S. A. Frost, Vectraxx . . . . . [6699-48]

✔ **Concurrent bias estimation and data association,** A. Poore, S. Danford, Numerica Corp. . . . . [6699-49]

✔ **Bias estimation using targets of opportunity,** B. D. Kragel, A. Poore, S. M. Herman, S. Danford, Numerica Corp. . . . . [6699-50]

OPTICS

✔ **A survey of maneuvering target tracking, part VIa: exact density-based nonlinear filtering,** X. Li, V. P. Jilkov, Univ. of New Orleans . . . . . [6699-51]

✔ **A survey of maneuvering target tracking, part VIb: approximate density-based nonlinear filters,** X. Li, V. P. Jilkov, Univ. of New Orleans . . . . . [6699-52]

✔ **Simulation of signal and data processing for a pair of GEO IR sensors,** K. Keil, W. J. Hupfer, EADS Astrium GmbH (Germany) . . . . . [6699-54]

✔ Posters-Wednesday

✔ **1D measurement of fluid speed by laser Doppler anemometry,** A. Osorio, Sr., E. Solarte, Sr., Univ. del Valle (Colombia) . . . . . [6699-53]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:30 am to 12:00 pm

Sensor Data Fusion

Chairs: **Rabinder N. Madan**, Office of Naval Research; **Juan R. Vasquez**, Air Force Institute of Technology

Data fusion handoff within a federation of fusion systems, P. J. Shea, B. Roskamp, Black River Systems Co. . [6699-31]

A comparison of two methods for computing track-to-track assignment probabilities, M. A. Horsley, MIT Lincoln Lab. . . . . [6699-32]

Distributed fusion using video sensors on multiple unmanned aerial vehicles, K. Chang, George Mason Univ.; M. K. Mallick, Toyon Research Corp. . . . . [6699-33]

Collaborative sensor management for decentralized asynchronous sensor networks, R. Tharmarasa, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-34]

Track-to-track association using intrinsic statistical properties, P. F. Singer, Raytheon Co. . . . . [6699-35]

Optimization based hybrid radar signal fusion for unresolved target detection, N. Nandakumaran, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-36]

Collaborative distributed sensor management for multitarget tracking using hierarchical Markov decision processes, D. Akselrod, A. Sinha, T. Kirubarajan, McMaster Univ. (Canada) . . . . . [6699-37]

Lunch/Exhibition Break

SESSION 6 . . . . . Thurs. 1:30 to 5:25 pm

Track and Fusion Processing

Chairs: **Oliver E. Drummond**, Consulting Engineer; **Albert J. Perrella, Jr.**, Institute for Defense Analyses

Optimal PHD filter for single-target detection and tracking, R. P. Mahler, Lockheed Martin Co. . . . . [6699-38]

Minimum trace fusion of N tracks in the presence of arbitrarily correlated track-to-track errors, D. H. McCabe, Naval Surface Warfare Ctr. . . . . [6699-39]

Concurrent bias estimation and data association: simulations, A. Poore, S. Danford, Numerica Corp. [6699-40]

Metrics for evaluating track covariance consistency, O. E. Drummond, T. L. Ogle, CyberRnD, Inc.; S. Waugh, Missile Defense Agency . . . . . [6699-41]

The PMHT: solutions for some of its problems, M. Wieneke, W. Koch, FGAN-FKIE (Germany) . . . . . [6699-42]

Anti-particle filters with homotopy, F. E. Daum, Raytheon Co.; J. Huang, Raytheon Space and Airborne Systems . . . . . [6699-43]

IMM/MHT tracking with an unscented particle filter with application to ground targets, J. A. Lancaster, S. S. Blackman, L. Yu, Raytheon Space and Airborne Systems . . . . . [6699-44]

A multiple model filter approach for impact point prediction, V. C. Ravindra, Y. Bar-Shalom, P. K. Willett, Univ. of Connecticut . . . . . [6699-45]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC661 Advanced Image Processing and Applications (Iftekharuddin) Monday 27, 8:30 am - 5:30 pm

SC728 Network Centric Target Tracking and Classification (Drummond) Monday 27, 8:30 am - 5:30 pm

Publish in the world body of scientific literature just 2 to 4 weeks after the conference.

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Conference 6700

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6700

Mathematics of Data/Image Pattern Recognition, Compression, Coding, and Encryption X, with Applications

Conference Chairs: **Gerhard X. Ritter**, Univ. of Florida; **Mark S. Schmalz**, Univ. of Florida; **Junior Barrera**, Univ. de São Paulo (Brazil); **Jaakko T. Astola**, Tampere Univ. of Technology (Finland)

Program Committee: **Stefano Baronti**, Istituto di Fisica Applicata Nello Carrara (Italy); **Mark L. Fowler**, Binghamton Univ.; **Victoria T. Franques**, U.S. Dept. of Energy; **Andrea Garzelli**, Univ. degli Studi di Siena (Italy); **Abdelsalam A. Helal**, Univ. of Florida; **Lifford McLauchlan**, Texas A&M Univ.; **Daniel S. Myers**, Sandia National Labs.; **James F. Scholl**, College of Optical Sciences/The Univ. of Arizona

Sunday 26 August

Introductory Remarks . . . . . 1:30 to 1:35 pm

Chair: **Mark S. Schmalz**, Univ. of Florida

SESSION 1 . . . . . Sun. 1:35 to 3:15 pm

Compression

Chair: **Lifford McLauchlan**, Texas A&M Univ.

Model-based compression of the calibration matrix for hyperspectral imaging systems, J. F. Scholl, College of Optical Sciences/The Univ. of Arizona; E. K. Hege, MKS Imaging Technology, LLC; D. G. O'Connell, Oceanit Labs., Inc.; E. L. Dereniak, College of Optical Sciences/The Univ. of Arizona . . . . . [6700-01]

Optimization of a lossless object-based compression embedded on GAIA, a next-generation space telescope, E. Oseret, C. Timsit, Univ. de Versailles Saint-Quentin-en Yvelines (France) . . . . . [6700-02]

Design of object based compression algorithms for video imagery, M. S. Schmalz, Univ. of Florida . . . . . [6700-03]

Design of multichannel filter banks for subband coding of audio signals, A. Goel, R. K. Baghel, L. Gupta, Maulana Azad National Institute of Technology (India) . . . . . [6700-04]

SESSION 2 . . . . . Sun. 3:40 to 4:55 pm

Image Quality and Error Analysis

Chair: **Mark S. Schmalz**, Univ. of Florida

The optimum running-type approximation for time-limited worst-case measures of error based on Fredholm integral equation using Pincherle-Goursat kernel, Y. Kida, Ohu Univ. (Japan); T. Kida, Nihon Univ. (Japan) . . . . . [6700-05]

Mesh-free multiresolution solver for PDEs with large gradients, H. C. Morris, San José State Univ.; A. Limon, Claremont Graduate Univ. . . . . [6700-06]

Perceptual assessment of image quality in multimedia technology, K. Fliegel, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6700-07]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

Introductory Remarks . . . . . 1:30 to 1:35 pm

Chair: **Junior Barrera**, Univ. de São Paulo (Brazil)

SESSION 3 . . . . . Mon. 8:35 to 9:50 am

Watermarking and Security

Chair: **James F. Scholl**, College of Optical Sciences/ The Univ. of Arizona

Adaptive model and neural network based watermark identification, L. McLauchlan, Texas A&M Univ.; M. Mehrubeoglu, Texas A&M Univ.-Corpus Christi . . . [6700-08]

Compressed versus uncompressed domain video watermarking, S. A. Duta, M. P. Mitrea, F. Prêteux, Institut National des Télécommunications (France) . . . . . [6700-09]

Adaptive fingerprint enhancement and identification, L. McLauchlan, Texas A&M Univ.; M. Mehrubeoglu, Texas A&M Univ.-Corpus Christi . . . . . [6700-10]

SESSION 4 . . . . . Mon. 10:25 am to 12:05 pm

Pattern Recognition and Analysis

Chair: **Junior Barrera**, Univ. de São Paulo (Brazil)

Multiresolution training of Kohonen neural networks, D. E. Tamir, Texas State Univ. San Marcos . . . . . [6700-11]

Generation of lattice independent vector sets for pattern recognition applications, G. Urcid-Serrano, J. C. Valdiviezo-Navarro, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [6700-12]

The validity of pyramid K-means, D. E. Tamir, Texas State Univ. San Marcos; C. Y. Park, Kwandong University (South Korea); W. Yoo, Gannon Univ. . . . . [6700-13]

Two evolutionary algorithms optimize clusters and automate feature selection in multispectral images, G. H. Burgin, D. B. Fogel, W. Porto, Natural Selection, Inc.; J. C. Jafolla, Surface Optics Corp.; P. Kagey, Lockheed Martin Orincon . . . . . [6700-14]

Lunch Break

SESSION 5 . . . . . Mon. 2:00 to 3:15 pm

Image Analysis in Medicine

Chair: **Gerhard X. Ritter**, Univ. of Florida

Real-time analysis of biomolecular interactions in SPR imaging, N. François, C. I. Fetita, Institut National des Télécommunications (France); M. Mucchielli, Institut de Chimie des Substances Naturelles (France); F. Prêteux, Institut National des Télécommunications (France); H. Delacroix, Institut de Chimie des Substances Naturelles (France)[6700-15]

Automated diagnosis of interstitial lung diseases (ILD) and emphysema in MDCT imaging, C. I. Fetita, K. Chang Chien, Institut National des Télécommunications (France); P. Brillet, Avicenne Hospital (France); F. Prêteux, Institut National des Télécommunications (France) . . . . . [6700-16]

Robust discriminant wavelet packets for meningioma image classification, H. A. Qureshi, N. M. Rajpoot, Univ. of Warwick (United Kingdom); T. W. Nattkemper, Univ. Bielefeld (Germany); V. Hans, Evangelisches Krankenhaus Bielefeld GmbH (Germany) . . . . . [6700-17]

SESSION 6 . . . . . Mon. 3:45 to 5:00 pm

Pattern Recognition and Multimedia

Chair: **Jaakko T. Astola**, Tampere Univ. of Technology (Finland)

Recognition of photon patterns in advanced Compton telescopes, A. Zoglauer, Univ. of California/Berkeley; R. Andritschke, G. Kanbach, Max-Planck-Institut für extraterrestrische Physik (Germany); S. E. Boggs, Univ. of California/Berkeley . . . . . [6700-18]

Interactive TV on parliament session, J. Royer, Institut National des Télécommunications (France); H. Nguyen, Alcatel (France); M. Preda, F. Prêteux, Institut National des Télécommunications (France); O. Martinot, Alcatel (France) . . . . . [6700-19]

A crop identification model from remote sensing image, A. Qiong, B. Yang, Chinese Academy of Agricultural Sciences (China) . . . . . [6700-20]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

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✔ **Parallel hierarchical method in networks,** O. V. Malinochka, L. I. Timchenko, Kiev Univ. of Economy and Transport Technology (Ukraine) . . . . . [6700-21]

✔ **Wavelet decomposition of embedded spline spaces,** Y. K. Demjanovich, Saint-Petersburg State Univ. (Russia) and Petersburg Railway State Univ. (Russia); O. M. Kosogorov, A. A. Makarov, Saint-Petersburg State Univ. (Russia) . . . . . [6700-22]

✔ **A novel application of image mosaic algorithm,** L. Gu, S. Guo, R. Ren, Jilin Univ. (China) . . . . . [6700-23]

✔ **How improved image processing algorithms can increase the accuracy of in vivo corneal topography diagnosis,** L. A. V. Carvalho, O. M. Bruno, Univ. de São Paulo (Brazil) . . . . . [6700-24]

✔ **A novel watermark image scrambling algorithm,** R. Cao, F. Gui, Hua Qiao Univ. (China) . . . . . [6700-25]

✔ **Digital audio watermarking using moment-preserving (MP) in time domain,** D. S. Choi, H. Jung, H. Choi, T. Kim, Seoul National Univ. of Technology (South Korea) . [6700-26]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC661 Advanced Image Processing and Applications (Iftekharuddin) Monday 27, 8:30 am - 5:30 pm

OPTICS

Conference 6701

Sunday-Wednesday 26-29 August 2007 • Proceedings of SPIE Vol. 6701

Wavelets XII

Conference Chairs: **Dimitri Van De Ville**, École Polytechnique Fédérale de Lausanne (Switzerland); **Vivek K. Goyal**, Massachusetts Institute of Technology; **Manos Papadakis**, Univ. of Houston

Program Committee: **Akram Aldroubi**, Vanderbilt Univ.; **Radu V. Balan**, Siemens Corporate Research; **John J. Benedetto**, Univ. of Maryland/College Park; **Emmanuel J. Candes**, California Institute of Technology; **Peter G. Casazza**, Univ. of Missouri/Columbia; **Minh N. Do**, Univ. of Illinois at Urbana-Champaign; **Pier L. Dragotti**, Imperial College London (United Kingdom); **Jalal M. Fadili**, Ctr. National de la Recherche Scientifique (France); **Hans G. Feichtinger**, Univ. Vienna (Austria); **C. Sinan Güntürk**, New York Univ.; **Christopher E. Heil**, Georgia Institute of Technology; **Jelena Kovacevic**, Carnegie Mellon Univ.; **Ilya Krishtal**, Northern Illinois Univ.; **Andrew F. Laine**, Columbia Univ.; **Michael Liebling**, California Institute of Technology; **Raghu Machiraju**, The Ohio State Univ.; **François G. Meyer**, Univ. of Colorado/Boulder; **Torsten Möller**, Simon Fraser Univ. (Canada); **Truong-Thao Nguyen**, City College/CUNY; **Jean-Christophe Olivo-Marin**, Institut Pasteur (France); **Ilya Pollak**, Purdue Univ.; **Alexander M. Powell**, Vanderbilt Univ.; **Naoki Saito**, Univ. of California/Davis; **Ivan W. Selesnick**, Polytechnic Univ.; **Jean-Luc Starck**, CEA Saclay (France); **Thomas Strohmer**, Univ. of California/Davis; **Michael A. Unser**, École Polytechnique Fédérale de Lausanne (Switzerland); **Pierre Vandergheynst**, École Polytechnique Fédérale de Lausanne (Switzerland); **Yves Wiaux**, École Polytechnique Fédérale de Lausanne (Switzerland); **Ozgur Yilmaz**, Univ. of British Columbia (Canada)

Sunday 26 August

Opening Remarks . . . . . 9:00 to 9:10 am

Chair: **Dimitri Van De Ville**, École Polytechnique Fédérale de Lausanne (Switzerland)

Keynote Presentation . . . . . 9:10 to 9:50 am

SESSION 2 . . . . . Sun. 10:20 am to 12:20 pm

Special Session on Frames and Course Quantization

Chairs: **Truong-Thao Nguyen**, City College/CUNY; **C. Sinan Güntürk**, New York Univ.; **Alexander M. Powell**, Vanderbilt Univ.; **Ozgur Yilmaz**, Univ. of British Columbia (Canada)

Random rounding in redundant representations, B. G. Bodmann, S. P. Lipshitz, Univ. of Waterloo (Canada) [6701-02]

Sigma-delta quantization for compressive sensing applications, P. T. Boufounos, R. G. Baraniuk, Rice Univ. . . . . [6701-03]

An improved family of exponentially accurate sigma-delta quantization schemes, F. Krahmer, New York Univ. [6701-04]

The tiling phenomenon of sigma-delta modulators with time-varying inputs, N. T. Thao, City College/CUNY[6701-05]

The beta\alpha-encoder, Y. Wang, D. Jimenez, Georgia Institute of Technology . . . . . [6701-06]

On quantization of finite frame expansions: sigma-delta schemes of arbitrary order, M. C. Lammers, Univ. of North Carolina Wilmington; A. M. Powell, Vanderbilt Univ.; O. Yilmaz, Univ. of British Columbia (Canada) . . . . . [6701-07]

Lunch Break

SESSION 3 . . . . . Sun. 2:00 to 3:40 pm

Wavelets: New Designs

Chair: **Thomas Strohmer**, Univ. of California/Davis

Complex B-splines in R^n, P. Massopust, Technische Univ. München (Germany) . . . . . [6701-08]

Multiscale representation for data on the sphere and applications to geopotential data, M. Shahram, D. L. Donoho, Stanford Univ.; J. Starck, Commissariat à l'Energie Atomique (France) . . . . . [6701-09]

Isotropic multiresolution analysis for texture, M. Papadakis, S. K. Alexander, R. Azencott, S. Baid, X. Li, J. R. Romero, Univ. of Houston . . . . . [6701-10]

A new family of rotation-covariant wavelets on the hexagonal lattice, L. Condat, B. Forster-Heinlein, Forschungszentrum für Umwelt und Gesundheit, GmbH (Germany); D. Van De Ville, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6701-11]

An M-channel directional filter bank compatible with the contourlet and shearlet frequency tiling, G. R. Easley, System Planning Corp.; V. Patel, D. M. Healy, Jr., Univ. of Maryland/College Park . . . . . [6701-12]

SESSION 4 . . . . . Sun. 4:00 to 6:00 pm

Special Session on Wavelets in Bio-Imaging

Chairs: **Jelena Kovacevic**, Carnegie Mellon Univ.; **Jean-Christophe Olivo-Marin**, Institut Pasteur (France)

A fast iterative thresholding algorithm for wavelet-regularized deconvolution, C. R. Vonesch, M. A. Unser, École Polytechnique Fédérale de Lausanne (Switzerland) [6701-13]

Wavelet-based restoration methods: application to 3D confocal microscopy images, C. Chaux, Institut National de Recherche en Informatique et en Automatique (France); L. Blanc-Féraud, Univ. de Nice Sophia Antipolis (France); J. B. Zerubia, Institut National de Recherche en Informatique et en Automatique (France) . . . . . [6701-14]

Some uses of wavelets for restoring and analysing the three-dimensional motion patterns of live cochlear structures, J. H. R. Boutet de Monvel, Karolinska Institute (Sweden) . . . . . [6701-15]

Multiresolution techniques for the classification of biometric and bioimage datasets, A. Chebira, J. Kovacevic, Carnegie Mellon Univ. . . . . [6701-16]

Detection of curvilinear objects in biological noisy image using feature-adapted fast slant stack, S. Berlemont, Institut Pasteur (France) and Genomic Vision (France) and Univ. of Paris V (France); A. Bensimon, Genomic Vision (France); J. Olivo-Marin, Institut Pasteur (France) . . . . . [6701-17]

Active contour-based multiresolution transforms for the segmentation of fluorescence microscope images, G. Srinivasa, Carnegie Mellon Univ.; M. C. Fickus, Air Force Institute of Technology; J. Kovacevic, Carnegie Mellon Univ. . . . . [6701-18]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:30 to 10:10 am

Special Session on Geometrical X-lets and Nonseparable Bases

Chair: **Minh N. Do**, Univ. of Illinois at Urbana-Champaign

Curvelets and wave atoms for mirror-extended images, L. Demanet, Stanford Univ.; L. Ying, The Univ. of Texas at Austin . . . . . [6701-19]

Video processing using the surfacelet transform: construction and applications, Y. M. Lu, M. N. Do, Univ. of Illinois at Urbana-Champaign . . . . . [6701-20]

Minimum total variation synthesis using shearlets, D. Labate, North Carolina State Univ.; K. Guo, Missouri State Univ.; W. Lim, Lehigh Univ. . . . . [6701-21]

Geometric estimation with orthogonal bandlet bases, G. Peyré, Univ. Paris Dauphine (France); E. Le Pennec, Univ. Paris 7-Denis Diderot (France); C. Dossal, Univ. Bordeaux I (France) . . . . . [6701-22]

Image representation and compression using directionlets, V. Velisavljevic, Deutsche Telekom Labs. (Germany); B. Beferull-Lozano, Univ. de València (Spain); M. Vetterli, École Polytechnique Fédérale de Lausanne (Switzerland) and Univ. of California/Berkeley; P. L. Dragotti, Imperial College London (United Kingdom) . . . . . [6701-23]

SESSION 6 . . . . . Mon. 10:40 am to 12:00 pm

Special Session on Sampling and Operator Theory I

Chairs: **Akram Aldroubi**, Vanderbilt Univ.; **Ilya Krishtal**, Northern Illinois Univ.

Reconstructing functions in shift-invariant spaces from their average sample values, E. Acosta Reyes, Vanderbilt Univ. . . . . [6701-24]

The redundancy of localized frames and superframes, R. V. Balan, Siemens Corporate Research; Z. Landau, City College/CUNY . . . . . [6701-25]

On slanted matrices, frames and sampling, A. Aldroubi, Vanderbilt Univ.; A. G. Baskakov, Voronezh State Univ. (Russia); I. Krishtal, Northern Illinois Univ. . . . . [6701-26]

Localized operators and the construction of localized frames, F. Futamura, Southwestern Univ.; A. Aldroubi, Vanderbilt Univ. . . . . [6701-27]

Lunch Break

SESSION 7 . . . . . Mon. 1:30 to 2:50 pm

Special Session on Sampling and Operator Theory II

Chairs: **Akram Aldroubi**, Vanderbilt Univ.; **Ilya Krishtal**, Northern Illinois Univ.

Operator-like wavelets, I. Khalidov, D. Van De Ville, T. Blu, M. A. Unser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6701-28]

Operator sampling, MIMO channel identification, and recovery of matrices with sparse representations, G. E. Pfander, Jacobs Univ. Bremen (Germany); D. F. Walnut, George Mason Univ. . . . . [6701-29]

Estimation algorithms with noisy frame coefficients, A. M. Powell, Vanderbilt Univ. . . . . [6701-30]

The unreasonable effectiveness of Banach algebras in numerical analysis, T. Strohmer, Univ. of California/ Davis . . . . . [6701-31]

SESSION 8 . . . . . Mon. 3:20 to 4:40 pm

Special Session on Wavelets in Neuro-Imaging

Chair: **Jalal M. Fadili**, Ctr. National de la Recherche Scientifique (France)

Low-distortion embeddings of neuroimaging datasets, F. G. Meyer, X. Shen, Univ. of Colorado/Boulder . . . . . [6701-32]

Compressed sensing MRI, M. Lustig, Stanford Univ.[6701-33]

Bayesian fMRI data analysis with sparse spatial basis function priors, G. Flandin, NeuroSpin (France) and Wellcome Trust Ctr. for Neuroimaging (United Kingdom) and Institut Fédératif de Recherche n49 (France); W. D. Penny, Wellcome Trust Ctr. for Neuroimaging (United Kingdom) . . . . [6701-34]

Activelets and sparsity: a new way to detect brain activation from fMRI data, I. Khalidov, D. Van De Ville, Ecole Polytechnique Fédérale de Lausanne (Switzerland); J. M. Fadili, Ecole Nationale Supérieure d'Ingénieurs de Caen (France); M. A. Unser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6701-35]

Keynote Presentation . . . . . 4:40 to 5:20 pm

Wavelets, operators, and invariance principles *(Invited Paper),* M. A. Unser, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6701-36]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Discrete unitary transforms generated by moving waves,** A. M. Grigoryan, The Univ. of Texas at San Antonio; M. M. Grigoryan, Yerevan State Univ. (Armenia) . . . . . [6701-78]

✔ **New discrete unitary Haar-type heap transforms,** A. M. Grigoryan, The Univ. of Texas at San Antonio; M. M. Grigoryan, Yerevan State Univ. (Armenia) . . . . . [6701-79]

✔ **Multiple description coding of 3D meshes by quantized frame expansions,** M. O. Bici, G. Bozdagi Akar, Middle East Technical Univ. (Turkey) . . . . . [6701-80]

✔ **High-dimensional data compression via PHLCT,** Z. Zhang, N. Saito, Univ. of California/Davis . . . . . [6701-81]

✔ **Stability of the multifractal spectra by transformations of discrete series: tests of MF and algorithms improvement,** Á. Corvalán, Univ. de Buenos Aires (Argentina); E. P. Serrano, Univ. de San Martin (Argentina) . . . . . [6701-82]

✔ **Wavelet packets frames in multiresolution structures,** E. P. Serrano, Univ. de San Martin (Argentina); R. A. Cardo, A. M. Figliola, Univ. Nacional de General Sarmiento (Argentina) . . . . . [6701-83]

✔ **Wavelet-based stereo images reconstruction using depth images,** L. Jovanov, A. Pizurica, W. Philips, Univ. Gent (Belgium) . . . . . [6701-84]

✔ **Estimation of chirp rates of music-adapted prolate spheroidal atoms using reassignment,** B. A. Mesz, Univ. de San Martin (Argentina) . . . . . [6701-85]

✔ **Colon tissue biopsy classification using wavlet transform,** K. Masood, N. M. Rajpoot, Univ. of Warwick (United Kingdom) . . . . . [6701-86]

✔ **Affine scaling transformation algorithms for harmonic retrieval in a compressive sampling framework,** S. D. Cabrera, A. Yousefi, J. G. Rosiles, The Univ. of Texas at El Paso; A. Brito, Xerox Corp. . . . . [6701-87]

✔ **Short-term spectral analysis and synthesis improvements with optimized oversampled inverse filter banks,** J. Gauthier, L. C. Duval, Institut Français du Pétrole (France); J. Pesquet, Univ. de Marne-la-Vallée (France) [6701-88]

✔ **Tight frame wavelets with equal norms highpass and bandpass filters,** F. Abdelnour, United States Patent and Trademark Office . . . . . [6701-89]

✔ **Wavelet noise reduction based on energy features,** S. A. Hojjatoleslami, Univ. of Kent (United Kingdom) . . . [6701-90]

✔ **Video denoising based on a Laplace distribution with local variance in 3D complex wavelet domain,** H. Rabbani, Amirkabir Univ. of Technology (Iran); I. W. Selesnick, Polytechnic Univ. . . . . [6701-91]

✔ **Modeling statistical properties of wavelets using a mixture of bivariate Cauchy models and its application for image denoising in complex wavelet domain,** H. Rabbani, Amirkabir Univ. of Technology (Iran); I. W. Selesnick, Polytechnic Univ.; M. Vafadust, Amirkabir Univ. of Technology (Iran) . . . . . [6701-92]

✔ **Fast and sparse algorithm for seismic-wave equations using curvelets,** J. Ma, Tsinghua Univ. (China) . . . [6701-93]

Tuesday 28 August

SESSION 10 . . . . . Tues. 8:00 to 11:50 am

Special Session on Wavelets in Physics

Chairs: **Pierre Vandergheynst**, École Polytechnique Fédérale de Lausanne (Switzerland); **Yves Wiaux**, École Polytechnique Fédérale de Lausanne (Switzerland)

Regularization of inverse problems with adaptive discrepancy terms: application to multispectral data, S. Anthoine, Univ. de Nice Sophia Antipolis (France) . [6701-37]

Modeling images of the quiet sun in the extreme UV, P. Chainais, Univ. Blaise Pascal (France); V. Delouille, J. Hochedez, Royal Observatory of Belgium (Belgium) [6701-38]

Chains of chirplets for the detection of gravitational wave chirps, E. Chassande-Mottin, Ctr. National de la Recherche Scientifique (France) and Observatoire de la Côte d'Azur (France); A. Pai, Max-Planck-Institut für Gravitationsphysik (Germany); O. Rabaste, Ctr. National de la Recherche Scientifique (France) . . . . . [6701-39]

Beta-lattice multiresolution of quasicrystalline Bragg peaks, J. P. Gazeau, Univ. Paris 7-Denis Diderot (France) and Ctr. National de la Recherche Scientifique (France); A. El Kharrat, Univ. Paris 7-Denis Diderot (France) . . . . . [6701-40]

Frames of Poisson wavelets on the sphere and their application in geophysical modeling, M. Holschneider, B. Minchev, Univ. Potsdam (Germany); I. Panet, Geographical Survey Institute (Japan); A. Chambodut, Ecole et Observatoire des Sciences de la Terre (France); M. Mandea, GeoForschungsZentrum Potsdam e.V. (Germany) . [6701-41]

Detecting dark energy with wavelets on the sphere, J. McEwen, Univ. of Cambridge (United Kingdom) . . [6701-42]

CMB data analysis and inpainting on the sphere, Y. Moudden, P. Abrial, J. Starck, Commissariat à l'Energie Atomique (France); J. M. Fadili, Ctr. National de la Recherche Scientifique (France); J. Bobin, Commissariat à l'Energie Atomique (France) . . . . . [6701-43]

A spatiospectral localization approach to estimating potential fields on the surface of a sphere from noisy incomplete data taken at satellite altitudes, F. J. Simons, F. A. Dahlen, Princeton Univ. . . . . [6701-44]

Time-frequency multipliers for sound synthesis, P. Depalle, McGill Univ. (Canada); R. Kronland-Martinet, Ctr. National de la Recherche Scientifique (France); B. Torrésani, Univ. de Provence (France) . . . . . [6701-45]

Probing the Gaussianity and the statistical isotropy of the CMB with spherical wavelets, P. Vielva, Instituto de Física de Cantabria (Spain) . . . . . [6701-46]

Lunch/Exhibition Break

SESSION 11 . . . . . Tues. 1:30 to 2:30 pm

Wavelets and Filterbank Designs

Chair: **Michael Liebling**, California Institute of Technology

Extending Vaidyanathan's procedure to improve the performance of unitary filter banks with a fixed lowpass by using additional elementary building blocks, P. Steffen, W. Brandhuber, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) . . . . . [6701-47]

Hilbert-like tight frame wavelets with symmetric envelope, F. Abdelnour, United States Patent and Trademark Office . . . . . [6701-48]

Distributed video coding based on sampling of signals with finite rate of innovation, V. Chaisinthop, P. L. Dragotti, Imperial College London (United Kingdom) . . . . . [6701-49]

SESSION 12 . . . . . Tues. 2:30 to 5:40 pm

Special Session on Wavelets for Denoising and Restoration

Chair: **Ivan W. Selesnick**, Polytechnic Univ.

Image sequence denoising via sparse and redundant representations, M. Protter, M. Elad, Technion-Israel Institute of Technology (Israel) . . . . . [6701-50]

Predictive compression and denoising with overcomplete decompositions: a simple way to reject structured "noise", O. G. Guleryuz, DoCoMo Communications Labs. USA, Inc. . . . . [6701-51]

Image restoration using adaptive Gaussian scale mixtures in overcomplete pyramids, J. Portilla, Consejo Superior de Investigaciones Científicas (Spain); J. A. Guerrero-Colón, Univ. de Granada (Spain) . . . . . [6701-52]

Video denoising in the wavelet domain using a Bayesian algorithm, N. Gupta, E. I. Plotkin, M. N. S. Swamy, Concordia Univ. (Canada) . . . . . [6701-53]

SURE-based interscale-intercolor wavelet thresholding for color image denoising, F. Luisier, T. Blu, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6701-54]

Signal-dependent noise characterization in Haar wavelets domain, K. Hirakawa, Harvard Univ. . . . . [6701-55]

Double-density complex wavelet cartoon-texture decomposition, G. A. Hewer, W. Kuo, G. Hanson, Naval Air Warfare Ctr. . . . . [6701-56]

Wavelet-based signal denoising via estimation of elliptically contoured multivariate Laplace vectors, I. W. Selesnick, Polytechnic Univ. . . . . [6701-57]

Conference 6701

Wednesday 29 August

SESSION 13 . . . . . Wed. 8:00 to 10:00 am

Special Session on Finite-Dimensional Frames, Time-Frequency Analysis, and Applications

Chairs: **Radu V. Balan**, Siemens Corporate Research; **Peter G. Casazza**, Univ. of Missouri/Columbia

Algorithms for doing signal reconstruction without phase, P. G. Casazza, Univ. of Missouri/Columbia; R. V. Balan, Siemens Corporate Research; D. Edidin, Univ. of Missouri/Columbia; B. G. Bodmann, Univ. of Houston . . . . . [6701-58]

Modeling sensor networks with fusion frames, G. Kutyniok, Princeton Univ.; P. G. Casazza, Univ. of Missouri/Columbia; S. Li, San Francisco State Univ.; C. J. Rozell, Rice Univ.[6701-59]

Multiscale moment transforms over the integer lattice, M. C. Fickus, G. S. Seetharaman, M. E. Oxley, Air Force Institute of Technology . . . . . [6701-60]

Redundancy for infinite frames and localization for finite ones., R. V. Balan, Siemens Corporate Research; Z. Landau, City College/CUNY; R. Vershynin, Univ. of California/Davis . . . . . [6701-61]

Burst erasures and the mean square error for cyclic frames, B. G. Bodmann, Univ. of Waterloo (Canada) [6701-62]

Some B-spline Riesz sequences of translates can have a sampling property, S. Li, San Francisco State Univ. [6701-63]

SESSION 14 . . . . . Wed. 10:30 to 11:10 am

Special Session on Wavelets in Medical Imaging

Chairs: **François G. Meyer**, Univ. of Colorado/Boulder; **Andrew F. Laine**, Columbia Univ.

A unified variational approach to iterative thresholding algorithms: applications in magnetoencephalography, M. Fornasier, Princeton Univ. . . . . [6701-64]

Wavelets and Bayesian priors as latent signal models in hierarchical sparse component analysis: applications to medical imaging, E. Roussos, Princeton Univ. . . . [6701-65]

SESSION 15 . . . . . Wed. 11:10 am to 12:30 pm

Emerging Applications

Chair: **Naoki Saito**, Univ. of California/Davis

Learning adapted dictionaries for geometry and texture separation, G. Peyré, Univ. Paris Dauphine (France); J. M. Fadili, Ctr. National de la Recherche Scientifique (France); J. Starck, Commissariat à l'Energie Atomique (France) [6701-66]

Morphological diversity and sparsity: new insights into multivariate data analysis, J. Bobin, Commissariat à l'Energie Atomique (France); J. M. Fadili, Ctr. National de la Recherche Scientifique (France); J. Starck, Y. Moudden, Commissariat à l'Energie Atomique (France) . . . . . [6701-67]

Automated discrimination of shapes in high dimensions, L. H. Lieu, N. Saito, Univ. of California/Davis . . . . . [6701-68]

Coherent noise removal in seismic data with dual-tree M-band wavelets, L. C. Duval, Institut Français du Pétrole (France); C. Chaux, Institut National de Recherche en Informatique et en Automatique (France); S. Ker, Institut Français du Pétrole (France) . . . . . [6701-69]

Lunch/Exhibition Break

SESSION 16 . . . . . Wed. 2:00 to 4:50 pm

Special Session on Sparsity and Compressed Sampling

Chair: **Pier L. Dragotti**, Imperial College London (United Kingdom)

Average case analysis of multichannel sparse approximations using p-thresholding, P. Vandergheynst, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6701-70]

Analytic sensing: reconstructing pointwise sources from boundary Laplace measurements, D. Kandaswamy, D. Van De Ville, M. A. Unser, T. Blu, École Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6701-71]

L0-based sparse approximations, J. de la Portilla Muelas, Instituto de Optica (Spain); L. Mancera Pascual, Univ. de Granada (Spain) . . . . . [6701-72]

Sparsity-based imaging, M. L. Moravec, Rice Univ.; J. K. Romberg, Georgia Institute of Technology; R. G. Baraniuk, Rice Univ. . . . . [6701-73]

Annihilating filter-based decoding in the compressed sensing framework, A. Hormati, M. Vetterli, École Polytechnique Fédérale de Lausanne (Switzerland) [6701-74]

Sampling signals from a union of subspaces, Y. M. Lu, M. N. Do, Univ. of Illinois at Urbana-Champaign . . . . . [6701-75]

Geometric wavelets based nonlinear reaction-diffusion equation for texture-preserving denoising, J. Ma, Tsinghua Univ. (China) . . . . . [6701-76]

Keynote Presentation . . . . . 4:50 to 5:30 pm

Self-consistency: a general recipe for wavelet estimation with irregularly spaced and/or incomplete data, X. Meng, Harvard Univ. . . . . [6701-77]

Closing Remarks . . . . . 5:30 to 5:40 pm

Virek K. Goyal, Massachusetts Institute of Technology

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC661 Advanced Image Processing and Applications (Iftekharuddin) Monday 27, 8:30 am - 5:30 pm

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Conference 6702

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6702

Soft X-Ray Lasers and Applications VII

Conference Chairs: **Gregory J. Tallents**, The Univ. of York (United Kingdom); **James Dunn**, Lawrence Livermore National Lab.

Program Committee: **Ernst E. Fill**, Max-Planck-Institut für Quantenoptik (Germany); **Sylvie Jacquemot**, École Polytechnique (France); **Gerard Jamelot**, Univ. Paris-Sud II (France); **Yoshiaki Kato**, Japan Atomic Energy Agency (Japan); **Ciaran L. S. Lewis**, Queen's Univ. Belfast (United Kingdom); **Peter-Viktor Nickles**, Max-Born-Institut (Germany); **Joseph Nilsen**, Lawrence Livermore National Lab.; **Geoffrey J. Pert**, The Univ. of York (United Kingdom); **Jorge J. G. Rocca**, Colorado State Univ.; **Szymon Suckewer**, Princeton Univ.; **Alexander V. Vinogradov**, P.N. Lebedev Physical Institute (Russia)

Tuesday 28 August

X-Ray/UV Optics Technical Event . 8:00 to 10:00 pm

Please see page 14 for details.

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:30 to 10:10 am

Laser Development and Applications

Chair: **James Dunn**, Lawrence Livermore National Lab.

High-brightness tabletop soft x-ray lasers at high repetition rate: injection-seeding of dense plasma amplifiers and other developments *(Invited Paper),* J. J. G. Rocca, Y. Wang, B. M. Luther, E. Granados, M. A. Berrill, M. A. Larotonda, D. A. Alessi, D. H. Martz, D. Patel, F. Pedaci, C. S. Menoni, Colorado State Univ.; V. N. Shlyaptsev, Lawrence Livermore National Lab. . . . . [6702-01]

New results at the Bern X-ray Laser Facility *(Invited Paper),* J. E. Balmer, M. Gruenig, C. Imesch, F. Staub, Univ. Bern (Switzerland) . . . . . [6702-02]

Plasma interactions in laser irradiated cavities studied with soft x-ray: interferometry using a capillary discharge laser, M. A. Purvis, J. Grava, J. Filevich, M. C. Marconi, J. J. G. Rocca, Colorado State Univ.; J. Dunn, S. J. Moon, J. Nilsen, V. N. Shlyaptsev, Lawrence Livermore National Lab.; E. Jankowska, Colorado State Univ. . . . . [6702-03]

Characterization of the nickel-like molybdenum x-ray laser emission, M. H. Edwards, N. Booth, Z. Zhai, G. J. Tallents, The Univ. of York (United Kingdom); T. Dzelzainis, C. L. S. Lewis, Queen's Univ. (United Kingdom) . . . . . [6702-04]

SESSION 2 . . . . . Wed. 10:40 am to 12:00 pm

OFI and Toward Shorter Wavelengths

Chair: **Gregory J. Tallents**, The Univ. of York (United Kingdom)

Ultrashort pulse-driven optical-field-ionization x-ray lasers *(Invited Paper),* J. Lin, National Chung Cheng Univ. (Taiwan); M. Chou, P. Lin, Institute of Atomic and Molecular Sciences (Taiwan); C. Lin, National Chung Cheng Univ. (Taiwan); S. Chen, J. Wang, Institute of Atomic and Molecular Sciences (Taiwan) . . . . . [6702-05]

Dramatic enhancement of optical-field-ionization collisional-excitation x-ray lasing by an optically preformed plasma waveguide, M. Chou, Institute of Atomic and Molecular Sciences (Taiwan) and National Chung Cheng Univ. (Taiwan); P. Lin, Institute of Atomic and Molecular Sciences (Taiwan); C. Lin, J. Lin, National Chung Cheng Univ. (Taiwan); J. Wang, S. Chen, Institute of Atomic and Molecular Sciences (Taiwan) . . . . . [6702-06]

The practicality of x-ray lasers using exploding foils for the sub-5-nm wavelength range *(Invited Paper),* G. J. Pert, The Univ. of York (United Kingdom) . . . . . [6702-07]

Lunch/Exhibition Break

SESSION 3 . . . . . Wed. 1:30 to 3:00 pm

Seeded Lasers

Chair: **Joseph Nilsen**, Lawrence Livermore National Lab.

Characterization of an OFI seeded soft x-ray laser *(Invited Paper),* S. Sebban, École Nationale Supérieure de Techniques Avancées (France) . . . . . [6702-08]

Full characterization of a GRIP Ni-like Ag amplifier for seeding with high harmonics at 13.9 nm *(Invited Paper),* K. A. Janulewicz, J. Tuemmler, P. Nickles, Max-Born-Institut (Germany); H. T. Kim, I. W. Choi, C. Kim, D. Ko, J. Lee, Kwangju Institute of Science and Technology (South Korea) . . . . . [6702-09]

Development of a high-repetition-rate seeded x-ray laser *(Invited Paper),* A. Klisnick, Univ. Paris-Sud II (France) . . . . . [6702-10]

SESSION 4 . . . . . Wed. 3:30 to 5:00 pm

Free Electron Lasers and Synchrotron Sources

Chair: **Geoffrey J. Pert**, The Univ. of York (United Kingdom)

Ultrafast coherent diffractive imaging with x-ray free-electron lasers *(Invited Paper),* H. N. Chapman, Lawrence Livermore National Lab. . . . . [6702-11]

Applications of the FLASH FEL for high-energy density science, R. W. Lee, Univ. of California/Berkeley; J. S. Wark, B. Nagler, Univ. of Oxford (United Kingdom); A. J. Nelson, Lawrence Livermore National Lab.; P. A. Heimann, Lawrence Berkeley National Lab.; F. Khattak, D. Riley, T. Dzelzainis, Queen's Univ. (United Kingdom); T. Whitcher, Univ. of Oxford (United Kingdom); T. Tschentscher, S. Toleikis, R. Faeustlin, Deutsches Elektronen-Synchrotron (Germany); M. Fajardo, Instituto Superior Técnico (Portugal); M. Kozlová, Fyzikální Ústav (Czech Republic); P. Zeitoun, École Nationale Supérieure de Techniques Avancées (France); P. Mercere, Synchrotron SOLEIL (France); S. Moon, H. Chung, H. A. Scott, Lawrence Livermore National Lab.; D. H. Schneider, T. Schenkel, Lawrence Berkeley National Lab.; H. N. Chapman, S. Bajt, Lawrence Livermore National Lab. . . . . [6702-12]

Relativistic Thomson scattering in compact linacs and storage rings: a route to quasi-monochromatic tunable laboratory-scale x-ray sources, A. V. Vinogradov, M. V. Gorbunkov, Y. Y. Maslova, P.N. Lebedev Physical Institute (Russia) . . . . . [6702-13]

Inverse Compton backscattering source driven by the multi 10-TW laser installed at Daresbury, G. Priebe, Council for the Central Lab. of the Research Councils (United Kingdom); S. P. Malton, Univ. College London (United Kingdom) and Council for the Central Lab. of the Research Councils (United Kingdom); M. A. MacDonald, D. Laundy, G. P. Diakun, L. B. Jones, D. J. Holder, G. J. Hirst, S. L. Smith, E. A. Seddon, Council for the Central Lab. of the Research Councils (United Kingdom) . . . . . [6702-14]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Development of OPCPA system for x-ray laser driver and prepulse control,** M. Kishimoto, Japan Atomic Energy Agency (Japan) . . . . . [6702-31]

✔ **Optimization of nitrogen filled capillary pinch for soft x-ray laser recombination pumping,** P. Vrba, Institute of Plasma Physics (Czech Republic) and Czech Technical Univ. in Prague (Czech Republic); M. Vrbova, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6702-32]

✔ **Development of ultrafast soft x-ray beamline at PALS and surface modification of solids by high-order harmonics,** K. Jakubczak, T. Mocek, J. Polan, P. Homer, B. Rus, Fyzikální Ústav (Czech Republic); I. J. Kim, C. M. Kim, G. H. Lee, C. H. Nam, Korea Advanced Institute of Science and Technology (South Korea); V. Hajkova, J. Chalupsky, L. Juha, Fyzikální Ústav (Czech Republic) . . . . . [6702-33]

✔ **Optical-field-ionization argon x-ray lasing in an optically-preformed plasma waveguide,** P. Lin, Institute of Atomic and Molecular Sciences (Taiwan) and National Taiwan Univ. (Taiwan); M. Chou, Institute of Atomic and Molecular Sciences (Taiwan) and National Chung Cheng Univ. (Taiwan); C. Lin, National Chung Cheng Univ. (Taiwan) and National Chung Cheng Univ. (Taiwan); H. Yang, Institute of Atomic and Molecular Sciences (Taiwan) and National Taiwan Normal Univ. (Taiwan); J. Lin, National Chung Cheng Univ. (Taiwan); J. Wang, Institute of Atomic and Molecular Sciences (Taiwan) and National Taiwan Univ. (Taiwan) and National Central Univ. (Taiwan); S. Chen, Institute of Atomic and Molecular Sciences (Taiwan) and National Central Univ. (Taiwan) . . . . . [6702-34]

✔ **Gallium-based avalanche photon counter with picosecond timing resolution for X to visible range,** J. Blazej, I. Prochazka, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6702-35]

✔ **Target delivery system for high-repetition-rate lasers,** J. Polan, T. Havlicek, B. Rus, Fyzikální Ústav (Czech Republic) . . . . . [6702-36]

Conference 6702

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:30 to 10:00 am

X-Ray Lasers Applications I

Chair: **Peter-Viktor Nickles**, Max-Born-Institut (Germany)

Development of soft x-ray lasers at PALS and their applications in dense plasma physics *(Invited Paper)*, B. Rus, T. Mocek, M. Kozlová, J. Polan, P. Homer, M. Stupka, Fyzikální Ústav (Czech Republic); G. J. Tallents, M. H. Edwards, The Univ. of York (United Kingdom); J. Dunn, A. J. Nelson, Lawrence Livermore National Lab.; L. Juha, Fyzikální Ústav (Czech Republic); M. Fajardo, Instituto Superior Tecnico (Portugal); P. Zeitoun, École Nationale Supérieure de Techniques Avancées (France); N. Booth, Z. Zhai, The Univ. of York (United Kingdom); M. E. Foord, R. L. Shepherd, Lawrence Livermore National Lab.; W. Rozmus, Univ. of Alberta (Canada); H. A. Baldis, Univ. of California/Davis; J. Feldhaus, H. Wabnitz, Deutsches Elektronen-Synchrotron (Germany) . . . [6702-15]

X-ray lasers as probes to measure plasma ablation rates, G. J. Tallents, M. H. Edwards, D. S. Whittaker, P. Mistry, G. J. Pert, The Univ. of York (United Kingdom); B. Rus, T. Mocek, Fyzikální Ústav (Czech Republic) . . . . . [6702-16]

Interferometric lithography with sub-100-nm resolution using a tabletop 46.9-nm laser, M. C. Marconi, P. Wachulak, D. Patel, Colorado State Univ.; M. G. Capeluto, Univ. de Buenos Aires (Argentina); C. S. Menoni, J. J. G. Rocca, Colorado State Univ. . . . . [6702-17]

Tabletop EUV holography with sub-200-nm spatial resolution, P. Wachulak, M. C. Marconi, R. A. Bartels, C. S. Menoni, J. J. G. Rocca, Colorado State Univ. . . . . [6702-18]

SESSION 6 . . . . . Thurs. 10:30 am to 12:20 pm

X-Ray Lasers Applications II

Chair: **Sylvie Jacquemot**, École Polytechnique (France)

Neutral nanocluster structure and chemistry studied by soft x-ray laser single-photon ionization *(Invited Paper)*, E. R. Bernstein, F. Dong, S. C. Heinbuch, J. J. G. Rocca, Colorado State Univ. . . . . [6702-19]

Nanoscale ablation with soft x-ray lasers, F. Brizuela, H. Bravo, M. A. Berrill, B. Langdon, G. O. Vaschenko, C. S. Menoni, J. J. G. Rocca, Colorado State Univ.; O. E. Hemberg, B. H. Frazer, JMAR Technologies, Inc.; W. Chao, Univ. of California/Berkeley; E. H. Anderson, Lawrence Berkeley National Lab.; D. T. Attwood, Jr., Univ. of California/Berkeley . . . . . [6702-20]

Compact 70-nm spatial resolution microscope using a desktop-size soft x-ray laser, C. A. Brewer, F. Brizuela, D. H. Martz, M. C. Marconi, J. J. G. Rocca, C. S. Menoni, Colorado State Univ.; W. Chao, Univ. of California/Berkeley; E. H. Anderson, Lawrence Berkeley National Lab.; D. T. Attwood, Jr., Univ. of California/Berkeley; A. V. Vinogradov, I. A. Artioukov, P.N. Lebedev Physical Institute (Russia); Y. P. Pershyn, V. Kondratenko, Kharkov Polytechnical Institute (Ukraine) . . . . . [6702-21]

Searching for plasmas with anomalous dispersion in the soft x-ray regime, J. Nilsen, Lawrence Livermore National Lab. . . . . [6702-22]

21-nm x-ray laser Thomson scattering of laser-heated exploding foil plasmas, J. Dunn, Lawrence Livermore National Lab.; B. Rus, T. Mocek, Fyzikální Ústav (Czech Republic); A. J. Nelson, M. E. Foord, Lawrence Livermore National Lab.; W. Rozmus, Univ. of Alberta (Canada); H. A. Baldis, Univ. of California/Davis; R. L. Shepherd, Lawrence Livermore National Lab.; M. Kozlová, J. Polan, P. Homer, M. Stupka, Fyzikální Ústav (Czech Republic) . . . . . [6702-23]

Lunch/Exhibition Break

SESSION 7 . . . . . Thurs. 1:50 to 3:20 pm

Overviews

Chair: **Jorge J. G. Rocca**, Colorado State Univ.

Recent progress on x-ray laser source development and application activities at JAEA *(Invited Paper)*, M. Kishimoto, Japan Atomic Energy Agency (Japan) . . . . . [6702-24]

LASERIX: a high-repetition-rate laser facility for performing intense XUV sources, D. R. Ros, Univ. Paris-Sud XI (France) . . . . . [6702-25]

EUV lasers on low-inductive capillary discharges, V. A. Burtsev, E. P. Bolshakov, N. V. Kalinin, V. A. Kubasov, V. I. Chernobrovin, D. V. Efremov Scientific Research Institute of Electrophysical Apparatus (Russia) . . . . . [6702-26]

Research into energy and temporal characteristics of x-ray emission from solid state cathode medium of high-current glow discharge, A. B. Karabut, State Scientific-Industrial Association (Russia) . . . . . [6702-27]

SESSION 8 . . . . . Thurs. 3:50 to 4:50 pm

X-Ray Optics

Chair: **Alexander V. Vinogradov**, P.N. Lebedev Physical Institute (Russia)

Multilayer mirror as a K-α x-ray spectrometer from 20-70 keV at the Titan Laser Facility, B. R. Maddox, H. Park, S. Bajt, B. A. Remington, M. A. McKernan, Lawrence Livermore National Lab. . . . . [6702-28]

Structural transformations in multilayers and bulk materials irradiated by EUV lasers, D. L. Voronov, Lawrence Berkeley National Lab.; E. N. Zubarev, Y. P. Pershyn, V. A. Sevryukova, V. V. Kondratenko, Kharkov Polytechnical Institute (Ukraine); A. V. Vinogradov, I. A. Artioukov, Y. A. Uspenskiy, P.N. Lebedev Physical Institute (Russia); M. E. Grisham, Colorado State Univ.; G. O. Vaschenko, Cymer, Inc.; C. S. Menoni, J. J. G. Rocca, Colorado State Univ. . . . . [6702-29]

Advances in short-wavelength x-ray multilayer optics: toward high-throughput multimirror systems for the wavelengths <10 nm, I. A. Artyukov, P.N. Lebedev Physical Institute (Russia); Y. A. Bugaev, O. Y. Devizenko, Kharkov Polytechnical Institute (Ukraine); R. M. Feschenko, P.N. Lebedev Physical Institute (Russia); V. V. Kondratenko, Kharkov Polytechnical Institute (Ukraine); Y. A. Uspenski, A. V. Vinogradov, P.N. Lebedev Physical Institute (Russia) [6702-30]

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Conference 6703

Sunday-Monday 26-27 August 2007 • Proceedings of SPIE Vol. 6703

Ultrafast X-Ray Sources and Detectors

Conference Chairs: **Zenghu Chang**, Kansas State Univ.; **George A. Kyrala**, Los Alamos National Lab.; **Jean-Claude Kieffer**, Institut National de la Recherche Scientifique (Canada)

Program Committee: **Bernhard W. Adams**, Argonne National Lab.; **Fred Bijkerk**, FOM-Institute for Plasma Physics Rijnhuizen (Netherlands); **Paul B. Corkum**, National Research Council Canada (Canada); **Anatoly Y. Faenov**, Institute for High Temperatures (Russia); **Roger W. Falcone**, Univ. of California/Berkeley; **Henryk Fiedorowicz**, Wojskowa Akademia Techniczna (Poland); **Philip A. Heimann**, Lawrence Berkeley National Lab.; **Xun Hou**, Xi'an Institute of Optics and Precision Mechanics (China); **Paul A. Jaanimagi**, Univ. of Rochester; **Victor L. Kantsyrev**, Univ. of Nevada/Reno; **Ronnie L. Shepherd**, Lawrence Livermore National Lab.; **Jin Wang**, Argonne National Lab.

Sunday 26 August

SESSION 1 . . . . . Sun. 8:00 to 10:10 am

X-Ray Generation and Application

Chair: **Victor L. Kantsyrev**, Univ. of Nevada/Reno

Some 10-fs x-ray emission switches *(Invited Paper)*, F. B. Rosmej, Univ. de Provence (France) . . . . . [6703-01]

Ultra-intense-laser produced high-Z backlighters for Compton radiography, R. Tommasini, H. Park, P. K. Patel, B. R. Maddox, S. Le Pape, S. P. Hatchett II, B. A. Remington, M. H. Key, N. Izumi, M. Tabak, J. A. Koch, O. L. Landen, Lawrence Livermore National Lab.; J. F. Seely, G. E. Holland, Naval Research Lab.; L. T. Hudson, National Institute of Standards and Technology . . . . . [6703-02]

Applications of laser-produced betatron radiation, A. Rousse, K. Ta Phuoc, R. Fitour, S. Corde, F. Albert, École Nationale Supérieure de Techniques Avancées (France) . . . . . [6703-03]

LASERIX: a European versatile high-repetition-rate x-ray facility for applications in the XUV range, D. R. Ros, Univ. Paris-Sud II (France) . . . . . [6703-04]

Spatially resolved x-ray spectroscopy for heavy ion beam interaction with solid matter investigations, S. A. Pikuz, Jr., Institute for High Energy Densities (Russia); O. Rosmej, Gesellschaft für Schwerionenforschung mbH (Germany); A. Y. Faenov, I. Y. Skobelev, Institute for High Temperatures (Russia); S. Korostiy, A. Blazevic, Gesellschaft für Schwerionenforschung mbH (Germany); A. D. Fertman, Institute for Theoretical and Experimental Physics (Russia); V. P. Efremov, Institute for High Energy Densities (Russia); D. H. H. Hoffmann, Technische Univ. Darmstadt (Germany) [6703-05]

Modern x-ray sources based on university-scale 1-MA z-pinch generators, V. L. Kantsyrev, Univ. of Nevada/Reno . . . . . [6703-06]

SESSION 2 . . . . . Sun. 10:40 am to 12:20 pm

EUV X-Ray Sources and Applications

Chair: **Henryk Fiedorowicz**, Wojskowa Akademia Techniczna (Poland)

CO_2 laser-produced Sn plasma as the solution for high-volume manufacturing EUV lithography, A. Endo, T. Abe, Y. Ueno, T. Asayama, H. Komori, G. Soumagne, H. Mizoguchi, A. Sumitani, K. Toyoda, Extreme Ultraviolet Lithography System Development Association (Japan) . . . . . [6703-07]

Dynamics of laser-produced Sn-based plasmas for a monochromatic 13.5-nm extreme ultraviolet source, Y. Tao, M. S. Tillack, K. L. Sequoia, R. Burdt, F. Najmabadi, Univ. of California/San Diego . . . . . [6703-08]

Theoretical and experimental investigation of soft x-rays emitted from TIN plasmas for lithographic application, P. Demir, Middle East Technical Univ. (Turkey); E. Kacar, E. Akman, Kocaeli Univ. (Turkey); S. K. Bilikmen, Middle East Technical Univ. (Turkey); A. Demir, Kocaeli Univ. (Turkey) . . . . . [6703-09]

Micro and nanoprocessing of organic polymers using a compact laser plasma EUV source equipped with EUV optical systems, H. Fiedorowicz, A. S. Bartnik, R. Jarocki, J. Kostecki, R. Rakowski, A. Szczurek, M. Szczurek, Wojskowa Akademia Techniczna (Poland) . . . . . [6703-10]

New 100-Hz repetition rate soft x-ray laser plasma source for ultrafast XANES applications, S. Fourmaux, L. Lecherbourg, M. Harmand, M. Servol, J. Kieffer, Institut National de la Recherche Scientifique (Canada) . . [6703-11]

Lunch Break

SESSION 3 . . . . . Sun. 1:30 to 3:10 pm

Attosecond Pulse and High Harmonic Generation

Chair: **Jean-Claude Kieffer**, Institut National de la Recherche Scientifique (Canada)

Keynote

Probing molecules through high harmonics generation with long-wavelength laser fields *(Invited Paper)*, D. Comtois, H. C. Bandulet, H. Pépin, Institut National de la Recherche Scientifique (Canada); P. B. Corkum, National Research Council Canada (Canada); J. Kieffer, Institut National de la Recherche Scientifique (Canada); D. M. Villeneuve, National Research Council Canada (Canada) . . . . . [6703-12]

Measurement of attosecond XUV pulses generated with polarization gating, S. Ghimire, X. Feng, Z. Chang, Kansas State Univ. . . . . [6703-13]

Dispersive broadband multilayer XUV optics for attosecond pulses, U. Kleineberg, Ludwig-Maximilians-Univ. München (Germany); E. Goulielmakis, Max-Planck-Institut für Quantenoptik (Germany); M. Hofstetter, Ludwig-Maximilians-Univ. München (Germany); M. Schultze, Max-Planck-Institut für Quantenoptik (Germany); M. Uiberacker, V. S. Yakovlev, Ludwig-Maximilians-Univ. München (Germany); F. Krausz, Max-Planck-Institut für Quantenoptik (Germany) . . . . . [6703-14]

Carrier envelope phase effects on polarization gated attosecond spectra, Z. Chang, Kansas State Univ. [6703-15]

SESSION 4 . . . . . Sun. 3:40 to 6:10 pm

Ultrafast Detectors and Applications

Chairs: **Philip A. Heimann**, Lawrence Berkeley National Lab.; **Jin Wang**, Argonne National Lab.

Ultrafast x-ray streak camera development at the Advanced Light Source Facility *(Invited Paper)*, J. Feng, Lawrence Berkeley National Lab. . . . . [6703-16]

Ultrafast x-ray imaging of highly transient multiphase sprays and flows *(Invited Paper)*, J. Wang, Argonne National Lab. . . . . [6703-17]

New streak cameras performances investigation at the Advanced Laser Light Source Facility, S. Fourmaux, C. Martel, L. Lecherbourg, Institut National de la Recherche Scientifique (Canada); S. Magnan, C. Y. Coté, Axis Photonique Inc. (Canada); J. Kieffer, Institut National de la Recherche Scientifique (Canada) . . . . . [6703-18]

Space charge effects in the axis PX1 x-ray streak camera, M. H. Edwards, N. Booth, Z. Zhai, G. J. Tallents, The Univ. of York (United Kingdom); T. Dzelzainis, C. L. S. Lewis, Queen's Univ. Belfast (United Kingdom) . . . . . [6703-19]

Calibration of gated MCP responses in the x-ray region: spatial gain variations, G. A. Kyrala, S. C. Evans, T. Archuletta, J. Cowan, J. A. Oertel, P. Sanchez, Los Alamos National Lab. . . . . [6703-20]

Front and back side processed unintentionally doped GaAs Scottky detectors for x-ray detection, A. F. Semendy, Army Research Lab.; S. Singh, Prime Circuits Inc.; M. S. Litz, P. S. Wijewarnasuriya, K. Blaine, N. K. Dhar, Army Research Lab. . . . . [6703-21]

Pixel array detector for the capture of femtosecond duration x-ray images, H. T. Philipp, L. J. Koerner, M. Pouchet, M. W. Tate, S. M. Gruner, Cornell Univ. . . [6703-22]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Effects of the x-ray radiation field from laser produced plasmas on the distributions of the populations,** W. Wang, Institute of Physics (China) and Capital Normal Univ. (China) . . . . . [6703-23]

✔ **Study of 2D plasma evolution based on similarity equations,** T. Cheng, Institute of Physics (China) . [6703-24]

Conference 6704

Thursday 30 August 2007 • Proceedings of SPIE Vol. 6704

Advances in Metrology for X-Ray and EUV Optics II

Conference Chairs: **Lahsen Assoufid**, Argonne National Lab.; **Peter Z. Takacs**, Brookhaven National Lab.; **Masaru Ohtsuka**, Canon Inc. (Japan)

Program Committee: **Daniele Cocco**, Sincrotrone Trieste S.C.p.A. (Italy); **Leslie L. Deck**, Zygo Corp.; **Jean-Jacques Fermé**, Société Europeenne De Systèmes Optiques (France); **Klaus R. Freischlad**, ADE Phase Shift; **Ralf D. Geckeler**, Physikalisch-Technische Bundesanstalt (Germany); **Olivier Hignette**, European Synchrotron Radiation Facility (France); **Wayne R. McKinney**, Lawrence Berkeley National Lab.; **Paul E. Murphy**, QED Technologies Inc.; **Francois A. Polack**, LURE/Univ. Paris-Sud (France); **Seungyu Rah**, Pohang Univ. of Science and Technology (South Korea); **Kawal J. S. Sawhney**, Diamond Light Source Ltd. (United Kingdom); **Frank Siewert**, BESSY GmbH (Germany); **Kazuto Yamauchi**, Osaka Univ. (Japan); **Valeriy V. Yashchuk**, Lawrence Berkeley National Lab.

Thursday 30 August

SESSION 1 . . . . . Thurs. 8:30 to 10:10 am

Chairs: **Masaru Ohtsuka**, Canon Inc. (Japan); **Ralf D. Geckeler**, Physikalisch-Technische Bundesanstalt (Germany)

Suppressing vibration errors in phase shifting interferometry, L. L. Deck, Zygo Corp. . . . . [6704-01]

High-order-harmonics wavefront measurement and optimization, J. Gautier, A. Morlens, P. Zeitoun, G. Rey, J. P. Goddet, S. Sebban, École Nationale Supérieure de Techniques Avancées (France); G. Dollivaire, X. Levecq, S. Bucourt, Imagine Optic (France) . . . . . [6704-02]

Hard x-ray wavefront measurement and control for hard x-ray nanofocusing, S. Handa, H. Mimura, T. Kimura, H. Yumoto, S. Matsuyama, Y. Sano, Osaka Univ. (Japan); K. Tamasaku, Y. Nishino, The Institute of Physical and Chemical Research (RIKEN) (Japan); M. Yabashi, Japan Synchrotron Radiation Research Institute (Japan); T. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan); K. Yamauchi, Osaka Univ. (Japan) . . . . . [6704-03]

Microstitching interferometer and relative angle determinable stitching interferometer for half-a-meter-long x-ray mirror, H. Ohashi, Japan Synchrotron Radiation Research Institute (Japan); T. Tsumura, H. Okada, JTEC Corp. (Japan); H. Mimura, Osaka Univ. (Japan); T. Masunaga, JTEC Corp. (Japan); Y. Senba, S. Goto, Japan Synchrotron Radiation Research Institute (Japan); K. Yamauchi, Osaka Univ. (Japan); T. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan) . . . . . [6704-04]

Microstitching tool for evaluating the surface profile of nanofocusing x-ray K-B mirrors, L. Assoufid, A. T. Macrander, C. M. Kewish, J. Qian, C. Liu, R. Conley, Jr., Argonne National Lab.; D. A. Lindley, C. E. Saxer, KLA-Tencor Corp. . . . . [6704-05]

SESSION 2 . . . . . Thurs. 10:40 am to 12:00 pm

Chairs: **Wayne R. McKinney**, Lawrence Berkeley National Lab.; **Leslie L. Deck**, Zygo Corp.

Optimized use and calibration of autocollimators in deflectometry, R. D. Geckeler, A. Just, Physikalisch-Technische Bundesanstalt (Germany) . . . . . [6704-06]

Binary pseudo-random grating as a standard test surface for measurement of modulation transfer function of interferometric microscopes, V. V. Yashchuk, W. R. McKinney, Lawrence Berkeley National Lab.; P. Z. Takacs, Brookhaven National Lab. . . . . [6704-07]

Precision tiltmeter as a reference for slope measuring instruments, J. L. Kirschman, E. E. Domning, G. Y. Morrison, B. V. Smith, V. V. Yashchuk, Lawrence Berkeley National Lab. . . . . [6704-08]

Proposal for a universal test mirror for characterization of slope measuring instruments, V. V. Yashchuk, W. R. McKinney, A. Warwick, Lawrence Berkeley National Lab.; T. Noll, F. Siewert, T. Zeschke, BESSY GmbH (Germany); R. D. Geckeler, Physikalisch-Technische Bundesanstalt (Germany) . . . . . [6704-09]

Lunch/Exhibition Break

SESSION 3 . . . . . Thurs. 1:30 to 3:00 pm

Chairs: **Lahsen Assoufid**, Argonne National Lab.; **Haruhiko Ohashi**, Japan Synchrotron Radiation Research Institute (Japan)

Results of the second metrology round-robin measurements between the APS, ESRF, and SPring-8 Laboratories focused on spherical and aspheric x-ray mirrors, A. Rommeveaux, European Synchrotron Radiation Facility (France); L. Assoufid, Argonne National Lab.; H. Ohashi, Japan Synchrotron Radiation Research Institute (Japan); H. Mimura, K. Yamauchi, Osaka Univ. (Japan); J. Qian, Argonne National Lab.; T. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan); C. Morawe, European Synchrotron Radiation Facility (France); A. T. Macrander, A. M. Khounsary, Argonne National Lab.; S. Goto, Japan Synchrotron Radiation Research Institute (Japan) . . . . . [6704-10]

Comparison of surface slope errors acquired with a long trace profiler and a Fizeau interferometer, J. Qian, L. Assoufid, A. T. Macrander, Argonne National Lab. . [6704-11]

Surface gradient integrated profiler for x-ray and EUV optics, Y. Higashi, High Energy Accelerator Research Organization (Japan) . . . . . [6704-12]

Progress in the x-ray optics and metrology lab at Diamond Light Source, S. G. Alcock, K. J. S. Sawhney, Diamond Light Source Ltd. (United Kingdom) . . . . . [6704-13]

SESSION 4 . . . . . Thurs. 3:30 to 5:10 pm

Chairs: **Peter Z. Takacs**, Brookhaven National Lab.; **Valeriy V. Yashchuk**, Lawrence Berkeley National Lab.

Recent developments on the Daresbury Laboratory long trace profiler, A. J. Gleeson, Council for the Central Lab. of the Research Councils (United Kingdom) . . . . . [6704-14]

New procedures for the adjustment of elliptically bent mirrors with the long trace profiler, W. R. McKinney, S. C. Irick, J. L. Kirschman, A. A. MacDowell, A. Warwick, V. V. Yashchuk, Lawrence Berkeley National Lab. . . . . [6704-15]

Performance and calibration of long trace profilometer, A. K. Saxena, Indian Institute of Astrophysics (India); R. Mukund, Bhabha Atomic Research Ctr. (India) . . . . . [6704-16]

Systematic error reduction: non-tilting reference beam method for long trace profiler, S. Qian, K. Qian, Brookhaven National Lab.; Y. Hong, L. Sheng, National Synchrotron Radiation Lab. (China); P. Z. Takacs, Brookhaven National Lab. . . . . [6704-17]

Flat-field calibration of CCD detector for long trace profilers, J. L. Kirschman, E. E. Domning, S. C. Irick, A. A. MacDowell, W. R. McKinney, G. Y. Morrison, B. V. Smith, A. Warwick, V. V. Yashchuk, Lawrence Berkeley National Lab. . . . . [6704-18]

Conference 6705

Monday-Tuesday 27-28 August 2007 • Proceedings of SPIE Vol. 6705

Advances in X-Ray/EUV Optics and Components II

Conference Chairs: **Ali M. Khounsary**, Argonne National Lab.; **Christian Morawe**, European Synchrotron Radiation Facility (France); **Shunji Goto**, Japan Synchrotron Radiation Research Institute (Japan)

Program Committee: **Lahsen Assoufid**, Argonne National Lab.; **Sasa Bajt**, Lawrence Livermore National Lab.; **Stefan Braun**, Fraunhofer-Institut für Werkstoff- und Strahltechnik (Germany); **Sultan B. Dabagov**, Istituto Nazionale di Fisica Nucleare (Italy); **Hans M. Hertz**, Kungliga Tekniska Högskolan (Sweden); **Olivier Hignette**, European Synchrotron Radiation Facility (France); **Werner H. Jark**, Sincrotrone Trieste S.C.p.A. (Italy); **Igor V. Kozhevnikov**, A.V. Shubnikov Institute of Crystallography (Russia); **George A. Kyrala**, Los Alamos National Lab.; **Carolyn A. MacDonald**, SUNY/Univ. at Albany; **Howard A. Padmore**, Lawrence Berkeley National Lab.; **Ladislav Pina**, Czech Technical Univ. (France); **Yuriy Y. Platonov**, Rigaku/MSC, Inc.; **Kawal J. S. Sawhney**, Diamond Light Source Ltd. (United Kingdom); **Anatoly A. Snigirev**, European Synchrotron Radiation Facility (France); **Peter Z. Takacs**, Brookhaven National Lab.; **John S. Taylor**, Lawrence Livermore National Lab.; **Edmond I. C. Turcu**, Rutherford Appleton Lab. (United Kingdom); **Kazuto Yamauchi**, Osaka Univ. (Japan)

Monday 27 August

SESSION 1 . . . . . Mon. 8:50 to 10:10 am

Optics Development Facilities

Chairs: **Shunji Goto**, Japan Synchrotron Radiation Research Institute (Japan); **Hans M. Hertz**, Kungliga Tekniska Högskolan (Sweden)

Active microstructured arrays for x-ray optics, A. G. Michette, King's College London (United Kingdom); T. W. Button, The Univ. of Birmingham (United Kingdom); C. C. Dunare, Univ. of Edinburgh (United Kingdom); C. Feldman, Univ. of Leicester (United Kingdom); M. Folkard, Mount Vernon Hospital (United Kingdom); C. McFaul, G. R. Morrison, King's College London (United Kingdom); W. Parkes, Univ. of Edinburgh (United Kingdom); S. J. Pfauntsch, A. K. Powell, S. Sahraei, King's College London (United Kingdom); J. T. M. Stevenson, The Univ. of Edinburgh (United Kingdom); R. Willingale, Univ. of Leicester (United Kingdom); D. Zhang, The Univ. of Birmingham (United Kingdom) . . . . . [6705-01]

Hard x-ray focusing by single bounce capillary, A. A. Snigirev, European Synchrotron Radiation Facility (France); A. A. Bjeoumikhov, Institut für Geraetebau GmbH (Germany); A. I. Erko, BESSY GbmH (Germany); I. I. Snigireva, European Synchrotron Radiation Facility (France); M. V. Grigoriev, V. Yunkin, Institute of Microelectronics Technology and High Purity Materials (Russia); M. Erko, S. Bjeoumikhova, Institut für Geraetebau GmbH (Germany) . . . . . [6705-02]

The new ESRF multilayer deposition facility, C. Morawe, C. Borel, J. Peffen, European Synchrotron Radiation Facility (France) . . . . . [6705-03]

Multilayer growth in the APS rotary deposition system, R. Conley, Jr., C. Liu, C. M. Kewish, A. T. Macrander, Argonne National Lab.; C. Morawe, European Synchrotron Research Facility (France) . . . . . [6705-04]

SESSION 2 . . . . . Mon. 10:40 am to 12:00 pm

X-Ray Lenses and Applications

Chairs: **Ali M. Khounsary**, Argonne National Lab.; **Howard A. Padmore**, Lawrence Berkeley National Lab.

Silicon planar lenses for high-energy x-ray nanofocusing, A. A. Snigirev, European Synchrotron Radiation Facility (France); M. V. Grigoriev, Institute of Microelectronics Technology (Russia); M. Di Michiel, I. I. Snigireva, European Synchrotron Radiation Facility (France); V. Yunkin, Institute of Microelectronics Technology (Russia); S. Kuznetsov, Institute of Microelectronics Technology and High Purity Materials (Russia); G. Vaughan, P. Van Vaerenbergh, European Synchrotron Radiation Facility (France) . . . . . [6705-05]

Development of refractive focusing optics at Diamond, L. Alianelli, K. J. S. Sawhney, Diamond Light Source Ltd. (United Kingdom); I. M. Loader, D. W. Jenkins, R. Stevens, Rutherford Appleton Lab. (United Kingdom); A. A. Snigirev, I. I. Snigireva, European Synchrotron Radiation Facility (France) . [6705-06]

Nanopositioning of the silicon planar lenses used, P. Van Vaerenbergh, A. A. Snigirev, M. A. Nicola, I. I. Snigireva, European Synchrotron Radiation Facility (France); M. V. Grigoriev, Institute of Microelectronics Technology and High Purity Materials (Russia); G. Vaughan, European Synchrotron Radiation Facility (France) . . . . . [6705-07]

Projection-type x-ray microscope based on a spherical compound refractive x-ray lens, Y. I. Dudchik, Belarusian State Univ. (Belarus); C. K. Gary, H. Park, Adelphi Technology, Inc.; R. H. Pantell, Stanford Univ.; M. A. Piestrup, Adelphi Technology, Inc. . . . . [6705-08]

Lunch Break

SESSION 3 . . . . . Mon. 2:00 to 3:40 pm

Multilayer Optics

Chairs: **Christian Morawe**, European Synchrotron Radiation Facility (France); **Yuriy Y. Platonov**, Rigaku/MSC, Inc.

Deposition and analysis of a small d-spacing depth graded multilayer structure, D. M. Broadway, Y. Y. Platonov, Rigaku/MSC, Inc.; R. C. Mancini, Univ. of Nevada/Reno; R. Tommasini, Lawrence Livermore National Lab. . . . . [6705-09]

Influence of impurities on structure and performance of Cr/Sc multilayer mirrors, N. Ghafoor, F. Eriksson, Linköpings Univ. (Sweden); U. Kreissig, Forschungszentrum Dresden-Rossendorf (Germany); J. Birch, Linköpings Univ. (Sweden) . . . . . [6705-10]

XUV optics for attosecond applications, G. Julien, A. Morlens, P. Zeitoun, G. Rey, J. P. Goddet, S. Sebban, École Nationale Supérieure de Techniques Avancées (France); F. Delmotte, M. Ravet-Krill, F. Bridou, Institut d'Optique (France) . . . . . [6705-11]

Metrology design for micro-mirrors with replicated multilayers, L. Sveda, Czech Technical Univ. in Prague (Czech Republic) and REFLEX s.r.o. (Czech Republic); A. J. Inneman, V. Semencova, REFLEX s.r.o. (Czech Republic); L. Pina, REFLEX s.r.o. (Czech Republic) and Czech Technical Univ. in Prague (Czech Republic); R. Hudec, REFLEX s.r.o. (Czech Republic); R. Havlikova, Czech Technical Univ. in Prague (Czech Republic) . . . . . [6705-12]

Development of an ultrahigh-resolution diffraction grating for soft x-rays, D. L. Voronov, R. Cambie, Lawrence Berkeley National Lab.; R. M. Feshchenko, P.N. Lebedev Physical Institute (Russia); E. M. Gullikson, H. A. Padmore, Lawrence Berkeley National Lab.; A. V. Vinogradov, P.N. Lebedev Physical Institute (Russia); V. V. Yashchuk, Lawrence Berkeley National Lab. . . . . [6705-13]

SESSION 4 . . . . . Mon. 4:10 to 5:10 pm

Zone Plates and Applications

Chairs: **John S. Taylor**, Lawrence Livermore National Lab.; **Anatoly A. Snigirev**, European Synchrotron Radiation Facility (France)

Laboratory-scale arrangement for soft x-ray zone plate efficiency measurements, M. C. Bertilson, P. A. Takman, A. Holmberg, U. Vogt, H. M. Hertz, Kungliga Tekniska Högskolan (Sweden) . . . . . [6705-14]

Focusing high-energy x-rays with stacked Fresnel zone plates, I. I. Snigireva, A. A. Snigirev, European Synchrotron Radiation Facility (France); V. G. Kohn, Russian Research Ctr. Kurchatov Institute (Russia); V. Yunkin, M. V. Grigoriev, S. Kuznetsov, Institute of Microelectronics Technology and High Purity Materials (Russia); G. Vaughan, M. Di Michiel, European Synchrotron Radiation Facility (France) . . . . . [6705-15]

Zone plates for hard x-rays based on fiber (SPCVD) technology, R. M. Feshchenko, I. A. Artyukov, A. V. Vinogradov, P.N. Lebedev Physical Institute (Russia); K. M. Golant, General Physics Institute (Russia); A. N. Mitrofanov, P.N. Lebedev Physical Institute (Russia); S. V. Lavrishchev, General Physics Institute (Russia); A. V. Popov, Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation (Russia) . . . . . [6705-16]

✔ Posters-Monday

Chairs: ***Ali M. Khounsary**, Argonne National Lab.; **Christian Morawe**, European Synchrotron Radiation Facility (France)*

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **EUV remote sensing by a newly developed Mg/SiC mirror on a small satellite,** I. Yoshikawa, G. Murakami, K. Yoshioka, The Univ. of Tokyo (Japan) . . . . . [6705-31]

✔ **Study of optical properties of x-ray system based on two zone plates,** A. Kuyumchyan, Institute of Microelectronics Technology and High Purity Materials (Russia); V. G. Kohn, Russian Research Ctr. Kurchatov Institute (Russia); I. I. Snigireva, A. A. Snigirev, European Synchrotron Radiation Facility (France); A. A. Isoyan, A. S. Kuznetsov, E. V. Shulakov, V. V. Aristov, Institute of Microelectronics Technology and High Purity Materials (Russia) . . . [6705-32]

✔ **Experimental study of Kumakhov polycapillary optics for hard x-ray microfocusing,** O. V. Mikhin, S. V. Nikitina, A. A. Priladyshev, Institute for Roentgen Optics (Russia); A. A. Snigirev, I. I. Snigireva, European Synchrotron Radiation Facility (France) . . . . . [6705-33]

✔ **High-performance multilayer coatings for 105 nm,** E. Y. Taracheva, S. A. Yulin, T. Feigl, N. Kaiser, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [6705-34]

OPTICS

✔ **X-ray transfocator based on al parabolic refractive lenses for high energy x-ray focusing and collimation,** M. Rossat, G. Vaughan, J. Wright, I. I. Snigireva, A. A. Snigirev, A. Bytchkov, C. Curfs, European Synchrotron Radiation Facility (France) . . . . . [6705-35]

✔ **X-ray collimators based on compound refractive lenses,** S. Kuznetsov, Institute of Microelectronics Technology and High Purity Materials (Russia); G. Vaughan, J. Wright, I. I. Snigireva, A. A. Snigirev, European Synchrotron Radiation Facility (France); M. V. Grigoriev, V. Yunkin, Institute of Microelectronics Technology and High Purity Materials (Russia) . . . . . [6705-36]

✔ **High-energy-resolution monochromator for nuclear resonant scattering of synchrotron radiation by Te-125 at 35.49 keV,** Y. Imai, Japan Synchrotron Radiation Research Institute (Japan) and Japan Science and Technology Agency (Japan); M. Seto, Kyoto Univ. and Japan Science and Technology Agency (Japan); Y. Yoda, Japan Synchrotron Radiation Research Institute (Japan) and Japan Science and Technology Agency (Japan); S. Kitao, R. Masuda, S. Higashitaniguchi, C. Inaba, Kyoto Univ. and Japan Science and Technology Agency (Japan) . . [6705-38]

✔ **Micro-optics test bench at the ESRF,** A. A. Snigirev, R. Hustache, J. Massonnat, L. Claustre, I. I. Snigireva, European Synchrotron Radiation Facility (France); M. V. Grigoriev, Institute of Microelectronics Technology (Russia); P. Duboc, European Synchrotron Radiation Facility (France) . . . . . [6705-37]

Tuesday 28 August

SESSION 5 . . . . . Tues. 8:40 to 10:00 am

Optics and Beam Coherence

Chairs: **Christian Morawe**, European Synchrotron Radiation Facility (France); **Howard A. Padmore**, Lawrence Berkeley National Lab.

Characterization of beryllium and CVD diamond for synchrotron radiation beamline windows and x-ray beam monitor, S. Goto, S. Takahashi, T. Kudo, Japan Synchrotron Radiation Research Institute (Japan); M. Yabashi, K. Tamasaku, Y. Nishino, T. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan) . . . . . [6705-17]

Simulation of partially coherent image formation in x-ray microscopy, O. von Hofsten, P. A. Takman, U. Vogt, Kungliga Tekniska Högskolan (Sweden) . . . . . [6705-18]

Perfect-crystal x-ray optics to utilize x-ray coherence, H. Yamazaki, Japan Synchrotron Radiation Research Institute (Japan); T. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan) . . . . . [6705-19]

Diamonds for x-ray optical applications at 3rd and 4th generation x-ray sources, J. W. Hartwig, P. Van Vaerenbergh, F. Masiello, A. Rommeveaux, A. I. Chumakov, G. Carbone, European Synchrotron Radiation Facility (France); S. H. Connell, D. Dube, R. Setshedi, M. Rebak, Univ. of the Witwatersrand (South Africa); R. C. Burns, J. O. Hansen, Element Six Technologies (South Africa) . . . . . [6705-20]

SESSION 6 . . . . . Tues. 10:30 am to 12:10 pm

Mirrors and Applications

Chairs: **Shunji Goto**, Japan Synchrotron Radiation Research Institute (Japan); **Olivier Hignette**, European Synchrotron Radiation Facility (France)

Reflective optics for sub-10-nm hard x-ray focusing, H. Mimura, S. Matsuyama, H. Yumoto, S. Handa, T. Kimura, Y. Sano, Osaka Univ. (Japan); K. Tamasaku, Y. Nishino, The Institute of Physical and Chemical Research (RIKEN) (Japan); M. Yabashi, Japan Synchrotron Radiation Research Institute (Japan); T. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan); K. Yamauchi, Osaka Univ. (Japan) . . . . . [6705-21]

Large thin adaptive x-ray mirrors, P. Doel, C. Atkins, D. Brooks, Univ. College London (United Kingdom); T. W. Button, The Univ. of Birmingham (United Kingdom); C. Feldman, R. Willingale, Univ. of Leicester (United Kingdom); J. Yao, Univ. College London (United Kingdom); D. Zhang, The Univ. of Birmingham (United Kingdom) . . . . . [6705-22]

Effect of x-ray beamline optics on x-ray photon correlation spectroscopy experiments, A. R. Sandy, S. Narayanan, M. S. Sprung, Argonne National Lab. . . . . [6705-23]

Soft x-ray mirrors for the LCLS, M. J. Pivovaroff, R. M. Bionta, Lawrence Livermore National Lab.; P. M. Stefan, SSRL Beam Line Development Group; R. Soufli, Lawrence Livermore National Lab. . . . . [6705-24]

Beam-splitting mirrors for an APS beamline, A. M. Khounsary, I. McNulty, Argonne National Lab. . . . . [6705-25]

Lunch/Exhibition Break

SESSION 7 . . . . . Tues. 2:00 to 3:40 pm

Thermal Issues and Prospects in EUV and X-Ray Optics

Chairs: **Ali M. Khounsary**, Argonne National Lab.; **Kazuto Yamauchi**, Osaka Univ. (Japan)

Direct water-cooled crystal development for SPring-8 bending magnet beamlines, K. Takeshita, S. Goto, Japan Synchrotron Radiation Research Institute (Japan); T. Ishikawa, The Institute of Physical and Chemical Research (RIKEN) (Japan) . . . . . [6705-26]

Multilayer optics under CHESS A2 wiggler beam, A. Y. Kazimirov, P. Revesz, Cornell Univ. . . . . [6705-27]

Interdiffusion studies of Cr/Sc soft x-ray multilayer mirrors, F. Eriksson, N. Ghafoor, J. Birch, Linköpings Univ. (Sweden) . . . . . [6705-28]

Measurement of thermal contact conductance of SPring-8 beamline components, T. Mochizuki, H. Ohashi, S. Goto, M. Sano, S. Takahashi, Japan Synchrotron Radiation Research Institute (Japan) . . . . . [6705-29]

Corrector of quasi-static large-scale optical distortions for EUV projection lithography at 13.5 nm, S. A. Dimakov, S.I. Vavilov State Optical Institute (Russia) . . . . . [6705-30]

X-Ray/UV Optics Technical Event . 8:00 to 10:00 pm

Please see page 14 for details.

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Conference 6706

Monday-Wednesday 27-29 August 2007 • Proceedings of SPIE Vol. 6706

Hard X-Ray and Gamma-Ray Detector Physics IX

Conference Chairs: **Ralph B. James**, Brookhaven National Lab.; **Arnold Burger**, Fisk Univ.; **Larry A. Franks**, Consultant

Program Committee: **Toru Aoki**, Shizuoka Univ. (Japan); **H. Bradford Barber**, The Univ. of Arizona; **Zane W. Bell**, Oak Ridge National Lab.; **Lynn A. Boatner**, Oak Ridge National Lab.; **Aleksey E. Bolotnikov**, Brookhaven National Lab.; **Muren Chu**, Consultant; **F. Patrick Doty**, Sandia National Labs.; **Michael Fiederle**, Albert-Ludwigs-Univ. Freiburg (Germany); **Jonathan E. Grindlay**, Harvard-Smithsonian Ctr. for Astrophysics; **Yoshinori Hatanaka**, Aichi Univ. of Technology (Japan); **Zhong He**, Univ. of Michigan; **Alan Janos**, U.S. Dept. of Homeland Security; **Warnick J. Kernan**, National Security Technologies, LLC; **Glenn F. Knoll**, Univ. of Michigan; **Henric S. Krawczynski**, Washington Univ. in St. Louis; **Longxia Li**, Yinnel Tech, Inc.; **Paul N. Luke**, Lawrence Berkeley National Lab.; **Kelvin G. Lynn**, Washington State Univ.; **Krishna C. Mandal**, EIC Labs., Inc.; **Jim L. Matteson**, Univ. of California/San Diego; **Douglas S. McGregor**, Kansas State Univ.; **Robert D. McLaren**, Consultant; **Richard W. Olsen**, Consultant; **Alan Owens**, European Space Agency (Netherlands); **Ann M. Parsons**, NASA Goddard Space Flight Ctr.; **Bradley E. Patt**, Gamma Medica-Ideas, Inc.; **Eugenio Perillo**, Univ. degli Studi di Napoli Federico II (Italy); **Raulf M. Polichar**, Science Applications International Corp.; **James M. Ryan**, Univ. of New Hampshire; **Eiichi Sato**, Iwate Medical Univ. (Japan); **Michael M. Schieber**, The Hebrew Univ. of Jerusalem (Israel); **Paul Siffert**, Ctr. National de la Recherche Scientifique (France); **Michael R. Squillante**, Radiation Monitoring Devices, Inc.; **Csaba Szeles**, eV Products, Inc.; **Gary C. Tepper**, Virginia Commonwealth Univ.; **Jacob I. Trombka**, NASA Goddard Space Flight Ctr.; **Tümay O. Tümer**, Nova R&D, Inc.; **Sergey E. Ulin**, Moscow Engineering Physics Institute (Russia); **Lodewijk van Den Berg**, Constellation Technology Corp.; **Peter E. Vanier**, Brookhaven National Lab.; **Nikolay B. Zaletaev**, Orion Research and Production Association (Russia); **Klaus Ziock**, Lawrence Livermore National Lab.

Monday 27 August

Introduction and Welcome . . . . . 8:30 to 8:40 am

Chairs: **Ralph B. James**, Brookhaven National Lab.; **Arnold Burger**, Fisk Univ.; **Larry A. Franks**, Consultant

SESSION 1 . . . . . Mon. 8:40 to 10:20 am

CZT I and CdTe

Chair: **Alan Janos**, U.S. Department of Homeland Security

Recent developments of large-volume cadmium zinc telluride high-resolution radiation detectors *(Invited Paper)*, H. Chen, S. A. Awadalla, P. Lu, A. MacDonald, J. M. MacKenzie, T. Hasanen, W. Chen, R. F. Redden, G. K. Bindley, Redlen Technologies (Canada); A. E. Bolotnikov, G. S. Camarda, Y. Cui, A. Hossain, R. B. James, Brookhaven National Lab. . . . . [6706-01]

Optimization of virtual Frisch-grid CdZnTe detector designs for imaging and spectroscopy of gamma rays *(Invited Paper)*, A. E. Bolotnikov, G. S. Camarda, Y. Cui, A. Hossain, R. B. James, Brookhaven National Lab. . . . . [6706-02]

Growth of detector grade thick films CdTe from the vapor phase, M. Fiederle, R. Sorgenfrei, K. Bachem, A. Ehler, Albert-Ludwigs-Univ. Freiburg (Germany) . . . . . [6706-03]

Defects studies and electric field distribution in CdZnTe detectors, G. S. Camarda, A. E. Bolotnikov, Y. Cui, A. Hossain, Brookhaven National Lab.; A. Burger, M. Groza, Fisk Univ.; R. B. James, Brookhaven National Lab. . . . . [6706-04]

SESSION 2 . . . . . Mon. 10:40 am to 12:10 pm

CZT II

Chair: **Robert D. McLaren**, Consultant

Crystal growth and characterization of Cd(1-x) Zn(x)Te radiation detectors *(Invited Paper)*, K. G. Lynn, K. A. Jones, G. Ciampi, R. Soundararajan, Washington State Univ.[6706-05]

Vertical Bridgman growth of $Cd_{1-x}Zn_xTe$ room temperature radiation detectors, K. A. Jones, G. Ciampi, K. G. Lynn, R. Soundararajan, Washington State Univ. . . . . [6706-06]

In situ characterization of crystal growth and heat treatment for semiconductor materials, D. W. Akers, Idaho National Lab. . . . . [6706-07]

Differential aperture x-ray microscopy near Te precipitates in CdZnTe, E. A. Miller, M. Toloczko, C. E. Seifert, A. Seifert, Pacific Northwest National Lab.; W. Liu, Argonne National Lab.; M. Bliss, Pacific Northwest National Lab. . . . . [6706-08]

Lunch Break

SESSION 3 . . . . . Mon. 1:40 to 3:10 pm

Applications I

Chair: **Nerine J. Cherepy**, Lawrence Livermore National Lab.

Gamma-ray/neutron/cosmic ray spectrometers for future planetary resource and scientific exploration *(Invited Paper)*, J. I. Trombka, NASA Goddard Space Flight Ctr. . . . . [6706-09]

Wide-field hard x-ray survey telescope: ProtoEXIST, J. S. Hong, J. E. Grindlay, A. Copete, Harvard-Smithsonian Ctr. for Astrophysics; R. G. Baker, S. D. Barthelmy, N. A. Gehrels, NASA Goddard Space Flight Ctr.; A. B. Garson III, H. S. Krawczynski, Washington Univ. in St. Louis . . . . . [6706-10]

Application of CdTe photon-counting x-ray imager to material discriminated x-ray CT, T. Aoki, Y. Takahashi, A. Koike, H. Morii, T. Nakashima, H. Mimura, Shizuoka Univ. (Japan) . . . . . [6706-11]

Background simulations for the energetic x-ray imaging survey telescope EXIST and the balloon-borne prototype experiment ProtoEXIST, A. B. Garson III, Washington Univ. in St. Louis; J. E. Grindlay, J. S. Hong, Harvard-Smithsonian Ctr. for Astrophysics; I. V. Jung, H. S. Krawczynski, Washington Univ. in St. Louis; E. I. Novikova, Naval Research Lab.; G. Weidenspointer, Ctr. d'Etude Spatiale des Rayonnements (France) . . . . . [6706-12]

SESSION 4 . . . . . Mon. 3:40 to 5:40 pm

Other Materials I

Chair: **Michael M. Schieber**, The Hebrew Univ. of Jerusalem (Israel)

GaSe and GaTe anisotropic layered semiconductors for radiation detectors, K. C. Mandal, M. Choi, S. H. Kang, R. D. Rauh, EIC Labs., Inc.; J. Wei, H. Zhang, L. Zheng, Stony Brook Univ.; U. N. Roy, Y. Cui, M. Groza, A. Burger, Fisk Univ. . . . . [6706-13]

X-ray and gamma-ray detectors based on synthetic diamond, N. B. Zaletaev, Orion Research and Production Association (Russia); A. G. Alekseyev, Troitsk Institute for Innovation and Fusion Research (Russia); V. S. Khrunov, Institute for Physico-Technical Problems (Russia); A. V. Kostyaev, Joint-Stock Co. (Russia); V. P. Nikiforova, Orion Research and Production Association (Russia) . . . [6706-14]

Mercuric iodide photocell technology for room temperature readout of scintillators, W. J. Kernan, National Security Technologies, LLC; L. A. Franks, Consultant; A. Burger, M. Groza, Fisk Univ. . . . . [6706-15]

Fabrication and characterization of amorphous selenium-based nuclear detectors, K. C. Mandal, S. H. Kang, M. Choi, A. G. Smirnov, EIC Labs., Inc. . . . . [6706-16]

Deconvolution of complex gamma ray pulse height spectra separating the continuum and discrete lines, T. P. McClanahan, J. I. Trombka, NASA Goddard Space Flight Ctr.; M. H. Lowe, The George Washington Univ. . . . . [6706-17]

Fabrication and performance of mercuric iodide pixellated detectors, L. van den Berg, L. F. Bastian, Constellation Technology Corp.; Z. Feng, Univ. of Michigan; M. A. Capote, Aguila Technologies, Inc. . . . . [6706-18]

Iteration method of gamma-spectra processing, S. E. Ulin, V. V. Dmitrenko, V. M. Grachev, Z. M. Uteshev, K. F. Vlasik, Moscow Engineering Physics Institute (Russia) . . . . . [6706-55]

Tuesday 28 August

SESSION 5 . . . . . Tues. 8:40 to 10:00 am

CZT III and CdTe

Chair: **Douglas S. McGregor**, Kansas State Univ.

Large volume 3D CZT gamma-ray imaging spectrometers *(Invited Paper)*, Z. He, F. Zhang, Univ. of Michigan; H. S. Krawczynski, Washington Univ. in St. Louis . . . . . [6706-19]

Material dependence of bulk leakage current in CdZnTe detectors *(Invited Paper)*, M. S. Amman, P. N. Luke, J. S. Lee, Lawrence Berkeley National Lab. . . . . [6706-20]

Performance measurements of Al/CdTe/Pt pixel diode detectors, S. Ishikawa, S. Watanabe, S. Takeda, K. Nakazawa, T. Takahashi, Japan Aerospace Exploration Agency (Japan) . . . . . [6706-21]

SESSION 6 . . . . . Tues. 10:30 am to 12:00 pm

Other Materials II

Chair: **Lodewijk van Den Berg**, Constellation Technology Corp.

Recent improvements of composite boron nitride semiconductor neutron detectors *(Invited Paper)*, M. M. Schieber, O. Khakhan, A. Fleider, The Hebrew Univ. of Jerusalem (Israel) . . . . . [6706-22]

First principles calculation of bulk semiconductor mobilities for radiation detection application, V. Lordi, D. Aberg, A. J. Williamson, K. J. Wu, Lawrence Livermore National Lab. . . . . [6706-23]

X-ray detection by epitaxial CVD diamond for medical radiology applications, C. Manfredotti, E. Vittone, A. Lo Giudice, Univ. degli Studi di Torino (Italy) . . . . . [6706-24]

Signal processing versus adaptive grids for identification of Compton scattering within single pixels of a planar germanium detector and the resulting SPECT images, D. P. Scraggs, A. J. Boston, H. C. Boston, R. J. Cooper, A. N. Grint, P. J. Nolan, D. C. Oxley, The Univ. of Liverpool (United Kingdom); A. Berry, T. Beveridge, J. Gillam, C. J. Hall, R. A. Lewis, Monash Univ. (Australia) . . . . . [6706-25]

Lunch/Exhibition Break

OPTICS

SESSION 7 . . . . . Tues. 1:30 to 3:10 pm

Applications II

Chair: **Warnick J. Kernan**, National Security Technologies, LLC

Current progress in non-scanning x-ray backscattering inspection system, M. Gertsenshteyn, V. Grubsky, T. P. Jannson, K. Shoemaker, Physical Optics Corp. . . . [6706-26]

A new Si/CdTe semiconductor Compton camera developed for high angular resolution, S. Takeda, S. Ishikawa, S. Watanabe, H. Odaka, K. Nakazawa, T. Takahashi, Japan Aerospace Exploration Agency (Japan); H. Tajima, Stanford Linear Accelerator Ctr.; Y. Kuroda, M. Onishi, Mitsubishi Heavy Industries, Ltd. (Japan); Y. Fukazawa, H. Yasuda, Hiroshima Univ. (Japan) . . . . . [6706-27]

Evaluation of 0.5-mm thick double-sided silicon strip detector for Compton telescope, H. Yasuda, S. Nishino, T. Tanaka, Y. Fukazawa, T. Ohsugi, Hiroshima Univ. (Japan); S. Takeda, S. Ishikawa, Japan Aerospace Exploration Agency (Japan) . . . . . [6706-28]

First results from the 128x128 pixel mixed-mode Si x-ray detector chip, W. Vernon, M. Allin, R. Hamlin, T. Hontz, D. Nguyen, Area Detector Systems Corp.; X. Nguyen-Huu, Univ. of California/San Diego; F. L. Augustine, Augustine Engineering; S. M. Gruner, D. R. Schuette, M. W. Tate, L. J. Koerner, Cornell Univ. . . . . [6706-29]

4 pi direction sensitive gamma imager with RENA-3 readout ASIC, Y. Du, W. Li, B. D. Yanoff, J. S. Gordon, D. E. Castleberry, GE Global Research . . . . . [6706-30]

SESSION 8 . . . . . Tues. 3:40 to 5:30 pm

CZT IV and CdTe

Chair: **Kelvin G. Lynn**, Washington State Univ.

Characterization of the homogeneity of CdZnTe detector grade crystals *(Invited Paper),* M. Fiederle, A. Fauler, A. Zwerger, M. Dambacher, Albert-Ludwigs-Univ. Freiburg (Germany) . . . . . [6706-31]

CZT x-rays detectors obtained by the boron encapsulated vertical Bridgman method, A. Zappettini, M. Zha, M. Pavesi, M. Zanichelli, L. Marchini, Consiglio Nazionale delle Ricerche (Italy); N. Auricchio, E. Caroli, Istituto di Astrofisica Spaziale e Fisica Cosmica (Italy); E. Gombia, R. Mosca, Consiglio Nazionale delle Ricerche (Italy) . . . . . [6706-32]

Simple x-ray computed tomography system utilizing a cadmium telluride detector, E. Sato, Iwate Medical Univ. (Japan); S. Nomiya, Raytech Corp. (Japan); K. Hitomi, Tohoku Institute of Technology (Japan); H. Onabe, Raytech Corp. (Japan); T. Shoji, Tohoku Institute of Technology (Japan); E. Tanaka, Tokyo Univ. of Agriculture and Technology (Japan); T. Kawai, Hamamatsu Photonics K.K. (Japan); T. Inoue, A. Ogawa, S. Sato, Iwate Medical Univ. (Japan); T. Ichimaru, Hirosaki Univ. (Japan); K. Takayama, Tohoku Univ. (Japan) . . . . . [6706-33]

Mapping and annealing of dislocations in CdTe crystals, A. Choubey, J. Toman, Univ. of Durham (United Kingdom); J. Mullins, B. J. Cantwell, Durham Scientific Crystals Ltd. (United Kingdom); D. P. Halliday, Univ. of Durham (United Kingdom); A. Basu, Durham Scientific Crystals Ltd. (United Kingdom); A. W. Brinkman, Univ. of Durham (United Kingdom) . . . . [6706-34]

Tunable narrow-photon-energy x-ray source using a silicon single crystal, E. Sato, Iwate Medical Univ. (Japan); E. Tanaka, Tokyo Univ. of Agriculture and Technology (Japan); H. Mori, National Cardiovascular Ctr. Research Institute (Japan); T. Kawai, Hamamatsu Photonics K.K. (Japan); T. Inoue, A. Ogawa, M. Izumisawa, M. Shozushima, K. Takahasi, S. Sato, Iwate Medical Univ. (Japan); T. Ichimaru, Hirosaki Univ. (Japan); K. Takayama, Tohoku Univ. (Japan) . . . . . [6706-35]

X-Ray/UV Optics Technical Event . 8:00 to 10:00 pm

Please see page 14 for details.

Wednesday 29 August

SESSION 9 . . . . . Wed. 8:20 to 10:00 am

Applications III

Chair: **Peter E. Vanier**, Brookhaven National Lab.

Keynote

DNDO research and development priorities and programs *(Invited Paper),* A. Janos, U.S. Department of Homeland Security . . . . . [6706-36]

Field deployable gamma radiation detectors for DHS use, S. Mukhopadhyay, National Security Technologies, LLC . . . . . [6706-37]

Results from the characterization of advanced gamma tracking array prototype detectors and their consequences for the next-generation nuclear physics spectrometer, M. R. Dimmock, A. J. Boston, L. Nelson, S. V. Rigby, The Univ. of Liverpool (United Kingdom); I. H. Lazarus, J. Simpson, Daresbury Lab. (United Kingdom); C. Parisel, C. Santos, Institut de Recherches Subatomiques (France) . . . . . [6706-38]

An adapted modulation transfer function for x-ray backscatter radiography by selective detection, N. F. Sabri, E. T. Dugan, D. Shedlock, A. M. Jacobs, Univ. of Florida . . . . . [6706-39]

SESSION 10 . . . . . Wed. 10:30 am to 12:40 pm

Scintillators

Chair: **Raulf M. Polichar**, Science Applications International Corp.

Simplified system-level model of scintillator detectors *(Invited Paper),* S. A. Payne, T. R. Niedermayr, N. J. Cherepy, G. Hull, A. Drobshoff, Lawrence Livermore National Lab. . . . . [6706-40]

Barium iodide single crystal scintillator detectors, N. J. Cherepy, G. Hull, T. R. Niedermayr, A. Drobshoff, S. A. Payne, Lawrence Livermore National Lab.; U. N. Roy, Y. Cui, A. Bhattacharaya, M. Harrison, M. Guo, M. Groza, A. Burger, Fisk Univ. . . . . [6706-41]

Ce-doped single crystal and ceramic garnet for gamma-ray detection, G. Hull, T. R. Niedermayr, J. Roberts, J. Kuntz, R. Sanner, T. Tillotson, A. Drobshoff, S. A. Payne, N. J. Cherepy, Lawrence Livermore National Lab. . . . . [6706-42]

New rare-earth-activated phosphate glass scintillators, J. S. Neal, L. A. Boatner, D. J. Wisniewski, Oak Ridge National Lab. . . . . [6706-43]

Performance of new ceramic scintillators for gamma- and x-ray detection, D. J. Wisniewski, L. A. Boatner, J. S. Neal, G. E. Jellison, Jr., J. O. Ramey, A. North, M. Wisniewska, Oak Ridge National Lab. . . . . [6706-44]

LaF_3:Ce nanocomposite scintillator for gamma-ray detection, E. A. McKigney, R. E. Muenchausen, D. W. Cooke, R. E. Del Sesto, R. D. Gilbertson, M. K. Bacrania, B. L. Bennett, L. G. Jacobsohn, T. M. McCleskey, K. C. Ott, S. C. Sitarz, J. F. Smith, S. Stange, Los Alamos National Lab. . . . . [6706-45]

✔ Posters-Wednesday

Chair: ***Aleksey E. Bolotnikov,*** *Brookhaven National Lab.*

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Recrystallization in ceramic material fabricated from $Cd_{1-x}Zn_xTe$ nanopowders,** N. N. Kolesnikov, E. B. Borisenko, D. N. Borisenko, V. V. Kveder, Institute of Solid State Physics (Russia); R. B. James, Brookhaven National Lab. . . . . [6706-46]

✔ **Evaluation of the multipixel photon counters with inorganic scintillators,** K. Hitomi, Tohoku Institute of Technology (Japan); E. Sato, Iwate Medical Univ. (Japan); S. Nomiya, Raytech Corp. (Japan); T. Shoji, Tohoku Institute of Technology (Japan) . . . . . [6706-47]

✔ **Study of radiation detectors based on semi-insulating GaAs and InP: aspects of material and electrode technology,** F. Dubecky, Institute of Electrical Engineering (Slovak Republic); V. Necas, Slovak Univ. of Technology (Slovak Republic) . . . . . [6706-48]

✔ **Dielectrometric approach to x-ray and gamma-ray detection,** M. Reznikov, Physical Optics Corp. . . . [6706-49]

✔ **Investigation of TlBr detector response under high flux x-rays,** H. Kim, L. J. Cirignano, Y. N. Dmitriev, K. S. Shah, M. R. Squillante, H. P. Wong, Radiation Monitoring Devices, Inc. . . . . [6706-50]

✔ **Position sensitive detector for PET,** N. Basharuli, Z. Htet, Moscow Engineering Physics Institute (Russia); M. Namtalishvili, Georgian Academy of Sciences (Georgia); V. S. Belyaev, Moscow Engineering Physics Institute (Russia); G. Hashimoto, Kyoto Univ. (Japan); A. Gambino, Univ. degli Studi di Napoli Federico II (Italy) . . . . . [6706-51]

✔ **Study and realization of real-time, in-depth dosimetry system for IORT (intra operative radiation therapy),** R. Brancaccio, F. Casali, M. P. Morigi, M. Bettuzzi, A. Berdondini, Univ. degli Studi di Bologna (Italy); C. Bruno, Y. F. Tchuente Siaka, A. Santaniello, Univ. della Calabria (Italy); E. Lamanna, Univ. degli studi Magna Græcia di Catanzaro (Italy) . . . . . [6706-52]

✔ **Surface sensitivity in large mass bolometers: discrimination of the origin of events,** C. Salvioni, Univ. degli Studi dell'Insubria (Italy) and Istituto Nazionale di Fisica Nucleare (Italy) . . . . . [6706-53]

✔ **The crystal geometry and the aspect ratio effects on spectral performance of CdZnTe Frisch collar device,** A. Kargar, M. J. Harrison, R. B. Lowell, D. S. McGregor, Kansas State Univ. . . . . [6706-54]

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Conference 6707

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6707

Penetrating Radiation Systems and Applications VIII

Conference Chairs: **F. Patrick Doty**, Sandia National Labs.; **H. Bradford Barber**, The Univ. of Arizona; **Hans Roehrig**, The Univ. of Arizona

Tuesday 28 August

Penetrating Radiation Technical Event . . . . . 8:00 to 10:00 pm

Please see page 14 for details.

Wednesday 29 August

SESSION 1 . . . . . Wed. 1:30 to 3:20 pm

Scintillators I

Chair: **H. Bradford Barber**, The Univ. of Arizona

Methodology for packaging reliable scintillation detectors *(Invited Paper)*, F. Wilkinson III, Alpha Spectra, Inc. [6707-01]

Using LaX scintillator in a new low-background Compton telescope *(Invited Paper)*, J. M. Ryan, P. L. Bloser, J. R. Macri, M. L. McConnell, Univ. of New Hampshire . [6707-02]

New scintillator compositions, W. W. Higgins, E. Vanlouf, J. Glodo, A. Churilov, K. S. Shah, Radiation Monitoring Devices, Inc. . . . . [6707-03]

Structure and properties of lanthanide halides, F. P. Doty, Sandia National Labs. . . . . [6707-04]

Fracture and deformation behavior of single crystal and polycrystalline rare earth halides, K. O. Findley, S. Kilpatrick, D. F. Bahr, Washington State Univ. . . . . [6707-05]

SESSION 2 . . . . . Wed. 3:40 to 5:50 pm

Scintillators II

Chair: **F. Patrick Doty**, Sandia National Labs.

Engineering solution synthesis of rare-earth-doped metal halides and their optical properties *(Invited Paper)*, R. E. Riman, Rutgers Univ. . . . . [6707-06]

Ion-induced luminescence *(Invited Paper)*, P. Rossi, Sandia National Labs. . . . . [6707-07]

$LaBr_3$-$CrBr_3$ thermodynamics, P. Yang, Sandia National Labs. [6707-09]

Synthesis of lanthanide halides, T. J. Boyle, Sandia National Labs. . . . . [6707-09]

Low-pressure Bridgman growth of cerium-doped lanthanum bromide, M. J. Harrison, T. N. Krehbiel, A. M. Hageman, D. S. McGregor, Kansas State Univ. . . . [6707-10]

High-performance nanosized grain polycrystalline $LaBr_3$:Ce for special nuclear material detection, C. Chen, J. Cooley, K. J. McClellan, C. R. Stanek, D. Byler, H. Volz, R. Dickerson, D. Dombrowski, T. Tucker, B. Bartram, B. Ewing, M. Mauro, R. Weinberg, Los Alamos National Lab. . . . [6707-11]

✔ Posters-Wednesday

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✔ **Measuring slip system rotation in rock salt as a function of applied strain,** S. Kilpatrick, K. O. Findley, Washington State Univ. . . . . [6707-33]

✔ **Purification of tellurium to 6N using a multistage vacuum distillation method,** A. M. Hageman, M. J. Harrison, N. Fritz, T. N. Krehbiel, R. White, J. Patenaude, D. S. McGregor, Kansas State Univ. . . . . [6707-34]

✔ **Order and charge collection correlations in organic materials for neutron detection,** F. P. Doty, T. M. Wilson, M. J. King, D. A. Chinn, B. A. Simmons, Sandia National Labs. . . . . [6707-35]

✔ **Investigation of CaF_2 scintillator for D-D neutron interrogation,** A. J. Antolak, A. Herr, T. Raber, D. H. Morse, K. Leung, Sandia National Labs. . . . . [6707-36]

Thursday 30 August

SESSION 3 . . . . . Thurs. 8:10 to 9:55 am

Scintillators III

Chair: **Irina Shestakova**, Radiation Monitoring Devices, Inc.

Scintillation properties and applications of reduced-afterglow co-doped CsI:Tl *(Invited Paper)*, V. V. Nagarkar, V. B. Gaysinskiy, L. Ovechkina, S. R. Miller, Radiation Monitoring Devices, Inc.; C. Brecher, A. Lempicki, ALEM Associates . . . . . [6707-12]

Gamma tube for photofission-based active interrogation, A. J. Antolak, K. Leung, J. Reijonen, M. J. King, D. H. Morse, T. Raber, R. A. Gough, B. L. Doyle, Sandia National Labs. . . . . [6707-13]

Radioluminescence and radiation effects in metal organic framework materials, A. J. Skulan, Sandia National Labs. . . . . [6707-14]

High-resolution beta imaging probe for radioguided surgery, I. Shestakova, V. B. Gaysinskiy, S. C. Thacker, S. Cool, Radiation Monitoring Devices, Inc.; B. Stack, Univ. of Arkansas for Medical Sciences; V. V. Nagarkar, Radiation Monitoring Devices, Inc. . . . . [6707-15]

Neutron imaging with a 3x3 array of pinholes, G. P. Grim, R. D. Day, D. D. Clark, V. E. Fatherley, F. P. Garcia, S. A. Jaramillo, A. J. Montoya, G. L. Morgan, J. A. Oertel, T. A. Ortiz, J. R. Payton, P. D. Pasuchanics, D. W. Schmidt, A. C. Valdez, C. H. Wilde, M. D. Wilke, Los Alamos National Lab. . . . [6707-16]

SESSION 4 . . . . . Thurs. 10:20 to 11:50 am

Biomedical Imaging

Chair: **Vivek V. Nagarkar**, Radiation Monitoring Devices, Inc.

Advantages of semiconductor CZT for medical imaging *(Invited Paper)*, D. J. Wagenaar, S. Chowdhury, K. B. Parnham, G. Maehlum, B. E. Patt, Gamma Medica-Ideas, Inc. . . . . [6707-17]

Recent advances in small animal SPECT/CT, B. H. Hasegawa, M. Sun, A. B. Hwang, T. Funk, C. Taylor, P. Despre's, S. Prevrhal, M. Pan, K. Teo, H. F. VanBrocklin, E. W. Izaguirre, Univ. of California/San Francisco . . . . . [6707-18]

New residual charge removal methods for selenium detectors., D. L. Y. Lee, DxRay, Inc. . . . . [6707-19]

Design and initial performance evaluation of a full-field digital mammography upgrade cassette, E. Toker, M. A. Baisal, Bioptics, Inc. . . . . [6707-20]

Lunch/Exhibition Break

SESSION 5 . . . . . Thurs. 1:00 to 3:05 pm

Gamma-Ray and X-Ray Imaging I

Chair: **Bruce H. Hasegawa**, Univ. of California/San Francisco

Fast maximum-likelihood estimation methods for scintillation cameras and other optical sensors *(Invited Paper)*, L. R. Furenlid, College of Optical Sciences/The Univ. of Arizona . . . . . [6707-21]

Advances in monolithic CMOS sensors for charged-particle imaging, S. Kleinfelder, Univ. of California/Irvine . . . . . [6707-22]

A Bayesian sequential processor approach to spectroscopic portal system decisions, K. E. Sale, J. V. Candy, D. H. Chambers, T. Gosnell, S. Prussin, Lawrence Livermore National Lab. . . . . [6707-23]

DQE of a CsI based CCD imaging detector for application in crystallography, H. Roehrig, The Univ. of Arizona; W. V. Schempp, Rigaku Corp. . . . . [6707-24]

Radiography and tomography system using refractive lenses, C. K. Gary, H. Park, Adelphi Technology, Inc.; R. H. Pantell, Stanford Univ.; Y. I. Dudchik, Institute of Applied Physics Problems (Belarus) . . . . . [6707-25]

Fluorescent x-ray tomography system for atomic imaging, E. Sato, Iwate Medical Univ. (Japan); K. Hitomi, Tohoku Institute of Technology (Japan); S. Nomiya, Raytech Corp. (Japan); E. Tanaka, Tokyo Univ. of Agriculture and Technology (Japan); T. Kawai, Hamamatsu Photonics K.K. (Japan); T. Inoue, A. Ogawa, M. Izumisawa, M. Shozushima, S. Sato, Iwate Medical Univ. (Japan); K. Takayama, Tohoku Univ. (Japan) . . . . . [6707-26]

SESSION 6 . . . . . Thurs. 3:35 to 5:35 pm

Gamma-Ray and X-Ray Imaging II

Chair: **Hans Roehrig**, The Univ. of Arizona

Liquids identification with x-ray diffraction, G. Harding, J. Delfs, GE Security (Germany) . . . . . [6707-27]

Image quality analysis of a color LCD, as well as a monochrome LCD using a Foveon color CMOS camera, W. J. Dallas, H. Roehrig, E. A. Krupinski, The Univ. of Arizona . . . . . [6707-28]

Chromaticity noise measured with a Konica-Minolta CS200 colotimeter and a Foveon color camera, H. Roehrig, W. J. Dallas, E. A. Krupinski, The Univ. of Arizona; G. R. Redford, Areté Associates . . . . . [6707-29]

Finite element Compton tomography, T. P. Jannson, P. Paki-Amouzou, N. V. Menon, Physical Optics Corp. . . . [6707-30]

High-dose-rate pulse x-ray detection using a multipixel photon counter, E. Sato, Iwate Medical Univ. (Japan); K. Hitomi, Tohoku Institute of Technology (Japan); S. Nomiya, H. Onabe, Raytech Corp. (Japan); T. Shoji, Tohoku Institute of Technology (Japan); E. Tanaka, Tokyo Univ. of Agriculture and Technology (Japan); T. Kawai, Hamamatsu Photonics K.K. (Japan); T. Inoue, A. Ogawa, S. Sato, Iwate Medical Univ. (Japan); K. Takayama, Tohoku Univ. (Japan) . . . . . [6707-31]

Secondary penetrating radiation registration by interacting x-ray beams from cathode of high-current glow discharge with targets made of various materials, A. B. Karabut, State Scientific-Industrial Association (Russia) . . . . . [6707-32]

Conference 6708

Monday-Tuesday 27-28 August 2007 • Proceedings of SPIE Vol. 6708

Atmospheric Optics: Models, Measurements, and Target-in-the-Loop Propagation

Conference Chairs: **Stephen M. Hammel**, Space and Naval Warfare Systems Ctr., San Diego; **Alexander M. J. van Eijk**, TNO Defence, Security and Safety (Netherlands); **Michael T. Valley**, Sandia National Labs.; **Mikhail A. Vorontsov**, Army Research Lab.

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Monday 27 August

SESSION 1 . . . . . Mon. 8:30 am to 12:00 pm

Turbulence Measurement and Modeling

Chair: **Mikhail Vorontsov,** Army Research Lab.

Analysis of free-space laser signal intensity over a 2.33 km optical path, A. Tunick, Army Research Lab. . . . . [6708-01]

Free space optical system performance for laser beam propagation through non-Kolmogorov turbulence for uplink and downlink paths, I. Toselli, Politecnico di Torino (Italy); L. C. Andrews, R. L. Phillips, Univ. of Central Florida; V. Ferrero, Politecnico di Torino (Italy) . . . . . [6708-02]

SCIDAR at Mount John University Observatory, J. L. Mohr, Univ. of Canterbury (New Zealand); R. A. Johnston, Applied Research Associates, Inc. (New Zealand); C. C. Worley, P. L. Cottrell, Univ. of Canterbury (New Zealand) . . . . . [6708-03]

Turbulence effects on laser propagation in a marine environment, V. M. Gadwal, S. M. Hammel, Space & Naval Warfare Systems Command SPAWARSYSCEN . . . [6708-04]

Strong atmospheric turbulence modeling using geometric optics of multiple scattering, H. Yuksel, Univ. of Maryland/College Park; F. Kunter, Bogaziçi Univ. (Turkey) . . . [6708-05]

The Levy Brownian motion family as a new paradigm in the modeling of turbulent wave-front phase, D. G. Perez, Pontificia Univ. Catolica de Valparaiso (Chile); L. Zunino, M. Garavaglia, Univ. Nacional de la Plata (Argentina) . [6708-06]

Evaluating the performance of a bulk optical turbulence model in a maritime environment, P. A. Frederickson, Naval Postgraduate School; S. M. Hammel, D. Tsintikidis, Space and Naval Warfare Systems Ctr., San Diego . . . . . [6708-07]

Coherent illumination for wavefront sensing and imaging, M. Velluet, V. Michau, T. Fusco, J. Conan, ONERA (France) . . . . . [6708-08]

Experimental analysis and wave-optics simulation of turbulence aspects of maritime laser propagation, B. P. Venet, MZA Associates Corp. . . . . [6708-09]

Lunch Break

SESSION 2 . . . . . Mon. 1:20 to 3:00 pm

Turbulence Compensation and TIL Mitigation

Chair: **Michael Valley,** Sandia National Labs.

Turbulence effect mitigation using adaptive optics post-processing of holographically recorded short-exposure images, M. Aubailly, Univ. of Maryland/College Park; M. A. Vorontsov, Army Research Lab. . . . . [6708-10]

Integrated multi-dithering control for adaptive atmospheric turbulence compensation, D. Loizos, Johns Hopkins Univ.; L. Liu, Univ. of Maryland/College Park; P. Sotiriadis, Johns Hopkins Univ.; G. Cauwenberghs, Univ. of California/San Diego; M. A. Vorontsov, Army Research Lab. and Univ. of Maryland/College Park . . . . . [6708-11]

Adaptive compensation over a 2.33 km propagation path with retro reflectors under strong scintillation conditions, E. Polnau, Univ. of Maryland/College Park; M. A. Vorontsov, U.S. Army Research Lab. and Univ. of Maryland/College Park; L. A. Beresnev, U.S. Army Research Lab. . . . . [6708-12]

Coherent combining of multiple beams with multi-dithering technique: 100 KHz closed-loop compensation demonstration, L. Liu, Univ. of Maryland/College Park; D. Loizos, P. Sotiriadis, Johns Hopkins Univ.; M. A. Vorontsov, Army Research Lab. and Univ. of Maryland/College Park . . . . . [6708-13]

Anisoplanatic imaging through atmospheric turbulence: brightness function approach, M. A. Vorontsov, Univ. of Maryland/College Park and U.S. Army Research Lab.; S. L. Lachinova, Univ. of Maryland/College Park; V. V. Dudorov, V. V. Kolosov, Institute of Atmospheric Optics (Russia) . [6708-14]

SESSION 3 . . . . . Mon. 3:30 to 4:30 pm

TIL Propagation and Tracking I

Chair: **Alexander van Eijk,** TNO Defense Security and Safety (Netherlands)

Uncooperative target-in-the-loop performance with backscattered speckle-field effects, J. E. Kansky, D. C. Homoelle, D. V. Murphy, MIT Lincoln Lab. . . . . [6708-15]

The BEFWM system for detection and phase conjugation of a weak laser beam, A. Khizhnyak, V. B. Markov, MetroLaser, Inc. . . . . [6708-16]

TIL system with nonlinear phase conjugation, A. Khizhnyak, V. B. Markov, MetroLaser, Inc. . . . . [6708-17]

Tuesday 28 August

SESSION 4 . . . . . Tues. 8:30 to 9:30 am

TIL Propagation and Tracking II

Chair: **Thomas Weyrauch,** Univ. of Maryland/College Park

Laboratory demonstration of wavefront-based stochastic parallel gradient descent adaptive optics system, M. S. Belen'kii, Trex Enterprises Corp.; J. D. Barchers, E. Berg, Science Applications International Corp.; D. G. Bruns, Trex Enterprises Corp.; D. Fung, R. Gallant, C. Kirk, Science Applications International Corp.; V. A. Rye, H. Runyeon, Trex Enterprises Corp.; J. Voas, Pipeline Processing Co. [6708-18]

Application of stereo laser tracking methods for quantifying flight dynamics, M. T. Valley, T. J. Miller, Jr., P. L. Reu, Sandia National Labs.; H. Schreier, Correlated Solutions Inc. . . . . [6708-19]

Coherent beam combining with micro-processor based SPGD controller, L. Liu, Univ. of Maryland/College Park; M. A. Vorontsov, Army Research Lab. and Univ. of Maryland/College Park; A. P. Rostov, Institute of Atmospheric Optics (Russia) . . . . . [6708-20]

SESSION 5 . . . . . Tues. 9:30 am to 12:00 pm

Aerosol Extinction: Modeling and Measurement

Chair: **Frank Eaton,** Air Force Research Lab.

The use of multi-band transmission data, collected at Scripps pier (La Jolla) in November 2006, for the investigation of aerosol characteristics, A. N. de Jong, TNO (Netherlands); A. M. J. van Eijk, TNO Defence, Security and Safety (Netherlands); P. J. Fritz, TNO (Netherlands); M. M. Moerman, L. H. Cohen, TNO-FEL (Netherlands) . . [6708-21]

Production of sea-spray aerosol in the surf zone of the San Diego Bay, J. Kusmierczyk-Michulec, TNO Defence, Security and Safety (Netherlands); J. J. Piazzola, Univ. de Toulon et du var (France); M. J. Francius, M. M. Moerman, TNO-FEL (Netherlands); A. M. J. Van Eijk, TNO Defence, Security and Safety (Netherlands); D. Merrit, J. Fontana, JDF&A [6708-22]

Sea spray aerosol and wave energy dissipation in the surf zone, M. J. Francius, TNO Defence, Security and Safety (Netherlands); J. Piazolla, P. Forget, O. Le Calve, Univ. du Sud Toulon-Var (France); J. Kusmierczyk-Michulec, TNO Defence, Security and Safety (Netherlands) . . . . . [6708-23]

Can we predict aerosol extinction in a coastal environment?, D. Tsintikidis, D. Kichura, S. M. Hammel, Space and Naval Warfare Systems Ctr., San Diego . . . . . [6708-24]

Ångström coefficient as a tracer of the continental aerosols, J. Kusmierczyk-Michulec, A. M. J. Van Eijk, TNO Defence, Security and Safety (Netherlands) . . . . . [6708-25]

Satellite retrieved aerosol properties for battlespace characterization and sensor performance, R. M. Schoemaker, TNO (Netherlands) . . . . . [6708-26]

Lunch/Exhibition Break

SESSION 6 . . . . . Tues. 1:20 to 4:30 pm

Novel Methods and Designs

Chair: **Steve Hammel,** Space and Naval Warfare Systems Ctr.

Adaptive optical antennas: design and evaluation, T. Weyrauch, Univ. of Maryland/College Park; G. V. Simonova, Institute for Monitoring of Climatic and Ecological Systems (Russia); L. A. Beresnev, M. A. Vorontsov, G. W. Carhart, Army Research Lab.; E. Polnau, Univ. of Maryland/College Park . . . . . [6708-27]

Wavefront correctors based on semi-passive bimorph elements for adaptive optics applications: new designs, L. A. Beresnev, Army Research Lab. . . . . [6708-28]

Adaptive compensation of atmospheric phase distortions with Strehl ratio exceeding one: super-focusing effect, M. A. Vorontsov, Army Research Lab.; V. V. Kolosov, Institute of Atmospheric Optics (Russia) . . . . . [6708-29]

Finding the range to a distant object near the sea surface, M. Degache, TNO-FEL (Netherlands); S. M. Hammel, Space and Naval Warfare Systems Ctr., San Diego . . . . . [6708-30]

Optical beam tracking based on nonlinear lens mechanism, A. S. Koujelev, A. E. Dudelzak, Canadian Space Agency (Canada) . . . . . [6708-31]

Self-pumped phase conjugation in a liquid crystal light-valve with tilted feedback mirror, U. Bortolozzo, Lab. Physique Statistique - ENS (France); S. Residori, Institut Non Linéaire de Nice Sophia Antipolis (France); J. Huignard, Thales Research & Technology (France) . . . . . [6708-32]

Intensity and polarization characteristics of the light scattered by the ice crystals of cirrus clouds with preferred orientations, A. V. Burnashov, Institute of Atmospheric Optics (Russia) . . . . . [6708-33]

Picosecond eye-safe Raman laser for advanced ranging and tracking, O. V. Kulagin, N. F. Andreev, A. M. Sergeev, Institute of Applied Physics (Russia); M. T. Valley, Sandia National Labs. . . . . [6708-34]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC135 Adaptive Optics (Tyson) Tuesday 28, 8:30 am - 5:30 pm

SC134 Optical Design Fundamentals for Infrared Systems (Riedl) Sunday 26, 8:30 am - 5:30 pm

SC835 Infrared Systems - Technology & Design (Daniels) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

Conference 6709

Tuesday-Thursday 28-30 August 2007 • Proceedings of SPIE Vol. 6709

Free-Space Laser Communications VII

Conference Chairs: **Arun K. Majumdar**, LCResearch, Inc.; **Christopher C. Davis**, Univ. of Maryland/College Park

Program Committee: **Larry C. Andrews**, Univ. of Central Florida; **Shlomi Arnon**, Ben-Gurion Univ. of the Negev (Israel); **Mikhail S. Belen'kii**, Trex Enterprises Corp.; **Naresh Chand**, BAE Systems North America; **Frank D. Eaton**, Air Force Research Lab.; **G. Charmaine Gilbreath**, Naval Research Lab.; **Hennes Henniger**, DLR Standort Oberpfaffenhofen (Germany); **Andrew S. Keys**, NASA Marshall Space Flight Ctr.; **Anton Kohnle**, FGAN-FOM (Germany); **Michela Muñoz-Fernández**, Jet Propulsion Lab.; **Dominic C. O'Brien**, Univ. of Oxford (United Kingdom); **Narasimha S. Prasad**, NASA Langley Research Ctr.; **William S. Rabinovich**, Naval Research Lab.; **Marcos Reyes Garcia-Talavera**, Instituto de Astrofísica de Canarias (Spain); **Jennifer C. Ricklin**, Defense Advanced Research Projects Agency; **Thomas M. Shay**, Air Force Research Lab.; **Deepak Varshneya**, Cubic Defense Applications Group

Tuesday 28 August

SESSION 1 . . . . . Tues. 8:30 to 10:20 am

Components and Systems Design and Analysis I

Chairs: **Arun K. Majumdar**, LCResearch, Inc.; **Christopher C. Davis**, Univ. of Maryland/College Park

Optical cross links and their applications on distributed space architecture *(Invited Paper)*, V. W. S. Chan, Massachusetts Institute of Technology . . . . . [6709-01]

Evaluation of cone tracking: for optical free space communication with a retro modulator, E. Saint Georges, NovaSol . . . . . [6709-02]

An integrated test-bed for PAT testing and verification of inter-satellite lasercom terminals, L. Liu, L. Wang, J. Sun, Z. Luan, D. Liu, N. Xu, X. Zhong, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6709-03]

Design of a very small inertially-stabilized optical space terminal, J. J. Scozzafava, D. M. Boroson, J. W. Burnside, M. L. Glynn, C. M. DeFranzo, C. DeVoe, MIT Lincoln Lab.[6709-04]

Efficiency penalty of photon-counting with timing jitter, A. L. Kachelmyer, D. M. Boroson, MIT Lincoln Lab. . . [6709-05]

SESSION 2 . . . . . Tues. 10:50 am to 12:10 pm

Components and Systems Design and Analysis II

Chairs: **Naresh Chand**, BAE Systems North America; **Frank D. Eaton**, Air Force Research Lab.

Robust free space optical alignment systems using geometrical constraints, T. Ho, J. Rzasa, S. D. Milner, C. C. Davis, Univ. of Maryland/College Park . . . . . [6709-06]

A novel high-speed electro-optic beam scanner based on KTN crystals, J. J. Foshee, Air Force Research Lab.; S. Tang, Y. Tang, Crystal Research, Inc. . . . . [6709-07]

Optical free space communication beam tracking optimization with an 8 quadrant PSD and small spot size, E. Saint Georges, J. Sender, G. Tartakovsky, NovaSol [6709-08]

Optical wireless communications with low voltage self-powered sensor motes, D. C. O'Brien, J. Liu, W. Yuan, S. Sivathasan, G. E. Faulkner, S. Collins, S. J. Elston, Univ. of Oxford (United Kingdom) . . . . . [6709-09]

Lunch/Exhibition Break

SESSION 3 . . . . . Tues. 1:50 to 3:30 pm

Coding and Networking I

Chairs: **Christopher C. Davis**, Univ. of Maryland/College Park; **Shlomi Arnon**, Ben-Gurion Univ. of the Negev (Israel)

Indoor optical wireless communication: interference experimentation and evaluation, O. Bouchet, C. Rouet, France Télécom (France) . . . . . [6709-11]

Optical wireless communication in sensor networks: data harvesting, D. Kedar, S. Arnon, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6709-12]

Quantitative evaluation of radiation transfer for quantum communication in free space, N. Antonietti, Politecnico di Torino (Italy) . . . . . [6709-13]

Optical high-capacity satellite downlinks via high-altitude platform relays, M. Knapek, J. Horwath, D. Giggenbach, B. Epple, H. Bischl, N. Courville, F. Moll, DLR Standort Oberpfaffenhofen (Germany) . . . . . [6709-14]

Wide angle infrared cloud imaging for measuring cloud statistics in support of earth space optical communication, P. W. Nugent, J. A. Shaw, Montana State Univ./Bozeman; S. Piazzolla, Jet Propulsion Lab. . . . . [6709-15]

SESSION 4 . . . . . Tues. 4:00 to 5:00 pm

Coding and Networking II

Chairs: **Christopher C. Davis**, Univ. of Maryland/College Park; **G. Charmaine Gilbreath**, Naval Research Lab.

A precise pointing technique for FSO links and networks using kinematic GPS and local sensors, Y. Shim, S. D. Milner, C. C. Davis, Univ. of Maryland/College Park [6709-16]

Topology reconfiguration of FSO and directional wireless networks with successive approximations, E. Baskaran, C. C. Davis, S. D. Milner, Univ. of Maryland/College Park[6709-17]

Mobility control for joint coverage-connectivity optimization in directional FSO/RF wireless backbone networks, J. Llorca, S. D. Milner, C. C. Davis, Univ. of Maryland/College Park . . . . . [6709-18]

Wednesday 29 August

SESSION 5 . . . . . Wed. 8:50 to 10:10 am

Optical Turbulence and Scintillation

Chairs: **Arun K. Majumdar**, LCResearch, Inc.; **Larry C. Andrews**, Univ. of Central Florida

Turbulence inner scale sensor for arbitrary atmospheric paths, M. S. Belen'kii, D. G. Bruns, K. Hughes, L. Moyer, Trex Enterprises Corp.; L. Wright, Air Force Research Lab.[6709-19]

Kolmogorov and non-Kolmogorov turbulence and its effects on optical communication links, A. Zilberman, E. Golbraikh, S. Arnon, N. S. Kopeika, Ben-Gurion Univ. of the Negev (Israel) . . . . . [6709-20]

Measuring optical turbulence parameters with a three-aperture receiver, D. Wayne, Florida Space Institute; R. L. Phillips, L. C. Andrews, Univ. of Central Florida; M. R. Borbath, Harris Corp.; B. Griffis, Computer Science Corp.; D. J. Galus, Harris Corp. . . . . [6709-21]

Reconstruction of probability density function of intensity fluctuations relevant to free-space laser communications through atmospheric turbulence, A. K. Majumdar, LCResearch, Inc.; C. E. Luna, P. S. Idell, The Boeing Co. . . . . [6709-23]

SESSION 6 . . . . . Wed. 10:40 am to 12:20 pm

Mitigation, Scintillation, and Adaptive Control

Chairs: **Jennifer C. Ricklin**, Defense Advanced Research Projects Agency; **Mikhail S. Belen'kii**, Trex Enterprises Corp.

A novel technique for scintillation suppression in optical communications, T. M. Shay, C. A. Robin, J. B. Spring, A. Gavrielides, Air Force Research Lab. . . . . [6709-24]

The effect of an interferer on atmospheric optical communication that uses diversity incoherent or diversity coherent receivers, E. J. Lee, V. W. S. Chan, Massachusetts Institute of Technology . . . . . [6709-25]

Optimizing partial spatially coherent beams for free space laser communications, X. Xiao, D. G. Voelz, New Mexico State Univ. . . . . [6709-26]

Saturation and frequency weighting in adaptive control of laser beam jitter, N. O. Perez Arancibia, S. Gibson, T. Tsao, Univ. of California/Los Angeles . . . . . [6709-27]

Scintillation index and aperture averaging on a 16km modulated retro-reflector free-space optical link, M. L. Plett, Univ. of Maryland/College Park; R. Mahon, L-3 Communications Titan Group; W. S. Rabinovich, Naval Research Lab.; M. S. Ferraro, Sachs Freeman Associates, Inc.; C. I. Moore, Naval Research Lab. . . . . [6709-28]

Lunch/Exhibition Break

SESSION 7 . . . . . Wed. 1:50 to 3:30 pm

Experimental Measurements, Concepts, and Performance I

Chairs: **Thomas M. Shay**, Air Force Research Lab.; **Dominic C. O'Brien**, Univ. of Oxford (United Kingdom)

Theoretical model of a phase-locked optical amplifier array with a very large number of elements, T. M. Shay, Air Force Research Lab. . . . . [6709-29]

Self-synchronous phase locking of a nine element 100-W fiber amplifier array, T. M. Shay, V. Benham, Air Force Research Lab.; J. T. Baker, Boeing LTS, Inc.; D. E. Pilkington, C. A. Lu, A. D. Sanchez, D. J. Nelson, Air Force Research Lab. . . . . [6709-30]

10 Gb/s optical heterodyne receiver for intersatellite communications links, C. Wree, D. Becker, D. Mohr, A. Joshi, Discovery Semiconductors, Inc. . . . . [6709-31]

Fiberbundle-receiver: a new concept for high speed and high sensitivity tracking, C. Fuchs, H. Henniger, D. Giggenbach, DLR Standort Oberpfaffenhofen (Germany) . . . . . [6709-32]

Remote sensing with passive specular probes, D. Slater, Nearfield Systems Inc. . . . . [6709-33]

SESSION 8 . . . . . Wed. 4:00 to 6:00 pm

Experimental Measurements, Concepts, and Performance II

Chairs: **Narasimha S. Prasad**, NASA Langley Research Ctr.; **William S. Rabinovich**, Naval Research Lab.

Coherent optical communications receiver design investigations, M. Muñoz-Fernández, Jet Propulsion Lab. . . . . [6709-34]

Achievable data rate for ultraviolet communications through the atmosphere, Z. Xu, G. Chen, Univ. of California/Riverside . . . . . [6709-35]

Demonstration of gigabit per second and greater data rates at extremely high efficiency using superconducting nanowire single photon detectors, B. S. Robinson, A. J. Kerman, E. A. Dauler, MIT Lincoln Lab. . . . . [6709-36]

Demonstration of photon-counting, high-efficiency communications at telecom wavelengths using efficient upconversion and silicon photon-detectors, M. E. Grein, B. S. Robinson, L. E. Elgin, MIT Lincoln Lab. . . . . [6709-37]

16 km modulated retro-reflector free-space optical link across the Chesapeake Bay, M. L. Plett, Univ. of Maryland/College Park; R. Mahon, L-3 Communications Titan Group; W. S. Rabinovich, Naval Research Lab.; M. S. Ferraro, Sachs Freeman Associates, Inc.; C. I. Moore, Naval Research Lab. . . . . [6709-38]

Experimental demonstration of novel scintillation suppression technique, C. A. Robin, T. M. Shay, J. B. Spring, A. Gavrielides, Air Force Research Lab. . . . . [6709-39]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Experiment research on orthogonal tilting scanner,** A. Li, Tongji Univ. (China); L. Liu, J. Sun, X. Zhong, Z. Luan, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6709-50]

✔ **Single and double shearing interferometers series for laser wave front testing,** Z. Luan, L. Liu, L. Wang, J. Sun, D. Xu, D. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6709-51]

✔ **Technical scheme and corresponding experiment for the PAT performance of a lasercom using an integrated test-bed,** J. Sun, L. Liu, L. Wang, Z. Luan, D. Liu, N. Xu, X. Zhong, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6709-52]

✔ **Scintillation index of electromagnetic Gaussian Schell-model beams on propagation through atmospheric turbulence,** W. Lu, L. Liu, J. Sun, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6709-53]

✔ **Polarization phase-shifting double-shearing interferometer for the test of the diffraction-limited wavefront,** L. Wang, Z. Luan, J. Sun, Y. Zhou, D. Liu, L. Liu, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6709-54]

✔ **Coherent detection of position errors in inter-satellite laser communications,** N. Xu, L. Liu, D. Liu, J. Sun, Z. Luan, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6709-55]

✔ **Complex model of terrestrial FSO links,** O. Wilfert, Z. Kolka, Brno Univ. of Technology (Czech Republic); O. Fiser, Institute of Atmospheric Physics (Czech Republic); R. Kopp, Brno Univ. of Technology (Czech Republic) . . . . . [6709-56]

✔ **Narrow-band high-power semiconductor lasers for optical communication,** Z. Buchta, O. Cip, Institute of Scientific Instruments (Czech Republic); O. Wilfert, Brno Univ. of Technology (Czech Republic); J. Lazar, Institute of Scientific Instruments (Czech Republic) . . . . . [6709-57]

✔ **Demodulation of FM data in free-space optical communication systems using discrete wavelet transformation,** N. M. Namazi, The Catholic Univ. of America; H. R. Burris, G. C. Gilbreath, Naval Research Lab. . . . . [6709-58]

Thursday 30 August

SESSION 9 . . . . . Thurs. 8:30 to 10:10 am

Free-Space Link Performance I

Chairs: **Marcos Reyes Garcia-Talavera**, Instituto de Astrofísica de Canarias (Spain); **Michela Muñoz-Fernández**, Jet Propulsion Lab.

Link performance of mobile links, H. Henniger, DLR Standort Oberpfaffenhofen (Germany) . . . . . [6709-40]

Tracking in a ground-to-satellite optical link: effects due to lead-ahead and aperture mismatch including temporal tracking response, S. Basu, D. G. Voelz, New Mexico State Univ. . . . . [6709-41]

Performance optimization of FSO communications based on measurements from successful FSO demonstrations, B. Epple, DLR Standort Oberpfaffenhofen (Germany) [6709-42]

Wavelength selection criteria and link availability affecting optical links in satellite, aerial, and downlink scenarios, F. Moll, M. Knapek, DLR Standort Oberpfaffenhofen (Germany) . . . . . [6709-43]

3.5 micron free space optical channel performance analysis, C. Ting, E. J. Burlbaw, J. Ding, A. R. Geiger, Y. Huang, M. Gutierrez, C. J. Urbina, Akamai Physics Inc. . . . . [6709-44]

SESSION 10 . . . . . Thurs. 10:40 am to 12:20 pm

Free-Space Link Performance II

Chairs: **Hennes Henniger**, DLR Standort Oberpfaffenhofen (Germany); **Anton Kohnle**, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany)

A survey of technology-driven capacity limits for free-space laser communications, D. M. Boroson, MIT Lincoln Lab. . . . . [6709-45]

Evaluation of commercial directional RF and free-space optical transceivers in different weather conditions, J. Rzasa, S. D. Milner, C. C. Davis, Univ. of Maryland/College Park . . . . . [6709-46]

Transmission of high definition imagery using hybrid FSO/RF links, J. Franco, J. Rzasa, S. D. Milner, C. C. Davis, Univ. of Maryland/College Park . . . . . [6709-47]

Observation of atmospheric influence on OICETS inter-orbit laser communication demonstrations, Y. Takayama, T. Jono, Y. Koyama, N. Kura, Japan Aerospace Exploration Agency (Japan); K. Shiratama, NEC TOSHIBA Space Systems, Ltd. (Japan); B. Demelenne, European Space Agency (Belgium); Z. Sodnik, A. Bird, European Space Agency (Netherlands); K. Arai, Japan Aerospace Exploration Agency (Japan) . . . . . [6709-48]

Data analysis results from the KODEN experiments, M. Toyoshima, Y. Takayama, H. Kunimori, National Institute of Information and Communications Technology (Japan); T. Jono, K. Arai, Japan Aerospace Exploration Agency (Japan)[6709-49]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC135 Adaptive Optics (Tyson) Tuesday 28, 8:30 am - 5:30 pm

Conference 6710

Sunday-Tuesday 26-28 August 2007 • Proceedings of SPIE Vol. 6710

Quantum Communications and Quantum Imaging V

Conference Chairs: **Ronald E. Meyers**, Army Research Lab.; **Yanhua Shih**, Univ. of Maryland/Baltimore County; **Keith S. Deacon**, Army Research Lab.

Program Committee: **Stefania A. Castelletto**, The Univ. of Melbourne (Australia); **Richard J. Hughes**, Los Alamos National Lab.; **Yoon-Ho Kim**, Pohang Univ. of Science and Technology (South Korea); **Todd B. Pittman**, Univ. of Maryland/Baltimore County; **Barry C. Sanders**, Univ. of Calgary (Canada); **Alexander V. Sergienko**, Boston Univ.; **Dmitry V. Strekalov**, Jet Propulsion Lab.; **Shigeki Takeuchi**, Hokkaido Univ. (Japan); **Zhi Zhao**, Oak Ridge National Lab.

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:35 am

Quantum Imaging I

Modeling of classical ghost images formed using pseudo-thermal light sources, S. C. Crosby, S. A. Castelletto, R. E. Scholten, A. Roberts, The Univ. of Melbourne (Australia) . . . . . [6710-01]

Ghost imaging with intense entangled fields, A. Andreoni, E. Puddu, Univ. degli Studi dell'Insubria (Italy); I. P. Degiovanni, Istituto Nazionale di Ricerca Metrologica (Italy); M. Bondani, Consiglio Nazionale delle Ricerche (Italy); S. A. Castelletto, The Univ. of Melbourne (Australia) . . . . . [6710-02]

Sub-shot-noise intensity correlations in a mesoscopic dichromatic twin-beam, M. Bondani, Consiglio Nazionale delle Ricerche (Italy); A. Allevi, G. Zambra, Univ. degli Studi dell'Insubria (Italy); M. G. Paris, Univ. degli Studi di Milano (Italy); A. Andreoni, Univ. degli Studi dell'Insubria (Italy) . . . . . [6710-03]

CCD-based detection of quantum spatial correlation of twin beams for high-sensitivity imaging, O. Jedrkiewicz, Univ. degli Studi dell'Insubria (Italy); G. Molina-Terriza, Institut de Ciències Fotòniques (Spain); E. Brambilla, L. Caspani, A. C. Gatti, L. A. Lugiato, P. Di Trapani, Univ. degli Studi dell'Insubria (Italy) . . . . . [6710-04]

Entangled Light Sources for Quantum Imaging, R. W. Boyd, Univ. of Rochester . . . . . [6710-05]

SESSION 2 . . . . . Sun. 11:00 am to 12:40 pm

Quantum Imaging II

Is entanglement dispensable in quantum lithography?, M. D'Angelo, Univ. degli Studi di Bari (Italy); G. Scarcelli, Wellman Ctr. for Photomedicine; Y. Shih, Univ. of Maryland/Baltimore County . . . . . [6710-06]

Non-local aspects of two-photon correlation using chaotic light, E. S. Fonseca, I. Vidal Silva de Lima, D. P. Caetano, J. M. Hickmann, Univ. Federal de Estado de Alagoas (Brazil) . . . . . [6710-07]

New Two-Photon Quantum Ghost Imaging Experiments, R. E. Meyers, K. S. Deacon, Army Research Lab.; Y. Shih, Univ. of Maryland/Baltimore County . . . . . [6710-08]

Quantum Imaging: Recent Progress, M. I. Kolobov, Univ. of Lille I (France); I. V. Sokolov, L. V. Magdenko, St. Petersburg Univ. (Russia) . . . . . [6710-09]

Lunch Break

SESSION 3 . . . . . Sun. 1:40 to 3:20 pm

Quantum Technology I

Development of a parametric down-conversion source for two-photon absorption experiments, T. B. Pittman, Univ. of Maryland/Baltimore County; S. Hendrickson, Johns Hopkins Univ.; J. D. Franson, Univ. of Maryland/Baltimore County . . . . . [6710-10]

Why is the orbital angular momentum conserved in spontaneous parametric down-conversion?, S. Feng, C. Chen, G. A. Barbosa, P. Kumar, Northwestern Univ. [6710-11]

The orbital angular momentum spectrum of photons generated via parametric down-conversion or Raman transitions, C. I. Osorio, Univ. Politècnica de Catalunya (Spain); J. P. Torres, Institut de Ciències Fotòniques (Spain) . . . . . [6710-12]

Unheralded single-photon source using two-photon absorption, B. C. Jacobs, Johns Hopkins Univ. . . [6710-13]

SESSION 4 . . . . . Sun. 3:40 to 5:20 pm

Quantum Technology II

Universal quantum computation in decoherence-free subspace with neutral atoms, P. Xue, Univ. of Calgary (Canada) . . . . . [6710-14]

Tunable control and use of the spectrum of photons in quantum optics applications, A. C. Valencia, M. Hendrych, X. Shi, N. Garcia Gonzalez, A. Cerè, Institut de Ciències Fotòniques (Spain); J. P. Torres, Institut de Ciències Fotòniques (Spain) and Univ. de Catalunya (Spain) . . . . . [6710-15]

Steering light by electromagnetically-induced transparency, A. I. Lvovsky, F. Vewinger, J. Appel, E. V. Figueroa Barragan, K. Marzlin, Univ. of Calgary (Canada) . . . . . [6710-16]

Cavity QED with chip-based toroidal microresonators, B. Dayan, T. Aoki, E. Wilcut, W. P. Bowen, California Institute of Technology; S. A. Parkins, Univ. of Auckland (New Zealand); T. J. Kippenberg, K. J. Vahala, California Institute of Technology . . . . . [6710-17]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Monday 27 August

SESSION 5 . . . . . Mon. 8:30 to 10:35 am

Quantum Communications I

Quantum hacking: attacking practical quantum key distribution systems, B. Qi, C. F. Fung, Y. Zhao, X. Ma, Univ. of Toronto (Canada); K. Tamaki, NTT Corp. (Japan); C. Chen, H. Lo, Univ. of Toronto (Canada) . . . . . [6710-18]

Towards a practical quantum repeater, A. Kuzmich, Georgia Institute of Technology . . . . . [6710-19]

10 Gbps secure communication by quantum stream cipher Y-00 for high definition television, O. Hirota, Tamagawa Univ. (Japan) . . . . . [6710-20]

Quantum networking with quantum dots coupled to micro-cavities, E. Waks, D. Sridharan, Univ. of Maryland/College Park . . . . . [6710-21]

Quantum effects of a partially coherent beam propagating through the atmosphere, G. P. Berman, Los Alamos National Lab.; A. A. Chumak, Instytut Fizyki (Ukraine) . . . . . [6710-22]

SESSION 6 . . . . . Mon. 11:00 am to 12:40 pm

Entanglement I

Compact sources of correlated and entangled photons, M. Fiorentino, S. M. Spillane, Hewlett-Packard Labs.; T. D. Roberts, AdvR, Inc.; R. G. Beausoleil, Hewlett-Packard Labs. . . . . [6710-23]

Experimental study of different Bell states within the linewidth of SPDC, M. Genovese, Istituto Nazionale di Ricerca Metrologica (Italy) . . . . . [6710-24]

Gravitationally Induced Decoherence of Optical Entanglement, T. C. Ralph, G. J. Milburn, T. Downes, The Univ. of Queensland (Australia) . . . . . [6710-25]

Reliability of photon NOON-state production schemes, A. Garuccio, Univ. degli Studi di Bari (Italy) and Instituto Nazionale Di Fisica Nucleare (Italy); V. Tamma, M. D'Angelo, Univ. degli Studi di Bari (Italy) . . . . . [6710-26]

Lunch Break

SESSION 7 . . . . . Mon. 1:40 to 3:20 pm

Quantum Communications II

Quantum communications over optical fiber networks, T. E. Chapuran, R. J. Runser, P. Toliver, N. A. Peters, M. S. Goodman, S. R. McNown, J. T. Kosloski, Telcordia Technologies, Inc.; R. J. Hughes, G. Peterson, K. P. McCabe, J. E. Nordholt, K. Tyagi, P. A. Hiskett, N. Dallmann, Los Alamos National Lab.; L. B. Mercer, H. Dardy, Naval Research Lab. . . . . [6710-27]

Long distance decoy state quantum key distribution in optical fiber, D. Rosenberg, J. W. Harrington, P. R. Rice, P. A. Hiskett, C. G. Peterson, R. J. Hughes, Los Alamos National Lab.; S. W. Nam, A. E. Lita, National Institute of Standards and Technology; J. E. Nordholt, Los Alamos National Lab.[6710-28]

Quantum stream cipher part V: on the optimal modulation scheme and the implementation of deliberate signal randomization, K. Kato, National Tsing Hua Univ. (Taiwan); O. Hirota, Tamagawa Univ. (Japan) . . . . . [6710-29]

Optimal eavesdropping strategies in quantum cryptography using photonic quantum control, S. D. Bartlett, The Univ. of Sydney (Australia) . . . . . [6710-30]

SESSION 8 . . . . . Mon. 3:45 to 5:25 pm

Quantum Technology III

Extremely stable quantum key distribution based on a Faraday mirror type Sagnac interferometer with polarizing beamsplitters, L. Wu, H. Ma, J. Zhao, Institute of Physics (China) . . . . . [6710-31]

Preparation of general single-ququart states using ultrafast spontaneous parametric down-conversion, S. Baek, Pohang Univ. of Science and Technology (South Korea); S. S. Straupe, S. P. Kulik, M.V. Lomonosov Moscow State Univ. (Russia); Y. Kim, Pohang Univ. of Science and Technology (South Korea) . . . . . [6710-32]

Entangling operations and rapid measurement of atomic clock-state qubits for violating Bell inequalities, R. Stock, Univ. of Calgary (Canada) and Univ. of Toronto (Canada); N. S. Babcock, Univ. of Calgary (Canada); M. G. Raizen, The Univ. of Texas at Austin; B. C. Sanders, Univ. of Calgary (Canada) . . . . . [6710-33]

Gradient Echo Quantum Memory for Light using Two-level Atoms, J. J. Longdell, Univ. of Otago (New Zealand); G. Hetet, A. L. Alexander, P. K. Lam, M. J. Sellars, The Australian National Univ. (Australia) . . . . . [6710-34]

✔ Posters-Monday

Poster authors will begin displaying posters after 10:00 am Monday morning. A poster session, with authors present at their posters, will be held Monday evening from 6:00 to 7:30 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Monday. Poster presenters who have not set up by 5:00 pm on Monday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Tuesday 28 August

SESSION 9 . . . . . Tues. 8:30 to 11:20 am

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Conference 6711

Wednesday-Thursday 29-30 August 2007 • Proceedings of SPIE Vol. 6711

Advanced Wavefront Control: Methods, Devices, and Applications V

Conference Chairs: **Richard A. Carreras**, Air Force Research Lab.; **John D. Gonglewski**, Air Force Research Lab.; **Troy A. Rhoadarmer**, Science Applications International Corp.

Program Committee: **Geoff P. Andersen**, U.S. Air Force Academy; **Jeffrey D. Barchers**, Science Applications International Corp.; **Leonid A. Beresnev**, Army Research Lab.; **Thomas G. Bifano**, Boston Univ.; **Philip J. Bos**, Kent State Univ.; **James M. Brase**, Lawrence Livermore National Lab.; **Keith A. Bush**, AgilOptics, Inc.; **David C. Dayton**, Applied Technology Associates; **Lewis F. DeSandre**, Office of Naval Research; **Sergey A. Dimakov**, S.I. Vavilov State Optical Institute (Russia); **Matthew E. Goda**, Air Force Institute of Technology; **Mark T. Gruneisen**, Air Force Research Lab.; **Gordon D. Love**, Univ. of Durham (United Kingdom); **Justin D. Mansell**, MZA Associates Corp.; **Dan K. Marker**, Air Force Research Lab.; **Kent L. Miller**, Air Force Office of Scientific Research; **Scot S. Olivier**, Lawrence Livermore National Lab.; **James F. Riker**, Air Force Research Lab.; **James R. Rotgé**, The Boeing Co.; **Darryl J. Sanchez**, The Univ. of New Mexico; **Don D. Seeley**, High Energy Laser Joint Technology Office; **Michael L. Shilko, Sr.**, ITT Industries, Inc.; **Vladimir Y. Venediktov**, Research Institute for Laser Physics (Russia)

Wednesday 29 August

SESSION 1 . . . . . Wed. 8:30 to 10:30 am

Image-Based Wavefront Sensing

Chairs: **James R. Rotgé**, The Boeing Co.; **Justin D. Mansell**, MZA Associates Corp.

Image based wavefront-sensorless adaptive optics *(Invited Paper)*, M. J. Booth, Univ. of Oxford (United Kingdom) . . . . . [6711-01]

Phase-diversity adaptive optics for future telescopes *(Invited Paper)*, R. Paxman, B. Thelen, R. Murphy, K. Gleichman, J. A. Georges III, General Dynamics Advanced Information Systems . . . . . [6711-02]

The optical spatial heterodyne interferometric Fourier transform technique (SHIFT) and a resulting interferometer, J. A. Georges III, General Dynamics Advanced Information Systems . . . . . [6711-03]

A high speed closed loop dual deformable mirror phase diversity testbed, J. A. Georges III, P. Dorrance, K. Gleichman, J. Jonik, D. Liskow, V. I. Naik, S. Parker, R. Paxman, M. Warmuth, A. Wilson, T. Zaugg, General Dynamics Advanced Information Systems . . . . . [6711-04]

AI&T and calibration of a phase-diversity wavefront sensing and control testbed, V. I. Naik, J. A. Georges III, P. Dorrance, K. Gleichman, J. Jonik, D. Liskow, S. Parker, R. Paxman, M. Warmuth, A. Wilson, T. Zaugg, General Dynamics Advanced Information Systems . . . . . [6711-05]

SESSION 2 . . . . . Wed. 11:00 am to 12:50 pm

Advanced Hardware Techniques for Adaptive Optics I

Chairs: **Dan K. Marker**, Air Force Research Lab.; **David C. Dayton**, Applied Technology Associates

Low-cost high-speed control for adaptive optics *(Invited Paper)*, C. D. Saunter, G. D. Love, Durham Univ. (United Kingdom) . . . . . [6711-06]

Characterization and closed-loop demonstration novel electro-static membrane mirror using COTS membranes, D. C. Dayton, Applied Technology Associates; J. D. Mansell, MZA Associates Corp.; J. D. Gonglewski, Air Force Research Lab.; R. W. Praus II, MZA Associates Corp. . . . . [6711-07]

Stabilization of the sodium beacon: a proposal to achieve full-sky coverage for laser guidestar adaptive optics, D. J. Sanchez, Air Force Research Lab. . . . . [6711-08]

Actuator fault detection via electrical impedance testing, R. M. Morgan, W. K. Wilkie, X. Bao, E. Sidick, Jet Propulsion Lab. . . . . [6711-09]

Closed-loop adaptive optics using a membrane-mirror-on-VLSI phase modulator: preliminary results, T. L. Simpkins, C. Warde, Optron Systems, Inc. . . . . [6711-10]

Lunch Break

SESSION 3 . . . . . Wed. 1:50 to 2:50 pm

Advanced Hardware Techniques for Adaptive Optics II

Chairs: **Dan K. Marker**, Air Force Research Lab.; **David C. Dayton**, Applied Technology Associates

Real time wave front transformation and correction, J. Zhang, L. Wu II, B. Liu, Harbin Institute of Technology (China) . . . . . [6711-11]

Atmospheric turbulence generator testbed for adaptive optical systems testing, C. C. Wilcox, J. R. Andrews, S. R. Restaino, Naval Research Lab.; S. W. Teare, New Mexico Institute of Mining and Technology; T. Martinez, Air Force Research Lab.; D. M. Payne, Narrascape, Inc. . . . . [6711-12]

Open-loop performance of a MEMS reflective wavefront sensor, J. R. Andrews, Naval Research Lab.; S. W. Teare, New Mexico Institute of Mining and Technology; S. R. Restaino, Naval Research Lab.; D. V. Wick, Sandia National Labs.; C. C. Wilcox, Naval Research Lab.; T. Martinez, Air Force Research Lab. . . . . [6711-13]

SESSION 4 . . . . . Wed. 2:50 to 5:30 pm

Advanced Modeling and Simulation for Adaptive Optics

Chairs: **Lewis F. DeSandre**, Office of Naval Research; **John D. Gonglewski**, Air Force Research Lab.

Wavefront-based stochastic parallel gradient descent beam control *(Invited Paper)*, M. S. Belen'kii, V. A. Rye, H. Runyeon, Trex Enterprises Corp. . . . . [6711-14]

Numerical analysis of hybrid wavefront-based stochastic parallel gradient descent AO system for correcting beacon anisoplanatism and thermal blooming, M. S. Belen'kii, V. A. Rye, H. Runyeon, Trex Enterprises Corp. . . . . [6711-15]

An improved temporally phase-shifted SRI design, T. M. Venema, Air Force Institute of Technology; J. D. Schmidt, Univ. of Dayton . . . . . [6711-16]

Wavefront control toolbox for James Webb Space Telescope testbed, S. Shiri, D. L. Aronstein, J. S. Smith, B. H. Dean, NASA Goddard Space Flight Ctr.; E. M. E. Sabatke, Ball Aerospace & Technologies Corp. . . . . [6711-17]

Novel wavefront sensor based on phase-shifting interferometry, A. Khizhnyak, V. B. Markov, J. D. Trolinger, MetroLaser, Inc. . . . . [6711-18]

Arbitrary expected fringe producing by employing phase-only liquid crystal spatial light modulator, L. Wu II, Harbin Institute of Technology (China) . . . . . [6711-19]

Thursday 30 August

SESSION 5 . . . . . Thurs. 8:30 to 10:40 am

Multi-Conjugated Adaptive Optics Techniques

Chairs: **Darryl J. Sanchez**, The Univ. of New Mexico; **Troy A. Rhoadarmer**, Science Applications International Corp.

Progress toward low-cost compact adaptive optics systems *(Invited Paper)*, J. D. Mansell, R. W. Praus II, S. Coy, MZA Associates Corp. . . . . [6711-20]

Implementation of a projection-on-constraints algorithm for beam intensity redistribution, C. C. Beckner, Jr., Air Force Research Lab.; D. Oesch, Science Applications International Corp. . . . . [6711-21]

Emulation of optical effects of atmospheric turbulence using two liquid-crystal spatial light modulators, J. D. Schmidt, Univ. of Dayton; M. E. Goda, Air Force Institute of Technology; B. D. Duncan, Univ. of Dayton . . . . . [6711-22]

Linear analysis of closed-loop field conjugation by decentralized multi-conjugate adaptive optics, L. H. Lee, Lockheed Martin Advanced Technology Ctr. . . . . [6711-23]

Wave front sensing of an optical vortex and its correction with the help of bimorph mirror, F. A. Starikov, RFNC-VNIIEF (Russia) . . . . . [6711-24

MCAO: a case study, J. M. Roche, P. J. Reardon, K. Pitalo, Univ. of Alabama in Huntsville; T. R. Rimmele, K. Richards, National Solar Observatory . . . . . [6711-25]

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Control system of position actuators for segmented mirror active optics,** Z. Zhang, X. Du, Nanjing Institute of Astronomical Optics & Technology (China) . . . . . [6711-26]

OPTICS

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC135 Adaptive Optics (Tyson) Tuesday 28, 8:30 am - 5:30 pm

SC134 Optical Design Fundamentals for Infrared Systems (Riedl) Sunday 26, 8:30 am - 5:30 pm

SC835 Infrared Systems - Technology & Design (Daniels) Tuesday/Wednesday 28-29, 8:30 am - 5:30 pm/8:30 am - 12:30 pm

Conference 6712

Sunday 26 August 2007 • Proceedings of SPIE Vol. 6712

Unconventional Imaging III

Conference Chairs: **Jean J. Dolne**, The Boeing Co.; **Victor L. Gamiz**, Air Force Research Lab.; **Paul S. Idell**, The Boeing Co.

Program Committee: **John F. Belsher**, The Optical Sciences Co.; **Keith A. Bush**, Intellite, Inc.; **Paul W. Fairchild**, Trex Enterprises; **James R. Fienup**, Univ. of Rochester; **Richard A. Hutchin**, Optical Physics Co.; **Charles L. Matson**, Air Force Research Lab.; **Paul F. McManamon**, Air Force Research Lab.; **Timothy J. Schulz**, Michigan Technological Univ.; **Marija Strojnik-Scholl**, Ctr. de Investigaciones en Óptica, A.C.; **Laura J. Ulibarri**, Air Force Research Lab.; **David G. Voelz**, New Mexico State Univ.

Sunday 26 August

SESSION 1 . . . . . Sun. 8:30 to 10:10 am

Active Imaging

Chair: **Victor L. Gamiz**, Air Force Research Lab.

Phase and frequency stability in synthetic aperture ladar, T. J. Karr, J. H. Glezen, H. Lee, Northrop Grumman Corp. . . . . [6712-01]

Signal-to-noise ratios of coherent imaging ladar, T. J. Karr, Northrop Grumman Corp. . . . . [6712-02]

Maximum a-posteriori estimation of detector array non-uniformity and shift in sequences of short exposure images, D. C. Dayton, Applied Technology Associates; J. D. Gonglewski, Air Force Research Lab. . . . . [6712-03]

Image synthesis from a series of coherent frames of pupil intensity, J. D. Phillips, S. C. Cain, Air Force Institute of Technology . . . . . [6712-04]

Optical synthetic aperture radar, J. J. Dolne, The Boeing Co. . . . . [6712-05]

SESSION 2 . . . . . Sun. 10:40 am to 12:20 pm

Image Synthesis snd Formation

Chair: **Jean J. Dolne**, The Boeing Co.

Image formation by use of continuously self-imaging gratings, G. Druart, N. Guérineau, R. Haïdar, J. Primot, ONERA (France) . . . . . [6712-06]

New approaches to image super-resolution beyond the diffraction limit, E. B. Barrett, Lockheed Martin Corp.[6712-07]

Fourier image sharpness sensor for high-speed wavefront correction, K. N. Walker, R. K. Tyson, The Univ. of North Carolina at Charlotte . . . . . [6712-08]

Range estimation based on multiple imaging, Q. Yang, L. Liu, D. Liu, Z. Luan, Shanghai Institute of Optics and Fine Mechanics (China) . . . . . [6712-09]

Estimating object shape from return flux measurements using a sinusoid beam dither method, S. Avula, D. G. Voelz, S. P. Adepu, New Mexico State Univ.; G. W. Lukesh, S. Chandler, Nukove Scientific Consulting, LLC . . . . . [6712-10]

Lunch/Exhibition Break

SESSION 3 . . . . . Sun. 1:20 to 3:00 pm

Image Processing

Chair: **Jean J. Dolne**, The Boeing Co.

A comparative study of algorithms for radar imaging from gapped data, X. Xu, Beihang Univ. (China); R. Luan, Beihang Univ (China); L. Jia, Y. Huang, Beihang Univ. (China) [6712-11]

Hyper-spectral imaging using an optical fiber transition element, B. C. Bush, L. J. Otten III, Photon Research Associates, Inc.; J. Schmoll, Univ. of Durham (United Kingdom) . . . . . [6712-12]

Coherent ladar has double the phase, T. J. Karr, Northrop Grumman Corp. . . . . [6712-13]

Real time phase diversity and wavefront sensing, J. J. Dolne, The Boeing Co. . . . . [6712-14]

Lab demo of real time phase diversity, J. J. Dolne, The Boeing Co. . . . . [6712-15]

SESSION 4 . . . . . Sun. 3:30 to 5:30 pm

Algorithm Optimization

Chair: **Timothy J. Schulz**, Michigan Technological Univ.

Digital and optical superresolution of low-resolution image sequences, S. Prasad, The Univ. of New Mexico . [6712-16]

Flight demonstration of real-time image stitching and fusion, K. L. Bernier, J. J. Güell, The Boeing Co.; T. Schmidt, Krell Technologies, Inc.; J. N. Sanders-Reed, Boeing-SVS, Inc. . . . . [6712-17]

Sparse bumped back illuminated active pixel hybrid FPA, D. Kingrey, DRS Sensors & Targeting Systems, Inc.; J. R. Janesick, Sarnoff Corp. . . . . [6712-18]

Technical assessment of a 100W CW fiber laser amplifier for Fourier telescopy imaging, X. J. Pan, D. W. Hult, Trex Enterprises Corp. . . . . [6712-19]

Evolutionary optimization of graphical models for robust fingerprinting of objects and behavior recognition in video imagery, S. Medasani, Y. Owechko, HRL Labs., LLC [6712-20]

Swarm optimization methods for cognitive image analysis, Y. Owechko, S. Medasani, HRL Labs., LLC . . . . . [6712-21]

All-Conference Plenary Session . . . . . Sun. 6:00 to 7:30 pm

6:00 to 6:45 pm: **Technology to Enable our Solar Technology Future,** D. W. Merfeld, GE Global Research

6:45 to 7:30 pm: **The Concept of the Photon - Updated,** M. O. Scully, Texas A&M Univ.

See p. 8 for presentation overview.

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC135 Adaptive Optics (Tyson) Tuesday 28, 8:30 am - 5:30 pm

Conference 6713

Monday-Tuesday 27-28 August 2007 • Proceedings of SPIE Vol. 6713

NanoPhotonics and MacroPhotonics for Space Environments

Conference Chairs: **Edward W. Taylor**, International Photonics Consultants, Inc.; **David A. Cardimona**, Air Force Research Lab.

Program Committee: **Mansoor Alam**, Nufern; **Natalie Clark**, NASA Langley Research Ctr.; **Richard O. Claus**, Virginia Polytechnic Institute and State Univ.; **Douglas M. Craig**, Air Force Research Lab.; **Raluca Dinu**, Lumera Corp.; **Alexandre I. Fedoseyev**, CFD Research Corp.; **Michael J. Hayduk**, Air Force Research Lab.; **Dan-Hong Huang**, Air Force Research Lab.; **James E. Nichter**, Air Force Research Lab.; **Melanie N. Ott**, NASA Goddard Space Flight Ctr.; **Narasimha S. Prasad**, NASA Langley Research Ctr.; **Anthony D. Sanchez**, Air Force Research Lab.; **Robert C. Stirbl**, Jet Propulsion Lab.

Monday 27 August

Welcome and Introductions . . . . Mon. 8:25 to 8:30 am

Chair: **Edward W. Taylor**, International Photonics Consultants, Inc.

SESSION 1 . . . . . Mon. 8:30 to 10:05 am

Polymer/Organic Materials and Components for Space Environments

Chair: **Raluca Dinu**, Lumera Corp.

Optical signal processor operating at wavelength of 1.55 um using electro-optic polymer waveguides, B. Seo, S. K. Kim, H. R. Fetterman, Univ. of California/Los Angeles; D. Jin, R. Dinu, Lumera Corp. . . . . [6713-01]

Record high intrinsic hyperpolarizabilities for polymeric electro-optic modulators *(Invited Paper)*, K. J. Clays, J. Perez-Moreno, Katholieke Univ. Leuven (Belgium); M. G. Kuzyk, Washington State Univ.; Y. Zhao, Technical Institute of Physics and Chemistry (China) . . . . . [6713-02]

Advances in semiconducting polymer lasers *(Invited Paper)*, I. D. W. Samuel, G. A. Turnbull, Univ. of St. Andrews (United Kingdom) . . . . . [6713-03]

Supramolecular photonics: molecular self-assembly and controlled lattice hardening for electro-optic coefficients beyond 450 pm/V *(Invited Paper)*, A. K. Jen, J. Luo, T. Kim, Z. Shi, Y. Cheng, S. Jang, S. Huang, X. Zhou, B. Polishak, L. R. Dalton, B. H. Robinson, P. Sullivan, Univ. of Washington; N. N. Peyghambarian, R. Norwood, College of Optical Sciences/The Univ. of Arizona; W. H. Steier, Univ. of Southern California; D. Jin, R. Dinu, Lumera Corp. . . . . [6713-04]

SESSION 2 . . . . . Mon. 10:35 am to 12:00 pm

Nano-Polymer Materials and Components in Space Radiation Environments I

Chair: **Natalie Clark**, NASA Langley Research Ctr.

DARPA's supermolecular photonics engineering program (MORPH) *(Keynote)*, D. K. Shenoy, Defense Advanced Research Projects Agency . . . . . [6713-05]

Radiation resistance of QD-based polymer/organic photoconductive and photovoltaic detectors, E. W. Taylor, International Photonics Consultants, Inc.; D. Wood, R. O. Claus, NanoSonic, Inc.; D. M. Craig, Air Force Research Lab. . . . . [6713-06]

Hardening of polymer optical materials with laser cycling and gamma-rays *(Invited Paper)*, M. G. Kuzyk, Washington State Univ.; E. W. Taylor, International Photonics Consultants, Inc.; N. B. Embaye, Y. Zhu, J. Zhou, Washington State Univ. . . . . [6713-07]

Lunch Break

SESSION 3 . . . . . Mon. 1:00 to 3:15 pm

Nano-Polymer Materials and Components in Space Radiation Environments II

Chair: **Alexandre I. Fedoseyev**, CFD Research Corp.

Radiation effects in quantum dot superlattices and their physical 3D modeling *(Invited Paper)*, A. I. Fedoseyev, A. Raman, M. Turowski, CFD Research Corp. . . . . [6713-08]

Modeling-based optimization of the photovoltaic quantum dot superlattices, Q. Shao, A. A. Balandin, E. P. Pokatilov, D. L. Nika, Univ. of California/Riverside; A. I. Fedoseyev, M. Turowski, CFD Research Corp. . . . . [6713-09]

Novel hybrid electro-optic modulators with horizontal taper structure, G. Yu, B. Li, D. Jin, L. Zheng, Y. Fang, R. Dinu, Lumera Corp. . . . . [6713-10]

Discrete carbon nanotube photonic devices for space applications *(Invited Paper)*, K. Bosnick, National Institute for Nanotechnology (Canada) . . . . . [6713-11]

In-situ monitoring of slow light structures in dye-doped polymer waveguide materials, E. M. McKenna, Jr., A. Lin, A. R. Mickelson, Univ. of Colorado/Boulder . . . . . [6713-12]

Experimental research on radiation induced changes of polymer optical fiber under gamma-ray irradiation *(Invited Paper)*, W. Ge, Xi'an Institute of Optics and Precision Mechanics (China) and Xinjiang Univ. (China) . . . . . [6713-13]

SESSION 4 . . . . . Mon. 3:45 to 5:35 pm

Photonics Technology for Space Applications I

Chair: **Narasimha S. Prasad**, NASA Langley Research Ctr.

Space qualification issues in acousto-optic and electro-optic devices *(Invited Paper)*, N. S. Prasad, NASA Langley Research Ctr.; E. W. Taylor, International Photonics Consultants, Inc.; S. B. Trivedi, J. I. Soos, Brimrose Corp. of America . . . . . [6713-14]

Advanced optical technologies for space exploration *(Invited Paper)*, N. Clark, NASA Langley Research Ctr. . . . . [6713-15]

Sensor and actuator ASICs for space missions, D. Kerns, Sigenics, Inc. . . . . [6713-16]

Combustion-based synthesis of semiconducting metal-oxide nanowires and nanostructures, S. D. Tse, F. Xu, Rutgers Univ. . . . . [6713-17]

Tunable liquid crystal filters for space exploration, C. Crandall, High Chiva Systems, Inc.; N. Clark, P. Davis, NASA Langley Research Ctr. . . . . [6713-18]

Tuesday 28 August

Welcome and Introductions . . . . Tues. 8:35 to 8:40 am

Chair: **David A. Cardimona**, Air Force Research Lab.

SESSION 5 . . . . . Tues. 8:40 am to 12:00 pm

Novel Photonic Devices and Concepts for Space-Based Applications

Chair: **Dan-Hong Huang**, Air Force Research Lab.

Integrated multi-modal sensing *(Keynote)*, K. C. Reinhardt, Air Force Office of Scientific Research [6713-19]

A quantum dot longwave infrared photodetector with integrated optical amplifier, X. Lu, Univ. of Massachusetts/Lowell; M. J. Meisner, Raytheon Missile Systems . [6713-20]

A longwave infrared transparent conductive coating by printing or spraying at room temperature, X. Lu, Univ. of Massachusetts/Lowell; X. Han, Brewer Science, Inc. [6713-21]

Nanophotonic structure for enhancing infrared detection *(Invited Paper)*, S. Lin, C. Chang, A. Chang, Rensselaer Polytechnic Institute; D. Huang, Air Force Research Lab. . . . . [6713-22]

The darkest manmade material: nanostructure and randomness *(Invited Paper)*, S. Lin, Z. Yang, L. Ci, J. A. Bur, P. M. Ajayan, Rensselaer Polytechnic Institute . . . . [6713-23]

Improving SNR of fiber Bragg grating sensor by digital signal processing, J. Ning, Y. Zhang, H. Cui, Stevens Institute of Technology . . . . . [6713-24]

Plasmon assisted photonic crystal quantum dot sensors, R. V. Shenoi, Ctr. for High Technology Materials; J. Rosenberg, California Institute of Technology; D. A. Ramirez, Y. D. Sharma, R. Allaturi, The Univ. of New Mexico; O. J. Painter, California Institute of Technology; S. Krishna, The Univ. of New Mexico . . . . . [6713-25]

Lunch/Exhibition Break

OPTICS

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SESSION 6 . . . . . Tues. 1:30 to 3:10 pm

Photonics Technology for Space Applications II

Chair: **Melanie N. Ott**, NASA Goddard Space Flight Ctr.

Requirements validation testing on the 7 optical fiber array connector/cable assemblies for the lunar reconnaissance orbiter (LRO) *(Invited Paper)*, M. N. Ott, X. Jin, NASA Goddard Space Flight Ctr.; F. V. LaRocca, MEI Technologies, Inc.; A. J. Matuszeski, NASA Goddard Space Flight Ctr.; R. F. Chuska, S. L. Macmurphy, MEI Technologies, Inc. [6713-26]

Investigation of radiation-induced photodarkening in passive erbium-, ytterbium-, and Yb/Er co-doped optical fibers, B. P. Fox, K. Simmons-Potter, J. H. Simmons, The Univ. of Arizona; W. J. Thomes, Jr., R. P. Bambha, D. A. V. Kliner, Sandia National Labs. . . . . [6713-27]

Space flight qualification on a novel five-fiber array assembly for the lunar orbiter laser altimeter (LOLA) at NASA Goddard Space Flight Center, X. Jin, M. N. Ott, NASA Goddard Space Flight Ctr.; F. V. LaRocca, R. F. Chuska, MEI Technologies, Inc.; S. M. Schmidt, A. J. Matuszeski, NASA Goddard Space Flight Ctr.; S. L. Macmurphy, MEI Technologies, Inc. . . . . [6713-28]

Investigation of hermetically sealed COTS LiNbO3 optical modulator for use in laser/lidar space-flight applications *(Invited Paper)*, F. V. LaRocca, Muniz Engineering, Inc.; M. N. Ott, X. Jin, NASA Goddard Space Flight Ctr.; J. S. Canham, Swales Areospace; R. F. Chuska, S. L. Macmurphy, Muniz Engineering, Inc.; T. L. Jamison, NASA Goddard Space Flight Ctr. . . . . [6713-29]

SESSION 7 . . . . . Tues. 3:40 to 5:10 pm

Photonics Technology for Space Applications III

Chair: **Robert C. Stirbl**, Jet Propulsion Lab.

Waveguide PPLN second harmonic generator for NASA's space interferometry mission (SIM) *(Invited Paper)*, D. Chang, I. Poberezhskiy, J. Mulder, Jet Propulsion Lab. . . . . [6713-30]

Compact electro-optic imaging Fourier transform spectrometer, T. Chao, Jet Propulsion Lab. . . . . [6713-31]

3D photonic crystals for use in compact integrated photonic circuits, J. S. Rodgers, Space & Naval Warfare Systems Command SPAWARSYSCEN; K. Mansour, Jet Propulsion Lab. . . . . [6713-32]

Silicon-on-sapphire fiber optic transceiver technology for space applications, C. Kuznia, Ultra Communications, Inc. . . . . [6713-33]

Courses of Related Interest

See pages 162-187 for full course descriptions.

SC497 Nanophotonics (Prasad) Sunday 26, 1:30 - 5:30 pm

Conference 6714

Thursday 30 August 2007 • Proceedings of SPIE Vol. 6714

Adaptive Coded Aperture Imaging and Non-Imaging Sensors

Conference Chairs: **David P. Casasent**, Carnegie Mellon Univ.; **Timothy Clark**, Defense Advanced Research Projects Agency

Program Committee: **David J. Brady**, Duke Univ.; **Michael T. Eismann**, Air Force Research Lab.; **Stephen R. Gottesman**, Northrop Grumman Corp.; **Abhijit Mahalanobis**, Lockheed Martin Missiles and Fire Control; **Mark A. Neifeld**, The Univ. of Arizona; **Demetri Psaltis**, California Institute of Technology; **Stanley Rogers**, Air Force Research Lab.; **Christopher W. Slinger**, QinetiQ (United Kingdom); **Nikola S. Subotic**, Michigan Tech Research Institute; **Rebecca A. Wilson**, QinetiQ (United Kingdom)

Wednesday 29 August

✔ Posters-Wednesday

Poster authors will begin displaying posters after 10:00 am Wednesday morning. A poster session, with authors present at their posters, will be held Wednesday evening from 5:30 to 7:00 pm. Light refreshments will be served.

Poster Setup

Poster presenters may set up their posters between 10:00 am and 5:00 pm on Wednesday. Poster presenters who have not set up by 5:00 pm on Wednesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

✔ **Widebandwidth ESA lens constraints,** E. Jaska, DARPA . . . . . [6714-20]

Thursday 30 August

SESSION 1 . . . . . Thurs. 8:30 to 10:00 am

Imaging and Non-Imaging Sensors Needs

Chairs: **Timothy Clark**, Defense Advanced Research Projects Agency; **David P. Casasent**, Carnegie Mellon Univ.

U.S. Army imaging and non-imaging sensor needs *(Keynote),* C. A. Agee, U.S. Army ISR Integration [6714-01]

DARPA interest in diffractive sensors *(Invited Paper),* T. Clark, Defense Advanced Research Projects Agency[6714-02]

Imaging sensors with extreme from factors *(Invited Paper),* R. A. Athale, MITRE Corp. . . . . [6714-03]

SESSION 2 . . . . . Thurs. 10:20 to 12:00 am

Imaging and Non-Imaging Diffractive System Concepts

Chair: **Stephen R. Gottesman**, Northrop Grumman Corp.

Coded apertures: past, present and future application and design, S. R. Gottesman, Northrop Grumman Corp. [6714-04]

Agile, detecting and discriminating, infrared electro-optical system (ADDIOS) application to coded aperture imaging and non-imaging sensor systems, M. A. Gutin, Applied Science Innovations, Inc.; S. Rogers, Air Force Research Lab.; O. N. Gutin, X. Wang, Applied Science Innovations, Inc.; D. Warner, J. Gueits, Air Force Research Lab. . . . . [6714-05]

Large-scale optical lensless imaging with geometric fibre constructs, A. F. Abouraddy, Y. Fink, Massachusetts Institute of Technology . . . . . [6714-06]

An investigation into the potential use of high resolution, adaptive coded aperture systems, in the mid-wave infrared, C. W. Slinger, N. Gordon, M. E. McNie, D. Payne, K. Ridley, M. Strens, G. De Villiers, R. A. Wilson, QinetiQ Ltd. (United Kingdom); M. T. Eismann, Air Force Research Lab. [6714-07]

Beam steering and pointing with counter-rotating grisms, C. W. Chen, Raytheon Space and Airborne Systems [6714-08]

Lunch/Exhibition Break

SESSION 3 . . . . . Thurs. 1:10 to 3:30 pm

Diffractive Imaging Hardware

Chair: **Stanley Rogers**, Air Force Research Lab.

Infrared performance analysis of an adaptive coded aperture "diffractive imaging" system employing MEMS "etalon shutter" technologies, C. W. Slinger, QinetiQ Ltd. (United Kingdom); S. Rogers, Air Force Research Lab.; M. E. McNie, QinetiQ Ltd. (United Kingdom) . . . . . [6714-09]

Single-disperser design for snapshot coded aperture spectral imaging, A. A. Wagadarikar, R. John, R. Willett, Duke Univ.; T. J. Schulz, Michigan Technological Univ.; M. Gehm, The Univ. of Arizona; D. J. Brady, Duke Univ. . . . . [6714-10]

Reconfigurable mask for adaptive coded aperture imaging based on an addressable MOEMS microshutter array, M. E. McNie, D. Combes, G. Smith, N. Price, K. Brunson, QinetiQ Ltd. (United Kingdom); K. Lewis, Sciovis Ltd. (United Kingdom); C. W. Slinger, QinetiQ Ltd. (United Kingdom); S. Rogers, Air Force Research Lab. . . . . [6714-11]

Dynamic aperture optical arrays based on polymeric MEMS actuators for large scale coding elements with application in visible to MWIR, S. H. Goodwin-Johansson, J. Carlson, B. Stoner, RTI International; D. J. Brady, J. Kim, Duke Univ.; S. Rogers, Air Force Research Lab. . . . . [6714-12]

IR performance study of an adaptive coded aperture "diffractive imaging" system employing MEMS "eyelid shutter" technologies, A. Mahalanobis, Lockheed Martin Missiles and Fire Control; S. Rogers, Air Force Research Lab.; D. J. Brady, Duke Univ. . . . . [6714-13]

Interferometric control of contact line, shape, and aberrations of liquid lens, I. G. Voitenko, R. F. Storm, R. T. Westfall, Eclipse Energy Systems, Inc.; S. Rogers, Air Force Research Lab. . . . . [6714-14]

Eclipse SteerTechTM liquid lenslet beam steering technology, R. T. Westfall, Eclipse Energy Systems, Inc.; S. Rogers, Air Force Research Lab.; K. C. Shannon III, Eclipse Energy Systems, Inc. . . . . [6714-15]

SESSION 4 . . . . . Thurs. 3:50 to 5:30 pm

Imaging and Non-Imaging Algorithms

Chair: **Nikola S. Subotic**, Michigan Tech Research Institute

System models for IR diffractive optical systems based on a coherence theoretic framework, N. S. Subotic, Michigan Tech Research Institute; M. T. Eismann, Air Force Research Lab.; C. Roussi, Michigan Tech Research Institute; J. Meola, Air Force Research Lab. . . . . [6714-16]

Optimum orthogonal binary coded apertures for object recognition *(Invited Paper),* D. C. Braunreiter, Science Applications International Corp. . . . . [6714-17]

DAZLE: a new approach to adaptive imaging *(Invited Paper),* R. L. Kellogg, Argon ST, Inc.; M. J. Escuti, North Carolina State Univ. . . . . [6714-18]

Compressive imaging using shift invariant coded PSFs, D. J. Brady, Duke Univ.; R. Coifman, Plain Sight Systems, Inc.; M. Maggioni, R. Willett, Duke Univ.; A. Mahalanobis, Lockheed Martin Missiles and Fire Control; N. Pitsianis, Duke Univ. . . . . [6714-19]

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SPIE is an authorized provider of Continuing Education Units (CEUs) though IACET—The International Association of Continuing Education and Training. SPIE awards CEUs to participants who successfully attend courses, and complete and return the evaluation form within 30 days of the course presentation. SPIE maintains a record of all CEUs earned for each participant for seven years.

Professional Development from SPIE

SPIE.org/education

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
NanoEngineering					
SC496 **Fabrication and Processing of Nanostructures** *(Cao)* 8:30 am to 5:30 pm, $450 / $535, p. 163 SC497 **Nanophotonics** *(Prasad)* 1:30 to 5:30 pm, $230 / $275, p. 162 FC		SC655 **Introduction to Optical Tweezers and Optical Micromanipulation** *(Dholakia, Spalding)* 6:00 to 10:00 pm, $230 / $275, p. 163	WS851 **Nanotechnology: Science & Applications** *(Brahmbatt)* 8:30 am to 5:30 pm, $410 / $495, p. 164		
NanoScience					
		SC608 **Photonic Crystals: A Crash Course, from Bandgaps to Fibers** *(Johnson)* 1:30 to 5:30 pm, $230 / $275, p. 162		SC727 **Nanoplasmonics** *(Stockman)* 8:30 am to 5:30 pm, $410 / $495, p. 162	
Solar Energy & Its Applications					
SC798 **Practical Radiometry** *(Strojnik-Scholl)* 8:30 am to 5:30 pm, $410 / $495, p. 168	SC388 **Non-Imaging Optics** *(Winston)* 8:30 am to 12:30 pm, $230 / $275, p. 165	SC797 **The Science and Technology of Organic Solar Cells** *(Peumans)* 1:30 to 5:30 pm, $230 / $275, p. 164			
Organic Photonics and Electronics					
SC798 **Practical Radiometry** *(Strojnik-Scholl)* 8:30 am to 5:30 pm, $410 / $495, p. 168 SC799 **Solid State Lighting Phosphors** *(Summers)* 8:30 am to 12:30 pm, $230 / $275, p.166 SC490 **Solid State Lighting I** *(Ferguson)* 1:30 to 5:30 pm, $230 / $275, p. 165		SC797 **The Science and Technology of Organic Solar Cells** *(Peumans)* 1:30 to 5:30 pm, $230 / $275, p. 164			

Price Key
SPIE Member/Non-Member

SPIE Foundation Courses

Look for this symbol to identify SPIE Foundation Courses FC

What are SPIE Foundation Courses?

Foundation courses provide an introduction to and overview of the technical area they address. They are an ideal entry point for understanding core concepts and tools if you're new to a field, looking to brush up your knowledge in a specific area, or want to take a closer look at a specialization you're considering pursuing. Courses are taught by instructors with deep knowledge and years of in- the-field experience, and offer the unique opportunity to learn from some of the most accomplished optics professionals in their respective industries.

SPIE Foundation Courses are ideal for:

- Technical sales professionals looking to increase their knowledge to better work with customers
- Early career professionals who need an in-depth background in their specialization
- Mid-career professionals interested in changing focus to a new field
- Companies looking for training for their entry- level engineers
- Professionals seeking to broaden their skills with interdisciplinary training
- Anyone looking to gain a fundamental understanding of the subject

Daily Course Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Illumination Engineering					
SC798 **Practical Radiometry** *(Strojnik-Scholl)* 8:30 am to 5:30 pm, $410 / $495, p. 168	SC388 **Non-Imaging Optics** *(Winston)* 8:30 am to 12:30 pm, $230 / $275, p. 165	SC657 **Accurate Measurement of LED Optical Properties** *(Tirpak)* 8:30 am to 12:30 pm, $230 / $275, p. 166			
SC799 **Solid State Lighting Phosphors** *(Summers)* 8:30 am to 12:30 pm, $230 / $275, p. 166	SC011 **Design of Efficient Illumination Systems** *(Cassarly)* 1:30 to 5:30 pm, $230 / $275, p. 165				
SC490 **Solid State Lighting I** *(Ferguson)* 1:30 to 5:30 pm, $230 / $275, p. 165					
Astronomical Optics and Instrumentation					
SC134 **Optical Design Fundamentals for Infrared Systems** *(Riedl)* 8:30 am to 5:30 pm, $450 / $535, p. 167 (FC)	SC504 **Introduction to CCD and CMOS Imaging Sensors and Applications** *(Janesick)* 8:30 am to 5:30 pm, $530 / $615, p. 172	SC135 **Adaptive Optics** *(Tyson)* 8:30 am to 5:30 pm, $445 / $530, p. 167	SC219 **Materials: Properties and Fabrication for Stable Optical Systems** *(Paquin)* 8:30 am to 5:30 pm, $410 / $495, p. 173		
SC798 **Practical Radiometry** *(Strojnik)* 8:30 am to 5:30 pm, $410 / $495, p. 168		SC218 **Advanced Composite Materials for Optomechanical Systems** *(Zweben)* 8:30 am to 5:30 pm, $410 / $495, p. 173	SC068 **Use of CCD and CMOS Sensors in Visible Imaging Applications** *(Lomheim)* 8:30 am to 12:30 pm, $230 / $275, p. 171		
		SC561 **Optomechanics for Space Applications** *(Shipley)* 8:30 am to 5:30 pm, $410 / $495, p. 168			
		SC017 **Principles of Fourier Optics and Diffraction** *(Gaskill)* 8:30 am to 5:30 pm, $515 / $600, p. 167 (FC)	SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $230 / $275, p. 172		
Atmospheric and Space Optical Systems					
		SC135 **Adaptive Optics** *(Tyson)* 8:30 am to 5:30 pm, $445 / $530, p. 167			
		SC561 **Optomechanics for Space Applications** *(Shipley)* 8:30 am to 5:30 pm, $410 / $495, p. 168			
Remote Sensing Instrumentation					
SC134 **Optical Design Fundamentals for Infrared Systems** *(Riedl)* 8:30 am to 5:30 pm, $450 / $535, p. 167 (FC)	SC504 **Introduction to CCD and CMOS Imaging Sensors and Applications** *(Janesick)* 8:30 am to 5:30 pm, $530 / $615, p. 172	SC835 **Infrared Systems - Technology & Design** *(Daniels)* 8:30 am to 5:30 pm/8:30 am to 12:30 pm, $840 / $965, p. 180			
SC798 **Practical Radiometry** *(Strojnik)* 8:30 am to 5:30 pm, $410 / $495, p. 168		SC561 **Optomechanics for Space Applications** *(Shipley)* 8:30 am to 5:30 pm, $410 / $495, p. 168	SC068 **Use of CCD and CMOS Sensors in Visible Imaging Applications** *(Lomheim)* 8:30 am to 12:30 pm, $230 / $275, p. 171		
SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* 1:30 to 5:30 pm, $230 / $275, p. 169		SC206 **Polarized Light: A Practical Hands-on Introduction** *(Fisher)* 8:30 am to 5:30 pm, $410 / $495, p. 169 (FC)	SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $230 / $275, p. 172		

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday

Image and Signal Processing

Monday

SC661 **Advanced Image Processing and Applications** *(Iftekharuddin)* 8:30 am to 5:30 pm, $410 / $495, p. 170

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* 8:30 am to 5:30 pm, $410 / $495, p. 170 FC

Tuesday

SC017 **Principles of Fourier Optics and Diffraction** *(Gaskill)* 8:30 am to 5:30 pm, $515 / $600, p. 167 FC

Detectors and Imaging Devices

Sunday

SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* 1:30 to 5:30 pm, $230 / $275, p. 171

Monday

SC504 **Introduction to CCD and CMOS Imaging Sensors and Applications** *(Janesick)* 8:30 am to 5:30 pm, $530 / $615, p. 172

Wednesday

SC068 **Use of CCD and CMOS Sensors in Visible Imaging Applications** *(Lomheim)* 8:30 am to 12:30 pm, $230 / $275, p.171

SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $230 / $275, p. 172

Optomechanics

Sunday

SC014 **Introduction to Optomechanical Design** *(Vukobratovich)* 8:30 am to 5:30 pm, $780 / $985, p. 172

Tuesday

SC218 **Advanced Composite Materials for Optomechanical Systems** *(Zweben)* 8:30 am to 5:30 pm, $410 / $495, p. 173

SC220 **Optical Alignment Mechanisms** *(Guyer)* 8:30 am to 12:30 pm, $230 / $275, p. 174

SC781 **Opto-mechanical Analysis** *(Hatheway)* 8:30 am to 5:30 pm, $410 / $495, p. 175 FC

SC561 **Optomechanics for Space Applications** *(Shipley)* 8:30 am to 5:30 pm, $410 / $495, p. 168

Wednesday

SC254 **Integrated Opto-Mechanical Analysis** *(Doyle, Michels)* 8:30 am to 5:30 pm, $455 / $540, p. 174

SC219 **Materials: Properties and Fabrication for Stable Optical Systems** *(Paquin)* 8:30 am to 5:30 pm, $410 / $495, p. 173

SC015 **Structural Adhesives for Optical Bonding** *(Daly)* 8:30 am to 12:30 pm, $230 / $275, p. 172

SC447 **Principles for Mounting Optical Components** *(Yoder, Jr.)* 8:30 am to 5:30 pm, $850 / $1055, p. 174 FC

Optical Design

Sunday

SC156 **Basic Optics for Engineers** *(Ducharme)* 8:30 am to 5:30 pm, $445 / $530, p. 176 FC

SC134 **Optical Design Fundamentals for Infrared Systems** *(Riedl)* 8:30 am to 5:30 pm, $450 / $535, p. 167 FC

SC001 **Optical System Design: Layout Principles and Practice** *(Smith)* 8:30 am to 5:30 pm, $480 / $565, p. 175 FC

SC792 **Polarization in Optical Design** *(Chipman)* 8:30 am to 12:30 pm, $230 / $275, p. 178

SC003 **Practical Optical System Design - EXPANDED 2 Day Format** *(Fischer)* 8:30 am to 5:30 pm, $855 / $1060, p. 175 FC

SC020 **Optical Scattering: Measurement and Analysis** *(Stover)* 1:30 to 5:30 pm, $285 / $330, p. 182

Monday

SC010 **Introduction to Optical Alignment Techniques** *(Ruda)* 8:30 am to 5:30 pm, $780 / $985, p. 176

SC006 **Modern Lens Design** *(Smith)* 8:30 am to 5:30 pm/8:30 am to 12:30 pm, $800 / $925, p. 178

SC492 **Predicting, Modeling, and Interpreting Light Scattered by Surfaces** *(Germer)* 8:30 am to 12:30 pm, $230 / $275, p. 183

SC659 **Understanding Reflective Optical Design** *(Contreras)* 8:30 am to 5:30 pm, $410 / $495, p. 177

SC384 **The Design of Plastic Optical Systems** *(Schaub)* 1:30 to 5:30 pm, $230 / $275, p. 177

Tuesday

SC206 **Polarized Light: A Practical Hands-on Introduction** *(Fisher)* 8:30 am to 5:30 pm, $410 / $495, p. 169

SC017 **Principles of Fourier Optics and Diffraction** *(Gaskill)* 8:30 am to 5:30 pm, $515 / $600, p. 167 FC

Wednesday

WS609 **Basic Optics for Non-Optics Personnel** *(Harding)* 8:30 to 11:00 am, $50 / $100, p. 178

SC552 **Aspheric Optics: Design, Fabrication, and Test** *(Fischer)* 1:30 to 5:30 pm, $305 / $350, p. 177

Daily Course Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday

Optical Systems Engineering

Sunday

SC560 **Exploring Optical Aberrations** *(Mahajan)* 8:30 am to 5:30 pm, $560 / $640, p. 179

SC134 **Optical Design Fundamentals for Infrared Systems** *(Riedl)* 8:30 am to 5:30 pm, $450 / $535, p. 167 FC

SC001 **Optical System Design: Layout Principles and Practice** *(Smith)* 8:30 am to 5:30 pm, $480 / $565, p. 175 FC

SC792 **Polarization in Optical Design** *(Chipman)* 8:30 am to 12:30 pm, $230 / $275, p. 180

SC003 **Practical Optical System Design - EXPANDED 2 Day Format** *(Fischer)* 8:30 am to 5:30 pm, $855 / $1060, p. 175 FC

SC798 **Practical Radiometry** *(Strojnik-Scholl)* 8:30 am to 5:30 pm, $410 / $495, p. 168

SC849 **Introduction to Wave Optics** *(Ghatak)* 1:30 to 5:30 pm, $250 / $295, p.181

SC020 **Optical Scattering: Measurement and Analysis** *(Stover)* 1:30 to 5:30 pm, $285 / $330, p. 182

Monday

SC010 **Introduction to Optical Alignment Techniques** *(Ruda)* 8:30 am to 5:30 pm, $780 / $985, p. 176

SC006 **Modern Lens Design** *(Smith)* 8:30 am to 5:30 pm/8:30 am to 12:30 pm, $800 / $925, p. 178

SC492 **Predicting, Modeling, and Interpreting Light Scattered by Surfaces** *(Germer)* 8:30 am to 12:30 pm, $230 / $275, p. 183

SC659 **Understanding Reflective Optical Design** *(Contreras)* 8:30 am to 5:30 pm, $410 / $495, p. 180

SC384 **The Design of Plastic Optical Systems** *(Schaub)* 1:30 to 5:30 pm, $230 / $275, p. 177

Tuesday

SC835 **Infrared Systems - Technology & Design** *(Daniels)* 8:30 am to 5:30 pm/8:30 am to 12:30 pm, $840 / $965, p. 180

SC017 **Principles of Fourier Optics and Diffraction** *(Gaskill)* 8:30 am to 5:30 pm, $515 / $600, p. 167 FC

Wednesday

SC325 **An Introduction to Lasers** *(Fisher)* 1:30 to 5:30 pm, $230 / $275, p. 179 FC

Optical Manufacturing and Testing

Monday

SC850 **Metrology for Modern Optical Manufacturing** *(Murphy)* 8:30 am to 12:30 pm, $230 / $275, p. 182

SC720 **Cost-Conscious Tolerancing of Optical Systems** *(Youngworth)* 1:30 to 5:30 pm, $230 / $275, p. 182

SC848 **Fundamentals of Single Point Diamond Turning** *(Schaefer)* 1:30 to 5:30 pm, $230 / $275, p. 182

SC384 **The Design of Plastic Optical Systems** *(Schaub)* 1:30 to 5:30 pm, $230 / $275, p. 177

Tuesday

SC321 **Thin Film Optical Coatings** *(Macleod)* 8:30 am to 5:30 pm, $410 / $495, p. 184 FC

Wednesday

SC552 **Aspheric Optics: Design, Fabrication, and Test** *(Fischer)* 1:30 to 5:30 pm, $305 / $350, p. 177

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Advanced Metrology					
SC020 **Optical Scattering: Measurement and Analysis** *(Stover)* 1:30 to 5:30 pm, $285 / $330, p. 182	SC213 **Introduction to Interferometric Optical Testing** *(Wyant)* 8:30 am to 12:30 pm, $230 / $275, p. 183 SC850 **Metrology for Modern Optical Manufacturing** *(Murphy)* 8:30 am to 12:30 pm, $230 / $275, p. 184 SC492 **Predicting, Modeling, and Interpreting Light Scattered by Surfaces** *(Germer)* 8:30 am to 12:30 pm, $230 / $275, p. 183	SC017 **Principles of Fourier Optics and Diffraction** *(Gaskill)* 8:30 am to 5:30 pm, $515 / $600, p. 167 (FC)	SC211 **Practical Interferometry and Fringe Analysis** *(Creath)* 8:30 am to 12:30 pm, $230 / $275, p. 183		
Thin Films					
		SC321 **Thin Film Optical Coatings** *(Macleod)* 8:30 am to 5:30 pm, $410 / $495, p. 184 (FC)			
Applications					
			SC325 **An Introduction to Lasers** *(Fisher)* 1:30 to 5:30 pm, $230 / $275, p. 185 (FC) SC552 **Aspheric Optics: Design, Fabrication, and Test** *(Fischer)* 1:30 to 5:30 pm, $305 / $350, p. 177		
The Business Side					
				WS756 **How to Start a Small High Tech Business Almost Anywhere** *(Udd)* 8:30 am to 12:30 pm, $230 / $275, p. 185	
Professional Development					
	WS777 **Optimizing Your Resume** *(Cain)* 1:30 to 3:30 pm, $50 / $100, p. 187 WS852 **Hands-On Optics: Making an Impact with Light (HOO): Terrific Telescopes Work** *(Walker, Sparks)* 2:00 to 5:00 pm, $20 / $25, p. 186	WS827 **Off the Beaten Path: Career Opportunities for Engineers in the Patent Boom (Law Degree Not Required)** *(Honeyman)* 1:30 to 5:30 pm, $230 / $275, p. 185	WS609 **Basic Optics for Non-Optics Personnel** *(Harding)* 8:30 to 11:00 am, $50 / $100, p. 186 WS667 **The Craft of Scientific Presentations: A Workshop on Technical Presentations** *(Krages)* 8:30 am to 12:30 pm, $75 / $125, p. 186 WS668 **The Craft of Scientific Writing: A Workshop on Technical Writing** *(Krages)* 1:30 to 5:30 pm, $75 / $125, p. 187 WS846 **Essential Skills for Engineering Project Leaders** (Hinkle) 1:30 to 5:30 pm, $90/$115, p.187		

NanoScience

Nanophotonics

SC497

Course level: Introductory
CEU .35 $230 / $275 USD
Sunday 1:30 to 5:30 pm

Nanophotonics, defined as nanoscale optical science and technology, is a new frontier. It offers challenging opportunities for studying the interaction between light and matter on a scale much smaller than the wavelength of radiation, as well as for the design of novel nanostructural optical materials and devices. Furthermore, the use of such a confined interaction to spatially localize photochemical processes offers exciting opportunities for nanofabrication. Nanophotonics is thus of considerable technological significance. Nanophotonics also has important biomedical applications in bioimaging, optical diagnostics and photodynamic therapy. This course will cover the fundamentals of nanoscale light-matter interaction; various nanoscale linear and nonlinear optical effects; near field geometry to probe nanoscale interactions; near field microscopy to probe nanoscale structure and dynamics; near field microscopy for nanoscopic imaging and bioimaging; photonic crystals and ordered nanoscale materials; nanocomposites for photonics; novel optical effects in nanostructural materials; nanofabrication using nanoscale photochemistry; and applications of nanophotonics for bioimaging, optical diagnostics and light activated therapy.

LEARNING OUTCOMES

This course will enable you to:

- become familiar with the fundamentals of nanoscale linear and nonlinear optical interactions
- learn about the use of near field microscopy to probe nanoscopic optical interactions
- learn how to use near field microscopy to conduct nanoscopic bioimaging
- learn the usage of near field microscopy for nanofabrication for technological applications
- become familiarized with the concept of photon localization in photonic crystals and ordered nanostructures
- identify opportunities for applications of nanostructures and nanocomposites for photonic applications
- learn about new enabling technologies using nanostructured materials
- learn about biomedical applications of nanophotonics.

INTENDED AUDIENCE

This course is intended for anyone who needs to learn about light-matter interactions at nanoscale as well as the applications of photonics for nanotechnology and nanobiotechnology. The course is appropriate for a multidisciplinary audience including engineers, materials scientists, optical physicists, theorists, chemists and biomedical researchers.

INSTRUCTOR

Paras Prasad is Photonics Science Professor and Director of the Photonics Research Laboratory at the State University of New York at Buffalo.

Photonic Crystals: A Crash Course, from Bandgaps to Fibers

SC608

Course level: Intermediate
CEU .35 $230 / $275 USD
Tuesday 1:30 to 5:30 pm

This half-day course will survey basic principles and developments in the field of photonic crystals, nano-structured optical materials that achieve new levels of control over optical phenomena. This leverage over photons is primarily achieved by the photonic band gap: a range of wavelengths in which light cannot propagate within a suitably designed crystal, forming a sort of optical insulator.

The course will begin with an introduction to the fundamentals of wave propagation in periodic systems, Bloch's theorem and band diagrams, and from there moves on to the origin of the photonic band gap and its realization in practical structures. After that we will cover a number of topics and applications important for understanding the field and its future.

Topics will include: the introduction of intentional defects to create waveguides, cavities, and ideal integrated optical devices in a crystal; exploitation of exotic dispersions for negative-refraction, super-prisms, and super-lensing; the combination of photonic band gaps and conventional index guiding to form easily fabricated hybrid systems (photonic-crystal slabs); the origin and control of losses in hybrid systems; photonic band gap and microstructured optical fibers; and computational approaches to understanding these systems (from brute-force simulation to semi-analytical techniques).

LEARNING OUTCOMES

This course will enable you to:

- learn the fundamental concepts necessary for understanding photonic crystals
- gain familiarity with the unusual phenomena and devices that have been enabled by photonic bandgaps, and the directions taken to achieve them in practice
- understand the principles and perspectives by which future applications in nano-structured photonics may be developed and described

INTENDED AUDIENCE

This course is designed for engineers and scientists who wish to understand how photonic crystals work and its potential applications to quantum optical devices and optoelectronics. It is aimed at those who have an understanding of elementary electromagnetism and some familiarity with the applications and governing principles of optical devices.

INSTRUCTOR

Steven Johnson received his Ph.D. in 2001 from the Dept. of Physics at MIT, where he also earned undergraduate degrees in computer science and mathematics. He is currently an assistant professor of applied mathematics at the Massachusetts Institute of Technology, and also consults for OmniGuide Communications Inc. on hollow bandgap fibers. Several free software packages he has written have seen widespread use in computational electromagnetism and other fields, including the MPB package to solve for photonic eigenmodes and the FFTW fast Fourier transform library (for which he received the 1999 J. H. Wilkinson Prize for Numerical Software, along with M. Frigo). In 2002, Kluwer published his Ph. D. thesis as a book *Photonic Crystals: The Road from Theory to Practice*. His recent work has ranged from the development of new semi-analytical and numerical methods for electromagnetism in high-index-contrast periodic systems to the design of integrated optical devices.

Nanoplasmonics

SC727

Course level: Intermediate
CEU .65 $410 / $495 USD
Thursday 8:30 am to 5:30 pm

Nanooptics deals with optical phenomena and spectroscopy on the nanoscale, i.e., in the regions of space whose size is much smaller than the light wavelength. While electromagnetic waves cannot be localized in the regions with sizes significantly less than half wavelength, nanooptics is based on electric fields oscillating at optical frequency. From the positions of the interaction with matter and spectroscopy, such local optical fields mostly produce the same type of responses as electromagnetic waves. Elementary excitations that are carriers of energy and coherence in nanooptics are surface plasmons (SPs). These local fields cause a wealth of gigantically enhanced optical phenomena of which the surface enhanced Raman scattering (SERS) is the most studied and widely known.

This one-day course will encompass the fundamental properties and applications of the surface plasmonics at the nanoscale. It will include coherent effects associated with phase memory of the SPs, in particular, coherent control of nanooptical phenomena. Nonlinear processes such as generation of harmonics and two-photon excitation by nanoscale fields will also be covered. Ultrafast (femtosecond and attosecond) phenomena are within the scope of this course. We will also include quantum phenomena associated with properties of surface plasmons as quantum quasiparticles such as quantum generation and fluctuations. Along with fundamental properties of SPs, we will consider many applications of nanoplasmonics, in particular, detection of ultrasmall amounts of chemical and biological compounds, scanning near-field optical microscopes or SNOMs, and nanolithography.

LEARNING OUTCOMES

This course will enable you to:

- Surface plasmon polaritons (SPPs) as electromagnetic waves at metal-dielectric interfaces
- Fast and slow SPPs in nanolayers as waves of different symmetry
- SPPs in cylindrical nanoplasmonic waveguides
- Nanooptical applications of SPPs: transfer of optical energy on nanoscale
- SPPs in adiabatically changing nanoplasmonic waveguides and nanofocusing
- Quasielectrostatic approximation for nanosystems
- Surface plasmons (SPs) as eigenmodes of nanosystem
- SPs in nanospheres and nanoshells; nanosphere plasmonic sensors
- Localization and delocalization of SPs on the nanoscale
- Linear optical responses on the nanoscale and local optical fields
- Optical responses of nanosphere aggregates; efficient nanolens
- Interference effects in SNOMs and the phases of local fields
- SP enhancement of fluorescence
- Giant enhancement of Raman scattering in nanoplasmonic systems
- Enhanced second and third harmonic generation in nanostructured systems
- Ultrafast nanoplasmonic optical responses
- Coherent control of optical responses on nanoscale: linear and nonlinear effects
- Two-photon excitation of nanosystems and its coherent control
- Quantization of SPs
- Quantum generation of SPs in nanosystem
- Many body effects in nanooptics: spatial dispersion and Landau damping
- Excitation quenching at metal surfaces
- Nanoimaging by Pendry's Perfect Lens; the role of many body effects

INTENDED AUDIENCE

This course is intended for engineers, physicists, chemists, and biologists interested in fundamentals and applications of nanooptics.

INSTRUCTOR

Mark Stockman is a Professor of Physics at Georgia State University at Atlanta, GA, USA. He has published over 120 scientific papers in leading journals. For the last 15 years, his work has been focused on nanoplasmonics, where he has developed many original ideas and approaches.

NanoEngineering

Fabrication and Processing of Nanostructures

SC496

Course level: Introductory
CEU .65 $450 / $535 USD
Sunday 8:30 am to 5:30 pm

The objective of this course is to provide attendees with a good understanding of the fundamentals and comprehensive knowledge of the recent advances in nanostructure fabrication and processing. Specifically, this course will cover (1) basic principles (including thermodynamics, kinetics and mass transfer) related to nanoscale fabrication and processing, (2) a comprehensive review of the established techniques and methods in the synthesis of nanostructured materials and nanoscale structures, and (3) various applications of the above techniques and methods. The detailed subjects will include self-assembly, fundamentals of colloids and related topics, quantum dots (zero-dimensional nanostructures), quantum wires (one-dimensional nanostructures), soft lithography, and applications of nanostructured materials.

LEARNING OUTCOMES

This course will enable you to:

- fabricate and process nanostructures from various functional materials
- understand the fundamentals of various methods used in nanostructure fabrication and processing
- become familiar with various classes of nanostructures and nanomaterials
- explore various applications of nanostructures and nanomaterials.

INTENDED AUDIENCE

Anyone who wants to learn the know-how to fabricate nanostructures and synthesize nanomaterials, and/or to acquire a better understanding of the fundamentals in nanostructure processing. This course will be of value to those who either have been working on the synthesis of nanomaterials and fabrication of nanostructure, or those who plan to enter the field. This course will also be valuable to those who want to have a general knowledge of nanotechnology and nanoscience.

INSTRUCTOR

Guozhong Cao is an Associate Professor of Materials Science and Engineering at the University of Washington, and has worked on various materials processing over 16 years. He has published 130 papers and won awards including the University Distinguished Teaching Award, the College Outstanding Educator Award, and the European Union Fellowship. Prof. Cao has developed and taught two graduate courses on the synthesis and processing of nanomaterials. Recently he also published a textbook for graduate and upper-level undergraduate students: Nanostructures and Nanomaterials: Synthesis, Properties, and Applications (pp.434+xiv, Imperial College Press, London, March 2004).

COURSE PRICE INCLUDES the text *Nanostructures And Nanomaterials: Synthesis, Properties And Applications* (2004) by the instructor.

Introduction to Optical Tweezers and Optical Micromanipulation

SC655

Course level: Introductory
CEU .35 $230 / $275 USD
Tuesday 6:00 to 10:00 pm

This course is intended as an introduction to systems that use light for actuation and micromanipulation, including examples from the biological and colloid sciences. Throughout, the emphasis will upon basic principles and designs. You will learn of opportunities for enhanced degrees of control, resolution, and sensitivity - as well as many tradeoffs and limitations. The course will provide "hands-on" experience using a real optical tweezers system.

LEARNING OUTCOMES

This course will enable you to:

- discriminate between a variety of approaches to optical micromanipulation
- explain a simple alignment protocol for optimizing the optical interaction
- describe various aspects of data analysis for some optical manipulation systems
- identify key options for enhanced degrees of control, resolution, and sensitivity

INTENDED AUDIENCE

This material is appropriate to researchers who are considering work with optical micromanipulation.

INSTRUCTORS

Kishan Dholakia is a Professor of Physics at the University of St. Andrews (Scotland).

Gabriel Spalding is a Professor of Physics at Illinois Wesleyan.

The instructors are Chairs of Conference AM226, Optical Trapping and Optical Micromanipulation, and are collaborating on a forthcoming, introductory-level book on the same topics, for Cambridge University Press.

Nanotechnology: Science & Applications

WS851

Course level: Intermediate
CEU .65 $410 / $495 USD
Wednesday 8:30 am to 5:30 pm

This course provides attendees with a basic understanding of the scientific background behind the new emerging field of Nanotechnology and how it enables new applications in various fields. The course concentrates on molecular behavior of matter and how it gives rise to next generation performance capability in electronic devices, data storage devices, etc. Many practical and useful examples are included throughout. You will become familiar with huge grant opportunities available from National Science Foundation for Nanotechnology based applications.

LEARNING OUTCOMES

This course will enable you to:

- gain an overview of the various applications enabled by Nanotechnology, including Scanning Probe Microscopes, Nano Imprint Lithography, Dip Pen Lithography, MEMS & NEMS, etc.
- comprehend the basic science behind Nanotechnology
- become familiar with the leading players in this emerging field
- apply to NSF for government grants

INTENDED AUDIENCE

This material is intended for anyone who needs to learn about Nanotechnology; graduate level understanding is preferable. Those who want to learn about how to apply to NSF for government grants will find this course valuable.

INSTRUCTOR

Dhaval Brahmbatt is President and founder of PHYchip Corporation, a Nanotechnology Commercialization company. He has been involved in emerging technologies and their engineering applications for over 25 years. He is the founder and past Chairman of IEEE SF Bay Area Nanotechnology Council, and teaches Nanotechnology at both graduate and undergraduate levels. He has worked with National Science Foundation for past several years as outside reviewer of phase I/II grant applications.

Solar Energy + Applications

The Science and Technology of Organic Solar Cells

SC797

Course level: Intermediate
CEU .65 $230 / $275 USD
Tuesday 1:30 to 5:30 pm

Organic solar cells are attractive because they can potentially be made at very low cost using roll-to-roll coating. This tutorial will start with an introduction to the physics of organic semiconductors. We will discuss why conjugated organic molecules are semiconducting and how the structural (polymorphism, anisotropy, etc.), electronic (mobility, energy levels, etc.) and optical (absorption cross section, etc.) properties of organic semiconductors are different from their inorganic counterparts. The important processes that occur in organic solar cells and methods to improve the efficiency of each process will be described in detail. Based on the physical properties and an understanding of the important processes that occur in the conversion of optical energy to electrical energy, we will study various solar cell device designs including single layer Schottky-type cells, planar heterojunction cells, bulk heterojunction cells, and multijunction cells. Predictive device modeling will be addressed in detail. Prospects for raising the power conversion efficiency from the current value of 4-6% to >20% will be discussed.

LEARNING OUTCOMES

This course will enable you to:

- teach processing options for the fabrication of organic solar cells from bare substrate to complete cell
- help you understand why organic semiconductors are attractive for solar cell applications from an economical point of view
- teach how to design efficient organic and organic-inorganic solar cells in a rational way using computer simulation and an understanding of the underlying physics
- summarize and assess the latest developments in organic solar cells
- help you identify the major scientific, technological and business barriers that need to be addressed to enable the large-scale fabrication and deployment of organic solar cells
- teach the limitations to efficiency and lifetime and will outline strategies to overcome these concerns

INTENDED AUDIENCE

The course is intended for engineers and scientists who want to learn how organic solar cells are made, how they work, and how much potential they have.

INSTRUCTOR

Peter Peumans is an assistant professor of Electrical Engineering and is an expert in organic device modeling and characterization. He has developed several efficient solar cell device architectures and has contributed to today's understanding of the mechanisms that play a role in organic solar cells. Dr. Peumans also contributed to the development of vapor phase deposition techniques that lend themselves to reel-to-reel processing of organic and organic/inorganic nanocomposite solar cells. He has written a widely cited review article on small molecule based organic PV cells for the Journal of Applied Physics. Dr. Peumans holds 9 patents and is the recipient of an NSF CAREER award. His current work at Stanford focuses on small molecular weight organic solar cells, new approaches to low-cost silicon solar cells, and molecular electronics. He teaches classes on solid state physics, semiconductor device physics and organic electronics.

Non-Imaging Optics

SC388

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

See p. 165 for full course description.

Organic Photonics and Electronics

Solid State Lighting I

SC490

Course level: Introductory
CEU .35 $230 / $275 USD
Sunday 1:30 to 5:30 pm

See p. 165 for full course description.

Practical Radiometry

SC798

Course level: Introductory
CEU .65 $410 / $495 USD
Sunday 8:30 am to 5:30 pm

See p. 168 for full course description.

The Science and Technology of Organic Solar Cells

SC797

Course level: Intermediate
CEU .65 $230 / $275 USD
Tuesday 1:30 to 5:30 pm

See p. 164 for full course description.

Solid State Lighting Phosphors

SC799

Course level: Introductory
CEU .35 $230 / $275 USD
Sunday 8:30 am to 12:30 pm

See p. 166 for full course description.

Illumination Engineering

Practical Radiometry

SC798

Course level: Introductory
CEU .65 $410 / $495 USD
Sunday 8:30 am to 5:30 pm

See p.168 for full course description.

Non-Imaging Optics

SC388

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

Nonimaging optics departs from the methods of traditional optical design by instead developing techniques for maximizing the collecting power of illumination elements and systems. Nonimaging designs exceed the concentration attainable with focusing techniques by factors of four or more and approach the theoretical limit (ideal concentrators). This course develops the conceptual foundations and is an excellent companion to Dr. David Jenkins' course which emphasizes applications.

LEARNING OUTCOMES

This course will enable you to:

- formulate the limit to light collection posed by a particular application
- distinguish between imaging and nonimaging solutions
- classify the nonimaging algorithms
- solve the nonimaging problem in particular contexts
- compute specific nonimaging designs
- estimate the performance of a nonimaging design
- compare the relative performance of nonimaging and imaging designs
- identify the application of nonimaging designs in a variety of applications.

INTENDED AUDIENCE

The course is designed for optical designers, engineers, and scientists whose work encounters demanding problems of light collection or illumination. The course is self-contained. No specialized technical background required.

INSTRUCTOR

Roland Winston is Founding Professor in the Schools of Engineering & Natural Science, University of California, Merced. He founded the field of nonimaging optics and, working with students and colleagues, has applied it to a variety of problems in radiation detection, illumination and solar energy concentration. In 2005, he authored, with J. C. Minano and P. Benitez, the book, *Nonimaging Optics*, Elsevier (Academic Press).

Practical Radiometry

SC798

Course level: Introductory
CEU .65 $410 / $495 USD
Sunday 8:30 am to 5:30 pm

See p. xxx for full course description.

Solid State Lighting I

SC490 CD

Course level: Introductory
CEU .35 $230 / $275 USD
Sunday 1:30 to 5:30 pm

The recent development of high-brightness LEDs based on III-Nitrides and AlInGaP has led to the possibility of revolutionary new approaches for lighting that have become known as Solid State Lighting. Solid State Lighting technology has largely been developed by those in the compound semiconductor community who have little or no understanding of the lighting industry. A similar lack of knowledge also exists about the advances of LEDs for lighting applications in the general lighting community. The scope of this course is to provide a state-of-the-art review of the Solid State Lighting technology from both the perspective of the solid state scientist and those involved in the lighting industry.

LEARNING OUTCOMES

This course will enable you to:

- review the historical development of LEDs
- understand how an LED works and how it is modified for lighting applications
- review current and future uses of solid state lighting
- understand CIE chromaticity diagrams and how the eye perceives light
- review the differences of general illumination sources with solid state lighting sources
- understand the basics of illumination design
- rationalize metrics used to measure the properties of LEDs with those used in general illumination.

INTENDED AUDIENCE

Anyone wants to develop an understanding of Solid State Lighting and its future applications in general illumination. This course will be of value to those who either design their own optics or those who work directly or indirectly with optical designers, as you will now understand what is really going on as well as how to ask the right questions of your designers.

INSTRUCTOR

Ian Ferguson is a Professor of Electrical and Computer Engineering at Georgia Institute of Technology and he has been involved in the growth of semiconductor materials and devices for over 16 years. He became interested in Solid State Lighting since its inception about 5 to 6 years ago.

Design of Efficient Illumination Systems

SC011 CD

Course level: Intermediate
CEU .35 $230 / $275 USD
Monday 1:30 to 5:30 pm

Illumination systems are included in fiber illuminators, projectors, and lithography systems. The design of an illumination system requires balancing uniformity, maximizing the collection efficiency from the source, and minimizing the size of the optical package. These choices are examined for systems using lightpipes, lens arrays, faceted optics, tailored edge rays designs, and integrating spheres through a combination of computer simulations, hardware demonstrations and discussions.

LEARNING OUTCOMES

This course will enable you to:

- describe the differences between illuminance, intensity and luminance
- compute the required source luminance given typical illumination system specifications
- compute the change in luminance introduced by an integrating sphere
- distinguish between a Kohler illuminator and an Abbe illuminator
- explain the difference in uniformity performance between a tailored edge ray reflector and a standard conic reflector
- design a lightpipe system to provide uniform illuminance
- design a lens array system to create a uniform illuminance distribution
- design a reflector with facets to create a uniform illuminance distribution

INTENDED AUDIENCE

Individuals who design illumination systems or need to interface with those designers will find this course appropriate. Previous exposure to Optical Fundamentals (Reflection, Refraction, Lenses, Reflectors) is expected.

INSTRUCTOR

William Cassarly is a Senior Illumination Engineer with Optical Research Associates. Cassarly worked at GE for 13 years, holds 20 patents, and has worked extensively in the areas of illumination system design, sources, photometry, light pipes, and non-imaging optics. Bill was awarded the GE Corporate 'D. R. Mack Advanced Course Supervisor Award' for his efforts in the training of GE Engineers.

Solid State Lighting Phosphors

SC799

Course level: Introductory
CEU .35 $230 / $275 USD
Sunday 8:30 am to 12:30 pm

The development of blue and UV InGaN light emitting diodes is being complemented by a parallel exploration of new phosphor material systems for use with these new diode technologies. Currently, two approaches are being investigated: the use of a blue LED phosphor pump which combines with the phosphor emission to give a white spectrum, and secondly the use of a tri-color red, green and blue phosphor set, which are pumped in the near-UV, between 380-406 nm. For both approaches it is necessary to develop highly efficient and long-lived phosphor materials that are well matched to the excitation conditions of the diode, and whose spectral emission properties produce a high color rendition index (>95).

This course, therefore, complements the Solid State Lighting I & II courses (SC490 & SC770), by providing an in depth review of the recent developments in phosphors for SSL. Examples of excitation and emission spectra will be given for the important material systems. The scope is to provide a state-of-the-art review of Solid State Lighting Phosphors from both the perspective of the solid state device engineer and the lighting designer.

LEARNING OUTCOMES

This course will enable you to:

- understand the fundamentals of phosphor science and technology, including the physics of phosphors; energy conversion issues; single activator phosphors and transition mechanisms
- understand the unique requirements for LED phosphors
- obtain a comprehensive review of recent work on blue diode pumped phosphors and UV diode pumped phosphors
- understand the mechanisms governing phosphor life
- summarize recent trends and future requirements for solid state lighting phosphors

INTENDED AUDIENCE

Those who have an interest in Solid State Lighting and who want to understand the issues involved in manipulating the source spectrum using phosphors. This course will also be of value to those who understand LEDs, but who want to better understand the elements of lighting design.

INSTRUCTOR

Christopher Summers received his B.S. and Ph.D. in Physics from Reading University in the UK. He has held positions at Bell Labs, GTE Labs, and McDonnell Douglas Research Labs. Following McDonnell Douglas, he joined the Georgia Tech Research Institute in 1981 and in 1993 became Director of the Phosphor Technology Center of Excellence. He is currently a professor in the Georgia Tech School of Materials Science and Engineering and an adjunct faculty member in the schools of Physics and Electrical and Computer Engineering. He has a research history in electro-optical materials characterization, the molecular beam epitaxy of infrared and electronic materials and the synthesis of phosphor materials. His current research interests are in the development of new phosphor material systems for flat panel displays and solid state lighting. Also he is investigating light propagation through 2D photonic crystals, and the use of 3D photonic crystals infiltrated by atomic layer deposition for studying luminescence modification and tunability. He has received numerous awards and honors, holds six patents, and has over 300 publications.

Course notes include the instructor's chapter "Phosphors for Solid State Lighting: Diode Phosphors" from the forthcoming SPIE text *Solid State Lighting* (Editors: I. T. Ferguson and N. Narendran).

Accurate Measurement of LED Optical Properties

SC657

Course level: Intermediate
CEU .35 $230 / $275 USD
Tuesday 8:30 am to 12:30 pm

This course provides attendees with a working knowledge of the optical properties of LEDs and how to measure them correctly. The course concentrates on techniques for controlling variables that can lead to large errors. Traceability to NIST and uncertainty are explained clearly. Many practical examples are included throughout, including actual measurements of die and packaged LEDs. Attendees will be able to identify and control critical variables to give high accuracy measurements.

LEARNING OUTCOMES

This course will enable you to:

- describe the various optical properties of LEDs
- perform measurements consistent with current standards
- specify measurement systems and conditions for LED measurement
- identify and control critical parameters that affect accuracy
- improve existing equipment and measurement consistency
- prepare uncertainty budgets and NIST traceability routes

INTENDED AUDIENCE

This material is intended for anyone who measures, supervises or specifies optical properties of LEDs. Attendees at all levels of knowledge will benefit from attendance.

INSTRUCTOR

Alan Tirpak is an Applications Engineer with Optronic Laboratories in Orlando, FL. Alan holds Bachelor and Master of Science degrees in Physics from the University of Central Florida (UCF). His research activities include published work at the College of Optics and Photonics (COP), formerly CREOL and the UCF Department of Physics which involved the mechanism of photo-thermal refraction in silicate glass in the area of non-linear optics as well as on HIBS, a Sandia National Labs patented ion beam analysis tool, to increase the sensitivity of the instrument. Mr Tirpak has worked on industrial projects for both Raytheon and The Department of Defense prior to his joining Optronic Laboratories.

COURSE PRICE INCLUDES a CD-ROM copy of the presentations within the course, provided by the instructor.

Astronomical Optics and Instrumentation

Principles of Fourier Optics and Diffraction

SC017 CD FC

Course level: Intermediate
CEU .65 $515 / $600 USD
Tuesday 8:30 am to 5:30 pm

This course introduces the application of Fourier theory in diffraction and image formation. The first part of the course provides a review of a number of mathematical topics, including convolution and the Fourier transform. Next, the phenomenon of diffraction is introduced, the effects of lenses on diffraction are discussed, and the propagation of Gaussian beams is treated. Finally, the effects of diffraction on the performance of image-forming systems and other optical devices are discussed.

LEARNING OUTCOMES

This course will enable you to:

- understand convolution and Fourier transform operations
- describe the general effects of diffraction in the Fresnel and Fraunhofer regions
- understand the effects of lenses on diffraction
- predict the Fraunhofer diffraction patterns associated with specific apertures
- describe the propagation of Gaussian beams
- understand the effects of diffraction on image formation and image resolution
- calculate the Point-Spread Functions (PSF) and Optical Transfer Functions (OTF) for various imaging systems

INTENDED AUDIENCE

This course is intended for scientists and engineers who need to understand the diffraction of optical wavefields and the effects of diffraction on the performance of image-forming systems and other optical devices.

INSTRUCTOR

Jack Gaskill is Professor Emeritus of Optical Sciences at the University of Arizona where, for more than 30 years, his teaching activities were devoted primarily to the applications of Fourier theory in optics. He has taught more than 40 off-campus short courses in Fourier optics and related subjects. Gaskill is author of the textbook, *Linear Systems, Fourier Transforms, and Optics* (Wiley, 1978), and is a Past President of SPIE.

COURSE PRICE INCLUDES the textbook, *Linear Systems, Fourier Transforms, and Optics* (Wiley, 1978), by the instructor.

Use of CCD and CMOS Sensors in Visible Imaging Applications

SC068 VT

Course level: Introductory
CEU .35 $230 / $275 USD
Wednesday 8:30 am to 12:30 pm

See p. 171 for full course description.

Optical Design Fundamentals for Infrared Systems

SC134

Course level: Intermediate
CEU .65 $450 / $535 USD
Sunday 8:30 am to 5:30 pm

This course will provide practical and directly applicable design and evaluation guidelines for the initial optical layout phase of IR systems. Simple but powerful expressions will be developed and presented as approximations to predict quickly expected system performance. In addition to conventional refractive and reflective optical components and systems, applications of diffractive (binary) optics for the infrared spectrum will be discussed. Since single point diamond turning is a very effective method for producing IR components such as aspheres and diffractive elements, as well as classical and modern reflective systems, details and practical hints will be presented for consideration in the design phase of IR systems.

LEARNING OUTCOMES

This course will enable you to:

- understand basic radiometric and fundamental optical design principles
- predict third order aberration effects on image quality
- determine advantages as well as shortcoming and limitations of specific optical configurations
- evaluate whether a chosen optical system will be a candidate for your application
- compare results from approximations to exact computer calculations
- interface with more knowledge and comfort with seasoned optical design experts for more sophisticated requirements.
- incorporate manufacturing aspects of single point diamond turning at the layout stage and take advantage of the additional design freedom this technology offers

INTENDED AUDIENCE

Engineers, scientists and technicians who need to be able to apply the basic knowledge of optical design. Also included in the intended audience are managers who need to understand the principle of lens design. The fabrication aspect of diamond turning IR components will be of interest to designers as well as manufacturing personnel.

INSTRUCTOR

Max Riedl is currently technical adviser of several U.S. corporations. He holds a Dipl. Ing. (F.H.) degree in precision mechanics and optics, and has worked in the field of mathematical and electro-optical instruments for more than 50 years. Riedl is a Fellow of SPIE and the author of the SPIE Tutorial Text *Optical Design Fundamentals for Infrared Systems*.

COURSE PRICE INCLUDES the textbook *Optical Design Fundamentals for Infrared Systems* (SPIE, 2001), by Max Riedl.

Adaptive Optics

SC135

Course level: Introductory
CEU .65 $445 / $530 USD
Tuesday 8:30 am to 5:30 pm

Adaptive optics are used to improve imagery and the transmission of optical signals by sensing a wavefront disturbance and using the information for real-time control of an active optical element such as a deformable mirror. This course covers the basic principles of adaptive optics with emphasis on improving image resolution by atmospheric turbulence compensation.

LEARNING OUTCOMES

This course will enable you to:

- identify the applications and types of adaptive optics systems
- understand the operation of wavefront sensors, deformable mirrors, and laser guide stars
- predict the performance of an adaptive optics system
- estimate the effects of noise, constraints imposed by the control algorithm or bandwidth, and wavefront reconstructor limitations
- compare the advantages and disadvantages of systems to execute informed “make-buy” decisions on components.

INTENDED AUDIENCE

This course is intended for engineers, scientists, technicians, and students to understand the basic principles and applications of adaptive optics and to make basic performance predictions.

INSTRUCTOR

Robert Tyson is an Associate Professor of Physics and Optical Science at the University of North Carolina at Charlotte. He has been working in the field of adaptive optics for over 25 years. He is author of *Principles of Adaptive Optics*, *Introduction to Adaptive Optics*, and co-author of *Field Guide to Adaptive Optics*.

COURSE PRICE INCLUDES the text *Introduction to Adaptive Optics* (SPIE, 2000), by Robert Tyson.

Multispectral and Hyperspectral Image Sensors

SC194 VT

Course level: Advanced
CEU .35 $230 / $275 USD
Wednesday 1:30 to 5:30 pm

See p. 172 for full course description.

Advanced Composite Materials for Optomechanical Systems

SC218

Course level: Intermediate
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

See p. 173 for full course description.

Materials: Properties and Fabrication for Stable Optical Systems

SC219

Course level: Intermediate
CEU .65 $410 / $495 USD
Wednesday 8:30 am to 5:30 pm

See p. 173 for full course description.

Introduction to CCD and CMOS Imaging Sensors and Applications

SC504 CD

Course level: Introductory
CEU .65 $530 / $615 USD
Monday 8:30 am to 5:30 pm

See p. 172 for full course description.

Optomechanics for Space Applications

SC561

Course level: Introductory
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

See p. 168 for full course description.

Practical Radiometry

SC798

Course level: Introductory
CEU .65 $410 / $495 USD
Sunday 8:30 am to 5:30 pm

This course will provide attendees with a basic working knowledge of radiometric concepts. Radiometry deals with generation, propagation, modification, and detection of radiation. It is based on the generation of radiation in matter, propagation through a partially transmissive 3-dimensional space, and detection in matter. Many practical and useful examples are included throughout. While the geometrical concepts employed in radiometry often imply detailed calculations, useful and reasonable approximations will be emphasized.

The following topics will be included:

- Concepts of geometrical optics (ray, beam, optical system, object and image similarity)
- Generation of radiation: sources
- Detection of radiation
- Spatial extent of sources: point and extended sources
- Geometry of sources and detectors
- Directional properties of sources and detectors
- Angle, projected angle, solid angle, and projected solid angle
- Spectral and radiative characteristics of sources (power)
- Spectral characteristics of sources and detectors
- Derived radiometric quantities and units: radiance, exitance (emittance), incidence (irradiance), intensity
- Blackbody radiators and emissivity
- Planck´s law, Wien´s law, Stefan-Boltzmann´s law, and Kirchoff´s law
- Stray light, and configuration factors
- Two invariants of optical systems: throughput (etendue) and radiance
- Loss of information between plane 1 and plane 2
- Radiance at the sensor
- Detected radiance

LEARNING OUTCOMES

This course will enable you to:

- predict the amount of radiation incident at plane 2 if that known in plane 1 is given.
- identify the transmission characteristics if radiation is known at point 1 and point 2
- evaluate the two invariants of an optical system
- evaluate radiative signal at select planes
- evaluate radiative noise at select planes
- assess the quality of an optical system based on its ability to transfer and maintain optical signals

INTENDED AUDIENCE

This material is intended for anyone who needs to learn how radiation carries information from point 1 to point 2 and how the propagation in 3-D space may affect it. Those who either design their own optics or who work with optical designers will find this course valuable. Only algebra, geometry and basic trigonometry are required to appreciate the course contents.

INSTRUCTOR

Marija Strojnik earned a BS degree in Physics from Arizona State University, MS degree in Engineering from the UCLA, and Ph. D. degree in Optical Sciences from the University of Arizona. She worked in industry for over 12 years, followed by a 12-year teaching career; she is currently a professor (E) at the Optical Research Center in Mexico. She has developed novel radiometric systems for defense, aerospace, and interplanetary applications. Dr. Strojnik has been organizing SPIE conferences on Infrared and Optical Systems, has taught radiometry for the past 15 years, and wrote a chapter on radiometry in the *Optical Engineering Handbook* (Marcel-Dekker, 2001). She is a fellow of the OSA and of SPIE.

Atmospheric and Space Optical Systems

Adaptive Optics

SC135

Course level: Introductory
CEU .65 $445 / $530 USD
Tuesday 8:30 am to 5:30 pm

See p. 167 for full course description.

Optomechanics for Space Applications

SC561

Course level: Introductory
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

Optomechanics intended for flight applications on satellite, rocket, or high altitude balloon payloads have special design requirements in addition to those necessary for earth-based systems. Space environment conditions such as micro-gravity, vacuum, radiation, temperature gradients, and jitter impose special constraints on optomechanical design. Optics and their mounts must not only survive launch loads, but also meet mass and envelope restrictions, maintain precision alignment, and demonstrate long-term stability. Further, these systems must operate remotely once they arrive on-orbit and remain reliable throughout the life of the mission. This course reviews environmental conditions for common orbits, spacecraft, and launch vehicles and describes how they influence optomechanical design requirements. The effect of space conditions on materials is covered in detail. Participants are provided with tools necessary for selecting suitable structural and optical materials, lubricants, and adhesives for flight design. Optomechanical principles appropriate for flight designs are reviewed and methods for resolving common design issues are presented. Flight design examples related to course topics are covered in detail at the end of the day.

LEARNING OUTCOMES

This course will enable you to:

- acquire a basic understanding of space environments in different orbits
- identify specific design constraints unique to flight hardware design
- choose suitable materials for space-based optomechanical components
- determine what types of contamination control are critical for flight hardware
- evaluate fracture probability in optical components
- recognize optomechanical solutions suitable for flight conditions
- understand general design and test requirements imposed by launch vehicles

INTENDED AUDIENCE

Engineers, scientists, managers and technicians interested in the special design parameters involved in specifying and/or developing space-based instrumentation. The course is intended to equip these participants with a basic knowledge of the space environment and how it affects optomechanical design.

INSTRUCTOR

Ann Shipley develops X-ray and UV instruments at the University of Colorado Center for Astrophysics and Space Astronomy in Boulder, Colorado. Ann was previously employed at University of California, San Diego and at Hughes Aircraft Company. She has worked with satellite, sounding rocket, and high altitude balloon hardware for more than twenty years. Her most recent work has involved space borne astronomical instruments and applications. Her design, analysis and test experience ranges from optomechanical systems to satellite structures.

Prerequisite: SC014 *Introduction to Optomechanical Design*, by Daniel Vukobratovich, or equivalent knowledge of optomechanical principles.

Remote Sensing Instrumentation

Use of CCD and CMOS Sensors in Visible Imaging Applications

SC068 CD

Course level: Introductory
CEU .35 $230 / $275 USD
Wednesday 8:30 am to 12:30 pm

See p. 171 for full course description.

Optical Design Fundamentals for Infrared Systems

SC134 FC

Course level: Intermediate
CEU .65 $450 / $535 USD
Sunday 8:30 am to 5:30 pm

See p. 167 for full course description.

Infrared Focal Plane Arrays

SC152

Course level: Introductory
CEU .35 $230 / $275 USD
Sunday 1:30 to 5:30 pm

The course presents a fundamental understanding of two-dimensional arrays applied to detecting the infrared spectrum. The physics and electronics associated with 2-D infrared detection are stressed with special emphasis on the hybrid architecture unique to two-dimensional infrared arrays.

LEARNING OUTCOMES

This course will enable you to:

- develop the building blocks of 2-D arrays
- explain charge transfer concepts of various architectures
- describe various input electronics circuits
- discuss testing techniques used in the IR for 2-D arrays
- provide an overview of current technologies
- demonstrate aliasing effects
- review room temperature arrays
- discuss dual band arrays.

INTENDED AUDIENCE

This material is intended for engineers, scientists and project managers who need to learn more about two-dimensional IR arrays from a user's point of view. It gives the student insight into the optical detection process, as well as what is available to application engineers, advantages, characteristics and performance.

INSTRUCTORS

Eustace Dereniak is a Professor of Optical Sciences and Electrical and Computer Engineering at the University of Arizona, Tucson, AZ. His research interests are in the areas of detectors for optical radiation, imaging spectrometers and imaging polarimeters instrument development. Dereniak is a co-author of several textbooks and has authored book chapters. His publications also include over 100 authored or co-authored refereed articles. He spent many years in industrial research with Raytheon, Rockwell International, and Ball Brothers Research Corporation. He has taught extensively and is a Fellow of the SPIE and OSA, and a member of the Board of Directors of SPIE.

John Hubbs is an engineer with Ball Aerospace and Technologies.

Multispectral and Hyperspectral Image Sensors

SC194 VT

Course level: Advanced
CEU .35 $230 / $275 USD
Wednesday 1:30 to 5:30 pm

See p. 172 for full course description.

Polarized Light: A Practical Hands-on Introduction

SC206 FC

Course level: Introductory
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

Covering introductory and intermediate topics in polarized light, simple explanations, and concepts are the emphasis of this hands-on course. There are demonstrations, and each participant receives two linear polarizers, a circular polarizer, a quarter-wave plate and a half-wave plate. Topics include: linear polarizers, mechanical strains, birefringence, orthogonality, circular polarization, matrices, reflective properties, practical applications, optical activity, and Faraday rotation. The goal of the course is that each participant retains a sound grasp of each concept, and the use of mathematics is kept to a minimum. Attendees learn to appreciate a light beam's "polarization degree of freedom," and how to use polarization-modifying elements to convert a beam's state of polarization from one form to another.

LEARNING OUTCOMES

This course will enable you to:

- understand the different states of pure polarization
- understand how to convert one state of polarization to another
- measure a given beam's state of polarization
- know how the different polarization-modifying elements (HWP, QWP, Faraday rotator, etc.) operate
- apply the proper polarization-modifying element to alter the state or polarization of a polarized beam
- learn how polarization changes upon reflection
- understand the difference between optical activity and Faraday rotation
- appreciate the interference of two orthogonally polarized beams
- appreciate the many practical applications associated with the control of the state of polarization
- specify what polarization element will be suitable for a particular function
- develop a fundamental picture of the meaning of circularly polarized light.

INTENDED AUDIENCE

This presentation is aimed at researchers, engineers, technicians, managers and others who wish to develop an intuitive grasp of polarization concepts.

INSTRUCTOR

Robert Fisher is the owner of RA Fisher Associates, and has been active in laser physics and in nonlinear optics for the last 35 years. He has taught graduate courses at the Univ. of California, Davis, and worked at both Lawrence Livermore National Lab. and Los Alamos National Lab. He is an SPIE Fellow and an OSA Fellow, and was a member of SPIE's Board of Directors.

Introduction to CCD and CMOS Imaging Sensors and Applications

SC504 CD

Course level: Introductory
CEU .65 $530 / $615 USD
Monday 8:30 am to 5:30 pm

See p. 172 for full course description.

Optomechanics for Space Applications

SC561

Course level: Introductory
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

See p. 168 for full course description.

Practical Radiometry

SC798

Course level: Introductory
CEU .65 $410 / $495 USD
Sunday 8:30 am to 5:30 pm

See p. 168 for full course description.

Infrared Systems - Technology & Design

SC835

Course level: Intermediate
CEU 1.00 $840 / $965 USD
Tuesday/Wednesday 8:30 am to 5:30 pm/8:30 am to 12:30 pm

See p. 180 for full course description.

Image and Signal Processing

Principles of Fourier Optics and Diffraction

SC017 CD FC

Course level: Intermediate
CEU .65 $515 / $600 USD
Tuesday 8:30 am to 5:30 pm

See p. 167 for full course description.

Advanced Image Processing and Applications

SC661

Course level: Intermediate
CEU .65 $410 / $495 USD
Monday 8:30 am to 5:30 pm

This course presents both fundamental and advanced concepts useful in different aspects of optical, digital, biomedical and multimedia image processing. It is aimed at people interested in learning practical applications of image processing techniques for solving biomedical image modeling and recognition, video image segmentation, feature extraction, statistical modeling and automatic target recognition (ATR) problems. This course will review fundamentals of image processing and recent progress in image segmentation, modeling and feature extraction. Qualitative insight into the mathematical operations performed by image processing functions will be provided.

LEARNING OUTCOMES

This course will enable you to:

- identify the usefulness of image processing in several application areas
- explain the underlying principles and techniques of image processing
- understand image enhancement, image restoration, and image segmentation approaches
- describe fundamental concepts employed in digital imaging (sampling, quantization, aliasing, frequency decomposition, filtering, interpolation, histogram, etc.)
- explain multiresolution analysis and fractal analysis for image texture
- describe the process of feature extraction and segmentation
- appreciate several case studies such as: 1) texture analysis in biomedical images and brain tumor recognition; 2) multiresolution analysis and adaptive ATR; 3) video image segmentation; 4) content-based image retrieval (optional)

INTENDED AUDIENCE

Scientists, engineers and managers interested in a fundamental and/or advanced exposition of image processing techniques and applications.

INSTRUCTOR

Khan Iftekharuddin is associate professor at the department of electrical and computer engineering, University of Memphis. He holds an appointment with the joint graduate program in biomedical engineering at the U of M and University of Tennessee at Memphis. His research interests include sensor signal acquisition and modeling, digital, optical and multimedia signal and image processing, optical computing and interconnection, applications of neural inference techniques and automatic target recognition. He has published over 80 technical articles including many invited talks, and has one patent on the application of signal processing algorithms. He is a fellow of SPIE, a senior member of IEEE, and a member of OSA.

Network Centric Target Tracking and Classification

SC728

Course level: Intermediate
CEU .65 $410 / $495 USD
Monday 8:30 am to 5:30 pm

This course is offered in response to the growing interest in network centric processing systems. It is designed to provide each attendee with the knowledge and insights to effectively deal with systems for multiple target tracking and classification with distributed sensor data. The emphasis is on the information needed to analyze, select, design, develop, and evaluate algorithms for practical sensor fusion to track and classify small targets. The term classification is used here in the more general sense to include decisions, detection, target typing, identification, or recognition. Of particular interest are algorithms that provide a single consistent target view across platforms (sometimes called SIAP) so that users on the distributed platform can coordinate their actions. This course is based on pertinent material of the speaker's intensive five-day short course supplemented by recent findings.

LEARNING OUTCOMES

This course will enable you to:

- understand the issues and alternative algorithm concepts for tracking multiple targets using sensor data corrupted by close targets, sensor biases, merged measurements, false signals, and background clutter
- understand the challenges of fusing data from multiple, distributed sensors
- understand the algorithms for feature aided tracking and processing attributes provided by legacy sensors
- understand the issues and alternative algorithm architectures for tracking with multiple sensors (sensor data fusion), including recent developments in tracklets and hybrid fusion
- understand the alternatives and challenges of developing a network centric tracking with multiple frame data association such as MHT or MFA
- enumerate appropriate alternative algorithm designs and formulate the equations for your applications
- establish criteria and conduct trade-offs to select the algorithm architecture and algorithms for network centric tracking and classification systems
- design, develop, and evaluate tracking systems for a tactical, strategic, or air traffic control systems

INTENDED AUDIENCE

This intensive course is designed for engineers, scientists, and managers concerned with fusing multiple sensor data for target tracking and classification systems. Familiarity with single sensor data association and manipulations of vector-matrix equations is desirable. The course starts at the introductory level and builds up to advanced sensor data fusion techniques. The critical details for designing algorithms for network centric processing under challenging conditions, such as clutter and dim targets that are close or crossing, are highlighted.

INSTRUCTOR

Oliver Drummond , an independent consulting engineer or casual employee for a variety of organizations, is recognized internationally as an expert in multiple-sensors multiple-target tracking and classification. He earned his Ph.D. at UCLA and has over 25 years experience in various aspects of single and multiple sensor target tracking. He has presented his advanced, intensive five-day course on this topic (or portions of it) throughout the United States, Europe, Turkey, and Israel. He has worked for The Aerospace Corp., Hughes Aircraft Co., and General Dynamics. He is currently working for a number of organizations on DOD funded sensor fusion projects on multiple target tracking and classification. In 1989, he introduced and has chaired ever since the SPIE ongoing sequence of annual SPIE conferences entitled Signal and Data Processing of Small Targets.

Detectors and Imaging Devices

Use of CCD and CMOS Sensors in Visible Imaging Applications

SC068 VT

Course level: Introductory
CEU .35 $230 / $275 USD
Wednesday 8:30 am to 12:30 pm

This course will describe the imaging capabilities of visible sensors and illustrate their use with examples as varied as satellite imaging and commercial color scanning applications. The methodology for configuring and specifying a visible imaging system will be described, including the role of charge-coupled device (CCD), and complementary metal-oxide-silicon (CMOS) focal plane technologies.

LEARNING OUTCOMES

This course will enable you to:

- understand the fundamentals of CCD and CMOS imaging operation, pixel signal formation, charge-to-voltage conversion, multiplexing and formation of the video signal
- understand and compare CCDs and other competing visible imaging device architectures [e.g. CMOS imagers and Charge Injection Devices (CID)]
- describe the processing functions of the video signal chain through analog-to-digital conversion
- describe signal propagation through a visible sensor and define the key imager/camera noise components
- define the key modulation transfer function (MTF) components of a visible imaging system
- analyze system imaging capability by the joint use of the system MTF and signal-to-noise ratio using an imaging simulation approach
- describe a detailed example of tailoring of a visible sensor system for a multispectral pushbroom satellite imaging application
- list important technical criteria for specifying the design, fabrication, and verification for state-of-the-art visible imaging devices
- have access to a bibliography on CCDs, visible imaging devices, and other related subjects
- have access to an appendix that describes in detail an example of tailoring a CCD-based imaging system for motion-picture to High Definition Television (HDTV) signal conversion (Telecine)
- have access to an appendix that describes image formation, signal manipulation and processing, and noise effects for intensified (low-light level) imaging systems

INTENDED AUDIENCE

Engineers, scientists, and managers who are interested in utilizing CCD, CMOS or CID sensors in advanced camera and imaging applications.

INSTRUCTOR

Terrence Lomheim holds the position of Distinguished Engineer at The Aerospace Corp. He has 27 years of hardware and analysis experience in visible and infrared electro-optical systems, focal plane technology, and applied optics, and has authored and co-authored 45 publications in these technical areas. He is a Fellow of the SPIE.

Infrared Focal Plane Arrays

SC152

Course level: Introductory
CEU .35 $230 / $275 USD
Sunday 1:30 to 5:30 pm

The course presents a fundamental understanding of two-dimensional arrays applied to detecting the infrared spectrum. The physics and electronics associated with 2-D infrared detection are stressed with special emphasis on the hybrid architecture unique to two-dimensional infrared arrays.

LEARNING OUTCOMES

This course will enable you to:

- develop the building blocks of 2-D arrays
- explain charge transfer concepts of various architectures
- describe various input electronics circuits
- discuss testing techniques used in the IR for 2-D arrays
- provide an overview of current technologies
- demonstrate aliasing effects
- review room temperature arrays
- discuss dual band arrays.

INTENDED AUDIENCE

This material is intended for engineers, scientists and project managers who need to learn more about two-dimensional IR arrays from a user's point of view. It gives the student insight into the optical detection process, as well as what is available to application engineers, advantages, characteristics and performance.

INSTRUCTORS

Eustace Dereniak is a Professor of Optical Sciences and Electrical and Computer Engineering at the University of Arizona, Tucson, AZ. His research interests are in the areas of detectors for optical radiation, imaging spectrometers and imaging polarimeters instrument development. Dereniak is a co-author of several textbooks and has authored book chapters. His publications also include over 100 authored or co-authored refereed articles. He spent many years in industrial research with Raytheon, Rockwell International, and Ball Brothers Research Corporation. He has taught extensively and is a Fellow of the SPIE and OSA, and a member of the Board of Directors of SPIE.

John Hubbs is an engineer with Ball Aerospace and Technologies.

Multispectral and Hyperspectral Image Sensors

SC194 VT

Course level: Advanced
CEU .35 $230 / $275 USD
Wednesday 1:30 to 5:30 pm

This course will describe the imaging capabilities and applications of the principal types of multispectral (MS) and hyperspectral (HS) sensors. The focus will be on sensors that work in the visible, near-infrared and shortwave-infrared spectral regimes, but the course will touch on longwave-infrared applications. A summary of the salient features of classical color imaging (human observation) will also be provided in an appendix.

LEARNING OUTCOMES

This course will enable you to:

- understand many of the applications and advantages of multispectral (MS) and hyperspectral (HS) imaging
- describe and categorize the properties of the principal MS / HS design types (multi-band scanner, starers with filter wheels, dispersive, wedge, and Fourier transform imagers with 2D arrays, etc.)
- list and define the relevant radiometric radiometric quantities, concepts and phenomenology
- understand the process of translating system requirements into sensor hardware constraints and specifications
- analyze signal-to-noise ratio, modulation-transfer-function, and spatial / spectral sampling for MS and HS sensors
- define, understand and apply the relevant noise-equivalent figures-of-merit (Noise-equivalent reflectance difference, Noise-equivalent temperature difference, Noise-equivalent spectral radiance, Noise-equivalent irradiance, etc.)
- describe the elements of the image chain from photons-in to bits-out (photon detection, video signal manipulation, analog processing, and digitization)
- list and review key imager subsystem technology elements (optical, focal plane, video electronics, and thermal)
- formulate a detailed end-to-end design example of a satellite imaging scanning HS sensor
- provide an appendix that summarizes color imaging principles and sensor associated elements for human observation applications (e.g. color television, still cameras, etc.)

INTENDED AUDIENCE

Engineers, scientists, and technical managers who are interested in understanding and applying multispectral and hyperspectral sensors in advanced military, civil, scientific and commercial applications.

INSTRUCTOR

Terrence Lomheim holds the position of Distinguished Engineer at The Aerospace Corp. He has 27 years of hardware and analysis experience in visible and infrared electro-optical systems, focal plane technology, and applied optics, and has authored and co-authored 45 publications in these technical areas. He is a Fellow of the SPIE.

Introduction to CCD and CMOS Imaging Sensors and Applications

SC504 CD

Course level: Introductory
CEU .65 $530 / $615 USD
Monday 8:30 am to 5:30 pm

This course provides a review of general theory and operation for CCD and CMOS imaging technologies looking at the development and application statuses of both. Performance differences between CMOS and CCD imaging arrays are covered. Fundamental performance limits behind major sensor operations are presented in addition to image defects, shorts, device yield, popular chip foundries, chip cost; custom designed and off-the-shelf sensors. We discuss operation principles behind popular commercial and scientific CMOS pixel architectures, and various array readout schemes. We cover backside illuminated arrays for UV, EUV and x-ray applications; high QE frontside illuminated sensors; deep depletion CCDs, ultra large CMOS and CCD arrays; high speed/ low noise parallel readout sensors. We describe the photon transfer technique in measuring performance and calibrating camera and chip systems, and charge transfer mechanisms. We review correlated double sampling theory used to achieve low noise performance and conclude with a look at future research and development trends for each technology.

LEARNING OUTCOMES

This course will enable you to:

- describe operating CMOS and CCD arrays and camera systems for commercial and scientific imaging applications
- explain how CCD and CMOS arrays are designed, fabricated, tested and calibrated
- know how to apply test methodologies and performance standards
- list specifications and requirements to select a sensor for your imaging application
- recognize performance differences between CMOS and CCD technologies
- understand how video signals are processed for optimum signal-to-noise performance
- become familiar with current and future imaging technologies and applications

INTENDED AUDIENCE

This course is for scientists, engineers, and managers involved with high performance CCD and CMOS imaging sensors and camera systems.

INSTRUCTOR

James Janesick is currently the director of the CMOS/ CCD advanced development group for Sarnoff Corporation. Previously he was with Conexant Systems Inc. developing CMOS imaging arrays for commercial applications. He was technology director of Pixel Vision, Inc. for five years developing high speed backside illuminated CCDs for scientific and cinema cameras. Prior to this Janesick was with the Jet Propulsion Laboratory for 22 years where as group leader he designed scientific ground and flight based imaging systems. He has authored 75 publications and has contributed to many NASA Tech Briefs and patents for various CCD and CMOS innovations. Janesick received NASA medals for Exceptional Engineering Achievement (1982 and 1992) and was the recipient of the SPIE Educator Award (2004).

COURSE PRICE INCLUDES the textbooks *Scientific Charge-Coupled Devices* (SPIE, 2001) and *Photon Transfer* (SPIE, 2007), by James Janesick.

Optomechanics

Introduction to Optomechanical Design

SC014 DVD

Course level: Introductory
CEU 1.30 $780 / $985 USD
Sunday/Monday 8:30 am to 5:30 pm

This course will provide the training needed for the optical engineer to work with the mechanical features of optical systems. The emphasis is on providing techniques for rapid estimation of optical system performance. Subject matter includes material properties for optomechanical design, kinematic design, athermalization techniques, window design, lens and mirror mounting.

LEARNING OUTCOMES

This course will enable you to:

- select materials for use in optomechanical systems
- determine the effects of temperature changes on optical systems, and develop design solutions for those effects
- design high performance optical windows
- design low stress mounts for lenses
- select appropriate mounting techniques for mirrors and prisms
- describe different approaches to large and lightweight mirror design.

INTENDED AUDIENCE

Engineers who need to solve optomechanical design problems. Optical designers will find that the course will give insight into the mechanical aspects of optical systems. The course will also interest those managing projects involving optomechanics. Short course SC001, Optical System Design: Layout Principles and Practice, or a firm understanding of its content, is required as background to this course.

INSTRUCTOR

Daniel Vukobratovich is a senior principal engineer at Raytheon. He has over 20 years of experience in optomechanics, is a founding member of the SPIE working group in optomechanics, and is fellow of SPIE. He has taught optomechanics in 11 countries, consulted with over 50 companies and written over 50 publications in optomechanics.

Structural Adhesives for Optical Bonding

SC015

Course level: Intermediate
CEU .35 $230 / $275 USD
Wednesday 8:30 am to 12:30 pm

Optomechanical systems require secure mounting of optical elements. This important aspect of the design can cause a production to stop if sound engineering is not applied. A wide variety of adhesives are discussed with respect to their relevant properties. Design considerations, differing mounting techniques, production concerns, and reliability are reviewed. The instructor gives success and failure case histories.

LEARNING OUTCOMES

This course will enable you to:

- understand and classify adhesives and how they work (epoxy, urethane, silicone, acrylic, RTV, VU-cure, etc.)
- identify properties that affect use
- obtain a users guide to adhesive selection and an adhesive property matrix
- make optic-to-mount considerations
- understand contamination/outgassing
- identify uses of testing; witness sample testing, pull tests, outgassing testing, stress birefringence, optical stability.

INTENDED AUDIENCE

This course is for engineers, managers, and technicians, this course provides a foundation for the correct design for successful optical mounting; an understanding of the best options to employ for each application, and the selection and approach conducive to production. A bound course outline is provided including summaries of popular adhesives and their properties. Some adhesive samples are available.

INSTRUCTOR

John Daly has been a consultant for the past 10 years. He has experience in the applications of adhesives to our industry. Daly has more than 20 years of experience in academia, aerospace, medical, commercial, and industrial fields. He has a B.S. in Mechanical Engineering Ph.D. in Applied Physics. His exposure to these areas for applications of laser, electro-optic, and photonic technologies has covered research, development, production, and management.

Advanced Composite Materials for Optomechanical Systems

SC218

Course level: Intermediate
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

Advanced composite materials have been used successfully in optomechanical systems since the 1970s. They are being used increasingly in numerous commercial and military applications including: optical benches, telescopes, binoculars, mirrors, metrology and photolithography equipment, and other optomechanical systems, along with thermal management and optoelectronic packaging. Numerous and growing numbers of polymer matrix-, metal matrix-, ceramic matrix- and carbon/carbon composites provide great improvements in stiffness, strength, dimensional stability, thermal conductivity and corrosion resistance over conventional materials of construction, and are considerably lighter. Low-cost, net-shape manufacturing processes make many of these materials economically attractive.

LEARNING OUTCOMES

This course will enable you to:

- acquire terminology and the basic properties and characteristics of the four classes of composites used in optomechanical systems
- select appropriate candidate composites and perform design studies
- improve thermal and moisture dimensional stability
- increase stiffness
- reduce weight
- increase acceleration and deceleration
- reduce vibrations
- reduce thermal stresses by matching CTEs
- increase thermal conductivity
- reduce thermal design complexity

INTENDED AUDIENCE

This course is designed for engineers, scientists and managers involved in design and manufacture of optomechanical and high-speed mechanical systems and thermal management.

INSTRUCTOR

Carl Zweben an independent consultant on composites and advanced thermal management materials, was for many years Advanced Technology Manager and Division Fellow at GE Astro Space. He has over 40 years' experience in development and application of all types of advanced composites in optomechanical systems, dimensionally stable structures, machine components, electronic and optoelectronic packaging and thermal control. He is a Life Fellow of ASME, a Fellow of ASM and SAMPE, and an Associate Fellow of AIAA. He is the first winner of the GE Engineer-of-the-Year and One-in-a-Thousand awards. He has taught over 200 composites and thermal materials short courses.

Materials: Properties and Fabrication for Stable Optical Systems

SC219

Course level: Intermediate
CEU .65 $410 / $495 USD
Wednesday 8:30 am to 5:30 pm

This course describes materials and their properties for instrument and optical systems, emphasizing dimensional stability of components and covering issues such as UHV & cryo compatibility, options for mirrors, benches and other structures, and athermalization of both refractive and reflective systems. Optical materials such as glasses, beryllium and silicon carbide will be reviewed. Structural materials covered include: aluminum alloys, steels & invars, and composites. Fabrication methods will be described for each material.

LEARNING OUTCOMES

This course will enable you to:

- identify material properties important for your application
- understand the thermal dependence of properties
- distinguish between various materials and grades
- perform trades to determine suitable material(s)
- explain causes and solutions for dimensional instability
- specify manufacturing processes for dimensionally stable components.

INTENDED AUDIENCE

Managers, engineers and technicians involved in design of mirrors and selection of materials and processes for mirrors and components in precision instruments and optical systems.

INSTRUCTOR

Roger Paquin is an advanced materials consultant in Tucson, Arizona. His primary emphasis is application of advanced processes to fabrication of dimensionally stable mirrors and structures. Paquin is known for his development of these processes for lightweight, near-net-shape, low scatter mirrors of beryllium, low expansion glasses and silicon carbide. His consulting practice emphasizes materials and processes selection for optical and instrument systems applications. He has over 40 years of materials engineering experience, has published extensively and is a Fellow of SPIE.

Optical Alignment Mechanisms

SC220

Course level: Intermediate
CEU .35 $230 / $275 USD
Tuesday 8:30 am to 12:30 pm

This is a practical "how to" course dealing with the design and fabrication of precision optical alignment and adjustment devices. The course uses example optical systems to identify typical alignment requirements and provides a catalog of proven adjustment techniques.

LEARNING OUTCOMES

This course will enable you to:

- learn to assess degrees-of-freedom an optical element must have to align it in its system
- define range-of-adjustment vs. resolution-of-adjustment for these mechanisms
- identify appropriate design guidelines and pitfalls
- understand material choices, important tolerances, and mount stability
- determine where to get the hardware made.

INTENDED AUDIENCE

This course is intended to help the mechanical or opto-mechanical design engineer identify and characterize the degrees-of-freedom necessary to align an optical system and to provide him with a catalog of proven configurations. While the course primarily addresses small optics, the concepts apply to larger systems as well. A general knowledge of optics is required; familiarity with optical measurement and mounting techniques is highly recommended.

INSTRUCTOR

Robert Guyer specializes in the design of lasers, stable optical mounts, gimbaled systems, and precision mechanisms. Mr. Guyer is an Engineering Fellow at BAE Systems in Nashua, New Hampshire, and has over 40 years military, space, and commercial opto-mechanical product development experience with BAE Systems, RCA, GE, Lockheed Martin, and AFAB Group. He is a registered Professional Engineer and committed Corvette enthusiast.

Integrated Opto-Mechanical Analysis

SC254

Course level: Advanced
CEU .65 $455 / $540 USD
Wednesday 8:30 am to 5:30 pm

This course presents opto-mechanical modeling methods to design and analyze high performance optical systems. Emphasized are the application of finite element techniques to model optical elements and support structures for static, dynamic, and thermal analyses. The integration of the thermal and structural response quantities into optical design software including ZEMAX and CODEV is also presented that allow optical performance metrics such as wavefront error to be computed as a function of the environment and mechanical design variables. Advanced techniques including the modeling of adaptive optics and design optimization are also discussed. Examples will be drawn from ground-based, airborne, and spaceborne optical systems.

LEARNING OUTCOMES

This course will enable you to:

- integrate thermal and structural results into optical models
- effectively model optical mounts, flexures, and metering structures
- perform optical surface evaluation using Zernike polynomials
- predict optical errors and line-of-sight jitter in vibration environments
- predict surface distortion and develop back-outs for test and assembly induced errors
- effectively model lightweight mirrors
- predict optical coating effects
- perform thermo-elastic analysis of optical systems
- predict the effects of stress birefringence on optical performance
- effectively analyze structural adhesives and RTV used for mounting optical elements
- model adaptive optics, predict system correctability and system performance
- use numerical optimization techniques to improve designs

INTENDED AUDIENCE

This course is intended for mechanical engineers interested in learning about the details of finite element and integrated modeling techniques as applied to optical systems. Working knowledge of finite element software and/or a fundamental understanding of the theory and application of the finite element method are recommended.

INSTRUCTORS

Keith Doyle has 20 years' experience in the field of optical engineering, specializing in opto-mechanics and the multidisciplinary modeling of optical systems. He has worked on a diverse range of optical instruments including those for the astronomy, microlithography, telecommunications, consumer optics, and defense industries. He is currently a Vice President of Sigmadyne and has authored or co-authored over 25-publications in this field. Previous employers include Optical Research Associates and MIT Lincoln Laboratory. He received his Ph.D. in engineering mechanics and a minor in optical sciences from the University of Arizona in 1993

Gregory Michels has 13 years' experience applying opto-mechanical analysis techniques to a wide array of systems for laser fusion research, microlithography, entertainment imaging, astronomy, and remote sensing. He is currently a Vice President of Sigmadyne and has authored or co-authored over 15-publications in this field. Before co-founding Sigmadyne, Inc. he spent five years as a mechanical analyst at Eastman Kodak Company in Rochester NY providing analysis support of the Optical Bench Assembly for NASA's Chandra X-Ray Observatory. He received his MS in mechanical engineering from the University of Rochester in 1994.

COURSE PRICE INCLUDES the text, *Integrated Optomechanical Analysis* (SPIE, 2002), by Keith Doyle, Victor Genberg, and Gregory Michels. The text includes an accompanying CD-ROM with examples.

Principles for Mounting Optical Components

SC447

Course level: Intermediate
CEU 1.30 $850 / $1055 USD
Tuesday/Wednesday 8:30 am to 5:30 pm

This intermediate level, two-day course reviews techniques commonly used to mount individual and multiple lenses, windows, shells, optical filters, and prisms, as well as small and large mirrors in optical instruments. Mounting means described include retaining rings, flanges, clamps, adhesives, sealing compounds, and flexures. Many examples of component mountings in typical optical instrument applications are considered in order to illustrate successful design configurations. Techniques for precision alignment of individual lens elements and lens assemblies are summarized. Analytical techniques for estimating stress buildup within typical optical components due to imposed mounting forces are discussed. The important consequences of changing materials properties, interface geometry, and part dimensions on these stresses are presented. The effects of temperature changes on mechanical forces and stresses in lens mounts also are discussed.

LEARNING OUTCOMES

This course will enable you to:

- identify critical aspects of the optic-to-mount interface
- appreciate the impacts of extreme environments on optics
- understand the importance of proper optical and mechanical material choices
- compare alternative mounting designs for individual optical components and assemblies
- apply proven precision lens alignment techniques
- estimate axial and radial contact stresses in optical components due to mounting forces
- estimate bending stresses in optical components resulting from imposed forces
- anticipate how temperature changes may affect optical hardware
- learn how others have solved typical mounting design problems.

INTENDED AUDIENCE

Participation in this course will help optical and mechanical technicians, engineers, designers, scientists, project managers, and team supervisors as well as individuals from other technical disciplines learn how optical components can best be integrated into instruments, as well as learn techniques for analyzing optomechanical designs, and ways to solve common design problems relating to packaging of optical systems and potential stress buildup in optics due to mechanical causes.

INSTRUCTOR

Paul Yoder, Jr. serves various clients as an independent consultant in optical and optomechanical engineering. He has designed optical instruments for military, aerospace, commercial, and medical applications for over 50 years. He is a fellow of both OSA and SPIE, and a founding member of SPIE's Optomechanical Instrument Working Group. Yoder teaches courses for industry, government agencies, OSA, and SPIE, and has taught graduate-level courses at the University of Connecticut.

COURSE PRICE INCLUDES the text *Mounting Optics in Optical Instruments, 3rd Edition*, by Paul R. Yoder, Jr. (SPIE, 2005).

Optomechanics for Space Applications

SC561

Course level: Introductory
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

See p. 168 for full course description.

Optomechanical Analysis

SC781

Course level: Advanced
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

This course teaches the basic requirements for accurately predicting the influences of thermal, structural and servo system designs on the performance and quality of optical imaging systems. It is based upon the instructor's forty years' experience in designing, analyzing and building complex optical systems, especially for the Federal market place. It incorporates elements from some of his earlier tutorials, "Finite Element Methods in Optics," "Optical Flexures" and "Optomechanics and the Tolerancing of Instruments." The instructor will review the goals of "Integrated Analysis" as promoted by NASA and DoD since the early 90's. Strengths and weakness of various approaches will be discussed. Special optomechanical modeling tools (the Optomechanical Constraint Equations and the Optical Analog) will be presented in some detail. Analytical error functions will be developed and evaluated. Sources of analytical error will be discussed and analyzed. Analytical error budgets will be developed and compared for various approaches to end-to-end analysis of systems. A candidate strategy will be presented for consideration.

The course will be illuminated with both text book-type problems and actual examples of applications from the instructor's experiences. The students will learn the strengths and weakness of the analytical methods in the various disciplines, how to estimate the sources and magnitudes of errors in various approaches to analysis, how to put together an error budget for a proposed analytical effort and how to select the most appropriate methods for end-to-end system analysis.

LEARNING OUTCOMES

This course will enable you to:

- plan and execute multidisciplinary analytical procedures
- know the strengths and weakness of individual analytical routines
- estimate the errors contributed by various steps in the analytical process
- make a complete error budget for end-to-end analysis of optical systems
- evaluate alternative approaches to the system analysis process

INTENDED AUDIENCE

Optics professionals (engineers, scientists, and their managers) who are responsible for planning, designing and building optical instruments.

INSTRUCTOR

Alson Hatheway is a mechanical engineer and president of his own company. He has over forty years experience in designing, analyzing and building new optical and photonic products. He has authored 59 technical papers, presented three different tutorials and holds four patents. He is a fellow of SPIE, a founder of the Optomechanical / Instrument Technical Group and currently its chairman.

Optical Design

Optical System Design: Layout Principles and Practice

SC001 CD

Course level: Introductory
CEU .65 $480 / $565 USD
Sunday 8:30 am to 5:30 pm

This course provides the background and principles necessary to understand how optical imaging systems function, and teaches the simple methods and techniques with which you can lay out a system which will satisfy the performance requirements of your application.

Optical system imagery can readily be calculated using the cardinal points of Gauss, or by simple ray tracing. These principles can be extended to specific equations for the layout and analysis of multi-component systems. System performance limits due to diffraction, human vision, sensor

characteristics and radiometric throughput should be taken into account.

This course provides simple methods of arriving at, and understanding, the first-order layout by a process which determines the component powers and locations for an optical system. This process will produce an image of the right size, in the right location and with the right orientation. The course will emphasize practical applications, not abstract theory.

LEARNING OUTCOMES

This course will enable you to:

- diagram ray paths and do simple ray tracing
- describe the performance ceilings imposed on optical systems by diffraction, the human eye, and through-put limits
- predict the imaging characteristics of multi-component systems
- name and describe the cardinal (Gauss) points, the focal lengths, and the imaging properties of optical elements and systems
- apply layout principles to telescopes, microscopes, beam expanders, power and field changers, magnifiers, field and relay lenses, condenser and illumination systems, periscopes, endoscopes, plus anamorphic, zoom and afocal systems
- adapt a known configuration to suit your application
- construct an optimal system to meet the needs of your specific requirement

INTENDED AUDIENCE

This course is intended for engineers, scientists, managers, technicians and students who want to understand the principles of optical system imagery, and who want to carry out optical system design/layout. The course approach uses only simple mathematics, and is intended to equip the participant to analyze, calculate, and design the best and simplest layout possible.

INSTRUCTOR

Warren Smith is Chief Scientist Emeritus at Rockwell Collins Optronics in Carlsbad, CA. He is active as an independent consultant in optical engineering and lens design. Author of three books, *Modern Optical Engineering* (2000), *Modern Lens Design* (2002), and *Practical Optical System Layout* (1997), he has over 60 years of practical experience in lens and optical system design. Smith has taught his popular one-week optics course to several thousand students at over 45 venues since 1972. Past president and Fellow of both SPIE and OSA, he received the SPIE Gold Medal in 1985 and the OSA Fraunhofer Medal in 2001.

COURSE PRICE INCLUDES the textbook *Modern Optical Engineering* (SPIE, 2000), by Warren J. Smith.

Please note that this course replaces Warren Smith's past course offerings, SC001 Understanding Optical Imaging Systems, and SC002 Principles of Optical Systems Layout, by combining those two half-day courses into a full-day course.

Practical Optical System Design - EXPANDED 2 Day Format

SC003 CD

Course level: Intermediate
CEU 1.30 $855 / $1060 USD
Sunday/Monday 8:30 am to 5:30 pm

This course is a 2-day version of the popular single day course that has been offered at SPIE conferences for many years. By extending the course to 2 days the slower pace will permit more explanations and attendee interactions.

The course will provide attendees with a basic working knowledge of optical design, or more specifically, lens design. While the course will concentrate on optical system configurations and performance optimization and analysis, many practical and useful examples will be included throughout. Even if you have never used an optical design program before, or if you have never worked in the field, you will become fluent with how one designs optical systems for many varied applications. Both imaging and non-imaging systems will be included.

Specific Topics and Agenda include:

- Basic Optics: What lenses & mirrors do and how to specify optical systems
- Image Quality: Diffraction and geometrical aberrations and how to get rid of them
- Useful First Order Relationships: Handy useful rules of thumb
- Chromatic Aberrations: Changes in performance as a function of wavelength
- Optical Path Difference: What is it and why is it so important?
- Aspheric Surfaces: What they can do to improve performance
- Stops and Pupils: Fundamental & important parameters in all optical systems
- Optical Configurations: A key ingredient in any optical design
- Glass Selection: Choosing the optimum glasses for a given application
- Optical Design Process: How to optimize the performance of an optical system
- Gaussian Beam Optics: Necessary for designing optics for lasers
- Infrared and Ultraviolet optics: Similarities and difference from visible optics
- Environmental Considerations: Thermal expansion and other issues
- Optical Testing: How to characterize and measure optical performance
- Tolerancing & Producibility: How we tolerance a lens and hardware issues
- Use of Off-the-Shelf Optics: When you can and cannot use catalog components
- Telescope Optics: Design comparisons for various telescope forms
- Opto-Mechanics: Never underestimate the importance of mechanics
- Computer Aided Optical Design: Two real examples including tolerancing
- Bloopers and Blunders in Optics: We should learn from our mistakes

LEARNING OUTCOMES

This course will enable you to:

- specify an optical system for your application
- describe image degrading aberrations and explain how to get rid of them
- work fluently with all aspects of optics and optical design
- explain how computer programs are used to optimize and analyze an optical system
- work with mechanical designers, optical manufacturers, assembly, and testing persons
- take a task or project from initial specifications through design and manufacturing to final hardware

INTENDED AUDIENCE

This course is intended for anyone who needs to learn how to design optical systems. It will be of value to those who either design their own optics or those who work directly or indirectly with optical designers (especially mechanical engineers), as you will now understand what is really going on and how to ask the right questions of your designers.

INSTRUCTOR

Robert Fischer is President and founder of OPTICS 1, Inc., and has been involved in optical system design and engineering for over 25 years. Fischer is co-author of *Optical System Design* co-published by SPIE and McGraw-Hill. He is also a past president of SPIE.

COURSE PRICE INCLUDES the text *Optical System Design,* by Robert E. Fischer (SPIE, 2000).

Modern Lens Design

SC006

Course level: Intermediate
CEU 1.00 $800 / $925 USD
Monday/Tuesday 8:30 am to 5:30 pm/ 8:30 am to 12:30 pm

See p. 178 for full course description.

Introduction to Optical Alignment Techniques

SC010 CD

Course level: Introductory
CEU 1.30 $780 / $985 USD
Monday/Tuesday 8:30 am to 5:30 pm

This course discusses the equipment, techniques, tricks, and skills necessary to align optical systems and devices. You learn to identify errors in an optical system, and how to align lens systems.

LEARNING OUTCOMES

This course will enable you to:

- determine if errors in the optical system are due to misalignment errors or other factors such as fabrication, design, or mounting problems
- recognize and understand the fundamental imaging errors associated with optical systems
- diagnose (qualitatively and quantitively) what is wrong with an optical system by simply observing these fundamental imaging errors
- use the variety of tools available for aligning optical systems, and more importantly, how to "tweak" logically the adjustments on these devices so that the alignment proceeds quickly and efficiently
- align basic lens systems and telescopes
- align more complex optical systems such as those containing off-axis aspheric surfaces, and maintain alignment using automatic mounting techniques.

INTENDED AUDIENCE

This course is directed toward engineers and technicians needing basic practical information and techniques to achieve alignment of simple optical systems, as well as seemingly more complicated off-axis aspheric mirrors. To benefit most from this course you will need a basic knowledge of the elementary properties of lenses and optical systems (i.e. focal lengths, f/numbers, magnification, and other imaging properties) and a working knowledge of simple interferometry. Some familiarity with the basic aberrations such as spherical aberration, coma, and astigmatism will be helpful.

INSTRUCTOR

Mitchell Ruda Ph.D., is president of Ruda & Associates, Inc., an optical engineering consulting firm, located in Tucson, Arizona. He is a fellow of SPIE.

Principles of Fourier Optics and Diffraction

SC017 CD

Course level: Intermediate
CEU .65 $515 / $600 USD
Tuesday 8:30 am to 5:30 pm

See p. 167 for full course description.

Optical Scattering: Measurement and Analysis

SC020

Course level: Intermediate
CEU .35 $285 / $330 USD
Sunday 1:30 to 5:30 pm

See p. 182 for full course description.

Optical Design Fundamentals for Infrared Systems

SC134

Course level: Intermediate
CEU .65 $450 / $535 USD
Sunday 8:30 am to 5:30 pm

See p.167 for full course description.

Basic Optics for Engineers

SC156 DVD

Course level: Introductory
CEU .65 $445 / $530 USD
Sunday 8:30 am to 5:30 pm

This course introduces each of the following basic areas of optics, from an engineering point of view: geometrical optics, image quality, flux transfer, sources, detectors, and lasers. Basic calculations and concepts are emphasized.

LEARNING OUTCOMES

This course will enable you to:

- compute the following image properties: size, location, fidelity, brightness
- estimate diffraction-limited imaging performance
- explain optical diagrams
- describe the factors that affect flux transfer efficiency, and their quantitative description
- compute the spectral distribution of a source
- describe the difference between photon and thermal detectors
- calculate the signal to noise performance of a sensor (D* and noise equivalent power)
- differentiate between sensitivity and responsivity
- explain the main factors of laser beams: monochromaticity, collimation, and propagation.

INTENDED AUDIENCE

This class is intended for engineers, technicians, and managers who need to understand and apply basic optics concepts in their work. The basics in each of the areas are covered, and are intended for those with little or no prior background in optics, or for those who need a fundamental refresher course.

INSTRUCTOR

Alfred Ducharme is a professor of optics and electrical engineering in the College of Engineering and Computer Science at the University of Central Florida. He received a B.S. in Electrical Engineering from the University of Massachusetts - Lowell, and both a M.S. and Ph.D. in Electrical Engineering from the University of Central Florida - School of Optics (CREOL). Dr. Ducharme is the Program Coordinator for the 4-year undergraduate program in Photonics (BSEET-Photonics) offered by the Engineering Technology Department.

COURSE PRICE INCLUDES the text *Basic Electro-Optics for Electrical Engineers* by Glenn D. Boreman (SPIE, 1998).

Polarized Light: A Practical Hands-on Introduction

SC206 FC

Course level: Introductory
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

See p. 169 for full course description.

The Design of Plastic Optical Systems

SC384

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 1:30 to 5:30 pm

This course provides attendees with the understanding of how and when plastic optical systems can be effectively used in products, and provides the optical engineer with design methods for integrating plastic optical components into product designs. Course topics include description of the manufacturing processes, tool design features, materials properties, design methods unique to molded optical elements, manufacturing tolerances, coatings, test methods, sources of manufacturing services, and examples of products that use optical elements.

LEARNING OUTCOMES

This course will enable you to:

- understand the advantages and limitations of plastic optical systems
- identify the appropriate material and manufacturing method for a product
- design manufacturable optical systems using plastic components
- avoid design problems that are unique to plastic optical systems
- minimize the production cost and maximize the performance of your products

INTENDED AUDIENCE

This course is primarily directed to optical engineers who have limited experience with precision plastic molding processes and the unique design limitations associated with these processes. It is also beneficial to technical management staff who need to understand the advantages and limitations of molded plastic optical components.

INSTRUCTOR

Michael Schaub is a Senior Optical Engineer at Raytheon. Prior to joining Raytheon he worked for a precision injection molded optics firm. He has over 10 years experience in the design and manufacture of plastic optical systems. He holds a Ph.D. from the University of Arizona's Optical Sciences Center, an M.Sc. from the University of Oxford, and a B.S. from the University of Rochester's Institute of Optics.

Predicting, Modeling, and Interpreting Light Scattered by Surfaces

SC492

Course level: Intermediate
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

See p. 183 for full course description.

Aspheric Optics: Design, Fabrication, and Test

SC552 CD

Course level: Introductory
CEU .35 $305 / $350 USD
Wednesday 1:30 to 5:30 pm

This course will provide attendees with a broad and useful understanding of aspheric surfaces and components. Aspheric or non-spherical surfaces in a lens or mirror system can bring significant benefits to the optical performance. This is not without the liabilities of added cost, delivery time, and even producibility. The course will begin with lens design, and specifically how and when to incorporate aspherics into a variety of lens design forms. We discuss what aspherics will do for a design, and also what they will not do. We then will discuss how aspheric surfaces are manufactured along with recommendations on how to specify aspherics. Several methods for predicting performance for systems with asphere induced wavefront irregularities will be shown. We also will discuss the testing of aspherics.

LEARNING OUTCOMES

This course will enable you to:

- identify when and where in a lens or mirror design to consider aspheric surfaces
- optimize your design using aspherics
- specify the resulting aspheric component and predict performance due to errors
- understand how aspherics are manufactured and tested

INTENDED AUDIENCE

This course is intended for anyone who designs optical systems. It will be of value to those who either design their own optics or those who work directly or indirectly with optical designers, as you will now understand what is really going on with aspheric surfaces and how to ask the right questions of your designers or fabricators.

INSTRUCTOR

Robert Fischer is President and founder of OPTICS 1, Inc., and has been involved in optical system design and engineering for over 25 years. Fischer is co-author of *Optical System Design* co-published by SPIE and McGraw-Hill. He is also a past president of SPIE.

COURSE PRICE INCLUDES the text, *Optical System Design* (SPIE, 2000), by Robert E. Fischer.

Understanding Reflective Optical Design

SC659

Course level: Intermediate
CEU .65 $410 / $495 USD
Monday 8:30 am to 5:30 pm

This course provides attendees with a working knowledge of reflective optical system design. The morning session concentrates on analytical differences from refractive systems, including basic 1st order layout considerations and optimization techniques. It provides an overview of the conceptual development of various reflective designs, and provides an understanding of the basic capabilities, advantages and disadvantages of many common reflective forms. The afternoon session offers insights into departing from symmetry, understanding aberration forms with off axis apertures, a discussion of segmented mirror systems, and a brief overview of I&T (integration and test) considerations and manufacturing techniques.

LEARNING OUTCOMES

This course will enable you to:

- develop and analyze the appropriate set of 1st order parameters for reflective systems
- identify the advantages and constraints of various common reflective forms
- define and evaluate analysis parameters unique to reflective system design
- trace the logical progression of reflective system from the single to multiple mirrors
- establish reasonable starting point layouts for 3 mirror design forms
- identify situations that may call for departing from symmetry in the design and understand the advantages and limitations of this technique
- recognize aberration forms in off-axis apertures and methods to mitigate them
- identify the basic advantages and constraints of designs with segmented mirrors
- develop strategies for integration and test of reflective architectures
- plan for basic manufacturing considerations

INTENDED AUDIENCE

This material is intended for anyone who needs to design or specify reflective optical systems, or who works with optical designers on a regular basis. A basic understanding of 1st order optics is helpful; a brief overview will be provided. No optical design experience is required, but a basic knowledge of optical aberrations will be assumed for the optical design specific discussions. The more in depth, design oriented portions of the course will include summary information valuable to engineers of other disciplines. Those who have either little optical design experience or just minimal reflective design experience will find this course especially valuable.

INSTRUCTOR

James Contreras is a principal optical engineer at Ball Aerospace and Technologies Corporation in Boulder, CO. He has extensive experience in the design, analysis and fabrication of reflective optical systems for a variety of applications, and is currently the lead optical design engineer at Ball for the James Webb Space Telescope.

Polarization in Optical Design

SC792

Course level: Intermediate
CEU .35 $230 / $275 USD
Sunday 8:30 am to 12:30 pm

This course provides a survey of issues associated with calculating polarization effects in optical systems using optical design programs. Many optical systems are polarization critical and require careful attention to polarization issues. Such systems include liquid crystal projectors, imaging with active laser illumination, very high numerical aperture optical systems in microlithography and data storage, DVD players, imaging into tissue and turbid media, optical coherence tomography, and interferometers.

Polarization effects are complex: retardance has three degrees of freedom, diattenuation (partial polarization) has three degrees of freedom, and depolarization, the coupling of polarized into partially polarized light, has nine degrees of freedom. Due to this complexity, polarization components and the polarization performance of optical systems are rarely completely specified.

The polarization aberrations introduced by thin films and uniaxial crystals can be readily evaluated in several commercial optical design codes. These routines are complex and most optical engineers are unfamiliar with the capabilities and the forms of output. But these polarization ray tracing routines provide better methods to communicate polarization performance and specifications between different groups teamed on complex optical problems. Better means of technical communication speed the development of complex systems.

LEARNING OUTCOMES

This course will enable you to:

- understand how to follow the polarization changes along a ray path through a series of lenses, mirrors, polarization elements and anisotropic materials
- learn to calculate the Jones matrices for ray paths through sequences of thin film coated optical elements and interpret the "instrumental polarization" or polarization aberrations associated with ray paths
- understand how polarization state dependent point spread functions and modulation transfer functions are calculated
- visualize the Maltese cross, linear polarization tilt, and other fundamental polarization aberration patterns which occur in many systems. Picture configurations like the crossed folding mirror which reduces polarization aberrations
- develop appropriate polarization specifications for optical systems

INTENDED AUDIENCE

This class is intended for optical engineers, scientists, and managers who need to understand and apply polarization concepts to optical systems. Some prior exposure to optical design programs and to linear algebra would be helpful.

INSTRUCTOR

Russell Chipman is a Professor of Optical Sciences at the University of Arizona, Tucson AZ. He runs the Polarization Laboratory which performs measurements and simulations of polarization elements, liquid crystals, and polarization aberrations. He managed optics departments at JDS Uniphase and Johnson and Johnson and was also a Physics professor at the University of Alabama in Huntsville. He has developed many unique spectropolarimeters and imaging polarimeters and conducted studies into polarization in fiber components, waveguides, liquid crystals, polarization elements, and natural polarization signatures. He holds twelve patents in optics. He received his BS from MIT and Ph. D. in Optical Science from the University of Arizona. Prof. Chipman is a Fellow and a former member of the Board of Directors of SPIE.

Basic Optics for Non-Optics Personnel

WS609

Course level: Introductory
CEU .20 $50 / $100 USD
Wednesday 8:30 to 11:00 am

This course will provide the technical manager, sales engineering, marketing staff, or other non-optics personnel with a basic understanding of the terms, specifications, and measurements used in optical technology to facilitate effective communication with optics professionals on a functional level. Topics to be covered include basic concepts such as interference, diffraction, polarization and aberrations, definitions relating to color and optical quality, and an overview of the basic measures of optical performance such as MTF and wavefront error. The material will be presented with a minimal amount of math, rather emphasising working concepts, definitions, rules of thumb, and visual interpretation of specifications. Specific applications will include defining basic imaging needs such as magnification and depth-of-field, understanding MTF curves and interferograms, and interpreting radiometric terms.

LEARNING OUTCOMES

This course will enable you to:

- Read and understand optical system descriptions and papers
- Ask the right questions about optical component performance
- Understand basic optical specifications for lenses, filters, and other components
- Select the right off-the-shelf lenses, filters, and beam directing optics
- Interpret optical data such as interferogram, MTF and aberration reports

INTENDED AUDIENCE

This course is intended for the non-optical professional who needs to understand basic optics and interface with optics professionals.

INSTRUCTOR

Kevin Harding has been active in the optics industry for over 25 years, and has taught machine vision and optical inspection methods for over 20 years in over 70 workshops and tutorials, including engineering workshops on machine vision, metrology, NDT, and interferometry used by vendors and system houses to train their own engineers. He has been recognized for his leadership in machine vision by the Society of Manufacturing Engineers, Automated Imaging Association, and Engineering Society of Detroit.

Optical Systems Engineering

Optical System Design: Layout Principles and Practice

SC001

FC

Course level: Introductory
CEU .65 $480 / $565 USD
Sunday 8:30 am to 5:30 pm

See p. 175 for full course description.

Practical Optical System Design - EXPANDED 2 Day Format

SC003

FC

Course level: Intermediate
CEU 1.30 $855 / $1060 USD
Sunday/Monday 8:30 am to 5:30 pm

See p. 175 for full course description.

Modern Lens Design

SC006

Course level: Intermediate
CEU 1.00 $800 / $925 USD
Monday/Tuesday 8:30 am to 5:30 pm/ 8:30 am to 12:30 pm

The course begins with a brief review of paraxial optics, then third-order aberration theory, as it applies to optical design, is covered. Factors that affect aberrations and the principles of aberration correction are discussed. Advanced techniques of practical lens design are illustrated with easy-to-understand examples drawn from the design of anastigmats and telescope objectives. These demonstrate design improvement techniques that are applicable to most optical systems. Telephoto and retrofocus lenses, optics for laser systems, mirror and catadioptric systems are discussed. Descriptions of petzval and microscope objectives; fifth-order, inherent and induced aberrations, diffractive surfaces, double gauss lenses, zoom and wide angle lenses are included. Computer lens design, design for manufacture, stop shift theory, and apochromatic systems are explained as well.

LEARNING OUTCOMES

This course will enable you to:

- understand the source and correction of aberrations
- determine how to improve a lens design
- use optical design software to best advantage
- understand the limits imposed by aberration theory
- create a new system design from scratch
- design toleranced, easily manufacturable lenses
- understand which lens types are suitable for various applications
- interpret ray-intercept plots.

INTENDED AUDIENCE

This course is intended for optical engineers and scientists who have some knowledge of lens design and who want to increase their optical design proficiency through a better understanding of the subject.

INSTRUCTOR

Warren Smith is Chief Scientist Emeritus at Rockwell Collins Optronics in Carlsbad, CA. He is active as an independent consultant in optical engineering and lens design. Author of three books, *Modern Optical Engineering* (2000), *Modern Lens Design* (2002), and *Practical Optical System Layout* (1997), he has over 60 years of practical experience in lens and optical system design. Smith has taught his popular one-week optics course to several thousand students at over 45 venues since 1972. Past president and Fellow of both SPIE and OSA, he received the SPIE Gold Medal in 1985 and the OSA Fraunhofer Medal in 2001.

COURSE PRICE INCLUDES the SPIE text PM145, *Modern Lens Design*, by Warren J. Smith (2nd edition, SPIE/McGraw-Hill, 2004).

Introduction to Optical Alignment Techniques

SC010

Course level: Introductory
CEU 1.30 $780 / $985 USD
Monday/Tuesday 8:30 am to 5:30 pm

See p. 176 for full course description.

Principles of Fourier Optics and Diffraction

SC017

FC

Course level: Intermediate
CEU .65 $515 / $600 USD
Tuesday 8:30 am to 5:30 pm

See p. 167 for full course description.

Optical Scattering: Measurement and Analysis

SC020

Course level: Intermediate
CEU .35 $285 / $330 USD
Sunday 1:30 to 5:30 pm

See p. 182 for full course description.

Optical Design Fundamentals for Infrared Systems

SC134

FC

Course level: Intermediate
CEU .65 $450 / $535 USD
Sunday 8:30 am to 5:30 pm

See p. 167 for full course description.

An Introduction to Lasers

SC325

FC

Course level: Introductory
CEU .35 $230 / $275 USD
Wednesday 1:30 to 5:30 pm

This course introduces the enabling technology of lasers to those having little to no prior knowledge. We use a minimum of mathematics, relying instead on simple pictures to explain the principles of laser action, laser modes, mode-locking, single-longitudinal mode operation (SLM), the MOPA (Master-Oscillator, Power-Amplifier), Q-switched operation, etc. We review the unusual features of laser light, namely the potential narrow-band properties and the ability to focus a laser beam to a very small and intense spot. The various laser types are discussed. Each topic is explained in simple terms with an emphasis on underlying physical principles and a minimum of mathematics. References and materials are identified.

LEARNING OUTCOMES

This course will enable you to:

- understand how feedback provides favoritism for certain modes
- understand how one configures both ring lasers and linear lasers
- learn of the various common gain media for laser action
- select the correct laser for your needs
- understand the processes of mode-locking and SLM operation
- appreciate how lenses concentrate laser beams
- understand issues of average power, peak power, energy, duration, etc.
- appreciate the large variety of lasers presently available.

INTENDED AUDIENCE

This material is intended for engineers, technicians, and managers who need a fundamental understanding of lasers and their applications.

INSTRUCTOR

Robert Fisher is the owner of RA Fisher Associates, and has been active in laser physics and in nonlinear optics for the last 35 years. He has taught graduate courses at the Univ. of California, Davis, and worked at both Lawrence Livermore National Lab. and Los Alamos National Lab. He is an SPIE Fellow and an OSA Fellow, and was a member of SPIE's Board of Directors.

The Design of Plastic Optical Systems

SC384

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 1:30 to 5:30 pm

See p. 177 for full course description.

Predicting, Modeling, and Interpreting Light Scattered by Surfaces

SC492

Course level: Intermediate
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

See p. 183 for full course description.

Exploring Optical Aberrations

SC560

Course level: Intermediate
CEU .65 $560 / $640 USD
Sunday 8:30 am to 5:30 pm

The quality of an optical system is determined by its aberrations. This course will explore the effect of aberrations on image quality. Starting with basic aberrations of optical systems, we will discuss how they affect central irradiance on a target, energy on a detector, and line of sight and resolution of a system. The importance of the use of Zernike polynomials in optical testing and design, spot diagrams in optical system analysis, and Strehl ratio for aberration tolerance will be covered. The chromatic aberrations will also be discussed.

LEARNING OUTCOMES

This course will enable you to:

- acquire a working knowledge of aberrations and their effect on energy on detector, line of sight error, and MTF
- specify fabrication tolerance based on Strehl ratio and Rayleigh's quarter wave rule
- specify fabrication and assembly errors based on a certain aberration tolerance
- understand the significance and use of Zernike polynomials in optical design and testing
- develop an effective working interface between system engineers/engineering managers and optical designers

INTENDED AUDIENCE

This course is intended for anyone interested in acquiring a working knowledge of aberrations. Those who have a background in lens and optical system design or optical testing will benefit from this course. Moreover, managers and system engineers will find this course helpful in communicating effectively with optical engineers and designers.

INSTRUCTOR

Virendra Mahajan is a graduate of the College of Optical Sciences, University of Arizona, where he is an adjunct professor. He has over 30 years of experience working on space optical systems, last 22 at The Aerospace Corporation. He is a Fellow of SPIE, Optical Society of America, and Optical Society of India, and the recipient of SPIE's 2006 Conrady Award. He is the author of *Aberration Theory Made Simple* (1991), the editor of *Selected Papers on Effects of Aberrations in Optical Imaging* (1993), and the author of *Optical Imaging and Aberrations, Part I: Ray Geometrical Optics* (1998) and *Part II: Wave Diffraction Optics* (2001), all published by the SPIE Press.

COURSE PRICE INCLUDES the texts *Aberration Theory Made Simple* and the two-volume set *Optical Imaging and Aberrations* (SPIE), both authored by the instructor.

Understanding Reflective Optical Design *Expanded!*

SC659

Course level: Intermediate
CEU .65 $410 / $495 USD
Monday 8:30 am to 5:30 pm

This course provides attendees with a working knowledge of reflective optical system design. The morning session concentrates on analytical differences from refractive systems, including basic 1st order layout considerations and optimization techniques. It provides an overview of the conceptual development of various reflective designs, and provides an understanding of the basic capabilities, advantages and disadvantages of many common reflective forms. The afternoon session offers insights into departing from symmetry, understanding aberration forms with off axis apertures, a discussion of segmented mirror systems, and a brief overview of I&T (integration and test) considerations and manufacturing techniques.

LEARNING OUTCOMES

This course will enable you to:

- develop and analyze the appropriate set of 1st order parameters for reflective systems
- identify the advantages and constraints of various common reflective forms
- define and evaluate analysis parameters unique to reflective system design
- trace the logical progression of reflective system from the single to multiple mirrors
- establish reasonable starting point layouts for 3 mirror design forms
- identify situations that may call for departing from symmetry in the design and understand the advantages and limitations of this technique
- recognize aberration forms in off-axis apertures and methods to mitigate them
- identify the basic advantages and constraints of designs with segmented mirrors
- develop strategies for integration and test of reflective architectures
- plan for basic manufacturing considerations

INTENDED AUDIENCE

This material is intended for anyone who needs to design or specify reflective optical systems, or who works with optical designers on a regular basis. A basic understanding of 1st order optics is helpful; a brief overview will be provided. No optical design experience is required, but a basic knowledge of optical aberrations will be assumed for the optical design specific discussions. The more in depth, design oriented portions of the course will include summary information valuable to engineers of other disciplines. Those who have either little optical design experience or just minimal reflective design experience will find this course especially valuable.

INSTRUCTOR

James Contreras is a principal optical engineer at Ball Aerospace and Technologies Corporation in Boulder, CO. He has extensive experience in the design, analysis and fabrication of reflective optical systems for a variety of applications, and is currently the lead optical design engineer at Ball for the James Webb Space Telescope.

Polarization in Optical Design

SC792

Course level: Intermediate
CEU .35 $230 / $275 USD
Sunday 8:30 am to 12:30 pm

This course provides a survey of issues associated with calculating polarization effects in optical systems using optical design programs. Many optical systems are polarization critical and require careful attention to polarization issues. Such systems include liquid crystal projectors, imaging with active laser illumination, very high numerical aperture optical systems in microlithography and data storage, DVD players, imaging into tissue and turbid media, optical coherence tomography, and interferometers.

Polarization effects are complex: retardance has three degrees of freedom, diattenuation (partial polarization) has three degrees of freedom, and depolarization, the coupling of polarized into partially polarized light, has nine degrees of freedom. Due to this complexity, polarization components and the polarization performance of optical systems are rarely completely specified.

The polarization aberrations introduced by thin films and uniaxial crystals can be readily evaluated in several commercial optical design codes. These routines are complex and most optical engineers are unfamiliar with the capabilities and the forms of output. But these polarization ray tracing routines provide better methods to communicate polarization performance and specifications between different groups teamed on complex optical problems. Better means of technical communication speed the development of complex systems.

LEARNING OUTCOMES

This course will enable you to:

- understand how to follow the polarization changes along a ray path through a series of lenses, mirrors, polarization elements and anisotropic materials
- learn to calculate the Jones matrices for ray paths through sequences of thin film coated optical elements and interpret the “instrumental polarization” or polarization aberrations associated with ray paths
- understand how polarization state dependent point spread functions and modulation transfer functions are calculated
- visualize the Maltese cross, linear polarization tilt, and other fundamental polarization aberration patterns which occur in many systems. Picture configurations like the crossed folding mirror which reduces polarization aberrations
- develop appropriate polarization specifications for optical systems

INTENDED AUDIENCE

This class is intended for optical engineers, scientists, and managers who need to understand and apply polarization concepts to optical systems. Some prior exposure to optical design programs and to linear algebra would be helpful.

INSTRUCTOR

Russell Chipman is a Professor of Optical Sciences at the University of Arizona, Tucson AZ. He runs the Polarization Laboratory which performs measurements and simulations of polarization elements, liquid crystals, and polarization aberrations. He managed optics departments at JDS Uniphase and Johnson and Johnson and was also a Physics professor at the University of Alabama in Huntsville. He has developed many unique spectropolarimeters and imaging polarimeters and conducted studies into polarization in fiber components, waveguides, liquid crystals, polarization elements, and natural polarization signatures. He holds twelve patents in optics. He received his BS from MIT and Ph. D. in Optical Science from the University of Arizona. Prof. Chipman is a Fellow and a former member of the Board of Directors of SPIE.

Practical Radiometry

SC798

Course level: Introductory
CEU .65 $410 / $495 USD
Sunday 8:30 am to 5:30 pm

See p. 168 for full course description.

Infrared Systems - Technology & Design

SC835

Course level: Intermediate
CEU 1.00 $840 / $965 USD
Tuesday/Wednesday 8:30 am to 5:30 pm/8:30 am to 12:30 pm

This course covers the range of topics necessary to understand the theoretical principles of modern infrared-technology. It combines numerous engineering disciplines necessary for the development of infrared systems. Practical engineering calculations are highlighted, with examples of trade studies illustrating the interrelationships among the various hardware characteristics.

This course is comprised of four sections:

Section 1 introduces the geometrical optics concepts including image formation, stops and pupils, thick lenses and lens combinations, image quality, and the properties of infrared materials.

Section 2 covers the essentials of radiometry necessary for the quantitative understanding of infrared signatures and flux transfer. These concepts are then developed and applied to flux-transfer calculations for blackbody, graybody, and selective radiator sources. Remote temperature calibrations and measurements are then used as an illustration of these radiometric principles.

Section 3 is devoted to fundamental background issues for optical detection-processes. It compares the characteristics of cooled and uncooled detectors with an emphasis on spectral and blackbody responsivity, detectivity (D*), as well as the noise mechanisms related to optical detection. The detector parameters and capabilities of single detectors and third generation focal plane arrays (FPAs) are analyzed.

With this acquired background, Section 4 considers the systems-design aspects of infrared imagers. The impact of scan format on signal-to-noise ratio is described, and the engineering tradeoffs inherent in the development of infrared search and track (IRST) systems are explained. Figures of merit such as MTF, NETD, and MRTD of staring arrays are examined for the performance metrics of thermal sensitivity and spatial resolution of thermal imaging systems (TIS). Contrast threshold functions based on Johnson and visible cycles (often denoted as N- and V-cycles) are specified. The interrelationships among the design parameters are identified through trade-study examples.

LEARNING OUTCOMES

This course will enable you to:

- learn the principles and fundamentals of infrared optical design
- choose the proper infrared materials suite for your applications
- quickly execute flux-transfer calculations
- calibrate infrared sources and target signatures
- recognize the importance of background in thermal signatures
- have an appreciation for the capacity of infrared systems and learn the interaction of its critical components (optics, detectors, and electronics) in the production of a final infrared image
- assess the influence of noise mechanisms related to optical detection
- comprehend the fundamental response mechanisms and differences between cooled and uncooled single detectors as well as focal plane arrays (FPAs)
- comprehend the central theory behind third generation infrared imagers
- define and use common descriptors for detector and system performance (R, D*, NEP, NEI, MTF, NETD, and MRTD)
- estimate system performance given subsystem and component specifications
- apply design tradeoffs in both infrared search and track systems (IRST) and thermal-imaging systems (TIS)
- carry out the preliminary design of infrared systems for different thermal applications

INTENDED AUDIENCE

This course is directed to the practicing engineers and/or scientists who require both theoretical and effective practical technical information to design, build, and/or test infrared systems in a wide variety of thermal applications. A background at the bachelor's level in engineering is highly recommended. The participant should also have ample understanding of Fourier analysis and random processes.

INSTRUCTOR

Arnold Daniels is a senior engineer with extensive experience in the development of advanced optical and electro-optical systems. His areas of expertise include applications for infrared search & track and thermal imaging systems, infrared radiometry testing and measurements, thermographic nondestructive testing, Fourier analysis, image processing, data acquisition systems, precision optical alignment, and adaptive optics. He earned an M.S. in Electrical Engineering from the University of Tel-Aviv and received a doctoral degree in Electro-Optics from the school of Optics (CREOL) at the University of Central Florida. In 1995 he received the Rudolf Kingslake medal and prizefor the most noteworthy original paper to appear in SPIE's Journal of Optical Engineering. He is presently developing aerospace systems for network centric operations and defense applications at Boeing-SVS.

COURSE PRICE INCLUDES the *SPIE Field Guide to Infrared Systems Design* by Arnold Daniels (2006, SPIE), and *Infrared Detectors and Systems*, by Eustace L. Dereniak and Glenn D. Boreman (Wiley, 1996.)

Introduction to Wave Optics

SC849 ***New!***

Course level: Introductory
CEU .35 $250 / $295 USD
Sunday 1:30 to 5:30 pm

Knowledge of wave optics is required to understand many important optical phenomena and also the working of numerous optical devices. The course will start with Huygens principle, followed by interference and diffraction of light waves. Many interesting and practical examples like antireflection coatings, fiber Bragg gratings, diffraction spreading of laser beams and holography will be discussed. The polarization characteristics of an optical beam along with its applications will also be covered.

LEARNING OUTCOMES

This course will enable you to:

- acquire the basic concepts of wave optics
- describe how light can constructively and destructively interfere
- explain why a light beam spreads out after passing through an aperture
- summarize the polarization characteristics of electromagnetic waves
- appreciate the operation of many modern optical devices that utilize wave optics

INTENDED AUDIENCE

Engineers, managers, marketing professionals, or exhibitors & sales staff who are starting out in the field, or are interested in broadening their technical expertise. The only prerequisite is school level trigonometry.

INSTRUCTOR

Ajoy Ghatak has been teaching applied optics, fiber optics and other related areas at IIT Delhi for the last 35 years. He has authored several books including the text *OPTICS* (Tata/McGraw-Hill, 2005) and a coauthored text, *Introduction To Fiber Optics* (Cambridge University Press, 2004). He received the 2003 Optical Society of America Esther Hoffman Beller award in recognition of his outstanding contributions to optical science and engineering education.

COURSE PRICE INCLUDES the text OPTICS (Tata/McGraw-Hill, 2005) by the instructor.

Optical Manufacturing and Testing

Thin Film Optical Coatings

SC321 FC

Course level: Intermediate
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

See p. 184 for full course description.

The Design of Plastic Optical Systems

SC384

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 1:30 to 5:30 pm

See p. 177 for full course description.

Aspheric Optics: Design, Fabrication, and Test

SC552

Course level: Introductory
CEU .35 $305 / $350 USD
Wednesday 1:30 to 5:30 pm

See p. 177 for full course description.

Cost-Conscious Tolerancing of Optical Systems

SC720

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 1:30 to 5:30 pm

The purpose of this course is to present concepts, tools, and methods that will help attendees determine optimal tolerances for optical systems. Topics in the course apply to all volumes of systems being developed - from single systems to millions of units. The course provides a background to effective tolerancing with discussions on variability and relevant applied statistics. Tolerance analysis and assignment with strong methodology is then covered. The course concludes by giving an introduction to useful tools including design of experiments and statistical process control. References and examples are included to help practicing researchers, designers, engineers, and technicians practically apply the concepts to plan, design, engineer, and build high-quality cost-competitive optical systems.

LEARNING OUTCOMES

This course will enable you to:

- define variability and comprehend its impact on nominal systems
- understand and utilize fundamental applied statistics
- construct tolerance analysis budgets
- perform detailed tolerance analysis
- explain repeatability and reproducibility
- summarize different design of experiment and statistical process control strategies

INTENDED AUDIENCE

This material is intended for managers, engineers, and technical staff involved in product design from concept through manufacturing.

INSTRUCTOR

Richard Youngworth is an optical engineer at Ball Aerospace & Technologies Corp. in Boulder, Colorado. He has a B.S. in electrical engineering from the University of Colorado at Boulder and earned his Ph.D. in Optics at the University of Rochester by researching tolerance analysis of optical systems.

Fundamentals of Single Point Diamond Turning

SC848 ***New!***

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 1:30 to 5:30 pm

This course provides attendees with a basic working knowledge of single point diamond turning of optical components. The course covers a wide range of topics and should provide the attendee with an understanding of the process capabilities of this technology. Key subject matter includes; equipment, processes, cutting mechanics, material selection, fixturing, metrology, applications, component design, optical tolerancing, and producibility.

LEARNING OUTCOMES

This course will enable you to:

- gain valuable insight into process capabilities
- make informed decisions with regards to material selections and part geometries
- properly specify and tolerance component drawings
- identify cost and producibility drivers
- understand the current state-of-the-art in diamond turning technology

INTENDED AUDIENCE

This material is intended for anyone who designs, fabricates, or procures, single-point diamond turned components and wishes to gain valuable insight into the overall fabrication process for the purpose of making better decisions.

INSTRUCTOR

John Schaefer is a Sr. Principal Process Engineer for ELCAN Optical Technologies, a Raytheon Company, and has more than 20 years of hands-on experience in single point diamond turning. He has extensive experience in process development, concurrent engineering, productionization, interferometry, asphere metrology, and equipment specification and procurement.

Metrology for Modern Optical Manufacturing

SC850 ***New!***

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

This course provides attendees with a broad overview of optical surface metrology, with a focus on how to choose tools and techniques to support modern optical manufacturing processes. First we will review metrology principles and definitions of measurement capability (e.g. accuracy, lateral resolution, etc.). After establishing this basic language, we will discuss the metrology challenges that modern optical applications present (e.g. greater aperture sizes, improved accuracy specifications, and more complex shapes such as aspheres and free-forms).

We will next compare the capabilities and limitations of various tools for the measurement of figure, mid-spatial frequencies, and finish (e.g. Fizeau interferometers, stylus profilometry, interference microscopes, various null tests for aspheres). Examples of "real" data from some measurement tools will be provided. Finally we will review how to identify measurement performance limitations, and techniques for extending capability such as error calibration, averaging, and subaperture stitching.

LEARNING OUTCOMES

This course will enable you to:

- summarize various steps and challenges in fabricating optics for "modern" applications
- define key performance characteristics of a measurement
- distinguish between the various commercially-available metrology technologies
- compare which metrology tools and techniques are appropriate for different manufacturing processes and surface specifications
- understand the advantages and limitations of today's metrology technologies, particularly in regard to asphere/freeform testing and various steps of the manufacturing process
- select the metrology approach most suited to your production needs

INTENDED AUDIENCE

This material is intended for engineers, optical designers, technicians, QC inspectors and managers who want an overview of surface metrology principles and methods. It will be of particular use to those looking to understand the limitations of their measurement tools, as well as the challenges associated with measuring surfaces manufactured with modern methods (such as aspheres).

INSTRUCTOR

Paul Murphy is Optical Engineering Manager at QED Technologies, where he has developed advanced products and processes for optical manufacturing and metrology. He received his Ph.D. in interferometric non-null asphere testing from The Institute of Optics at the University of Rochester, and guest lectures on optical metrology for their graduate-level instrumental optics course.

Advanced Metrology

Principles of Fourier Optics and Diffraction

SC017 FC

Course level: Intermediate
CEU .65 $515 / $600 USD
Tuesday 8:30 am to 5:30 pm

See p. 167 for full course description.

Optical Scattering: Measurement and Analysis

SC020 VT

Course level: Intermediate
CEU .35 $285 / $330 USD
Sunday 1:30 to 5:30 pm

Optical scatter can be used as a sensitive indicator of surface and bulk defects in many processes. In its various quantitative forms (BRDF, TIS, DSC), it has been used to calculate and map component parameters such as surface texture statistics, particle size, stray radiation and surface appearance. Originally used almost exclusively in the optics industry, it is now finding use as a source of fast, non-contact metrology in a variety of industries where defect-free surfaces are important (defense optics, semiconductors, computer disks, flat panel displays, and surface appearance). The use of scattering standards in the semiconductor industry has become much more important over the last ten years and SEMI has introduced a suite of written standards that are useful across many industries. The course emphasizes quantifying, understanding and measuring scatter. Modeling scatter is emphasized in SC492 taught by Thomas Germer.

LEARNING OUTCOMES

This course will enable you to:

- quantify and analyze scatter in terms of BRDF, TIS and DSC units
- convert from scatter units to roughness statistics and understand when it is appropriate
- understand and overcome the various difficulties in comparing roughness statistics found from profilometers and scatterometers for both one- and two- dimensional samples
- understand the process of obtaining scatter data and evaluate system calibration
- evaluate the use of scatter measurement for specific applications such as: stray system radiation, surface micro-roughness, particulate sizing, background sensor noise
- understand the use of polystyrene latex sphere depositions as a scattering standard
- understand the suite of SEMI standards now going into place in the semiconductor industry

INTENDED AUDIENCE

Engineers, scientists, and managers who need to understand and apply the basic concepts of scatter metrology to laboratory research and industrial process control. Some knowledge of calculus is helpful, but the course does not require that the student follow mathematical derivations.

The instructor has designed the course to complement SC492, working in conjunction with SC492's instructor Thomas Germer to coordinate the material.

INSTRUCTOR

John Stover is President of The Scatter Works, Inc., a Tucson firm that concentrates on scatter based metrology standards, consulting, and measurement services as they apply to applications in diverse industries. He has a Ph.D. from Purdue University in Electrical Engineering and has researched light scatter related problems for over 30 years in varied industrial and academic settings. His past accomplishments include leading a team of engineers at TMA Technologies as they developed state-of-the-art scatterometers and verified the theoretical relationship between surface roughness and scatter. He led a semiconductor industry team dedicated to comparing scatter models and measurements of surface defects to improve wafer metrology. He has been active with international standards organizations for over 20 years and currently leads a SEMI Task Force in automatic surface inspection. A SPIE Fellow, Dr. Stover has been active for many years as an author, conference chairman, and editor, and has over one hundred publications.

COURSE PRICE INCLUDES the text Optical Scattering: Measurement and Analysis, 2nd Edition (SPIE, 1995), by John Stover.

Predicting, Modeling, and Interpreting Light Scattered by Surfaces

SC492

Course level: Intermediate
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

The measurement of light scattered by surfaces can be used to locate and identify roughness, particulates, and defects on a wide variety of materials. Applications include the inspection of silicon wafers, optics, and storage media, characterization of thin film roughness, identification of objects in remote sensing, and prediction of optical system performance. The aim of this course is to provide tools to engineers and scientists to enable them to predict scattering for different sources, differentiate amongst different scattering sources, and to design instrumentation that maximizes sensitivity or differentiation amongst scattering sources for their specific application. Emphasis will be placed on the use of the SCATMECH library of scattering codes and the Modeled Integrated Scatter Tool (MIST) in order to minimize the mathematics that can often be a barrier to those who would otherwise be interested in using optical scatter. The measurement of scatter is emphasized in SC020 taught by John Stover.

LEARNING OUTCOMES

This course will enable you to:

- quantify scatter in terms of intensity and polarization properties
- identify likely sources of scatter from a material or thin film
- predict scatter from specific scatter sources: roughness, particles, and subsurface defects
- design experiments that differentiate among scattering sources
- use MIST to evaluate or visualize optical scatter in a variety of applications.
- define the limitations of light scattering

INTENDED AUDIENCE

This course is intended for scientists and engineers who are interested in modeling, predicting, and interpreting light scatter from surfaces for material inspection, optical design, or remote sensing applications.

The instructor has designed the course to complement SC020, working in conjunction with SC020's instructor John Stover to coordinate the material.

INSTRUCTOR

Thomas Germer is a physicist specializing in optical scattering in the Optical Technology Division at the National Institute of Standards and Technology in Gaithersburg, Maryland. He has published over sixty technical papers and has developed the SCATMECH library of polarized light scattering codes, and the associated MIST program.

Attendees will be provided with a CD-ROM containing the public domain SCATMECH library, the MIST program, and all of the example programs discussed in the class.

Introduction to Interferometric Optical Testing

SC213 CD

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

This short course introduces the field of interferometric optical testing. Topics covered include basic interferometers for optical testing, and concepts of phase-shifting interferometry including error analysis. Long wavelength interferometry, testing of aspheric surfaces, measurement of surface microstructure, and the state-of-the-art of direct phase measurement interferometers are also discussed.

LEARNING OUTCOMES

This course will enable you to:

- Explain the basic concepts of interferometric optical testing
- Appreciate the power, capabilities, and limitations of phase-shifting interferometry
- Understand techniques, advantages, and disadvantages of long-wavelength interferometry
- Compare different aspheric testing techniques
- Understand capabilities and techniques for measuring surface microstructure
- Describe the current state-of-the-art of direct phase measurement interferometers

INTENDED AUDIENCE

Engineers, scientists, and managers who need to understand the basic concepts of interferometric optical testing.

INSTRUCTOR

James Wyant is Dean of the College of Optical Sciences and Professor of Optical Sciences at the University of Arizona. He was a founder of the WYKO Corporation and served as its president from 1984 to 1997. Dr. Wyant was the 1986 President of SPIE.

Practical Interferometry and Fringe Analysis

SC211

Course level: Intermediate
CEU .35 $230 / $275 USD
Wednesday 8:30 am to 12:30 pm

You've no doubt heard of interferometric testing and all the wonderful things it can do to solve your measurement problems. You may have attended an introduction to interferometry or been shopping for an instrument. But how do you get started? How do you determine which type of interferometer will solve your problem? Do you make your own or buy a commercial instrument? Once you've got an instrument how can you be sure you aligned it correctly and are getting the best data you can for your measurement problem?

This intermediate-level course offers an overview of the fundamentals of interferometric testing and the analysis of interferometric fringe patterns applicable to many different areas of interferometry, optical testing, nondestructive testing, and metrology. It is geared towards technically minded types who have had some exposure to the basics of interferometry and want to find out more about the practical nuts and bolts of using interferometry as a tool. We will begin with an overview of the basic fundamentals of interferometry including formation of interference fringes for different types of sources, fringe visibility and how fringes relate to basic properties of the object being tested. We then will cover common interferometer types and phase modulation techniques, essentials for creating, detecting and digitizing fringes, alignment and environmental considerations and calibration.

Throughout this course real-world problems will be used as examples. The second half of the class will focus on these same questions from the aspect of fringe analysis techniques. We will outline the basic techniques and then brainstorm how you determine whether you got good data and how you would begin if you were analyzing your own raw fringe data. During this discussion common pitfalls and sources of errors will be pointed out to help streamline your process of getting up and running to take your own measurements. Attendees are encouraged to bring along their real-world problems and offer them as starting points for our discussion.

LEARNING OUTCOMES

This course will enable you to:

- understand the basic components of monochromatic, narrowband and white light interferometers
- ensure that you are choosing the right type of interferometer for your application
- list the necessary steps to set up an interferometer and take a measurement
- differentiate the pros and cons of various measurement and analysis techniques
- evaluate the tradeoffs between techniques
- outline simple tests to determine if you are getting good measurements
- help you decide which technique is best for a particular application

INTENDED AUDIENCE

This course is for engineers working with optical interferometry, optical testing, surface metrology, experimental mechanics, nondestructive testing, and Moire grating techniques. It will be assumed that attendees have a basic knowledge of geometrical optics and interferometry.

INSTRUCTOR

Katherine Creath is a Research Professor of Optical Sciences and Medicine at the University of Arizona and an internationally recognized expert consulting in optical testing, metrology and system design. She has more than 20 years of experience in interferometry and optical testing and is a Fellow of SPIE and OSA.

Metrology for Modern Optical Manufacturing

SC850 ***New!***

Course level: Introductory
CEU .35 $230 / $275 USD
Monday 8:30 am to 12:30 pm

This course provides attendees with a broad overview of optical surface metrology, with a focus on how to choose tools and techniques to support modern optical manufacturing processes. First we will review metrology principles and definitions of measurement capability (e.g. accuracy, lateral resolution, etc.). After establishing this basic language, we will discuss the metrology challenges that modern optical applications present (e.g. greater aperture sizes, improved accuracy specifications, and more complex shapes such as aspheres and free-forms).

We will next compare the capabilities and limitations of various tools for the measurement of figure, mid-spatial frequencies, and finish (e.g. Fizeau interferometers, stylus profilometry, interference microscopes, various null tests for aspheres). Examples of "real" data from some measurement tools will be provided. Finally we will review how to identify measurement performance limitations, and techniques for extending capability such as error calibration, averaging, and subaperture stitching.

LEARNING OUTCOMES

This course will enable you to:

- summarize various steps and challenges in fabricating optics for "modern" applications
- define key performance characteristics of a measurement
- distinguish between the various commercially-available metrology technologies
- compare which metrology tools and techniques are appropriate for different manufacturing processes and surface specifications
- understand the advantages and limitations of today's metrology technologies, particularly in regard to asphere/freeform testing and various steps of the manufacturing process
- select the metrology approach most suited to your production needs

INTENDED AUDIENCE

This material is intended for engineers, optical designers, technicians, QC inspectors and managers who want an overview of surface metrology principles and methods. It will be of particular use to those looking to understand the limitations of their measurement tools, as well as the challenges associated with measuring surfaces manufactured with modern methods (such as aspheres).

INSTRUCTOR

Paul Murphy is Optical Engineering Manager at QED Technologies, where he has developed advanced products and processes for optical manufacturing and metrology. He received his Ph.D. in interferometric non-null asphere testing from The Institute of Optics at the University of Rochester, and guest lectures on optical metrology for their graduate-level instrumental optics course.

Thin Films

Thin Film Optical Coatings

SC321 FC

Course level: Intermediate
CEU .65 $410 / $495 USD
Tuesday 8:30 am to 5:30 pm

Virtually no modern optical system could operate without optical coatings. Much of any optical system consists of a series of coated and shaped surfaces. The shape determines the power of the surface but it is the coating that determines the specular properties, the amount of light transmitted or reflected, the phase change, the emittance, the color, the polarization, the retardation, including even the mechanical properties. Optical coatings consist of assemblies of thin films of materials where interference properties combine with the intrinsic properties of the materials to yield the desired optical performance. They act to reduce the reflectance losses of lenses, increase the reflectance of mirrors, reduce glare and electromagnetic emission from display systems, improve the thermal insulation of buildings, protect eyes from laser radiation, analyze gases, act as anticounterfeiting devices on banknotes, multiplex or demultiplex communication signals, separate or combine color channels in display projectors, and these are just a few of their roles. This course emphasizes understanding and takes students from fundamentals to techniques for design and manufacture.

LEARNING OUTCOMES

This course will enable you to:

- understand the basic principles of optical interference coatings
- perform many rapid design calculations and assessments without needing a computer
- speak knowledgeably about the parameters that characterize optical coatings
- design simple coatings given a suitably equipped computer
- know the advantages and disadvantages of the basic processes for the production of these filters
- understand the influence of errors in monitoring and estimate tolerances in production.

INTENDED AUDIENCE

Anyone who is or wishes to become involved in the manufacture or use of optical coatings or who wants to know more about this rapidly growing and important field. The level is appropriate for someone who has completed high school mathematics and/or science.

INSTRUCTOR

H. Angus Macleod is President of Thin Film Center, a software, training and consulting company in optical coatings, and is Professor Emeritus of Optical Sciences at the University of Arizona. He has been deeply involved in optical coatings for close to forty years.

Applications

An Introduction to Lasers

SC325

Course level: Introductory
CEU .35 $230 / $275 USD
Wednesday 1:30 to 5:30 pm

This course introduces the enabling technology of lasers to those having little to no prior knowledge. We use a minimum of mathematics, relying instead on simple pictures to explain the principles of laser action, laser modes, mode-locking, single-longitudinal mode operation (SLM), the MOPA (Master-Oscillator, Power-Amplifier), Q-switched operation, etc. We review the unusual features of laser light, namely the potential narrow-band properties and the ability to focus a laser beam to a very small and intense spot. The various laser types are discussed. Each topic is explained in simple terms with an emphasis on underlying physical principles and a minimum of mathematics. References and materials are identified.

LEARNING OUTCOMES

This course will enable you to:

- understand how feedback provides favoritism for certain modes
- understand how one configures both ring lasers and linear lasers
- learn of the various common gain media for laser action
- select the correct laser for your needs
- understand the processes of mode-locking and SLM operation
- appreciate how lenses concentrate laser beams
- understand issues of average power, peak power, energy, duration, etc.
- appreciate the large variety of lasers presently available.

INTENDED AUDIENCE

This material is intended for engineers, technicians, and managers who need a fundamental understanding of lasers and their applications.

INSTRUCTOR

Robert Fisher is the owner of RA Fisher Associates, and has been active in laser physics and in nonlinear optics for the last 35 years. He has taught graduate courses at the Univ. of California, Davis, and worked at both Lawrence Livermore National Lab. and Los Alamos National Lab. He is an SPIE Fellow and an OSA Fellow, and was a member of SPIE's Board of Directors.

Aspheric Optics: Design, Fabrication, and Test

SC552

Course level: Introductory
CEU .35 $305 / $350 USD
Wednesday 1:30 to 5:30 pm

See p. 177 for full course description.

The Business Side

How to Start a Small High Tech Business Almost Anywhere

WS756

Course level: Introductory
CEU .35 $230 / $275 USD
Thursday 8:30 am to 12:30 pm

This course focuses on the elements that can minimize investment capital and the time needed to set up a viable and vibrant small business with growth potential. For individuals contemplating or engaged in starting a small business, understanding the process can literally be the difference between success and failure.

It is possible to set up such an entity within a large company, where one or a handful of individuals can grow new ideas and technology into high tech products that can have a significant impact on the competitiveness of the company.

The course provides an overview of the skills necessary to operate a successful high tech business within a large organization, and points out how these skills can form the basis for developing small high tech businesses as spin-offs or standalone entities. It also addresses the steps needed to start a small high tech business, even under less-than-ideal conditions.

Elements to be considered include: motivation; start up planning; types of organizations that can be operated; and the set up of structures that will greatly aid success. Crucial topics such as consulting, small business contracts, subcontracts, intellectual property, licensing, product development, long term planning, and mergers/acquisitions will be reviewed.

LEARNING OUTCOMES

This course will enable you to:

- identify specific skills that can have high payoff for individuals establishing high tech operations, and discuss ways to hone these skills
- describe the advantages and pitfalls associated with operating a small high tech business
- list the series of steps necessary for starting a small high tech business (i.e., decision to leave a job, vision for the new company, funding, the type of organization to be formed, a strategic and tactical plan, an operational plan, marketing)
- discuss intellectual property and how to minimize the cost of acquiring and developing an effective patent base, as well as how to offset some costs by licensing/joint ventures
- study examples of small companies that establish leverage to develop relationships with other organizations
- outline some of the issues that a small business may face during a merger or acquisition

INTENDED AUDIENCE

Engineers, scientists, technicians and managers in both large and small organizations can benefit from this course. People from large organizations will benefit from developing skills that can make their own organizations more cost effective and efficient, as well as understanding the advantages and disadvantages of having small businesses as partners.

INSTRUCTOR

Eric Udd is President of Columbia Gorge Research, LLC. He worked at McDonnell Douglas from 1977 to 1993 as an Engineer/Scientist, Unit Chief, Manager and McDonnell Douglas Fellow, building a fiber optic sensor program that grew to a large organization-wide effort. In 1993 he left McDonnell Douglas to found Blue Road Research in Troutdale, Oregon, where he now serves as Vice President of Technology. He founded Columbia Gorge Research, LLC in 2004 as his second company and plans to "retire into it". Eric Udd has taught many courses for SPIE, UCLA Extension, OSA, Sensors Expo and other organizations. He has chaired approximately 30 international conferences, holds over 40 issued patents, has written approximately 150 papers, edited two books on fiber sensors, and is a Fellow of the SPIE. Mr. Udd is currently working on a book titled "How to Start a Small High Tech Business in Troutdale, Oregon!?!"

Professional Development

Off the Beaten Path: Career Opportunities for Engineers in the Patent Boom (Law Degree Not Required)

WS827

Course level: Introductory
CEU .35 $230 / $275 USD
Tuesday 1:30 to 5:30 pm

Looking for a position where you are exposed to cutting edge technology, while at the same time not becoming pigeon-holed into a specific technological field, never to return? A position in the ever-growing field of intellectual property (IP) support might be for you. Law firms, businesses, and government entities are hiring engineers as never before due to the explosion in the number of patent filings over the last decade.

This course will skim over the patent basics only to the extent necessary to indoctrinate those having no background in the area. Next, you will be guided to the places of opportunity - law firms, in-house corporate, and the United States Patent and Trademark Office - and provided with job descriptions for each. Finally, and most importantly, you will learn how to get the job you want from actual practitioners in the field. These insiders will provide you with the tips you need to get around the "outside-looking-in" barrier that keeps most people out.

LEARNING OUTCOMES

This course will enable you to:

- gain an understanding of the basics of the patent and IP field
- learn about the different types of jobs and the specific opportunities available
- avoid common obstacles and barriers to entry
- develop a winning strategy to secure a career in this rapidly growing industry
- get direct advice from current professionals in the patent and IP support field

INTENDED AUDIENCE

Anyone who has interest in employment in the field of patents. This course intends to expose engineers, scientists, and others to opportunities outside the realm of the typical science / technology career track. Practicing engineers, students and early-career professionals, corporate executives, and others may have interest.

INSTRUCTOR

Marshall Honeyman is a patent attorney in Kansas City, Missouri where he is Of Counsel to the law firm of Lathrop and Gage, L.C. Earlier, he worked in the U.S. Patent and Trademark Office (USPTO) as an Associate Solicitor, handling law suits brought against the USPTO as well as handling appeals to the Court of Appeals for the Federal Circuit. Before that, Marshall served as a USPTO Patent Examiner, specializing in the examination of inventions relating to illumination technologies.

Hands-On Optics: Making an Impact with Light (HOO): Terrific Telescopes Work

WS852

Course level: Introductory
CEU .30 $20 / $25 USD
Monday 2:00 to 5:00 pm

This workshop will train attendees on the use of Terrific Telescopes, a hands-on activity kit intended to engage and enrich the math/science learning experience for students in the middle grades. It was developed as part of HOO, a four year program funded by a $1.7 million dollar grant from the U.S. National Science Foundation (NSF) to design and implement a science enrichment program for children ages 11 to 14 years old.

LEARNING OUTCOMES

This course will enable you to:

- describe the basic concepts presented in the HOO module "Terrific Telescopes"
- list the materials included in the "Terrific Telescopes" kit and those that must be supplied by the educator for presentation of the module
- explain basic laser safety as it relates to the materials and activities included in the "Terrific Telescopes" module
- utilize the manual provided to conduct teacher-led demonstrations showing how light behaves
- assess student understanding of the concepts presented

INTENDED AUDIENCE

Optics professionals, university students, and pre-college teachers.

INSTRUCTORS

Connie Walker earned her Ph.D. in Astronomy from the University of Arizona and is Senior Science Education Specialist and Astronomer at the National Optical Astronomy Observatory in Tucson, AZ. She is part of a team responsible for the development and implementation of programs and workshops that train and partner pre-college teachers and community educators with professional and amateur astronomers. These programs involve students and their families in hands-on, inquiry-based activities in astronomy and science. She was instrumental in developing six modules plus the Terrific Telescope kit for Hands-On Optics.

Robert Sparks earned an M.S. in Physics from Michigan State University and is a Science Education Specialist at the National Optical Astronomy Observatory in Tucson, AZ. He taught high school physics, math and astronomy for 11 years before joining the HOO Team. He has been revising the HOO modules, planning and delivering HOO professional development workshops, and working on the development of new modules.

This workshop is **free**. **You must register to attend.**

Basic Optics for Non-Optics Personnel

WS609

Course level: Introductory
CEU .20 $50 / $100 USD
Wednesday 8:30 to 11:00 am

This course will provide the technical manager, sales engineering, marketing staff, or other non-optics personnel with a basic understanding of the terms, specifications, and measurements used in optical technology to facilitate effective communication with optics professionals on a functional level. Topics to be covered include basic concepts such as interference, diffraction, polarization and aberrations, definitions relating to color and optical quality, and an overview of the basic measures of optical performance such as MTF and wavefront error. The material will be presented with a minimal amount of math, rather emphasising working concepts, definitions, rules of thumb, and visual interpretation of specifications. Specific applications will include defining basic imaging needs such as magnification and depth-of-field, understanding MTF curves and interferograms, and interpreting radiometric terms.

LEARNING OUTCOMES

This course will enable you to:

- Read and understand optical system descriptions and papers
- Ask the right questions about optical component performance
- Understand basic optical specifications for lenses, filters, and other components
- Select the right off-the-shelf lenses, filters, and beam directing optics
- Interpret optical data such as interferogram, MTF and aberration reports

INTENDED AUDIENCE

This course is intended for the non-optical professional who needs to understand basic optics and interface with optics professionals.

INSTRUCTOR

Kevin Harding has been active in the optics industry for over 25 years, and has taught machine vision and optical inspection methods for over 20 years in over 70 workshops and tutorials, including engineering workshops on machine vision, metrology, NDT, and interferometry used by vendors and system houses to train their own engineers. He has been recognized for his leadership in machine vision by the Society of Manufacturing Engineers, Automated Imaging Association, and Engineering Society of Detroit.

The Craft of Scientific Presentations: A Workshop on Technical Presentations

WS667

Course level: Introductory
CEU .35 $75 / $125 USD
Wednesday 8:30 am to 12:30 pm

This course provides attendees with an overview of what distinguishes the best scientific presentations. The course introduces a new design for presentation slides that is both more memorable and persuasive from what is typically shown at conferences.

LEARNING OUTCOMES

This course will enable you to:

- account for the audience, purpose, and occasion in a presentation,
- logically structure the introduction, middle, and ending of a scientific presentation,
- create a memorable and persuasive set of presentation slides, and
- deliver a presentation with more confidence.

INTENDED AUDIENCE

This material is intended for anyone who needs to present scientific research. Those who either have not yet presented or have made several presentations will find this course valuable.

INSTRUCTOR

Kathryn Krages AMLS, MA, holds degrees in library science and journalism. Assistant professor of medical informatics & clinical epidemiology at Oregon Health & Science University in Portland, she teaches a scientific writing and communication course to OHSU graduate students, both on campus and via the Internet. Ms. Krages has more than 15 years' experience as a grant writer. Additionally, she has edited evidence-based medicine reviews for the Oregon Evidence-based Practice Center, a federally-funded research center at OHSU, and served as editorial manager of the journal Medical Decision Making under two editors-in-chief.

COURSE PRICE INCLUDES the text *The Craft of Scientific Presentations* by the instructor. This workshop is **free** to SPIE Student Members. **You must register to attend.**

The Craft of Scientific Writing: A Workshop on Technical Writing

WS668

Course level: Introductory
CEU .35 $75 / $125 USD
Wednesday 1:30 to 5:30 pm

This course provides an overview on writing a scientific paper. The course focuses on the structure, language, and illustration of scientific papers.

LEARNING OUTCOMES

This course will enable you to:

- account for the audience, purpose, and occasion in a scientific paper,
- logically structure the introduction, middle, and ending of a scientific paper,
- understand how to make your language clear, energetic, and fluid, and
- avoid the most common mechanical errors in scientific writing.

INTENDED AUDIENCE

This material is intended for anyone who needs to write about scientific research. Those who either have not yet written a paper or have written several papers will find this course valuable.

INSTRUCTOR

Kathryn Krages AMLS, MA, holds degrees in library science and journalism. Assistant professor of medical informatics & clinical epidemiology at Oregon Health & Science University in Portland, she teaches a scientific writing and communication course to OHSU graduate students, both on campus and via the Internet. Ms. Krages has more than 15 years' experience as a grant writer. Additionally, she has edited evidence-based medicine reviews for the Oregon Evidence-based Practice Center, a federally-funded research center at OHSU, and served as editorial manager of the journal Medical Decision Making under two editors-in-chief.

COURSE PRICE INCLUDES the text *The Craft of Scientific Writing* by the instructor. This workshop is **free** to SPIE Student Members. **You must register to attend.**

Optimizing Your Resume

WS777

Course level: Introductory
CEU .20 $50 / $100 USD
Monday 1:30 to 3:30 pm

Today's job market pits you against hundreds, if not thousands, of candidates who have approximately the same credentials as you do. How do you stand out in the crowd? This workshop, which concentrates on students and recent graduates, will review a number of strategies, tips, and tools that you can use to increase the impact of your resume and cover letter. We'll examine ways to translate your educational experience into a format that is attractive to potential employers, and how to create tailored versions of your job search materials for multiple targets. The process of creating your resume will be discussed, with a focus on both layout/formatting and writing style. We'll also look at cover letters, lists of references, and other materials used in your job search.

LEARNING OUTCOMES

This course will enable you to:

- translate your educational and work experience into a focused and effective resume
- avoid common mistakes and misconceptions
- learn how HR and hiring managers typically review resumes
- tailor your resume and cover letter for multiple job targets
- choose an effective layout and format to ensure maximum impact

INTENDED AUDIENCE

This material is intended primarily for students, recent graduates, and early-career professionals who want to improve the quality and effectiveness of their job search materials.

INSTRUCTOR

John Cain is a former professional resume writer, and has written more than 500 resumes and cover letters for multiple industries and professions, focusing primarily on technical fields. He currently develops technical education programs for SPIE.

*This workshop is free to SPIE student members, but **you must register to attend**.*

Essential Skills for Engineering Project Leaders

WS846

Course level: Introductory
CEU .35 $90 / $115 USD
Wednesday 1:30 to 5:30 pm

This workshop teaches skills needed to lead technical projects, drive innovation, and influence others. Attendees learn the difference between leadership and management, and how to develop specific leadership skills that are important to technical professionals who lead projects or need assistance from others to get things done. Participants engage in exercises that assess their individual leadership abilities and provide guidance for further skill development.

LEARNING OUTCOMES

This course will enable you to:

- ∑ become more influential
- ∑ improve your ability to effectively lead projects and teams
- ∑ identify leadership development goals specific to your individual needs
- ∑ get more support for ideas that will benefit your company
- ∑ build rapport with your boss and your peers

INTENDED AUDIENCE

This material is intended for early-career technical professionals who can benefit from improving leadership skills. The course is tailored for engineers and other technical professionals through the use of real-world case studies, exercises and examples pertaining to the experiences of individuals and teams involved in technology projects.

INSTRUCTOR

Gary C. Hinkle is President and founder of Auxilium, Inc. His experience includes a broad variety of management and staff assignments with small, medium, and large companies involved in the development and manufacturing of high-tech products. Gary led several high-profile projects including the development of a U.S. Army vehicle maintenance system, and he directed the development of 9-1-1 systems used in the majority of Public Safety Answering Points in the U.S. He also served as engineering manager for the world's best selling oscilloscope product line at Tektronix. His design and management experience spans the electronics, mechanical and software engineering disciplines.

COURSE PRICE INCLUDES a comprehensive workbook and email/phone follow-up with the instructor after the workshop to assist with implementation.

In-Company Training

Any SPIE Course Can Be Held at Your Company–Anytime, Anywhere

SPIE offers over 800 different courses that run from one-day to three-day sessions, taught by world-renowned experts from industry and academia. SPIE can schedule any course to fit your timeframe and training budget.

Interested in learning more? Contact SPIE today!

Contact: Gayle Lemieux, SPIE Education Services
gaylel@spie.og · Tel: +1 360 685 5537

SPIE

Optics + Photonics 2007

SPIE Optics + Photonics will be held at the San Diego Convention Center, 111 West Harbor Drive, San Diego, CA, 92101 and at the San Diego Marriott Hotel & Marina located adjacent to the Convention Center at 333 West Harbor Drive.

Information on Venue and Travel can also be found on SPIE.org

Registration Hours

San Diego Convention Center, Hall D Lobby

Sunday 26 August . . . . . 7:00 am to 5:00 pm

Monday 27 August . . . . . 7:15 am to 5:00 pm

Tuesday 28 August . . . . . 7:30 am to 5:00 pm

Wednesday 29 August . . . . . 7:30 am to 5:00 pm

Thursday 30 August . . . . . 7:45 am 4:00 pm

Proceedings and CD-ROMs as part of a registration include tax and shipping. Proceedings and CD-ROM's purchased separately do not include shipping or taxes. Please see details on the registration form.

SPIE members receive 15% off conference and course registration fees.

Conference Registration

Includes access to the conferences, panels, technical events, poster sessions, coffee breaks, exhibition, desserts in the exhibition hall Tuesday and Wednesday. Prices increase by $100 USD after 15 August 2007, PLUS you must register onsite after that date.

Course and Workshop Registration

Courses and workshops are priced separately. Course only registration includes your selected course(s), course notes, coffee breaks, and admittance to the exhibition. Course prices include California state tax. Prices increase $50 USD after 15 August 2007.

Students save 50% on course registration. Proof of full-time student status is required; please include your student ID number or proof of student status with your registration. Offer applies to undergraduate/graduate students who are enrolled full time and have not yet received their Ph.D.

Refund Policy for Preregistration

There is a $35 service charge for processing refunds. A letter requesting the refund should state the preregistrant's name and to whom the check should be made payable. Requests for preregistration or banquet ticket refunds must be received no later than 4pm PST, 15 August 2007. All registration fees will be forfeited after this date. Membership dues are not refundable. SPIE Digital Library subscriptions are not refundable.

Exhibition

Tuesday 28 August . . . . . 10:00 am to 5:00 pm

Wednesday 29 August . . . . . 10:00 am to 5:00 pm

Thursday 30 August . . . . . 10:00 am to 2:00 pm

Admission is included in your conference, course or workshop fees. Or you can register to attend only the exhibition.

Speaker Check-In Desk / Preview Station

San Diego Convention Center Ballroom 20 Foyer

Sunday through Thursday . . . . . 7:30 am to 5:00 pm

All conference rooms will have a computer workstation, LCD projector, screen, lapel microphone, and laser pointer. All Presenters are requested to come to the speaker check-in desk to confirm display settings of their presentations from their memory devices or laptops with the audiovisual equipment being used at this symposium.

Audio, Video, Digital Recording Policy

In the Meeting Rooms and Poster Sessions: For copyright reasons, recordings of any kind are strictly prohibited without prior written consent of the presenter in any conference session, short course or of posters presented. Each presenter being taped must file a signed written consent form. Individuals not complying with this policy will be asked to leave a given session and asked to surrender their film or recording media. Consent forms are available at the SPIE Audiovisual Desk.

In the Exhibition Hall: For security and courtesy reasons, photographing or videotaping individual booths and displays in the exhibit hall is allowed ONLY with explicit permission from on-site company representatives. Individuals not complying with this policy will be asked to surrender their film and to leave the exhibit hall.

Poster Sessions

San Diego Convention Center Ballroom 20B

Monday 27 August . . . . . 6:00 to 7:30 pm

Tuesday 28 August . . . . . 8:00 to 10:00 pm

Wednesday 29 August . . . . . 5:30 to 7:00 pm

Conference attendees are invited to attend the poster sessions on Monday, Tuesday, and Wednesday evening. Each evening will represent a different set of conferences. Come view the posters, ask questions, and enjoy the refreshments. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster Setup

Poster presenters may set up between 10:00 am and 3:00 pm on the day of their assigned presentation. Poster presenters who have not set up by 4:30 pm on the day of their presentation will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

SPIE Guest Hospitality Suite

San Diego Marriott Hotel and Marina, SPIE Suite

Monday-Thursday, 27-30 August . . . 8:30 to 10:00 am

Guests of attendees are invited to meet, relax, and enjoy a cup of coffee and breakfast breads in SPIE's Guest Hospitality Suite. This suite is for guests of attendees only. The hotel concierge will be available during the portion of this time to answer travel, shopping, and tourist questions.

SPIE Marketplace

Located in the Convention Center, Upper Level Ballroom Lobby

The SPIE Marketplace is your source for the latest SPIE Press books, Proceedings, and Educational and Professional Development materials. You can become a member of SPIE, explore the Digital Library, and take home a souvenir.

Course Materials Desk

San Diego Convention Center, Hall D Lobby

Open during Registration hours

If you have registered to attend a course, please stop by the Course Materials Desk AFTER you pick up your badge, to obtain your course notes and to find out where the class will be located. You may also get a copy of the latest Education Services catalog to see the many courses SPIE has available at symposia, on video and CD-ROM, and to discover the opportunities of customized In-Company courses.

Cashier and Badge Corrections

Receipts - Preregistered attendees who did not receive a receipt prior to the meeting may obtain a new copy of their registration receipt onsite at the Badge Corrections and Receipts counter in the registration area.

Badge Corrections - Attendees who need a correction to their badge information onsite may do so at the Badge Corrections and Receipts counter in the registration area. Please have your badge removed from the badge holder, marked with your changes, and ready to hand to the attendant upon approaching the counter.

Cashier Station - If you are paying by cash or check as part of your onsite registration, wish to add a short course, workshop, or special event requiring payment, or have questions regarding your registration please see the onsite cashier at the Cashier station in the registration area.

Apply now for your Visa!

Please apply for your visas as soon as possible and no later than 3 months before the meeting. Information on visas for meeting organizers and participants is available at: http://national-academies.org/visas

Letters of Invitation

Individuals requiring letters of invitation to obtain travel visas to present their papers may access and print an Invitation Letter Request Form found at this web site: SPIE.org/InvitationLetterPDF

Please fill out a separate form for each person requesting a letter. All letters of invitation will be sent by airmail and by PDF e-mail attachment unless a courier account number or credit card number with expiration date is provided with the original request. Please allow ample time for processing requests. SPIE is not able to contact U.S. Embassies in support of an individual attempting to gain entry to attend an SPIE meeting. Because the application for a visa can be a lengthy process, we recommend that you start your visa application process as soon as you have been notified that your paper has been accepted. We also recommend that you secure your travel visa before registering for the symposium. Cancellations after the preregistration cutoff can result in a cancellation fee.

NEWS FROM YOUR FIELD. DELIVERED DAILY.

SPIE Newsroom reporters are experts from Academia and Industry covering news from your technical field. The Newsroom features first-person articles and interviews with international leaders in their technologies, like **Tuan Vo-Dinh**, Director of the Fitzpatrick Institute for Photonics Duke University, and **Naomi Halas**, Head of Halas Nanophotonics Group, Rice University.

newsroom.spie.org

News Feeds • Video Interviews • Patent News • E-Alerts

SPIEWorks Career Fair

Special 2-Day Event!

Tuesday 28 August . . . . . 11:00 am to 3:00 pm

Wednesday 29 August . . . . . 11:00 am to 3:00 pm

Job Seekers

Whether you are looking for a better job, re-entering the workforce or just starting your career, this career fair is a great place to start!

- Get 'face-to-face' time with employers and interview on the spot
- Learn more about the jobs available in our industry
- Network
- Post your resume online today! Visit SPIEworks.com

All SPIEWorks services are free to individuals seeking employment.

Employers

Don't Miss This Recruiting Opportunity—hire top talent at Optics + Photonics.

SPIEWorks offers a customized recruitment package in conjunction with this conference. A typical Career Fair package includes:

- 2 x 6 draped table
- Job postings on the SPIEWorks website
- Resume access (includes data on who plans to attend the conference)
- A display banner on the homepage to promote your recruiting effort
- Promotion of your company on signage and in show programs.

For more information, contact Dave Baggenstos at 360.715.3705 or email sales@SPIEworks.com. Reserve your space today!

Internet Pavilion

SPIE will have a complimentary Internet Pavilion at the meeting site on Sunday through Thursday where attendees can use provided workstations or hook up their laptop to an Ethernet connection to access the Internet.

Complimentary Internet Wireless Access

SPIE is pleased to provide complimentary wireless access to the Internet for all conference attendees bringing 802.11b wireless-enabled laptops or PDAs. Coverage locations and connection settings will be posted in the final program and on-site.

Properly secure your computer before accessing the public wireless network. Failure to do so may allow unauthorized access to your laptop as well as potentially introduce viruses to your computer and/or presentation.

Media Center

The on-site Media Center provides media representatives with conference space, refreshments, convenient one-stop-shopping for press releases, and allows news to be communicated via phone, and high-speed internet connections. Credentialed members of the press can pre-register by e-mailing: name, organization, and contact information to media@SPIE.org. Registration and exhibition fees are waived for media representatives. For more information about SPIE media services, see SPIE.org/resources.

Press Representatives

Media/Press: For credentialed press and media representatives, please email contact information, title and organization to media@SPIE.org.

SPIE Copy Center

Sunday through Thursday during registration hours San Diego Copy will provide a copy service during the week for symposium attendees. The rates are 5 cents per copy and $1 per transparency ($2.50 for color). The Copy Center will be located near registration.

Business Center

FedEx Kinko's is the in-house business center for the San Diego Convention Center. It is located inside Lobby D. The company provides small package FedEx shipping, packing supplies, color copying services, fax services and office supplies. Phone (619) 525-5450, Fax (619) 525-5477. Email usa1324@fedexkinkos.com.

SPIE Message Center

The SPIE Message Center telephone number is 619 525-6200. Messages will be taken during registration hours Sunday through Thursday. Please check the message board at the message center near SPIE registration daily to receive your messages.

Luggage/Package Storage and Coat Check

San Diego Convention Center- Near Registration

Sunday through Thursday

Complimentary luggage/package and coat storage will be available to attendees.

Please note hours of operation posted onsite. If you intend to stay later than closing time, you will need to claim your checked items before it closes.

Coffee Breaks

Complimentary coffee will be served twice each day of the conference at approximately 10:00 am and 3:00 pm. Please check the individual technical conference listings for exact times and locations.

Refreshment Purchases

For attendee purchase of light refreshments, including continental breakfast, specialty carts will be set up throughout the Convention Center Sunday through Thursday.

Cash Lunches and Exhibition Concessions

A cash sandwich bar will be available in the Convention Center at the Ballroom Lobby on Sunday and Monday from 11:30 am to 2:00 pm.

Visit the Café Express located in the back of the exhibition halls on Tuesday, Wednesday, and Thursday featuring Domestic and International Cuisine. They will serve hot and cold snacks, beverages, deli-type sandwiches, salads, hot entrees, and pastries and will be open 11:00 am to 2:00 pm.

Free Popcorn

Popcorn carts will be located in Exhibition Hall D&E and will be open from 11:00 am to 2:00 pm Tuesday through Thursday.

Desserts

Tuesday and Wednesday

Dessert snacks will be served from 3:00 to 3:30 pm. Complimentary tickets for the dessert snacks will be included in attendee registration packets.

Laser Pointer Safety Information

SPIE supplies tested and safety approved laser pointers for all conference meeting rooms, and for short course rooms if instructors request one. For safety reasons, SPIE requests that presenters use our provided laser pointers available in each meeting room.

If using your own laser pointer, have it tested at your facility to make sure it has <5 mW power output. Laser pointers in Class II and IIIa (<5 mW) are eye safe if power output is correct - but don't automatically trust the labeling. Commercially available laser pointers, red or green (or any color), could be incorrectly labeled as to their wavelength and power output.

Presenters intending to use their own laser pointer for presentations are required to come to the Audiovisual Desk onsite and test their pointer on our power meter. If the pointer fails the safe power level you may not use the pointer at the conference. You will be required to sign a waiver releasing SPIE of any liability for use of potentially non-safe laser pointers.

Use of a personal laser pointer at an SPIE event represents user's acceptance of liability for use of a non-SPIE supplied laser pointer device. Misuse of any laser pointer could lead to eye damage. In California, it is a criminal misdemeanor to shine a laser pointer at individuals "who perceive they are at risk."

Underage Persons on Exhibition Floor

For safety and insurance reasons, no persons under the age of 16 will be allowed in the exhibition area during move-in and move-out. During open exhibition hours, only children over the age of 12 accompanied by an adult will be allowed in the exhibition area.

Child Care Services

The San Diego Marriott Hotel & Marina does not provide child care services, however, a child sitting service available in San Diego and recommended by the San Diego Marriott Hotel & Marina is: Marion's Child Care, email amy@hotelchildcare.com, within San Diego call (619) 303-4379, or 1-888-891-5029, www.hotelchildcare.com

SPIE does not imply an endorsement or recommendation of this service. It is provided on an "information only" basis for your further analysis and decision. Other services may be available.

No Suitcasing Policy

Suitcasing is the act of soliciting business in the aisles during the exhibition or in other public spaces, including another company's booth or a hotel lobby.

Please note that while all meeting attendees are invited to the exhibition, any attendee who is observed to be soliciting business in the aisles or other public spaces, in another company's booth, or in violation of any portion of SPIE Exhibition Policy will be asked to leave immediately. Additional penalties may be applied. Please report any violations you may observe to show management.

Unsecured Items

Personal belongings such as briefcases, backpacks, coats, book bags, etc. should not be left unattended in meeting rooms or public areas. These items will be subject to removal by security upon discovery.

Travel Information

About San Diego

Welcome to San Diego, California's second largest city and the United States' seventh largest. Where blue skies keep watch on 70 miles of beaches and a gentle Mediterranean climate begs for a day of everything and nothing. Bordered by Mexico, the Pacific Ocean, the Anza-Borrego Desert and the Laguna Mountains, San Diego county's 4,200 square miles offer immense options for business and pleasure.

For more information about San Diego, sightseeing, shopping and restaurants, visit their web site at: WWW.SANDIEGO.ORG

Restaurant Reservations and Information Desk

The San Diego CC Corporation operates a Restaurant Reservations and Information Desk in the Hall B lobby of the CC. The desk will be staffed Sunday through Thursday, during the convention from 9:00 am to 6:00 pm. If you wish to pre-plan your individual or group dining arrangements, you may call Laurie Peters at 619-525-5291.

Flying to San Diego

San Diego International Airport (SAN) is conveniently located three miles northwest of downtown San Diego. Numerous airlines fly into and out of SAN. For a complete listing view. http://www.san.org/airport/flights/airlines.asp

Visit http://www.san.org/ for more complete information about the San Diego Airport.

Driving Directions to the San Diego Convention Center

FROM NORTH COUNTY COASTAL- If traveling on Interstate 5 South, take the Front Street exit. Continue on Front Street until you reach Harbor Drive, turn left. Follow signage to the parking entrance located in the front of the CC (CC Court).

FROM NORTH COUNTY INLAND - If traveling on Interstate 15 South, take the 163 south Interstate off-ramp. Proceed on the 163 south until the freeway ends and becomes 10th Avenue in downtown San Diego. Follow 10th Avenue to Market Street and turn right, then turn left on 5th Avenue. Take 5th Avenue to Harbor Drive, turn right. Continue on Harbor Drive following the signage to the parking entrance in the front of the CC (CC Court).

FROM SOUTH COUNTY - If traveling north on Interstate 5, take the Crosby Street exit. At the bottom of the off-ramp, turn left on Caesar Chavez Parkway. Follow Caesar Chavez Parkway to Harbor Drive turn right. Follow signage to the parking entrance in the front of the CC (CC Court).

FROM EAST COUNTY - If traveling on 94 West, proceed until it ends and becomes F Street in downtown San Diego. Follow F Street to 8th Avenue, turn left. Take 8th Avenue to Market Street, turn right. Continue on Market Street to Front Street, turn left. Take Front Street to Harbor Drive and turn left. Follow signage to the parking entrance in the front of the CC (CC Court).

FROM EAST COUNTY - If traveling on Interstate 8 west, take the 163 south exit. Proceed on the 163 south until the freeway ends and becomes 10th Avenue in downtown San Diego. Follow 10th Avenue to Market Street and turn right. Take Market Street to Front Street and turn left. Take Front Street to Harbor Drive and turn left. Follow signage to the parking entrance in the front of the CC (CC Court).

FROM SAN DIEGO INTERNATIONAL AIRPORT - Go out of parking lot, following signs to Interstate 5/Downtown. The ramp will put you onto Harbor Drive, going south. Follow Harbor Drive to the parking entrance in the front of the CC (CC Court).

Parking

(Note: All rates are subject to change)

At San Diego Convention Center

For underground parking, the CC parking entrance is at the north end of Harbor Drive off Convention Center Way. A special convention parking rate of $8 per day will be in effect at the San Diego CC for the duration of the meeting. However, please note that parking rates are subject to change and during Padre baseball season, parking rates increase by $10 during home games. Exhibitors may purchase a parking permit at the parking office inside the garage which allows in and out privileges for move-in/move-out days only. Exhibitors should purchase their $8 parking ticket at the gate, proceed to the parking office inside, hand in the $8 parking ticket along with an additional $4 to receive the $12 Parking Pass (with in & out privileges only on move-in/move-out days). Exhibitor badge ID is necessary to obtain the permit. They are open from 5am to 11:00 pm, with no overnight parking. For further information contact Ace Parking at 619-237-0399.

At applicable hotels, Hotel Guest Parking:

San Diego Marriott Hotel & Marina
For guests: Self $19, Valet $25
Non-Guests: Self $20, Valet $28

Holiday Inn On The Bay
For guests: Self $20, Valet $24
Non-Guests pay regular posted parking rate.

The Sofia Hotel
Valet only: $25

San Diego Marriott Gaslamp Quarter
Valet only: $26

Omni San Diego Hotel
Self $14, Valet $26

Town And Country Resort & CC
Self $7

Holiday Inn Express (Formerly Quality Inn & Suites)
Self: $12

Comfort Inn
Self: $12

Parking in Downtown San Diego

Directly across the street at the east end of the Center is a 2,000 space parking structure.

Metered street parking is available in some areas. Parking meters are enforced Monday through Saturday, from 8 a.m. until 6 p.m., unless otherwise posted. Metered spots are free on Sunday and designated holidays. Meters accept nickels, dimes, quarters, and prepaid electronic debit cards.

http://www.sandiego.gov/parkingmanagement/enforcement/cards.shtml

For more information:

- Gaslamp Quarter Parking Information
  http://www.gaslamp.org/
- City of San Diego Special Events Parking information
  http://www.sandiego.gov/eventsparking/index.shtml

Car Rental

Hertz Car Rental has been selected as the official car rental agency for this Symposium. To reserve a car, identify yourself as an Optics & Photonics Conference attendee using the Hertz Meeting Code CV# 029B0010.

In the United States call 1-800-654-2240.
In Canada call 1-800-263-0600, or 1-416-620-9620 in Toronto.
In Europe and Asia call the nearest Hertz Reservation Center or travel agent. Please Note: When booking from International Hertz locations, the CV # must be entered with the letters CV before the number. Outside of these areas call 1-405-749-4434.
Or
Book on-line at www.hertz.com by following the links. Type in the "renting city" or "airport code". Enter your dates and times. Enter your flight information if applicable. Click "YES" for Discount, Coupon or other offer. Click CONTINUE. Scroll down to the bottom of the page and enter the Convention (CV) # 029B0010. Click CONTINUE. By entering the Convention (CV) # 029B0010, Hertz will determine the convention rates or lower rates which may be available at the time. The rate presented is derived from searching multiple discount plans and special offers to find the best rate at the time, given applicable constraints. The first date of the rental determines the rates.

Discount Convention Rates as follows:

	Daily	Weekend	Weekly
Economy (2DR):	$36.00	$21.00	$144.00
Compact (4DR):	$41.00	$23.00	$154.00
Mid-size (2/4DR):	$46.00	$25.00	$175.00
Sporty (2DR)	$48.00	$28.00	$185.00
Full-size (4DR):	$51.00	$31.00	$196.00
Towncar:	$82.00	$63.00	$350.00
Minivan:	$57.00	$57.00	$288.00

Rates include free unlimited mileage and are guaranteed one week prior through one week after the event dates. Rentals are subject to car availability. Advance reservations are recommended as some cities sell out early during popular times of the year. Blackout dates may apply. At the time of reservation booking, these rates will automatically be compared to Hertz published rates, assuring that you are quoted the best comparable rate.

Standard rental qualifications apply. Taxes, vehicle licensing fees, tax reimbursement/transportation fees and optional items, such as refueling, are extra.

Park & Ride

Several trolley stations have associated park and ride lots making the park-and-ride option attractive. The closest trolley stop with free park & ride lots is the Old Town Trolley Station at Taylor Street and Pacific Hwy. The Old Town Trolley Station is located at 4005 Taylor Street, right there, at the lights. Distance from the airport is approximately 4 1/2 miles.

Taxi Service

Taxi service from the San Diego Airport to the downtown hotels is $15 - $20 depending on traffic.

Public Transportation

Find Trolley, Bus Schedule and Route Information at the eStore. http://www.sdcommute.com/estore/Index.asp

Shuttles

Holiday Inn on the Bay, Holiday Inn Express & Comfort Inn each offer complimentary airport shuttles.

The Xpress Shuttle provides daily shuttles between the Marriott Marina Hotel & the Airport at a quarter to and a quarter past the hour from 4:45 am to 3:45 pm.

Call Xpress Shuttle on the courtesy phone from the "Shuttles for Hire" Island and the shuttle will pick you up within 10 minutes. Watch for the yellow & blue van. Cash or credit cards accepted by driver, but checks are not.

For further information from Xpress Shuttle call 1-800-900-7433. www.XpressShuttle.com

One way fares for 2007 (subject to change) from the San Diego airport to:
The San Diego Marriott Hotel & Marina $6
The San Diego Marriott Gaslamp Quarter $7
The Sofia Hotel $7
The Omni Hotel $7
Town & Country Resort $10

Cloud 9 Shuttle from the San Diego Airport to downtown San Diego hotels is also available. Cloud 9 Shuttle runs 24 hours per day, seven days a week. At the airport, look for assistants dressed in blue shirts and khaki pants by the "Shuttles for Hire" Island. The assistants will call the shuttle for you. Otherwise you may call on the courtesy phone inside the baggage claim area to arrange for pickup. Information and reservations online are available at. Cash and credit cards accepted - no checks. To cancel a reservation, you must call Cloud9 to notify them to avoid a penalty fee. To book your return to the airport, call for reservations at least 24 hours in advance. Cloud 9 Shuttle recommends a pickup time of at least 2 hours prior to flight departure time. Shuttle stops enroute to load/unload passengers. For additional information call 1-800-974-8885 or 1-858-974-8885. Rates vary depending on the hotel you are traveling to.www.cloud9shuttle.com

One way fares for 2007 (subject to change) from the San Diego Airport to:
The San Diego Marriott Hotel & Marina $8
The San Diego Marriott Gaslamp Quarter $8
The Sofia Hotel $8
Omni Hotel $8
The Town & Country Resort $11.50

San Diego Trolley and Buses

The San Diego Trolley is known for its reliability, safety, and convenience. Often called San Diego's "moving landmark", the Trolley is also a fun way to get around, whether commuting to work, traveling to the International Border, or heading to Centre City's shopping, restaurants, harbor and historic attractions. The San Diego Trolley now serves historic Old Town, California's birthplace, as well as Mission Valley, Fashion Valley, and Qualcomm Stadium at Jack Murphy Field. Trolley cars are red, and they travel above ground on light rail lines. If attendees purchase Day Tripper Passes from the Transit estore on-line before their arrival date, they can then use the Trolley system (Bus 992 from the airport to the America Plaza Trolley Station) to their hotel, and to and from the CC for unlimited rides at one flat rate. The trolley cash fare in the downtown zone is $1.25* one way, and more for trips outside the downtown zone. *Downtown San Diego cash fare allows unlimited rides (including round trips) within the Center City area only for two-hours from the time of ticket purchase. Senior/Disabled (any distance) $1.00.

Trolley Tickets are good for travel for two hours from the time of validation and may be used to travel until the expiration time stamped on the ticket. Day Tripper Passes (for 2 to 4 days) provide unlimited Trolley and bus use on day(s) valid, and cost $5.00 for one-day, $9 for two days, $12 for 3 days and $15 for 4 days. Day Tripper passes can be purchased at Trolley Station ticket vendomats, or in advance via the Transit eStore. Fares are subject to change at any time.

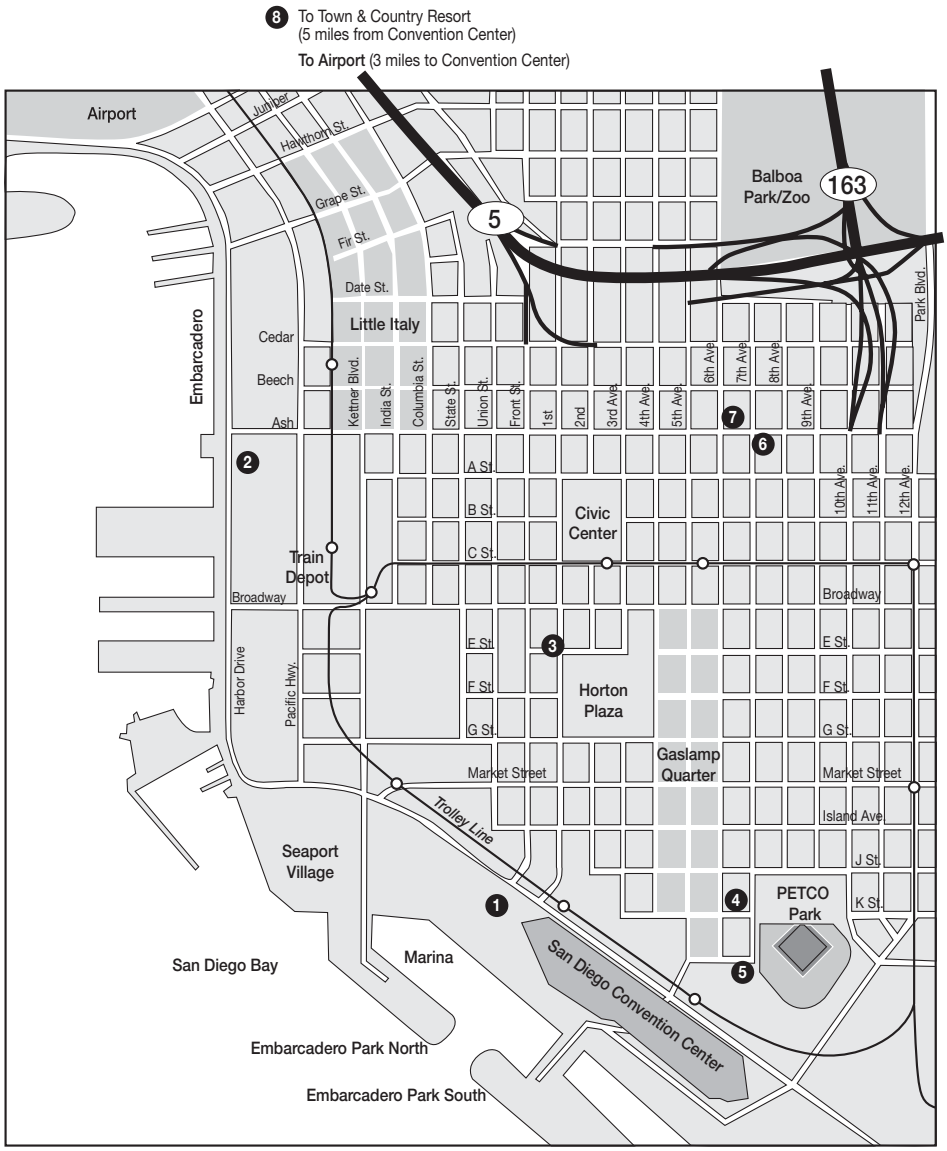
Trolley From the Airport

Attendees can catch the Airport Flyer bus 992 from any terminal to the America Plaza Trolley Station to ride the Trolley to any Optics & Photonics conference Hotel. The CC is at the CC stop, the Marriott Gaslamp at the Seaport Village stop, The Holiday Inn on the Bay is at the American Plaza C Street & Kettner stop, the closest trolley stop to the Sofia Hotel is between 2nd & 3rd on C Street and the Omni Hotel is walking distance from the CC stop. The Town & Country is at the Fashion Valley stop. The Holiday Inn Express and the Comfort Inn are about 2 blocks walking distance from the C Street trolley stop.

Hotel Locations:

1. San Diego Marriott Hotel & Marina
2. Holiday Inn on the Bay
3. The Sofia Hotel
4. San Diego Marriott Gaslamp Quarter
5. Omni San Diego Hotel
6. Comfort Inn Downtown San Diego
7. Holiday Inn Express
8. Town & Country Resort

Plese see next page for Hotel Reservation Information



Hotel Reservation Form

SPIE's Optics & Photonics

26–30 August 2007 • San Diego Convention Center • San Diego, California USA

Use this form to Fax or Mail your reservation to the hotel of your choice. Use one (1) form for each room request. Photocopy additional forms if necessary.

Please type or print clearly. Please fill out your reservation form completely, providing all phone, fax and E-mail contact numbers, in order that you can be reached easily if there are questions, and in order that an acknowledgement can be sent to you quickly. Unless otherwise requested, all confirmation notices are sent within 72 hours of receipt of the reservation.

Occupant Name _____
(first) (last)

Sharing with _____

Group Code (as applicable): _____

Acknowledgements can be sent by mail, fax or email. Send acknowledgement to:

Name _____

Company/Organization _____

Address _____

City _____

State/Province_____Zip/Postal Code _____

Country (other than USA) _____

Country Code if International_____

Daytime Telephone _____

Fax _____

Email _____

Reservations will not be processed without a form of payment to guarantee. Accepted Credit Cards are American Express, Diners Club, Discover, MasterCard or Visa.

Name as it appears on the card _____

Type of Credit Card _____

Card # _____

Expiration Date_____

Signature _____

Accommodations

Use this form to Fax or Mail your reservation to the hotel of your choice.

Guaranteed Reservations Only
Reservations made on-line, by phone or by fax for all hotels must be secured with a credit card to guarantee your reservation. If you are guaranteeing by check, then you must mail in your reservation, with the check, to the hotel.

Room Sub-Block Reservations
If you wish to make a reservation for a sub-block of 10 rooms or more at the San Diego Marriott Hotel & Marina, please contact Shanna Philpot, at 1-619-230-8961.

Deadlines, Cancellations, Changes
Each hotel has its own cut-off date. Hotel reservations are guaranteed prior to the cut-off date, providing the contracted block does not fill up. If the block does fill up prior to that date, the Hotel's current "Best Available Rates" may be offered. Any reservation received after the cut-off date may be charged the market rate. To cancel or make changes to a reservation call the hotel directly according to that hotel's own cancellation policy. Should you not arrive on your scheduled check-in date and do not pre-notify the hotel, you will be charged one night's room and tax and the remainder of your reservation will be cancelled. Reinstating your reservation after you have missed your check-in date, could result in your paying prevailing market rates for your room.

Type of Accommodation (check)

❑ Single (1 bed, 1 person) ❑ Double (1 bed, 2 persons)

❑ Double/Double (2 beds, 2-4 people)

❑ Cityview ❑ Bayview

❑ Smoking ❑ Non-Smoking (Can be requested but can't be guaranteed until check-in based on availability)

❑ Require special facilities in accordance with the Americans with Disabilities Act.

Arrival Date _____

Departure Date _____

Hotel Reservations

NOTE: DO NOT SEND RESERVATION FORM TO SPIE

A block of rooms at special conference rates has been reserved at eight San Diego area hotels for symposia attendees. Room rates at the hotels range from $124 to $213 per night for single or double rooms. The confernece rates cannot be guaranteed after the room blocks have been filled and will not be honored after the individual hotels' cut-off dates.

Reservations can be made directly with each individual hotel. Reservation instructions are outlined per hotel, below. You are encouraged to make your reservations early. Rates listed are subject to 10.5% room tax (subject to change).

THE HEADQUARTERS HOTEL FOR THE SPIE SAN DIEGO SYMPOSIUM IS THE:

1. SAN DIEGO MARRIOTT HOTEL & MARINA, Smoke free facility
333 West Harbor Drive, San Diego, CA, 92101
(next door to the Convention Center)

Rates: Cityview, single/double $193 + tax ;
Bayview, single/double $213 + tax
Additional Person add $20; Suites 30% off regular suite rates

Cut-off Date: **August 3, 2007**

Cancellation Policy: Notify the hotel prior to 6:00 pm on the day of arrival to avoid a penalty fee.

To make a reservation at the San Diego Marriott Hotel & Marina

By Telephone: Call Toll Free 1-800-228-9290 or 1-619-234-1500, ext. 6800 (Reservations). Be sure to mention "SPIE" to receive discounted rate.

By Fax: Fill out the Reservation Form and fax it to 1-619-230-8978.

By Mail: Fill out the Reservation Form and mail with credit card details or a check for one night's room plus tax to:

San Diego Marriott Hotel & Marina
Group Housing
Attn: Shanna Philpot
333 West Harbor Drive,
San Diego, CA, 92101

You will receive a confirmation by email from the hotel, when your reservation is processed.

Marriott Rewards: Account numbers may be given using either booking method in order to receive Marriott Rewards credit for the stay.

2. HOLIDAY INN ON THE BAY
1355 N. Harbor Drive, San Diego, CA, 92101
(one mile from the convention center)

Rates: Cityview, single/double $169 + tax; Bayview, add $30
Additional person (over two) add $15
Rates include complimentary shuttle to and from the airport.

Cut-off Date: **July 24, 2007**

Cancellation Policy: Hotel must be notified at least 72 hours prior to arrival to avoid a penalty fee.

To make a Reservation at the Holiday Inn on the Bay:

By Telephone: Call Toll Free 1-800-877-8920 or 1-619-232-3861 and ask for Reservations Dept. Refer to code SPI for conference rates.

By Fax: Fill out the Reservation Form and fax it to 1-619-232-3951.

By Mail with a check as payment for one night's room plus tax: Fill out the Reservation Form and mail all the details to: Holiday Inn on the Bay, 1355 N. Harbor Drive, San Diego, CA, 92101

You will receive a confirmation from the hotel, when your check is received.

3. THE SOFIA HOTEL, Smoke free facility
150 West Broadway, San Diego, CA, 92101
(6 blocks, easy walk to the convention center)

Rates: $150 single/double + tax

Cut-off Date: **July 25, 2007**

Cancellation Policy: Notify the hotel at least 24 hours prior to the arrival date to avoid a penalty fee.

To Make A Reservation at the Sofia Hotel:

By Telephone: 800-826-0009 or call the hotel at 619-234-9200

By Fax: Hotel Reservation Form to 619-544-9879

By Mail with a check as payment for one night's room + tax:
Fill out the Hotel Reservation form and mail to:
The Sofia Hotel, 150 West Broadway,
San Diego, CA, 92101

You will receive a confirmation from the hotel, when your check is received.

4. SAN DIEGO MARRIOTT GASLAMP QUARTER, Smoke free facility
660 K Street, San Diego, CA 92101
(2 blocks from the convention center)

Rates: Single/Double $209 + 10.5% tax

*Additional person (over two) ad $25

Cut-off Date: **August 3, 2007**

Cancellation Policy: Notify the hotel at least 72 hours prior to the arrival date to avoid a penalty fee.

To Make a Reservation at the San Diego Marriott Gaslamp Quarter:

By Telephone: Call Toll Free Reservations 1-888-800-8118 or 1-619-696-0234 to be transferred to Central Reservations.

By Fax: Fax Hotel Reservation Form to 1-619-446-6001

By Mail with a check or credit card information as payment:
Fill out the Hotel Reservation form and mail to:
San Diego Marriott Gaslamp Quarter, Attn. Reservations, 660 K Street, San Diego, CA, 92101

You will receive a confirmation from the hotel, when your check is received.

5. OMNI SAN DIEGO HOTEL
675 L Street, San Diego, CA, 92101
(across the street from the convention center)

Rates: $199 single/double + tax,
Additional person (over two) add $20

Cut off date: **July 24, 2007**

Cancellation Policy: Hotel must be notified before 12:00 Noon Pacific Time, 7 days prior to arrival to avoid penalty fee of first and last night's room and tax.

To Make a Reservation at the Omni San Diego Hotel

By Telephone: Call Central Reservations at 1-800-843-6664, or the hotel directly at 619-231-6664 to be switched to Central Reservations.

By Fax: Fax the completed Hotel Reservation form to 1-619-645-6517

By Mail with a check as payment for one night's room + tax:
Fill out the Hotel Reservation form and mail to:
Omni San Diego Hotel, 675 L. Street,
San Diego, CA, 92101

You will receive a confirmation from the hotel, when your check is received.

6. HOLIDAY INN EXPRESS
1430 Seventh Ave., San Diego, CA 92101
(1 mile, 9 blocks, 5 minute drive to Convention Center - Comfort Inn is across the street from the Holiday Inn Express)

Rates: $147 single/double + tax

Rate includes complimentary daily deluxe continental breakfast and complimentary shuttle to/ from the airport.

Cut-off Date: **July 23, 2007**

Cancellation Policy: Notify the hotel at least 72 hours prior to the arrival date to avoid a penalty fee.

To Make a Reservation at the Holiday Inn Express:

By Telephone: Call 1-800-884-5788 & specify the Holiday Inn Express, or call 1-619-696-0911

By Fax: Fax Hotel Reservation Form to 1-619-239-0138

By Mail: Mail Hotel Reservation Form with check for first night's room + tax or credit card information to:
Holiday Inn Express, 1430 7th Ave., San Diego, CA, 92101

7. COMFORT INN
719 Ash Street, San Diego, CA 92101
(1 mile, 9 blocks, 5 minute drive to Convention Center - Holiday Inn Express is across the street from the Comfort Inn)

Rates: $124 single, $124 double + tax; $134 triple, $144 quad

Rate includes complimentary daily deluxe continental breakfast and complimentary shuttle to/ from the airport.

Cut-off date: **July 23, 2007**

Cancellation Policy: Notify the hotel at least 72 hours prior to the arrival date to avoid a penalty fee.

To Make a Reservation at the Comfort Inn:

By Telephone: Call 1-800-404-6835 and specify the Comfort Inn, Or Call 1-619-232-2525

By Fax: Fax Hotel Reservation Form to 1-619-687-3024

By Mail: Mail Hotel Reservation Form with check for first night's room + tax or credit card information to:
Comfort Inn, 719 Ash Street, San Diego, CA, 92101

8. TOWN AND COUNTRY RESORT & CONVENTION CENTER
500 Hotel Circle North, San Diego, CA 92108
(5 miles, 10 min. drive from the convention center)

Rates: $131 single, $151 double +tax
Rate includes a complimentary trolley pass for each guest over the course of the conference, which can be used on any trolley route including to the convention center.

Cut-off date: **August 5, 2007**

Cancellation Policy: Notify the hotel at least 48 hours prior to the arrival date to avoid a penalty fee.

To Make a Reservation at the Town and Country Resort & Convention Center:

By Telephone: Call toll free 1-800-772-8527 or to the hotel directly at 619-291-7131 and ask for reservations. Refer to SPIE when calling in your reservation.

By Fax: Fax the completed Hotel Reservation form to 1-619-294-4681

By Email: res@towncountry.com

By Mail: Mail the completed Hotel Reservation form with credit card information, or a check for one night's room plus tax to:
Town and Country Resort & Convention Center,
500 Hotel Circle North, San Diego, CA 92108

Note: Each hotel observes a different cut-off date.

Information on Venue and Travel and Booking a hotel room online can also be found on SPIE.org/events/opadvance.

San Diego streets, and hotel locations shown on the previous page.

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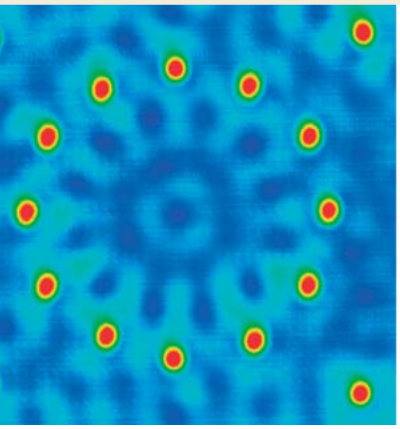
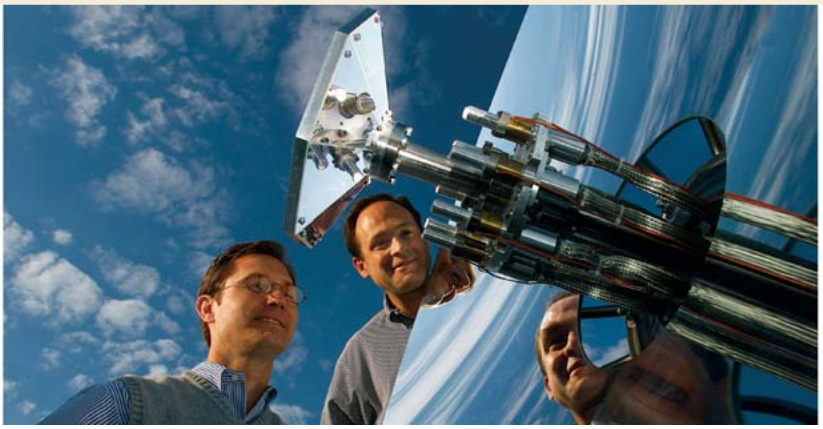


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