Frontiers in Optics 2009/Laser Science XXV

Featuring leaders of optics and photonics, including two Nobel Laureates, FiO/LS 2009 drew together industry luminaries from around the globe. Sessions on 3-D display, supercomputing and imaging at the nanoscale were the talk of the conference, and advances in these areas generated buzz throughout the event. Green energy was also a central theme, with discussions of how to make integrated photonic circuits more environmentally friendly and the popular solar car races demonstrating solar-powered miniature cars for a captive audience. Attended by more than 1,500 of the field's leaders and with more than 40 companies participating in the exhibition, and more than 1,000 presentations, FiO 2009 provided the latest technical advances, networking opportunities and so much more.

We look forward to seeing you next year at FiO 2010 in Rochester, NY from October 24–28.

Watch 2009 FiO Chairs Discuss This Year's Conference Highlights

Video Topics:

Overview of FiO 2009
Collocated Topical Meetings
The Future of 3-D Display—Special Symposium
Gravitational Wave Interferometry from Earth and Space—Special Symposium
Optics for Imaging at the Nanoscale and Beyond—Special Symposium
Phase Space Optical System Theory for the 21st Century—Special Symposium
Short Courses
Hot Topics in Optical Design and Instrumentation
Hot Topics in Optics in Information Sciences
Hot Topics in Photonics
Hot Topics in Optics in Biology in Medicine
Unveiling a Supermassive Black Hole at the Center of Our Galaxy—Plenary Session

View the chairs discussing highlights of FiO 2009 / Fall Optics & Photonics Congress – Lahsen Assoufid, Greg Quarles, and Markus

Testorf.

The 2009 Technical Program Features:

- Six special symposia
- 10 Tutorials
- Plenary session held by two of the industry's finest scientists; Andrea M. Ghez and Janos Kirz
- Ives Medal Lecture: Reobert Byer, Stanford University, USA
- Schawlow Prize Lecture: Robert Field, MIT, USA
- Three Short Courses

Collocated with the Fall OSA Optics & Photonics Congress**:**

Advances in Optical Materials (AIOM)
Adaptive Optics: Methods, Analysis and Applications (AO)
Computational Optical Sensing and Imaging (COSI)
Femtosecond Laser Microfabrication (LM)
Signal Recovery and Synthesis (SRS)

About FiO/LS

FiO/LS Pre-Conference Schedule
The Optical Society (OSA)
The APS Division of Laser Science (DLS)
Future Dates

Join your colleagues in San Jose, CA, USA, for a variety of themes, topics, and invited speakers at the Frontiers in Optics (FiO) 2009/Laser Science (LS) XXV conference.

These meetings focus on timely topics in optical science and engineering and provide a place for members to exchange ideas and to expand their network of colleagues in both academia and industry.

FiO/LS Pre-Conference Schedule

February 19, 2009	Call for Papers Submission Site Opens for FiO/LS 2009
May 26, 2009, 12:00 p.m. noon EDT (16.00 GMT)	FiO/LS Papers Submission Deadline
June 2009	Registration and Housing Open
July 2009	Authors of submitted papers are notified of acceptance/rejection
August 2009	FiO/LS 2008 Conference Program Available Online
September 11, 2009	Housing Deadline
September 16, 2009	Pre-registration deadline
September 21, 2009	Post deadline Paper Submission Deadline
October 2, 2009	Authors of post deadline papers are notified of

	acceptance/rejection
October 11-15, 2009	FiO/LS held at the San Jose Fairmont & St. Claire Hotel

The Optical Society (OSA)

FiO 2009—the 93rd OSA Annual Meeting—and LS XXV unite the OSA and American Physical Society (APS) communities for five days of quality, cutting-edge presentations, fascinating invited speakers and a variety of special events. The FiO 2009 conference will also offer a number of Short Courses designed to increase participants' knowledge of a specific subject while offering the experience of insightful teachers. An exhibit floor featuring leading optics companies will further enhance the meeting.

The APS Division of Laser Science (DLS)

The LS XXV meeting serves as the annual meeting of the American Physical Society (APS) of its Division of Laser Science (DLS) and provides an important forum for presenting the latest work on laser applications and development, spanning a broad range of topics in physics, biology and chemistry.

In collaboration with our colleagues at OSA, DLS will provide thorough coverage of mutually interesting topics in a number of joint sessions. Session schedules are coordinated to encourage your intellectual wanderings among DLS, OSA and joint sessions. Be prepared to engage in outstanding technical programs, exciting special symposia and networking events scheduled for this year's annual meeting.

Future Dates

Year	Dates	Location
2010	October 24–28	Rochester, NY
2011	October 16-20	San Jose, CA
2012	October 14–18	Rochester, NY
2013	October 6–10	Orlando, FL

Plenary Session and Awards Ceremony

The FiO 2009/LS XXV Plenary Session and Awards Ceremony is on Monday, October 12.

Plenary Session
Awards Ceremony

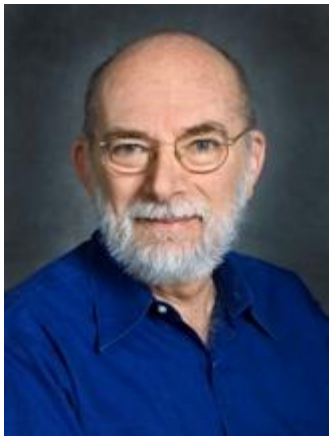
Plenary Session

Unveiling a Supermassive Black Hole at the Center of Our Galaxy
Andrea M. Ghez
Univ. of California at Los Angeles, USA

View presentation (PDF)
Ghez Video Part 1
Ghez Video Part 2
Ghez Video Part 3

Abstract: More than a quarter century ago, it was suggested that galaxies such as our own Milky Way may harbor massive, though possibly dormant, central black holes. Definitive proof, for or against, the existence of a massive central black hole lies in the assessment of the distribution of matter in the center of the Galaxy. The motion of the stars in the vicinity of a black hole offers a way to determine this distribution. Based on 10 years of high resolution imaging, Dr. Ghez's team has moved the case for a supermassive black hole at the Galactic Center from a possibility to a certainty. Additionally, spectroscopy has revealed that the stars orbiting in such close proximity are apparently massive and young; the origin of these stars is difficult to explain, given the strong tidal forces, and may provide key insight into the growth of the central black hole.

Biography: Andrea M. Ghez, professor of physics and astronomy, is one of the world's leading experts in observational astrophysics, whose work sheds light on how our Milky Way Galaxy, Sun



X-Ray Microscopy
Janos Kirz
Advanced Light Source, Lawrence Berkeley Natl. Lab, USA

View presentation (PDF)
Kirz Video Part 1
Kirz Video Part 2
Kirz Video Part 3
Kirz Video Part 4
Kirz Video Part 5

Abstract: X-rays penetrate objects opaque to electrons and visible light. X-ray spectra near absorption edges reveal the local chemical environment. Linear and circular dichroism provide contrast in magnetic materials. Advances in X-ray optics, as well as lensless imaging methods, provide high spatial resolution. X-ray free-electon lasers coming on line may open the door to sub-nm resolution imaging of macromolecules.

Biography: Janos Kirz received his Ph.D. in physics from the University of California, Berkeley, in 1963. He spent most of his professional life at Stony Brook University, where he is currently Distinguished Professor Emeritus. His interest in X-ray microscopy dates to a stay at Oxford University in 1972–1973. During the past 5 years he has been at the Advanced Light Source, Lawrence Berkeley Laboratory, where he served as Acting Director

and Earth came to be.

Working in the field of high resolution imaging, Professor Ghez has used the Keck telescopes to demonstrate the existence of a supermassive black hole at the center of our galaxy, with a mass 4 million times that of our sun. She has also discovered that most, if not all, stars shortly after birth have companion stars and that in most cases the separations of these companions pairs are smaller than the size of our solar system. For her research at Keck, Professor Ghez was named in *Discover Magazine*'s 20th anniversary issue (2000) as one of the top 20 scientists in the country under 40, who "have demonstrated once-in-a-generation insight" and "will likely change our fundamental understanding of the world and our place in it." Her work at the center of our Galaxy was also selected by the journal *Science* as one of the top 10 science results for 2002.

A member of the University of California at Los Angeles (UCLA) faculty since 1994, Professor Ghez also serves as a member of the Institute of Geophysics and Planetary Physics. She received a B.S. from MIT in 1987 and a Ph.D. in physics from Caltech in 1992. Before coming to UCLA, she was a Hubble Postdoctoral Research Fellow at University of Arizona's Steward Observatory. Her honors and awards include a MacArthur Fellowship (2008), Aaronson Award from the University of Arizona (2006), election to the National Academy of Sciences (2004) and the American Academy of Arts & Sciences (2004), the Sackler Prize from Tel Aviv University (2004), the Maria Goeppert-Mayer Award from the American Physical Society (1999), the Newton Lacy Pierce Prize from the American Astronomical Society (1998), Sloan Fellowship (1996), and a Packard Fellowship (1996).

Professor Ghez has served on numerous national committees and boards. Currently, her service work includes membership on the National Research Council's Board on Physics and Astronomy and the Thirty-Meter-Telescope's Science Advisory Committee.

(2004–2006) and is currently Scientific Advisor.

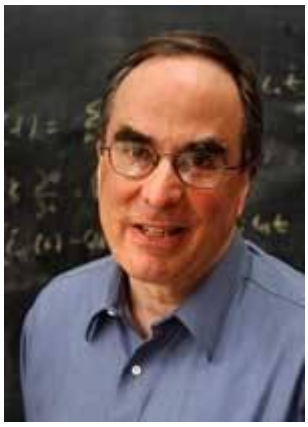
Awards Addresses

Robert L. Byer
Stanford Univ., USA
2009 Frederic Ives Medal/Jarus W. Quinn Endowment Recipient

View presentation (PDF)

Ives Medal Lecture: **Surfing Lightwaves; meeting the challenges of the 21st Century**

Abstract: In the fifty years since the demonstration of the laser, coherent light has changed the way we work, communicate and play. The generation and control of light is critical for meeting important challenges of the 21st century



Robert W. Field
MIT, USA
2009 Arthur L. Schawlow Prize in Laser Science Recipient

View presentation (PDF)

Schawlow Prize Lecture: **Acetylene: Just Large Enough**

Abstract: What can acetylene (H-C≡C-H) do that a diatomic molecule cannot? It can undergo bond-breaking isomerization. The minimum energy isomerization path from acetylene to vinylidene is a very large-amplitude local-bend.

from fundamental science to the generation of energy.

Biography: Robert L. Byer has conducted research and taught classes on lasers and nonlinear optics at Stanford University since 1969. He has made extraordinary contributions to laser science and technology including the demonstration of the first tunable visible parametric oscillator, the development of the Q-switched unstable resonator Nd:YAG laser, remote sensing using tunable infrared sources, and precision spectroscopy using Coherent Anti Stokes Raman Scattering (CARS). Byer's ongoing research includes development of nonlinear optical materials and laser diode pumped solid-state laser sources for applications to gravitational wave detection and to laser particle acceleration.

Currently the William R. Kenan Jr. Professor of Applied Physics, Byer has served as vice provost and dean of research at Stanford as well as chair of the Department of Applied Physics, director of the Edward L. Ginzton Laboratory, and Director of the Hansen Experimental Physics Laboratory. He is a founding member of the California Council on Science and Technology and served as chair from 1995–1999. He has been a member of the National Ignition Facility since 2000 and was a member of the Air Force Scientific Advisory Board from 2002–2006. He has served as president of both OSA and IEEE LEOS.

Byer has published more than 500 papers and holds 50 patents in the fields of lasers and nonlinear optics. He is a fellow of OSA, IEEE, APS, AAAS, and LEOS, and is a member of the National Academy of Engineering and the National Academy of Science.

How are large-amplitude motions encoded in a spectrum? At high vibrational excitation, anharmonic interactions between vibrational normal-modes become very strong and all of the textbook energy level patterns, upon which assignments are based, are shattered. Most vibrational eigenstates are complex, one might even say "ergodic," mixtures of many normal-mode basis-states. However, large-amplitude-motion states comprise a tiny fraction of all eigenstates. How does one **gain access** to these rare large-amplitude states? How does one **distinguish** a large-amplitude state from an ergodic state in a spectrum? How does one **use** large-amplitude states to map the chemically interesting isomerization path on the S_0 potential energy surface? Access is provided by a "local-bender pluck" state, which exploits anharmonic interactions on the S_1 potential energy surface to escape Franck-Condon restrictions in the $S_1 \rightarrow S_0$ Stimulated Emission Pumping (SEP) spectrum. A relatively low *trans-cis* isomerization barrier on S_1 provides spectroscopic access to eigenstates proximal to a high barrier on S_0. Electronic properties (such as the electric dipole transition moment) serve as embedded reporters on the existence and extent of large-amplitude motions. However, electronic properties give rise to minuscule level splittings. How does one combine a survey over a wide spectral region in search of rare large-amplitude local-bender states yet simultaneously achieve the extremely high resolution necessary to read what the embedded reporter has written? Brooks Pate (University of Virginia) has developed "Chirped Pulse Microwave Spectroscopy (CPMW)," which combines the previously unimaginable combination of survey (10GHz), high-resolution (100kHz), and accurate relative-intensity (1 part in 104) capabilities. The CPMW scheme is perfectly suited to 20 Hz repetition rate pulsed supersonic jet molecular beams and Q-switched Nd:YAG pumped pulsed tunable lasers, upon which most small-molecule spectroscopists depend.

This research has been supported by the

Department of Energy (Grant: DE-FG0287ER13671).

Biography: Robert W. Field majored in chemistry at Amherst College (AB thesis with Cooper H. Langford, 1965). He became a physical chemist in the research group of William Klemperer at Harvard University, where he discovered his affinity for multiple resonance spectroscopies and spectroscopic perturbations (PhD, 1972). As a post-doc with Herbert P. Broida and David O. Harris at University of California at Santa Barbara (1971–1974) he performed the first microwave-optical and optical-optical double resonance studies of diatomic molecules using tunable lasers and showed how to extract global insights into the electronic structure of the alkaline earth monoxides from the systematic study of spectroscopic perturbations. At MIT (Assistant Professor 1974, Associate Professor 1978, Professor 1982, Haslam and Dewey Professor 1999) his students and post-docs have continued to develop new laser spectroscopic techniques (most notably Stimulated Emission Pumping) with a goal of uncovering and exploiting unconventional patterns that encode the mechanisms of far-from-equilibrium molecular dynamics, particularly Intramolecular Vibrational Redistribution, Doorway-Mediated Intersystem Crossing, and energy exchange between a Rydberg electron and a molecular ion-core. He is a Fellow of the American Physical Society (APS), The Optical Society (OSA), the American Academy of Arts and Sciences, and the American Association for the Advancement of Science. He has received the Broida (1980) and Plyler (1988) Prizes of the APS, the Lippincott (1990) and Meggers (1996) Awards of the OSA, and the Bomem-Michelson Award of the Coblentz Society. His favorite molecules have been CO, CaF, and acetylene. His book (co-authored with Helene Lefebvre-Brion, 2004), “The Spectra and Dynamics of Diatomic Molecules,” is the user’s guide for both theorists and experimentalists.

Invited Speakers

Frontiers in Optics Invited Speakers
Laser Science Invited Speakers

FiO 1: Optical Design and Instrumentation

NOTE: Roger Angel is unable to attend FiO 2009; **Greg P. Smestad** (Solar Energy Materials and Solar Cells, and Sol Ideas Technology Development, USA) will give the keynote talk.

1.1: Novel Optical Architectures in Emerging Technologies (Joint with FiO 7)

Invited Speakers:

FWR1, **Biomolecular Sensing with Ultrafine Optical Fibers and Plasmonic Nanostructures**, *Donald J. Sirbuly[1], Sarah Baker[2], Sanja Zlatanovic[3], Jason Steiner[1], Sadik Esener[1,3]; [1]NanoEngineering Dept., Univ. of California at San Diego, USA, [2]Physical and Life Sciences Directorate, Lawrence Livermore Natl. Lab, USA, [3]Electrical and Computer Engineering, Univ. of California at San Diego, USA*

FWR2, **Advances in Microendoscope Design and Application**, *Arthur Gmitro, Houssine Makhlouf, Andrew Rouse; Univ. of Arizona, USA*

FWX1, **Miniaturization of Adaptive Optics Scanning Laser Ophthalmoscope** *Austin Roorda[1], David Merino[1], Kaccie Y. Li[1], Yuhua Zhang[2]; [1]Univ. of California at Berkeley, USA, [2]Univ. of Alabama, Birmingham, USA*

1.2: Novel Optical Architectures Using Free-Form Surfaces

Tutorial Speaker:

FThN1, **Fabrication and Testing of Large Free-Form Surfaces**, *James Burge; Univ. of Arizona, USA*

Invited Speakers:

FThH1, **Can You Make/Measure this Asphere for Me?** *Greg Forbes; QED Technologies Inc., USA*

FThN2, **Application of Radial Basis Functions to the Design of a Freeform Single Element See-through Head-Worn Display**, *Ozan Cakmakci[1], Jannick Rolland[2]; [1]Optical Res. Associates, USA, [2]Inst. of Optics, Univ. of Rochester, USA*

1.3: Optics for Renewable Energy

Keynote Speaker:

FMB1, **Optics of Solar Cells**, *Greg P. Smestad[1,2]; [1]Solar Energy Materials and Solar Cells, USA, [2]Sol Ideas Technology Development, USA*

Invited Speaker:

FMB2, **Solar Production of Fuels**, *Anastasios Melis; Univ. of California at Berkeley, USA*

1.4: Polarization and Birefringence in Optical Design

Invited Speakers:

FThF1, **Photoaligned Liquid Crystal Polymers for Space Variant Polarization Control**, *Scott McEldowney[1], David M. Shemo[2], Russell A. Chipman[3]; [1]Microsoft Corp., USA, [2]JDS Uniphase, USA, [3]Univ. of Arizona, USA*

FThF2, **Optical Imaging Instrumentation with Spatially Engineered Polarization**, *Qiwen Zhan; Univ. of Dayton, USA*

FThL1, **Polarization Aberration Functions in Three Dimensions**, *Russell Chipman; Univ. of Arizona, USA*

1.6: Diffractive and Holographic Optics

FTuH1, **Dynamic Holograms**, *Guoqiang Li; Univ. of Missouri at St. Louis, USA*

FTuO1, Applications and Engineering of Three-Dimensional Optics, *Eric Johnson[1], Pradeep Srinivasan[1], Menelaos Poutous[1], Zachary Roth[1], Raymond Rumpf[2]; [1]Univ. of North Carolina at Charlotte, USA, [2]Prime Res. LC, USA*

FTuV1, **Role of Surface Plasmon Polariton in the Diffraction of a Metal Nano-Slit**, *Yann Gravel, Yunlong Sheng; Univ. Laval, Canada*

FThB3, **Live Cell Imaging with Field-Based 3-D Microscopy**, *Michael Feld, Wonshik Choi; MIT, USA*

View Computational Optical Sensing and Imaging (COSI) invited speakers.

FiO 2: Optical Sciences

2.1: Extreme Light Sources (Joint with FiO 6)

Tutorial Speaker:

FMI1, **High Peak Power Laser Technologies: New Directions**, *Christopher Barty; Lawrence Livermore Natl. Lab, USA*

Invited Speakers:

FMI2, **The Extreme Light Infrastructure Project**, *Jean-Paul Chambaret; Lab. d'Optique Appliquée, France*

FMI3, **An Overview of the Activities of the UK's High Power Laser Programme**, *John Collier[1,2]; [1]Central Laser Facility, Science and Technology Facilities Council (STFC), Rutherford Appleton Lab, UK, [2]Dept. of Physics, Swansea Univ., UK*

FTuK1, **Status of the National Ignition Facility**, *Peter (Jeff) Wisoff; Lawrence Livermore Natl. Lab, USA*

FTuK2, **The Texas Petawatt Laser**, *Todd Ditmire; Univ. of Texas at Austin, USA*

2.2: Short Wavelength—Generation and Applications

Tutorial Speaker:

FTuS1, **EUV Lithography–The Next Generation of Computer Chip Manufacture**, *Martin Richardson; CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA*

Invited Speakers:

FTuS3, **High Brightness Plasma-Based Soft X-Ray Lasers and Applications**, *James Dunn; Lawrence Livermore Natl. Lab, USA*

FTuZ1, **Coherent X-Rays from Ultrafast Lasers, and Applications—Attosecond Science Meets Nonlinear Optics**, *Henry C. Kapteyn, Margaret M. Murnane; JILA, Univ. of Colorado at Boulder, USA*

FTuZ2, **Nanoscale Microscopy with Table-Top Extreme Ultraviolet Lasers**, *C. S. Menoni[1], F. Brizuela[1], C. Brewer[1], Y. Wang[1], F. Pedaci[1], B. M. Luther[1], W. Chao[1,2], E. H. Anderson[1,2], D. T. Attwood[1,2], A. V. Vinogradov[3], I. A. Artioukov[3], A. G. Ponomareko[4], V. V. Kondratenko[4], M. C. Marconi[1], J. J. Rocca[1,4]; [1]Colorado State Univ., USA, [2]Lawrence Berkeley Natl. Lab, Univ. of California, USA, [3]P. N. Lebedev Physical Inst., Russian Acad. of Sciences, Russian Federation, [4]Technical Univ., Ukraine*

FTuZ3, **Extreme High Harmonics from Relativistically Oscillating Surfaces**, *Matt Zepf; Queen's Univ. Belfast, Ireland*

2.3: Biomedical Applications of Ultrafast Optics (Joint with FiO 3 and 7)

Invited Speakers:

FWA1, **Nanosurgery with Femtosecond Lasers**, *Eric Mazur; Harvard Univ., USA*

FWA2, **Improvements in Two-Photon Fluorescence Microscopy**, *Kengyeh K. Chu, Tom Bifano, Jerome Mertz; Boston Univ., USA*

FWA3, **Tissue Imaging with Shaped Femtosecond Laser Pulses**, *Warren S. Warren; Duke Univ., USA*

Symposium: Gravitational Wave Interferometry from Earth and Space (Joint with Laser Science)

FiO 3: Optics in Biology and Medicine

Watch Adam Wax, Subcommittee Member, discuss what's hot in Optics in Biology and Medicine.

3.1: Optics in Interventional Medicine

FThP1, **Photodynamic Therapy: A Bridge between Technology and Medicine**, *Tayyaba Hasan; Massachusetts General Hospital, USA*

FThP4, **User-Friendly, Open-Source Computational Tools for Biophotonics**, *Vasan Venugoplan; Univ. of California at Irvine, USA*

3.2: Optical Trapping and Micromanipulation

Invited Speakers:

FWM1, **Optical Trapping and Manipulation Using Microfabricated Optical Tweezers Based on Diffractive Optics and Surface Plasmons**, *Ken Crozier; Harvard Univ., USA*

FWS1, **High-Resolution, High-Stability, High-Frequency Optical Tweezers Methods with a Simple Video Camera**, *Wesley Wong; Rowland Inst., Harvard Univ., USA*

FWS4, **Optical Phase Conjugation for Tissue Turbidity Suppression**, *Changhuei Yang; Caltech, USA*

FWY1, **Multimode Light in Action**, *Roberta Zambrini; IFISC (UIB-CSIC), Univ. Illes Balears, Spain*

3.3: Optical Biosensing

Invited Speakers:

FTuY3, **Designing Interfaces for Optical Biosensors**, *Ashutosh Chilkoti; Duke Univ., USA*

3.4: Tissue Imaging and Spectroscopy

Invited Speakers:

FME1, **Imaging Metal Nanoparticle Distribution within Tumors**, *J. Park[1], P. Puvanakrishnan[1], P. Diagaradjane[2], J. A. Schwartz[3], J. D. Payne[3], A. K. Dunn[1], S. Krishnan[2], J. W. Tunnell[1]; [1]Univ. of Texas at Austin, USA, [2]Radiation Oncology, MD Anderson Cancer Ctr., USA, [3]Nanospectra Biosciences Inc., USA*

3.5: Microscopy and OCT

Invited Speakers:

FMK1, **Nonlinear Coherent Imaging of Nanostructures and Single Molecules**, *Eric Potma; Univ. of California at Irvine, USA*

FThV1, **Advances in High-Speed Imaging by Objective-Coupled Planar Illumination Microscopy**, *Timothy Holy; Washington Univ. in St. Louis, USA*

FThV6, **Title to Be Announced**, *Max Diem; Northeastern Univ., USA*

3.6: Molecular Imaging and Nanomedicine

Invited Speakers:

FTuL1, **Molecular Probes for Microendoscopy**, *Chris Contag; Stanford Univ. School of Medicine, USA*

FTuL4, **Biomimetic Strategies for Modification of Surfaces with Passivating and Targeting Moieties**, *Phillip B. Messersmith; Northwestern Univ., USA*

2.3: Biomedical Applications of Ultrafast Optics (Joint with FiO 2 and 7)

7.1: Molecular Imaging in the Eye (Joint with FiO 7)

FiO 4: Optics in Information Science

4.1: Optical Information Processing and Transport in the Age of Nanophotonics and Metamaterials

Invited Speakers:

FWB1, **Optofluidic Nano-Plasmonics for Biochemical Sensing**, *Yeshaiahu Fainman, Lin Pang, Boris Slutsky, Joanna Ptasinski; Univ. of California at San Diego, USA*

4.2: Optical Signals and System in Four Dimensions

Invited Speakers:

FTuU3, **Title to Be Announced**, *Aristide Dogariu; CREOL & FPCE, Univ. of Central Florida, USA*

FThR2, **Multi-Channel Incoherent Digital Holography**, *Joseph Rosen, Barak Katz; Ben Gurion Univ. of the Negev, Israel*

4.3: Computational Imaging and Photography (Joint with FiO 1)

Invited Speakers:

FThR1, **Emerging Integrated Computational Imaging Systems**, *Nicholas George, Wanli Chi; Univ. of Rochester, USA*

FThX1, **4-D Frequency Analysis of Computational Cameras for Depth of Field Extension**, *Anat Levin; Weizmann Inst. of Science, Israel*

FThX2, **Optimization and Application of Hybrid Optical-Digital Imaging Systems**, *Andrew Harvey, Mads Demenikov, Gonzalo D. Muyo, Tom Vettenburg; Heriot-Watt Univ., UK*

View Computational Optical Sensing and Imaging (COSI) invited speakers.

4.4: Wavefront Design for Information Transport and Sensing

Invited Speakers:

FTuG1, **Modulation of Polarization Properties of Beams for Laser Communications and LIDAR Systems Operating in Random Media**, *Olga Korotkova; Univ. of Miami, USA*

FTuG2, **Vectographic Computer-Generated Optical Elements**, *Grover Swartzlander; Ctr. for Imaging Science, Rochester Inst. of Technology, USA*

FTuU1, **SLM Microscopy: Wavefront Shaping for Microscopy with Spatial Light Modulators**, *Monica Ritsch-Marte; Innsbruck Medical Univ., Austria*

FTuU2, **Optimal Transmission of Light through Disordered Materials**, *Allard Mosk; Univ. of Twente, Netherlands*

Symposium: Phase Space Optics—Optical System Theory for the 21st Century

FiO 5: Photonics

5.1: Novel Fiber and Integrated-Optical Devices

Invited Speakers:

FTuD1, **Novel Fiber Lasers with Advanced Glasses and Fiber Designs**, *Axel Schülzgen; Univ. of Arizona, USA*

FTuP3, **Principal Modes in Graded-Index Multimode Fibers**, *Mahdieh Shemirani, Joseph Kahn; Stanford Univ., USA*

FWE1, **Multimaterial Fiber Devices and Systems**, *Ofer Shapira; MIT, USA*

FWF1, **Why Use Photonic Crystal Fibers for Sensing?** *Jonathan Knight; Univ. of Bath, UK*

FWG4, **Fiber Optic Sensors Based On Surface Plasmon Resonance**, *Banshi D. Gupta; Indian Inst. of Technology, India*

5.2: Photonic Devices for Sensing Applications

Invited Speakers:

FTuE3, **Advances in Chemical and Biological Sensing Using Emerging Soft Glass Optical Fibers**, *Yinlan Ruan, Heike Ebendorff-Heidepriem, Afshar V. Shahraam, Stephen Warren-Smith, Tanya Monro; Univ. of Adelaide, Australia*

FWG1, **Optical Manipulation using Silicon Nanophotonics**, *David Erickson; Cornell Univ., USA*

FWT1, **Plasmonics on Optical Fibers: New Tools for Biochemical Sensing**, *Jacques Albert, Maria Derosa, Anatoli Ianoul, Yanina Shevchenko, Alexander Beliaev, David A. D. Blair, Nur Ahamad; Carleton Univ., Canada*

5.3: All-Optical Signal Processing Devices and Applications

Invited Speakers:

FTuI1, **Polychromatic High Speed Sampling**, *Stojan Radic; Univ. of California San Diego, USA*

FTuI4, **Advances in High-Confinement Fibers**, *Msaaki Hirano; Sumitomo Electric Industries, Ltd., Japan*

FTuW1, **All-Optical Header Processing Using Semiconductor Optical Amplifiers**, *Roderick P. Webb[1], X. Yang[2], R. J. Manning[1], G. D. Maxwell[3], A. J. Poustie[3], S. Lardenois[3],*

D. Cotter[1]; [1]Tyndall Natl. Inst., Univ. College Cork, Ireland, [2]School of Electrical Engineering, Bangor Univ., UK, [3]CIP Technologies, UK

FWK1, **Nonlinear Optics on a Chip: Breaking the Terabit per Second Barrier**, *Benjamin J. Eggleton; Univ. of Sydney, Australia*

5.4: Optical Communication

Invited Speakers:

FMD1, **Bi-Directional Multi-Service 60-GHz MM-Wave Radio-over-Fiber Network Interoperable with Multi-Gigabit Wireless Transceiver for Very High Throughput Inbuilding HD Video and Data Delivery**, *Gee-Kung Chang, Arshad Chowdhury, Hung-Chang Chien; Georgia Tech, USA*

FTuC1, **Next-Generation Optical Access Networks**, *Leonid Kazovsky[1], Shing-Wa Wong[1], She-Hwa Yen[1], Shinji Yamashita[1]; [1]Stanford Univ., USA, [1]Fujitsu Labs Ltd., Japan*

FTuC2, **Agile WDM Layer for FlexSelectTM Metro Optical Network**, *Shan Zhong, Jean-Luc Archambault, Loudon Blair; Ciena Corp., USA*

FTuP1, **Extended Reach Passive Optical Networks**, *Chang-Hee Lee; KAIST, Republic of Korea*

5.5: Silicon Photonics

Invited Speakers:

FML1, **Deterministic Aperiodic Structures for Nanoplasmonics**, *Luca Dal Negro; Boston Univ., USA*

FML6, **Erbium Doped Silicon Photonic Crystals for Light Sources and Amplifiers**, *Jelena Vučković[1], Maria Makarova[1], Yiyang Gong[1], Selcuk Yerçi[2], Rui Li[2], Luca Dal Negro[2]; [1]Dept. of Electrical Engineering and Ginzton Lab, Stanford Univ., USA, [2]Dept. of Electrical and Computer Engineering, Boston Univ., USA*

FWN1, **Photonic Signal Processing in CMOS-Compatible Silicon**, *Mahmoud S. Rasras; Bell Labs, Alcatel Lucent, USA*

FWN3, **Cascaded Silicon Raman Laser Using Tunable Ring Resonator**, *Haisheng Rong[1], Omri Raday[2], Mario Paniccia[1]; [1]Intel Corp., USA, [2]Intel Corp., Israel*

FWZ1, **Green Integrated Photonics**, *Sasan Fathpour; CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA*

5.6: Design and Fabrication of Plasmonic Devices and Metamaterials (Joint with FiO 6)

Invited Speakers:

FMA1, **About Energy, Linear Momentum and Mass Transfer by Electromagnetic Wave in Negative Refraction Media**, *Victor Veselago; Moscow Inst. of Physics and Technology, Russian Federation*

FMH1, **Three-Dimensional Metallic Metamaterials: Coupling Matters**, *Harald Giessen; Univ. of Stuttgart, Germany*

FTuB1, **Active Terahertz Metamaterials**, *Hou-Tong Chen; Los Alamos Natl. Lab, USA*

FTuN1, **Optical Metamaterials**, *Xiang Zhang; Univ. of California at Berkeley, USA*

FWC3, **Terahertz Electromagnetic Phenomena near Metallic Nanogap Structures**, *D. S. Kim[1], M. A. Seo[1], H. R. Park[1], J. S. Kyoung[1], S. M. Koo[1], N. K. Park[1], O. K. Suwal[2], S. S. Choi[2]; [1]Seoul Natl. Univ., Republic of Korea, [2]Sun Moon Univ., Republic of Korea*

FWP1, **Ultrafast Optical Nonlinearities in Hybrid Metal-J-Aggregate Nanostructures**, *Christoph Lienau; Carl von Ossietzky Univ., Germany*

FWP4, **Tailoring Polarization States of Visible Light through Metallic Nanostructures**, *J.-Y. Laluet, E. Laux, E. Lombard, A. Drezet, C. Genet, Thomas W. Ebbesen; Univ. de Strasbourg and CNRS, France*

View Advances in Optical Materials (AIOM) invited speakers.

FiO 6: Quantum Electronics

6.1: High-Power Continuous-Wave and Fiber Lasers

Invited Speakers:

FThD1, **High Power CW and Pulsed Fiber Lasers with Double Cladding Fiber Made in China**, *Qihong Lou, Jun Zhou, Bin He, Songtao Du; Shanghai Inst. of Optics and Fine Mechanics, China*

FThD2, **100-kW Coherently Combined Nd:YAG MOPA Laser Array**, *Stuart J. McNaught, Charles P. Asman, Hagop Injeyan, Andrew Jankevics, Adam M. F. Johnson, Gina C. Jones, Hiroshi Komine, Jason Machan, Jay Marmo, Michael McClellan, Randy Simpson, Jeff Sollee, Marcy M. Valley, Mark Weber, S. Benjamin Weiss; Northrop Grumman*

Aerospace Systems, USA

FThD5, **Spatial Filtering Properties of Large-Mode-Area Fibers with Confined Gain Dopants**, *John R. Marciante; Univ. of Rochester, USA*

FThJ1, **Title to Be Announced**, *Valentin Gapontsev; IPG Photonics Corp., USA*

FThJ4, **High-Power Fiber Lasers and Amplifiers**, *Andreas Tünnermann[1,2], Thomas Schreiber[1,2], Jens Limpert[1,2]; [1]Friedrich-Schiller Univ. Jena, Germany, [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany*

6.2: Microcavity Devices

Invited Speakers:

FThC1, **Crystalline Whispering Gallery Mode Resonators: Recent Advances and Future Trends**, *Lute Maleki, Andrey B. Matsko, Anatoliy A. Savchenkov, Vladimir S. Ilchenko, David Seidel; OEwaves, Inc., USA*

FThC4, **Applications of High-*Q* Optical Microresonators in Communication**, *Mani Hossein-Zadeh; Ctr. for High Technology Materials, Univ. of New Mexico, USA*

FThO3, **Simultaneous Oscillation of Wavelength-Tunable Singlemode Lasers Using Er:ZBLALiP Whispering Gallery Mode Resonator**, *Patrice Féron[1], Lei Xiao[1,2], Stéphane Trébaol[1], Yannick Dumeige[1], Yann G. Boucher[1], ZhiPing Cai[2], Michel Mortier[3]; [1]Univ. de Rennes 1, France, [2]Xiamen Univ., China, [3]Lab de Chimie Appliqúee de l'Etat Solide-LCAES, CNRS-UMR, France*

FThU3, **Quantum Computing with Rydberg Atoms in Cavities**, *M. Everitt, J. Dunningham, B. T. H. Varcoe; Univ. of Leeds, UK*

6.3: Nonlinear Statistical Optics

Invited Speakers:

FTuR1, **Freak Ocean Waves in One and Two Dimensions**, *Peter Janssen, Jean-Raymond Bidlot; European Ctr. for Medium-Range Weather Forecasts, UK*

FTuR2, **Rogue Waves in Optics**, *J. M. Dudley[1], G. Genty[2], F. Dias[3]; [1]Univ. of Franche-Comté, France, [2]Tampere Univ. of Technology, Finland, [3]Ctr. de Mathématiques et de Leurs Applications, École Normale Supérieure de Cachan, France*

FTuR3, **Methods for Simulating Rare Events in Optical Systems**, *Gino Biondini[1], Richard O. Moore[2]; [1]SUNY Buffalo, USA, [2]New Jersey Inst. of Technology, USA*

FWD1, **Thermodynamic Approach of Statistical Nonlinear Optics**, *B. Kibler[1], B. Barviau[1], S. Coen[2], J. Fleischer[3], A. Kudlinski[4], P. Aschieri[5], G. Millot[1], A. Picozzi[1]; [1]Univ. de Bourgogne, France, [2]Univ. of Auckland, New Zealand, [3]Princeton Univ., USA, [4]Univ. de Lille, France, [5]Univ. de Nice Sophia Antipolis, France*

FWD4, **Gravity-Like Effects on Light and Fiber Supercontinuum**, *Dmitry Skryabin; Univ. of Bath, UK*

6.4: Quantum Optics in Waveguides

Invited Speakers:

FMG1, **Quantum Information Science with Photons on a Chip**, *Alberto Peruzzo, Alberto Politi, Jonathan C. F. Matthews, Anthony Laing, Pruet Kalasuwan, Xiao-Qi Zhou, Maria Rodas, Martin J. Cryan, John G. Rarity, Andre Stefanov, Siyuan Yu, Mark G. Thompson, Jeremy O'Brien; Univ. of Bristol, UK*

FMG4, **Quantum Optics in Waveguide Lattices**, *Yaron Bromberg[1], Yoav Lahini[1], Roberto Morandotti[2], Yaron Silberberg[1]; [1]Weizmann Inst. of Science, Israel, [2]INRS, Canada*

FWJ3, **Photon Pair Generation in Birefringent Fiber: A Route to Better Photons**, *Jeff S. Lundeen[1], Offir Cohen[2], Pierre Mahou[2], Brian J. Smith[2], Ian A. Walmsley[2]; [1]Inst. for Natl. Measurement Standards, Natl. Res. Council Canada, Canada, [2]Clarendon Lab, Univ. of Oxford, UK*

FWJ5, **Quantum Logic Gates with Fiber-Generated Entanglement in the Telecommunications Band**, *Prem Kumar, Monika Patel, Milja Medic, Matthew A. Hall, Joseph B. Altepeter; Northwestern Univ., USA*

6.5: Entanglement Generation and Measurement

Tutorial Speaker:

JTuB1, **Efficient Algorithms for Quantum State and Process Tomography**, *Andrew Doherty; Univ. of Queensland, Australia*

Invited Speakers:

JMA1, **Synthesizing Arbitrary Photon States in a Superconducting Resonator: The Quantum Digital to Analog Converter**, *John Martinis, Max Hofheinz, H. Wang, M. Ansmann, Radoslaw C. Bialczak, Erik Lucero, M. Neeley, A. D. O'Connell, D. Sank, J. Wenner, A. N. Cleland; Univ. of California at Santa Barbara, USA*

JWD1, **Strong Interactions of Single Atoms and Photons with Toroidal Micro-**

Resonators, *H. Jeff Kimble; Caltech, USA.*

JWD6, **Measurement-Based Entanglement and Quantum Information Processing with Remote Ions**, *Peter Maunz, Steven Olmschenk, David Hayes, Dzmitry N. Matsukevich, Christopher Monroe; Joint Quantum Inst., Univ. of Maryland and NIST, USA*

JWE1, **Hyperentangled Photons for Communication and Metrology**, *Paul Kwiat[1], Julio Barreiro[1,2]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Univ. Innsbruck, Austria*

JWE4, **Quantum Field State Control and Measurement in a Cavity**, *J. M. Raimond, S. Deléglise, C. Sayrin, X. Zhou, I. Dotsenko, S, Gleyzes, M. Brune, S. Haroche; École Normale Supérieure, France*

6.6: Anderson Localization of Classical and Quantum Waves

Invited Speakers:

FMC1, **Multiple Scattering of Light in Atomic Gases: From Levy Flights to Random Lasers**, *Robin Kaiser; Univ. de Nice Sophia-Antipolis, France*

FMC4, **Photons, Dust and Honey Bees**, *Pierre Barthelemy, Jacopo Bertolotti, Diederik S. Wiersma; European Lab for Non Linear Spectroscopy, Univ. of Florence, Italy*

FTuJ1, **Probing Localization in Absorbing Systems via Loschmidt Echos**, *Tsampikos Kottos[1,2]; [1]Wesleyan Univ., USA, [2]Max-Planck-Inst., Germany*

FTuJ4, **Quantum Optics of Random Media**, *Sergey E. Skipetrov; CNRS, Univ. Joseph Fourier, France*

2.1: Extreme Light Sources (Joint with FiO 2)

5.6: Design and Fabrication of Plasmonic Devices and Metamaterials (Joint with FiO 5)

FiO 7: Vision and Color

7.1: Molecular Imaging in the Eye (Joint with FiO 3)

Tutorial Speaker:

FThQ1, **Molecular Imaging in the Eye**, *Frederick Fitzke; Univ. College London, UK*

Invited Speakers:

FThQ3, *In vivo* **Cellular Imaging of the Rodent Retina**, *Jason Porter; Univ. of Houston, USA*

FThQ4, **Molecular Imaging with OCT**, *Joseph Izatt; Dept. of Biomedical Engineering, Duke Univ., USA*

View Adaptive Optics: Methods, Analysis and Applications (AO) invited speakers.

7.2: Advances in Adaptive Optics Imaging of the Living Retina

Invited Speakers:

JWB3, **Adaptive Optics Psychophysics**, *Heidi Hofer; Univ. of Houston, USA*

JWF1, **Adaptive Optics Instrumentation**, *Stephen A. Burns[1], Zhangyi Zhong[1], Weiyao Zou[1], Cong Deng[1], Daniel Ferguson[2], Xiaofeng Qi[1]; [1]Indiana Univ., USA, [2]Physical Sciences Inc., USA*

JWF3, **Adaptive Optics-OCT Imaging of the Retina**, *Donald T. Miller; Indiana Univ., USA*

View Adaptive Optics: Methods, Analysis and Applications (AO) invited speakers.

7.3: Light in the Eye

Tutorial Speaker:

FTuQ1, **Light and Eye Safety**, *David Sliney; Consulting Medical Physicist, USA*

Invited Speakers:

FTuQ2, **Unexpected Retinal Damage below the ANSI Standard**, *Jennifer Hunter[1], Jessica I. W. Morgan[2], William H. Merigan[1], David R. Williams[1]; [1]Univ. of Rochester, USA, [2]Univ. of Pennsylvania, USA*

FTuQ3, **Light Exposure and the Retina**, *Jacque Duncan; Univ. of California at San Francisco, USA*

[1.1: Novel Optical Architectures in Emerging Technologies (Joint with FiO 1)]

[2.3: Biomedical Applications of Ultrafast Optics (Joint with FiO 2 and 3)]

LS 1: Optical Probes of Molecular Chirality and Supramolecular Chiral Assemblies

Invited Speakers:

LSMB1, **Probing Molecular Chirality by Conventional and Fluorescence Detected Electronic Circular Dichroism**, *Nina Berova; Columbia Univ., USA*

LSMB2, **Optical Activity at Interfaces**, *Peer Fischer; Rowland Inst. at Harvard, Harvard Univ., USA*

LSMB3, **Intrinsic Chiroptical Response and Its Mediation by Extrinsic Perturbations**, *Patrick H. Vaccaro; Yale Univ., USA*

LSMB4, **Circularly Polarized Luminescence from Single Chiral Molecules**, *Michael D. Barnes, Ruthanne Hassey-Paradise, D. Venkataraman; Univ. of Massachusetts, Amherst, USA*

LSMF1, **Chiroptical Imaging of Crystals by Mueller Matrix Microscopy**, *John Freudenthal[1,2], Erica Gunn[2], Bart Kahr[1,2]; [1]New York Univ., USA, [2]Univ. of Washington, USA*

LSMF2, **Second-Order Nonlinear Optical Imaging of Chiral Crystals**, *Ellen Gualtieri, Victoria Hall, Sarah Harden, David Kissick, Ronald Wampler, Debbie Wanapun, Garth J. Simpson; Purdue Univ., USA*

LSMF3, **Structural Origin of Circularly Polarized Iridescence in Jeweled Beetles**, *Mohan Srinivasarao; Georgia Tech, USA*

LS 2: Single-Molecule Biophysics

Invited Speakers:

LSWA1, **Single-Molecule Biophysical Imaging, Superresolution, and Trapping**, *W. E. Moerner; Stanford Univ., USA*

LSWA2, **Optical Nanoscopy: FPALM Breaks the Diffraction Limit**, *Samuel Hess; Univ. of Maine, USA*

LSWD1, **Real-Time 3-D Single-Particle Tracking Spectroscopy for Cellular Dynamics**, *Haw Yang; Princeton Univ., USA*

LSWD4, **Tracking Fluorescence Correlation Spectroscopy of Individual Biomolecules**, *Kevin McHale[1,2], Andrew Berglund[3], Ke Zhang[1], Charles Limouse[1], Chandra Raman[1,4], Hideo Mabuchi[1]; [1]Stanford Univ., USA, [2]Lab of Chemical Physics, NIDDK, NIH, USA, [3]CNST Nanofabrication Res. Group, NIST, USA, [4]Georgia Tech, USA*

LSWD5, **Local Structural Flexibility of Nucleic Acid Probed by a Wide Field Single Molecule FRET Imaging Technique**, *Tae-Hee Lee; Pennsylvania State Univ., USA*

LSThB1, **Investigating Amyloid Nucleation and Growth Using Single Molecule Fluorescence Microscopy**, *Keith Berland, David G. Lynn, Yan Liang; Emory Univ., USA*

LSThB2, **3-D Localization in Fluorescence Photoactivation Localization Microscopy and Particle Tracking**, *Joerg Bewersdorf[1,2], Michael J. Mlodzianoski[1,2], Stefanie E. K. Kirschbaum[2,3,4,5], Manuel F. Juette[1,2,4,5]; [1]Yale Univ. School of Medicine, USA, [2]Inst. for Molecular Biophysics, The Jackson Lab, USA, [3]Dept. of Physics and Astronomy, Univ. of Maine, USA, [4]Dept. of Biophysical Chemistry, Univ. of Heidelberg, Germany, [5]Dept. of New Materials and Biosystems, Max Planck Inst. for Metals Res., Germany*

LSThB3, **Single Molecule Imaging of Axonal Transport in Live Neurons**, *Harsha V. Mudrakola, Chengbiao Wu, Kai Zhang, Bianxiao Cui; Stanford Univ., USA*

LSThB4, **Probing Cellular Events with Single Quantum Dot Imaging**, *Maxime Dahan; Lab Kastler Brossel, École Normale Supérieure, France*

LSThD1, **Imaging Gene Transcription**, *Christopher J. Fecko; Univ. of North Carolina at Chapel Hill, USA*

LSThD2, **Total Internal Reflection with Fluorescence Correlation Spectroscopy**, *Nancy Thompson; Univ. of North Carolina at Chapel Hill, USA*

LSThD3, **DNA Repair Protein Dynamics through Single-Molecule Fluorescence**, *Keith R. Weninger[1], Lauryn E. Sass[2], Vanessa C. DeRocco[2], Trevor Anderson[1], Dorothy A. Erie[2]; [1]North Carolina State Univ., USA, [2]Univ. of North Carolina at Chapel Hill, USA*

LSThF1, **Non-Scanning Two-Photon Microscopy for Imaging in Live Cells**, *Christine Payne; Georgia Tech, USA*

LSThF2, **Tracking Single Quantum Dots in Three Dimensions: Following Cell Receptor Traffic and Membrane Topology**, *Nathan P. Wells[1], Diane S. Lidke[2], M. Lisa Phipps[1], Peter M. Goodwin[1], Bridget S. Wilson[2], James Werner[1]; [1]Los Alamos Natl. Lab, USA, [2]Univ. of New Mexico, USA*

LSThF3, **Dissecting the Molecular Mechanism of Kinesin with Single Molecule Imaging**, *Ahmet Yildiz; Univ. of California at Berkeley, USA*

LS 3: Micro- and Nanofluidic Systems

Invited Speakers:

LSMC1, **Applications of Silicon Photonic Technology for Clinical Diagnostics and Highly Multiplexed Biomolecular Detection**, *Adam L. Washburn, Abraham J. Qavi, Matthew S. Luchansky, Ji-Yeon Byeon, Ryan C. Bailey; Univ. of Illinois at Urbana-Champaign, USA*

LSMC2, **Ion Conductance Microscopy of Nanometer Pores**, *Lane A. Baker; Indiana Univ., USA*

LSMC4, **Massively Parallel Opto/Electric Manipulation of Colloidal Particles**, *Steve Wereley; Purdue Univ., USA*

LSMG1, **Optical and Microfluidic Techniques for Cellular Analysis**, *Daniel T. Chiu; Univ. of Washington, USA*

LSMG2, **Optical Microcavities: Label-Free Detection down to Single Virus Particles**, *Frank Vollmer[1], Stephen Arnold[2]; [1]Rowland Inst., Harvard Univ., USA, [2]Polytechnic Inst., New York Univ., USA*

LSMG4, **Ultrafast Laser Nanomachining of Analytical and Diagnostic Biomedical Devices**, *Alan J. Hunt; Univ. of Michigan, USA*

LSMG5, **Optical and Electrical Characterization of Fluid Transport in Nanoscale Channels**, *Stephen C. Jacobson, John M. Perry, Kaimeng Zhou; Indiana Univ., USA*

LSTuF1, **Single Molecule Tracking as a Probe of Free Volume Transitions in Stimulus-Responsive Polymers—Do Single Molecules Behave Like Caribou?** *Lindsay C. C. Elliott[1], Paul Bohn[2]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Univ. of Notre Dame, USA*

LSTuF4, **Micro- and Nanofluidics for Single Biomolecule Analysis**, *Yoshinobu Baba; Nagoya Univ., Japan*

LS 4: Second-Order Nonlinear Optics

Invited Speakers:

LSWB1, **Sum Frequency Generation (SFG) Vibrational Spectroscopy and Its Application in Surface Science and Catalysis**, *Gabor A. Somorjai, George J. Holinga; Univ. of California at Berkeley, USA*

LSWB2, **Nonlinear Optical Studies of Conjugated Polymer Films and Interfaces**, *Ian M. Craig, Benjamin J. Schwartz; Univ. of California at Los Angeles, USA*

LSWB5, **Resonant UV SHG Studies of Ion Adsorption at Aqueous Interfaces**, *Richard J. Saykally[1,2]; [1]Univ. of California at Berkeley, USA, [2]Lawrence Berkeley Natl. Lab, USA*

LSWE1, **Nonlinear Optics in Metamaterials**, *David Cho[1], Wei Wu[2], Feng Wang[1], Xiang Zhang[3], Yuen-Ron Shen[1]; [1]Physics Dept., Univ. of California at Berkeley, USA, [2]Quantum Science Res., Hewlett-Packard Labs, USA, [3]Dept. of Mechanical Engineering, Univ. of California at Berkeley, USA*

LSWE2, **New Perspectives in Vibrational Sum-Frequency Spectroscopy**, *John T. Fourkas; Univ. of Maryland at College Park, USA*

LSWE3, **Polarization-Rotation and Two-Dimensional IR-Visible Sum Frequency Generation Spectroscopy for Surface Analysis**, *Keng C. Chou; Univ. of British Columbia, USA*

LSWH1, **Imaging Nonlinear Optical Stokes Ellipsometry for Thin Film and Microparticle Characterization**, *Garth J. Simpson; Purdue Univ., USA*

LSWH2, **Electronically Resonant Hyper-Raman Scattering in Solution**, *Anne M. Kelley; Univ. of California at Merced, USA*

LSWH3, **Title to Be Announced**, *Steven Baldelli; Univ. of Houston, USA*

LSWK1, **Vibrationally-Electronically Doubly-Resonant Sum-Frequency Generation Spectroscopy of Molecular Thin Films**, *Taka-aki Ishibashi; Hiroshima Univ., Japan*

LSWK2, **Measurement of Surface Chirality with Nonlinear Spectroscopy: A Quantitative Approach**, *Yan-yan Xu, Feng Wei, Yuan Guo, Hongfei Wang; Inst. of Chemistry, Chinese Acad. of Sciences, China*

LS 5: Cavity Optomechanics

Invited Speakers:

LSTuB1, **Cavity Optomechanics with Ions**, *K. Vahala[1], M. Herrmann[2], S. Knünz[2], V. Batteiger[2], G. Saathoff[2], T. W. Hänsch[2], Th Udem[2]; [1]Caltech, USA, [2]Max-Planck-Inst. für Quantenoptik, Germany*

LSTuB2, **Preparation and Detection of a Mechanical Resonator Near the Ground State of Motion**, *Keith Schwab; Cornell Univ., USA*

LSTuB5, **Cooling Acoustic Oscillators with Electromagnetic Parametric Transducers and Prospects of Measuring below the Standard Quantum Limit of Displacement**, *Michael Tobar; Univ. of Western Australia, Australia*

LSTuE1, **Control and Sensing of Ultracold Atoms and Molecules by Nanomechanical Cantilevers**, *Pierre Meystre; Univ. of Arizona, USA*

LSTuE2, **Optomechanics of Phononic-Photonic Crystal Defect Cavities**, *Matt Eichenfield, Jasper Chan, Ryan M. Camacho, Kerry J. Vahala, Oskar J. Painter; Caltech, USA*

LSTuE3, **Sensing Nanomechanical Motion with a Shot-Noise Limited Microwave Cavity Interferometer**, *Konrad W. Lehnert, John D. Teufel, Tobias Donner, Jennifer W. Harlow, Manuel A. Castellanos-Betran; JILA, NIST, Univ. of Colorado, USA*

LSTuH1, **Demonstration of Micromechanics in the Strong Coupling Regime**, *Simon Groeblacher, Klemens Hammerer, Michael Vanner, Markus Aspelmeyer; IQOQI, Austrian Acad. of Sciences, Austria*

LSTuH2, **Measurement of Attractive and Repulsive Casimir Forces and Applications to Nanomechanics**, *Jeremy Munday[1], Federico Capasso[2]; [1]Thomas J. Watson Labs of Applied Physics, Caltech, USA, [2]Harvard Univ., USA*

LSTuH3, **Exploring the Quantum Limit in Gravitational Wave Detection**, *Nergis Mavalvala; MIT, USA*

LSTuH4, **Silicon Optomechanics**, *Hong X. Tang; Yale Univ., USA*

LSTuK1, **Optomechanical Correlations between Light and Mirrors**, *A. Heidmann, P. Verlot, A. Tavernarakis, C. Molinelli, A. Kuhn, T. Briant, P.-f. Cohadon; Lab Kastler Brossel, École Normale Supérieure, Univ. Pierre et Marie Curie, CNRS, France*

LSTuK2, **Resolved-Sideband Laser Cooling and Measurement of a Micromechanical Oscillator Close to the Quantum Limit**, *Tobias J. Kippenberg[1,2]; [1]Swiss Federal Inst. of Technology Lausanne (EFPL), Switzerland, [2]Max Planck Inst. of Quantum Optics, Germany*

LS 6: Optoelectronic Materials Characterization

Invited Speakers:

LSTuD1, **Strong Coupling of Propagating Laser Light to Single Emitters: From Absorption to Stimulated Emission**, *Vahid Sandoghdar; ETH Zurich, Switzerland*

LSTuD2, **Single Quantum Dots for Probing Local Environments**, *Haw Yang; Princeton Univ., USA*

LSTuG1, **Using Fluorescence Microscopy of Oligomer Aggregates to Understand the Properties of Conjugated Polymers Used in Photovoltaic Devices**, *Linda Peteanu[1], Gizelle A. Sherwood[1], Kelly Zewe[1], Jurjen Wildeman[2], James H. Werner[3], Andrew P. Shreve[3]; [1]Carnegie Mellon Univ., USA, [2]Zernike Inst. for Advanced Materials, Univ. of Groningen, Netherlands, [3]Ctr. for Integrated Nanotechnologies, Los Alamos Natl. Labs, USA*

LSTuG7, **New Aspects of Nanocrystal Lasing**, *Victor I. Klimov; Los Alamos Natl. Lab, USA*

LSTuJ1, **Quantum Dots, Experiments, Theory, Predictions, Tests and Unknowns**, *Rudolph A. Marcus; Caltech, USA*

LSTuJ4, **Non-Blinking Semiconductor Nanocrystals**, *Xiaoyong Wang[1], Xiaofan Ren[2], Keith Kahen[2], Megan A. Hahn[1], Manju Rajeswaran[2], Sara Maccagnano-Zacher[3], John Silcox[3], George E. Cragg[4], Alexander L. Efros[4], Todd Krauss[1,5]; [1]Univ. of Rochester, USA, [2]Eastman Kodak Co., USA, [3]Cornell Univ., USA, [4]NRL, USA, [5]Inst. of Optics, Univ. of Rochester, USA*

LSWG1, **Ultrafast Photoemission Electron Microscopy: Imaging Nonlinear Plasmonic Phenomena on the Femto/Nano Scale**, *Hrvoje Petek; Univ. of Pittsburgh, USA*

LSWG2, **New Interface-Selective Electronic Spectroscopy and its Extension to Femtosecond Time-Resolved Measurements**, *Tahei Tahara; RIKEN, Japan*

LSWG5, **Ultrafast Hybrid Plasmonics: New Routes to Nanoscale Imaging and Energy Propagation**, *Gary Wiederrecht; Argonne Natl. Lab, USA*

LSWJ2, **Ultrafast Laser-Induced Magnetization Dynamics**, *Bert Koopmans; Eindhoven Univ. of Technology, Netherlands*

LSWJ4, **Dynamic Signatures of Exciton-Plasmon Interactions in Hybrid Semiconductor-Metal Nanostructures**, *Marc Achermann; Univ. of Massachusetts at Amherst, USA*

LSWJ5, **One-Dimensional Exciton Dynamics in Carbon Nanotubes**, *Tobias Hertel, Zipeng Zhu, Dominik Stich, Jared Crochet; Univ. of Wurzburg, Germany*

LS 7: Ultrafast X-Ray Science

Invited Speakers:

LSMD1, **Title to Be Announced**, *Jerome Hastings; Stanford Linear Accelerator Ctr., Stanford Univ., USA*

LSMD2, **The X-Ray Pump-Probe Instrument at LCLS**, *David Fritz; SLAC Natl. Accelerator Lab, Stanford Univ., USA*

LSMD3, **Watching Atoms Move: Using X-Ray Diffraction to Observe Structural Dynamics in Crystals on Fundamental Time Scales**, *Steven L. Johnson; Paul Scherrer Inst., Switzerland*

LSMD4, **Time-Resolved X-Ray Solution Scattering Reveals Solution-Phase Structural**

Dynamics, *Harry Ihee; KAIST, Republic of Korea*

LSMH1, **Ultrafast X-Ray Physics with the X-Ray Split and Delay Unit at FLASH**, *F. Sorgenfrei, W. F. Schlotter, M. Nagasono, M. Beye, T. Beeck, W. Wurth, A. Föhlisch; Inst. für Experimentalphysik, Univ. Hamburg and Ctr. for Free-Electron Laser Science, Germany*

LSMH2, **Magnetization Dynamics on the Nanoscale**, *Yves Acremann; PULSE Inst., Stanford Linear Accelerator Ctr., USA*

LSMH3, **Ultrafast Electron and Spin Dynamics in Complex Materials**, *Hermann A. Dürr; Helmholtz Zentrum Berlin, BESSY II, Germany*

LSTuC1, **Sub-Picosecond Intersystem Crossings and Structural Dynamics: Combined Ultrafast Optical and X-Ray Absorption Studies**, *Majed Chergui; Lab of Ultrafast Spectroscopy, École Polytechnique Fédérale de Lausanne, Switzerland*

LSTuC2, **Structural Tracking of Chemical Reactions in Solution by Time-Resolved X-Ray Scattering**, *Martin Meedom Nielsen; Nano-Science Ctr., Univ. of Copenhagen, Denmark*

LSTuC3, **Ultrafast Photochemical Dynamics in Solution**, *Munira Khalil; Univ. of Washington, USA*

LSTuC4, **Ultrafast Soft X-Ray Spectroscopy of Spin-Crossover Dynamics in Solvated Transition-Metal Complexes**, *Nils Huse[1], Ha Na Cho[1,2], Tae-Kyu Kim[2], Lindsey Jamula[3], James McCusker[3], Robert Schoenlein[4,1]; [1]Chemical Sciences Div., Lawrence Berkeley Natl. Lab, USA, [2]Pusan Natl. Univ., Republic of Korea, [3]Michigan State Univ., USA, [4]Advanced Light Source, Lawrence Berkeley Natl. Lab, USA*

LS 8: Multidimensional Spectroscopy

Invited Speakers:

LSWC1, **Investigating the Major Light Harvesting Complex of Photosystem II with 2-D Electronic Spectroscopy**, *G. S. Schlau-Cohen, T. R. Calhoun, N. S. Ginsberg, G. R. Fleming; Univ. of California at Berkeley, USA*

LSWC2, **Coherence in Electronic Energy Transfer: The Intermediate Coupling Regime**, *Gregory D. Scholes, Elisabetta Collini; Univ. of Toronto, Canada*

LSWC3, **Optical Two-Dimensional Fourier Transform Spectroscopy of Semiconductors**, *S. T. Cundiff, A. D. Bristow, D. Karaiskaj, X. Dai; JILA, NIST, Univ. of Colorado, USA*

LSWC4, **Exciton Relaxation and Energy Transfer Dynamics in Size Selected Polythiophenes**, *Andrew T. Healy, Nathan P. Wells, Bryan W. Boudouris, Marc A. Hillmyer,*

David A. Blank; Univ. of Minnesota, USA

LSWF1, **Water and Hydrogen-Bond Dynamics in Aqueous Solutions**, *Damien Laage[1], Guillaume Stirnemann[1], Fabio Sterpone[1], James T. Hynes[1,2]; [1]École Normale Supérieure, France, [2]Univ. of Colorado, USA*

LSWF2, **Watching Ultrafast Molecular Dynamics: 2-D IR Chemical Exchange Spectroscopy**, *Michael D. Fayer; Stanford Univ., USA*

LSWF3, **Ultrafast Dynamics of Hydrogen Bond Exchange in Aqueous Ionic Solutions**, *Sungnam Park[1,2], Michael Odelius[3], Kelly J. Gaffney[2]; [1]Korea Univ., Republic of Korea, [2]Stanford Univ., USA, [3]Stockholm Univ., Sweden*

LSWI1, **Femtosecond Vibrational Optical Activity and IR Photon Echo Studies of Small Organic Molecules**, *MinHaeng Cho; Korea Univ., Republic of Korea*

LSWI2, **Correlating Energy Transport Time on a Molecular Level with Distance Using Relaxation-Assisted 2DIR**, *Igor V. Rubtsov[1], Valeriy M. Kasyanenko[1], Zhiwei Lin[1], Christopher S. Keating[1], Grigory I. Rubtsov[2], James P. Donahue[1]; [1]Tulane Univ., USA, [2]Inst. for Nuclear Res., Russian Federation*

LS 9: Coherent X-Ray Imaging

Invited Speakers:

LSThA1, **What Kind of Data Do We Expect in Single-Molecule Imaging Experiments and How Do We Process It?** *Veit Elser, Duane Ne-Te Loh; Cornell Univ., USA*

LSThA2, **The Coherent X-Ray Imaging Instrument at LCLS**, *Sébastien Boutet; SLAC Natl. Accelerator Lab, Stanford Univ., USA*

LSThA3, **Femtosecond Dynamic Diffraction Imaging with Free Electron Lasers: X-Ray Snapshots of Ultra-Fast Nanoscale Phenomena**, *Anton Barty[1], Henry N. Chapman[2], Michael J. Bogan[1], Sébastien Boutet[1,3,4], Matthias Frank[1], Stefan P. Hau-Riege[1], Stefano Marchesini[1,5], Bruce W. Woods[1], Saša Bajt[1], W. Henry Benner[1], Richard A. London[1], Elke Plönjes[6], Marion Kuhlmann[6], Rolf Treusch[6], Stefan Düsterer[6], Thomas Tschentscher[6], Jochen R. Schneider[6], Eberhard Spiller[7], Thomas Möller[8], Christoph Bostedt[8], Matthias Hoener[8], David A. Shapiro[5], Keith O. Hodgson[3], David van der Spoel[4], Magnus Bergh[4], Carl Caleman[4], Gösta Huldt[4], Bianca Iwan[4], M. Marvin Seibert[4], Filipe R. N. C. Maia[4], Abraham Szöke[1,4], Nicusor Timneanu[4], Janos Hajdu[3,4]; [1]Lawrence Livermore Natl. Lab, USA, [2]Ctr. for Free Electron Laser Science, Univ. Hamburg, Germany, [3]Stanford Synchrotron Radiation Lab, Stanford Linear Accelerator Ctr., USA, [4]Uppsala Univ., Sweden, [5]Univ. of California at Davis, USA, [6]Deutsches Elektronen-Synchrotron, DESY, Germany, [7]Spiller X-Ray Optics, USA, [8]Inst. für Atomare Physik, Technische Univ. Berlin, Germany*

LSThA4, **Title to Be Announced**, *Stefan Hau-Riege; Lawerence Livermore Natl. Lab, USA*

LSThE1, **Ankylography: Three-Dimensional Structure Determination from a Single View**, *Jianwei Miao; Univ. of California at Los Angeles, USA*

LSThE2, **Imaging of Domain Structures by Coherent X-Ray Diffraction**, *Ian Robinson; Univ. College London, UK*

LS 10: X-Ray Photon Correlation Spectroscopy

Invited Speakers:

LSThC1, **The X-Ray Photon Correlation Spectroscopy Instrument at LCLS**, *Aymeric Robert; Linac Coherent Light Source, SLAC Natl. Accelerator Lab, Stanford Univ., USA*

LSThC2, **Title to Be Announced**, *Simon Mochrie; Yale Univ., USA*

LSThC3, **Using X-Ray Correlation Spectroscopy to Test Dynamical Scaling**, *Mark Sutton; McGill Univ., Canada*

LS 11: High Field Dynamics

Invited Speakers:

LSTuI1, **Fast Electron Migration in Finite Systems under Attosecond and XFEL Light Pulses**, *Jan-Michael Rost, Ulf Saalmann, Ionut Georgescu, Christian Gnodtke, Alexey Mikaberidze; Max-Planck-Inst. for the Physics of Complex Systems, Germany*

LSTuI2, **Strong-Field Atomic Physics in the X-Ray Regime**, *Louis DiMauro; Ohio State Univ., USA*

LSTuI3, **Probing Coupled Electronic and Nuclear Dynamics Using Coherent Electrons and X-Rays**, *Wen Li[1], Xibin Zhou[1], Robynne Lock[1], Serguei Patchkovskii[2], Albert Stolow[2], Etienne Gagnon[1], Arvinder Sandhu[1], Robin Santra[3], Phay Ho[3], Vandana Sharma[1], Craig W. Hogle[1], Predrag Ranitovic[4], C. Lewis Cocke[4], Margaret Murnane[1], Henry C. Kapteyn[1]; [1]JILA, Univ. of Colorado at Boulder, USA, [2]Natl. Res. Council Canada, Canada, [3]Argonne Natl. Lab, USA, [4]Kansas State Univ., USA*

LSTuL1, **First Science with the LCLS X-Ray Free Electron Laser**, *John D. Bozek; SLAC Natl. Accelerator Lab, Stanford Univ., USA*

LSTuL3, **X-Ray Probing of High Field Ionization in the Attosecond Limit**, *Stephen R. Leone; Lawrence Berkeley Natl. Lab, Univ. of California at Berkeley, USA*

LSTuL4, **Ptychographic Imaging in Materials and Life Sciences**, *Andreas Menzel[1], Cameron M. Kewish[1], Pierre Thibault[1], Martin Dierolf[2], Franz Pfeiffer[2], Oliver Bunk[1]; [1]Paul Scherrer Inst., Switzerland, [2]Technische Univ. München, Germany*

Special Symposia at Frontiers in Optics 2009/Laser Science XXV

The Future of 3-D Display: The Marketplace and the Technology

Symposium organizer: Hong Hua; Univ. of Arizona, USA

3-D displays have become substantially critical for many applications, including medical and scientific visualization, flight simulation and training, engineering design, and entertainment. One example is the reviving enthusiasm in 3-D cinema. A recent animated film, "Beowulf", was shown in 3-D in many theaters around the world and generated millions of dollars in box office revenue. There is also increasing interest in developing 3-D home entertainment systems. On the technology side, many of the traditional displays methods, such as 3-D projection systems and head mounted displays, have been making steady improvements, and several different new display concepts and technologies have emerged. This symposium aims at bringing together researchers who are involved in 3-D display technologies, a range of applications, and research vis-à-vis human factor.

See Lahsen Assoufid, FiO Program Chair, discuss highlights of the symposium.

Keynote Speaker

FTuA1, **3-D Entertainment: A Revolution that has Already Started**, *Rod Archer; RealD Inc., USA*

Tutorial Speaker

FTuA2, **What Should We Know about Human Depth Perception in Constructing 3-D Displays?** *Martin Banks; Univ. of California at Berkeley, USA*

Invited Speakers

FTuF1, **Three-Dimensional Sensing, Visualization, and Display by Integral Imaging**, *Bahram Javidi[1], Manuel Martinez-Corral[2], Adrian Stern[3], Edward Watson[4]; [1]Univ. of Connecticut, USA, [2]Univ. of Valencia, Spain, [3]Ben Gurion Univ. of the Negev, Israel, [4]AFRL, USA*

FTuF2, **Development of Integral Images**, *Pingfan Wu, Douglas S. Dunn, Robert L. Smithson, Steven J. Rhyner; 3M Corp., USA*

FTuF3, **Problems in Physically Based Simulations of Real-World Environments**, *Donald P. Greenberg; Program of Computer Graphics, Cornell Univ., USA*

FTuM1, **Accommodation Responses to Stereoscopic Images**, *Kazuhiko Ukai; Waseda Univ., Japan*

FTuM2, **A Novel 3-D Display that Presents Nearly Correct Focus Cues**, *Martin S. Banks[1], Gordon D. Love[2], David M. Hoffman[1], Philip J. W. Hands[2], Andrew K. Kirby[2]; [1]Univ. of California at Berkeley, USA, [2]Durham Univ., UK*

FTuM3, **Volumetric True 3-D Display Using Multi-Focal Scanned Light**, *Brian Schowengerdt; Univ. of Washington, USA*

FTuM4, **3-D TV Based on Integral Method Using Extremely High-Resolution Video System**, *Masahiro Kawakita, Jun Arai, Fumio Okano; NHK Science & Technical Res. Labs, Japan*

FTuT1, **Large Area 3-D Updateable Holographic Displays Using Photorefractive Polymers**, *Nasser Peyghambarian; Univ. of Arizona, USA*

FTuT2, **Progress in Volumetric Three-Dimensional Displays and Their Applications**, *Gregg E. Favalora; Actuality Systems Inc., USA*

FTuT3, **The Coming Generation of Head Worn Displays**, *Kevin Thompson[1], James P. McGuire[1], Ozan Cakmakci[1], Jannick P. Rolland[2]; [1]Optical Res. Associates, USA, [2]Inst. of Optics, Univ. of Rochester, USA*

Gravitational Wave Interferometry from Earth and Space

Symposium organizer: Michael Barnes[1], David Reitze[2]; [1]Univ. of Massachusetts Amherst, USA, [2]Univ. of Florida, USA

Within the past 10 years, kilometer-scale terrestrial gravitational wave detectors have been built to search for gravitational waves emitted from cataclysmic astrophysical sources such as colliding black holes and the Big Bang. In order to detect gravitational waves, surface-based interferometers have been developed with unprecedented sensitivities, approaching 10^{-19} m/s. Plans are underway to develop space-based gravitational wave detectors that will open up a whole new window on the universe. Large-scale underground optical and atom interferometers are in the planning phases. This symposium will cover the emerging field of gravitational wave astronomy with an emphasis on the central role lasers and optical technologies play in the operation of gravitational wave detectors.

See Tom Carruthers, FiO Program Chair, discuss highlights of the symposium.

Tutorial Speaker

JMB1, **Gravitational Wave Interferometry**, *Peter Fritschel; MIT, USA*

Invited Speakers

JMB2, **LISA: Detecting Gravitational Waves from Space**, *Jeffrey Livas; NASA Goddard Space Flight Ctr., USA*

JMB4, **The Virgo Gravitational Wave Detector**, *François Bondu; Univ. de Rennes 1, France*

JTuA1, **Next Generation Interferometers for Gravitational Wave Astronomy**, *Rana Adhikari; Caltech, USA*

JTuA3, **GEO600 and Directions in Optics Related Research for Interferometric Gravitational Wave Detector**, *Sheila Rowan; Univ. of Glasgow, UK*

JTuA5, **Japanese Gravitational Wave Detectors: LCGT and DECIGO**, *Seiji Kawamura, LCGT Collaboration, DECIGO Working Group; Natl. Astronomical Observatory of Japan, Japan*

Laser Science Symposium on Undergraduate Research

Symposium organizer: Harold Metcalf; Stony Brook Univ., USA

This special DLS annual symposium is rapidly becoming one of the most successful DLS traditions (this year's is the ninth of a series that began at the Long Beach meeting in 2001). During the past several years the number of undergraduates presenting papers has grown from only 10 to nearly 40, and the talks have been of outstanding quality, some absolutely stellar. Last year's posters were outstanding as well, and generated a great deal of lively interest and on-the-spot discussion. This year's symposium will consist of afternoon poster and oral sessions. The event provides an opportunity for some of the student members of our community, who are already among the finest young scientists to be found anywhere, to present their work before an audience of their peers as well as the larger optics community. All are invited and encouraged to attend the sessions.

View the Complete Program

Optics for Imaging at the Nanoscale and Beyond

Symposium organizers: Lahsen Assoufid, Ian McNulty, Christian Schroer, Valeriy Yashchuk; Argonne Natl. Lab, USA

Powerful and exciting new tools have enabled imaging with light at unprecedented resolution reaching well into the nanoscale, from the visible to the x-ray region. This symposium brings the latest optical methods for nanoscale imaging across a broad spectral range to the fore. Rapidly developing techniques are covered including single-molecule fluorescence and coherent diffractive imaging, and novel optical elements such as 4-PI lenses, Fresnel zone plates, and singular optics. Researchers in fundamental as well as applied and industrial fields will find this symposium to address a wide range of topics relevant to imaging with light at the nanoscale.

See Lahsen Assoufid, FiO Program Chair, discuss highlights of the symposium.

Tutorial Speaker

FThA1, **Introduction to Diffraction Limited X-Ray Optics**, *David Attwood; Lawrence Berkeley Natl. Lab, USA*

Invited Speakers

FThA3, **Singular and Other Novel X-Ray Diffractive Optics**, *Anne Sakdinawat; Lawrence Berkeley Natl. Lab, Univ. of California at Berkeley, USA*

FThA4, **Laboratory X-Ray Micro- and Nano-Imaging**, *Hans M. Hertz, M. Bertilson, E. Chubarova, O. Hemberg, O. v Hofsten, A. Holmberg, M. Lindblom, U. Lundström, D. Nilsson, M. Otendal, J. Reinspach, P. Skoglund, P. Takman, T. Tuohimaa, U. Vogt; Royal Inst. of Technology, Sweden*

FThG1, **X-Ray Nano-Tomography at HZB**, *Gerd Schneider[1], Peter Guttmann[1], Stefan Heim[1], Waltraud Müller[2], Jim McNally[2]; [1]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Elektronenspeicherring BESSY II, Germany, [2]Lab of Receptor Biology and Gene Expression, Natl. Cancer Inst., Natl. Inst. of Health, USA*

FThG2, **X-Ray Refractive Optics for Nanofocusing**, *Anatoly Snigirev; European Synchrotron Radiation Facility, France*

FThG3, **10nm-Level Focusing of Hard X-Rays by KB Mirrors**, *Kazuto Yamauchi; Osaka Univ., Japan*

FThM1, **Intracellular Nanoscale Imaging with Fluorescence Photoactivation Localization Microscopy**, *Samuel Hess; Univ. of Maine, USA*

FThM2, **Nanoscale X-Ray Focusing with Reflective Optics**, *Gene E. Ice[1], Jonathan Z. Tischler[1], Jae-Young Choi[2], Wenjun Liu[3], Ali Khounsary[3], Lahsen Assoufid[3], Deming Shu[3], Chian Liu[3]; [1]Oak Ridge Natl. Lab, USA, [2]Pohang Accelerator Lab, Republic of Korea, [3]Advanced Photon Source, Argonne Natl. Lab, USA*

FThM3, **Fabrication of Freeform Mirrors: Metrology and Figuring**, *Helge Thiess, H. Lasser; Carl Zeiss Laser Optics GmbH, Germany*

FThM4, **The Hard X-Ray Nanoprobe Beamline at Argonne National Laboratory**, *Jörg Maser, Martin V. Holt, Robert P. Winarski, Volker Rose, Gregory Brian Stephenson, Peter Fuesz; Argonne Natl. Lab, USA*

FThT1, **Multi-Modal Scanning X-Ray Microscopy**, *Andreas Menzel[1], Pierre Thibault[1], Martin Dierolf[1,2], Cameron M. Kewish[1], Franz Pfeiffer[1]; [1]Paul Scherrer Inst., Switzerland, [2]Ecole Polytechnique Fédérale de Lausanne, Switzerland*

FThT3, **Future Developments for Hard X-Ray Zone Plates**, *Wenbing Yun; XRADIA Inc., USA*

OSA Topical Meeting Highlights

Symposium organizer: Michael Duncan, NRL, USA

OSA offers a wide variety of topical meetings where cutting-edge research is presented. In an effort to bring some of the outstanding presentations that are given at these meetings to a broader audience, the committee has chosen, for the fourth year in a row, to offer a special session devoted to important papers from many of the topical meetings. One select presentation from each of a number of topical meetings held in 2009 (or late 2008) will be highlighted so that FiO attendees may see the type of exciting research being reported. The papers in this special session have been chosen by topical meeting attendees and by the topical meeting chairs.

Invited Speakers

Nonlinear Optics, 2009
FWO1, **Active Terahertz Metamaterials**, *Hou-Tong Chen, John F. O'Hara, Abul K. Azad, Antoinette J. Taylor; Los Alamos Natl. Lab, USA*

Integrated Photonics and Nanophotonics Research and Applications, 2009
FWO2, **Photonics in Supercomputing: The Road to Exascale**, *Jeffrey Kash; IBM Res., USA*

Optical Trapping Applications, 2009
FWO3, **Optical Manipulation of Femtoliter Aqueous Droplets for Nanochemistry Applications**, *Ana Jofre, Ben Faulk, Jason Case; Univ. of North Carolina at Charlotte, USA*

Advanced Solid-State Photonics, 2009
FWO4, **Fourier Domain Mode Locking (FDML): A New Laser Operating Regime and Applications for Biomedical Imaging, Profilometry, Ranging and Sensing**, *Robert Huber; Ludwig-Maximilians-Univ. München, Germany*

Digital Holography and Three-Dimensional Imaging, 2009
FWV1, **Deflectometry Challenges Interferometry: 3-D-Metrology from Nanometer to Meter**, *Gerd Häusler[1,2], M. C. Knauer[1], C. Faber[1], C. Richter[1], S. Peterhänsel[1], C. Kranitzky[1], K. Veit[2]; [1]Univ. of Erlangen-Nuremberg, Germany, [2]3D-Shape GmbH, Germany*

Slow and Fast Light, 2009
FWV2, **Manipulating Slow Light by Ultrahigh-Q Nanocavities and Their Coupled Arrays**, *Masaya Notomi, T. Tanabe, E. Kuramochi, H. Taniyama; NTT Basic Res. Labs, Japan*

Novel Techniques in Microscopy, 2009
FWV3, **Wide Field, Minimally Invasive OCT: Recent Advances and Clinical Implications**, *Ben Vakoc, Brett E. Bouma; Massachusetts General Hospital, USA*

Phase Space Optics—Optical System Theory for the 21st Century

Symposium organizer: Markus Testorf; Dartmouth College, USA

This special symposium is aimed at promoting phase space optics, i.e. optical system theory in terms of the Wigner distribution function and related joint signal transformations. In recent years phase space optics has expanded its scope significantly, and it is recognized as an important complement to standard Fourier optics. Important applications that have benefited from phase space concepts include phase retrieval, computational imaging with extended focal depth, and generalized sampling strategies. The special symposium will feature invited presentations given by experts representing the cutting edge of research in this area.

Watch Markus Testorf, Subcommittee Chair and Symposium Organizer, discuss highlights of the symposium.

Tutorial Speaker

FWQ1, **Wigner Distribution, Partial Coherence, and Phase Space Optics**, *Martin J. Bastiaans; Dept. of Electrical Engineering, Eidhoven Univ. of Technology, Netherlands*

Invited Speakers

FWQ2, **The Connection between Rays and Waves**, *Miguel A. Alonso; Inst. of Optics, Univ. of Rochester, USA*

FWQ3, **Novel Optical Devices for Extended Field of View**, *Jorge Ojeda-Castañeda; Univ. of Guanajuato, Mexico*

FWW1, **Wigner Cross-Terms in Sampled and Other Periodic Signals**, *William T. Rhodes[1], John J. Healy[2], John T. Sheridan[2]; [1]Florida Atlantic Univ., USA, [2]Univ. College Dublin, Ireland*

FWW2, **The Radon-Wigner Transform and Its Application to First-Order Optical Systems**, *Genaro Saavedra, Walter D. Furlan; Univ. de València, Spain*

FWW3, **Design of Rotating Beams**, *Tatiana Alieva[1], Eugeny Abramochkin[2]; [1]Univ. Complutense de Madrid, Spain, [2]PN Lebedev Physical Inst., Samara Branch, Russian Federatio*n

Short Courses

Short Courses are designed to increase your knowledge of a specific subject while offering you the experience of experts in industry and academia. Top-quality instructors stay current on the subject matter required to advance your research and career goals. An added benefit of attending a Short Course is the availability of continuing education units (CEUs).

Continuing Education Units (CEUs)

Demonstrate your commitment to continuing education and advancement in the optical field by earning continuing education units (CEUs). The CEU is a nationally recognized unit of measure for continuing education and training programs that meet established criteria. Certificates awarding CEUs are presented to all individuals who complete a Short Course, CEU form and course evaluation. Forms will be available on-site and certificates will be mailed to participants.

Registration

Each Short Course requires a separate fee. Paid registration includes admission to the course and one copy of the Short Course Notes. Advance registration is advisable. The number of seats in each course is limited, and on-site registration is not guaranteed.

Free Offer to Student Members. The FiO sponsoring organizations will offer student members of APS or OSA limited free Short Course registration. Free student member course registration will begin immediately after the pre-registration deadline of September 16, 2009. There will not be free student registration for sold-out courses, and on-site registration is not guaranteed. Register early to guarantee your seat at a Short Course.

Schedule

For course descriptions, select the course number.

Sunday, October 11, 2009, 9:00 a.m. - 12:30 p.m.

SC235 **Nanophotonics: Materials, Fabrication and Characterization**, *Joseph W. Haus, Andrew Sarangan, Qiwen Zhan; Univ. of Dayton, USA*
SC324 **Plasmonics,** *Stefan Maier; Experimental Solid State Group, Dept. of Physics, Imperial College London, UK*
CANCELLED NEW! **SC326 Patent Fundamentals**, *Mohammed N. Islam; Optics and Photonics and Solid State Electronics Lab, Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA*

Schedule Sunday, October 11, 2009, 1:30 p.m. - 5:00 p.m.

SC274 **Polarization Engineering,** *Russell Chipman; Univ. of Arizona, USA*
CANCELLED **SC322 Silicon Nanophotonics**, *Jelena Vuckovic; Edward L. Ginzton Lab, Stanford Univ., USA*
CANCELLED NEW! **SC340 Tissue Optics and Optical Coherence Tomography**, *Kirill Larin[1], Valery V. Tuchin[2]; [1]Univ. of Houston, USA, [2]Saratov State Univ., Russian Federation*

2009 Exhibitor & Sponsor List

Click here for the 2008 Exhibitor List.

2009 Exhibitor List (as of October 5, 2009)

ALPAO
American Elements
American Institute of Physics
American Physical Society (APS)
Amplitude Laser, Inc.
Chroma Technology Corp.
Coherent, Inc.
Del Mar Photonics
Elsevier
Fianium Ltd.
Femtolasers, Inc.
Gooch & Housego
Imagine Optic
IOP Publishing Ltd.

JK Consulting
LaserFest
Laser Focus World
Laser Quantum
MPF Products, Inc.
Nature Publishing Group
Onyx Optics, Inc.
OPN
OP-TEC
Optikos Corporation
Optimax Systems, Inc.
The Optical Society (OSA)
OSA Corporate Membership
OSA Foundation
OSA - Interactive Science Publishing
Photonics Media/Laurin Publishing
Physics Today
PolarOnyx, Inc.
Swamp Optics, LLC
Taylor & Francis
Thorlabs
University of Arizona, College of Optical Sciences
University of Central Florida
University of Rochester
Wiley-Blackwell
Zygo Corporation

Special Events

OSA Young Professionals Networking Event with Corporate Members

Tuesday, October 13, 8:00 a.m.–9:30 a.m.
Courtyard Atrium, Sainte Claire Hotel

This invitation-only event puts Young Professionals in contact with highly successful OSA members who will share practical career advice. If you are an OSA member who has graduated within the last 3 years, contact KiKi L'Italien at klital@osa.org to determine whether space is still available.

Young Professionals Bloggers
Watch for OSA's own Young Professional Bloggers who will be reporting on events and their own experiences at FiO! Links to their posts will be shared via the Conference Twitter stream #FiO or posts on the OSA.org homepage.

OSA Division and Technical Group Meetings

Network with peers, meet group leaders, and get involved in planning future group activities by attending technical group and/or division meetings during FiO. The division meetings will encompass

the technical groups affiliated with the division. Should you have any suggestions for any of the technical group activities, contact the respective technical group chair with your input. Please check back regularly for more information. If you are interested in organizing an activity at FiO for your respective technical group, please contact your group chair or Naomi Chávez at nchave@osa.org.

Imaging Sensing and Pattern Recognition Technical Group Meeting
Wednesday, October 14, 4:00 p.m.–5:00 p.m.*, Cupertino Room, Fairmont Hotel*

Join the OSA Imaging Sensing and Pattern Recognition Technical Group for an informal discussion of results presented at the COSI and SRS topical meetings and at FiO. Light refreshments will be served.

What's Hot in Optics Today?

Sunday, October 11, 2009, 4:00 p.m.–6:00 p.m.
Regency Ballroom, Fairmont Hotel

What's hot in optics today? Find out what scientific and technical advances are being made over the entire field of optics. The division Chairs of OSA's technical groups will be presenting recent advancements in their respective technical areas. The overviews highlight recent developments in optics and are designed to be informative and accessible even to the nontechnical attendee. Please check back regularly for more information.

1st International OSA Student Chapter Solar Car Competition

Preliminary races: Sunday, October 11, 4:00 p.m.–7:00 p.m.
Final races: Tuesday, October 13, 12:00 p.m.–2:00 p.m.
Imperial Ballroom, Fairmont Hotel

OSA Student Chapters compete to build their own solar cars and race them. The chapters will work to optimize light capturing efficiency, and demonstrate sustainability and aesthetic appeal. OSA families and guests are welcome to attend! Please note: children 12 and under must be accompanied by an adult and strollers are not permitted.

Welcome Reception

Sunday, October 11, 2009, 6:00 p.m.–7:30 p.m.
Ballroom, Sainte Claire Hotel

Free to all Technical Conference Attendees: Get the FiO 2009/LS XXV meeting off to a great start by attending the welcome reception! Meet with colleagues from around the world and enjoy light hors d'oeuvres.

OSA Spouse, Family and Friends Events

Fairmont San Jose Hotel

Monday, October 12, 8:30 a.m.–10:00 a.m.
Hospitality Suite – stop by to get information on what to see and do in San Jose. Download the flyer.

Tuesday, October 13, 9:00 a.m.–5:00 p.m.

Bus trip to Monterey – space is limited, so sign up at the OSA Membership Booth by 5:00 PM on Monday, October 12. Download the flyer.

Plenary Session and Awards Presentation

Monday, October 12, 2009, 8:00 a.m.–12:00 p.m.
Regency Ballroom, Fairmont Hotel

The 2009 Joint FiO/LS Awards Ceremony and Plenary Session will feature two world-renowned speakers. See the plenary page for detailed descriptions of the speakers and their presentations.

OSA Fellow Member Lunch

Tuesday, October 13, 2009, 12:00 p.m.–1:30 p.m.
(Sponsored by the OSA Foundation)
Silicon Valley Capital Club
50 W San Fernando, Suite 1700
San Jose, California 95113
Tel.: +1 408.971.9300

In September, invitations will be sent out to Fellow Emeritus and Honorary Members. Please email rsvp@osa.org by October 2, 2009 to reserve your place.

Meet the Editors of the APS Journals

Tuesday, October 13, 2009, 3:30 p.m.–5:30 p.m.
Bamboo Lounge, Fairmont Hotel

The Editors of the APS journals cordially invite you to join them for conversation and refreshments. Your questions, criticisms, compliments, and suggestions about the journals are welcome. We hope you will be able to join us.

Minorities and Women in OSA (MWOSA) Tea

Tuesday, October 13, 2009, 4:30 p.m.–5:30 p.m.
Sainte Claire Room, Sainte Claire Hotel

Dr. Linda M. Garverick (leadership consultant, process facilitator, and executive coach) is the featured speaker for this free event. Dr. Garverick's presentation will be"*From Objectivity to Conscious Subjectivity: Understanding Unconscious Bias to Create Fair Evaluation & Promotion Practices*." Everyone is welcome to attend; refreshments will be served!

There is limited space for this event. Please RSVP to mwosa@osa.org by October 2, 2009.

Division of Laser Science Annual Business Meeting

Tuesday, October 13, 2009, 6:00 p.m.–7:00 p.m.
California Room, Fairmont Hotel

All members and interested parties are invited to attend the annual business meeting of the Division of

Laser Science (DLS). The DLS officers will report on the activities of the past year and on plans for the future. Questions will be taken from the floor. This is your opportunity to help define the operations of the DLS and the LS Conference.

OSA's Annual Business Meeting

Tuesday, October 13, 2009, 6:00 p.m.–7:00 p.m.
Piedmont Room, Fairmont Hotel

Learn more about OSA and join the OSA Board of Directors for the Society's annual business meeting. The 2008 activity reports will be presented and the results of the Board of Directors election will be announced. To view the slate of candidates, go to http://www.osa.org/aboutosa/leadership/electionprocess/default.aspx.

Agenda

I. Welcome
2009 OSA President, Thomas Baer

II. 2008 Activity Reports from Society Representatives
Chair, Meetings Council: Edward Watson
Chair, Board of Meetings: David Fittinghoff
Chair, Member and Education Services Council: Irene Georgakoudi
Chair, Corporate Associates Committee: Paul Crosby
Chair, Public Policy Committee: Alex Fong
Chair, International Council: Satoshi Kawata
Chair, Board of Editors: Tony Heinz
Chair, Publications Council: Govind Agrawal
Chair, OSA Foundation: G. Michael Morris

Treasurer: Stephen Fantone

III. 2009 Election Results
2009 OSA President, Thomas Baer
2010 Vice President and Directors at Large

OSA Member Reception

Tuesday, October 13, 2009, 7:00 p.m.–8:30 p.m.
Ballroom, Sainte Claire Hotel
(Free Event for all OSA Members)

Join OSA President Tom Baer for a special reception in honor of OSA members. This free event is an OSA Annual Meeting tradition and is a great opportunity to meet friends and have a relaxing good time. Beverages and delicious appetizers will be served. Please bring your conference registration badge or OSA member ID number.

Laser Science Banquet

Tuesday, October 13, 2009, 7:00 p.m.–10:00 p.m.
Gordon Biersch

33 East San Fernando Street
San Jose, California 95113
Tel.: +1 408.294.6785

Join your colleagues for the annual LS Banquet. Tickets are required for this event and can be purchased during registration for US $50. There is a limited quantity of tickets and tickets must be purchased by 12:00 p.m. on Monday, October 12.

Export Regulation Fundamentals for the Optics and Photonics Industry

Wednesday, October 14, 2009, 9:00 a.m.–12:00 p.m.
Sainte Claire Room, Sainte Claire Hotel
(Presented by the OSA Corporate Associates)

With the global nature of business, it is a necessity for every company employee involved in non-U.S. transactions to fully understand the regulations surrounding export controls. This course will provide the foundation by covering need-to-know information about International Traffic in Arms Regulations (ITAR), Export Administration Regulations (EAR) and your compliance, data management, and licensing responsibilities. Registration required. Employees of OSA Corporate Associates receive a special registration rate.

Joint FiO/LS Poster Session

Wednesday, October 14, 2009, 12:00 p.m.–1:30 p.m.
Imperial Ballroom, Fairmont Hotel

Poster presentations offer an effective way to communicate new research findings and provide an opportunity for lively and detailed discussion between presenters and interested viewers. Please stop by the Regency Ballroom to enjoy the poster session.

FiO Postdeadline Papers

Wednesday, October 14, 2009, 6:30 p.m.–8:00 p.m.
Empire, Crystal, and Gold Rooms, Fairmont Hotel

The FiO 2009 Technical Program Committee accepted a limited number of postdeadline papers for presentation. The purpose of postdeadline sessions is to give participants the opportunity to hear new and significant material in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timeliness were accepted. More information, including the schedule and locations, will be posted in the weeks preceding the conference.

View Postdeadline Abstracts

2009 OSA Science Educators Day

Thursday, October 15, 2009, 5:30 p.m.–8:00 p.m.
McCaw Hall, Frances C. Arrillaga Alumni Center, Stanford Univ.
326 Galvez St
Stanford, California 94305
Tel.: +1 650.723.2021

Sponsored by The Optical Society and the Stanford Student Chapter, Science Educators' Day (EDAY) provides middle and high school science teachers with a wide variety of optics-focused lesson plans and classroom demonstration guides. EDAY attendees receive materials that can be used in middle and high school classrooms.

The event includes:

- Approximately 20 stations with educators demonstrating and discussing hands-on materials for teaching optics to secondary school students
- Gift bags containing demonstration aids and lesson plans for the first 100 registrants
- Additional optics materials available as door prizes
- A buffet dinner allowing you to mingle with fellow teachers and conference attendees

Questions? Email EDAY@osa.org. Space will be limited! Register by Friday, October 2, 2009!

Agenda of Sessions — Sunday, October 11

7:00 a.m.–3:00 p.m.	**OSA Student Chapter Leadership Meeting,** *Plaza Ballroom, Crowne Plaza Hotel*
7:00 a.m.–6:00 p.m.	**Registration,** *Market Street Foyer, Fairmont Hotel*
9:00 a.m.–12:30 p.m.	**Short Courses,** *Locations will be provided at registration* **SC235: Nanophotonics: Materials, Fabrication and Characterization,** *Joseph W. Haus, Andrew Sarangan, Qiwen Zhan; Univ. of Dayton, USA* **SC324: Plasmonics,** *Stefan Maier; Experimental Solid State Group, Dept. of Physics, Imperial College London, UK* **SC326: Patent Fundamentals,** *Mohammed N. Islam; Optics and Photonics and Solid State Electronics Lab, Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA*
12:30 p.m.–1:30 p.m.	**Lunch Break** *(on your own)*
1:30 p.m.–5:00 p.m.	**Short Courses,** *Locations will be provided at registration* **SC274: Polarization Engineering,** *Russell Chipman; Univ. of Arizona, USA* **SC322: Silicon Nanophotonics,** *Jelena Vučković; Edward L. Ginzton Lab, Stanford Univ., USA* **SC340: Tissue Optics and Optical Coherence Tomography,** *Kirill Larin[1], Valery V. Tuchin[2]; [1]Univ. of Houston, USA, [2]Saratov State Univ., Russian Federation*
4:00 p.m.–6:00 p.m.	**What's Hot in Optics Today?** *Regency Ballroom, Fairmont Hotel*
4:00 p.m.–7:00 p.m.	**1st International OSA Student Chapter Solar Mini-Car Preliminary Races,** *Imperial Ballroom, Fairmont Hotel*
6:00 p.m.–7:30 p.m.	**FiO/LS Welcome Reception,** *Ballroom, Sainte Claire Hotel*

Key to Shading

Frontiers in Optics | Laser Science | Joint | Fall OSA Optics & Photonics Congress

Agenda of Sessions — Monday, October 12

	Empire	Crystal	Gold	Valley	California
7:00 a.m.–6:00 p.m.	**Registration,** *Market Street Foyer, Fairmont Hotel*				
8:00 a.m.–12:00 p.m.	**2009 Joint FiO/LS Awards Ceremony and Plenary Session,** *Regency Ballroom, Fairmont Hotel*				
10:00 a.m.–10:30 a.m.	**Coffee Break,** *Regency and Imperial Ballroom Foyer, Fairmont Hotel*				
12:00 p.m.–1:30 p.m.	**Lunch Break** *(on your own)*				
12:00 p.m.–2:00 p.m.	**LSMA: Laser Science Symposium on Undergraduate Research Posters,** *Cupertino Room, Fairmont Hotel*				
1:30 p.m.–3:30 p.m.	**JMA: Entanglement Generation and Measurement I** (Joint FiO/LS)	**FMA: Metamaterials I**	**FMB: Optics for Renewable Energy**	**FMC: Anderson Localization I**	**FMD: RF Photonics**
3:30 p.m.–4:00 p.m.	**Coffee Break,** *Regency and Imperial Ballroom Foyer, Fairmont Hotel*				
4:00 p.m.–6:00 p.m.	**FMG: Quantum Optics in Waveguides I**	**FMH: Metamaterials II** (ends at 5:45 p.m.)	**JMB: Gravitational Wave Interferometers I** (Joint FiO/LS)	**FMI: High Peak Power Laser Technology I** (ends at 5:45 p.m.)	**FMJ: Integrated Optical Sensors**
6:30 p.m.–8:30 p.m.	**OSA Student Member Reception,** *O'Flaherty's Irish Pub, 25 N. Pedro Street, San Jose, California 95110, Phone: 408.947.8007*				

Key to Shading

Frontiers in Optics | Laser Science | Joint | Fall OSA Optics & Photonics Congress

Glen Ellen	Atherton	Sacramento	Piedmont	Hillsborough	Fairfield
Registration, *Market Street Foyer, Fairmont Hotel*					
2009 Joint FiO/LS Awards Ceremony and Plenary Session, *Regency Ballroom, Fairmont Hotel*					
Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*					
Lunch Break *(on your own)*					
LSMA: Laser Science Symposium on Undergraduate Research Posters, *Cupertino Room, Fairmont Hotel*					
FME: Tissue Imaging and Spectroscopy	**FMF: Spatial Nonlinearities: Solitons and Beams**	**LSMB: Advances in Chiroptical Spectroscopy I**	**LSMC: Micro- and Nanofluidics I** (ends at 3:15 p.m.)	**LSMD: Ultrafast X-Ray Science I**	**LSME: Laser Science Symposium on Undergraduate Research I** (2:00 p.m.–4:00 p.m.)
Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*					
FMK: Microscopy and OCT I	**FML: Silicon Photonics I**	**LSMF: Advances in Chiroptical Spectroscopy II** (ends at 5:30 p.m.)	**LSMG: Micro- and Nanofluidics II** (ends at 6:15 p.m.)	**LSMH: Ultrafast X-Ray Science II** (ends at 5:45 p.m.)	**LSMI: Laser Science Symposium on Undergraduate Research II** (4:30 p.m.–6:30 p.m.)
OSA Student Member Reception, *O'Flaherty's Irish Pub, 25 N. Pedro Street, San Jose, California 95110, Phone: 408.947.8007*					

Agenda of Sessions — Tuesday, October 13

	Empire	Crystal	Gold	Valley	California	Glen Ellen
7:00 a.m.–5:30 p.m.	**Registration,** *Market Street Foyer, Fairmont Hotel*					
8:00 a.m.–10:00 a.m.	**FTuA: 3-D Entertainment in the Marketplace** (ends at 9:30 a.m.)	**FTuB: Plasmonic Emitters and Resonators**	**JTuA: Gravitational Wave Interferometers II** (Joint FiO/LS) (ends at 10:15 a.m.)	**FTuC: Optical Communication** (ends at 10:15 a.m.)	**FTuD: Novel Fiber Devices I**	**JTuB: Entanglement Generation and Measurement II** (Joint FiO/LS)
8:00 a.m.–9:30 a.m.	**OSA Young Professionals Networking Event with Corporate Members,** *Courtyard Atrium, Sainte Claire Hotel*					
9:00 a.m.–12:00 p.m.	**Student Programming: Painless Publishing, Science Policy and OSA Traveling Lecturer,** *Regency Ballroom II, Fairmont Hotel*					
10:00 a.m.–10:30 a.m.	**Coffee Break,** *Imperial Ballroom, Fairmont Hotel*					
10:00 a.m.–4:00 p.m.	**Exhibit Hall Open,** *Imperial Ballroom, Fairmont Hotel*					
10:30 a.m.–12:00 p.m.	**FTuF: 3-D Capturing, Visualization and Displays**	**FTuG: Wavefront Design for Information Transport and Sensing I** (ends at 11:45 a.m.)	**FTuH: Diffractive and Holographic Optics I**	**FTuI: All-Optical Signal Processing I**	**FTuJ: Anderson Localization II**	**FTuK: High Peak Power Laser Technology II**
12:00 p.m.–1:30 p.m.	**Exhibit Only Time,** *Imperial Ballroom, Fairmont Hotel*					
12:00 p.m.–2:00 p.m.	**1st International OSA Student Chapter Solar Mini-Car Final Races,** *Imperial Ballroom, Fairmont Hotel*					
12:00 p.m.–1:30 p.m.	**OSA Fellow Member Lunch,** *Silicon Valley Capital Club, 50 W. San Fernando, Suite 1700, San Jose, California 95113, Phone: 408.971.9300*					
12:00 p.m.–1:30 p.m.	**Lunch Break** *(on your own)*					
1:30 p.m.–3:30 p.m.	**FTuM: Emerging 3-D Display Technologies and Research Frontiers I** (ends at 3:00 p.m.)	**FTuN: Negative Index Materials and Cloaking**	**FTuO: Diffractive and Holographic Optics II**	**FTuP: Optical Access**	**FTuQ: Light in the Eye**	**FTuR: Rogue Waves and Related Phenomena**
3:30 p.m.–4:00 p.m.	**Coffee Break/Exhibits,** *Imperial Ballroom, Fairmont Hotel*					
3:30 p.m.–5:30 p.m.	**Meet the Editors of the APS Journals,** *Bamboo Lounge, Fairmont Hotel*					
4:00 p.m.–5:30 p.m.	**FTuT: Emerging 3-D Display Technologies and Research Frontiers II**	**FTuU: Wavefront Design for Information Transport and Sensing II**	**FTuV: Metamaterials in Emerging Technologies**	**FTuW: All-Optical Signal Processing II**	**FTuX: Novel Optics of Periodic Structures**	**FTuY: Optical Biosensing** (ends at 5:45 p.m.)
4:30 p.m.–5:30 p.m.	**Minorities and Women in OSA (MWOSA) Tea,** *Sainte Claire Room, Sainte Claire Hotel*					
6:00 p.m.–7:00 p.m.	**OSA Annual Business Meeting,** *Piedmont Room, Fairmont Hotel*					
6:00 p.m.–7:00 p.m.	**DLS Annual Business Meeting,** *California Room, Fairmont Hotel*					
6:00 p.m.–7:30 p.m.	**JTuC: Joint AO/COSI/LM/SRS Welcome Reception and Poster Session,** *Regency Ballroom, Fairmont Hotel*					
7:00 p.m.–8:30 p.m.	**OSA Member Reception,** *Ballroom, Sainte Claire Hotel*					
7:00 p.m.–10:00 p.m.	**Laser Science Banquet,** *Gordon Biersch, 33 East San Fernando Street, San Jose, California, Phone: 408.294.6785*					

Key to Shading

Frontiers in Optics | Laser Science | Joint | Fall OSA Optics & Photonics Congress

				Fall OSA Optics & Photonics Congress			
				AO	LM	COSI	SRS
Atherton	**Sacramento**	**Piedmont**	**Hillsborough**	**Fairfield**	**Belvedere**	**Club Regent**	**Cupertino**
Registration, *Market Street Foyer, Fairmont Hotel*							
FTuE: Fiber Optics Sensors	**LSTuA: General Laser Science**	**LSTuB: Cavity Optomechanics I**	**LSTuC: Ultrafast X-Ray Science III**	**AOTuA: Adaptive Optics Systems I** (ends at 9:50 a.m.)	**LMTuA: Fundamentals of Femtosecond Laser Interactions with Materials**	**CTuA: Computational Imaging and Compressive Sensing**	**STuA: Imaging from Limited and Compressed Data**
OSA Young Professionals Networking Event with Corporate Members, *Courtyard Atrium, Sainte Claire Hotel*							
Student Programming: Painless Publishing, Science Policy and OSA Traveling Lecturer, *Regency Ballroom II, Fairmont Hotel*							
Coffee Break, *Imperial Ballroom, Fairmont Hotel*							
Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*							
FTuL: Molecular Imaging and Nanomedicine	**LSTuD: Photophysics of Quantum Dots and Nanostructures I**	**LSTuE: Cavity Optomechanics II**	**LSTuF: Micro- and Nanofluidics III**	**AOTuB: Wavefront Sensing I**	**LMTuB: Three-Dimensional Micromachining with Femtosecond Lasers**	**CTuB: Light Field Representations**	**STuB: Inverse Scattering**
Exhibit Only Time, *Imperial Ballroom, Fairmont Hotel*							
1st International OSA Student Chapter Solar Mini-Car Final Races, *Imperial Ballroom, Fairmont Hotel*							
OSA Fellow Member Lunch, *Silicon Valley Capital Club, 50 W. San Fernando, Suite 1700, San Jose, California 95113, Phone: 408.971.9300*							
Lunch Break *(on your own)*							
FTuS: Short Wavelength Generation and Applications I: From EUV to X-Rays (ends at 3:15 p.m.)	**LSTuG: Optoelectronic Materials Characterization** (ends at 3:45 p.m.)	**LSTuH: Cavity Optomechanics III**	**LSTuI: High Field Dynamics I**	**AOTuC: High Contrast Imaging and Point Spread Function Calibration I** (ends at 3:10 p.m.)	**LMTuC: Fabrication of Waveguides with Femtosecond Laser Systems**	**CTuC: Constraints on Imaging**	**STuC: Atmospheric Imaging**
Coffee Break/Exhibits, *Imperial Ballroom, Fairmont Hotel*							
Meet the Editors of the APS Journals, *Bamboo Lounge, Fairmont Hotel*							
FTuZ: Short Wavelength Generation and Applications II: Spectroscopy and Microscopy	**LSTuJ: Photophysics of Quantum Dots and Nanostructures II**	**LSTuK: Cavity Optomechanics IV** (ends at 5:15 p.m.)	**LSTuL: High Field Dynamics II** (ends at 5:45 p.m.)	**AOTuD: System Simulation and Modeling I** (ends at 5:20 p.m.)	**LMTuD: Surface Processing and Panel Discussion on Femtosecond Laser Micromachining** (ends at 6:00 p.m.)	**CTuD: 3-D Imaging and PSF Design** (ends at 5:45 p.m.)	**STuD: Time-Frequency and Phase-Space Methods** (ends at 5:15 p.m.)
Minorities and Women in OSA (MWOSA) Tea, *Sainte Claire Room, Sainte Claire Hotel*							
OSA Annual Business Meeting, *Piedmont Room, Fairmont Hotel*							
DLS Annual Business Meeting, *California Room, Fairmont Hotel*							
JTuC: Joint AO/COSI/LM/SRS Welcome Reception and Poster Session, *Regency Ballroom, Fairmont Hotel*							
OSA Member Reception, *Ballroom, Sainte Claire Hotel*							
Laser Science Banquet, *Gordon Biersch, 33 East San Fernando Street, San Jose, California, Phone: 408.294.6785*							

Agenda of Sessions — Wednesday, October 14

	Empire	Crystal	Gold	Valley	California	Glen Ellen
7:30 a.m.–5:30 p.m.	**Registration,** *Market Street Foyer, Fairmont Hotel*					
8:00 a.m.–10:00 a.m.	**FWA: Biomedical Applications of Ultrafast Lasers**	**FWB: Optical Information Processing and Transport in the Age of Nanophotonics and Metamaterials**	**FWC: Extraordinary Transmission and Structured Surface**	**FWD: Turbulence and Other Nonlinear Phenomena**	**FWE: Novel Fiber Devices II** (ends at 9:45 a.m.)	**FWF: Photonic Bandgap Devices** (ends at 9:45 a.m.)
9:00 a.m.–12:00 p.m.	**Export Regulation Fundamentals for the Optics and Photonics Industry,** *Sainte Claire Room, Sainte Claire Hotel*					
10:00 a.m.–10:30 a.m.	**Coffee Break,** *Imperial Ballroom, Fairmont Hotel*					
10:00 a.m.–4:00 p.m.	**Exhibit Hall Open,** *Imperial Ballroom, Fairmont Hotel*					
10:30 a.m.–12:00 p.m.	**FWH: Coherence and Fundamental Optics I** (ends at 12:15 p.m.)	**FWI: Optics in Information Sciences**	**FWJ: Quantum Optics in Waveguides II** (ends at 12:15 p.m.)	**FWK: All-Optical Signal Processing III**	**FWL: Optical Communication Devices**	**FWM: Optical Trapping and Micromanipulation I** (ends at 11:45 a.m.)
12:00 p.m.–1:30 p.m.	**JWC: Joint FiO/LS Poster Session,** *Imperial Ballroom, Fairmont Hotel*					
12:00 p.m.–1:30 p.m.	**Lunch Break** *(on your own)*					
1:30 p.m.–3:30 p.m.	**JWD: Entanglement Generation and Measurement III** (Joint FiO/LS)	**FWO: OSA Topical Meeting Highlights I**	**FWP: Metamaterials III**	**FWQ: Phase Space Optics—Optical System Theory for the 21st Century I** (ends at 3:15 p.m.)	**FWR: Novel Optical Architectures in Emerging Technologies I**	**FWS: Optical Trapping and Micromanipulation II**
3:30 p.m.–4:00 p.m.	**Coffee Break/Exhibits,** *Imperial Ballroom, Fairmont Hotel*					
4:00 p.m.–5:30 p.m.	**FWU: Coherence and Fundamental Optics II**	**FWV: OSA Topical Meeting Highlights II**	**JWE: Entanglement Generation and Measurement IV** (Joint FiO/LS) (ends at 6:00 p.m.)	**FWW: Phase Space Optics—Optical System Theory for the 21st Century II**	**FWX: Novel Optical Architectures in Emerging Technologies II**	**FWY: Optical Trapping and Micromanipulation III**
6:30 p.m.–8:00 p.m.	**FiO Postdeadline Paper Sessions,** *See the Postdeadline Papers Book in your registration bag for exact times and locations*					
6:30 p.m.–8:00 p.m.	**AIOM Welcome Reception,** *Regency Ballroom I, Fairmont Hotel*					

Key to Shading

Frontiers in Optics | Laser Science | Joint | Fall OSA Optics & Photonics Congress

				AO	AIOM	COSI	SRS
Atherton	**Sacramento**	**Piedmont**	**Hillsborough**	**Fairfield**	**Belvedere**	**Club Regent**	**Cupertino**
Registration, *Market Street Foyer, Fairmont Hotel*							
FWG: Photonic Sensing Devices	**LSWA: Single-Molecule Biophysics I**	**LSWB: Second-Order Nonlinear Optics I**	**LSWC: Multidimensional Spectroscopy I**		**AWA: Semiconductor Materials** (ends at 9:45 a.m.)	**JWA: Joint AO/COSI/SRS Session**	
Export Regulation Fundamentals for the Optics and Photonics Industry, *Sainte Claire Room, Sainte Claire Hotel*							
Coffee Break, *Imperial Ballroom, Fairmont Hotel*							
Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*							
FWN: Silicon Photonics II	**LSWD: Single-Molecule Biophysics II**	**LSWE: Second-Order Nonlinear Optics II**	**LSWF: Multidimensional Spectroscopy II**	**AOWA: High Contrast Imaging and Point Spread Function Calibration II** (ends at 11:50 a.m.)	**AWB: Laser-Material Interactions** (ends at 11:45 a.m.)	**CWA: Polarization Sensing and Imaging**	**JWB: Advances in Adaptive Optics Imaging of the Living Retina I** (Joint AO/FiO)
JWC: Joint FiO/LS Poster Session, *Imperial Ballroom, Fairmont Hotel*							
Lunch Break *(on your own)*							
FWT: Plasmonic Sensors (ends at 3:15 p.m.)	**LSWG: Ultrafast Spectroscopy I**	**LSWH: Second-Order Nonlinear Optics III** (ends at 3:15 p.m.)	**LSWI: Multidimensional Spectroscopy III** (ends at 3:00 p.m.)	**AOWB: Control Algorithms and Architecture**	**AWC: Oxide Crystals** (ends at 3:15 p.m.)	**CWB: Multi Aperture Systems** (ends at 3:15 p.m.)	**SWA: Phase Retrieval Methods** (ends at 3:15 p.m.)
Coffee Break/Exhibits, *Imperial Ballroom, Fairmont Hotel*							
FWZ: Silicon Photonics III	**LSWJ: Ultrafast Spectroscopy II** (ends at 6:15 p.m.)	**LSWK: Second-Order Nonlinear Optics IV** (ends at 5:45 p.m.)		**JWF: Advances in Adaptive Optics Imaging of the Living Retina II** (Joint AO/FiO)	**AWD: Optical Ceramics**		
FiO Postdeadline Paper Sessions, *See the Postdeadline Papers Book in your registration bag for exact times and locations*							
AIOM Welcome Reception, *Regency Ballroom I, Fairmont Hotel*							

Agenda of Sessions — Thursday, October 15

	Empire	Crystal	Gold	Valley	California
7:30 a.m.–5:00 p.m.	**Registration,** *Market Street Foyer, Fairmont Hotel*				
8:00 a.m.–10:00 a.m.	**LSThA: X-Ray Imaging I**	**FThA: Nanofocusing Optics I**	**FThB: Diffractive and Holographic Optics III**	**FThC: Micro-Cavity Devices I**	**FThD: High-Power Fiber Lasers I**
10:00 a.m.–10:30 a.m.	**Coffee Break,** *Regency and Imperial Ballroom Foyer, Fairmont Hotel*				
10:30 a.m.–12:00 p.m.	**LSThC: X-Ray Photon Correlation Spectroscopy**	**FThG: Nanofocusing Optics II**	**FThH: Aspheric and Freeform Optical Surfaces: Design, Characterization and Alignment I** (ends at 11:45 a.m.)	**FThI: Novel Nonlinear Optical Phenomena**	**FThJ: High-Power Fiber Lasers II**
12:00 p.m.–1:30 p.m.	**Lunch Break** *(on your own)*				
1:30 p.m.–3:30 p.m.	**LSThE: X-Ray Imaging II** (ends at 2:45 p.m.)	**FThM: Nanoscale Methods and Instruments I**	**FThN: Aspheric and Freeform Optical Surfaces: Design, Characterization and Alignment II**	**FThO: Micro-Cavity Devices II**	**FThP: Optics in Interventional Medicine**
3:30 p.m.–4:00 p.m.	**Coffee Break,** *Regency and Imperial Ballroom Foyer, Fairmont Hotel*				
4:00 p.m.–6:00 p.m.	**FThS: Optical Nonlinear Properties of Materials** (ends at 5:45 p.m.)	**FThT: Nanoscale Methods and Instruments II** (ends at 5:15 p.m.)		**FThU: Micro-Cavity Devices III**	
5:30 p.m.–8:00 p.m.	**Science Educators' Day,** *McCaw Hall, Frances C. Arrillaga Alumni Center, Stanford Univ., 326 Galvez Street, Stanford, California 94305, Phone: 650.723.2021*				

Key to Shading

Frontiers in Optics | Laser Science | Joint | Fall OSA Optics & Photonics Congress

			Fall OSA Optics & Photonics Congress		
			AO	AIOM	COSI
Glen Ellen	**Atherton**	**Sacramento**	**Fairfield**	**Belvedere**	**Club Regent**
Registration, *Market Street Foyer, Fairmont Hotel*					
FThE: Integrated Optics	**LSThB: Single-Molecule Biophysics III**	**FThF: Polarization and Birefringence in Optical Design I**	**AOThA: Adaptive Optics Systems II** (ends at 9:40 a.m.)	**AThA: Nanostructured Materials** (ends at 9:30 a.m.)	**CThA: New Imaging Concepts**
Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*					
FThK: Optoelectronics	**LSThD: Single-Molecule Biophysics IV**	**FThL: Polarization and Birefringence in Optical Design II** (ends at 11:45 a.m.)	**AOThB: System Simulation and Modeling II** (ends at 11:30 a.m.)	**AThB: Applications of Nanophotonics**	**CThB: Pupil Encoding Methods** (ends at 12:15 p.m.)
Lunch Break *(on your own)*					
FThQ: Molecular Imaging in the Eye	**LSThF: Single-Molecule Biophysics V** (ends at 3:00 p.m.)	**FThR: Computational Imaging and Photography I**	**AOThC: Wavefront Sensing II** (ends at 3:10 p.m.)	**AThC: Glass Synthesis and Properties** (ends at 3:15 p.m.)	**CThC: Imaging through Complex Media and Spectroscopy** (ends at 3:00 p.m.)
Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*					
FThV: Microscopy and OCT II	**FThW: Plasmonic Waveguides and Devices** (ends at 5:45 p.m.)	**FThX: Computational Imaging and Photography II**	**AOThD: Wavefront Correction Technology** (ends at 5:30 p.m.)	**AThD: Optical Fibers**	**CThD: COSI Panel Discussion** (4:00 p.m.–5:00 p.m.)
Science Educators' Day, *McCaw Hall, Frances C. Arrillaga Alumni Center, Stanford Univ., 326 Galvez Street, Stanford, California 94305, Phone: 650.723.2021*					

FiO/LS/Fall Congress Key to Authors and Presiders

(Bold denotes presider or presenting author. Presentation numbers are listed in alphabetical order.)

Key to Authors and Presiders

(Bold denotes Presider or Presenting Author)

Empire	Crystal	Gold	Valley	California
JOINT FiO/LS	FiO			

8:00 a.m.–12:00 p.m. 2009 Joint FiO/LS Awards Ceremony and Plenary Session, *Regency Ballroom, Fairmont Hotel*

10:00 a.m.–10:30 a.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

12:00 p.m.–1:30 p.m. Lunch Break *(on your own)*

12:00 p.m.–2:00 p.m. LSMA: Laser Science Symposium on Undergraduate Research Posters, *Cupertino Room, Fairmont Hotel (See the Program in your registration bag.)*

1:30 p.m.–3:30 p.m.
JMA • Entanglement Generation and Measurement I
Paul Voss; Georgia Tech, USA, Presider

JMA1 • 1:30 p.m. Invited

Synthesizing Arbitrary Photon States in a Superconducting Resonator: The Quantum Digital to Analog Converter, *John Martinis, Max Hofheinz, H. Wang, M. Ansmann, Radoslaw C. Bialczak, Erik Lucero, M. Neeley, A. D. O'Connell, D. Sank, J. Wenner, A. N. Cleland; Univ. of California at Santa Barbara, USA.* Arbitrary microwave photon states have been synthesized by coupling a high-*Q* resonator to a superconducting qubit. We analyze a variety of states by mapping out the Wigner function, and show movies of their decay.

JMA2 • 2:00 p.m.

Nonlocal Modulation of Biphotons, *S. Sensarn, G. Y. Yin, S. E. Harris; Stanford Univ., USA.* We experimentally describe a new quantum effect where temporal modulation of one photon of an entangled pair, as measured by frequency-domain correlation, may be negated or enhanced by modulation of the second photon.

1:30 p.m.–3:30 p.m.
FMA • Metamaterials I
Hou-Tong Chen; Los Alamos Natl. Lab, USA, Presider

FMA1 • 1:30 p.m. Invited

About Energy, Linear Momentum and Mass Transfer by Electromagnetic Wave in Negative Refraction Media, *Victor Veselago; Moscow Inst. of Physics and Technology, Russian Federation.* The question of linear momentum of the photon, propagating in a refractive medium, in particular in a medium with negative index of refraction, is discussed.

FMA2 • 2:00 p.m.

Optical Modes on Anisotropic Epsilon-near-Zero Films, *Zhimin Shi, Andreas C. Liapis, Robert W. Boyd; Inst. of Optics, Univ. of Rochester, USA.* We show both in reflectance and mode calculation that an anisotropic epsilon-near-zero nanocomposite film sandwiched between two different dielectric media can support bounded TM optical modes, while the Brewster tunneling phenomenon is also greatly modified.

1:30 p.m.–3:30 p.m.
FMB • Optics for Renewable Energy
Alan Kost; Univ. of Arizona, USA, Presider

FMB1 • 1:30 p.m. Keynote

Optics of Solar Cells, *Greg P. Smestad[1,2]; [1]Solar Energy Materials and Solar Cells, USA; [2]Sol Ideas Technology Development, USA.* Key advances in solar concentrator and non-concentrator photovoltaic module optics will be reviewed. Likewise, we present how the optics within the solar cell itself can maximize its solar conversion efficiency while reducing the $/Wp cost.

Greg P. Smestad, Ph.D., has over 20 years of experience as a scientist and engineer in the field of solar energy materials. For most of that time, he has served as Associate Editor for Elsevier's Solar Energy Materials and Solar Cells, an international peer-reviewed journal. He is currently a reviewer for California Energy Commission PIER/EISG grants, and for the U.S. Department of Energy. He is principal and owner of Sol Ideas Technology Development, a consultancy he founded to specialize in photovoltaics, optics and solar cells. A native of San Jose, Dr. Smestad received his Ph.D. in Physical Chemistry from the Swiss Federal Institute of Technology in Lausanne and his Masters degree in Materials Science from Stanford University. His career includes roles as an III-V Czochralski growth engineer, LED optics design specialist, photovoltaic thin films researcher, electrochemist and professor. In 2002, SPIE published his tutorial book "Optoelectronics of Solar Cells".

1:30 p.m.–3:30 p.m.
FMC • Anderson Localization I
Tsampikos Kottos; Wesleyan Univ., USA, Presider

FMC1 • 1:30 p.m. Invited

Multiple Scattering of Light in Atomic Gases: From Levy Flights to Random Lasers, *Robin Kaiser; Univ. de Nice Sophia-Antipolis, France.* Cold atoms have emerged as interesting quantum system to study coherent transport properties of light. We study the interplay between Anderson localization and Dicke subradiance, Levy flights of photons and random lasing with cold atoms.

FMC2 • 2:00 p.m.

Intensity Correlations in Disordered Photonic Lattices, *Yoav Lahini[1], Yaron Bromberg[1], Francesca Pozzi[2], Sorel Marc[2], Roberto Morandotti[3], Demetrios Christodoulides[4], Yaron Silberberg[1]; [1]Weizmann Inst. of Science, Israel, [2]Univ. of Glasgow, UK, [3]INRS, Canada, [4]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We experimentally study intensity correlations for light in one dimensional disordered media exhibiting Anderson localization. We measure the effect of nonlinearity on these intensity correlations.

1:30 p.m.–3:30 p.m.
FMD • RF Photonics
Leonid Kazovsky; Stanford Univ., USA, Presider

FMD1 • 1:30 p.m. Invited

Bi-Directional Multi-Service 60-GHz MM-Wave Radio-over-Fiber Network Interoperable with Multi-Gigabit Wireless Transceiver for Very High Throughput In-building HD Video and Data Delivery, *Gee-Kung Chang, Arshad Chowdhury, Hung-Chang Chien; Georgia Tech, USA.* We demonstrate, for the first time, a bi-directional in-building radio-over-fiber network with 60-GHz optical-wireless access supporting multi-gigabit uncompressed high-definition video and data delivery using all-optical conversion at the head-end and single-chip wireless transceiver at the mobile end-terminals.

FMD2 • 2:00 p.m.

Injection Locked Coupled Optoelectronic Oscillator with Long-Term Feedback Stabilization, *Charles Williams, Franklyn Quinlan, Josue Davila-Rodriguez, Dimitrios Mandridis, Peter J. Delfyett; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* A semiconductor based, optically injection-locked coupled optoelectronic oscillator with long term feedback stabilization, operating at 10.24 GHz is presented. Optical supermode suppression, RF supermode noise spur suppression by 11 dB, and linewidth reduction is observed.

Glen Ellen	Atherton	Sacramento	Piedmont	Hillsborough
FiO		LS		

8:00 a.m.–12:00 p.m. 2009 Joint FiO/LS Awards Ceremony and Plenary Session, *Regency Ballroom, Fairmont Hotel*

10:00 a.m.–10:30 a.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

12:00 p.m.–1:30 p.m. Lunch Break *(on your own)*

12:00 p.m.–2:00 p.m. LSMA: Laser Science Symposium on Undergraduate Research Posters, *Cupertino Room, Fairmont Hotel (See the Program in your registration bag.)*

1:30 p.m.–3:30 p.m. FME • Tissue Imaging and Spectroscopy

Urs Utzinger; Univ. of Arizona, USA, Presider

FME1 • 1:30 p.m. Invited

Imaging Metal Nanoparticle Tumor Targeting Kinetics, *J. Park[1], P. Puvanakrishnan[1], P. Diagaradjane[2], J. A. Schwartz[3], J. D. Payne[3], A. K. Dunn[1], S. Krishnan[2], J. W. Tunnell[1]; [1]Univ. of Texas at Austin, USA, [2]Radiation Oncology, MD Anderson Cancer Ctr., USA, [3]Nanospectra Biosciences Inc., USA.* Metal nanoparticles constitute multifunctional nanovectors for the combined targeting, imaging, and treatment of solid tumors. We demonstrate the *in vivo* targeting kinetics of metal nanoparticles (rods and shells) using multiphoton microscopy, narrowband imaging, and DOS.

FME2 • 2:00 p.m.

Quantitative Cerebral Blood Flow Measurement through Thinned Skull with Multi Exposure Speckle Imaging, *Ashwin Parthasarathy, Adrien Ponticorvo, S. M . Shams Kazmi, Andrew K. Dunn; Univ. of Texas at Austin, USA.* We present a new Multi-Exposure Speckle Imaging instrument and a new speckle model to predict correlation times of flow *in vivo* that are unaffected by the presence of static scatterers such as an intact/thinned skull.

1:30 p.m.–3:30 p.m. FMF • Spatial Nonlinearities: Solitons and Beams

Eric W. Van Stryland; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, Presider

FMF1 • 1:30 p.m.

Nonlinear Diffraction from a Straight Edge, *Wenjie Wan, Dmitry V. Dylov, Christopher Barsi, Jason W. Fleischer; Princeton Univ., USA.* We experimentally demonstrate diffraction from a straight edge in a medium with self-focusing nonlinearity. Theoretically, we interpret the optical flow as a spatially-dispersive shock wave with negative pressure.

FMF2 • 1:45 p.m.

Moiré Filter in Volume Bragg Grating, *Sergiy Mokhov[1], Leonid Glebov[1], Julien Lumeau[1], Vadim Smirnov[2], Boris Zeldovich[1]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]OptiGrate, USA.* We propose narrow-band moiré filter in volume Bragg grating. It can be tunable via transverse degrees of freedom absent in fibers. Filter at 1550 nm with bandwidth of 50 pm and transmission 95% was demonstrated.

FMF3 • 2:00 p.m.

Vortices in the near Field of Atomic Radiation Emitted near an Interface, *Xin Li, Henk F. Arnoldus; Mississippi State Univ., USA.* The energy flow pattern for radiation emitted by an atom near an interface exhibits numerous singularities and vortices in the near field. The optical vortices are of nanoscale dimension.

1:30 p.m.–3:30 p.m. LSMB • Advances in Chiroptical Spectroscopy I

Bart Kahr; New York Univ., USA, Presider

LSMB1 • 1:30 p.m. Invited

Probing Molecular Chirality by Conventional and Fluorescence Detected Electronic Circular Dichroism, *Nina Berova; Columbia Univ., USA.* We discuss recent results on probing molecular and supramolecular chirality by CD sensitive porphyrins, metalloporphyrins and other fluorescent reporter groups where for the chiroptical analysis a conventional CD and ellipsoidal mirror FDCD detectors were employed.

LSMB2 • 2:00 p.m. Invited

Optical Activity at Interfaces, *Peer Fischer; Rowland Inst. at Harvard, Harvard Univ., USA.* Polarimetry requires long path-lengths. Here we consider chiro-optical phenomena that arise at an interface and therefore allow the analysis of microfluidic volumes. New effects due to the addition of a magnetic field are also described.

1:30 p.m.–3:15 p.m. LSMC • Micro- and Nanofluidics I

Stephen Jacobson; Indiana Univ., USA, Presider

LSMC1 • 1:30 p.m. Invited

Applications of Silicon Photonic Technology for Clinical Diagnostics and Highly Multiplexed Biomolecular Detection, *Adam L. Washburn, Abraham J. Qavi, Matthew S. Luchansky, Ji-Yeon Byeon, Ryan C. Bailey; Univ. of Illinois at Urbana-Champaign, USA.* Silicon photonic structures are incredibly responsive to binding-induced changes in the refractive index environment surrounding the device. We are developing microring resonator arrays as a robust platform for sensitive, label-free, and highly multiplexed biomolecular detection.

LSMC2 • 2:00 p.m. Invited

Ion Conductance Microscopy of Nanometer Pores, *Lane A. Baker; Indiana Univ., USA.* Scanning ion conductance microscopy was used to interrogate ion currents emanating from nanometer-scale pores of a polymer membrane. Transport activity of individual pores was measured from ion current images and corresponding topographic images recorded simultaneously.

1:30 p.m.–3:30 p.m. LSMD • Ultrafast X-Ray Science I

David A. Reis; Univ. of Michigan, USA, Presider

LSMD1 • 1:30 p.m. Invited

Title to Be Announced, *Jerome Hastings; SLAC Natl. Accelerator Lab, Stanford Univ., USA.* Abstract not available.

LSMD2 • 2:00 p.m. Invited

The X-Ray Pump-Probe Instrument at LCLS, *David Fritz; SLAC Natl. Accelerator Lab, Stanford Univ., USA.* The X-ray Pump-Probe instrument (XPP) will be the first hard X-ray experimental station to operate at the LCLS in the fall of 2010. The design, status and capabilities of XPP will be presented.

2:00 p.m.–4:00 p.m. LSME: Laser Science Symposium on Undergraduate Research I,
Fairfield Room, Fairmont Hotel (See the Program in your registration bag.)

Empire | Crystal | Gold | Valley | California

JOINT FiO/LS | FiO

JMA • Entanglement Generation and Measurement I—Continued

JMA3 • 2:15 p.m.
High-Efficiency Optical Quantum State Engineering, *Kevin T. McCusker, Paul G. Kwiat; Univ. of Illinois, USA*. We discuss a novel method of efficiently producing multi-photon states using repeated spontaneous parametric downconversion. By attempting downconversion several times, we can pseudo-deterministically add photons to a mode, producing various several-photon states.

JMA4 • 2:30 p.m.
Bright Entangled Photon Source Optimized for Single Mode Emission and Minimum Spectral Entanglement, *Philip Evans, Ryan Bennink, Warren Grice, Travis Humble, Jason Schaake; Oak Ridge Natl. Lab, USA*. We describe an entangled photon source based on collinear down-conversion in periodically-poled KTP at 1552 nm. The pump bandwidth, crystal length, and pump spatial mode are chosen so as to minimize spectral and spatial entanglement.

JMA5 • 2:45 p.m.
Correlated Photon Pair Generation by a Single Dual-Element PPKTP Waveguide at over GHz Repetition Rate, *Oliver Slattery, Lijun Ma, Xiao Tang; NIST, USA*. A compact scheme for high-speed frequency doubling and down-conversion on a single dual-element PPKTP waveguide is investigated. Optimal temperature is achieved and coincidence is observed at over GHz repetition rate with pulsed pump input scheme.

JMA6 • 3:00 p.m.
Direct Measurement of Transverse Mode Entanglement in Two-Photon States, *Henrique D. L. Pires[1], Carlos H. Monken[1,2], Martin P. van Exter[1]; [1]Huygens Lab, Leiden Univ., Netherlands, [2]Dept. de Física, Univ. Federal de Minas Gerais, Brazil.* We introduce and implement a new method to measure the Schmidt number of spatially entangled two-photon states by exploiting a connection between the Schmidt decomposition and the coherent-mode decomposition in classical coherence theory.

FMA • Metamaterials I—Continued

FMA3 • 2:15 p.m.
Multipole Metamaterials: A Mesoscopic Investigation towards Effective Linear and Nonlinear Optical Material Interaction, *Jörg Petschulat, Arkadi Chipouline, Andreas Tünnermann, Thomas Pertsch, Christoph Menzel, Carsten Rockstuhl, Thomas Paul, Falk Lederer; Friedrich-Schiller-Univ. Jena, Germany.* The multipole reinterpretation of plasmonic resonances occurring in meta-atoms is presented. The approach allows us to determine effective metamaterial parameters and inherently induces nonlinear optical response by considering higher order multipoles beyond the electric dipole.

FMA4 • 2:30 p.m.
Fabry-Perot Nanocavities in 3-D Plasmonic Crystals, *Alp Artar, Ahmet Ali Yanik, Hatice Altug; Boston Univ., USA*. Extraordinary light transmission through Fabry-Perot cavities in 3-D plasmonic crystals created by two physically separated plasmonic layers is demonstrated. These cavity resonances show large field enhancements and are highly sensitive to refractive index changes.

FMA5 • 2:45 p.m.
Tunable Plasmonic Resonances in Two-Dimensional Arrays via Nanoparticle Height Control, *John Henson, Jeff DiMaria, Roberto Paiella; Boston Univ., USA*. Experimental and theoretical investigations show that the collective plasmonic resonances of two-dimensional silver nanoparticle arrays can be effectively blue-shifted by increasing the particle height while still maintaining large field enhancements and small absorption losses.

FMA6 • 3:00 p.m.
Approximate Green's Function for a Uniaxially Anisotropic Slab, *Huikan Liu, Shivanand, Kevin J. Webb; Purdue Univ., USA*. An analytic solution for a line source image through a uniaxially anisotropic slab is supported by a finite element simulation. This allows a convenient means to evaluate the impact of material parameters in applications.

FMB • Optics for Renewable Energy—Continued

FMB2 • 2:15 p.m. Invited
Solar Production of Fuels, *Anastasios Melis; Univ. of California at Berkeley, USA*. Research aims to engineer the optical properties of sunlight absorption and utilization to improve solar energy conversion efficiency in microalgal photosynthesis. Further, application of metabolic transformation technologies in microalgae confers specific light-driven biofuels production.

FMB3 • 2:45 p.m.
Holographic Low Concentration Ratio Solar Concentrators, *Raymond K. Kostuk, Jose Castro, Deming Zhang; Univ. of Arizona, USA*. A model for holographic low concentration ratio concentrators for solar energy applications is presented and experimentally verified. The method is applied to two-dimensional holographic planar concentrators. Projected system energy yield is also evaluated.

FMB4 • 3:00 p.m.
GaAs-Based InAs/InGaAs Quantum Dot Solar Cells for Concentration Applications, *Kai Yang, Mohamed A. El-Emawy, Ting-yi Gu, Andreas Stintz, Luke F. Lester; Ctr. for High Technology Materials, Univ. of New Mexico, USA*. We report the I-V and spectral response characteristics of InAs/GaAs quantum dot (QD) solar cells. The results show that QD cells are promising for concentration due to significant differences in ideality factor behavior with voltage.

FMC • Anderson Localization I—Continued

FMC3 • 2:15 p.m.
Classification of Regimes of Wave in Non-Conservative Random Media, *Ben Payne, Alexey G. Yamilov; Missouri Univ. of Science and Technology, USA*. In search of a criterion of Anderson localization applicable in random media with absorption or gain, we explore the parameter space of the system and identify different regimes in wave transport.

FMC4 • 2:30 p.m. Invited
Photons, Dust and Honey Bees, *Pierre Barthelemy, Jacopo Bertolotti, Diederik S. Wiersma; European Lab for Non Linear Spectroscopy, Univ. of Florence, Italy.* Light transport, a new optical material called Levy glass is reported in which photons exhibit a Levy flight and hence super diffusion.

FMC5 • 3:00 p.m.
Nonuniversal Dynamic Conductance Fluctuations, *Abe Peña[1], Andrey A. Chabanov[1], Nicolas Cherroret[2], Sergey E. Skipetrov[2]; [1]Univ. of Texas at San Antonio, USA, [2]Lab de Physique et Modélisation des Milieux Condensés, Univ. Joseph Fourier, France*. Using diagrammatic calculations and pulsed microwave measurements, we show that sample-to-sample dynamic conductance fluctuations are nonuniversal and increase as a third power of delay time from an exciting pulse, *t*.

FMD • RF Photonics—Continued

FMD3 • 2:15 p.m.
Photonic Microwave Frequency Mixing Using an Optically Injected Semiconductor Laser, *Xuelei Fu, Cuicui Cui, Sze-Chun Chan; Dept. of Electronic Engineering, City Univ. of Hong Kong, China*. An optically injected semiconductor laser under instability is applied as a microwave frequency mixer. Up-conversion of radio-over-fiber (RoF) data to a 16-GHz subcarrier is experimentally demonstrated using a 2.5-Gbps-grade laser.

FMD4 • 2:30 p.m.
Quadruple Frequency Photonic Signal Generation by Optical Frequency Doubling, *Kiyotaka Sasagawa, Masahide Fujiwara, Toshihiko Noda, Takashi Tokuda, Jun Ohta; Nara Inst. of Science and Technology, Japan.* Two-tone photonic signal generation is demonstrated by using a single sideband optical modulator and a periodically poled lithium niobate waveguide. The frequency spacing is quadruple of the input RF frequency into the modulator.

FMD5 • 2:45 p.m.
Resonant Cavity Linear Interferometric Modulator, *Nazanin Hoghooghi, Ibrahim Ozdur, Josue Davila-Rodriguez, Mehmetcan Akbulut, Peter J. Delfyett Jr.; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA*. A purely linear resonant cavity interferometric modulator with a potential infinite spurious free dynamic range and multi-gigahertz bandwidth is proposed and the first experimental demonstration is presented.

FMD6 • 3:00 p.m.
Accuracy and Stability of Optical Pulse Characterization Using Sinusoidal Temporal Gratings, *Inuk Kang; Bell Labs, Alcatel Lucent, USA*. We analyze the accuracy of pulse characterization using sinusoidal temporal gratings as a function of the temporal modulation strength in the presence of noise. We show accurate and stable retrieval is feasible even for spectrally-complex pulses.

FiO

FME • Tissue Imaging and Spectroscopy—Continued

FME3 • 2:15 p.m.
Paper Withdrawn

FME4 • 2:30 p.m.
Characterizing the Optical Properties of Bone Using a Multi-Fiber Array and Diffuse Reflectance Spectroscopy, *Vincent M. Rossi[1,2,3], Scott B. Gustafson[4], Steven L. Jacques[3]; [1]Pacific Univ., USA, [2]Oregon State Univ., USA, [3]Oregon Health & Science Univ., USA, [4]VCA Raleigh Hills Animal Hospital, USA.* A multi-fiber array is used for diffuse reflectance spectroscopic measurements of visible and near-IR light in bone. Optical properties are determined by fitting resulting spectra versus source-collector fiber separation and spectra of native absorbers.

FME5 • 2:45 p.m.
Multiply Scattered Light Imaging for Low Cost and Flexible Detection of Subretinal Pathology, *Matthew S. Muller, Ann E. Elsner, Dean A. VanNasdale, Benno L. Petrig; School of Optometry, Indiana Univ., USA.* A novel technique to easily and rapidly switch between direct and indirect-scattered imaging modes using a rolling electronic aperture is applied to inexpensively detect early signs of retinal layer degradation.

FME6 • 3:00 p.m.
Angle-Resolved Low Coherence Interferometry for Endoscopic Detection of Dysplasia in Barrett's Esophagus, *Neil Terry[1], Yizheng Zhu[1], Nicholas J. Shaheen[2], Adam Wax[1]; [1]Duke Univ., USA, [2]Univ. of North Carolina, USA.* A clinical angle-resolved low coherence interferometry system designed to identify dysplasia *in vivo* in Barrett's esophagus patients is presented. We discuss the results of a clinical study of 23 Barrett's esophagus patients using the device.

FMF • Spatial Nonlinearities: Solitons and Beams—Continued

FMF4 • 2:15 p.m.
Nonlinear Airy Beams in Unbiased Photorefractive Media, *Shu Jia[1], Joyce Lee[1], Jason W. Fleischer[1], Georgios A. Siviloglou[2], Demetrios N. Christodoulides[2]; [1]Princeton Univ., USA, [2]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We experimentally and theoretically study the propagation of a truncated Airy beam in an unbiased photorefractive crystal. For extraordinary polarization, a solitary-wave balance between charge diffusion and two-wave mixing suppresses beam diffraction.

FMF5 • 2:30 p.m.
Observing Nonspecular Reflection of a Light Beam, *J. P. (Han) Woerdman, M. Merano, A. Aiello, M. P. van Exter; Univ. Leiden, Netherlands.* We present here the first experimental demonstration of angularly nonspecular reflection of a light beam by a planar mirror; it occurs due to a diffractive correction if the mirror reflectivity is below 100%.

FMF6 • 2:45 p.m.
Nonlinear Light Propagation in Fractal Waveguide Arrays, *Shu Jia, Jason W. Fleischer; Princeton Univ., USA.* We study nonlinear beam propagation in a fractal waveguide array, created by optically-inducing nested periodic arrays in a self-defocusing photorefractive crystal. Nonlinear mode coupling and energy transport between the folded bands is demonstrated.

FMF7 • 3:00 p.m.
Dispersion Compensation of Broadband (~100 nm) Laser Pulses for Nonlinear Optical Microscopy, *Dmitry Pestov, Yair Andegeko, Vadim V. Lozovoy, Marcos Dantus; Michigan State Univ., USA.* We compensate high-order dispersion of laser pulses with ~100-nm bandwidth at the focal plane of a laser-scanning two-photon microscope. Phase distortion correction accounts for significant increase of two-photon excitation fluorescence and second harmonic generation signal.

LS

LSMB • Advances in Chiroptical Spectroscopy I—Continued

LSMB3 • 2:30 p.m. Invited
Intrinsic Chiroptical Response and Its Mediation by Extrinsic Perturbations, *Patrick H. Vaccaro; Yale Univ., USA.* The technique of Cavity Ring-Down Polarimetry (CRDP) will be discussed, with special emphasis directed towards elucidation of nonresonant and resonant chiroptical properties under rarified conditions, as well as attendant implications for canonical condensed-phase measurements.

LSMB4 • 3:00 p.m. Invited
Circularly Polarized Luminescence from Single Chiral Molecules, *Michael D. Barnes, Ruthanne Hassey-Paradise, D. Venkataraman; Univ. of Massachusetts Amherst, USA.* We describe recent experiments probing circularly polarized luminescence from single chiral molecules in polymer-supported thin films. Correlation with dissymmetry parameter distributions previously observed in fluorescence excitation is discussed.

LSMC • Micro- and Nanofluidics I—Continued

LSMC3 • 2:30 p.m.
Complex Dynamic Optofluidics: Symbiotic Nonlinear Controls, Self-pulsation, and Chaos, *Elad Greenfield[1], Carmel Rotschild[1], Yuval Lamhot[1], Alexander Szameit[1], Yoni Nemirovsky[1], Mordechai Segev[1], Ramy El-Ganainy[2], Demetrios N. Christodoulides[2], Meirav Saraf[1], Efrat Lifshitz[1]; [1]Technion-Israel Inst. of Technology, Israel, [2]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We experimentally demonstrate dynamic nonlinear optofluidic controls: symbiotic action between light and fluid introduces a new class of high-level, entirely optofluidic devices, revealing a self-pulsating light-fluid oscillator and chaotic dynamics with universal traits.

LSMC4 • 2:45 p.m. Invited
Massively Parallel Opto/Electric Manipulation of Colloidal Particles, *Steve Wereley; Purdue Univ., USA.* We have recently developed a novel colloidal particle manipulation technique that we call Rapid Electrokinetic Patterning (REP) capable of dynamically manipulating colloids as small as 50 nm.

LSMD • Ultrafast X-Ray Science I—Continued

LSMD3 • 2:30 p.m. Invited
Watching Atoms Move: Using X-Ray Diffraction to Observe Structural Dynamics in Crystals on Fundamental Time Scales, *Steven L. Johnson; Paul Scherrer Inst., Switzerland.* Femtosecond pulses of X-rays generated at a synchrotron offer significant opportunities to study the structural evolution of crystals on fundamental time scales. Here I present some examples of novel dynamics revealed by X-ray probes.

LSMD4 • 3:00 p.m. Invited
Time-Resolved X-Ray Solution Scattering Reveals Solution-Phase Structural Dynamics, *Harry Ihee; KAIST, Republic of Korea.* Time-resolved X-ray solution scattering (liquidography) provides direct structural information generally difficult to extract from ultrafast optical spectroscopy such as the temporal progression of bond lengths and angles of all molecular species including short-lived intermediates.

2:00 p.m.–4:00 p.m. LSME: Laser Science Symposium on Undergraduate Research I,
Fairfield Room, Fairmont Hotel (See the Program in your registration bag.)

Empire	Crystal	Gold	Valley	California
JOINT FiO/LS	FiO			

JMA • Entanglement Generation and Measurement I—Continued

JMA7 • 3:15 p.m.
Spatial Entanglement and Optimal Single-Mode Coupling, *Ryan S. Bennink[1], Warren P. Grice[1], Doug S. Goodman[2], Andrew T. Ryan[3]; [1]Oak Ridge Natl. Lab, USA, [2]Univ. of Connecticut, USA, [3]Redwood Photonics, LLC, USA.* We theoretically and experimentally show that the single-mode collection efficiency of spontaneous parametric down-conversion photons is inversely related to the photons' degree of spatial entanglement.

FMA • Metamaterials I—Continued

FMA7 • 3:15 p.m.
Can We Have an Optical Memristor Using Metamaterials? *Nader Engheta, Michael E. Young; Univ. of Pennsylvania, USA.* Using the concepts of epsilon-negative and epsilon-near-zero metamaterials, we theoretically examine the notion of memristors with optical fields. By combining metamaterials with second-order optical nonlinear media, we study optical nanostructures with properties resembling memristors.

FMB • Optics for Renewable Energy—Continued

FMB5 • 3:15 p.m.
Resistance to Edge Recombination in InAs/InGaAs Quantum Dot Solar Cells, *Tingyi Gu, Kai Yang, Mohamed A. El-Emawy, Andreas Stintz, Luke F. Lester; Ctr. for High Technology Materials, Univ. of New Mexico, USA.* Compared to GaAs control cells, it is experimentally found that quantum dots-in-a-well (DWELL) solar cells are relatively insensitivity to edge recombination by suppressing lateral diffusion of carriers. Consequently, small area DWELL cells have superior efficiency.

FMC • Anderson Localization I—Continued

FMC6 • 3:15 p.m.
Effect of Evanescent Modes on Conductance Distribution in Disordered Waveguides, *Ben Payne, Tom Mahler, Alexey G. Yamilov; Missouri Univ. of Science and Technology, USA.* We demonstrate that proper account of evanescent modes in wave propagation results in a reduction of transport mean free path whilst preserving the universality of the conductance distribution and its single parameter scaling.

FMD • RF Photonics—Continued

FMD7 • 3:15 p.m.
Increasing the Sensitivity-Bandwidth Product of Resonant FSR Optical Modulators Using Coupled Resonators, *Yoo Seung Lee, Sang Shin Lee, William H. Steier; Univ. of Southern California, USA.* Electro-optical dual-disc (1:2 ratio of diameter), resonant, RF-optical modulators have been analyzed to enhance both the sensitivity and bandwidth compared to a single disc structure when modulating at the FSR.

3:30 p.m.–4:00 p.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

NOTES

FiO

FME • Tissue Imaging and Spectroscopy—Continued

FME7 • 3:15 p.m.
Phase Contrast Volume-Holographic Microscope, *Yuan Luo[1], Paul J. Gelsinger[2], Erich De Leon[2], Jennifer Harwell[2], Jennifer K. Barton[2,3], Raymond K. Kostuk[2,3], George Barbastathis[1,4]; [1]MIT, USA, [2]College of Optical Sciences, Univ. of Arizona, USA, [3]Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA, [4]Singapore-MIT Alliance for Res. and Technology (SMART) Ctr., Singapore.* A spatial-spectral multiplex volume holographic pupil with phase contrast is used to enhance high frequency feature information of biological structures. We demonstrate imaging performance with biological samples illuminated by an LED in real time.

FMF • Spatial Nonlinearities: Solitons and Beams—Continued

FMF8 • 3:15 p.m.
Beam Deflection Measurement via Interferometric Weak Value Amplification, *P. Ben Dixon, David J. Starling, Andrew N. Jordan, John C. Howell; Univ. of Rochester, USA.* We report on the use of an interferometric weak value technique to amplify very small transverse deflections of an optical beam. We measured the linear travel of a piezo actuator down to 20 femtometers.

LS

LSMB • Advances in Chiroptical Spectroscopy I—Continued

LSMD • Ultrafast X-Ray Science I—Continued

2:00 p.m.–4:00 p.m. LSME: Laser Science Symposium on Undergraduate Research I, *Fairfield Room, Fairmont Hotel (See the Program in your registration bag.)*

3:30 p.m.–4:00 p.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

NOTES

Empire

FiO

4:00 p.m.–6:00 p.m.
FMG • Quantum Optics in Waveguides I
Prem Kumar; Northwestern Univ., USA, Presider

FMG1 • 4:00 p.m. Invited

Quantum Information Science with Photons on a Chip, *Alberto Peruzzo, Alberto Politi, Jonathan C. F. Matthews, Anthony Laing, Pruet Kalasuwan, Xiao-Qi Zhou, Maria Rodas, Martin J. Cryan, John G. Rarity, Andre Stefanov, Siyuan Yu, Mark G. Thompson, Jeremy O'Brien; Univ. of Bristol, UK.* Quantum technologies based on photons will likely require integrated optics architectures for improved performance, miniaturization and scalability. We demonstrate high-fidelity silica-on-silicon integrated optical realizations of key quantum photonic circuits.

FMG2 • 4:30 p.m.

An Efficient, Optical Fiber-Based Waveguide Interface to a Single Quantum Dipole, *Marcelo I. Davanco[1,2], Kartik Srinivasan[1]; [1]Ctr. for Nanoscale Science and Technology, NIST, USA, [2]Maryland NanoCtr., Univ. of Maryland at Baltimore, USA.* We theoretically investigate a single emitter embedded in an optical waveguide providing highly efficient, optical fiber access to the dipole. Photoluminescence collection above 70 % and 15 dB transmission contrast upon resonant excitation are predicted.

Crystal

4:00 p.m.–5:45 p.m.
FMH • Metamaterials II
Christoph Lienau; Carl von Ossietzky Univ., Germany, Presider

FMH1 • 4:00 p.m. Invited

Three-Dimensional Metallic Metamaterials: Coupling Matters, *Harald Giessen; Univ. of Stuttgart, Germany.* We are going to discuss the optical properties of three-dimensional metallic metamaterials and investigate their coupling properties.

FMH2 • 4:30 p.m.

Large Single-Molecule Fluorescence Enhancements Produced by a Bowtie Nanoantenna, *Anika A. Kinkhabwala[1], Zongfu Yu[1], Shanhui Fan[1], Yuri Avlasevich[2], Klaus Mullen[2], W. E. Moerner[1]; [1]Stanford Univ., USA, [2]Max-Planck-Inst. for Polymer Res., Germany.* By coating a lithographically-fabricated bowtie nanoantenna with fluorescent molecules doped into a thin polymer layer, the enhancement of a single-molecule's fluorescence emission by factors up to 1340x is measured, much higher that previously reported.

Gold

JOINT FiO/LS

4:00 p.m.–6:00 p.m.
JMB • Gravitational Wave Interferometers I
Rana Adhikari; Caltech, USA, Presider

JMB1 • 4:00 p.m. Tutorial

Gravitational Wave Interferometry, *Peter Fritschel; MIT, USA.* Gravitational wave detectors aim to detect and study gravitational waves emitted by a variety of astrophysical and cosmological sources. I will explain how interferometric detectors work, and review existing and future instruments.

Peter Fritschel is a Principal Research Scientist at the Massachusetts Institute of Technology. He is the chief scientist of the Advanced LIGO project.

Thank you for attending FiO/LS/Fall Congress. Look for your post-conference survey via email and let us know your thoughts on the program.

Valley

FiO

4:00 p.m.–5:45 p.m.
FMI • High Peak Power Laser Technology I
Presider to Be Announced

FMI1 • 4:00 p.m. Tutorial

High Peak Power Laser Technologies: New Directions, *Christopher Barty; Lawrence Livermore Natl. Lab, USA.* This tutorial introduces the basics of ultrashort duration laser pulse amplification and reviews present technologies for both femtosecond and kJ petawatt peak power laser systems. A survey of present worldwide efforts will also be presented.

Dr. C. P. J. Barty is the Program Director of the Photon Science and Applications Program at Lawrence Livermore National Laboratory. His academic background includes Ph.D. and M.S. degrees in applied physics from Stanford University and bachelor degrees with honors in chemistry, physics and chemical engineering from North Carolina State University. During his career he has founded both the biennial international meeting on Ultrafast Optics and the International Conference on Ultrahigh Intensity Lasers. Currently, he is the Co-Chair of the International Committee on Ultrahigh Intensity Lasers. He has published approximately 150 manuscripts and presented over 100 invited talks, spanning topics in lasers, optics, materials science, medicine, chemistry, engineering and physics. He was elected a Fellow of The Optical Society for his pioneering work on intense short-pulse lasers and X-ray applications.

California

FiO

4:00 p.m.–6:00 p.m.
FMJ • Integrated Optical Sensors
Wan Kuang; Boise State Univ., USA, Presider

FMJ1 • 4:00 p.m.

A Mid-Infrared Integrated Optic Astronomical Beam Combiner for Stellar Interferometry, *Hsienkai Hsiao[1], Kim A. Winick[1], John D. Monnier[2]; [1]Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA, [2]Dept. of Astronomy, Univ. of Michigan, USA.* An integrated optic, mid-infrared, astronomical beam combiner was fabricated using lithium niobate waveguides. The device operated at L band and had on-chip electro-optic phase modulation for fringe tracking applications. Laboratory white-light fringe measurements were demonstrated.

FMJ2 • 4:15 p.m.

In-Plane All-Photonic Transduction of Microcantilever Arrays by a Differential Splitter Using a Double-Step Rib Waveguide, *Jong Wook Noh, Ryan Anderson, Seunghyun Kim, Gregory P. Nordin; Brigham Young Univ., USA.* We report the all-photonic transduction of microcantilevers using a differential splitter consisting of an asymmetric double-step multimode rib waveguide and aY-branch splitter. An average deflection sensitivity of 0.32×10^{-3} nm^{-1} is demonstrated for multiple microcantilever arrays.

FMJ3 • 4:30 p.m.

Slow Light Structure Base Exponential Gyro: Performance Analysis, *Ben Z. Steinberg, Jacob Scheuer; Tel Aviv Univ., Israel.* We study the performance of degenerate-modes CROW gyroscopes, and derive expression for the exponential sensitivity. Shot-noise sets a lower bound on the detectable rotation rate, which is significantly lower than that of a comparable FOG.

Glen Ellen	Atherton	Sacramento	Piedmont	Hillsborough
FiO		LS		

4:00 p.m.–6:00 p.m.
FMK • Microscopy and OCT I
Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA, Presider

FMK1 • 4:00 p.m. Invited

Nonlinear Coherent Imaging of Nanostructures and Single Molecules, *Hyunmin Kim, Eric Olaf Potma; Univ. of California at Irvine, USA.* We demonstrate that four-wave-mixing microscopy is a convenient method for visualizing the nonlinear properties of individual nano-structures, and that it offers a route towards probing the ultrafast spatio-temporal dynamics of fundamental excitations in nanomaterials.

FMK2 • 4:30 p.m.

Nano-Spectroscopy in the 2.5-10 Micron Wavelength Range Using Atomic Force Microscope, *Konstantin Vodopyanov[1], G. A. Hill[2], J. H. Rice[2], S. R. Meech[2], D. Q. M. Craig[2], M. M. Reading[2], A. Dazzi[3], K. Kjoller[4], C. Prater[4]; [1]Stanford Univ., USA, [2]Univ. of East Anglia, UK, [3]Univ. Paris-Sud, France, [4]Anasys Instruments Inc., USA.* We performed nanoscale atomic force microscope surface imaging with chemical identification and spatial resolution of 200 nm. The detection mechanism was based on recording resonant oscillations in the cantilever induced by a tunable mid-IR excitation.

4:00 p.m.–6:00 p.m.
FML • Silicon Photonics I
Sasan Fathpour; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, Presider

FML1 • 4:00 p.m. Invited

Deterministic Aperiodic Structures for Nanoplasmonics, *Luca Dal Negro; Boston Univ., USA.* In this paper, by combining light scattering, photoluminescence, Raman and near-field optical measurements with accurate electrodynamics calculations I will discuss the design, EBL nanofabrication and specific device applications of deterministic aperiodic nanoplasmonic structures (DANS).

FML2 • 4:30 p.m.

Two-Pump Four-Wave Mixing in Silicon Waveguides, *J. S. Park[1], S. Zlatanovic[1], M. L. Cooper[1], J. M. Chavez-Boggio[1], I. B. Divliansky[2], N. Alic[1], S. Mookherjea[1], S. Radic[1]; [1]Univ. of California at San Diego, USA, [2]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We report dual-pump four-wave mixing in silicon waveguides and demonstrate generation of up to 10 sidebands with self-seeded higher order pumps. A conversion efficiency of -8.38dB was measured between the signal and phase-conjugated idler.

4:00 p.m.–5:30 p.m.
LSMF • Advances in Chiroptical Spectroscopy II
Michael Barnes; Univ. of Massachusetts Amherst, USA, Presider

LSMF1 • 4:00 p.m. Invited

Chiroptical Imaging of Crystals by Mueller Matrix Microscopy, *John Freudenthal[1,2], Erica Gunn[2], Bart Kahr[1,2]; [1]New York Univ., USA, [2]Univ. of Washington, USA.* Mueller matrix microscopy is used to evaluate the heterogeneities and anisotropies in the circular birefringence and circular dichroism of crystalline materials.

LSMF2 • 4:30 p.m. Invited

Second-Order Nonlinear Optical Imaging of Chiral Crystals, *Ellen Gualtieri, Victoria Hall, Sarah Harden, David Kissick, Ronald Wampler, Debbie Wanapun, Garth J. Simpson; Purdue Univ., USA.* All chiral crystals are symmetry-allowed for second-harmonic generation, providing a sensitive and selective detection approach for characterizing protein crystals and crystals of active pharmaceutical ingredients. Methods and applications are described.

4:00 p.m.–6:15 p.m.
LSMG • Micro- and Nanofluidics II
Ryan C. Bailey; Univ. of Illinois, USA, Presider

LSMG1 • 4:00 p.m. Invited

Optical and Microfluidic Techniques for Cellular Analysis, *Daniel T. Chiu; Univ. of Washington, USA.* The presentation will highlight some of the recent work in our lab that integrates optical instrumentation with microfluidic devices for studying biological systems with single-cell resolutions.

LSMG2 • 4:30 p.m. Invited

Optical Microcavities: Label-Free Detection down to Single Virus Particles, *Frank Vollmer[1], Stephen Arnold[2]; [1]Rowland Inst., Harvard Univ., USA, [2]Polytechnic Inst., New York Univ., USA.* Binding of Influenza A virus particles is detected from the frequency shift of a microsphere cavity. To overcome limitations posed by diffusion, transport of nanoparticles to the sensing region is enhanced by optical gradient forces.

4:00 p.m.–5:45 p.m.
LSMH • Ultrafast X-Ray Science II
David Fritz; SLAC Natl. Accelerator Lab, Stanford Univ., USA, Presider

LSMH1 • 4:00 p.m. Invited

Ultrafast X-Ray Physics with the X-Ray Split and Delay Unit at FLASH, F. *Sorgenfrei, W. F. Schlotter, M. Nagasono, M. Beye, T. Beeck, W. Wurth, A. Föhlisch; Inst. für Experimentalphysik, Univ. Hamburg and Ctr. for Free-Electron Laser Science, Germany.* We have designed and implemented a femtosecond X-ray split and delay unit based on grazing incidence Mach-Zehnder optics at the Free-Electron-Laser at Hamburg (FLASH), which generates through the SASE mechanism intense, coherent soft X-ray radiation.

LSMH2 • 4:30 p.m. Invited

Magnetization Dynamics on the Nanoscale, *Yves Acremann; PULSE Inst., SLAC Natl. Accelerator Lab, Stanford Univ., USA.* A spin-polarized current can be used to reverse the magnetization of a ferromagnet. We observed the switching mechanism involved in spin transfer devices using time resolved x-ray microscopy.

4:30 p.m.–6:30 p.m. LSMI: Laser Science Symposium on Undergraduate Research II,
Fairfield Room, Fairmont Hotel (See the Program in your registration bag.)

Empire | Crystal | Gold | Valley | California

FiO | JOINT FiO/LS | FiO

FMG • Quantum Optics in Waveguides I—Continued

FMG3 • 4:45 p.m.
Ultrathin Optical Fibers as Tools in Atom Optics, *Laura Russell[1,2], Sile Nic Chormaic[1,2], Kieran Deasy[2,3], Michael Morrissey[2,3], Amy Watkins[1,2], Mary Frawley[1,2], Regine Schmidt[2]; [1]Univ. College Cork, Ireland, [2]Tyndall Natl. Inst., Ireland, [3]Cork Inst. of Technology, Ireland.* We present results obtained using a tapered optical fiber to probe the characteristics of a cloud of cold rubidium atoms. The atom cloud profile as a function of rubidium vapor pressure is studied.

FMG4 • 5:00 p.m. Invited
Quantum Optics in Waveguide Lattices, *Yaron Bromberg[1], Yoav Lahini[1], Roberto Morandotti[2], Yaron Silberberg[1]; [1]Weizmann Inst. of Science, Israel, [2]INRS, Canada.* We study the generation and manipulation of complex quantum correlations between photon pairs, using periodic and a-periodic lattices of evanescently coupled waveguides and simple input states.

FMG5 • 5:30 p.m.
Gaussian and Non-Gaussian Entanglement in Coupled Waveguides, *Amit Rai, Sumanta Das, G. S. Agarwal; Oklahoma State Univ., USA.* We report on evolution of entanglement in coupled silica waveguides. The waveguides can be fed in by pairs of single photons or two mode squeezed light. We also present results for leaky waveguides.

FMH • Metamaterials II—Continued

FMH3 • 4:45 p.m.
Two-Surface Plasmon Emission from Semiconductor by Coupling to Nanoantennas, *Amir Nevet, Alex Hayat, Pavel Ginzburg, Nikolai Berkovitch, Meir Orenstein; Technion-Israel Inst. of Technology, Israel.* We present two-surface plasmon emitter by coupling semiconductor two-photon emission to the near field of a plasmonic-nanoantenna. It is demonstrated that plasmonic nano-cavities are ideal for nonlinear enhancement of the very wideband TPE spectrum.

FMH4 • 5:00 p.m.
Plasmon-Enhanced Light Emission from InGaN Quantum Wells Using Chemically Synthesized Silver Nanoparticles, *John Henson[1], John Heckel[2], Emmanouil Dimakis[1], Josh Abell[1], George Chumanov[2], Theodore D. Moustakas[1], Roberto Paiella[1]; [1]Boston Univ., USA, [2]Clemson Univ., USA.* A simple technique to couple solid-state light-emitting materials to plasmonic nanostructures is demonstrated, based on chemically synthesized silver nanoparticles embedded in flexible resin films. Substantial photoluminescence efficiency enhancements are correspondingly obtained from InGaN quantum wells.

FMH5 • 5:15 p.m.
Localized Surface Plasmon Enhanced Imaging of Live Cells Based on Various Subwavelength Patterns, *Kyujung Kim, Dong Jun Kim, Donghyun Kim; Yonsei Univ., Republic of Korea.* We investigated localized surface plasmon (LSP) enhanced imaging to improve total internal reflection microscopy based on subwavelength patterns such as gratings and islands. Field intensity enhancement of LSP samples was numerically calculated and experimentally confirmed.

FMH6 • 5:30 p.m.
Can Optical Nanoantenna Links Compete with Plasmonic Waveguide Connections? *Nader Engheta[1], Andrea Alù[2]; [1]Univ. of Pennsylvania, USA, [2]Univ. of Texas at Austin, USA.* By properly matching optical nanoantennas using nanocircuit elements, we theoretically demonstrate that the optical wireless link between two nanoantennas at a given distance may exhibit much less loss as compared with links via plasmonic waveguides.

JMB • Gravitational Wave Interferometers I—Continued

JMB2 • 4:45 p.m. Invited
LISA: Detecting Gravitational Waves from Space, *Daniel Shaddock[1,2]; [1]JPL, Caltech, USA, [2]Australian Natl. Univ., Australia.* The laser interferometer space antenna (LISA), a joint NASA/ESA mission, will be the first dedicated gravitational wave detector in space. This presentation will provide a tutorial of the LISA measurement concept.

JMB3 • 5:15 p.m.
Material Tests for LISA, *Alix Preston, Guido Mueller; Univ. of Florida, USA.* LISA requires several ultra-stable structures such as the reference cavities, the optical benches, and the telescopes. We will present measurements of the stability of various materials for use in LISA.

JMB4 • 5:30 p.m. Invited
The Virgo Gravitational Wave Detector, *François Bondu; Univ. de Rennes 1, France.* The interferometer spectral-density of resolution is $6 \times 10^{-23}/\sqrt{\text{HZ}}$ at 250 Hz.. We show the performances of mirror surfaces and coatings, laser frequency and amplitude stabilizations, interferometer control. We discuss advanced Virgo optical-technologies.

FMI • High Peak Power Laser Technology I—Continued

FMI2 • 4:45 p.m. Invited
The Extreme Light Infrastructure Project ELI and Its Prototype APOLLON/ILE: "The Associated Laser Bottlenecks", *Jean Paul Chambaret[1], Patrick Georges[2], Gilles Chériaux[3], Gilles Rey[3], Catherine Le Blanc[4], Patrick Audebert[4], Denis Douillet[3], Jean Luc Paillard[4], Patrick Cavillac[1], Dominique Fournet[1], François Mathieu[1], Gérard Mourou[1]; [1]ILE, ENSTA-École Polytechnique, UMS 3205, France, [2]LCFIO, UMR 8501 Inst. d'Optique, Campus de Polytechnique, France, [3]LOA, ENSTA-École Polytechnique, UMR 7639, France, [4]LULI, UMR7605, École Polytechnique, France.* We will present the ELI Project consisting in a 200PW laser based high intensity physics users infrastructure. A French single beamline laser prototype called ILE/APOLLON is presently under construction. Associated technological bottlenecks will be described.

FMI3 • 5:15 p.m. Invited
An Overview of the Activities of the UK's High Power Laser Programme, *John Collier[1,2]; [1]Central Laser Facility, Science and Technology Facilities Council (STFC), Rutherford Appleton Lab, UK, [2]Dept. of Physics, Swansea Univ., UK.* I will review recent scientific highlights from the UK's high power laser programme and discuss our plans to establish a 10 PW capability on the existing Vulcan PW facility, including its anticipated scientific programme.

FMJ • Integrated Optical Sensors—Continued

FMJ4 • 4:45 p.m.
Compact Silicon-on-Insulator Diffractive Sensor Design, *Jonathan S. Maikisch, Thomas K. Gaylord; Georgia Tech, USA.* A compact, integrated silicon-on-insulator optical sensor design based on in-plane diffraction gratings for microfluidic detection of analytes is presented and analyzed. Optimization, characterization, and sensitivity analysis are performed. Preliminary experimental and fabrication results are presented.

FMJ5 • 5:00 p.m.
Swept-Wavelength Optical Sensor Interrogation with 10 µS Sweep Period Utilizing Sampled Grating Distributed Bragg Reflector Lasers, *Brandon George, Shane O'Connor, Dennis J. Derickson; California Polytechnic State Univ., USA.* A sensor interrogation source that can scan the 1525 nm to 1575 nm range with .001 nm resolution in less than 10 µS is demonstrated. The fast sweep time enables improved time-resolved sensor measurements.

FMJ6 • 5:15 p.m.
Ultra Small Silicon Resonator Based Temperature Sensor, *Gun-Duk Kim[1], Hak-Soon Lee[1], Sang-Shin Lee[1], Boo-Taek Lim[2], Hee-Kyoung Bae[2], Wan-Gyu Lee[2]; [1]Kwangwoon Univ., Republic of Korea, [2]Natl. NanoFab Ctr., Republic of Korea.* An ultra small temperature sensor was proposed and implemented utilizing a silicon ring resonator with a 4-µm ring radius. The observed sensitivity was ~85 pm/°C over the 38°C range around the room temperature.

FMJ7 • 5:30 p.m.
Selective Deposition of Thin Films for Integrated Notch Filters in Optofluidic Sensors, *Brian S. Phillips[1], Yue Zhao[1], Philip Measor[2], Holger Schmidt[2], Aaron R. Hawkins[1]; [1]Brigham Young Univ., USA, [2]Univ. of California at Santa Cruz, USA.* Selective deposition of dielectric thin films on an optofluidic sensor provides the means for localized, on-chip optical filtering. These integrated filters can provide increased sensitivity to fluorescence signals without the need for external (off-chip) components.

Glen Ellen | Atherton | Sacramento | Piedmont | Hillsborough

FiO

FMK • Microscopy and OCT I—Continued

FMK3 • 4:45 p.m.
Single-Pulse CARS Spectroscopy Using a Resonant Photonic Crystal Slab Filter (RPCS), *Jonathan M. Levitt, Ori Katz, Eran Grinvald, Yaron Silberberg; Weizmann Inst. of Science, Israel.* We present a simple scheme for performing single-beam vibrational spectroscopy with a single femtosecond pulse without a pulse-shaper. High-resolution microspectroscopy and vibrational imaging is demonstrated using a narrowband probe defined by an RPCS filter.

FMK4 • 5:00 p.m.
Toward Far-Field Sub-Diffraction-Limited CARS Microscopy via Molecular Coherence Driven by a Short-Pulse Sequence, *Alexei V. Sokolov, Xi Wang; Texas A&M Univ., USA.* We use timed femtosecond laser pulses to demonstrate effective doubling of spatial resolution with which Raman coherence is prepared, and discuss implications for CARS microscopy, with potential extensions to far-field imaging not limited by diffraction.

FMK5 • 5:15 p.m.
3-D Superlocalization with Double-Helix Microscopes, *Sri Rama Prasanna Pavani, Rafael Piestun; Univ. of Colorado at Boulder, USA.* Double-helix microscopes localize the three-dimensional (3-D) position of multiple particles with nanometer-scale precisions using a single image, and can be operated directly in microscope modalities such as bright-field, dark-field, fluorescence, and PALM/STORM/F-PALM type superresolution nanoscopy.

FMK6 • 5:30 p.m.
Transfer Function Analysis of Partially Coherent Phase Imaging Methods and Evaluation for Quantitative Imaging, *Shalin B. Mehta, Colin J. R. Sheppard; Optical Bioimaging Lab, Div. of Bioengineering, Natl. Univ. of Singapore, Singapore.* We present transfer function based analysis of contrast generated by various partially coherent phase imaging methods with emphasis on quantitative nature of differential phase contrast (DPC) and differential interference contrast (DIC).

FML • Silicon Photonics I—Continued

FML3 • 4:45 p.m.
Nanosecond Tunable Optical Delay Using Silicon Cavities, *Ali W. Elshaari, Stefan F. Preble; Rochester Inst. of Technology, USA.* We present a tunable delay element that is inherently insensitive to free-carrier loss and achieves up to nanosecond delays even when tuned slowly. This will enable electrically tunable buffers on a silicon chip.

FML4 • 5:00 p.m.
Realization of an Ultrafast Silicon Kerr Switch, *Lianghong Yin[1], Jonathan Y. Lee[2], Philippe M. Fauchet[1,2], Govind P. Agrawal[1]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Electrical and Computer Engineering, Univ. of Rochester, USA.* We demonstrate that cross-phase modulation induced nonlinear polarization-rotation can be used to realize sub-picosecond Kerr switching in a silicon waveguide using only a few watts of pump peak power. Our experimental results agree with theory.

FML5 • 5:15 p.m.
Propagation of Picosecond Pulses in Silicon Photonic Crystal Slab Waveguides, *Nicolae C. Panoiu[1], James F. McMillan[2], Chee Wei Wong[2]; [1]Univ. College London, UK, [2]Columbia Univ., USA.* We present a rigorous theoretical and numerical analysis of pulse propagation in silicon photonic crystal waveguides, showing that in the slow-light regime linear and nonlinear effects depend on the group-velocity as v_g^{-1} and v_g^{-2}, respectively.

FML6 • 5:30 p.m. Invited
Erbium Doped Silicon Photonic Crystals for Light Sources and Amplifiers, *Jelena Vučković[1], Maria Makarova[1], Yiyang Gong[1], Selcuk Yerçi[2], Rui Li[2], Luca Dal Negro[2]; [1]Dept. of Electrical Engineering and Ginzton Lab, Stanford Univ., USA, [2]Dept. of Electrical and Computer Engineering, Boston Univ., USA.* We demonstrated enhancement of light emission from Er-doped silicon photonic crystal cavities, as well as cavity linewidth narrowing with increasing optical pump power at low temperature — an indication of differential gain in the system.

LS

LSMF • Advances in Chiroptical Spectroscopy II—Continued

LSMF3 • 5:00 p.m. Invited
Structural Origin of Circularly Polarized Iridescence in Jeweled Beetles, *Mohan Srinivasarao; Georgia Tech, USA.* Iridescent metallic green beetle, *Chrysina gloriosa* selectively reflects left circularly polarized light, possesses an exoskeleton decorated by nearly hexagonal cells (~10μm). These structures are analogous to defects on the free surface of a cholesteric fluid.

LSMG • Micro- and Nanofluidics II—Continued

LSMG3 • 5:00 p.m.
A Compact Raman Probe for Rapid Reaction Monitoring in Microreactors, *Sergey Mozharov[1], Alison Nordon[1], John Girkin[2], David Littlejohn[1]; [1]Univ. of Strathclyde, UK, [2]Durham Univ., UK.* Raman spectrometry is currently not well adapted for rapid process control in microreactors. We report an efficient low-cost Raman probe capable of rapid optimisation and monitoring of chemical reactions at any point of the microchip.

LSMG4 • 5:15 p.m. Invited
Ultrafast Laser Nanomachining of Analytical and Diagnostic Biomedical Devices, *Alan J. Hunt; Univ. of Michigan, USA.* Taking advantage of precise damage by femtosecond lasers, we construct fluidic devices for biomedical analyses and diagnostics. We demonstrate lab-on-a-chip components for integrated chemical analysis, micro scale sensors, and nanopores for patch-clamp and resistive-pulse sensing.

LSMH • Ultrafast X-Ray Science II—Continued

LSMH3 • 5:00 p.m. Invited
Ultrafast Electron and Spin Dynamics in Complex Materials, *Hermann A. Dürr; Helmholtz Zentrum Berlin, BESSY II, Germany.* I will show how fs X-ray pulses can probe the dynamical interplay between electronic, spin and lattice degrees of freedom which determines the function of complex materials such as ferromagnets, highly correlated transition metal oxides.

LSMH4 • 5:30 p.m.
High-Repetition γ-Source Based on Compton Scattering of Picosecond CO_2 Laser Pulses, *Mikhail N. Polyanskiy[1], Igor Pogorelsky[1], Vitaly Yakimenko[1], Victor T. Platonenko[2]; [1]Brookhaven Natl. Lab, USA, [2]Moscow State Univ., Russian Federation.* High-repetition-rate gamma-source concept is based on Compton backscattering from the relativistic electron beam inside a picosecond CO_2 laser cavity. Proof-of-principle experiments combined with computer simulations allow evaluating the promise of this approach for various applications.

4:30 p.m.–6:30 p.m. LSMI: Laser Science Symposium on Undergraduate Research II,
Fairfield Room, Fairmont Hotel (See the Program in your registration bag.)

Empire	Crystal	Gold	Valley	California
FiO		JOINT FiO/LS	FiO	

FMG • Quantum Optics in Waveguides I—Continued

FMG6 • 5:45 p.m.
Two-Photon Transparency by Current Injection in Semiconductor Quantum Wells, *Alex Hayat, Amir Nevet, Meir Orenstein; Technion-Israel Inst. of Technology, Israel.* We demonstrate experimentally a major step towards semiconductor based nonlinear two-photon gain and lasing - namely the two-photon transparency. The one-photon luminescence is progressively reduced by current injection down to the two-photon transparency point.

JMB • Gravitational Wave Interferometers I—Continued

FMJ • Integrated Optical Sensors—Continued

FMJ8 • 5:45 p.m.
Critical Sensitivity Effect in a Waveguided Interferometer Sensor, *Ronen Levy, Shlomo Ruschin, Damian Goldring; Tel Aviv Univ., Israel.* An effect is reported where the spectral sensitivity close to a certain critical working point is non-linear and diverges to infinity. At the critical wavelength, a splitting or bifurcation of the minimum dip occurs.

6:30 p.m.–8:30 p.m. OSA Student Member Reception, *O'Flaherty's Irish Pub, 25 N. Pedro Street, San Jose, California 95110, Phone: 408.947.8007*

NOTES

Glen Ellen | Atherton | Sacramento | Piedmont | Hillsborough

FiO

FMK • Microscopy and OCT I—Continued

FMK7 • 5:45 p.m.
Quantitative Fourier Analysis of SHG Images of Porcine Cornea, *Raghu Ambekar Ramachandra Rao, Monal R. Mehta, Kimani C. Toussaint, Jr.; Univ. of Illinois at Urbana-Champaign, USA.* Fourier analysis is applied to cornea images obtained using second-harmonic generation microscopy. The orientation and maximum spatial frequency of collagen fibrils in selected regions of interest are determined.

FML • Silicon Photonics I—Continued

LS

LSMG • Micro- and Nanofluidics II—Continued

LSMG5 • 5:45 p.m. Invited
Optical and Electrical Characterization of Fluid Transport in Nanoscale Channels, *Stephen C. Jacobson, John M. Perry, Kaimeng Zhou; Indiana Univ., USA.* Nanofluidic channels integrated into microfluidic devices offer a unique platform for studying ion transport behavior. We present a method to fabricate these integrated devices in-plane, which permits simultaneous optical and electrical characterization.

4:30 p.m.–6:30 p.m. LSMI: Laser Science Symposium on Undergraduate Research II, *Fairfield Room, Fairmont Hotel (See the Program in your registration bag.)*

6:30 p.m.–8:30 p.m. OSA Student Member Reception, *O'Flaherty's Irish Pub, 25 N. Pedro Street, San Jose, California 95110, Phone: 408.947.8007*

NOTES

Empire

FiO

8:00 a.m.–9:30 a.m.
FTuA • 3-D Entertainment in the Marketplace
Hong Hua; Optical Sciences Ctr., Univ. of Arizona, USA, Presider

FTuA1 • 8:00 a.m. Keynote

3-D Entertainment: A Revolution that has Already Started, *Rod Archer; RealD Inc., USA.* A new era of 3-D entertainment has begun. This wave of change from the entertainment industry will soon bring huge opportunities to optical products companies worldwide. I will discuss the current state-of-the-art, challenges and rewards.

Crystal

FiO

8:00 a.m.–10:00 a.m.
FTuB • Plasmonic Emitters and Resonators
Harald Giessen; Univ. of Stuttgart, Germany, Presider

FTuB1 • 8:00 a.m. Invited

Active Terahertz Metamaterials, *Hou-Tong Chen; Los Alamos Natl. Lab, USA.* We demonstrate planar terahertz metamaterial devices enabling actively controllable transmission amplitude, phase, or frequency at room temperature via carrier depletion or photo excitation in the semiconductor substrate or in semiconductor materials incorporated into the metamaterial structure.

FTuB2 • 8:30 a.m.

Plasmonic Nano-Laser below the Diffraction Limit, *Volker J. Sorger[1], Rupert F. Oulton[1], Thomas Zentgraf[1], Chris W. Gladden[1], Guy Bartal[1], Ren-Min Ma[2], Lun Dai[2], Xiang Zhang[1,3]; [1]NSF Nanoscale Science and Engineering Ctr., Univ. of California at Berkeley, USA, [2]State Key Lab for Mesoscopic Physics and School of Physics, Peking Univ., China, [3]Materials Sciences Div., Lawrence Berkeley Natl. Lab, USA.* We report a plasmonic laser device exhibiting strong sub-wavelength confinement. These nanowire-based plasmonic lasers are not subjected to diffraction limitations, hence can operate below the photonic mode cut-off diameter of purely dielectric nanowire lasers.

Gold

JOINT FiO/LS

8:00 a.m.–10:15 a.m.
JTuA • Gravitational Wave Interferometers II
David H. Reitze; Univ. of Florida, USA, Presider

JTuA1 • 8:00 a.m. Invited

Next Generation Interferometers for Gravitational Wave Astronomy, *Rana Adhikari; Caltech, USA.* Kilometer scale interferometers (such as LIGO) are now being used to search for gravitational waves; fluctuations in space-time. I will describe the new generation of interferometric gravitational wave detectors and future prospects.

JTuA2 • 8:30 a.m.

210 W Single-Frequency Laser with 88% of Output Power in TEM_{00} Mode for Advanced LIGO, *Lutz Winkelmann, Oliver Puncken, Christian Veltkamp, Raphael Kluzik, Maik Frede, Joerg Neumann, Dietmar Kracht, Peter Weßels; Laser Zentrum Hannover e.V., Germany.* A solid-state laser for the next generation of gravitational wave detectors with 210W of single-frequency output power is presented. The measured TEM_{00} mode content, using a non-confocal ring cavity for beam analysis, was 88%.

Valley

FiO

8:00 a.m.–10:15 a.m.
FTuC • Optical Communication
Gee-Kung Chang; Georgia Tech, USA, Presider

FTuC1 • 8:00 a.m. Invited

Next-Generation Optical Access Networks, *Leonid Kazovsky[1], Shing-Wa Wong[1], She-Hwa Yen[1], Shinji Yamashita[2]; [1]Stanford Univ., USA, [2]Fujitsu Labs Ltd., Japan.* First-generation optical access networks have now been well-defined. This talk will focus on second- and third- generation networks including graceful evolution from single-wavelength to WDM and increasing integration of optical and wireless technologies.

FTuC2 • 8:30 a.m. Invited

Agile WDM Layer for FlexSelect™ Metro Optical Network, *Shan Zhong, Jean-Luc Archambault, Loudon Blair; Ciena Corp., USA.* This talk will introduce Ciena's FlexSelect™ architecture and share our vision on next generation service-converging metro optical network with enhanced agile WDM layer based on the multi-degree ROADM solutions and high-density agile interface.

California

FiO

8:00 a.m.–10:00 a.m.
FTuD • Novel Fiber Devices I
Jonathan Knight; Univ. of Bath, UK, Presider

FTuD1 • 8:00 a.m. Invited

Novel Fiber Lasers with Advanced Glasses and Fiber Designs, *Axel Schülzgen; Univ. of Arizona, USA.* We will discuss recent progress in combining microstructured fiber, highly-doped active glasses, and novel laser cavity designs to enhance the performance of very compact fiber lasers.

FTuD2 • 8:30 a.m.

Nearly Octave-Spanning Cascaded Four-Wave-Mixing Generation in Dispersion Optimized Highly Nonlinear Fiber, *Jose M. Chavez Boggio[1], Slaven Moro[1], Nikola Alic[1], Magnuss Karlsson[2], Joss Bland-Hawthorn[3], Stojan Radic[1]; [1]Univ. of California at San Diego, USA, [2]Chalmers Univ. of Technology, Sweden, [3]Univ. of Sydney, Australia.* Efficient generation of cascaded four-wave mixing using a dispersion flattened optical fiber is reported. The measured optical frequency comb (with 300 GHz spacing) spans over 900 nm.

For Fall Congress presentations on Tuesday, see pages 116-124.

Glen Ellen — JOINT FiO/LS

8:00 a.m.–10:00 a.m.
JTuB • Entanglement Generation and Measurement II
Paul Kwiat; Univ. of Illinois, USA, Presider

JTuB1 • 8:00 a.m. Tutorial

Efficient Algorithms for Quantum State and Process Tomography, *Andrew Doherty; Univ. of Queensland, Australia.* This talk will introduce numerical and analytical techniques of convex optimization. While these techniques have found wide application in quantum information, we will focus on applications to data analysis in quantum state and process tomography.

Andrew Doherty is a Senior Lecturer in Physics at the University of Queensland. He completed his Ph.D. under the supervision of Professor Dan Walls at the University of Auckland in 1999. From 2000–2003 he was a postdoctoral research at the California Institute of Technology and he moved to the University of Queensland in 2003. His research interests are in quantum measurement control and quantum information.

Atherton — FiO

8:00 a.m.–10:00 a.m.
FTuE • Fiber Optics Sensors
Ozdal Boyraz; Univ. of California at Irvine, USA, Presider

FTuE1 • 8:00 a.m.

Integrated Fiber Based Multimode Interference Bio/Chemical Sensor, *Jose G. Aguilar-Soto[1], Miguel A. Basurto-Pensado[2], Peng Zhang[3], Hyoung J. Cho[3], Patrick LiKamWa[4], Daniel A. May-Arrioja[1]; [1]INAOE, Mexico, [2]CIICAp, Univ. Autónoma del Estado de Morelos, Mexico, [3]Dept. of Mechanical, Materials and Aerospace Engineering, Univ. of Central Florida, USA, [4]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Here we designed, fabricated and tested a novel optical sensor for bio/chemical applications based on multimode interference (MMI) effects in a no-core multimode fiber that is integrated with single-mode fiber sections and PDMS microfluidic channels.

FTuE2 • 8:15 a.m.

Low Energy Type II Fiber Bragg Gratings, *Dan Grobnic, Christopher W. Smelser, Stephen J. Mihailov; Communications Res. Ctr. Canada, Canada.* Type II gratings are made with low energy ultrafast infrared pulses after the inscription of a type I grating that help coupling of the radiation during the type II exposure and lower the threshold.

FTuE3 • 8:30 a.m. Invited

Advances in Chemical and Biological Sensing Using Emerging Soft Glass Optical Fibers, *Yinlan Ruan, Heike Ebendorff-Heidepriem, Afshar V. Shahraam, Stephen Warren-Smith, Tanya Monro; Univ. of Adelaide, Australia.* Emerging subwavelength-core microstructured fibers provide new ways of interacting light with materials for sensing applications. Developments in the design, fabrication and application of these fibers for the sensitive-detection of chemicals and biomolecules will be reviewed.

Sacramento — LS

8:00 a.m.–10:00 a.m.
LSTuA • General Laser Science
Mike Barnes; Univ. of Massachusetts Amherst, USA, Presider

LSTuA1 • 8:00 a.m.

Coupling Efficiency of Hollow Optical Beams into Hollow-Core Fibers, *Francesco A. Narducci; Naval Air Systems Command, USA.* We experimentally and theoretically study the coupling efficiency of hollow optical beams to hollow-core fibers. The efficiency is compared to the coupling efficiency of Gaussian beams.

LSTuA2 • 8:15 a.m.

Light Switch for Positive and Negative Group Velocities, *T. Y. Abi-Salloum[1], Seth Meiselman[2], J. P. Davis[3], Francesco A. Narducci[3]; [1]Widener Univ., USA, [2]Drexel Univ., USA, [3]Naval Air Systems Command, USA.* We explore phenomena responsible for switching the group velocity of a probe between positive and negative regimes. We study a four-level N-Scheme in two distinct dressed states pictures. The presented study is supported by simulations.

LSTuA3 • 8:30 a.m.

Novel Matter-Wave Gyroscope via Vortex Superposition in BEC, *Kishore T. Kapale[1], Sulakshana Thanthvari[2], Jonathan P. Dowling[2]; [1]Western Illinois Univ., USA, [2]Louisiana State Univ., USA.* We present a novel matter-wave gyroscope employing a superposition of two counter-rotating vortices in Bose-Einstein condensates that can be generated using orbital angular momentum of light. We also discuss the sensitivity of such a device.

Piedmont — LS

8:00 a.m.–10:00 a.m.
LSTuB • Cavity Optomechanics I
Nergis Mavalvala; MIT, USA, Presider

LSTuB1 • 8:00 a.m. Invited

Cavity Optomechanics with Ions, *K. Vahala[1], M. Herrmann[2], S. Knünz[2], V. Batteiger[2], G. Saathoff[2], T. W. Hänsch[2], Th Udem[2]; [1]Caltech, USA, [2]Max-Planck-Inst. für Quantenoptik, Germany.* A trapped Mg^+ ion is laser cooled within a Paul trap, and is simultaneously excited using a continuous blue-detuned pump wave. The ion subsequently exhibits coherent oscillatory motion with a well-defined threshold.

LSTuB2 • 8:30 a.m. Invited

Preparation and Detection of a Mechanical Resonator Near the Ground State of Motion, *Keith Schwab; Cornell Univ., USA.* We have cooled the motion of a radio-frequency nanomechanical resonator by parametric coupling to a driven microwave frequency superconducting resonator and have observed occupation factors as low as <N>= 3.8 +/- 1.3. We expect to find the mechanical resonator in the quantum ground state of motion with probability 0.21. We have also identified three effects which limit further cooling and will comment on the prospect of producing colder states.

Hillsborough — LS

8:00 a.m.–10:00 a.m.
LSTuC • Ultrafast X-Ray Science III
Harry Ihee; KAIST, Republic of Korea, Presider

LSTuC1 • 8:00 a.m. Invited

Sub-Picosecond Intersystem Crossings and Structural Dynamics: Combined Ultrafast Optical and X-Ray Absorption Studies, *Majed Chergui; Lab of Ultrafast Spectroscopy, École Polytechnique Fédérale de Lausanne, Switzerland.* We will present different examples where the combination of optical and hard X-ray spectroscopies allowed us to obtain a complete picture of the dynamics of molecular processes in solutions.

LSTuC2 • 8:30 a.m. Invited

Structural Tracking of Chemical Reactions in Solution by Time-Resolved X-Ray Scattering, *Martin Meedom Nielsen; Nano-Science Ctr., Univ. of Copenhagen, Denmark.* Photo excitation of molecules creates transient structures and can initiate bimolecular reactions. Such processes have been tracked using optical pumping and picosecond X-ray scattering to probe key elements of transient structures in liquid environments

For Fall Congress presentations on Tuesday, see pages 116-124.

Empire | Crystal | Gold | Valley | California

FiO | JOINT FiO/LS | FiO

FTuA • 3-D Entertainment in the Marketplace—Continued

FTuA2 • 8:45 a.m. Tutorial

What Should We Know about Human Depth Perception in Constructing 3-D Displays? *Martin Banks; Univ. of California at Berkeley, USA.* A variety of perceptual issues arise in the use of stereoscopic displays including perceptual distortions, decreased visual performance and increased visual discomfort. I will discuss the causes of these effects and strategies for minimizing them.

Martin S. Banks is a Professor of Optometry, Vision Science, Psychology, and Neuroscience at the University of California at Berkeley. He is known for his research on human visual perception, particularly the perception of depth, and for his research on the integration of cues from different sensory organs. He was involved in the development of novel stereo displays that present nearly correct focus cues and other stereo displays that bypass the optics of the human eye. Professor Banks is a Fellow of the American Association for the Advancement of Science, Fellow of the American Psychological Society, Fellow of the Center for the Advanced Study of the Behavioral Sciences, recipient of the McCandless Award for Early Scientific Contribution, recipient of the Gottsdanker and Howard lectureships, the first recipient of the Koffka Award for Contribution in Perception and Development, and an Honorary Professor of the University of Wales, Cardiff.

FTuB • Plasmonic Emitters and Resonators—Continued

FTuB3 • 8:45 a.m.

Plasmonic Metal-Insulator-Metal Structures for Interaction with Erbium in Amorphous Silicon Nitride, *Yiyang Gong[1], Selçuk Yerci[2], Luca Dal Negro[2], Jelena Vučković[1]; [1]Stanford Univ., USA, [2]Boston Univ., USA.* We propose to use plasmonic modes in periodically patterned metal-insulator-metal structures to enhance emission from erbium doped silicon nitride. Enhancements of emission up to a factor of 2.3 are experimentally demonstrated.

FTuB4 • 9:00 a.m.

FDTD Simulation of Semiconductor Plasmonic Nano-Ring Laser Based on Realistic Semiconductor Gain Model, *Xi Chen[1], Bipin Bhola[2], Yingyan Huang[3], Seng-Tiong Ho[1]; [1]Northwestern Univ., USA, [2]Data Storage Inst., Singapore, [3]OptoNet. Inc, USA.* A nano-scale electrically pumped ring laser design is simulated using multi-level, multi-electron FDTD model. We discuss the regime where nano-ring laser is feasible in which the metal loss is compensated by semiconductor gain.

FTuB5 • 9:15 a.m.

Stimulated Emission in Microring Cavity with Gold Core, *J. K. Kitur[1], V. A. Podolskiy[2], M. A. Noginov[1]; [1]Norfolk State Univ., USA, [2]Oregon State Univ., USA.* We have demonstrated stimulated emission in microring cavity formed by dye-doped polymer deposited on a gold wire. The mode structure suggests that the stimulated emission originates from surface plasmon polaritons propagating at the gold-polymer interface.

JTuA • Gravitational Wave Interferometers II—Continued

JTuA3 • 8:45 a.m. Invited

GEO600 and Directions in Optics Related Research for Interferometric Gravitational Wave Detector, *Sheila Rowan; Univ. of Glasgow, UK.* This talk will discuss the design, status and plans for upgrades to the GEO 600 long-baseline interferometric gravitational wave detector.

JTuA4 • 9:15 a.m.

Adaptive Beam Shaping Using Photothermal Effects, *Muzammil A. Arain, William Z. Korth, Guido Mueller, David B. Tanner, David H. Reitze; Dept. of Physics, Univ. of Florida, USA.* We present an experimental demonstration of adaptive beam shaping via heat induced photo-thermal effects in optical elements. One application of the proposed system is for correction of astigmatic thermal aberrations in high power laser systems.

FTuC • Optical Communication—Continued

FTuC3 • 9:00 a.m.

Electronic Compensation of Optical Fiber Nonlinearity in on-off Keyed 40 Gb/s WDM Transmission Systems, *Nisar Ahmed, M. I. Hayee; Univ. of Minnesota at Duluth, USA.* We propose and analyze a novel technique to compensate fiber nonlinearity in on-off-keyed 40Gb/s long-haul WDM transmission systems. Our analysis shows that the proposed technique can increase the overall system margin by >1.0 dB.

FTuC4 • 9:15 a.m.

Minimization of Gain Error Due to Spectral Hole Burning Using HGC-EDFA with Generalized Dynamic Gain Range, *Júlio C R. F. de Oliveira[1], Adolfo F. Herbster[1,2], Juliano R. F. Oliveira[1], Aldário C. Bordonalli[2]; [1]CPqD Foundation, Campinas Mogi-Mirim, Brazil, [2]Univ. of Campinas, Brazil.* A method to minimize gain error due to SHB based on HGC-EDFA is demonstrated. A simultaneous pump and VOA attenuation control scheme provide SHB reduction control and enable add/drop of any number of channels (C-Band).

FTuD • Novel Fiber Devices I—Continued

FTuD3 • 8:45 a.m.

Compact MOFA System: A ~1-mJ, 1-ns Output from a Specialty Fiber at a Multi-kHz Repetition Rate, *Alexander V. Kir'yanov[1,2], Sergey M. Klimentov[1,3], Igor V. Mel'nikov[1,4]; [1]Optolink Ltd., Russian Federation, [2]Ctr. de Investigaciones en Óptica, Mexico, [3]A M Prokhorov General Physics Inst., Russian Acad. of Sciences, Russian Federation, [4]High Q Labs, Inc., Canada.* We present a compact laser system made of a hybrid Q-switched Nd^{3+}:YAG/Cr^{4+}:YAG microchip laser seeding an Yb-doped specialty-fiber amplifier with gain factor as high as 20-25 dB achieved for nanosecond pulses at 1-10-kHz repetition rate.

FTuD4 • 9:00 a.m.

Enhanced Soliton Self-Frequency Shift in a Longitudinally Varying Taper, *Alexander C. Judge[1], Ole Bang[2], Benjamin J. Eggleton[1], Boris T. Kuhlmey[1], Eric C. Mägi[1], Ravi Pant[1], C. Martijn de Sterke[1]; [1]Univ. of Sydney, Australia, [2]Technical Univ. of Denmark, Denmark.* We propose a method for the enhancement of the soliton self-frequency shift in a tapered PCF with a carefully designed waist diameter profile which optimizes the dispersion and nonlinearity at the soliton wavelength.

FTuD5 • 9:15 a.m.

All-Fiber Isolator Based on Faraday Rotation, *Lei Sun[1,2], Shibin Jiang[3], Jonathan D. Zuegel[2], John R. Marciante[1,2]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Lab for Laser Energetics, Univ. of Rochester, USA, [3]AdValue Photonics Inc., USA.* An all-fiber isolator with optical isolation of 18 dB is demonstrated. The fiber Faraday rotator uses 56-wt% terbium-doped silica fiber, and the fiber polarizers are Corning SP1060 single-polarization fiber.

For Fall Congress presentations on Tuesday, see pages 116-124.

JTuB • Entanglement Generation and Measurement II—Continued

JTuB2 • 8:45 a.m.
Evaluation of an Optimal Experiment Design Protocol Based on Convex Optimization for Photonic State Tomography, *Manuel de la Cruz Gutierrez[1,2], Ian A. Walmsley[1]; [1]Clarendon Lab, Oxford Univ., UK, [2]Univ. of Houston, USA.* We implemented a model-based optimized method of data acquisition for two-qubit tomography both theoretically and experimentally. Limitations of the method's results and their potential for larger qubit systems were also established.

JTuB3 • 9:00 a.m.
Improved Linear Optic Bell-State Measurement Using Ancillary Photons, *Warren Grice; Oak Ridge Natl. Lab, USA.* It is not possible to construct a linear optic device that unambiguously discriminates all four Bell states. However, the Bell-state measurement efficiency can be made arbitrarily close to unity by introducing additional entangled photons.

JTuB4 • 9:15 a.m.
Spatial Light Modulators to Measure Entanglement between Spatial States, *Barry Jack[1], Jonathan Leach[1], Jacquiline Romero[1], Sonja Franke-Arnold[1], Stephen Barnett[2], Miles Padgett[1]; [1]Univ. of Glasgow, UK, [2]Univ. of Strathclyde, UK.* We use spatial light modulators to observe single-photon, non-trivial superpositions of orbital angular momentum (OAM) states. Using the analogy between polarisation and two-dimensional OAM subspaces, we also measure entanglement between these complex modal superpositions.

FTuE • Fiber Optics Sensors—Continued

FTuE4 • 9:00 a.m.
Portable Photonic Crystal Fiber Sensor Based on Surface Enhanced Raman Scattering (SERS), *Chao Shi[1], Claire Gu[1], Rebecca Newhouse[1], Jin Zhang[1], Kazuki Tanaka[2], Bin Chen[2]; [1]Univ. of California at Santa Cruz, USA, [2]NASA Ames Res. Ctr., USA.* A molecular sensing system is theoretically analyzed and experimentally demonstrated with a hollow core photonic crystal fiber surface enhanced Raman scattering (SERS) probe to achieve high sensitivity and a portable Raman spectrometer to achieve flexibility.

FTuE5 • 9:15 a.m.
Antiresonant-Guiding Photonic Crystal Fibers for Refractive Index Gradients Sensing, *Roshni Biswas, Mikhail Kandel, Gaurav Mehta, H. Kulhandjian, Aleksandr Verevkin, Adly T. Fam, Natalia M. Litchinitser; SUNY Buffalo, USA.* We propose, design and experimentally demonstrate a novel, simple, distributed refractometric sensor based on unique spectral properties of anti-resonant-guiding photonic crystals fibers for measuring temperature gradients. Design optimization and potential applications will be discussed.

LSTuA • General Laser Science—Continued

LSTuA4 • 8:45 a.m.
Multipartite Quantum Nonlocality Using Functional Bell Inequalities, *Qiong Y. He[1], Eric G. Cavalcanti[2], Margaret D. Reid[1], Peter D. Drummond[1]; [1]Ctr. for Quantum-Atom Optics, Swinburne Univ., Australia, [2]Ctr. for Quantum Dynamics, Griffith Univ., Australia.* We show that arbitrary functions of continuous variables can be used to generate tests of local hidden variable theories. The effect of non-ideal detectors and noise is included, revealing that optimized functional inequalities are robust.

LSTuA5 • 9:00 a.m.
Diagrammatic Semiclassical Laser Theory, *Oleg Zaitsev[1], Lev Deych[2]; [1]Physics Inst., Univ. of Bonn, Germany, [2]Physics Dept., Queens College, CUNY, USA.* We derive semi-classical laser equations valid in all orders of nonlinearity. A diagrammatic representation allows us to take into account a weak effect of population pulsations in a controlled way, while treating the nonlinearity exactly.

LSTuA6 • 9:15 a.m.
Behavior of Lasers in the Small Particle Number Limit, *Kaushik Roy Choudhury, A. F. J. Levi; Univ. of Southern California, USA.* Master equations and random walk methods are used to study the dominant role of quantum fluctuations in determining the steady-state and temporal-behavior of small lasers. Suppression of lasing threshold and de-pinning of carriers is observed.

LSTuB • Cavity Optomechanics I—Continued

LSTuB3 • 9:00 a.m.
Optomechanical RF Signal Processing, *Mani Hossein-Zadeh[1], Kerry Vahala[2]; [1]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [2]Caltech, USA.* We have explored the applications of optomechanical oscillator (OMO) as an RF signal-processing element. RF frequency-conversion and injection locking in the optomechanical domain are demonstrated in the context of a microtoroidal OMO.

LSTuB4 • 9:15 a.m.
Mode Splitting of a Nanomechanical Oscillator under Parametric Interactions in a Cavity, *Sumei Huang, Girish S. Agarwal; Oklahoma State Univ., USA.* We show how a type I optical parametric amplifier inside the cavity can aid the normal mode splitting of the movable mirror coupled with the optical cavity in the resolved sideband regime.

LSTuC • Ultrafast X-Ray Science III—Continued

LSTuC3 • 9:00 a.m. Invited
Ultrafast Photochemical Dynamics in Solution, *Munira Khalil; Univ. of Washington, USA.* This talk will outline the use of X-ray absorption spectroscopy (XAS) for probing electronic and geometric changes dynamics following ultrafast charge transfer processes in transition metal complexes in solution.

For Fall Congress presentations on Tuesday, see pages 116-124.

Empire	Crystal	Gold	Valley	California
FiO		JOINT FiO/LS	FiO	

FTuB • Plasmonic Emitters and Resonators—Continued

FTuB6 • 9:30 a.m.
Design and Implementation of Plasmonic Resonators with Sub-Radiant and Fano Modes, *Yannick Sonnefraud[1], Niels Verellen[2,3], Heidar Sobhani[4], Feng Hao[4], Victor Moshchalkov[3], Pol Van Dorpe[2], Peter Nordlander[4], Stefan A. Maier[1]; [1]Imperial College London, UK, [2]IMEC, Belgium, [3]Inst. for Nanoscale Physics and Chemistry, Katholieke Univ. Leuven, Belgium, [4]Rice Univ., USA.* Design principles and implementations of plasmonic nanocavities sustaining sub-radiant and Fano-type modes are described. These structures show high sensing figures of merit and could form a basis for nanoscale optical sensors and metamaterials.

FTuB7 • 9:45 a.m.
Strong Mode Coupling in Hybrid Plasmonic-Photonic Microresonators Using Momentum Matching, *Maysamreza Chamanzar, Mohammad Soltani, Siva Yegnanarayanan, Babak Momeni, Ali Adibi; Georgia Tech, USA.* Efficient coupling to plasmonic ring resonators through the whispering-gallery mode of a SiN_x micro-disk resonator is proposed. The structure has a relatively high-Q hybrid mode with the large sensitivity advantage of surface plasmon polaritons.

JTuA • Gravitational Wave Interferometers II—Continued

JTuA5 • 9:30 a.m. Invited
Japanese Gravitational Wave Detectors: LCGT and DECIGO, *Seiji Kawamura, LCGT Collaboration, DECIGO Working Group; Natl. Astronomical Observatory of Japan, Japan.* The current status of LCGT, the Japanese 3km cryogenic gravitational wave detector to be built in the Kamioka mine, and DECIGO, the Japanese future space gravitational wave antenna, will be described in the talk.

JTuA6 • 10:00 a.m.
A White Light Cavity as a Non-Invasive, Compound Mirror for High Sensitivity, Broadband Signal Recycling in a Gravitational Wave Detector, *Mary Salit, Honam Yum, Selim M. Shahriar; Northwestern Univ., USA.* We describe a non-invasive design of a white light cavity acting as a compound mirror for signal recycling, yielding much higher sensitivity and bandwidth than what is achievable in advanced LIGO for gravitational wave detection.

FTuC • Optical Communication—Continued

FTuC5 • 9:30 a.m.
Orbital Angular Momentum Distribution in a Multi-Vortex Free-Space Optical Link, *Jaime A. Anguita; Univ. of the Andes, Chile.* In a vortex-multiplexed free-space optical link affected by turbulence, orbital angular momentum is transferred to adjacent states creating undesirable crosstalk. The underlying distributions governing crosstalk and the correlation between crosstalk events are studied.

FTuC6 • 9:45 a.m.
Comparison of Spreading of Beams of Different Kinds in Free Space and in the Turbulent Atmosphere, *Anabil Chaudhuri; Univ. of Rochester, USA.* Depending on the beam type, a criterion is used to estimate the distance of propagation up to which a beam preserves its beam like form both in free space and in the turbulent atmosphere.

FTuC7 • 10:00 a.m.
Effect of Splice Losses on Chromatic Dispersion Mapping along Dispersion Compensated Optical Transmission System, *Mirza Imran Baig[1], Faisal ul Hoda[1], Shinya Sato[2], Masaaki Imai[2]; [1]Sir Syed Univ. of Engineering and Technology, Pakistan, [2]Muroran Inst. of Technology, Japan.* A new formulation has been proposed for the mapping of chromatic dispersion (CD) along a dispersion compensated optical transmission system that enhanced the correction factor, which then leads to an improvement in the measurement results.

FTuD • Novel Fiber Devices I—Continued

FTuD6 • 9:30 a.m.
Optofluidic Tuning of MMI Bandpass Filter, *Jose E. Antonio-Lopez, Ivan Hernandez-Romano, Daniel A. May-Arrioja, Jose J. Sanchez-Mondragon, Daniel A. May-Arrioja; Inst. Natl. de Astrofísica, Óptica y Electrónica, Mexico.* An optofluidically tunable multimode interference (MMI) bandpass filter is demonstrated. This scheme allows for a tuning range of almost 40 nm, which can be made continuous by increasing the liquid level around the multimode fiber.

FTuD7 • 9:45 a.m.
High Temperature Stable Fiber Bragg Gratings in Hydrogen Loaded All-Silica Core Fiber, *Christopher Smelser, Dan Grobnic, Stephen Mihailov; Communications Res. Ctr. Canada, Canada.* High temperature stable fiber Bragg gratings are demonstrated in fluorine doped all-silica core fiber. The grating morphology suggests that the presence of hydrogen reduces the threshold of type II damage.

9:00 a.m.–12:00 p.m. Student Programming: Painless Publishing, Science Policy and OSA Traveling Lecturer, *Regency Ballroom II, Fairmont Hotel*

10:00 a.m.–10:30 a.m. Coffee Break, *Imperial Ballroom, Fairmont Hotel*

10:00 a.m.–4:00 p.m. Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*

For Fall Congress presentations on Tuesday, see pages 116-124.

Glen Ellen	Atherton	Sacramento	Piedmont	Hillsborough
JOINT FiO/LS	FiO	LS		

JTuB • Entanglement Generation and Measurement II—Continued

JTuB5 • 9:30 a.m.
High-Efficiency Single Photon Collection from Trapped Barium Ions, *Nathan Kurz, Gang Shu, Matthew R. Dietrich, Boris B. Blinov; Univ. of Washington, USA.* We have incorporated a high numerical aperture spherical mirror and aspherical corrector with a barium ion trap to improve photon collection efficiency by more than an order of magnitude for generation of ion-photon entanglement.

JTuB6 • 9:45 a.m.
Improving Ion Fluorescence Collection by Integrating High Numerical Aperture Spherical Mirror into Ion Trap, *Gang Shu, Nathan Kurz, Matthew R. Dietrich, Boris B. Blinov; Dept. of Physics, Univ. of Washington, USA.* We integrated a high N.A. spherical mirror into a Paul trap and improved its image by special aspheric correctors. We designed a trap based on metallic spherical mirror which greatly increases the ion-photon/ion-ion entanglement efficiency.

FTuE • Fiber Optics Sensors—Continued

FTuE6 • 9:30 a.m.
Simultaneous Measurement of Strain and Temperature Using an FBG Written in Erbium Doped Fiber, *Umesh K. Tiwari[1], K. Thyagarajan[2], M. R. Shenoy[2], Nahar Singh[1], Pawan Kakur[1]; [1]Central Scientific Instruments Organization, India, [2]Indian Inst. of Technology, India.* Fabrication and experimental characterization of a novel FBG sensor that can simultaneously measure strain and temperature is presented. It is shown that the strain sensitivity is 0.8 pm/με and temperature sensitivity is 12 pm/0C.

FTuE7 • 9:45 a.m.
End-of-Fiber Long-Period Fiber Grating-Based Sensors, *Michael R. Hutsel, Thomas K. Gaylord; Georgia Tech, USA.* Carbon-dioxide-laser-induced long-period fiber gratings are fabricated near fiber end-faces and assessed for use as sensors. The effects of changing the surrounding refractive index are characterized. A solvent vapor sensor is fabricated and experimentally evaluated.

LSTuA • General Laser Science—Continued

LSTuA7 • 9:30 a.m.
Operational Behavior of an Injection-Locked Quantum-Dash Fabry-Perot Laser at Zero-Detuning, *Michael C. Pochet[1], Nader A. Naderi[1], Nathan B. Terry[2], Vassilios Kovanis[2], Luke F. Lester[1]; [1]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [2]US AFRL, USA.* The behavior of a zero-detuned injection-locked Quantum-Dash Fabry-Perot laser under varied injected field ratios is investigated theoretically and experimentally. A low slave laser line-width enhancement factor is found to inhibit chaotic/Period-2 operation.

LSTuA8 • 9:45 a.m.
A Self-Injection Locked Unidirectional Diode Pumped Solid State Ring Laser Cavity, *Ronald W. Stites, Ken O'Hara; Pennsylvania State Univ., USA.* We present a novel single-mode unidirectional ring laser. By injecting a small amount of power from one beam path from the output coupler back into the other, unidirectional operation is forced, eliminating many intracavity elements.

LSTuB • Cavity Optomechanics I—Continued

LSTuB5 • 9:30 a.m. Invited
Cooling Acoustic Oscillators with Electromagnetic Parametric Transducers and Prospects of Measuring below the Standard Quantum Limit of Displacement, *Michael Tobar; Univ. of Western Australia, Australia.* We describe high-Q parametric transducers developed at the University of Western Australia for precise displacement measurements. This includes sapphire and niobium transducers, with the potential to reach the Standard Quantum Limit and Quantum Non Demolition.

LSTuC • Ultrafast X-Ray Science III—Continued

LSTuC4 • 9:30 a.m. Invited
Ultrafast Soft X-Ray Spectroscopy of Spin-Crossover Dynamics in Solvated Transition-Metal Complexes, *Nils Huse[1], Ha Na Cho[1,2], Tae-Kyu Kim[2], Lindsey Jamula[3], James McCusker[3], Robert Schoenlein[4,1]; [1]Chemical Sciences Div., Lawrence Berkeley Natl. Lab, USA, [2]Pusan Natl. Univ., Republic of Korea, [3]Michigan State Univ., USA, [4]Advanced Light Source, Lawrence Berkeley Natl. Lab, USA.* We report the first femtosecond time-resolved soft X-ray measurements of solvated transition-metal complexes. L-edge spectroscopy directly reveals dynamic changes in ligand field splitting of 3-D-orbitals associated with the spin transition, and mediated by ligand-bond changes.

9:30 a.m.–12:00 p.m. Student Programming: Painless Publishing, Science Policy and OSA Traveling Lecturer, *Regency Ballroom II, Fairmont Hotel*

10:00 a.m.–10:30 a.m. Coffee Break, *Imperial Ballroom, Fairmont Hotel*

10:00 a.m.–4:00 p.m. Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*

For Fall Congress presentations on Tuesday, see pages 116-124.

Empire	Crystal	Gold	Valley	California
FiO				

10:30 a.m.–12:00 p.m.
FTuF • 3-D Capturing, Visualization and Displays

Martin Banks; Univ. of California at Berkeley, USA, Presider

FTuF1 • 10:30 a.m. Invited

Three-Dimensional Sensing, Visualization, and Display by Integral Imaging, *Bahram Javidi[1], Manuel Martinez-Corral[2], Adrian Stern[3], Edward Watson[4]; [1]Univ. of Connecticut, USA, [2]Univ. of Valencia, Spain, [3]Ben Gurion Univ. of the Negev, Israel, [4]AFRL, USA.* This invited paper presents an overview of advances in 3-D sensing, visualization, and display by integral imaging. Theoretical and experimental results will be presented. Various applications and technical challenges will be discussed.

FTuF2 • 11:00 a.m. Invited

Development of Integral Images, *Pingfan Wu, Douglas S. Dunn, Robert L. Smithson, Steven J. Rhyner; 3M Corp., USA.* Development of Integral Images 3M has invented integral image products that have true 3-D appearance and exhibit full motion parallax. We will present the optics of the materials and analysis of image quality.

FTuF3 • 11:30 a.m. Invited

3-D TV Based on Integral Method Using Extremely High-Resolution Video System, *Masahiro Kawakita, Jun Arai, Fumio Okano; NHK Science and Technical Res. Labs, Japan.* We developed integral 3-D TV using extremely high-resolution video that had a resolution of 7680 x 4320 pixels. The resolution of the displayed 3-D images was four times higher than that of the previous system.

10:30 a.m.–11:45 a.m.
FTuG • Wavefront Design for Information Transport and Sensing I

Greg Gbur; Univ. of North Carolina at Charlotte, USA, Presider

FTuG1 • 10:30 a.m. Invited

Modulation of Coherence and Polarization Properties of Beams for Communications and LIDARs Operating in Atmospheric Turbulence, *Olga Korotkova; Univ. of Miami, USA.* We will demonstrate the ability of such statistical properties of light sources as states of coherence and polarization to improve performance of LaserCom and LIDAR systems operating through turbulent atmosphere.

FTuG2 • 11:00 a.m. Invited

Vectographic Computer-Generated Optical Elements, *Grover A. Swartzlander, Jr.; Chester F. Carlson Ctr. for Imaging Science, RIT, USA.* A new class of computer designed optical element is introduced. These thin, light weight elements are neither diffractive nor refractive. Achromatic elements such as optical vortices lenses, and highly chromatic elements are possible.

FTuG3 • 11:30 a.m.

Scintillation of Nonuniformly Polarized Beams in Atmospheric Turbulence, *Yalong Gu[1], Olga Korotkova[2], Greg Gbur[1]; [1]Univ. of North Carolina at Charlotte, USA, [2]Univ. of Miami, USA.* The scintillation properties of a class of non-uniformly polarized beams propagating in atmospheric turbulence are numerically investigated. They are demonstrated to have appreciably smaller scintillation than comparable beams of uniform polarization.

10:30 a.m.–12:00 p.m.
FTuH • Diffractive and Holographic Optics I

Presider to Be Announced

FTuH1 • 10:30 a.m. Invited

Dynamic Holograms, *Guoqiang Li; Univ. of Missouri at St. Louis, USA.* Recent work on dynamic holograms is reviewed. We report photorefractive polymeric hologram with subsecond response time and two-hour decay time which can be applied for rewritable 3-D display. The recording method is simple yet efficient.

FTuH2 • 11:00 a.m.

A 3CCD Imaging System Based on Holographic Gratings, *Selim M. Shahriar, Xue Liu, Shih Tseng; Northwestern Univ., USA.* We present a 3CCD imaging system based on multiplexed volume holographic gratings. The recombined image from the monochromatic images taken by individual CCD's shows the ability of such a system to perform high quality imaging.

FTuH3 • 11:15 a.m.

Self-Assembled Diffraction Grating for Microfluidic Velocimetry, *Antony Orth, Ethan Schonbrun, Kenneth B. Crozier; Harvard Univ., USA.* A self-assembled elastomeric diffraction grating is used to perform flow rate measurements in micro-fluidic channels. The simple fabrication technique alleviates the need for multi-step lithographic procedures while conserving optical access via the bottom wall.

FTuH4 • 11:30 a.m.

Excitation of Surface Plasmon Polaritons and Leaky Modes with Dielectric Gratings over Metallic Substrates, *Mehrdad Shokooh-Saremi, Robert Magnusson; Univ. of Texas at Arlington, USA.* A dielectric grating on a metallic substrate permits excitation of both surface-plasmon polaritons (SPPs) and resonant leaky-modes. We compare the spectral characteristics and local field structure of the excited classical SPPs and mixed leaky-mode SPPs.

10:30 a.m.–12:00 p.m.
FTuI • All-Optical Signal Processing I

Roderick P. Webb; Tyndall Natl. Inst., Univ. College Cork , Ireland, Presider

FTuI1 • 10:30 a.m. Invited

Polychromatic High Speed Sampling, *Stojan Radic; Univ. of California at San Diego, USA.* Recent advances in parametric devices have led to fundamental changes with respect to ultrafast waveform processing. We discuss physics, construction and basic implications stemming from one's ability to perform polychromatic sampling for the first time.

FTuI2 • 11:00 a.m.

Ultrafast Optical Sampling Using Nondegenerate Two-Photon Absorption in a GaAs Photodiode, *Paveen Apiratikul, Thomas E. Murphy; Univ. of Maryland at College Park, USA.* We demonstrate optical sampling based on non-degenerate two-photon absorption in a GaAs photodiode, using sampling pulses below the half-bandgap. The system is capable of resolving a quasi- 2 Tb/s signal with low background photocurrent.

FTuI3 • 11:15 a.m.

Raman-Assisted Fiber Optical Parametric Amplification (RAFOPA): Numerical Simulations and Experimental Results, *Cyril L. Guintrand, Jean Toulouse; Lehigh Univ., USA.* We investigate theoretically and experimentally the RAOPA. Performances of amplification and wavelength conversion are discussed. We demonstrate several benefits compare to simple OPA, such as gain and bandwidth increase, spectrum tailoring and power distribution flexibility.

FTuI4 • 11:30 a.m. Invited

Advances in High-Confinement Fibers, *Msaaki Hirano; Sumitomo Electric Industries, Ltd., Japan.* Recent progresses on silica-based high-confinement fiber as platform of various nonlinear processings are presented. Important characteristics for applying the fibers to nonlinear devices including nonlinear coefficient, bend loss and chromatic dispersions are discussed.

10:30 a.m.–12:00 p.m.
FTuJ • Anderson Localization II

Andrey A. Chabanov; Univ. of Texas at San Antonio, USA, Presider

FTuJ1 • 10:30 a.m. Invited

Probing Localization in Absorbing Systems via Loschmidt Echos, *Tsampikos Kottos[1,2]; [1]Wesleyan Univ., USA, [2]Max-Planck-Inst., Germany.* Using echo dynamics we probe diffusive or localized random media even in the presence of absorption. Our theory, based on a random matrix approach, is supported by experimental measurements with disordered quasi-one-dimensional waveguides.

FTuJ2 • 11:00 a.m.

Electromagnetic Modes and Dynamics of Localized Waves, *Jing Wang, Azriel Genack; Dept. of Physics, Queens College, CUNY, USA.* We have found the central frequencies, linewidths and field speckle patterns in transmission for quasimodes of random media. We study the time evolution of modes and correlation using time-frequency analysis.

FTuJ3 • 11:15 a.m.

Universal Mesoscopic Statistics and the Localization of Light, *Jongchul Park[1], Sheng Zhang[1,2], Samuel Gilman[1], Azriel Genack[1]; [1]Queens College, CUNY, USA, [2]Chiral Photonics Inc., USA.* The probability distribution of intensity through layered media changes from one dimensional to a mixture of a mesoscopic function of a single parameter, the "statistical conductance," and a distribution of intensity for Gaussian waves.

FTuJ4 • 11:30 a.m. Invited

Quantum Optics of Random Media, *Sergey E. Skipetrov; CNRS, Univ. Joseph Fourier, France.* We study quantum effects in multiple scattering of light in a random medium. A link between photocount statistics and Anderson localization is established. Novel ways of performing diffusing-wave spectroscopy of random media are proposed.

For Fall Congress presentations on Tuesday, see pages 116-124.

FiO

LS

10:30 a.m.–12:00 p.m.
FTuK • High Peak Power Laser Technology II
David H. Reitze; Univ. of Florida, USA, Presider

FTuK1 • 10:30 a.m. Invited
Status of the National Ignition Facility, *Edward I. Moses; Lawrence Livermore Natl. Lab, USA.* I will discuss the current status of NIF and NIF capabilities including demonstrating fusion, new opportunities in astrophysics and other areas of high energy density science, and LIFE, the near-term goal of clean fusion energy.

FTuK2 • 11:00 a.m. Invited
The Texas Petawatt Laser and Technology Development toward an Exawatt Laser, *Todd Ditmire; Univ. of Texas at Austin, USA.* We will report on the performance of the Texas Petawatt Laser and the science program we are pursuing on this system. We will also discuss how this technology might scale to an Exawatt-class laser.

FTuK3 • 11:30 a.m.
Generation of Sub-Three-Cycle, 16-TW Light Pulses through Noncollinear OPCPA, *Daniel Herrmann[1], Raphael Tautz[1], Laszlo Veisz[1], Franz Tavella[2], Karl Schmid[1], Christopher Sears[1], Vladimir Pervak[3], Ferenc Krausz[1,3]; [1]Max-Planck Inst. für Quantenoptik, Germany, [2]HASYLAB/DESY, Germany, [3]Ludwig-Maximilian-Univ. München, Germany.* We present a 16-TW (7.9 fs, 130 mJ) non-collinear optical parametric chirped-pulse amplification system. This unique source can serve as seed source for PW-class lasers and by itself allows for new experiments in high-field physics.

10:30 a.m.–12:00 p.m.
FTuL • Molecular Imaging and Nanomedicine
Michael J. Levene; Yale Univ., USA, Presider

FTuL1 • 10:30 a.m. Invited
Molecular Probes for Microendoscopy, *Chris Contag; Stanford Univ., USA.* Achieving cellular resolution and molecular specificity is the objective of *in vivo* molecular microensdoscopy. This requires co-development of optical technologies with molecular probes. We have identified unique peptides that provide molecular contrast for miniaturized confocal microscopes.

FTuL2 • 11:00 a.m.
Real-Time Phase-Free and Background-Free Detection of Nanoparticles and Viruses, *Anirban Mitra, Bradley Deutsch, Filipp Ignatovich, Lukas Novotny; Univ. of Rochester, USA.* We implement phase-sensitive optical detection and characterization of nanoparticles. The elimination of the phase contribution to the detected signal helps improve the measured particle size accuracy and resolution, compared to standard interferometric techniques.

FTuL3 • 11:15 a.m.
***In vivo* Imaging of Targeted Drug Delivery to Tumors Based on Fluorescence Resonance Energy Transfer and Optical Diffusion Tomography**, *Vaibhav Gaind, Kevin J. Webb, Sumith A. Kularatne, Philip S. Low; Purdue Univ., USA.* Experimental results for imaging a model for targeted anti-cancer drug delivery to a tumor in a mouse using fluorescence resonance energy transfer (FRET) and optical diffusion tomography (ODT) are presented.

FTuL4 • 11:30 a.m. Invited
Biomimetic Strategies for Modification of Surfaces with Passivating and Targeting Moieties, *Phillip B. Messersmith; Northwestern Univ., USA.* The use of nanoparticles in medicine requires great attention to surface properties due to the high surface areas of nanoparticles. In this talk I will describe biologically inspired strategies for controlling bio-interfacial phenomena at surfaces.

10:30 a.m.–12:00 p.m.
LSTuD • Photophysics of Quantum Dots and Nanostructures I
Kelly J. Gaffney; SLAC Natl. Accelerator Lab, Stanford Univ., USA, Presider

LSTuD1 • 10:30 a.m. Invited
Strong Coupling of Propagating Laser Light to Single Emitters: From Absorption to Stimulated Emission, *Vahid Sandoghdar; ETH Zurich, Switzerland.* Strong coupling of laser light to an emitter will be discussed in different contexts, ranging from absorption spectroscopy of single quantum dots at room temperature and stimulated emission of single dye molecules at cryogenic temperatures.

LSTuD2 • 11:00 a.m. Invited
Single Quantum Dots for Probing Local Environments, *Haw Yang; Princeton Univ., USA.* The intermittent emission of individual quantum dots makes it challenging to probe time-dependent changes. We explain strategies to overcome these difficulties and discuss using them as ratiometric resonance energy transfer-based probes and as temperature sensors.

LSTuD3 • 11:30 a.m.
Temperature Dependence of the Polarization and Linewidth of the Optical Transitions of Single Nitrogen-Vacancy Centers in Diamond, *Kai-Mei C. Fu[1], Charles Santori[1], Paul E. Barclay[1], Lachlan J. Rogers[2], Neil B. Manson[2], Raymond G. Beausoleil[1]; [1]Hewlett-Packard Labs, USA, [2]Australian Natl. Univ., Australia.* Polarization and photoluminescence excitation spectroscopy are used to measure the nitrogen-vacancy center optical transition polarization and linewidth as a function of temperature. Finite relaxation and line-broadening is observed even at temperatures below 25~K.

10:30 a.m.–12:00 p.m.
LSTuE • Cavity Optomechanics II
Kerry Vahala; Caltech, USA, Presider

LSTuE1 • 10:30 a.m. Invited
Control and Sensing of Ultracold Atoms and Molecules by Nanomechanical Cantilevers, *Pierre Meystre; Univ. of Arizona, USA.* We illustrate the potential of cavity optomechanics (COM) for control and sensing in two examples: a bi-stable configuration that controls the many-body state of ultra-cold atoms; and the quantum limit of COM-based inertial mass sensors.

LSTuE2 • 11:00 a.m. Invited
Optomechanics of Phononic-Photonic Crystal Defect Cavities, *Matt Eichenfield, Jasper Chan, Ryan M. Camacho, Kerry J. Vahala, Oskar J. Painter; Caltech, USA.* We present the theory and experimental realization of localized and strongly coupled optical and acoustic modes in periodic nanostructures. Properties of localized phonons with Gigahertz frequencies and sub-picogram masses are studied via all-optical measurements.

LSTuE3 • 11:30 a.m. Invited
Sensing Nanomechanical Motion with a Shot-Noise Limited Microwave Cavity Interferometer, *Konrad W. Lehnert, John D. Teufel, Tobias Donner, Jennifer W. Harlow, Manuel A. Castellanos-Betran; JILA, NIST, Univ. of Colorado, USA.* We measure the motion of a nano-mechanical oscillator with precision beyond the standard quantum limit, by using a microwave interferometer that operates near the shot-noise limit.

10:30 a.m.–12:00 p.m.
LSTuF • Micro- and Nanofluidics III
Paul Bohn; Univ. of Notre Dame, USA, Presider

LSTuF1 • 10:30 a.m. Invited
Single Molecule Tracking as a Probe of Free Volume Transitions in Stimulus-Responsive Polymers--Do Single Molecules Behave Like Caribou? *Lindsay C. C. Elliott[1], Paul Bohn[2]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Univ. of Notre Dame, USA.* Actively-switchable transport can be achieved in stimulus-responsive polymer brushes. Single molecule trajectories are used to understand local diffusion and, in turn, to study the polymer free volume distribution.

LSTuF2 • 11:00 a.m.
Quasi-Continuous Fiber Optic Liquid Level Sensor, *Syed H. Murshid; Florida Inst. of Technology, USA.* A quasi-continuous liquid level sensor that exploits changes in reflection upon contact with a target fluid has been successfully developed and tested for a host of liquids including liquid nitrogen, oils and boiling water.

LSTuF3 • 11:15 a.m.
An FPGA-Based Anti-Brownian Electrokinetic Trap for Studying Single Molecules in Solution, *Quan Wang, Alexandre Fürstenberg, Samuel Bockenhauer, W. E. Moerner; Stanford Univ., USA.* We have designed and implemented an Anti-Brownian ELectrokinetic (ABEL) trap on an FPGA platform, with programmable feedback algorithms and online tunable trapping parameters. Trapping of sub-10nm bio-molecules for seconds in buffer is achieved.

LSTuF4 • 11:30 a.m. Invited
Micro- and Nanofluidics for Single Biomolecule Analysis, *Yoshinobu Baba; Nagoya Univ., Japan.* I will describe real-time monitoring of an interaction between a single DNA and an enzyme molecule, an atto litre chamber for single enzymatic molecular reaction characterization, and single molecular trafficking analysis in a single cell.

For Fall Congress presentations on Tuesday, see pages 116-124.

FTuF • 3-D Capturing, Visualization and Displays—Continued

FTuH • Diffractive and Holographic Optics I—Continued

FTuH5 • 11:45 a.m.
Binary Diffractive Element for Linearizing Sinusoidal Scanning: Interference Approach Implementation, *Bahareh Haji-Saeed[1], Jed Khoury[1], Charles L. Woods[1], John Kierstead[2]; [1]AFRL, Sensors Directorate, USA, [2]Solid State Scientific Corp., USA.* In this paper we test and characterize our previously designed and fabricated optical corrective element with zooming capability for converting nonlinear sinusoidal scanning to linear scanning.

FTuI • All-Optical Signal Processing I—Continued

FTuJ • Anderson Localization II—Continued

12:00 p.m.–1:30 p.m. Exhibit Only Time, *Imperial Ballroom, Fairmont Hotel*

12:00 p.m.–2:00 p.m. 1st International OSA Student Chapter Solar Mini-Car Final Races, *Imperial Ballroom, Fairmont Hotel*

12:00 p.m.–1:30 p.m. OSA Fellow Member Lunch, *Silicon Valley Capital Club, 50 W. San Fernando, Suite 1700, San Jose, California 95113, Phone: 408.971.9300*

12:00 p.m.–1:30 p.m. Lunch Break *(on your own)*

NOTES

For Fall Congress presentations on Tuesday, see pages 116-124.

FiO

FTuK • High Peak Power Laser Technology II—Continued

FTuK4 • 11:45 a.m.
Generation of 100-J Sub-Picosecond Laser Pulse from High Energy Nd:Glass Chirped Pulse Amplification System, *Xudong Xie, Qihua Zhu, Xiaoming Zeng, Xiao Wang, Xiaojun Huang, Kainan Zhou, Yanlei Zuo, Feng Jing, Haiwu Yu; Res. Ctr. of Laser Fusion, China.* We demonstrated high energy broadband chirped pulse amplification at Nd:glass amplifiers system. Seed pulse generated by OPA was amplified up to 168J with 5.5nm and recompressed to 710 fs by tiled gratings compressor.

FTuL • Molecular Imaging and Nanomedicine—Continued

LS

LSTuD • Photophysics of Quantum Dots and Nanostructures I—Continued

LSTuD4 • 11:45 a.m.
Single Quantum Dot Spectroscopy via Non-Resonant Dot-Cavity Coupling, *Arka Majumdar[1], Dirk Englund[2], Andrei Faraon[1], Jelena Vučković[1]; [1]Stanford Univ., USA, [2]Harvard Univ., USA.* Coherent quantum dot spectroscopy is performed in a quantum dot coupled to a photonic crystal cavity by exploiting non-resonant dot-cavity coupling. This enables manipulation of the quantum dot levels and readout through cavity emission.

LSTuE • Cavity Optomechanics II—Continued

LSTuF • Micro- and Nanofluidics III—Continued

12:00 p.m.–1:30 p.m. Exhibit Only Time, *Imperial Ballroom, Fairmont Hotel*

12:00 p.m.–2:00 p.m. 1st International OSA Student Chapter Solar Mini-Car Final Races, *Imperial Ballroom, Fairmont Hotel*

12:00 p.m.–1:30 p.m. OSA Fellow Member Lunch, *Silicon Valley Capital Club, 50 W. San Fernando, Suite 1700, San Jose, California 95113, Phone: 408.971.9300*

12:00 p.m.–1:30 p.m. Lunch Break *(on your own)*

NOTES

For Fall Congress presentations on Tuesday, see pages 116-124.

Empire	Crystal	Gold	Valley	California

FiO

1:30 p.m.–3:00 p.m.
FTuM • Emerging 3-D Display Technologies and Research Frontiers I
Bahram Javidi; Univ. of Connecticut, USA, Presider

FTuM1 • 1:30 p.m. Invited
Accommodation Responses to Stereoscopic Images, *Kazuhiko Ukai; Waseda Univ., Japan.* Our recent attempts to measure and analyze the static and dynamic behaviors of accommodation and convergence when viewing stereoscopic images with discrepancy between accommodative and convergence stimuli and may cause visual fatigue will be introduced.

FTuM2 • 2:00 p.m. Invited
A Novel 3-D Display that Presents Nearly Correct Focus Cues, *Martin S. Banks[1], Gordon D. Love[2], David M. Hoffman[1], Philip J. W. Hands[2], Andrew K. Kirby[2]; [1]Univ. of California at Berkeley, USA, [2]Durham Univ., UK.* We describe a stereoscopic system that uses a fast, switchable lens (1000Hz), synchronized to the display, to construct a temporally-multiplexed image with correct focus cues. It has great potential for vision research and various applications.

1:30 p.m.–3:30 p.m.
FTuN • Negative Index Materials and Cloaking
Dai-Sik Kim; Seoul Natl. Univ., Republic of Korea, Presider

FTuN1 • 1:30 p.m. Invited
Optical Metamaterials, *Xiang Zhang; Univ. of California at Berkeley, USA.* I will discuss recent experimental demonstrations of intriguing phenomena associated with metamaterials and plasmonics. These include sub-diffraction imaging and focusing, negative refraction and negative-index metamaterials, cloaking at optical frequencies and sub-wavelength plasmonic lasers.

FTuN2 • 2:00 p.m.
Optical Cloaking Using Dielectrics, *Jason Valentine, Jensen Li, Thomas Zentgraf, Guy Bartal, Xiang Zhang; Univ. of California at Berkeley, USA.* We report an experimental realization of a dielectric optical cloak that conceals an object under a curved reflecting surface. The carpet cloak consists only of isotropic dielectric materials which enables broadband and low-loss invisibility.

1:30 p.m.–3:30 p.m.
FTuO • Diffractive and Holographic Optics II
Guoqiang Li; Univ. of Missouri at St. Louis, USA, Presider

FTuO1 • 1:30 p.m. Invited
Applications and Engineering of Three-Dimensional Optics, *Eric Johnson[1], Pradeep Srinivasan[1], Menelaos Poutous[1], Zachary Roth[1], Raymond Rumpf[2]; [1]Univ. of North Carolina at Charlotte, USA, [2]Prime Res. LC, USA.* Diffractive and micro-optical components have evolved over the last decade to enable many applications. This talk highlights optical elements that exhibit unique spectral, spatial, and polarization properties.

FTuO2 • 2:00 p.m.
Solution of the Phase Problem in the Theory of Structure Determination of Crystalline Media from X-Ray Diffraction Measurements, *Emil Wolf; Univ. of Rochester, USA.* We present solution to a long standing problem encountered in the theory of structure determination of crystalline media from X-ray diffraction experiments; namely the problem of determining phases of the diffracted beams.

1:30 p.m.–3:30 p.m.
FTuP • Optical Access
Anabil Chaudhuri; Univ. of Rochester, USA, Presider

FTuP1 • 1:30 p.m. Invited
Extended Reach Passive Optical Networks, *Chang-Hee Lee; KAIST, Republic of Korea.* Passive optical networks (PONs) with extended reach enable consolidation of central offices. A WDM-PON is most attractive for long distance PON, since it has a small splitting loss compared with a TDM-PON. Recent achievements and limiting factors for long reach WDM-PON will be addressed.

FTuP2 • 2:00 p.m.
Broadcast Signal Transmission Employing Low Noise Mutually Injected Fabry-Pérot Laser Diodes, *Sil-Gu Mun[1], Sang-Min Oh[1], Ki-Man Choi[2], Chang-Hee Lee[1]; [1]KAIST, Republic of Korea, [2]Next Generation Res. Dept., Korea Telecom Network Technology Lab, Republic of Korea.* We demonstrated a broadcast signal transmission using mutually injected Fabry-Pérot laser diodes. It can accommodate 125 channels of HDTV signals with 100 GHz channel spacing.

1:30 p.m.–3:30 p.m.
FTuQ • Light in the Eye
Melanie C. Campbell; Univ. of Waterloo, Canada, Presider

FTuQ1 • 1:30 p.m. Tutorial
Light and Eye Safety, *David Sliney; Consulting Medical Physicist, USA.* Extensive biomedical research has established thresholds for ocular injury from optical radiation—particularly with respect to laser exposure. US and international exposure limits exist for human cornea, lens and retina for all wavelengths of interest.

Dr. Sliney received his B.S. in physics from Virginia Polytechnic Institute, his M.S. in physics and radiological health from Emory University, and his Ph.D. in biophysics and medical physics from the University of London, Institute of Ophthalmology. He was the Manager of the Laser/Optical Radiation Program at the U.S. Army Center for Health Promotion and Preventive Medicine for many years until retiring in 2007. His research interests focus on subjects related to UV effects upon the eye, laser-tissue interactions, laser hazards and laser applications in medicine and surgery. He served as member, advisor and chairman of numerous committees and institutions, which are active in the establishment of safety standards for protection against non-ionizing radiation in particular from lasers and other high-intensity optical sources (ANSI, ISO, ACGIH, IEC, WHO, NCRP, and ICNIRP). He was a Fulbright Scholar to Yugoslavia in 1977 and received the Schawlow Award from the LIA in 2005 and the Wilkening Award in 2004. He co-authored the 1000-page handbook, "Safety with Lasers and Other Optical Sources" (Plenum Publishing Corp., New York, 1980). He served as President of the American Society for Photobiology, 2008–2009.

Thank you for attending FiO/LS/Fall Congress. Look for your post-conference survey via email and let us know your thoughts on the program.

For Fall Congress presentations on Tuesday, see pages 116-124.

FiO

1:30 p.m.–3:30 p.m.
FTuR • Rogue Waves and Related Phenomena
Colin J. McKinstrie; Bell Labs, Alcatel-Lucent, USA, Presider

FTuR1 • 1:30 p.m. Invited

Freak Ocean Waves in One and Two Dimensions, *Peter Janssen, Jean-Raymond Bidlot; European Ctr. for Medium-Range Weather Forecasts, UK.* We have developed a theory for the generation of freak ocean waves. The resulting measure for extreme sea states, namely maximum wave height, is compared with buoy observations.

FTuR2 • 2:00 p.m. Invited

Rogue Waves in Optics, *J. M. Dudley[1], G. Genty[2], F. Dias[3]; [1]Univ. of Franche-Comté, France, [2]Tampere Univ. of Technology, Finland, [3]Ctr. de Mathématiques et de Leurs Applications, École Normale Supérieure de Cachan, France.* We discuss recent studies of large amplitude extreme value "optical rogue wave" instabilities, focusing both on their intrinsic optical characteristics and their links with their oceanic counterparts.

1:30 p.m.–3:15 p.m.
FTuS • Short Wavelength Generation and Applications I: From EUV to X-Rays
Henry C. Kapteyn; Univ. of Colorado at Boulder, USA, Presider

FTuS1 • 1:30 p.m. Tutorial

EUV Lithography, *Martin Richardson; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* EUV lithography promises to be the next, and maybe the last, technology to extend Moore's Law fabrication of computer chips. We review the development, status and challenges this technology faces as it nears implementation.

Martin Richardson made his dissertation research in lasers and plasmas in the UK in the mid-60's, and had made many contributions to these fields since. He has lead major research programs at the Herzberg Institute, CNRC Laboratories in Ottawa, at the universities of Rochester and Central Florida and is now the founding director of the Townes Laser Institute, a new laser center at UCF associated with CREOL and the College of Optics and Photonics. His group at UCF was one of the first to recognize the potential for high repetition-rate laser-plasma sources for EUV lithography. He has held visiting appointments at other institutions including the Max-Born-Institute and the Max-Planck-Institute for Quantum Optics in Germany, the Institute for Laser Engineering at Osaka University, and the Prokhorov General Physics Institute in the Soviet Union. A recipient of the Schardin Medal, an OSA fellow, he has over 500 publications and numerous patents, is a past Assoc. Editor of JQE, and has organized many conferences on lasers and laser applications.

LS

1:30 p.m.–3:45 p.m.
LSTuG • Optoelectronic Materials Characterization
Kevin T. Early; Univ. of Massachusetts Amherst, USA, Presider

LSTuG1 • 1:30 p.m. Invited

Using Fluorescence Microscopy of Oligomer Aggregates to Understand the Properties of Conjugated Polymers Used in Photovoltaic Devices, *Linda Peteanu[1], Gizelle A. Sherwood[1], Kelly Zewe[1], Jurjen Wildeman[2], James H. Werner[3], Andrew P. Shreve[3]; [1]Carnegie Mellon Univ., USA, [2]Zernike Inst. for Advanced Materials, Univ. of Groningen, Netherlands, [3]Ctr. for Integrated Nanotechnologies, Los Alamos Natl. Labs, USA.* Fluorescence microscopy is used to probe variations in vibronic structure and emission lifetime between individual aggregates and trends with aggregate size and oligomer chain length. The results are compared to theoretical models and to polymers.

LSTuG2 • 2:00 p.m.

Enhancement of Triplet Yields in Cyanine-Like Molecules, *Scott Webster[1], Lazaro A. Padilha[1], Olga V. Przhonska[1,2], Davorin Peceli[1], Honghua Hu[1], Yurii L. Slominsky[3], Alexei D. Kachkovski[3], Alexei I. Tolmachov[3], Vladimir V. Kurdyukov[3], David J. Hagan[1], Eric W. Van Stryland[1]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Inst. of Physics, Natl. Acad. of Sciences, Ukraine, [3]Inst. of Organic Chemistry, Natl. Acad. of Sciences, Ukraine.* A series of oxo- and thio-squaraine dyes were investigated by femto/pico/nanosecond pump-probe techniques. Thio-squaraines show increased triplet quantum yields which are explained by quantum chemical calculations.

1:30 p.m.–3:30 p.m.
LSTuH • Cavity Optomechanics III
Pierre Meystre; Univ of Arizona, USA, Presider

LSTuH1 • 1:30 p.m. Invited

Demonstration of Micromechanics in the Strong Coupling Regime, *Simon Groeblacher, Klemens Hammerer, Michael Vanner, Markus Aspelmeyer; IQOQI, Austrian Acad. of Sciences, Austria.* We report the observation of optomechanical normal mode splitting, which is unambiguous evidence for strong coupling of cavity photons to a mechanical resonator. This paves the way towards full quantum optical control of nano- and micromechanical devices.

LSTuH2 • 2:00 p.m. Invited

Measurement of Attractive and Repulsive Casimir Forces and Applications to Nanomechanics, *Jeremy Munday[1], Federico Capasso[2], [1]Thomas J. Watson Labs of Applied Physics, Caltech, USA, [2]Harvard Univ., USA.* The Casimir force results from quantum fluctuations between objects. We discuss the measurement of attractive and repulsive forces, how they can lead to ultra-low static friction devices, and the idea of a QED torque.

1:30 p.m.–3:30 p.m.
LSTuI • High Field Dynamics I
Markus Guehr; SLAC Natl. Accelerator Lab, Stanford Univ., USA, Presider

LSTuI1 • 1:30 p.m. Invited

Fast Electron Migration in Finite Systems during Exposure to Intense Attosecond and XFEL Pulses, *Ulf Saalmann, Ionut Georgescu, Christian Gnodtke, Alexey Mikaberidze, Jan-Michael Rost; Max-Planck-Inst. for the Physics of Complex Systems, Germany.* We analyze migration of electrons on a 1-fs time scale in rare-gas-clusters following irradiation of the cluster with an attosecond or XFEL-pulse as it will be available at LCLS in Stanford and XFEL in Hamburg.

LSTuI2 • 2:00 p.m. Invited

Strong-Field Atomic Physics in the X-Ray Regime, *Louis DiMauro; Ohio State Univ., USA.* The talk examines the scaling of strong-field physics into the X-ray regime. A status report on the first experiments performed by the AMOS team using the LCLS XFEL at SLAC will also be presented.

For Fall Congress presentations on Tuesday, see pages 116-124.

FTuM • Emerging 3-D Display Technologies and Research Frontiers I—Continued

FTuM3 • 2:30 p.m. Invited

Volumetric True 3-D Display Using Multi-Focal Scanned Light, *Brian Schowengerdt; Univ. of Washington, USA.* Our novel 3-D volumetric displays scan multiple superimposed light beams with different focus levels, to optically position objects at different viewing distances, overcome accommodation/vergence conflicts, reduce fatigue, and provide more accurate cues to depth perception.

Thank you for attending FiO/LS/Fall Congress. Look for your post-conference survey via email and let us know your thoughts on the program.

FTuN • Negative Index Materials and Cloaking—Continued

FTuN3 • 2:15 p.m.

Yellow Light Negative-Index Metamaterials, *Shumin Xiao, Uday K. Chettiar, Alexander Kildishev, Vladimir Drachev, Vladimir Shalaev; Purdue Univ., USA.* A well established silver based fishnet design was further miniaturized. By studying its transmittance, reflectance, and corresponding numerical simulations, we reported a negative refractive index of -0.25 at yellow light of 580 nm.

FTuN4 • 2:30 p.m.

Near-Infrared Ground Plane Cloak Based on Silicon Nanorod Array, *Venkata Ananth Tamma[1], John Blair[2], Jin-Hyoung Lee[1], Qi Wu[1], Seuk-Joo Rhee[3], Christopher J. Summers[2], Won Park[1]; [1]Univ. of Colorado, USA, [2]Georgia Tech, USA, [3]Hankuk Univ. of Foreign Studies, Republic of Korea.* An optical frequency ground plane cloak was implemented using silicon nano-rod array. The cloak performance was directly visualized by the near-field scanning optical microscopy. The experimental data agreed well with the numerical simulations.

FTuN5 • 2:45 p.m.

Metal-Free Optical Material with Negative Permittivity, *G. Zgu[1], E. E. Narimanov[2], H. Li[1], Yu. A. Barnakov[1], M. A. Noginov[1]; [1]Norfolk State Univ., USA, [2]Purdue Univ., USA.* We have experimentally demonstrated negative permittivity in metal-free optical material (laser dye). This result paves the road to a new generation of nanoplasmonic materials and metamaterials with low loss and optical gain.

FTuO • Diffractive and Holographic Optics II—Continued

FTuO3 • 2:15 p.m.

Non-Destructive Quality Evaluation of Periodically Poled Domains of Lithium Niobate Crystal by Diffraction, *Krishnamoorthy Pandiyan, Yeon Sook Kang, Hwan Hong Lim, Byoung Joo Kim, Myoungsik Cha; Pusan Natl. Univ., Republic of Korea.* We demonstrate an efficient diffraction method for quality evaluation of periodically poled lithium niobate crystals. Microscopic statistical quantities could be easily obtained from the index modulation induced by the internal fields in the ferroelectric domains.

FTuO4 • 2:30 p.m.

Surface Inspection with LEDs, *Stephan Stürwald, Robert Schmitt; Fraunhofer Inst. for Production Technology IPT, Germany.* Phase-shifting holography allows quantitative phase contrast imaging of reflective and partially transparent samples. Light emitting diodes (LEDs) have been investigated as low coherent light sources for applicability as low cost light sources in phase-shifting holography.

FTuO5 • 2:45 p.m.

Measuring the Spatio-Temporal Field of Diffracting Ultrashort Pulses, *Pamela R. Bowlan[1], Madis Lõhmus[2], Peeter Piksarv[2], Heli Valtna-Lukner[2], Peeter Saari[2], Rick Trebino[1]; [1]School of Physics, Georgia Tech, USA, [2]Inst. of Physics, Univ. of Tartu, Estonia.* Using SEA TADPOLE, we directly measure the spatio-temporal field of diffracting ultrashort pulses with fs-temporal and μm-spatial resolutions. Using a circular aperture and an opaque disk, we observe boundary wave pulses including their superluminal speeds.

FTuP • Optical Access—Continued

FTuP3 • 2:15 p.m. Invited

Principal Modes in Graded-Index Multimode Fibers, *Mahdieh Shemirani, Joseph Kahn; Stanford Univ., USA.* We model multimode propagation, including spatial- and polarization-mode coupling. At low coupling, the impulse response is polarization-dependent; differential mode delays (DMDs) scale linearly with length. At high coupling, DMDs scale as the square-root of length.

FTuP4 • 2:45 p.m.

Beyond 100 Gb/s Transmission over Graded-Index Plastic Optical Fiber (GI-POF) Links, *Ivan B. Djordjevic[1], Lei Xu[2], Ting Wang[2]; [1]Univ. of Arizona, USA, [2]NEC Labs, USA.* We present a power-variable-rate-adaptive LDPC-coded-OFDM scheme, suitable for communication over GI-POF-links. We demonstrate that channel-capacity can be closely approached with proposed scheme. We show that transmission at 100Gb/s over 500m of perfluorinated-GI-POF-links can be achieved.

FTuQ • Light in the Eye—Continued

FTuQ2 • 2:15 p.m. Invited

Unexpected Retinal Damage below the ANSI Standard, *Jennifer Hunter[1], Jessica I. W. Morgan[2], William H. Merigan[1], David R. Williams[2]; [1]Univ. of Rochester, USA, [2]Univ. of Pennsylvania, USA.* Using a fluorescence-equipped adaptive optics scanning laser ophthalmoscope, we have discovered retinal changes in the *in vivo* macaque retina resulting from exposure to visible light at levels below the ANSI maximum permissible exposure.

FTuQ3 • 2:45 p.m. Invited

Light Exposure and the Retina, *Jacque Duncan; Univ. of California at San Francisco, USA.* Exposure to light is necessary to initiate phototransduction, the first step in visual perception. However, the risk that excessive exposure to light poses to retinal cells must be considered when developing new ocular imaging modalities.

For Fall Congress presentations on Tuesday, see pages 116-124.

FiO

FTuR • Rogue Waves and Related Phenomena—Continued

FTuR3 • 2:30 p.m. Invited

Methods for Simulating Rare Events in Optical Systems, *Gino Biondini[1], Richard O. Moore[2]; [1]SUNY Buffalo, USA, [2]New Jersey Inst. of Technology, USA.* We describe the application of importance sampling techniques to improve the efficiency of Monte Carlo computations of various rare event probabilities, including phase deviations in soliton-based communications and frequency comb generation.

FTuS • Short Wavelength Generation and Applications I: From EUV to X-Rays—Continued

FTuS2 • 2:15 p.m.

Table Top Schemes for Nano-Patterning with Extreme Ultraviolet Lasers, *Lukasz Urbanski[1], Przemyslaw W. Wachulak[1], Artak Isoyan[2], Fan Jian[2], Yang-Chun Cheng[2], Jorge J. Rocca[1], Carmen S. Menoni[1], Mario C. Marconi[1], Franco Cerrina[2]; [1]Colorado State Univ., USA, [2]Univ. of Wisconsin-Madison, USA.* We discuss different nanopatterning approaches using table top extreme ultraviolet lasers based on interferometric lithography, Talbot self imaging and holographic projection lithography.

FTuS3 • 2:30 p.m. Invited

High Brightness Plasma-Based Soft X-Ray Lasers and Applications, *James Dunn; Lawrence Livermore Natl. Lab, USA.* Plasma-based X-ray lasers are ultrabright, compact sources with continued improvements in efficiency, output energy, repetition rate, coherence and related characteristics. Results are presented for recent developments in sources and applications.

LS

LSTuG • Optoelectronic Materials Characterization—Continued

LSTuG3 • 2:15 p.m.

Coherent Acoustic Phonon Generation in Exciton Self-Trapping: Dependence on Coupling Strength, *Jason Mance, F. X. Morrissey, Susan L. Dexheimer; Washington State Univ., USA.* The dynamics of self-trapped exciton formation are studied in quasi-one-dimensional systems using femtosecond impulsive excitation techniques. Low temperature measurements reveal the generation of coherent acoustic waves associated with the formation of the localized lattice deformation.

LSTuG4 • 2:30 p.m.

Light-Induced Tuning and Enhancement of Two Photon Absorption in Bulk Semiconductor Single Crystal, *Adarsh Kumaran Nair Valsala Devi[1], Sharon Shwartz[1], Mordechai Segev[1], Lev Chuntonov[2], Zohar Amitay[2], Emil Zolotoyabko[3], Uri El-Hanany[4]; [1]Physics Dept., Technion-Israel Inst. of Technology, Israel, [2]Dept. of Chemistry, Technion-Israel Inst. of Technology, Israel, [3]Dept. of Materials Engineering, Technion-Israel Inst. of Technology, Israel, [4]43C Gordon St., Israel.* We demonstrate a light-induced method to enhance, control, and tune two-photon-absorption in bulk CZT:V crystals. The technique is reversible in real-time, and enhancement scales linearly with control-beam intensity, reaching 2.5 times of the original values.

LSTuG5 • 2:45 p.m.

Disorder-Mediated Dispersive Transport in a-SiGe Studied by Time-Resolved Terahertz Spectroscopy, *C. R. Hamner, Susan L. Dexheimer; Washington State Univ., USA.* Photo-excited carrier dynamics in a-SiGe:H are studied using optical-pump/terahertz-probe spectroscopy. We find dynamics that are dominated by dispersive transport with a time-dependent mobility that varies systematically with the degree of disorder in the material.

LSTuH • Cavity Optomechanics III—Continued

LSTuH3 • 2:30 p.m. Invited

Exploring the Quantum Limit in Gravitational Wave Detection, *Nergis Mavalvala; MIT, USA.* We describe experiments in which radiation pressure forces are used to optically trap and cool macroscopic oscillators, and discuss applications of this technique to gravitational-wave detection, and to observation of quantum effects involving macroscopic mechanical oscillators.

LSTuI • High Field Dynamics I—Continued

LSTuI3 • 2:30 p.m. Invited

Probing Coupled Electronic and Nuclear Dynamics Using Coherent Electrons and X-Rays, *Wen Li[1], Xibin Zhou[1], Robynne Lock[1], Serguei Patchkovskii[2], Albert Stolow[2], Etienne Gagnon[1], Arvinder Sandhu[1], Robin Santra[3], Phay Ho[3], Vandana Sharma[1], Craig W. Hogle[1], Predrag Ranitovic[4], C. Lewis Cocke[4], Margaret Murnane[1], Henry C. Kapteyn[1]; [1]JILA, Univ. of Colorado at Boulder, USA, [2]Natl. Res. Council Canada, Canada, [3]Argonne Natl. Lab, USA, [4]Kansas State Univ., USA.* I will present three studies in which the coupled electronic and nuclear dynamics in molecules are probed using high harmonic generation (HHG), HHG-based ultrashort X-ray laser and strong field ionization.

For Fall Congress presentations on Tuesday, see pages 116-124.

FTuN • Negative Index Materials and Cloaking—Continued

FTuN6 • 3:00 p.m.
Photorealistic Rendering of Metamaterials, Gradient Index Devices, and Polarization-Dependent Invisibility Cloaks, *Aaron J. Danner; Natl. Univ. of Singapore, Singapore.* Visually stunning depictions of devices such as invisibility cloaks in action are useful in assessing performance of imperfect metamaterials proposed for their fabrication. A comprehensive study on the invisible sphere will be presented.

FTuN7 • 3:15 p.m.
Mixing Plasmonic Cloaking with Second-Order Optical Nonlinearity, *Uday Chettiar, Nader Engheta; Univ. of Pennsylvania, USA.* Using plasmonic cloaks around second-order nonlinear optical materials, we theoretically show that relative values of second-harmonic induced dipoles can be enhanced as compared with uncloaked scenarios, while having relatively low scattering at the fundamental frequency.

FTuO • Diffractive and Holographic Optics II—Continued

FTuO6 • 3:00 p.m.
Reflection Phase Gratings: An Elegant Way of THz Beam Multiplexing, *Vishal S. Jagtap, Annick F. Dégardin, Alain J. Kreisler; SUPELEC/LGEP; CNRS/UMR-8507; UPMC Univ. Paris 06; Univ Paris-Sud 11, France.* Reflection phase gratings offer great potential as local oscillator beam multiplexer in heterodyne receiving passive terahertz imaging array. Using phase-retrieval algorithm, high diffraction efficiencies were achieved for three, four and five beam 1-D multiplexers.

FTuO7 • 3:15 p.m.
Improvements of Aperiodic Rigorous Coupled Wave Analysis, *Pavel Kwiecien, Ivan Richter; Faculty of Nuclear Sciences and Physical Engineering, Czech Technical Univ., Czech Republic.* Recent improvements and extensions of the aperiodic rigorous coupled wave analysis as the efficient and robust numerical frequency domain method for simulating the behavior of advanced photonic structures are discussed and demonstrated on several examples.

FTuP • Optical Access—Continued

FTuP5 • 3:00 p.m.
Dispersion Model of Two Simultaneously Propagating Spatial Domain Multiplexing (SDM) Channels of Same Wavelength in Step Index Multimode Fibers, *Syed H. Murshid, Abhijit Chakravarty; Florida Inst. of Technology, USA.* Spatial domain multiplexing allows co-propagation of spatially separated channels of same wavelength over a single strand of step index multimode fiber. Dispersion model for spatially multiplexed helically propagating channels is presented.

FTuQ • Light in the Eye—Continued

FTuQ4 • 3:15 p.m.
A Rat Eye Model for Studying and Treating Age-Related Macular Degeneration, *Melanie C. W. Campbell[1,2], Aden Seaman[1], Dafna Sussman[1,2], Mark Bird[1,2], Marsha L. Kisilak[1], Christopher J. Cookson[1], Kostadinka Bizheva[1,2], Laura Gowing[1], Kaitlin Bunghardt[1]; [1]Univ. of Waterloo, Canada, [2]Guelph Waterloo Physics Inst., Canada.* The rat eye model of age-related macular degeneration can give both high resolution imaging of fundus structures and localized light delivery in potential therapies. We induced and tracked AMD-like damage *in vivo*.

3:30 p.m.–4:00 p.m. Coffee Break/Exhibits, *Imperial Ballroom, Fairmont Hotel*

3:30 p.m.–5:30 p.m. Meet the Editors of the APS Journals, *Bamboo Lounge, Fairmont Hotel*

4:30 p.m.–5:30 p.m. Minorities and Women in OSA (MWOSA) Tea, *Sainte Claire Room, Sainte Claire Hotel*

NOTES

For Fall Congress presentations on Tuesday, see pages 116-124.

FTuR • Rogue Waves and Related Phenomena—Continued

FTuR4 • 3:00 p.m.
Spectral Dependence of Spatially-Incoherent Modulation Instability, *Can Sun, Dmitry V. Dylov, Jason W. Fleischer; Princeton Univ., USA.* We present the first experimental study of spatially-incoherent modulation instability for different spectral distributions. Characteristic behavior depends sensitively on the underlying profiles. The setup and results introduce a new experimental degree-of-freedom into nonlinear statistical optics.

FTuR5 • 3:15 p.m.
Characterisation and Optimisation of the Soliton Self-Frequency Shift in Photonic Crystal Fibres, *Ravi Pant, Alexander Judge, Eric C. Mägi, Boris T. Kuhlmey, Martijn de Sterke, Benjamin J. Eggleton; CUDOS, IPOS, Univ. of Sydney, Australia.* We develop a simple model to analyze the self-frequency shift in optical fibers. We use it to predict the frequency shift in two different fibers, and confirm the prediction by experiment and full numerical simulations.

FTuS • Short Wavelength Generation and Applications I: From EUV to X-Rays—Continued

FTuS4 • 3:00 p.m.
The Role of the Phase Locking Phenomenon in the Second and Third Harmonics Cavity Localization, *Vito Roppo[1,2], Crina M. Cojocaru[1], Giuseppe d'Aguanno[2], Fabrice Raineri[3], Rama Raj[3], Jose F. Trull[1], Ramon Vilaseca[1], Michael Scalora[2]; [1]Univ. Politècnica de Catalunya, Spain, [2]C. M. Bowden Res. Facility, USA, [3]Lab de Photonique et de Nanostructures, France.* We theoretically and experimentally study how the phase-locking mechanism changes effective dispersion of the medium at the harmonic frequencies making them become localized inside an opaque cavity designed to be resonant for the fundamental field.

LSTuG • Optoelectronic Materials Characterization—Continued

LSTuG6 • 3:00 p.m.
Synthesis and Characterization of Nanospherical Hydroxyapatite Using SDS as Template, *Michael S. L. Shanthi[1], M. Ashok[1], T. Balasubramanian[1], R. V. Mangalaraja[2]; [1]Dept. of Physics, Natl. Inst. of Technology, India, [2]Dept. of Materials Engineering, Univ. of Concepcion, Chile.* Spherical nano crystalline hydroxyapatite with diameter ~200 nm has been prepared by co-precipitation method. FTIR and XRD pattern confirmed the phase of HAp. The results obtained from SEM and EDS analysis also discussed.

LSTuG7 • 3:15 p.m. Invited
New Aspects of Nanocrystal Lasing, *Victor I. Klimov; Los Alamos Natl. Lab, USA.* In this talk, I will review our recent spectroscopic studies of specially engineered core-shell nanocrystals that exhibit a significant suppression of Auger recombination. This property greatly simplifies real-life applications of colloidal nanoparticles in lasing technologies.

LSTuH • Cavity Optomechanics III—Continued

LSTuH4 • 3:00 p.m. Invited
Silicon Optomechanics, *Hong X. Tang; Yale Univ., USA.* We demonstrate the convergence of silicon nanomechanics and nanophotonics by building silicon based optomechanical devices that operate on optical forces. Practical routes to optomechanical cooling and amplifications via circuit coupled optomechanical cavities will be discussed.

LSTuI • High Field Dynamics I—Continued

LSTuI4 • 3:00 p.m.
Ultrafast All-Optical Switching of Bistable Semiconductor Ring Lasers, *J. Javaloyes[1], A. Trita[2], G. Mezosi[1], F. Bragheri[2], I. Cristiani[2], G. Giuliani[2], M. Sorel[1], A. Scire[3], S. Balle[3]; [1]Univ. of Glasgow, UK, [2]Univ. di Pavia, Italy, [3]CSIC, Spain.* We have investigated the all-optical switching properties of bi-stable semiconductor ring lasers acting as a logic memory element. Theoretical results are in agreement with experiments on fabricated devices. Switching times of few ps are attained.

LSTuI5 • 3:15 p.m.
All-Optical Switch Using Recoil Resonances in Cold Atoms, *G. R. White[1], D. Duncan[1], J. P. Davis[2], F. A. Narducci[2]; [1]Aerospace Mass Properties Analysis, USA, [2]Naval Air Systems Command, USA.* We describe a technique by which optical switching between two non-collinear beams can be achieved using recoil resonances in cold atoms. We experimentally demonstrate this technique and explore the fundamental limitations to the switching speed.

3:30 p.m.–4:00 p.m. Coffee Break/Exhibits, *Imperial Ballroom, Fairmont Hotel*

3:30 p.m.–5:30 p.m. Meet the Editors of the APS Journals, *Bamboo Lounge, Fairmont Hotel*

4:30 p.m.–5:30 p.m. Minorities and Women in OSA (MWOSA) Tea, *Sainte Claire Room, Sainte Claire Hotel*

NOTES

For Fall Congress presentations on Tuesday, see pages 116-124.

4:00 p.m.–5:30 p.m.
FTuT • Emerging 3-D Display Technologies and Research Frontiers II

Brian Schowengerdt; Univ. of Washington, USA, Presider

FTuT1 • 4:00 p.m. Invited

Large Area 3-D Updateable Holographic Displays Using Photorefractive Polymers, *Nasser Peyghambarian; Univ. of Arizona, USA.* Photorefractive polymers are shown to be suitable for large area dynamic 3-D holographic display. We have demonstrated 6"x 6" updateable 3-D displays that can be erased and rewritten many times.

FTuT2 • 4:30 p.m. Invited

Progress in Volumetric Three-Dimensional Displays and Their Applications, *Gregg E. Favalora; Actuality Systems Inc., USA.* Volumetric displays create volume-filling 3-D imagery, usually with full parallax and a wide viewing angle. Widespread commercial adoption has not yet occurred, but may add value to fields such as medical imaging and petroleum exploration.

4:00 p.m.–5:30 p.m.
FTuU • Wavefront Design for Information Transport and Sensing II

Olga Korotkova; Univ. of Miami, USA, Presider

FTuU1 • 4:00 p.m. Invited

SLM Microscopy: Wavefront Shaping for Microscopy with Spatial Light Modulators, *Monika Ritsch-Marte; Innsbruck Medical Univ., Austria.* We present applications of spatial light modulators (SLMs) placed either in the imaging path or in the illumination path of a microscope allowing, for instance, the emulation of various phase contrast techniques.

FTuU2 • 4:30 p.m. Invited

Optimal Transmission of Light through Disordered Materials, *Allard Mosk; Univ. of Twente, Netherlands.* Disordered photonic materials scatter and blur incident light. By controlling the incident wavefront, we show it is possible to focus light through and even inside such materials. The focusing resolution can be surprisingly high.

4:00 p.m.–5:30 p.m.
FTuV • Metamaterials in Emerging Technologies

Yanina Shevchenko; Carleton Univ., Canada, Presider

FTuV1 • 4:00 p.m. Invited

Role of Surface Plasmon Polariton in the Diffraction of a Metal Nano-Slit, *Yann Gravel, Yunlong Sheng; Univ. Laval, Canada.* Closed-form rigorous solution of the Maxwell's equations for the transit surface plasmons polariton launched by incident beam on a nano-slit is obtained, which should be taken into account in the design of nano-optical integrated circuits.

FTuV2 • 4:30 p.m.

Fabrication of High Aspect Ratio Optical Light Pipes, *Winnie N. Ye[1], Peter Duane[2], Munib Wober[2], Kenneth B. Crozier[1]; [1]Harvard Univ., USA, [2]Zena Technologies Inc., USA.* We report fabrication techniques for high aspect ratio vertical light pipes in a 10μm thick SiO_2 layer. Light pipes with an aspect ratio of 2.8:1 and a sidewall angle of 89.5 degrees were demonstrated.

4:00 p.m.–5:30 p.m.
FTuW • All-Optical Signal Processing II

Inuk Kang; Bell Labs, Alcatel Lucent, USA, Presider

FTuW1 • 4:00 p.m. Invited

All-Optical Header Processing Using Semiconductor Optical Amplifiers, *Roderick P. Webb[1], X. Yang[2], R. J. Manning[1], G. D. Maxwell[3], A. J. Poustie[3], S. Lardenois[3], D. Cotter[1]; [1]Tyndall Natl. Inst., Univ. College Cork, Ireland, [2]School of Electrical Engineering, Bangor Univ., UK, [3]CIP Technologies, UK.* A pattern recognition system comprising three SOA-based logic gates locates programmable patterns of arbitrary length in 42Gb/s data. It will provide initial screening in an optoelectronic firewall being developed to protect future optical packet-based networks.

FTuW2 • 4:30 p.m.

Physical Origin of Data Pattern Inversion in Optical Injection-Locked VCSELs, *Weijian Yang[1], Peng Guo[1,2], Devang Parekh[1], Werner Hofmann[1], Markus C. Amann[4], Connie J. Chang-Hasnain[1]; [1]Dept. of Electrical Engineering and Computer Sciences, Univ. of California at Berkeley, USA, [2]State Key Lab of Advanced Optical Communication Systems and Networks, School of Electronics Engineering and Computer Science, Peking Univ., China, [3]Walter Schottky Inst., Technical Univ. of Munich, Germany.* The physical origin and criteria for adjustable data pattern inversion in optical injection locked VCSELs are explained with a novel model including the interference effect of master laser reflection. Simulation results agree well with experiments.

4:00 p.m.–5:30 p.m.
FTuX • Novel Optics of Periodic Structures

Ofer Shapira; MIT, USA, Presider

FTuX1 • 4:00 p.m.

Above-Threshold Analysis of Large-Area, High-Power, Vertically-Emitting Circular Bragg Lasers, *Xiankai Sun, Amnon Yariv; Caltech, USA.* An exact energy relation is derived for the vertically-emitting circular Bragg lasers. By including gain saturation effects, the modal pump level and energy conversion efficiency are compared between different types of lasers in above-threshold operation.

FTuX2 • 4:15 p.m.

Demonstration of Optically-Induced Three-Dimensional Photonic Lattices and Enhanced Discrete Diffraction, *Peng Zhang[1], Robert Egger[1], Zhigang Chen[1,2]; [1]San Francisco State Univ., USA, [2]Nankai Univ., China.* We report on the first experimental demonstration of reconfigurable three-dimensional photonic lattices by employing the optical induction technique. Enhanced discrete diffraction due to the waveguide modulation and coupling in such 3-D lattices is successfully observed.

FTuX3 • 4:30 p.m.

Observation of Terahertz π-Phase Shift in an Undoped PPLN Induced by External Magnetic Field, *Guohong Ma[1], Jielong Shi[1], Qibiao Zhu[1], Chunfang Li[1], Qi Wang[1], Weiming Liu[2], Sing Hai Tang[2]; [1]Shanghai Univ., China, [2]Natl. Univ. of Singapore, Singapore.* Magnetic field dependence of terahertz wave generation in PPLN crystal was investigated. A π phase shift occurs in an un-doped PPLN under magnetic field at ~ 0.45 T due to photorefractive effect in PPLN crystal.

For Fall Congress presentations on Tuesday, see pages 116-124.

FiO

4:00 p.m.–5:45 p.m.
FTuY • Optical Biosensing
Andrew K. Dunn; Univ. of Texas at Austin, USA, Presider

FTuY1 • 4:00 p.m.
Guided-Mode Resonance Biochemical Sensor Technology, *Robert Magnusson[1], Debra Wawro[2], Yiwu Ding[2]; [1]Univ. of Texas at Arlington, USA, [2]Resonant Sensors Inc., USA.* Optical leaky-mode resonance effects associated with periodic waveguides are reviewed and their application potential in biosensing is explained. Use of resonant sensors for label-free biochemical monitoring is described. Novel transmission-based sensor designs are discussed.

FTuY2 • 4:15 p.m.
Confocal Fluorescence Detection Using a Zone Plate Array in a Microfluidic Drop Splitter, *Ethan F. Schonbrun, Adam R. Abate, Paul Steinvurzel, David A. Weitz, Kenneth B. Crozier; Harvard Univ., USA.* By parallelizing both the optics and the microfluidics, we present a fluorescence measurement system capable of extremely high throughput. The system produces approximately 52,000 discrete fluorescence measurements per second.

FTuY3 • 4:30 p.m. Invited
Designing Interfaces for Optical Biosensors, *Ashutosh Chilkoti; Duke Univ., USA.* I will describe a label-free-biosensor that exploits the local surface-plasmon-resonance of noble metal nanostructures; and a polymer-brush-interface on glass that abolishes non-specific adsorption leading to a femtomolar limit-of-detection of protein analytes in whole blood.

4:00 p.m.–5:30 p.m.
FTuZ • Short Wavelength Generation and Applications II: Spectroscopy and Microscopy
Martin Richardson; Univ. of Central Florida, USA, Presider

FTuZ1 • 4:00 p.m. Invited
Coherent X-Rays from Ultrafast Lasers, and Applications—Attosecond Science Meets Nonlinear Optics, *Henry C. Kapteyn, Margaret M. Murnane; JILA, Univ. of Colorado at Boulder, USA.* Ultrafast short-wavelength light sources using high-harmonic generation provides a tabletop coherent EUV light source for new science. Recent rapid advances show that bright sources at soft and even hard X-ray wavelengths are now feasible.

FTuZ2 • 4:30 p.m. Invited
Nanoscale Microscopy with Table-Top Extreme Ultraviolet Lasers, *C. S. Menoni[1], F. Brizuela[1], C. Brewer[1], Y. Wang[1], F. Pedaci[1], B. M. Luther[1], W. Chao[1,2], E. H. Anderson[1,2], D. T. Attwood[1,2], A. V. Vinogradov[3], I. A. Artioukov[3], A. G. Ponomareko[4], V. V. Kondratenko[4], M. C. Marconi[1], J. J. Rocca[1,4]; [1]Colorado State Univ., USA, [2]Lawrence Berkeley Natl. Lab, Univ. of California, USA, [3]P. N. Lebedev Physical Inst., Russian Acad. of Sciences, Russian Federation, [4]Technical Univ., Ukraine.* We describe the successful implementation of full-field microscopes based on λ=13.2 nm and λ= 46.9 nm table-top lasers that can image nanostructures in transmission and reflection modes with a spatial resolution of ~50 nm.

LS

4:00 p.m.–5:30 p.m.
LSTuJ • Photophysics of Quantum Dots and Nanostructures II
Michael Barnes; University of Massachusetts at Amherst, USA, Presider

LSTuJ1 • 4:00 p.m. Invited
Quantum Dots, Experiments, Theory, Predictions, Tests and Unknowns, *Rudolph A. Marcus; Caltech, USA.* There is now a substantial body of data on the intermittent fluorescence of quantum dots (QD), such as CdSe.

LSTuJ2 • 4:30 p.m.
Photoluminescence from Single Quantum Dot/Organic Nanostructures: Ligand Effects on PL Dynamics, *Kevin T. Early, Michael Y. Odoi, Pallikkara K. Sudeep, Todd S. Emrick, Michael D. Barnes; Univ. of Massachusetts Amherst, USA.* The photoluminescence dynamics and saturation profiles of quantum dot/organic composites have been studied at the single particle level. We find strong evidence for multiexcitonic character in photoexcited particles arising from ligands coordinated to the surface.

4:00 p.m.–5:15 p.m.
LSTuK • Cavity Optomechanics IV
Hong Tang; Yale Univ., USA, Presider

LSTuK1 • 4:00 p.m. Invited
Optomechanical Correlations between Light and Mirrors, *A. Heidmann, P. Verlot, A. Tavernarakis, C. Molinelli, A. Kuhn, T. Briant, P.-F. Cohadon; Lab Kastler Brossel, École Normale Supérieure, Univ. Pierre et Marie Curie, CNRS, France.* We observed optomechanical correlations induced by radiation pressure between a light beam and the resulting mirror displacements. This scheme can be extended down to the quantum level, with applications in high-sensitivity measurements and quantum optics.

LSTuK2 • 4:30 p.m. Invited
Resolved-Sideband Laser Cooling and Measurement of a Micromechanical Oscillator Close to the Quantum Limit, *Tobias J. Kippenberg[1,2]; [1]Swiss Federal Inst. of Technology Lausanne (EFPL), Switzerland; [2]Max-Planck-Inst. of Quantum Optics, Germany.* Abstract not available.

4:00 p.m.–5:45 p.m.
LSTuL • High Field Dynamics II
Markus Guehr; SLAC Natl. Accelerator Lab, Stanford Univ., USA, Presider

LSTuL1 • 4:00 p.m. Invited
First Science with the LCLS X-Ray Free Electron Laser, *John D. Bozek; SLAC Natl. Accelerator Lab, Stanford Univ., USA.* Abstract not available.

LSTuL2 • 4:30 p.m.
Trojan-Like Wavepackets on 8-Shaped Orbits in Linearly Polarized Electromagnetic Field in Hydrogen Ion Molecule, *Matt K. Kalinski; Dept. of Chemistry and Biology, Utah State Univ., USA.* We discover the existence of 8-shaped orbits in the hydrogen ions molecules capable to maintain shape oscillatory wavepackets in linearly polarized field when its frequency is in resonance or twice the frequency of the motion.

For Fall Congress presentations on Tuesday, see pages 116-124.

FTuT • Emerging 3-D Display Technologies and Research Frontiers II—Continued

FTuT3 • 5:00 p.m. Invited

The Coming Generation of Head Worn Displays, *Kevin Thompson[1], James P. McGuire[1], Ozan Cakmakci[1], Jannick P. Rolland[2]; [1]Optical Res. Associates, USA, [2]Inst. of Optics, Univ. of Rochester, USA.* Within the last 5 years, a new generation of HWDs emerged, supporting full see-through augmented reality. The coming generation will bring HD resolution in a bright, low power display combined with freeform surfaces.

FTuU • Wavefront Design for Information Transport and Sensing II—Continued

FTuU3 • 5:00 p.m. Invited

Title to Be Announced, *Aristide Dogariu; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Abstract not available.

FTuV • Metamaterials in Emerging Technologies—Continued

FTuV3 • 4:45 p.m.

A Metamaterial Dielectric Pattern Nanoantenna Featuring Directive Emission QCL Device, *Jing Wu, Hossein Mosallaei; Northeastern Univ., USA.* The focus of this paper is to develop an array of dielectric patterned photonic crystal (PC) integrated with a quantum cascade laser (QCL) device to manipulate the radiation performance. A directive QCL nanoantenna is demonstrated.

FTuV4 • 5:00 p.m.

Plasmonic Nanoantennas Array Enabling Optical Communication, *Shabnam Ghadarghadr, Hossein Mosallaei; Northeastern Univ., USA.* This paper demonstrates a novel approach for designing photonic nanoantennas by placing plasmonic core-shells over an engineered layered-substrate. We illustrate that by manipulating the layered-substrate and antenna radiators one can achieve focused-beams in desired directions.

FTuV5 • 5:15 p.m.

Nonlinear Surface States at the Interface between a Simple Lattice and a Superlattice, *Robert Egger[1], Peng Zhang[1], Fajun Xiao[2], Xiaosheng Wang[1], Jianlin Zhao[2], Zhigang Chen[1,3]; [1]San Francisco State Univ., USA, [2]Northwestern Polytechnical Univ., China, [3]Nankai Univ., China.* We demonstrate nonlinear surface states at the interface between optically-induced simple (periodic) and super (bi-periodic) semi-infinite photonic lattices. Two types of interface solitons (with uniform or staggered phase) were observed depending on the excitation location.

FTuW • All-Optical Signal Processing II—Continued

FTuW3 • 4:45 p.m.

Spectral Phase Conjugation Using Temporal Imaging, *Onur Kuzucu, Yoshitomo Okawachi, Reza Salem, Mark A. Foster, Alexander L. Gaeta, Amy C. Turner-Foster, Michal Lipson; Cornell Univ., USA.* We demonstrate spectral phase conjugation with a temporal imaging system based on broadband four-wave mixing in silicon waveguides. Excellent compensation is observed for second- and third-order dispersion and self-phase modulation in optical fibers.

FTuW4 • 5:00 p.m.

Wavelength Conversion Using Counter-Propagating Signals in an SOA-DI Wavelength Converter, *Shaochun Cao, Julian Noad; Communications Res. Ctr. Canada, Canada.* We have compared simulation results of wavelength conversion using counter-propagating signals with those using co-propagating signals in an SOA-DI device and showed that the counter-propagating signals yield almost the same performance as the co-propagating signals.

FTuW5 • 5:15 p.m.

All-Optical Ultra-Fast Arithmetic Units Using Nonlinear Optical Materials, *Abdallah K. Cherri, Ayman S. Al-Zayed; Kuwait Univ., Kuwait.* All-optical ultra-fast arithmetic circuits are presented using nonlinear optical material. The all-optical proposed circuits use semiconductor optical amplifier and Mach-Zehnder interferometer as switches due to their compact size, thermal stability and low power operation.

FTuX • Novel Optics of Periodic Structures—Continued

FTuX4 • 4:45 p.m.

Nonreciprocal Goos-Hänchen Shift on Oblique Incidence Reflection off Antiferromagnets, *Thomas Dumelow[1,2], Francinete Lima[2,3], José A. P. da Costa[1], Eudenilson L. Albuquerque[2]; [1]Univ. do Estado do Rio Grande do Norte, Brazil, [2]Dept. de Física, Univ. Federal do Rio Grande do Norte, Brazil, [3]Escola Agrícola de Jundaí, Univ. Federal do Rio Grande do Norte, Brazil.* We investigate a lateral shift of the reflected beam on reflection, at oblique incidence, off an antiferromagnet in an external magnetic field. This shift is nonreciprocal, and depends on the direction of the applied field.

FTuX5 • 5:00 p.m.

Band Structure Calculation of Photonic Crystal Structures Fabricated via Multi-Beam-Interference Lithography, *Justin L. Stay, Thomas K. Gaylord; Georgia Tech, USA.* The band structures of both 2-D and 3-D photonic crystal structures defined via multi-beam-interference lithography are calculated theoretically. Examples of 2-D and 3-D structures with complete band gaps are presented.

FTuX6 • 5:15 p.m.

Liquid Crystal Assisted Slow Light Propagation in Photonic Crystal and Device Application, *Swati Rawal, Ravindra K. Sinha; Delhi College of Engineering, Univ. of Delhi, India.* We propose an elliptical air hole silicon-on-insulator photonic crystal waveguide based on liquid crystal infiltration for slow group velocity. It is also investigated for its application as an optical buffer and for time/wavelength division de-multiplexing.

6:00 p.m.–7:00 p.m. OSA Annual Business Meeting, *Piedmont Room, Fairmont Hotel*

6:00 p.m.–7:00 p.m. DLS Annual Business Meeting, *California Room, Fairmont Hotel*

7:00 p.m.–8:30 p.m. OSA Member Reception, *Ballroom, Sainte Claire Hotel*

7:00 p.m.–10:00 p.m. Laser Science Banquet, *Gordon Biersch, 33 East San Fernando Street, San Jose, California, Phone: 408.294.6785*

For Fall Congress presentations on Tuesday, see pages 116-124.

FTuY • Optical Biosensing—Continued

FTuY4 • 5:00 p.m.
Label-Free Screening of Protein Binding to Small Molecule Compound Microarray with a High-throughput Optical Scanning Microscope, *James P. Landry, Yiyan Fei, Yung-Shin Sun, Juntao Luo, Kit S. Lam, Xiangdong Zhu; Univ. of California at Davis, USA.* Using a label-free high-throughput optical scanning microscope we detected endpoints and binding kinetics of vascular endothelial growth factor (VEGF) protein with microarrays of small molecule compounds from the NCI Developmental Therapeutics Program.

FTuY5 • 5:15 p.m.
Spectral Characterization of the Voltage-Sensitive Dye di-4-ANEPPDHQ Applied to Probing Live GT1-7 Neurons, *Yu Wang[1], Gaoshan Jing[2], Svetlana Tatic-Lucic[2], Susan Perry[3], Filbert Bartoli[1]; [1]Ctr. for Optical Technologies, Dept. of Electrical and Computer Engineering, Lehigh Univ., USA, [2]Sherman Fairchild Ctr., Dept. of Electrical and Computer Engineering, Lehigh Univ., USA, [3]Dept. of Chemical Engineering, Lehigh Univ., USA.* The voltage-sensitive dye di-4-ANEPPDHQ was spectrally characterized in various solutions and in GT1-7 neurons. Its spectra depend on the local chemical and electrical environment. The excitation and emission bands are 430-515nm and 550-640nm for GT1-7.

FTuY6 • 5:30 p.m.
Broad-Beam Fluctuation Spectroscopy for Non-Flow Cytometry and Clinical Diagnostics, *Eben Olson, Richard Torres, Michael J. Levene; Yale Univ., USA.* We present a novel scanning fluctuation spectroscopy system, which we term Broad-beam Scanning Fluctuation Spectroscopy, for performing cytometry. BSFS is a viable alternative to flow cytometry for a wide variety of cell-based clinical diagnostics.

FTuZ • Short Wavelength Generation and Applications II: Spectroscopy and Microscopy—Continued

FTuZ3 • 5:00 p.m. Invited
Extreme High Harmonics from Relativistically Oscillating Surfaces, *Matt Zepf; Queen's Univ. Belfast, Ireland.* Relativistically oscillating surfaces have developed are poised to provide a step change in the performance of attosecond pulses, by providing a route to achieving both extreme brightness and photon energies extending to many keV.

LSTuJ • Photophysics of Quantum Dots and Nanostructures II—Continued

LSTuJ3 • 4:45 p.m.
Photon Antibunching from Hybrid Quantum Dot/Conjugated Organic Composite Nanostructures, *Michael Y. Odoi, Kevin T. Early, Pallikkara K. Sudeep, Todd S. Emrick, Michael D. Barnes; Univ. of Massachusetts, USA.* We have studied the photo-physical properties of isolated CdSe-OPV hybrid nanostructures with photon-pair correlation spectroscopy. We observed a strong wavelength dependent multi-excitonic emission by tuning the excitation in and out of the ligand absorption.

LSTuJ4 • 5:00 p.m. Invited
Non-Blinking Semiconductor Nanocrystals, *Xiaoyong Wang[1], Xiaofan Ren[2], Keith Kahen[2], Megan A. Hahn[1], Manju Rajeswaran[2], Sara Maccagnano-Zacher[3], John Silcox[3], George E. Cragg[4], Alexander L. Efros[4], Todd Krauss[1,5]; [1]Univ. of Rochester, USA, [2]Eastman Kodak Co., USA, [3]Cornell Univ., USA, [4]NRL, USA, [5]Inst. of Optics, Univ. of Rochester, USA.* The photoluminescence from single semiconductor nano-crystals exhibits intensity fluctuations, known as "blinking." We will discuss core-shell CdZnSe/ZnSe nano-crystals that exhibit continuous, non-blinking photoluminescence, and how these nano-crystals may enable breakthroughs in photonics applications.

LSTuK • Cavity Optomechanics IV—Continued

LSTuK3 • 5:00 p.m.
Squeezing of a Nanomechanical Oscillator, *Sumei Huang, Girish S. Agarwal; Oklahoma State Univ., USA.* We show squeezing of a nanomechanical mirror can be generated by injecting squeezed vacuum light and laser into the cavity in the resolved sideband regime. We can obtain more than 70% squeezing.

LSTuL • High Field Dynamics II—Continued

LSTuL3 • 4:45 p.m. Invited
X-Ray Probing of High Field Ionization in the Attosecond Limit, *Stephen R. Leone; Lawrence Berkeley Natl. Lab, Univ. of California at Berkeley, USA.* High order harmonics of a Ti:Sapphire laser are used to investigate high field ionization and dissociative ionization by the method of time-resolved X-ray core level spectroscopic transient absorption down to femtosecond and attosecond time limits.

LSTuL4 • 5:15 p.m Invited
Ptychographic Imaging in Materials and Life Sciences, *Andreas Menzel[1], Cameron M. Kewish[1], Pierre Thibault[1], Martin Dierolf[2], Franz Pfeiffer[2], Oliver Bunk[1]; [1]Paul Scherrer Inst., Switzerland, [2]Technische Univ. München, Germany.* Coherent diffractive imaging promises ultimate resolution in X-ray microscopy, and the use of ptychographic methods has proven particularly reliable and robust. Applications in materials and life sciences will be discussed.

6:00 p.m.–7:00 p.m. OSA Annual Business Meeting, *Piedmont Room, Fairmont Hotel*

6:00 p.m.–7:00 p.m. DLS Annual Business Meeting, *California Room, Fairmont Hotel*

7:00 p.m.–8:30 p.m. OSA Member Reception, *Ballroom, Sainte Claire Hotel*

7:00 p.m.–10:00 p.m. Laser Science Banquet, *Gordon Biersch, 33 East San Fernando Street, San Jose, California, Phone: 408.294.6785*

For Fall Congress presentations on Tuesday, see pages 116-124.

FiO

8:00 a.m.–10:00 a.m.
FWA • Biomedical Applications of Ultrafast Lasers
Csaba Toth; Lawrence Berkeley Natl. Lab, USA, Presider

FWA1 • 8:00 a.m. Invited

Nanosurgery with Femtosecond Lasers, *Samuel Chung, Valeria Nuzzo, Eric Mazur; Harvard Univ., USA.* Femtosecond laser pulses make it possible to ablate cell structures at the submicrometer scale. We apply this technique to study biological processes in living cells and to help identify the function of neurons in nematodes.

FWA2 • 8:30 a.m. Invited

Improvements in Two-Photon Fluorescence Microscopy, *Kengyeh K. Chu, Tom Bifano, Jerome Mertz; Boston Univ., USA.* We present a technique called differential aberration imaging (DAI) to improve the performance of two-photon microscopy. Theory and experimental results are presented.

8:00 a.m.–10:00 a.m.
FWB • Optical Information Processing and Transport in the Age of Nanophotonics and Metamaterials
Kevin Kelly; Rice Univ., USA, Presider

FWB1 • 8:00 a.m. Invited

Optofluidic Nano-Plasmonics for Biochemical Sensing, *Yeshaiahu Fainman, Lin Pang, Boris Slutsky, Joanna Ptasinski; Univ. of California at San Diego, USA.* We explore metal-dielectric nano-plasmonic structures for localization and resonant transmission of optical fields, investigate fabrication and integration of optofluidic nano-plasmonic systems and explore their applications for biochemical sensing.

FWB2 • 8:30 a.m.

Protocol for Obtaining Noise-Immune Absolute Ellipsometric Measurements with High Spatial Resolution, *Santosh Tripathi, Kimani C. Toussaint, Jr.; Univ. of Illinois at Urbana-Champaign, USA.* A protocol that utilizes Stokes parameters and inverse methods for obtaining noise immune absolute ellipsometric measurements with high spatial resolution is proposed. It is applicable for arbitrary scalar and vector beam inputs.

FWB3 • 8:45 a.m.

Modeling of Quantum Computing Based on Magneto-Optical Elastic Fiber Containing Organic Liquid Core with Aromatic Rings, *Shukhrat Egamov; Samarkand State Univ., Uzbekistan.* Faraday rotation spectra for different transparent liquids were reviewed for data processing applications. Magneto-optical elastic fibers with a core filled by aromatic liquids were used as a model of a basic element of computing devices.

8:00 a.m.–10:00 a.m.
FWC • Extraordinary Transmission and Structured Surface
Zhimin Shi; Inst. of Optics, Univ. of Rochester, USA, Presider

FWC1 • 8:00 a.m.

Resonant Transmission of THz Waves through Rectangular Apertures in Single-Walled Carbon Nanotube Film, *Doo-Jae Park[1], Jin-Young Moon[1], Soonil Lee[1], Rotermund Fabian[1], Yeong-Hwan Ahn[1], Dai-Sik Kim[2]; [1]Ajou Univ., Republic of Korea, [2]Seoul Natl. Univ., Republic of Korea.* We demonstrate fabrication of single-walled carbon nanotube films with good metallic properties and a Drude-like dispersion. Using the films with subwavelength hole arrays, we obtain enhanced terahertz transmission which is assisted by shape resonance.

FWC2 • 8:15 a.m.

Enhanced Transmission in Plasmonic Crystals: Interactions of Cavity Resonance and Surface Mode, *Wan Kuang[1], Alex English[1], Z.-C. Chang[2], Min-Hsiung Shih[3], William B. Knowlton[1], Jeunghoon Lee[1], William L. Hughes[1], Bernard Yurke[1]; [1]Boise State Univ., USA, [2]Natl. Tsing Hua Univ., Taiwan, [3]Academia Sinica, Taiwan.* Transmission of periodically modified Ag film is studied experimentally and numerically. Both cavity resonance and guided surface modes are identified as the sources of enhanced optical transmissions. Their interactions lead to anti-crossing behavior spectrally.

FWC3 • 8:30 a.m. Invited

Terahertz Nanogap Devices for Field Enhancement and Control, *D. S. Kim[1], M. A. Seo[1], H. R. Park[1], J. S. Kyoung[1], S. M. Koo[1], N. K. Park[1], O. K. Suwal[2], S. S. Choi[2]; [1]Seoul Natl. Univ., Republic of Korea, [2]Sun Moon Univ., Republic of Korea.* We show that terahertz electromagnetic waves transmit through λ/10,000 nanogap devices. Both non-resonant and resonant field enhancement are observed in nanogap and nanoantenna. We discuss applications of these structures.

8:00 a.m.–10:00 a.m.
FWD • Turbulence and Other Nonlinear Phenomena
Peter Janssen; European Ctr. for Medium-Range Weather Forecasts, UK, Presider

FWD1 • 8:00 a.m. Invited

Thermodynamic Approach of Statistical Nonlinear Optics, *B. Kibler[1], B. Barviau[1], S. Coen[2], J. Fleischer[3], A. Kudlinski[4], P. Aschieri[5], G. Millot[1], A. Picozzi[1]; [1]Univ. de Bourgogne, France, [2]Univ. of Auckland, New Zealand, [3]Princeton Univ., USA, [4]Univ. de Lille, France, [5]Univ. de Nice Sophia Antipolis, France.* The coherence properties of random nonlinear optical fields can be described in detail by thermodynamic arguments based on the wave turbulence theory. We shall review recent progress on this kinetic approach of statistical nonlinear optics.

FWD2 • 8:30 a.m.

Observation of Soliton Turbulence via Coupled Bump-on-Tail Instabilities, *Dmitry V. Dylov, Can Sun, Jason W. Fleischer; Princeton Univ., USA.* We experimentally observe the algebraic k^{-2} spectrum of soliton turbulence via the coupled interaction of two all-optical bump-on-tail instabilities. The observation confirms predictions of energy equipartition based on wave kinetic theory.

FWD3 • 8:45 a.m.

Universal Correlations in a Nonlinear Periodic 1-D System, *Yaron Silberberg[1], Yoav Lahini[1], Yaron Bromberg[1], Eran Small[1], Roberto Morandotti[2]; [1]Weizmann Inst. of Science, Israel, [2]INRS, Canada.* We study the statistical properties of thermal fields propagating in a nonlinear periodic 1-D lattice. We find that for strong nonlinearities universal field correlations emerge, and experimentally observe a signature of these correlations.

8:00 a.m.–9:45 a.m.
FWE • Novel Fiber Devices II
Jose M. Chavez Boggio; Univ. of California San Diego, USA, Presider

FWE1 • 8:00 a.m. Invited

Multimaterial Fiber Devices and Systems, *Ofer Shapira; MIT, USA.* Recent advances in the development of optoelectronic fibers enabled the fabrication of semiconductor devices over meters-long fiber resulting in a momentous increase in device density, paving the way to unprecedented complex functionalities of fiber systems.

FWE2 • 8:30 a.m.

Fiber Optic Color Synthesizer for Micro Scanning Display, *Hesam Arabi, S. An, K. Oh; Yonsei Univ., Republic of Korea.* In this paper we report a display including of RGB sources, a fiber optic color synthesizer, and a two-dimensional micro scanning mirror. We further report a micro collimator which can enhance image resolution.

FWE3 • 8:45 a.m.

Real-Time SLM for Fiber Excitation, *Edward J. Grace[1], Steffan A. E. Lewis[2]; [1]Imperial College London, UK, [2]GSI Group, UK.* We present a novel technique for direct real-time preferential excitation of fiber modes by use of digital holograms generated on a GPU.

For Fall Congress presentations on Wednesday, see pages 125-131.

FiO

8:00 a.m.–9:45 a.m.
FWF • Photonic Bandgap Devices
Peng Zhang; San Francisco State Univ., USA, Presider

FWF1 • 8:00 a.m. Invited
Why Use Photonic Crystal Fibers for Sensing? *Jonathan Knight; Univ. of Bath, UK.* Optical fibers with holes in them, either in their cladding or forming a core, can be used as fiber sensors. We describe the physics and related technologies enabling new and improved sensor configurations.

FWF2 • 8:30 a.m.
Luminescence of PbS Quantum Dots Entrained in Silica Microstructured Fiber Samples, *E. F. Chillcce, L. C. Barbosa, R. L. Braga, R. E. Ramos-Gonzales, A. C. Bordonalli; Univ. of Campinas, Brazil.* A preliminary luminescence spectral analysis of micro-structured silica fibers whose core regions are surrounded by PbS-core quantum-dots is presented. Dual core fiber samples with different quantum dot sizes and a 785nm pump laser were used.

FWF3 • 8:45 a.m.
Birefringence of Photonic Crystal Fibers with a General Lattice, *Arash Mafi[1], Karl W. Koch[2]; [1]Univ. of Wisconsin-Milwaukee, USA, [2]Corning Inc., USA.* We report on the influence of lattice shape on the birefringence properties of photonic crystal fibers and show novel properties such as very large or vanishing birefringence in nonsymmetric lattices and cores.

8:00 a.m.–10:00 a.m.
FWG • Photonic Sensing Devices
Jacques Albert; Carleton Univ., Canada, Presider

FWG1 • 8:00 a.m. Invited
Optical Manipulation Using Silicon Nanophotonics, *David Erickson; Cornell Univ., USA.* In this paper I review our work on the use of silicon nanophotonics for optical manipulation of nanoparticles and biomolecules, focusing on ways in which these techniques represent an improvement over free space manipulation.

FWG2 • 8:30 a.m.
Range Finding Using a Masked Folded Optic Imager, *Brett R. Nadler, Eric J. Tremblay, Jason H. Karp, Joseph E. Ford; Univ. of California at San Diego, USA.* High-resolution images of an unfocused laser beam were obtained by masking the aperture of an annular folded optic imager. Image processing yielded calibrated distance measurements correlated to the separation of the beam spots.

FWG3 • 8:45 a.m.
Sensing the Microwave Poynting Vector with a Cadmium Manganese Telluride Electric/Magnetic Field Sensor, *Chia-Chu Chen, John F. Whitaker; Univ. of Michigan, USA.* A map of the microwave Poynting vector along a 50-Ω microstrip was experimentally determined using a single cadmium manganese telluride crystal that exhibits both the Pockels and Faraday effects.

LS

8:00 a.m.–10:00 a.m.
LSWA • Single-Molecule Biophysics I
Christine Payne; Georgia Tech, USA, Presider

LSWA1 • 8:00 a.m. Invited
Single-Molecule Biophysical Imaging, Superresolution, and Trapping, *W. E. Moerner; Stanford Univ., USA.* Single-molecule emitters provide nanoscale light sources yielding unprecedented new information about biological systems. Novel methods and molecules, including superresolution imaging in three dimensions and anti-Brownian electrokinetic trapping of single biomolecules in solution, will be reviewed.

LSWA2 • 8:30 a.m. Invited
Fluorescence Nanoscopy: FPALM Breaks the Diffraction Limit, *Samuel Hess; Univ. of Maine, USA.* Localization microscopy methods image many small subsets of single molecules, determine the coordinates of each molecule by localization, and combine data from many molecules to create a fluorescence image of the sample with resolution (10-40 nm) significantly better than the diffraction-limited resolution. Biological applications of such methods are presented.

8:00 a.m.–10:00 a.m.
LSWB • Second-Order Nonlinear Optics I
Garth J. Simpson; Purdue Univ., USA, Presider

LSWB1 • 8:00 a.m. Invited
Sum Frequency Generation (SFG) Vibrational Spectroscopy and Its Application in Surface Science and Catalysis, *Gabor A. Somorjai, George J. Holinga; Univ. of California at Berkeley, USA.* SFG was applied to investigate adsorbed molecules at the solid-gas (liquid) interfaces and reaction intermediates of catalytic reactions at metal surfaces. SFG was used to characterize polymer films, electrochemical interfaces, and biomolecule adsorption.

LSWB2 • 8:30 a.m. Invited
Nonlinear Optical Studies of Conjugated Polymer Films and Interfaces, *Ian M. Craig, Benjamin J. Schwartz; Univ. of California at Los Angeles, USA.* The electronic structure of the conjugated polymer/metal interfaces that are present in polymer-based optoelectronic devices are poorly understood. In this talk, we present preliminary results of non-linear optical measurements aimed at characterizing conjugated polymer/metal interfaces.

8:00 a.m.–10:00 a.m.
LSWC • Multidimensional Spectroscopy I
Munira Khalil; Univ. of Washington, USA, Presider

LSWC1 • 8:00 a.m. Invited
Investigating the Major Light Harvesting Complex of Photosystem II with 2-D Electronic Spectroscopy, *G. S. Schlau-Cohen, T. R. Calhoun, N. S. Ginsberg, G. R. Fleming; Univ. of California at Berkeley, USA.* Two-dimensional electronic spectroscopy experiments on the major light harvesting complex of photosystem II, the most abundant light harvester, monitor ultrafast dynamics and reveal the design principles behind the functionality of this pigment protein complex.

LSWC2 • 8:30 a.m. Invited
Coherence in Electronic Energy Transfer: The Intermediate Coupling Regime, *Gregory D. Scholes, Elisabetta Collini; Univ. of Toronto, Canada.* We report a study of the role of coherence dynamics in the intermediate coupling regime of electronic energy transfer. Theoretical developments as well as the results of two-dimensional electronic spectroscopy will be described.

For Fall Congress presentations on Wednesday, see pages 125-131.

FWA • Biomedical Applications of Ultrafast Lasers—Continued

FWA3 • 9:00 a.m. Invited

Tissue Imaging with Shaped Femtosecond Laser Pulses, *Warren S. Warren; Duke Univ., USA.* Rapid laser pulse shaping permit detection of novel molecular signatures such as self- and cross-phase modulation or nonlinear absorption. These effects are used to discriminate between different melanins in tissue and to monitor neuronal activation.

FWA4 • 9:30 a.m.

Microprisms for *in vivo* Multiphoton Microscopy of Mouse Cortex, *Thomas Chia, Michael J. Levene; Yale Univ., USA.* Microprisms inserted into the cortex of mouse enable *in vivo* multiphoton microscopy, rotating the field-of-view from parallel to perpendicular to the surface of cortex and allowing imaging of the full cortical thickness.

Thank you for attending FiO/LS/Fall Congress. Look for your post-conference survey via email and let us know your thoughts on the program.

FWB • Optical Information Processing and Transport in the Age of Nanophotonics and Metamaterials—Continued

FWB4 • 9:00 a.m.

Slow and Fast Light Propagation in Semiconductor Quantum Dots, *Qiguang Yang[1], JaeTae Seo[1], Bagher Tabibi[1], William Yu[2]; [1]Hampton Univ., USA, [2]Worcester Polytechnic Inst., USA.* The group velocity of a laser pulse in semiconductor quantum dots has been investigated and both slow and fast light propagation were observed experimentally. The phenomena will be explained directly in time-domain in this paper.

FWB5 • 9:15 a.m.

Electrically Driven Optical Modulator with a Strongly Coupled Quantum Dot, *Andrei Faraon[1], Arka Majumdar[1], Hyochul Kim[2], Pierre Petroff[2], Jelena Vučković[1]; [1]Stanford Univ., USA, [2]Univ. of California at Santa Barbara, USA.* The frequency of a quantum-dot strongly coupled to a photonic-crystal cavity was electrically controlled. Electro-optic modulation (150MHz) of a coherently coupled probe laser is demonstrated. Operation at 10GHz and ~1fJ/bit are achievable with this device.

FWB6 • 9:30 a.m.

Confocal Microscopy Measurement of Light Squeezed in Sub-Wavelength Plasmonic Hole on Thin Metal Film, *Hyungjin Ma, Jun Xu, Nicholas Fang; Univ. of Illinois at Urbana-Champaign, USA.* We measured the phase delay of the squeezed light emerging from individual plasmonic holes on thin metal film by confocal microscope. A large phase shift has been observed, beyond prediction from earlier theoretical models.

FWC • Extraordinary Transmission and Structured Surface—Continued

FWC4 • 9:00 a.m.

Extraordinary Optical Transmission (EOT) through Multi-Layered Systems of Corrugated Metallic Thin Films, *Choon How Gan, Greg Gbur; Univ. of North Carolina at Charlotte, USA.* Optical transmission through multi-layered systems of metallic structures was investigated numerically. We find that these structures can significantly impede the field decay, often leading to EOT even for thicknesses much greater than the skin depth.

FWC5 • 9:15 a.m.

Sub-Wavelengh Sized Optical Cavity Resonators with Fishnet, *Jingjing Li[1], Lars Thylen[1,2,3], Alex Bratkovski[1], Shih-Yuan Wang[1], Stanley Williams[1]; [1]Hewlett-Packard Res. Lab, USA, [2]KTH Dept of Microelectronics and Applied Physics, Royal Inst. of Technology, Sweden, [3]Joint Res. Ctr. of Photonics of the Royal Inst. of Technology and Zhejiang Univ., China.* An optical cavity resonator of deep sub-wavelength size is demonstrated numerically by inserting a single layer of "fishnet" structure of negative refractive index into a Fabry-Perot cavity composed of two gold films.

FWC6 • 9:30 a.m.

Extraordinary Transmission and Nonlinear Response for Semiconductors in the UV Range, *Maria Antonietta Vincenti[1,2], Antonella D'Orazio[1], Domenico de Ceglia[2], Michael Scalora[2], Mark J. Bloemer[2]; [1]Politecnico di Bari, Italy, [2]Charles M. Bowden Res. Ctr. AMSRD-AMR-WS-ST, US Army RDECOM, USA.* We investigate the correlation between linear and nonlinear responses in single slits carved on semiconductor substrates to highlight the differences between nonlinear response produced in metals and a SH signal mostly generated by χ_2 contribution.

FWD • Turbulence and Other Nonlinear Phenomena—Continued

FWD4 • 9:00 a.m. Invited

Gravity-Like Effects on Light and Fiber Supercontinuum, *Dmitry Skryabin; Univ. of Bath, UK.* I'll describe how an intriguing gravity-like force created by optical solitons traps and blue-shifts light. This phenomenon plays paramount role in supercontinuum generation in optical fibers and may have other practical and fundamental applications.

FWD5 • 9:30 a.m.

Casimir-Like Light Pulse Interaction Induced by Amplified Spontaneous Noise in Laser Cavities, *Rafi Weill[1], Omri Gat[2], Vladimir Smulakovsky[1], Alexander Bekker[1], Baruch Fischer[1]; [1]Technion-Israel Inst. of Technology, Israel, [2]Hebrew Univ., Israel.* We present a new mechanism for light pulse interaction in mode-locked lasers induced by amplified spontaneous noise. It is a time-light domain Casimir-like mechanism. We show experimental evidence for this unique effect.

FWE • Novel Fiber Devices II—Continued

FWE4 • 9:00 a.m.

Soft-Landing of Preselected Single Nanoparticles on Optical Fiber Tapers for Spectroscopy and Detection, *Alexander Kuhlicke, Markus Gregor, Oliver Benson; Humboldt Univ. of Berlin, Germany.* We use a segmented linear Paul-trap to deposit single preselected microparticles on optical fiber tapers. Beyond detection and spectroscopy of these particles, this offers a new method to functionalise fiber tapers.

FWE5 • 9:15 a.m.

Color Filter Incorporating a Fabry-Perot Etalon, *Yeo-Taek Yoon[1], Hong-Shik Lee[1], Sang-Shin Lee[1], Byoung-Su Lee[2]; [1]Kwangwoon Univ., Republic of Korea, [2]SiliconFile Technologies, Republic of Korea.* Three color filters based on a simple Fabry-Perot etalon, which consists of an oxide thin film sandwiched in between two silver films, were demonstrated with no additional infrared cutoff filter included.

FWE6 • 9:30 a.m.

The Transition between Superluminal and Subluminal for Multiple Microspheres Optical Fiber System, *Yundong Zhang, Jing Zhang, Xuenan Zhang, Ping Yuan; Harbin Inst. of Technology, China.* The transition between superluminal and subluminal is investigated by adjusting the parameters of the outermost microsphere in doping gain medium. It is applied to the resonators with different parity number respectively.

For Fall Congress presentations on Wednesday, see pages 125-131.

FWF • Photonic Bandgap Devices—Continued

FWF4 • 9:00 a.m.
Photonic Interactions of Resonant Cesium Atoms and Opal Photonic Crystals, *Allard P. Mosk[1], Philip J. Harding[1,2], Pepijn W. H. Pinkse[3], Willem L. Vos[1,2]; [1]Univ. Twente, Netherlands, [2]FOM Inst. AMOLF, Netherlands, [3]Max-Planck-Inst. für Quantenoptik, Germany.* We present the first experiments on resonant atoms, Cesium vapor, in photonic crystals. The atomic transitions are strongly modified by photonic band structures of opal. Results are interpreted with an improved transfer-matrix model.

FWF5 • 9:15 a.m.
Direct, Efficient Coupling into Slow Light Photonic Crystal Waveguide: Role of Evanescent Modes, *Carel M. de Sterke[1], Kokou B. Dossou[2], Tom P. White[3], Lindsay C. Botten[2], Ross C. McPhedran[1]; [1]Univ. of Sydney, Australia, [2]CUDOS, School of Mathematical Sciences, Univ. of Technology, Sydney, Australia, [3]Univ. of St. Andrews, UK.* Efficient coupling between fast and slow PC waveguide modes is possible if strong evanescent modes are needed to match the fields across the interface. This occurs when the propagating modes have substantially different modal fields.

FWF6 • 9:30 a.m.
Very High Efficiency Bends for Low Group Velocities in Photonic Crystal Waveguides, *Murtaza Askari, Ali Adibi; Georgia Tech, USA.* We present experimental demonstration of high efficiency bends for low group velocity modes in photonic crystal waveguides. We show that careful modification of bend region can help improve bend bandwidth by 15nm for 1.55μm wavelength.

FWG • Photonic Sensing Devices—Continued

FWG4 • 9:00 a.m. Invited
Fiber Optic Sensors Based on Surface Plasmon Resonance, *Banshi D. Gupta; Indian Inst. of Technology Delhi, India.* Surface plasmon resonance based fiber optic sensors with different probe designs are presented. The modeling of each probe is carried out using ray optics. The performance of each probe is evaluated in terms of sensitivity.

FWG5 • 9:30 a.m.
Uniformity of Concentration Factor and BFL in Microlens Array for Image Detectors Applications, *Giuseppe Martini, Enrico Randone, Mohammad Fathi, Silvano Donati; Univ. Pavia, Italy.* We report a 35x gain for a 32x32, 50-micron diameter polymer cast microlens array used to recover fill-factor loss in a SPAD array. Concentration spread is < 6% and BFL spread is <0.5μm.

LSWA • Single-Molecule Biophysics I—Continued

LSWA3
Paper Withdrawn

LSWA4 • 9:15 a.m.
Watching Photophysics in Action: Single-Molecule Solution-Phase Studies of a Trapped Photosynthetic Antenna Protein, *Randall H. Goldsmith, Yan Jiang, W. E. Moerner; Stanford Univ., USA.* Simultaneous fluorescence intensity and lifetime fluctuations are observed in single molecules of Allophycocyanin in solution, allowing observation of different photophysical processes which suggest conformational heterogeneity. An electrokinetic trap that cancels Brownian motion enables solution-phase measurement.

LSWA5 • 9:30 a.m. Invited
Structured-Illumination Microscopy of Live Cells, *Mats Gustafsson; Univ. of California at San Francisco, USA.* Abstract not available.

LSWB • Second-Order Nonlinear Optics I—Continued

LSWB3 • 9:00 a.m.
Atto-Joules, High Bandwidth All Optical Modulation with a Nano-Fiber Embedded in Alkali Vapor, *Kenneth Salit, Mary Salit, Subramanian Krishnamurthy, Ye Wang, Prem Kumar, Selim M. Shahriar; Northwestern Univ., USA.* We report an all-optical modulator with 75 photons at 2 GHz, using a tapered nanofiber embedded in an alkali vapor. The switching energy is 19 atto-Joules, a record low value for modulation at this speed.

LSWB4 • 9:15 a.m.
Analysis of Aberrations Effect in Nonlinear Processes for Femtosecond Laser Pulses, *Rocio Borrego Varillas[1], Carolina Romero[1], Benjamin Alonso[1], Cruz Méndez[2], Javier R. Vázquez de Aldana[1], Emilio J. Gualda[3], Juan M. Bueno[3], Pablo Artal[3], Luis Roso[1,2]; [1]Univ. de Salamanca, Spain, [2]Ctr. de Láseres Pulsados Ultracortos Ultraintensos, Spain, [3]Lab de Óptica, Univ. de Murcia, Spain.* A method for the analysis and control of femtosecond pulse wavefronts generated in non-linear crystals by three-wave mixing processes is presented. The possibility to improve the efficiency of these processes is discussed.

LSWB5 • 9:30 a.m. Invited
Resonant UV SHG Studies of Ion Adsorption at Aqueous Interfaces, *Richard J. Saykally[1,2]; [1]Univ. of California at Berkeley, USA, [2]Lawrence Berkeley Natl. Lab, USA.* By exploiting the strong charge-transfer-to-solvent (CTTS) resonances characteristic of all anions in aqueous electrolytes, their interfacial properties are measured using SHG spectroscopy in the deep ultraviolet.

LSWC • Multidimensional Spectroscopy I—Continued

LSWC3 • 9:00 a.m. Invited
Optical Two-Dimensional Fourier Transform Spectroscopy of Semiconductors, *S. T. Cundiff, A. D. Bristow, D. Karaiskaj, X. Dai; JILA, NIST, Univ. of Colorado, USA.* Optical two-dimensional Fourier transform spectroscopy is used to study excitonic resonances in semiconductor nanostructures. The spectra show the dominance of many-body contributions. Two-quantum coherences are observed due to both biexcitons and many-body states.

LSWC4 • 9:30 a.m. Invited
Exciton Relaxation and Energy Transfer Dynamics in Size Selected Polythiophenes, *Andrew T. Healy, Nathan P. Wells, Bryan W. Boudouris, Marc A. Hillmyer, David A. Blank; Univ. of Minnesota, USA.* Using fluorescence upconversion and two-color photon echo spectroscopy we have investigated the initial relaxation and subsequent energy transfer dynamics in a series of size-selected polythiophenes with and without fullerene termination.

For Fall Congress presentations on Wednesday, see pages 125-131.

FWA • Biomedical Applications of Ultrafast Lasers—Continued

FWA5 • 9:45 a.m.
Multiphoton Histology of Entire Intact Mouse Organs, *Sonia Parra, Joseph P. Zinter, Michael J. Levene; Yale Univ., USA.* We present multiphoton fluorescence microscopy and second harmonic imaging of entire intact, fixed and optically cleared mouse organs. We achieved imaging depths of several millimeters in mouse intestine, heart, lung, brain and other organs.

FWB • Optical Information Processing and Transport in the Age of Nanophotonics and Metamaterials—Continued

FWB7 • 9:45 a.m.
Controlled Blinking Statistics of Single Colloidal Quantum Dots in a Half Cavity, *Ningning Xu[1,2], Vamsi K. Komarala[1], Yanpeng Zhang[1], Min Xiao[1]; [1]Univ. of Arkansas, USA, [2]Nankai Univ., China.* The blinking statistics of single CdSe/ZnS quantum dots can be modified and controlled by an optical mirror. We study the modified statistical and correlation properties of single quantum dots as a function of dot-mirror distance.

FWC • Extraordinary Transmission and Structured Surface—Continued

FWC7 • 9:45 a.m.
Theory and Simulations of Enhanced Transmission through Plasmonic Sub-Wavelength Structures, *Jan Fiala, Ivan Richter; Faculty of Nuclear Sciences and Physical Engineering, Czech Technical Univ. in Prague, Czech Republic.* The interaction of an electromagnetic wave with various classes of plasmonic sub-wavelength structures, including the apertures with/without supporting corrugations is theoretically studied and modeled, using several approximate and rigorous numerical approaches.

FWD • Turbulence and Other Nonlinear Phenomena—Continued

FWD6 • 9:45 a.m.
Nonlinear Focusing and Defocusing of Partially-Coherent Spatial Beams, *Can Sun, Dmitry V. Dylov, Jason W. Fleischer; Princeton Univ., USA.* We consider, experimentally and theoretically, the propagation of a partially-coherent spatial beam in both self-focusing and self-defocusing nonlinear media. Measurements of beam widths confirm the dynamical scaling predicted by a nonlinear Gaussian-Schell model.

9:00 a.m.–12:00 p.m. Export Regulation Fundamentals for the Optics and Photonics Industry, *Sainte Claire Room, Sainte Claire Hotel*

10:00 a.m.–10:30 a.m. Coffee Break, *Imperial Ballroom, Fairmont Hotel*

10:00 a.m.–4:00 p.m. Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*

NOTES

For Fall Congress presentations on Wednesday, see pages 125-131.

Glen Ellen	Atherton	Sacramento	Piedmont	Hillsborough
FiO		**LS**		
	FWG • Photonic Sensing Devices—Continued	**LSWA • Single-Molecule Biophysics I—Continued**	**LSWB • Second-Order Nonlinear Optics I—Continued**	**LSWC • Multidimensional Spectroscopy I—Continued**

FWG6 • 9:45 a.m.
Temperature Insensitive Dual Chirped LPG Bend Sensor, *Umesh K. Tiwari[1,2], K. Thyagarajan[1], M. R. Shenoy[1,2], Vandana Mishra[2], Nahar Singh[2], S.C. Jain[2], Pawan Kapur[2]; [1]Indian Inst. of Technology Delhi, India, [2]Central Scientific Instruments Organization, India.* Experimental measurements on a novel dual chirped LPG design is presented which exhibits very low temperature sensitivity and high bend sensitivity. Sensing properties of the proposed design are entirely different from normal LPG.

9:00 a.m.–12:00 p.m. Export Regulation Fundamentals for the Optics and Photonics Industry, *Sainte Claire Room, Sainte Claire Hotel*

10:00 a.m.–10:30 a.m. Coffee Break, *Imperial Ballroom, Fairmont Hotel*

10:00 a.m.–4:00 p.m. Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*

NOTES

For Fall Congress presentations on Wednesday, see pages 125-131.

10:30 a.m.–12:15 p.m.
FWH • Coherence and Fundamental Optics I
Boris Y. Zeldovich; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, Presider

FWH1 • 10:30 a.m.
Bases for the Description of Focused Electromagnetic Fields, *Nicole J. Moore[1], Miguel A. Alonso[2]; [1]Beloit College, USA, [2]Univ. of Rochester, USA.* Discrete bases for the efficient modeling of high numerical aperture fields are described. Several simple test cases are presented, including monochromatic fields with linear, radial and azimuthal polarization and a partially coherent field.

FWH2 • 10:45 a.m.
Structure Determination of Stochastic Media from Scattering Experiments, *Mayukh Lahiri, Emil Wolf; Univ. of Rochester, USA.* The classic method for determining the structure of crystalline media from X-ray and neutron diffraction experiments is generalized to determine the correlation functions of scattering potentials of stationary random media from scattering experiments.

FWH3 • 11:00 a.m.
The Generalized Wolf Shift for Cyclostationary Fields, *Robert W. Schoonover, Brynmor J. Davis, P. Scott Carney; Univ. of Illinois at Urbana-Champaign, USA.* Correlation-dependent, propagation-induced shifts in the generalized spectra of cyclostationary, random fields are predicted. This result generalizes the Wolf shift for stationary fields and is applicable to periodic trains of fast pulses.

10:30 a.m.–12:00 p.m.
FWI • Optics in Information Sciences
Monika Ritsch-Marte; Innsbruck Medical Univ., Austria, Presider

FWI1 • 10:30 a.m.
Compound Optical Receiver for Field of View Enhancement, *Bahareh Haji-Saeed[1], Jed Khoury[1], Charles Woods[1], John Kierstead[2]; [1]Sensors Directorate, AFRL, USA, [2]Solid State Scientific Corp., USA.* We propose using the smart antenna principle as the basis of a new design for smart optical receivers in LADAR systems. Our design was modeled in Simulink® using the fuzzy-logic maximum operation on video data.

FWI2 • 10:45 a.m.
Generation of Resolved Phonon Sidebands in a Self-Assembled Quantum Dot, *Michael B. Metcalfe[1,2], Stephen Carr[1], Solomon S. Glenn[1,2], John R. Lawall[1]; [1]NIST, USA, [2]Univ. of Maryland, USA.* InAs quantum dots (QD) are modulated with a surface acoustic wave inducing phonon sidebands of the fluorescence. This constitutes an important step towards sideband cooling of a nanomechanical resonator via coupling to an embedded QD.

FWI3 • 11:00 a.m.
Optical Delay Line Elements Based on Leaky-Mode Resonance Structures, *Mehrdad Shokooh-Saremi, Xin Wang, Robert Magnusson; Univ. of Texas at Arlington, USA.* Leaky-mode resonance bandpass filters are designed with particle swarm optimization. The spectral phase properties of these elements are studied. It is shown that these elements can operate as optical delay lines.

10:30 a.m.–12:15 p.m.
FWJ • Quantum Optics in Waveguides II
Alfred B. U'Ren; Univ. Nacional Autónoma de México, Mexico, Presider

FWJ1 • 10:30 a.m.
Modal, Spectral, and Polarization Entanglement in Guided-Wave Parametric Down-Conversion, *Mohammed F. Saleh[1], Bahaa E. A. Saleh[1,2], Malvin C. Teich[1,3]; [1]Dept. of Electrical and Computer Engineering, Boston Univ., USA, [2] CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [3]Dept. of Physics, Boston Univ., USA.* We offer a comprehensive theoretical study of the properties and applications of modal, spectral, and polarization entanglement of biphotons generated via spontaneous parametric down-conversion in 1-D planar and 2-D circular waveguides using continuous pumping.

FWJ2 • 10:45 a.m.
Generation of Polarization Entangled Photons from Type-II Domain Engineered PPLN Waveguides, *Krishna Thyagarajan[1], Kanupriya Sinha[2], Jasleen Lugani[1], Sankalpa Ghosh[1], Olivier Alibart[3], Dan Ostrowsky[3], Sebastian Tanzilli[3]; [1]Indian Inst. of Technology Delhi, India, [2]Univ. of Maryland, USA, [3]LPMC, CNRS UMR 6622, Univ. of Nice Sophia Antipolis, France.* We propose a new scheme of domain engineering in Lithium Niobate for generating non degenerate polarization entangled photon pairs by simultaneously satisfying the conditions for two different SPDC processes.

FWJ3 • 11:00 a.m. Invited
Photon Pair Generation in Birefringent Fiber: A Route to Better Photons, *Jeff S. Lundeen[1], Offir Cohen[2], Pierre Mahou[2], Brian J. Smith[2], Ian A. Walmsley[2]; [1]Inst. for Natl. Measurement Standards, Natl. Res. Council Canada, Canada, [2]Clarendon Lab, Univ. of Oxford, UK.* We show that birefringent waveguides, such as optical fibers, allow us to produce photons with desired spectral and spatial characteristics. Tailoring these characteristics is crucial for high-fidelity operation of waveguide quantum logic gates.

10:30 a.m.–12:00 p.m.
FWK • All-Optical Signal Processing III
Alexander Gaeta; Cornell Univ., USA, Presider

FWK1 • 10:30 a.m. Invited
Nonlinear Optics on a Chip: Breaking the Terabit per Second Barrier, *Benjamin J. Eggleton; Univ. of Sydney, Australia.* This paper reviews our recent progress in developing photonic integrated circuits based on highly nonlinear chalcogenide waveguides. Application to high speed performance monitoring will be discussed.

FWK2 • 11:00 a.m.
Widely-Tunable Cavity-Less 40 GHz Picosecond Pulse Source, *Bill Ping Piu Kuo, Andreas O. J. Wiberg, Camille-Sophie Bres, Evgeny Myslivets, Nikola Alic, Stojan Radic; Univ. of California at San Diego, USA.* We demonstrate a wavelength tunable 40 GHz optical pulse source using a cavity-less architecture. High-quality 2.2 ps picosecond pulses with SNR exceeding 30 dB are obtained over a wide - 95 nm tunable range.

10:30 a.m.–12:00 p.m.
FWL • Optical Communication Devices
Nikola Alic; Univ. of California at San Diego, USA, Presider

FWL1 • 10:30 a.m.
Ultra-Low Jitter Frequency Stabilized Mode-Locked Laser, *Ibrahim T. Ozdur[1], Mehmetcan Akbulut[1], Nazanin Hoghooghi[1], Dimitrios Mandridis[1], Sarper Ozharar[2], Franklyn Quinlan[3], Peter J. Delfyett[1]; [1]CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Northwestern Univ., USA, [3]NIST, USA.* We report a low noise, frequency stabilized, semiconductor based, 10.287 GHz actively mode-locked laser with 1000 finesse intracavity etalon, with a timing jitter (1Hz - 100MHz) of 3 fs and optical linewidth <1 kHz.

FWL2 • 10:45 a.m.
Ultra-Low Noise, Sub-100MHz Pulse Train Based on a Temporally Demultiplexed Mode-Locked Laser, *Dimitrios Mandridis[1], Ibrahim Ozdur[1], Peter J. Delfyett[1], Jason J. Plant[2], Paul W. Juodawlkis[2]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]MIT Lincoln Lab, USA.* A semiconductor low-noise, sub-100*MHz* repetition rate laser source is developed by time demultiplexing a harmonically mode-locked 2.56GHz, SCOWA-based mode-locked laser to the cavity fundamental frequency. The laser source is suitable for time-stretched photonic ADC.

FWL3 • 11:00 a.m.
A Novel Ellipse Model for Optically Injection-Locked VCSELs, *Peng Guo[1,2], Wei Jian Yang[1], Devang Parekh[1], Connie J. Chang-Hasnain[1]; [1]Dept. of Electrical Engineering and Computer Sciences, Univ. of California at Berkeley, USA, [2]State Key Lab of Advanced Optical Communication Systems and Networks, School of Electronics Engineering and Computer Science, Peking Univ., China.* A novel ellipse graphic tool is established based on injection-locked rate equations to analyze the cavity mode behavior of injection-locked vertical-cavity surface-emitting lasers. Calculation based on this model shows excellent agreement with the experimental results.

For Fall Congress presentations on Wednesday, see pages 125-131.

10:30 a.m.–11:45 a.m.
FWM • Optical Trapping and Micromanipulation I
Carlos López-Mariscal; NIST, USA, Presider

FWM1 • 10:30 a.m. Invited
Optical Trapping and Manipulation Using Microfabricated Optical Tweezers Based on Diffractive Optics and Surface Plasmons, *Kenneth B. Crozier; Harvard Univ., USA.* Microfabricated optical tweezers are reviewed. Fresnel zone plates are shown to offer comparable performance to traditional optical tweezers, when diffraction efficiency is taken into account. We demonstrate the manipulation of nanoparticles using surface plasmon polaritons.

FWM2 • 11:00 a.m.
Determining Single-Molecule ATP Binding Stoichiometry in a Multi-Subunit Enzyme with a Hardware-Based Anti-Brownian Electrokinetic Trap, *Yan Jiang[1,2], Adam Cohen[1,3], Nick Douglas[4], Judith Frydman[4], W. E. Moerner[1]; [1]Dept. of Chemistry, Stanford Univ., USA, [2]Dept. of Applied Physics, Stanford Univ., USA, [3]Dept. of Chemistry and Chemical Biology, Harvard Univ., USA, [4]Dept. of Biological Sciences, Stanford Univ., USA.* We developed a high-speed Anti-Brownian Electrokinetic trap capable of trapping sub-10nm fluorescent objects in solution. Single chaperonin enzymes loaded with Cy3-ATP are trapped, and display stepwise photobleaching intensity traces corresponding to the ATP binding stoichiometry.

10:30 a.m.–12:00 p.m.
FWN • Silicon Photonics II
Luca Dal Negro; Boston Univ., USA, Presider

FWN1 • 10:30 a.m. Invited
Photonic Signal Processing in CMOS-Compatible Silicon, *Mahmoud S. Rasras; Bell Labs, Alcatel Lucent, USA.* CMOS compatible photonics creates new information processing and transport solutions through monolithic electronic/photonic integration. Optical filters provide significant insight into the viability of this technology. We will present recent developments in this area.

FWN2 • 11:00 a.m.
Electronic-Nanophotonic Integration, *Yadong Wang[1], Qian Wang[1], Chongyang Liu[1], Ng Doris[1], Yongqiang Wei[1], Yingyan Huang[2], Seng-Tiong Ho[3]; [1]Data Storage Inst., Agency for Science, Technology and Res., Singapore, [2]OptoNet Inc., USA, [3]Northwestern Univ., USA.* Nanophotonic integration of III-V on silicon based on top-down coupling is presented. Light can be coupled up for amplification/absorption or coupled down for passive processing. Interlayer wafer bonding for this integration is described.

10:30 a.m.–12:00 p.m.
LSWD • Single-Molecule Biophysics II
Ahmet Yildiz; Univ. of California at Berkeley, USA, Presider

LSWD1 • 10:30 a.m. Invited
Real-Time 3-D Single-Particle Tracking Spectroscopy for Cellular Dynamics, *Haw Yang; Princeton Univ., USA.* Biological macromolecules and organelles can move in all directions inside a cell, making it extremely challenging to follow biochemical processes with molecular resolution. We discuss a new technique that can potentially overcome this difficulty.

LSWD2 • 11:00 a.m.
Photoactivatable Push-Pull Fluorophores for Single-Molecule Imaging in and out of Cells, *Samuel J. Lord[1], Hsiao-lu D. Lee[1], Nicholas R. Conley[1], Marissa K. Lee[1], Michael A. Thompson[1], Reichel Samuel[2], Ryan Weber[2], Na Liu[2], Robert J. Twieg[2], W. E. Moerner[1]; [1]Stanford Univ., USA, [2]Kent State Univ., USA.* We have designed a series of photoactivatable push-pull organic fluorophores, single molecules of which can be imaged in living cells. Photoactivatable probes are needed for superresolution imaging schemes that require active control of single-molecule emission.

10:30 a.m.–12:00 p.m.
LSWE • Second-Order Nonlinear Optics II
Anne M. Kelley; Univ. of California at Merced, USA, Presider

LSWE1 • 10:30 a.m. Invited
Nonlinear Optics in Metamaterials, *David Cho[1], Wei Wu[2], Feng Wang[1], Xiang Zhang[3], Yuen-Ron Shen[1]; [1]Physics Dept., Univ. of California at Berkeley, USA, [2]Quantum Science Res., Hewlett-Packard Labs, USA, [3]Dept. of Mechanical Engineering, Univ. of California at Berkeley, USA.* We describe spectroscopic studies of ultrafast photomodulation of the negative refraction of a fishnet metamaterial and resonant wave mixing processes in the metamaterials of fishnet and Cheveron structures.

LSWE2 • 11:00 a.m. Invited
New Perspectives in Vibrational Sum-Frequency Spectroscopy, *John T. Fourkas; Univ. of Maryland at College Park, USA.* Vibrational sum-frequency generation (VSFG) is a powerful technique for probing the organization of molecules at interfaces. We will discuss how different processes, including reorientation and energy transfer, can lead to new interpretations of VSFG spectra.

10:30 a.m.–12:00 p.m.
LSWF • Multidimensional Spectroscopy II
Munira Khalil; Univ. of Washington, USA, Presider

LSWF1 • 10:30 a.m. Invited
Water and Hydrogen-Bond Dynamics in Aqueous Solutions, *Damien Laage[1], Guillaume Stirnemann[1], Fabio Sterpone[1], James T. Hynes[1,2]; [1]École Normale Supérieure, France, [2]Univ. of Colorado, USA.* The water and hydrogen-bond dynamics is investigated in aqueous solutions. Based on numerical simulations and analytic models, we offer an interpretation for the recent time-resolved vibrational spectroscopy experiments.

LSWF2 • 11:00 a.m. Invited
Watching Ultrafast Molecular Dynamics: 2-D IR Chemical Exchange Spectroscopy, *Michael D. Fayer; Stanford Univ., USA.* Ultrafast 2-D IR vibrational echo chemical exchange spectroscopy is described. The measurements enable observation of molecule processes under thermal equilibrium conditions. Applications to molecular isomerization, hydrogen bond dynamics, and proteins structural substate switching are presented.

10:30 a.m.–12:00 p.m.
JWB • Advances in Adaptive Optics Imaging of the Living Retina I
Stephen A. Burns; Indiana Univ., USA, Presider

JWB1 • 10:30 a.m.
Off-Axis Estimation of Ocular Aberrations via Scanning Shack-Hartmann Wavefront-Sensor, *Xin Wei, Larry N. Thibos; School of Optometry, Indiana Univ., USA.* We developed a Scanning Hartmann Shack wavefront sensor by coupling the Shack Hartmann aberrometer with a scanning system. This instrument measures off-axis aberration of the human eye accurately and precisely in an efficient manner.

JWB2 • 10:45 a.m.
Optimal Correction of Subject Prescription on an Adaptive Scanning System for Retinal Imaging, *David Merino, Austin Roorda; School of Optometry, Univ. of California at Berkeley, USA.* The effect on image quality of subject's prescription on an AOSLO is assessed. Models considering different configurations available in literature have been studied. Factors to consider when implementing these configurations on real systems are addressed.

JWB3 • 11:00 a.m. Invited
Adaptive Optics Psychophysics, *Heidi Hofer; Univ. of Houston, USA.* Adaptive optics allows imaging of individual photoreceptors *in vivo* and viewing of arbitrary stimuli nearly free of optical blur. Combining these abilities has created new opportunities to study the retinal and neural limits on vision.

For Fall Congress presentations on Wednesday, see pages 125-131.

FWH • Coherence and Fundamental Optics I—Continued

FWH4 • 11:15 a.m.
A Topological Charge Selection Rule for Phase Singularities, *Miguel-Angel Garcia-March[1], Mario Zacarés[1], Javier Vijande[2], Albert Ferrando[3]; [1]Inst. de Matematica Pura y Aplicada, Univ. Politecnica de Valencia, Spain, [2]Dept. de Física Atómica, Molecular y Nuclear, Univ. de Valencia and IFIC (UV-CSIC), Spain, [3]Departament d'Optica, Univ. de Valencia (UV), Spain.* We present a study of the dynamics and decay pattern of phase singularities due to the action of a system with a discrete rotational symmetry of finite order. A topological charge conservation rule is identified.

FWH5 • 11:30 a.m.
Physical Evidence for New Characteristic Vector of Light Beams, *Chun-Fang Li; Dept. of Physics, Shanghai Univ., China.* The experimental data reported in Science 319, 787 (2008) are shown to demonstrate the existence of a new characteristic vector of light beams advanced in a previous paper Physical Review A 78, 063831 (2008).

FWH6 • 11:45 a.m.
Creating Polarization Singularities with an *N*-Pinhole Interferometer, *Robert W. Schoonover[1], Taco D. Visser[2]; [1]Univ. of Illinois Urbana-Champaign, USA, [2]Delft Univ. of Technology, Netherlands.* Electromagnetic fields diffracted by an *N*-pinhole interferometer are investigated. For *N* larger than two, a rich structure of polarization singularities is found even when the location of the pinholes is arbitrary.

FWH7 • 12:00 p.m.
Spatio-Temporal Characterization of Nonlinear Propagation, *Daniel E. Adams, Charles G. Durfee, Jeff A. Squier; Colorado School of Mines, USA.* We use Spatially Resolved Spectral Interferometery (SRSI) to investigate nonlinear propagation of ultrashort pulses in Kerr materials. SRSI provides phase and amplitude information from two spatial dimensions and fully characterizes the temporal profile of pulses.

FWI • Optics in Information Sciences—Continued

FWI4 • 11:15 a.m.
Factoring Different Numbers in a Single Run, *Vincenzo Tamma[1,2], Heyi Zhang[1], Xehua He[1], Augusto Garuccio[2], Yanhua Shih[1]; [1]Univ. of Maryland, Baltimore County, USA, [2]Univ. degli Studi di Bari, Italy.* We present the experimental realization of a new Gauss sums factorization algorithm, which, respect to the past realizations, avoids the pre-checking of the trial factors and allows obtaining the factors in a single run.

FWI5 • 11:30 a.m.
Applications of Similariton in Ultrafast Optics: Spectral Interferometry and Spectrotemporal Imaging, *Aram Zeytunyan[1], Garegin Yesayan[1], Levon Mouradian[1], Frederic Louradour[2], Alain Barthélémy[2]; [1]Yerevan State Univ., Armenia, [2]XLIM Inst. de Recherche, France.* We report on the comparative study of novel similariton-referencing methods of spectral interferometry and parabolic lensing - spectrotemporal imaging for femtosecond scale temporal measurements, based on the generation of nonlinear-dispersive similariton.

FWI6 • 11:45 a.m.
Competing Effects of Environment and Inter-Qubit Interactions in the Entanglement Dynamics of Two Qubits, *Sumanta Das, Girish Agarwal; Oklahoma State Univ., USA.* We show that coherent qubit-qubit interactions lead to bright and dark periods in the entanglement dynamics of two entangled qubits in contact with an environment. This behavior is further found to be generic in nature.

FWJ • Quantum Optics in Waveguides II—Continued

FWJ4 • 11:30 a.m.
Indistinguishability of Photons Produced by Raman Scattering, *Charles Santori, David Fattal, Kai-Mei C. Fu, Paul E. Barclay, Raymond G. Beausoleil; Hewlett-Packard Labs, USA.* The quantum indistinguishability of photons produced by Raman scattering in the presence of excited-state dephasing is analyzed. Increasing the laser detuning can help significantly if the noise correlation timescale falls within a certain window.

FWJ5 • 11:45 a.m. Invited
Quantum Logic Gates with Fiber-Generated Entanglement in the Telecommunications Band, *Prem Kumar, Monika Patel, Milja Medic, Matthew A. Hall, Joseph B. Altepeter; Northwestern Univ., USA.* Quantum states and gates in the 1.5-micron wavelength range can leverage the existing telecommunications infrastructure for communications-based quantum information processing. We present the latest results on characterization of a telecommunications-wavelength linear optics quantum controlled-NOT gate.

FWK • All-Optical Signal Processing III—Continued

FWK3 • 11:15 a.m.
Flexible All-Fiber Generation of Ultra-Wideband Signals via Pulse Compression and Differential Detection, *Avi Zadok[1], Xiaoxia Wu[2], Jacob Sendowski[1], Amnon Yariv[1], Alan E. Willner[2]; [1]Caltech, USA, [2]Univ. of Southern California, USA.* A flexible and simple scheme for generating ultra-wideband waveforms is proposed, using pulse compression in highly nonlinear fiber and differential detection. Center frequencies of 25 GHz, as well as FCC mask compliant waveforms, are demonstrated.

FWK4 • 11:30 a.m.
Addressable Optical Buffer via Angular Multiplexing in an Electromagnetically Induced Transparency Solid, *Yanfei Tu[1,2], Guoquan Zhang[1,2], Zhaohui Zhai[1,2], Jingjun Xu[1,2]; [1]MOE Key Lab of Weak Light Nonlinear Photonics, Nankai Univ., China, [2]Photonics Ctr., College of Physics Science, Nankai Univ., China.* We introduced angular multiplexing in light storage via electromagnetically induced transparency in a Pr^{3+}:Y_2SiO_5 crystal. Multi-channel buffer memory and addressable all-optical routing were demonstrated by selectively reading out stored pulses without cross-talk between neighboring channels.

FWK5 • 11:45 a.m.
Simultaneous Optical Pulse Multiplication and Shaping Based on the Amplitude-Assisted Phase-Only FBG Filter, *Xuxing Chen, Hongpu Li; Dept. of Electrical and Electronic Engineering, Shizuoka Univ., Japan.* A novel all-optical simultaneous pulse multiplication and shaping approach is proposed, which is based on the simultaneous utilization of two amplitude-assisted phase-only spectral filters realizable by using a short fiber Bragg grating.

FWL • Optical Communication Devices—Continued

FWL4 • 11:15 a.m.
A Bias Free, Quantum Random Number Generator, *Wei Wei, Hong Guo; School of Electronics Engineering and Computer Science, Peking Univ., China.* Based on the random photon emission of laser diode, we propose a new approach for true random number generation with convenient implementation, which is intrinsically bias free and suitable for high speed applications.

FWL5 • 11:30 a.m.
Nanophotonic Interconnects and 3-D Stacked Technology for Future Many-Core Architectures, *Xiang Zhang, Ahmed Louri; Univ. of Arizona, USA.* We explore silicon photonics and 3-D stacked technology to implement a photonic network-on-chips. The proposed scheme provides 2.56 Tb/sec bandwidth with a much reduced power consumption and latency compared to any leading on-chip photonic networks.

FWL6 • 11:45 a.m.
Large-Scale Tunable Optical Filter via Dynamic Stark Effect, *Yundong Zhang, Zhusong He, Hao Wu, Ping Yuna, Shuangqiang Liu; Harbin Inst. of Technology, China.* An optical filter scheme with a large tunability is proposed via dynamic Stark effect. Theory predicts that the tunability can reach over 100 GHz, what is important for laser communication and lidar systems.

For Fall Congress presentations on Wednesday, see pages 125-131.

FWM • Optical Trapping and Micromanipulation I—Continued

FWM3 • 11:15 a.m.
Time Averaged Optical Traps for the Investigation of Superfluidity in BEC, *Sebastian K. Schnelle, Kristian Weegink, Erik D. van Ooijen, Matthew J. Davis, Norman R. Heckenberg, Halina Rubinsztein-Dunlop; School of Physical Sciences, Univ. of Queensland, Australia.* We present the realization of a time averaged optical trap for the use with Bose-Einstein condensates. The trap is able to spatially scan a laser beam to create arbitrary two dimensional static or dynamic potentials.

FWM4 • 11:30 a.m.
Microfluidic Device for the 3-D Electrokinetic Manipulation of Single Molecules, *Jason K. King[1], Lloyd M. Davis[1], Brian K. Canfield[1], Philip C. Sampson[2], William H. Hofmeister[1]; [1]Univ. of Tennessee Space Inst. at Tullahoma, USA, [2]Vanderbilt Inst. for Integrative Biosystems Res. and Education, Vanderbilt Univ., USA.* We discuss the construction and characterization of a microfluidic device for the electrokinetic manipulation of sub-micron particles. A tetrahedral arrangement of four electrodes with 100-micron separation is used to provide control in three dimensions.

FWN • Silicon Photonics II—Continued

FWN3 • 11:15 a.m. Invited
Cascaded Silicon Raman Laser Using Tunable Ring Resonator, *Haisheng Rong[1], Omri Raday[2], Mario Paniccia[1]; [1]Intel Corp., USA, [2]Intel Corp., Israel.* We demonstrate a cascaded silicon Raman laser using a tunable ring resonator cavity whose resonance frequency and coupling coefficient can be tuned to their optimal values post fabrication to achieve desired lasing performance.

FWN4 • 11:45 a.m.
Integrated Fresnel Lens Structure in a Si-Slab Waveguide, *Masato Hata, Daiki Tanaka, Hiroyuki Tsuda; Graduate School of Science and Technology, Keio Univ., Japan.* We have proposed an integrated Fresnel lens with multiple slits in a Si slab waveguide. The slit width and the slit spacing were optimized and the integrated lens had a reflective loss of 0.38 dB.

LSWD • Single-Molecule Biophysics II—Continued

LSWD3 • 11:15 a.m.
Tracking Single Potassium Channels in Live Mammalian Cells, *Aubrey V. Weigel, Michael M. Tamkun, Diego Krapf; Colorado State Univ., USA.* Single molecule tracking in concert with mean square displacement and cumulative distribution function analysis is used to study Kv2.1 ion channel dynamics. Results show the channels are confined to clusters and they undergo anomalous subdiffusion.

LSWD4 • 11:30 a.m. Invited
Tracking Fluorescence Correlation Spectroscopy of Individual Biomolecules, *Kevin McHale[1,2], Andrew Berglund[3], Ke Zhang[1], Charles Limouse[1], Chandra Raman[1,4], Hideo Mabuchi[1]; [1]Stanford Univ., USA, [2]Lab of Chemical Physics, NIDDK, NIH, USA, [3]CNST Nanofabrication Res. Group, NIST, USA, [4]Georgia Tech, USA.* I will describe our group's ongoing research utilizing feedback microscopy to obtain tens-of-seconds per-molecule observation times in solution FCS and FRET assays. Results of recent studies on DNA mechanics will be presented.

LSWE • Second-Order Nonlinear Optics II—Continued

LSWE3 • 11:30 a.m. Invited
Polarization-Rotation and Two-Dimensional IR-Visible Sum Frequency Generation Spectroscopy for Surface Analysis, *Keng C. Chou; Univ. of British Columbia, USA.* Polarization-rotation and two-dimensional IR-visible sum frequency generation spectroscopy will be discussed for studying surface phase transitions of amorphous polymers and surface electronic states of conjugated polymers.

LSWF • Multidimensional Spectroscopy II—Continued

LSWF3 • 11:30 a.m. Invited
Ultrafast Dynamics of Hydrogen Bond Exchange in Aqueous Ionic Solutions, *Sungnam Park[1,2], Michael Odelius[3], Kelly J. Gaffney[2]; [1]Korea Univ., Republic of Korea, [2]Stanford Univ., USA, [3]Stockholm Univ., Sweden.* In aqueous perchlorate solutions, water-water and water-anion H-bond structures are spectrally well-separated. H-bond exchange dynamics of water is studied by 2DIR spectroscopy and molecular dynamics simulations.

JWB • Advances in Adaptive Optics Imaging of the Living Retina I—Continued

JWB4 • 11:30 a.m.
Experimental Test of Simulated Retinal Images Using Adaptive Optics, *Pablo De Gracia, Carlos Dorronsoro, Lucie Sawides, Enrique Gambra, Susana Marcos; Inst. de Óptica, Spain.* Ocular degradation is frequently assessed convolving images with the ocular point-spread-function, estimated from the wave-aberration. Comparisons of visual acuity measured using aberrated targets (viewed through adaptive-optics corrected aberrations) and under natural aberrations reveal consistent discrepancies.

JWB5 • 11:45 a.m.
High Resolution Wavefront Sensing and Mirror Control for Vision Science by Quantitative Phase Imaging, *Alaster J. Meehan, Phillip Bedggood, Brendan Allman, Keith A. Nugent, Andrew B. Metha; Univ. of Melbourne, Australia.* Quantitative Phase Imaging displays attractive features for ocular wavefront aberrometry. An adaptive-optics mirror control algorithm for ophthalmoscopy is demonstrated that takes advantage of its superior lateral resolution and similar accuracy compared to Hartmann-Shack systems.

For Fall Congress presentations on Wednesday, see pages 125-131.

12:00 p.m.–1:30 p.m.
JWC • Joint FiO/LS Poster Session

Optical Design and Instrumentation Posters

JWC1
Design of an Accurate Auto-Focusing Method by Using Elliptic Optical Apparatus, *Yung-Hsing Wang, Pin-Hao Hu, Meng-Che Tsai, Chia-Hsu Chen, Yang-Cheng Lin, Yu-Hsiu Chang, Ji-Bin Horng; Industrial Technology Res. Inst., Taiwan.* A novel auto-focusing measuring method by using elliptic mirror is proposed to improve detecting accuracy and miniaturize optical apparatus. The method is especially effective in machining and inspection for rough surface material, like solar cell.

JWC2
Two Techniques for Generating a Secondary Source with Desired Statistical Properties, *Andrey S. Ostrovsky[1,2], Miguel A. Olvera-Santamaría[1], Carolina Rickenstorff-Parrao[1], Gabriel Martínez-Niconoff[2], Victor Arrizón[2]; [1]Univ. Autonoma de Puebla, Mexico, [2]INAOE, Mexico.* Two complementary techniques for generating a secondary source with desired degree of polarization and transverse coherence length are proposed. The potentialities of these techniques are discussed and illustrated by examples of possible applications.

JWC3
A New LED Light Source for Display Cases, *Carsten Dam-Hansen, Paul Michael Petersen; DTU Fotonik, Technical Univ. of Denmark, Denmark.* We report a new LED light source suitable for illumination of gold objects. It has a variable correlated color temperature from 2760 K to 2200 K with a high color rendering index up to 97.

JWC4
Pattern Transfer by Diffractive Photomask, *Giuseppe A. Cirino[1], Ronaldo D. Mansano[2], Patrick Verdonck[3], Lucila H. Cescato[4], Euclydes Marega Jr[5], Luiz G. Neto[1]; [1]EESC, Dept. of Electrical Engineering, São Paulo Univ., Brazil, [2]PSI, Polytechnic School, Univ. of São Paulo, Brazil, [3]IMEC, Belgium, [4]Gleb Wataghin Physics Inst., Campinas State Univ., Brazil, [5]IFSC, Univ. of São Paulo, Brazil.* A phase-shift lithographic photomask for operation in proximity printing mode is fabricated based on a Fresnel computer-generated hologram. The results show an improvement of the achieved resolution as good as 1 μm.

JWC5
360-Degree Viewable Traditional Disk-Type Multiplex Holography, *Yih-Shyang Cheng, Shie-Hen Lin; Natl. Central Univ., Taiwan.* By tilting both the object and the film planes in hologram-recording process, the resulted traditional multiplex hologram can be viewed by the observers around the hologram simultaneously. Method for compensation of image distortion is proposed.

JWC6
Reliability of Content-Addressable Search in a Defocused Volume Holographic Data Storage System, *Bhargab Das, Joby Joseph, Kehar Singh; Indian Inst. of Technology Delhi, India.* The characteristics of correlation signals in a defocused holographic storage system depend on the similarities among the stored data sets. We achieve reliable performance by using data pages with sparseness values of 0.25 or less.

JWC7
Design of a Device for Synthetizing RGB Color Rainbow Holograms, *Jakub Svoboda, Pavel Fiala; Czech Technical Univ. in Prague, Czech Republic.* According to the needs of creating RGB color rainbow holograms of 3-D computer models, an original device for synthetizing non focused holograms has been designed. The device and the principle of the method is presented.

JWC8
Wide Emitting Freeform Lenses for Illumination, *Nikolai I. Petrov, Georgy Tananaev, Emil Aslanov; LG Technology Ctr., Moscow, Russian Federation.* Reflective and refractive type of lenses for LED emitting into circle and square illumination areas are proposed. Lens surface profiles for extended sources are obtained from the solution of the first order differential equations.

JWC9
Real Time Optical Vibrocardiography Using Image Processing, *Chester Wildey, Duncan MacFarlane; Univ. of Texas at Dallas, USA.* Optical remote sensing of heartbeats using image processing is reported. The system utilizes a single ccd camera, DSP and an adhered disc fiducial to realize real time measurement at rates of 13 Hz.

JWC10
Spatio-Temporal Amplitude and Phase Reconstruction of Complex Beams by Means of Fourier-Transform Spectral Interferometry, *Benjamín Alonso[1], Oscar Varela[1], Íñigo Sola[1], Rocío Borrego Varillas[1], Cruz Méndez[1,2], Julio San Román[1], Camilo Prieto[1], Amelle Zaïr[1], Luis Roso[1,2]; [1]Univ. of Salamanca, Spain, [2]Ctr. de Láseres Pulsados Ultracortos y Ultraintensos, Spain.* A compact device performing spatio-temporal amplitude and phase reconstruction of laser pulses based on spectral interferometry is presented, available for complex beams characterization as those produced by nonlinear effects or non-trivial optic systems.

JWC11
Accurate Measurement of Refractive Indices of Optical Wafers by Using Fabry-Perot Type Interference, *Hee Joo Choi[1], Hwan Hong Lim[1], In-Ho Bae[1], Han Seb Moon[1], Myoungsik Cha[1], Tae Bong Eom[2], Jung Jin Ju[3]; [1]Pusan Natl. Univ., Republic of Korea, [2]Korea Res. Inst. of Standards and Science, Republic of Korea, [3]Electronics and Telecommunications Res. Inst., Republic of Korea.* We investigated Fabry-Perot type interference from optical wafers to measure the refractive indices. This method is accurate (~10^{-5} for fused silica), insensitive to environmental perturbation, and simple to implement, compared to the conventional index-measurement methods.

Laser Science Posters

JWC12
Characteristic Study of Si_3N_4 in the Enrichment of Hardness in AISI 304 SS by Laser Surface Modification Technique, *Petchimuthu Rajarajan[1], Dillibabu Sastikumar[2], Rakesh Kaul[3], Asish Kumar Nath[4]; [1]Angel College of Engineering and Technology, India, [2]Natl. Inst. of Technology, India, [3]India Inst. of Technology, India, [4]Raja Ramanna Ctr. for Advanced Technology, India.* AISI 304 SS with preplaced Si_3N_4-Zr-Ni coating was laser treated for topological character modification. Smooth and crack free surface conditions with enhanced hardness (850HV) prevailed while the substrate was laser processed at 59 J/mm^2.

JWC13
Strong Visible Upconversion in Rare Earth Ion-Doped $NaYF_4$ Crystals, *Darayas N. Patel[1], Calvin Vance[1], Newton King[1], Malcolm Jessup[1], Lekara Green[1], Sergey Sarkisov[2]; [1]Oakwood Univ., USA, [2]SSS Optical Technologies, LLC, USA.* $NaYF_4$:Er^{3+},Yb^{3+}crystals were prepared by simple synthetic method. Under 980nm laser excitation, 408nm, 539nm and 655nm upconversion signals were recorded. Laser power and signal intensities of the upconverted emissions were obtained to understand the upconversion mechanisms.

JWC14
Generating Ultra-Short Pulses from a Q-Switched Microchip Laser, *Alex C. Butler, David J. Spence, David W. Coutts; Dept. of Physics, Macquarie Univ., Australia.* A numerical model, based on the laser rate equations, was used to predict the performance of passively Q-switched microchip lasers. The resulting designs were realised and shown to exhibit pulses of ~ 140 ps duration.

JWC15
980nm Pulsed High Peak Power VCSEL, *Zhenhua Tian, Shi Jingjing, Yan Zhang, Qin Li, Yongqiang Ning, Lijun Wang; Chinese Acad. of Sciences, China.* We have fabricated 980nm VCSEL of 400 μm and 600 μm diameters respectively, the output power reach more than 20 w when under pulsed condition. The current pulse and optical pulse were recorded and analyzed.

JWC16
Anti-Brownian ELectrokinetic (ABEL) Trapping of Single High Density Lipoprotein (HDL) Particles, *Samuel Bockenhauer[1], Alexandre Fürstenberg[1], Quan Wang[1], Michael Bokoch[2], Xiao Jie Yao[2], Brian DeVree[3], Roger K. Sunahara[3], Brian K. Kobilka[2], W. E. Moerner[1]; [1]Dept. of Chemistry, Stanford Univ., USA, [2]Dept. of Molecular and Cellular Physiology, Stanford Univ., USA, [3]Dept. of Pharmacology, Univ. of Michigan Medical School, USA.* The Anti-Brownian ELectrokinetic (ABEL) trap uses voltage feedback to electrokinetically cancel the Brownian motion of single particles in solution in microfluidic geometries. This allows trapping of single high density lipoprotein (HDL) particles for extended observation.

JWC17
Simple Device for Measuring Ultrashort Pulses in the Visible, *Dongjoo Lee, Rick Trebino; Swamp Optics, USA.* We demonstrate an extremely simple frequency-resolved-optical-gating (FROG) device (GRENOUILLE) ideal for measuring visible ultrashort pulses. By angle-tuning a thick crystal, its range includes almost the entire visible spectrum.

JWC18
Multielemental Mapping of Archeological Samples by Laser-Induced Breakdown Spectroscopy (LIBS), *Michaela Galiová[1], Jozef Kaiser[2], Karel Novotný[1], Radomír Malina[2], Aleš Hrdlička[1], Jan Novotný[2], David Procházka[2], Miroslav Liška[2], Viktor Kanický[1]; [1]Masaryk Univ., Czech Republic, [2]Brno Univ. of Technology, Czech Republic.* The capability of Laser-Induced Breakdown Spectroscopy for multi-elemental mapping of archeological samples with high-spatial resolution is discussed. The outcomes of double- and single pulse LIBS techniques are compared.

JWC19
Mapping of Nutrition Elements and Heavy Metals in Plant Tissue Slices by Laser-Induced Breakdown Spectroscopy, *Karel Novotný[1], Michaela Galiová[1], Lucie Krajcarová[1], Jozef Kaiser[2], Viktor Kanický[1], René Kizek[3], Vojtěch Adam[3], Miroslav Liška[2]; [1]Masaryk Univ., Czech Republic, [2]Brno Univ. of Technology, Czech Republic, [3]Mendel Univ. of Agriculture and Forestry, Czech Republic.* Double pulse LIBS was utilized for mapping the nutrition elements and the accumulation of the heavy metals in a plant tissue slices. Elemental maps obtained by this technique were compared with images from fluorescence microscopy.

JWC20
Auxiliary Locking System for the Advanced LIGO Gravitational Wave Interferometer, *Aidan F. Brooks, David Yeaton-Massey, Rana Adhikari; Caltech, USA.* The advanced LIGO gravitational wave interferometer requires an auxiliary locking system to prepare its main optical cavities for operation in a controlled deterministic way. This presentation will discuss research and development of that system.

For Fall Congress presentations on Wednesday, see pages 125-131.

JWC • Joint FiO/LS Poster Session—Continued

Optical Sciences Posters

JWC21
Slow Light Delay Predictions and Measurements in Hot Cesium Vapor, *Monte D. Anderson; Air Force Inst. of Technology, USA.* Tunable optical delays are observed in alkali vapor near resonant absorption lines. Pulses delayed across cesium D_2 ± 20GHz are measured and compared to model predictions.

JWC22
Microscopic Observation of Photodoping Process in Multilayer Ag/GeS_2 Film, *Takahiro Iijima[1], Moriaki Wakaki[1], Yoshihisa Murakami[2], Norihide Takeyama[3], Yoshikazu Kanai[3]; [1]Tokai Univ., Japan, [2]Tsukuba Univ. of Technology, Japan, [3]Genesia Corp., Japan.* The photodoping characteristics of multilayer films, GeS_2/Ag/GeS_2 and Ag/GeS_2/Ag, were analyzed and compared with the conventional two layer films. The feasibility to apply three layered films to optical memory and waveguide were discussed.

JWC23
Electronic Model for VCSELs: Switching Mode, Control of Threshold Current and Saturation, *J. H. Talla Mbe, P. Woafo; Univ. of Yaoundé, Cameroon.* We build an electronic model of VCSELs based on the mathematical rate equations of Danckaert et *al.*[1]. That electronic device generates polarization switching and also reduces the threshold current.

JWC24
Light Beam Travel around a Line Heat Source in Water, *Aditya Bhakta[1], George Barbastathis[1,2]; [1]MIT, USA, [2]Singapore-MIT Alliance for Res. and Technology, Singapore.* A heat source placed in quiescent fluid gives rise to a laminar convective plume. We compute the evolution of a laser beam due to the resultant index of refraction changes induced by the temperature profile.

JWC25
On Simultaneous Measurement of Polarization and Orbital Angular Momentum of Light, *Meenakshi Kohli, K. T. Kapale; Western Illinois Univ., USA.* We have theoretically devised and are experimentally implementing schemes for simultaneous measurement of polarization and orbital angular momentum (OAM) of light with the aim of understanding light carrying OAM emitted by rapidly rotating astrophysical objects.

JWC26
Terahertz Propagation on Plasmonic Crystal Surface, *Eui Su Lee, Young Bin Ji, Sang Hoon Kim, Tae-In Jeon; Korea Maritime Univ., Republic of Korea.* We present experimental and theoretical studies on terahertz surface plasmon propagation on slit and rectangular aperture arrays in an aluminum sheet. Terahertz waves are coupled onto the plasmonic structures via a parallel plate waveguide.

JWC27
Determination of the Beam Coherence-Polarization Matrix for an Expanded Laser Beam, *Bhaskar Kanseri[1], Hem C. Kandpal[1], Shyama Rath[2]; [1]Natl. Physical Lab, India, [2]Univ. of Delhi, India.* The Beam Coherence-Polarization (BCP) matrix for a pair of points in the cross-section of an expanded laser beam is investigated theoretically and determined experimentally using polarizers and rotators in a modified version of Young's interferometer.

Quantum Electronics Posters

JWC28
Atmospheric Propagation of Fiber and Solid State Lasers in Maritime Environments, *Timothy O. Murphy, Matthew A. Leigh, Andrew Baronavski, Adin Kawate; Envisioneering, Inc., USA.* We report atmospheric propagation measurements for lasers in maritime environments at the Pacific Missile Range Facility. Visible and near-IR lasers were directed along shorelines, into a boat, into a helicopter, and to a neighboring island.

JWC29
Observation of Interaction and Circular Motion of Solitons in Bessel-Like Ring Lattices, *Simon Huang, Xiaosheng Wang, Zhigang Chen; San Francisco State Univ., USA.* We demonstrate particle-like soliton interaction and rotation in Bessel-like photonic lattices. Attractive and repulsive rotations as well as planet-like orbiting of two solitons were observed with different initial phase relations.

JWC30
Nonclassical Nature of Counting Probabilities in the Detection of Light from the DPO, *Arnab Mitra, Reeta Vyas, Surendra Singh; Univ. of Arkansas, USA.* We show that both photon number and photoelectron counting probabilities can be used directly to demonstrate the nonclassical nature of light from the degenerate parametric oscillator.

JWC31
Construction of CNOT Using $SWAP^{1/2}$ Gates, *Subramanian Balakrishnan, Ramasubramanian Sankaranarayanan; Natl. Inst. of Technology-Tiruchirappalli, India.* We found that $SWAP^{\alpha}$ gates with $0 \leq \alpha \leq 1$ constitute one edge of Weyl chamber, the geometric structure of nonlocal two-qubit gates. In this family, $SWAP^{1/2}$ is the only perfect entangler and capable of constructing controlled-NOT.

JWC32
Symmetry-Broken Diffraction and Self-Trapping of Multi-Vortex Beams in Triangle Photonic Lattices, *Sheng Liu, Peng Zhang, Xuetao Gan, Jianlin Zhao; Inst. of Optical Information Science and Technology, Northwestern Polytechnical Univ., China.* We study the linear and nonlinear propagation dynamics of multi-vortex beams in a triangle photonic lattice. The symmetry-broken diffraction and moving self-trapping state of the input multi-vortex beam are observed.

JWC33
Polarization Dynamics of Individual Transverse Modes of a Vertical-Cavity Surface-Emitting Laser Subject to Optical Feedback, *Hong Lin, Erik G. Born, Nola J. Palombo, Madeline C. White; Bates College, USA.* We have experimentally studied polarization dynamics of transverse modes in a vertical-cavity surface-emitting laser with optical feedback. Correlation property of orthogonally polarized components of the first-order mode is different from that in the fundamental mode.

JWC34
Timing Jitter in Prelase-Initiated, Single-Mode Pulses from a Repetitively Q-Switched, Diode-Pumped, Nd:YAG Laser, *Henry Baker, Spencer Kimori, John R. Thompson, Thomas Shaffner, Troy J. Siemers; Virginia Military Inst., USA.* Single-mode pulses from an Nd:YAG laser display substantial timing jitter relative to the opening of the Q-switch, which is driven by prelase intensity fluctuations proximate to the opening of the Q-switch.

JWC35
Multi-Normal-Mode Splitting of a Cavity in the Presence of Atoms Towards the Superstrong Coupling Regime, *Jing Zhang[1], Xudong Yu[1], Min Xiao[2]; [1]Inst. of Opto-Electronics, China, [2]Univ. of Arkansas, USA.* Multi-normal-mode splitting peaks are experimentally observed in a system with doppler-broadened two-level atoms inside a relatively long optical cavity in the "superstrong coupling" regime.

Photonics Posters

JWC36
High Sensitivity Recording of Dynamic Population Gratings in Saturable Yb-Doped Fibers at 976nm, *Daniel García-Casillas, Serguei Stepanov; CICESE, Mexico.* High sensitivity recording of population gratings in Yb-doped fiber at typical pumping wavelength λ≈976nm is reported. Effective mixed (amplitude and phase) dynamic gratings with formation times below 1ms were recorded at sub-mW CW power level.

JWC37
Optical Switching by Long Period Grating Inscribed in Panda Fiber for Application in Fiber Communication, *Gagandeep Purohit, Bibhuti Bhushan Padhy, Sandipan Nalawade, Harneet Thakur; Defence Inst. of Advanced Technology, India.* LPGs by electric arc method in panda fiber at different exposure angles are inscribed. The peculiarity of the inscription process made the LPG to behave as thermo-optic switch for its application in communication.

JWC38
Bandwidth Enhancement in Multimode Fibers, *Arash Mafi; Univ. of Wisconsin at Milwaukee, USA.* We report on a substantial improvement in the bandwidth of graded index multimode fibers caused by a controlled intentional mode coupling. Scattering from micron size core inclusions induce the mode coupling with minimum power loss.

JWC39
Arbitrary Shuffler Using Cross-Point Waveguide Mirrors, *Yoichi Taira, Hidetoshi Numata; IBM Res., Tokyo Res. Lab, Japan.* Dual layer waveguides are used to realize an arbitrary channel shuffler. The channel mapping of two parallel waveguides is determined by the positions of optical vias, which consist of laser processed two 45 degree mirrors.

JWC40
Critical Wavelength in SMS Structures Employing GeO_2 Doped MMF, *Saurabh M. Tripathi[1], Emmanuel Marin[2], Arun Kumar[1], Jean-Pierre Meunier[2]; [1]Indian Inst. of Technology Delhi, India, [2]Lab Hubert Curien, Univ. de Lyon, France.* We demonstrate experimentally and explain theoretically that SMS structures employing GeO_2 doped multimode fibers are most sensitive near a critical wavelength and show opposite spectral shift around it with respect to change in ambient temperature.

JWC41
Fiber Optic Bending Sensor Based on Multimode Interference (MMI) Effects, *Daniel Lopez-Cortes[1], Jose R. Guzman-Sepulveda[2], Ivan Hernandez-Romano[1], Miguel Torres-Cisneros[2], Jose J. Sanchez-Mondragon[1], Daniel A. May-Arrioja[1]; [1]INAOE, Mexico, [2]Nanobiophotonics Group, DICIS, Univ. de Guanajuato, Mexico.* Here we report a fiber bending sensor based on multimode interference effects. Sensing is achieved through losses induced in the propagating modes, which directly affects the intensity of the imaged formed by the multimode fiber.

JWC42
Adaptive Interferometer for Detection of Laser Ultrasonic Signals Using Saturable Yb-Doped Fiber at 1064 nm, *Jesus A. Nuñez Quintero, Serguei Stepanov; Ctr. de Investigación Científica y de Educación Superior de Ensenada, Mexico.* Application of two waves mixing via dynamic population gratings in Yb-doped fibers with saturable absorption at 1064 nm for detecting laser induced ultrasonic signals in the linear configuration of an adaptive interferometric vibrometer is reported.

JWC43
Hartmann-Shack Wavefront Sensing of Zernike Polynomials for Nonlinear Materials Characterization, *Diego Rativa[1], Renato de Araujo[2], Brian Vohnsen[1]; [1]School of Physics. Univ. College of Dublin, Ireland, [2]Dept. of Electronics and Systems, Federal Univ. of Pernambuco, Brazil.* We propose a technique exploiting the Hartmann-Shack wavefront sensor as a tool for nonlinear optical characterization. Unlike the conventional Z-scan method, the presented technique is not so sensitive to misalignment, linear scattering, and sample imperfections.

JWC44
Long-Range Surface-Plasmon Waveguide Sensors with μ-Fluidic Channel, *Yang Joo[1], Seok Song[1], Daryl Ussery[2], Kyu Lee[2], Robert Magnusson[2]; [1]Dept. of Physics, Univ. of Hanyang, Republic of Korea, [2]Dept. of Electrical Engineering, Univ. of Texas at Arlington, USA.* Long-range surface-plasmon waveguide sensors consisting of asymmetric double metalfilms, a resonance grating and μ-fluidic channel sandwiched between the metal layers are described. 10^{-6} index resolution and sub-nm detection limit for sensing biomolecules are achievable.

For Fall Congress presentations on Wednesday, see pages 125-131.

JWC • Joint FiO/LS Poster Session—Continued

JWC45
Dependence of Parametric Gain on Crystal Parameters in Unidirectional Photorefractive Ring Cavity, *Mahendra K. Maurya, Tarun Kumar Yadav, Ram Anjore Yadav; Banaras Hindu Univ., India.* The dependence of parametric gain due to the two-beam coupling on absorption coefficient of materials and modulation ratio has been studied. Such amplification of signal beam is responsible for the oscillations.

JWC46
Fiber-Optic RF Phase Shifter, *Alex Mulvihill, Azad Siahmakoun; Physics and Optical Engineering, Rose-Hulman Inst. of Technology, USA.* A photonic RF phase shifter based on optical modulation and switching with capability of continuous 0°-360° phase-shifting is demonstrated. Experimental results for phase shifting in 50 MHz steps up to 0.5 GHz will be presented.

JWC47
Impact of the Gain Saturation on Steady States of Bright Optical Pulses in an Erbium-Doped Single-Mode Fiber Amplifier, *Mauro Sánchez Sánchez[1], Alexandre S. Shcherbakov[2]; [1]Univ. del Papaloapan Campus Loma Bonita, Mexico, [2]Inst. Nacional de Astrofisica, Óptica y Electrónica, Mexico.* Steady ultrashort bright optical pulses, which are originating in single-mode erbium-doped amplifier operating within a nonlinear transmission, are investigated. The amplitude and frequency distributions are estimated, and the impact of the gain saturation is revealed.

JWC48
All-Optical TE-TM Polarization Mode Conversion at 500Gb/s by Using Nonlinearities in SOAs, *Claudio Crognale, Antonella Di Giansante; Technolabs S.p.A., Italy.* Extreme optical gain nonlinear features in SOAs have been numerically investigated analyzing the performances of an interferometric SOA-based scheme capable to perform the all-optical polarization conversion of a 500Gb/s data-stream without any pattern-dependence.

JWC49
Bit Error Control for Optical Chaotic Communication by Applying Low-Frequency Noise, *Satoshi Ebisawa[1], Shinichi Komatsu[2]; [1]Gakushuin Univ., Japan, [2]Waseda Univ., Japan.* We numerically study the effect of channel noise in the chaotic laser diode transmitter-receiver array scheme, and show that the bit error rate can be decreased by applying low-frequency noise.

JWC50
CAD Analysis of Four Co-Propagating Spatial Domain Multiplexed (SDM) Channels of Same Wavelength in Optical Fibers, *Syed H. Murshid, Abhijit Chakravarty, Raka Biswas; Florida Inst. of Technology, USA.* A four channel spatially multiplexed optical system has been designed using commercially available CAD software. Two dimensional intensity plot and three dimensional beam profiles with CAD simulated output data are presented in this paper.

JWC52
Detection of Eavesdropping for Point-to-Multipoint Optical Chaotic Communication, *Kengo Suyama[1], Satoshi Ebisawa[2], Shinichi Komatsu[1]; [1]Waseda Univ., Japan, [2]Gakushuin Univ., Japan.* Based on the characteristics of point-to-multipoint optical chaotic communication system, we discuss the effect of parameter mismatch between the transmitter and receiver laser diodes and propose a new method for reasonably efficient of detecting eavesdropping.

JWC53
Design and Fabrication of Multilayer Si/SiO_2 Super-High N.A. GRIN Lens for Nanowaveguide to Optical Fiber Coupling, *Ter-Hoe Loh[1], Qian Wang[1], Keh-Ting Ng[1], Yingyan Huang[2], Seng-Tiong Ho[3]; [1]Data Storage Inst., Singapore, [2]OptoNet Inc., USA, [3]Northwestern Univ., USA.* Compact multilayer Si/SiO_2 asymmetric GRIN lens (length:10~20μm) for vertical optical mode-size transformation from sub-0.5μm of nanowaveguide to ~10μm of single-mode-fiber, is proposed and designed. We report success in deposition and etching of 6~8μm multilayer Si/SiO_2.

JWC54
Plasmonic Light Beaming Properties of Dual Sub-Wavelength Slits with Dielectric Surface Gratings, *Seyoon Kim, Junghyun Park, Yongjun Lim, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.* We numerically examine beaming properties of dual sub-wavelength slits with dielectric surface gratings. The dual sub-wavelength slits are used to generate two plasmonic sources having different phases for exciting plural surface plasmon polariton modes.

JWC55
Study of Electromagnetic Waves Propagation through Metamaterials, *Héctor Kinto Ramírez[1], Martha Alicia Palomino Ovando[1], Felipe Ramos Mendieta[2]; [1]Benemérita Univ. Autónoma de Puebla, Mexico, [2]Univ. Autónoma de Sonora, Mexico.* We calculate transit time of electromagnetic Gaussian packets traversing a periodic structure of alternate layers of dielectric-metamaterial, the packets are tuned at the tunneling modes that appear in the gap and we find superluminal phenomenon.

JWC56
Fabrication of Surface Plasmon-Polariton Couplers and Waveguide Devices, *Daryl Ussery[1], Hahn Young Song[1], Kyu Jin Lee[1], Robert Magnusson[1], Seok Ho Song[2]; [1]Univ. of Texas at Arlington, USA, [2]Hanyang Univ., Republic of Korea.* Described is holographic stepping-lithography fabrication of grating couplers and waveguide platforms for efficient surface plasmon-polariton (SPP) excitation on metallic structures. This provides consistent coupling with design flexibility and high efficiency for various SPP nanophotonic devices.

JWC57
Guided-Mode Resonances in Surface Plasmonic Waveguides, *Hahn Y. Song[1], Sangin Kim[2], Kyu J. Lee[3], Robert Magnusson[3]; [1]KAIST, Republic of Korea, [2]Ajou Univ., Republic of Korea, [3]Univ. of Texas at Arlington, USA.* Guided-mode resonances in single- and double-layer thin metal films with periodic slits have been investigated theoretically. The excitation of the surface plasmons (SPs) and resonance tuning through SP mode coupling are presented.

JWC58
Hole Depth Studies in Single-Defect Photonic Crystal Vertical-Cavity Surface-Emitting Lasers Using 3-D FDTD Simulations, *Kirk Ingold, Lisa Shay, Gregory Kilby; United States Military Acad., USA.* Three-dimensional finite difference time domain calculations are performed on single defect photonic crystal vertical-cavity surface emitting lasers. Simulation results are presented in comparison with measured near- and far-field radiation patterns and optical spectrum measurements.

JWC59
New Distributions with Soliton-Type Behavior and Their Waveguide Properties in Kerr Media, *Daysi Ramírez Martínez, Maribel M. Méndez Otero, M. Luis Arroyo Carrasco, Marcelo D. Iturbe Castillo; Benemérita Univ. Autónoma de Puebla, Mexico.* Novel field distributions for a positive and negative nonlinear Kerr media are propagated numerically obtaining a spatial soliton-like behavior. Their waveguide properties are analyzed and compared with ideal solitons.

Optics in Biology and Medicine Posters

JWC60
Optical Tweezing near and Far from Resonance, *Brooke C. Hester[1], Rani Kishore[1], Kristian Helmerson[1], Carly Levin[2], Naomi Halas[2]; [1]NIST, USA, [2]Dept. of Electrical and Computer Engineering, Rice Univ., USA.* We study the effects of optical tweezing near and far from the optical resonance of the trapped object. Single particles are manipulated and studied using a single-focus optical trap with variable wavelength.

JWC61
Analysis of Interference Patterns of Optical Vortices in Monochromatic and Polychromatic Light, which Passed Stochastic Screen, *Vladlen G. Shvedov, Vladimir I. Shostka, Nataliya V. Shostka; Taurida Natl. V. Vernadsky Univ., Ukraine.* The possibility of diagnostic phase singularities using stochastic screen, made from a number of couples of points with various orientation and equal length, joining centers of each couple of holes, is described in our work.

JWC62
Spatial Beam Endorsed Optical Trapping of Multiple Au Nanoparticles/*E. coli* and Gateway to Plasmonic Sensors, *Ranjeet Kumar, Chandra Shakher, Dalip Singh Mehta; Indian Inst. of Technology Delhi, India.* We demonstrate multiple trapping of Au nanoparticles (253 nm.) and also low refractive index microorganism *E.coli* bacteria, which is made possible by intra-cavity generated spatially inhomogeneous laser beam in optical tweezers.

JWC63
Superresolution Imaging and Force Characterization of Optical Tweezers Using High-Speed Cameras, *Juan P. Staforelli, Jose M. Brito, Esteban Vera, Carlos Saavedra, Sergio Torres; Univ. of Concepcion, Chile.* We propose a novel approach for using a high-speed camera for the characterization of optical tweezers by registering the trapped particle subpixel motion, while still providing simultaneous high resolution imaging by using multiframe superresolution.

JWC64
Compact Optical Tweezers Based on SLM for Real-Time Optical Trapping and Manipulation, *Martin Nyvlt, Marek Skeren; Czech Technical Univ. in Prague, Czech Republic.* We report a compact holographic optical tweezers based on an LCoS SLM. Optical traps are generated by diffraction of light on the Fresnel-type hologram generated by a fast parallel algorithm that enables real-time 3-D manipulation.

JWC65
The Multilayered Biological Structure Optical Characteristic Mathematical Modeling by Intracavity Laser Spectroscopy Method, *Kirill Kulikov; St. Petersburg Polytechnical State Univ., Russian Federation.* A mathematic model is constructed for predicting of the absorption spectrum and dispersion of a section of a biological structure in the cavity of an optical resonator.

JWC66
A Study of Fibroblast Growth Factor and Its Receptor Complex Using Light Scattering, *Pallavi Sharma, Dakshinamurthy Rajalingam, T. K. S. Kumar, Surendra Singh; Univ. of Arkansas, USA.* Dynamical light scattering technique was used to study the interaction of fibroblast growth factor and its receptor proteins in solution.

JWC67
Digital-Optical Experimental Set up for *in vitro* Cell Tracking Based on Cross Correlation Technique, *Irais V. Solís[1], Miguel Torres-Cisneros[1], Juan G. Aviña-Cervantes[1], Oscar G. Ibarra-Manzano[1], Eduardo Aguilera-Gómez[1], Hector Plascencia-Mora[1], Javier J. Sanchez-Mondragón[2]; [1]Nanobiophotonics Group, DICIS, Univ. de Guanajuato, Mexico, [2]Photonics and Physical Optics Lab, Inst. Nacional de Astrofisica, Óptica y Electrónica, Mexico.* An automatic cell tracking system based in the NCC technique is proposed. Image operations were performance by a FPGA while Fourier transforms were done by an optical correlator. The time consuming was reduced about 70%.

JWC68
Fluorescence Immunoassay for the Detection of Latent Tuberculosis Antigens with Single Molecule Sensitivity, *Barbara S. Smith, Michael S. Scherman, Aubrey V. Weigel, Kristen L. Jevsevar, Jarvis W. Hill, John S. Spencer, Michael R. McNeil, Diego Krapf; Colorado State Univ., USA.* The successful identification and detection at the single molecule level of Antigen 85b, an antigen released by tuberculosis, was accomplished using a fluorescence-based immunoassay. This work enables a method for the diagnosis of latent tuberculosis.

For Fall Congress presentations on Wednesday, see pages 125-131.

JWC • Joint FiO/LS Poster Session—Continued

JWC69
Development of Lipid Targeted Raman Probes for *Caenorhabditis elegans*, *Shobhit Charan[1,2,3], Fan-Ching Chien[3], Narendra Singh[3], Peilin Chen[3]; [1]Dept. of Chemistry, Natl. Taiwan Univ., Taiwan, [2]Taiwan Intl. Graduate Program, Nanoscience and Technology Program, Academia Sinica, Taiwan, [3]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* We have developed a nanoparticle based Raman probe (Ag@ Nile Red), which was capable of targeting the lipids, therefore, revealing the location of lipid droplets in live *Caenorhabditis elegans (C. elegans)*.

JWC70
Pseudo-Periodic Pattern for Absolute Bidimensional Position Retrieval of a Zone of Interest under Microscope, *July A. Galeano Zea, Patrick Sandoz; Univ. de Franche-Comte, France.* Vision system is used for absolute position measurement of a zone of view under microscope using pseudo-periodic pattern. Superimposition of recorded images in a common position reference system with subpixel accuracy is obtained by phase-computation.

JWC71
Towards Deformable Mirror Calibration Using Phase Diversity in Objective Coupled Planar Illumination Microscopy, *Diwakar Turaga, Timothy E. Holy; Washington Univ. School of Medicine, USA.* We have introduced a deformable mirror (DM) in the emission path of an OCPI microscope to allow for adaptive optics using phase diversity imaging. Currently we are implementing phase diversity algorithms to calibrate the DM.

JWC72
Super-Resolution Localization Microscopy by Quantum Dot Blinking, *Fan-Ching Chien, Peilin Chen; Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* The blinking effects of quantum dots have been utilized to localize individual quantum dots, which couldn't be resolved by conventional microscopy. It has been demonstrated that quantum dots could be localized with sub-10 nanometer resolution.

JWC73
Study of the Transversal Misalignment of an Axicon, *Pascal Dufour, Gabrielle Thériault, Yves De Koninck, Nathalie McCarthy; Univ. Laval, Canada.* We calculated the effect of the misalignment of a Gaussian beam with respect to an axicon and found that for small displacements, the focal line preserves its resolution and remains parallel to the optical axis.

JWC74
Noninvasive Estimation of Cultured Cell Conditions by a Laser Speckle Microscopy, *Yasuyuki Hirakawa[1], Yukihiro Fukunaga[2], Norio Miyoshi[2]; [1]Kurume Natl. College of Technology, Japan, [2]Univ. of Fukui, Japan.* Microscopic laser speckle observations of three types of human prostate cancers revealed that the laser speckle fluctuated differently depending not only on the cell line but also on the cell's ability to divide.

JWC75
Development of an Integrated Multiplexed Low Coherence Interferometer and Fluorescence Clinical Endoscope, *Kyu Hyun Kim, Tyler K. Drake, Michael G. DeSoto, Marcus H. Henderson, David F. Katz, Adam Wax; Duke Univ., USA.* The performance of a novel clinical endoscope with integrated multiplexed LCI and fluorescence measurements is evaluated. Feasibility and accuracy for measuring microbicidal gel distribution and thickness in the vaginal tract will be assessed.

JWC76
Formation and Functionalization of Metallic Nanoparticles with Biomimetic Multifunctional Catechols, *Kvar C. L. Black, Jose G. Rivera, Kelly M. Luckasevic, Zhongqiang Liu, Phillip B. Messersmith; Northwestern Univ., USA.* Catechols are employed by many organisms for diverse functions such as photoprotection, adhesion, immunity, and neuromodulation. We report the use of catechol-containing molecules as a biomimetic strategy to form and functionalize optically-active metallic nanoparticles (NPs).

Vision and Color Posters

JWC77
Spectral and Spatial Characteristics of the First Stiles-Crawford Effect: Experiment and Theory, *Brian Vohnsen, Diego Rativa; Univ. College Dublin, Ireland.* The first Stiles-Crawford effect describes a pupil-dependent visibility of a narrow light beam. Here new experiments are compared with theoretical analysis of retinal waveguiding across the visible spectrum to elucidate the influence of cone pigments.

JWC78
A Potential S-Cone Dominated ERG Response Shows Robust Delays in Type 1 Diabetes, *Tom Wright[1,2], Josefin Nilsson[2], Michelle McFarlane[1,3], Carol A. Westall[1,3]; [1]Hospital For Sick Children, Canada, [2]Sahlgrenska Acad., Sweden, [3]Dept. of Ophthalmology and Vision Sciences, Univ. of Toronto, Canada.* Diabetic retinopathy is a common, irreversible outcome of diabetes. Early detection is essential for successful intervention. A new s-cone dominated ERG response shows robust delays in adolescents with Type 1 diabetes prior to retinopathy.

JWC79
Validation of Computational Model for Predicting Visual Acuity from Wavefront Aberration Measurements, *Azadeh Faylienejad, Vasudevan Lakshminarayanan; Univ. of Waterloo, Canada.* Predictions of visual acuity by a model are evaluated by comparing to experimental results. Different levels of internal noise and thresholds were used. This template matching model gives good results in the presence of aberrations.

JWC80
A New Fast Scanning Infrared Photoretinoscope to Measure Peripheral Refraction as a Function of Accommodation, *Juan Tabernero, Frank Schaeffel; Inst. for Ophthalmic Res. Tubingen, Germany.* A new instrument designed to provide fast measurements (4 seconds) of the peripheral refraction (±45° horizontal field) is presented. Peripheral refraction in the vertical pupil meridian was measured as a function of the accommodative state.

JWC81
Strehl Ratio and Visual Acuity in a Pre-School Population, *Damber Thapa, Andre Fleck, William R. Bobier, Vasudevan Lakshminarayanan; Univ. of Waterloo, Canada.* Strehl ratios were calculated from MTFs obtained from Hartmann-Shack images. These were compared to three visual acuity groups of 6/6, 6/9 and 6/12. No significant differences in Strehl ratios were observed.

Optics in Information Science Posters

JWC82
Novel Colored Pulse Lasers Photography for High Speed Imaging, *Chien-Sheng Liu, Chia-Hsu Chen, Chia-Chao Chung, Po-Heng Lin, Kung-Hsuan Lin; Industrial Technology Res. Inst., Taiwan.* This study proposes a colored laser photography to obtain color images. Based on the RGB synthesis technique, a novel colored pulse lasers photography is designed for high speed imaging.

JWC83
3-D Field Correlation of Speckles Generated by Pupils with Multiple Apertures, *Alberto Lencina, Myrian Tebaldi, Néstor Bolognini; CIOp (CONICET La Plata - CIC), Argentina.* 3-D field correlation of objective speckles is evaluated for systems whose pupils have multiple apertures. Minimal suppositions were made on speckle and pupil properties. As a particular case, longitudinal correlations for square apertures are analyzed.

JWC84
Orbital Angular Momentum of Light in the Radio Range of the Electromagnetic Spectrum, *Jacob E. Brown, K. T. Kapale; Dept. of Physics, Western Illinois Univ., USA.* We study generation and detection of orbital angular momentum (OAM) of light in the radio range of the electromagnetic spectrum with potential application to understand OAM light that emitted by radio-active astrophysical objects.

12:00 p.m.–1:30 p.m. Lunch Break *(on your own)*

For Fall Congress presentations on Wednesday, see pages 125-131.

JOINT FiO/LS

1:30 p.m.–3:30 p.m.
JWD • Entanglement Generation and Measurement III
Kevin J. Resch; Inst. for Quantum Computing, Canada, Presider

JWD1 • 1:30 p.m. Invited

Strong Interactions of Single Atoms and Photons with Toroidal Micro-Resonators, *H. Jeff Kimble; Caltech, USA.* Strong radiative coupling between one atom and photon has been achieved with high-Q micro-toroidal resonators, thereby providing capabilities for diverse advances in quantum information science, including an efficient router for single photons and atom-atom interactions catalyzed by one photon.

JWD2 • 2:00 p.m.

Quantum Entanglement, Antibunching and Saturation of Atoms in Dipole Blockade, *Jeremie Gillet[1], Girish Agarwal[2], Thierry Bastin[1]; [1]Univ. de Liège, Belgium, [2]Oklahoma State Univ., USA.* We show how dipole blockade leads to quantum entanglement and antibunching of atoms. We further show how dipole blockade can be lifted by saturating the optical transitions.

FiO

1:30 p.m.–3:30 p.m.
FWO • OSA Topical Meeting Highlights I
Michael Duncan; NRL, USA, Presider

FWO1 • 1:30 p.m. Invited

Active Terahertz Metamaterials, *Hou-Tong Chen, John F. O'Hara, Abul K. Azad, Antoinette J. Taylor; Los Alamos Natl. Lab, USA.* We demonstrate THz metamaterials exhibiting either amplitude/phase control, via carrier injection or depletion in the active semiconductor substrate or frequency control, via photoexcitation of carriers into active semiconducting materials incorporated into the sub-wavelength metamaterial structure. (Nonlinear Optics, 2009)

FWO2 • 2:00 p.m. Invited

Photonics in Supercomputing: The Road to Exascale, *Jeffrey Kash; IBM Res., USA.* Optical interconnects in present and future supercomputers are reviewed, emphasizing Exaflop performance circa 2020, which is 1000X today's Petaflop computers. Power, density and cost requirements become increasingly stringent, ultimately driving the need for on-chip optics. (Integrated Photonics and Nanophotonics Research and Applications, 2009)

1:30 p.m.–3:30 p.m.
FWP • Metamaterials III
Yeonghwan Ahn; Ajou Univ., Republic of Korea, Presider

FWP1 • 1:30 p.m. Invited

Ultrafast Optical Nonlinearities in Hybrid Metal-J-Aggregate Nanostructures, *Christoph Lienau; Carl von Ossietzky Univ., Germany.* We study for the first time, the ultrafast optical nonlinearities of hybrid, metal-J-aggregate nanostructures using angle-resolved pump-probe-spectroscopy. Our results demonstrate that the strong coupling between surface plasmon polaritons and excitons drastically alters the polariton dynamics.

FWP2 • 2:00 p.m.

Characterization of the Loss in Plasmonic Modes of Metal-Insulator-Metal Waveguides by a Prism-Coupling Approach, *Chien-I Lin, Thomas K. Gaylord; Georgia Tech, USA.* A prism-coupler-based method is presented for characterizing plasmonic modes in metal-insulator-metal waveguides from the reflected power in a transverse configuration. The loss is obtained without physically changing the waveguide length as in conventional methods.

1:30 p.m.–3:15 p.m.
FWQ • Phase Space Optics—Optical System Theory for the 21st Century I
Markus Testorf; Dartmouth College, USA, Presider

FWQ1 • 1:30 p.m. Tutorial

Wigner Distribution, Partial Coherence, and Phase Space Optics, *Martin J. Bastiaans; Dept. of Electrical Engineering, Eindhoven Univ. of Technology, Netherlands.* The Wigner distribution is presented as a perfect means to treat partially coherent optical signals and their propagation through first-order optical systems from a radiometric and phase-space optical perspective.

Martin J. Bastiaans received an M.Sc. degree in electrical engineering (with honors) and a Ph.D. degree in technical sciences from Eindhoven University of Technology, Netherlands, in 1969 and 1983, respectively. In 1969, he became an assistant professor and, since 1985, he has been an associate professor with the Department of Electrical Engineering, Eindhoven University of Technology, currently in the Signal Processing Systems Group. His research covers different aspects in the general field of signal and system theory and includes a signal-theoretical approach of all kinds of problems that arise in Fourier optics. His main current research interest is in describing signals by means of a local frequency spectrum (such as the Wigner distribution) and related issues. Dr. Bastiaans is a Fellow of OSA and a senior member of IEEE. He is the author and co-author of more than 175 papers in international scientific journals, books and proceedings of scientific conferences.

1:30 p.m.–3:30 p.m.
FWR • Novel Optical Architectures in Emerging Technologies I
R. John Koshel; Photon Engineering LLC and College of Optical Sciences, Univ. of Arizona, USA, Presider

FWR1 • 1:30 p.m. Invited

Biomolecular Sensing with Ultrafine Optical Fibers and Plasmonic Nanostructures, *Donald J. Sirbuly[1], Sarah Baker[3], Sanja Zlatanovic[2], Jason Steiner[1], Sadik Esener[1,2], [1]NanoEngineering Dept., Univ. of California at San Diego, USA, [2]Electrical and Computer Engineering, Univ. of California at San Diego, USA,[3]Physical and Life Sciences Directorate, Lawrence Livermore Natl. Lab, USA.* Unique optical properties of one-dimensional semiconductor nanostructures will be presented and their use in compact evanescent field bio-detection systems discussed. These optical cavities are integrated into microfluidic flow cells for chemical functionalization, and multiplexed sensing.

FWR2 • 2:00 p.m. Invited

Advances in Microendoscope Design and Application, *Arthur Gmitro, Houssine Makhlouf, Andrew Rouse; Univ. of Arizona, USA.* Significant advances have been made in the design and application of confocal microendoscope systems for *in vivo* imaging of the human body. This presentation will review progress in the field and highlight important clinical applications.

For Fall Congress presentations on Wednesday, see pages 125-131.

FiO

1:30 p.m.–3:30 p.m.
FWS • Optical Trapping and Micromanipulation II
Presider to Be Announced

FWS1 • 1:30 p.m. Invited

High-Resolution, High-Stability, High-Frequency Optical Tweezers Methods with a Simple Video Camera, *Wesley Wong; Rowland Inst., Harvard Univ., USA.* We have developed a number of optical tweezers techniques for performing high-resolution (3-D, angstrom-level), high-stability (1-2 nm long-term), high-frequency (> 100 kHz) measurements using inexpensive video microscopy. Experimental demonstrations include quantification of protein folding kinetics.

FWS2 • 2:00 p.m.

Development of a Compact and High-Throughput Laser Trap Raman System for Fully Automated Single Cell Analysis, *Rui Liu[1], Tobias Moritz[1], Douglas Taylor[1,2], Dennis Matthews[1,3,4], James Chan[1,3]; [1]NSF Ctr. for Biophotonics Science and Technology, Univ. of California at Davis, USA, [2]Dept. of Pediatrics, Univ. of California at Davis Medical Ctr., USA, [3]Lawrence Livermore Natl. Lab, USA, [4]Dept. of Applied Science, Univ. of California at Davis, USA.* The translation of laser tweezers Raman spectroscopy is impeded by several instrumentation limitations. This paper presents our latest work in developing a faster (< 10s acquisition time), compact system for fully automated single cell analysis.

1:30 p.m.–3:15 p.m.
FWT • Plasmonic Sensors
Banshi D. Gupta; Indian Inst. of Technology Delhi, India, Presider

FWT1 • 1:30 p.m. Invited

Plasmonics on Optical Fibers: New Tools for Biochemical Sensing, *Jacques Albert, Maria Derosa, Anatoli Ianoul, Yanina Shevchenko, Alexander Beliaev, David A. D. Blair, Nur Ahamad; Carleton Univ., Canada.* Standard optical fibers coated with metal layers support plasmonic resonances at near infrared wavelengths. We use a fiber Bragg grating to measure their response to surface biochemical reactions involving DNA and proteins.

FWT2 • 2:00 p.m.

Surface-Enhanced Raman Spectroscopy with Gold Nanoring Dimers, *Mohamad G. Banaee, Kenneth B. Crozier; School of Engineering and Applied Science, Harvard Univ., USA.* Surface-enhanced Raman scattering of benzenethiol on gold nanoring dimers with 20 nm gaps was studied. The localized surface plasmon resonance wavelength was determined using reflection spectroscopy. A SERS enhancement factor of 2.0×10^6 was obtained.

LS

1:30 p.m.–3:30 p.m.
LSWG • Ultrafast Spectroscopy I
Marc Achermann; Univ. of Massachusetts Amherst, USA, Presider

LSWG1 • 1:30 p.m. Invited

Ultrafast Photoemission Electron Microscopy: Imaging Nonlinear Plasmonic Phenomena on the Femto/Nano Scale, *Hrvoje Petek; Univ. of Pittsburgh, USA.* By time-resolved two-photon photoemission electron microscopy, we generate movies with <50 nm spatial resolution and 330 as frame rate of surface plasmon dynamics defined by lithographically formed nano-optical elements in silver films.

LSWG2 • 2:00 p.m. Invited

New Interface-Selective Electronic Spectroscopy and Its Extension to Femtosecond Time-Resolved Measurements, *Tahei Tahara; RIKEN, Japan.* We report multiplex electronic sum-frequency generation (ESFG) spectroscopy and its extension to femtosecond time-resolved measurements (TR-ESFG), which provide unprecedentedly high-quality electronic spectral data containing rich information on static and dynamic properties of interfacial molecules.

1:30 p.m.–3:15 p.m.
LSWH • Second-Order Nonlinear Optics III
Ben Schwartz; Univ. of California at Los Angeles, USA, Presider

LSWH1 • 1:30 p.m. Invited

Imaging Nonlinear Optical Stokes Ellipsometry for Thin Film and Microparticle Characterization, *Nathan J. Begue, Garth J. Simpson; Purdue Univ., USA.* Nonlinear optical Stokes ellipsometry (NOSE) is shown to routinely provide precision of a few parts in 1000 in 12 ms acquisition times for determination of the $\chi^{(2)}$ tensor elements of thin films, enabling imaging applications with detailed polarization characterization.

LSWH2 • 2:00 p.m. Invited

Electronically Resonant Hyper-Raman Scattering in Solution, *Anne M. Kelley; Univ. of California at Merced, USA.* The theory and phenomenology of electronically resonant hyper-Raman scattering from organic molecules in solution is reviewed and its relationship to other electronically resonant nonlinear vibrational spectroscopies is discussed.

1:30 p.m.–3:00 p.m.
LSWI • Multidimensional Spectroscopy III
David Blank; Univ. of Minnesota, USA, Presider

LSWI1 • 1:30 p.m. Invited

Femtosecond Vibrational Optical Activity and IR Photon Echo Studies of Small Organic Molecules, *MinHaeng Cho; Korea Univ., Republic of Korea.* Ultrafast characterization of vibrational circular dichroism and optical rotatory dispersion is shown to be experimentally feasibly by using heterodyned spectral interferometric detection of the phase and amplitude of infrared optical activity free-induction-decay field in time.

LSWI2 • 2:00 p.m. Invited

Correlating Energy Transport Time on a Molecular Level with Distance Using Relaxation-Assisted 2DIR, *Igor V. Rubtsov[1], Valeriy M. Kasyanenko[1], Zhiwei Lin[1], Christopher S. Keating[1], Grigory I. Rubtsov[2], James P. Donahue[1]; [1]Tulane Univ., USA, [2]Inst. for Nuclear Res., Russian Federation.* A relaxation-assisted two-dimensional infrared spectroscopy method in discussed that relies on energy transport on a molecular level and shows strong cross-peak amplifications in various molecular systems, including peptides, model compounds, and transition metal complexes.

For Fall Congress presentations on Wednesday, see pages 125-131.

JOINT FiO/LS

JWD • Entanglement Generation and Measurement III—Continued

JWD3 • 2:15 p.m.
Quantum Chemistry on a Quantum Computer: First Steps and Prospects, *B. P. Lanyon[1], J. D. Whitfield[2], G. G. Gillett[1], M. E. Goggin[1], M. P. Almeida[1], I. Kassal[2], J. D. Biamonte[2], M. Mohseni[2], B. J. Powell[1], M. Barbieri[1], A. Aspuru-Guzik[2], Andrew G. White[1]; [1]Univ. of Queensland, Australia, [2]Harvard Univ., USA.* We use a photonic quantum computer to simulate the hydrogen molecule. This is the first experimental demonstration of efficient quantum chemistry, which promises to be a powerful new tool in biology, chemistry, and materials science.

JWD4 • 2:30 p.m.
Continuous Variable EPR Paradox for Angle and Orbital Angular Momentum, *Jonathan Leach[1], Barry Jack[1], Jacq Romero[1], Bob Boyd[2], Anand Jha[2], Steve M. Barnett[3], Sonja Franke-Arnold[1], Miles Padgett[1]; [1]Univ. of Glasgow, UK, [2]Univ. of Rochester, USA, [3]Univ. of Strathclyde, UK.* We demonstrate the Einstein-Podolsky-Rosen paradox for angle and orbital angular momentum states of light. We show strong angular position and orbital angular momentum correlations therefore demonstrating the quantum nature of the entangled light field.

JWD5 • 2:45 p.m.
Energy-Time Entanglement between Photons and Photon-Holes, *Serge Rosenblum, Meir Orenstein; Technion-Israel Inst. of Technology, Israel.* We propose a source that creates photon-holes in coherent beams. As a byproduct, the photon-hole creation is accompanied by emission of a photon that is energy-time entangled with the hole, allowing violation of Bell's inequality.

FiO

FWO • OSA Topical Meeting Highlights I—Continued

FWO3 • 2:30 p.m. Invited
Optical Manipulation of Femtoliter Aqueous Droplets for Nanochemistry Applications, *Ana Jofre, Ben Faulk, Jason Case; Univ. of North Carolina at Charlotte, USA.* We control and observe femtoliter volume reactions within aqueous nanodroplets. Chemical reagents sequestered in the nanodroplets mix when the nanodroplets are fused via optical manipulation. The subsequent reaction is probed by means of fluorescence excitation. (Optical Trapping Applications, 2009)

FWP • Metamaterials III—Continued

FWP3 • 2:15 p.m.
Soliplasmon Excitations at Metal/Dielectric/Kerr Structures, *Albert Ferrando[1,2], Yuri P. Bliokh[3], Konstantin Yu Bliokh[4,5], Mario Zacarés[2], Carles Milián[2,6], Daniel E. Ceballos[7]; [1]Dept. d'Òptica, Univ. de València, Spain, [2]Inst. Universitario de Matemática Pura y Aplicada (IUMPA), Univ. Politécnica de Valencia, Spain, [3]Technion-Israel Inst. of Technology, Israel, [4]Inst. of Radio Astronomy, Ukraine, [5]Dept. of Experimental Physics. Natl. Univ. of Ireland, Ireland, [6]ITACA, Univ. Politécnica de Valencia, Spain, [7]Ctr. de Investigaciones en Óptica A.C., Mexico.* We present novel optical phenomena based on the existence of a new type of quasi-particle excitation in metal/dielectric/Kerr structures. We discuss the possibility of excitation of surface plasmon polaritons via spatial solitons in these systems.

FWP4 • 2:30 p.m. Invited
Tailoring Polarization States of Visible Light through Metallic Nanostructures, *J.-Y. Laluet, E. Laux, E. Lombard, A. Drezet, C. Genet, Thomas W. Ebbesen; Univ. de Strasbourg and CNRS, France.* We focus on the possibility offered through the control of surface plasmons by metallic nanostructures (in particular chiral structures) to design optical devices with specific polarization properties. Our systems operate in the visible range.

FWQ • Phase Space Optics—Optical System Theory for the 21st Century—Continued

FWQ2 • 2:15 p.m. Invited
The Connection between Rays and Waves, *Miguel A. Alonso; Inst. of Optics, Univ. of Rochester, USA.* A survey of several ways of understanding the connection between the ray and wave models is presented, and many standard methods for estimating the propagation of waves based on rays are described and compared.

FWQ3 • 2:45 p.m. Invited
Novel Optical Devices for Extended Field of View, *Jorge Ojeda-Castañeda; Univ. of Guanajuato, Mexico.* We apply the ambiguity function for identifying and for analyzing a novel family set of phase-only masks that extend the depth of field, in a tunable fashion.

FWR • Novel Optical Architectures in Emerging Technologies I—Continued

FWR3 • 2:30 p.m.
Head Tracking for Real-Time Motion Correction in the MRI Environment Using a Single Camera, *Chester Wildey, Duncan MacFarlane; Univ. of Texas at Dallas, USA.* An optical head tracker for the MRI environment is reported. The system utilizes a single ccd camera, DSP and a 3-dimensional fiducial to realize real time 6-DOF motion measurement at rates of 10 Hz.

FWR4 • 2:45 p.m.
Enhanced Light Collection from a Point Fluorescent Source Using Multiscale Optics, *Rachel Noek, Justin Migacz, Caleb Knoernschild, Taehyun Kim, Jungsang Kim; Duke Univ., USA.* We have demonstrated enhancement of point source light collection by a factor of 18 over a traditional f/2.55 imaging system (~17%) across a 15 mm object space by integrating a high numerical aperture micromirror.

For Fall Congress presentations on Wednesday, see pages 125-131.

FiO

FWS • Optical Trapping and Micromanipulation II—Continued

FWS3 • 2:15 p.m.
Optical Manipulation with Particles Using the Holographic Optical Tweezers on Special Microfluidic Substrates, *Marek Škereň, Martin Nývlt, David Najdek, Pavel Fiala; Czech Technical Univ., Czech Republic.* Optical manipulation is presented with various micro-particles on special relief substrates working as the microfluidic devices. The substrates are prepared using the laser lithography. The manipulation is realized using the holographic optical tweezers.

FWS4 • 2:30 p.m. Invited
Optical Phase Conjugation for Tissue Turbidity Suppression, *Changhuei Yang, Meng Cui, Emily McDowell; Caltech, USA.* We will discuss our recent findings on the use of optical-phase-conjugation to undo optical tissue scatterings. Amongst other results, we discovered that light scattered hundreds of times still retains sufficient memory to enable path retracing.

FWT • Plasmonic Sensors—Continued

FWT3 • 2:15 p.m.
Wavelength and Pd Thickness Optimization for SPR-Based Hydrogen Sensors, *Gustavo O. Cavalcanti[1], Sergio C. Oliveira[2], Eduardo Fontana[1], Antonio Azevedo[1]; [1]Univ. Federal de Pernambuco, Brazil, [2]Univ. de Pernambuco, Brazil.* We investigate both theoretically and experimentally the performance of Pd films for hydrogen detection based on the surface plasmon resonance effect. Results yield important findings for the design of SPR-based H_2 sensors with maximum sensitivity.

FWT4 • 2:30 p.m.
Interfering SPR Sensor with Radial Polarization, *Tzu-Hsiang Lan, Chung-Hao Tien; Natl. Chiao Tung Univ., Taiwan.* For a collinear SPR sensor, the refractive-index-sensing range was constrained by objective lens. Utilizing the interfering SPPs, we demonstrated a new scheme to extend the measured range from 1.3 to 1.5 in a 1.45-NA microscopy.

FWT5 • 2:45 p.m.
Surface-Enhanced Raman Scattering from a Double-Resonance Plasmon Structure, *Yizhuo Chu, Mohamad G. Banaee, Kenneth B. Crozier; Harvard Univ., USA.* We report surface-enhanced Raman scattering measurements of a benzenethiol monolayer on a double resonance surface plasmon structure. The device enhances excitation and Raman scattered light simultaneously. The largest enhancement factor is measured to be 1.1×10^8.

LS

LSWG • Ultrafast Spectroscopy I—Continued

LSWG3 • 2:30 p.m.
ZnO Thin Films for Optoelectronic Applications, *T. Prasada Rao, M. C. Santhosh Kumar; Dept. of Physics, Natl. Inst. of Technology, India.* Effects of substrate temperature on crystallization behavior, optical, and electrical properties of the films was studied. Visible asymmetrical emission was observed in photoluminescence spectra. Electrical resistivity and carrier concentration are decreasing and increasing, respectively.

LSWG4 • 2:45 p.m.
Nanohybrid POSS-Copolymers as Advanced Solid-State Lasers, *Angel Costela[1], Inmaculada García-Moreno[1], Luis Cerdán[1], Olga García[2], Virginia Martín[1], Roberto Sastre[2]; [1]Inst. de Química Física Rocasolano, CSIC, Spain, [2]Inst. de Ciencia y Tecnología de Polímeros, CSIC, Spain.* We report on efficient and highly photostable solid-state lasers based on dye-doped polymer crosslinked with polyhedral oligomeric silsesquioxane (POSS) nanoparticles. Mechanisms for the improved laser action induced by the POSS presence will be discussed.

LSWH • Second-Order Nonlinear Optics III—Continued

LSWH3 • 2:30 p.m. Invited
Title to Be Announced, *Steven Baldelli; Univ. of Houston, USA.* Abstract not available.

LSWI • Multidimensional Spectroscopy III—Continued

LSWI3 • 2:30 p.m.
Optical Pulse Sequence Generation and Characterization via Phase-Only Multiple Independent Comb Shaping (MICS), *Dmitry Pestov, Vadim V. Lozovoy, Marcos Dantus; Michigan State Univ., USA.* We describe a pulse shaping technique for synthesis of optical pulse sequences, deemed suitable for pump-probe experiments and multidimensional spectroscopy. It enables straightforward programming, manipulation, and self-characterization of multi-pulse waveforms via one-dimensional phase-only shaping.

LSWI4 • 2:45 p.m.
Excited State Spectroscopy, Coherence, and Control in the Isomerization of Polyenes in Solution, *Kuo-Chun Tang, Kenneth G. Spears, Roseanne J. Sension; Univ. of Michigan, USA.* UV-Visible transient absorption spectroscopy has been used to study the excited-state reaction dynamics of 7-dehydrocholesterol and cis-stilbene in solution. UV-pulse-shaping has been used to manipulate the excitation pulse and influence reaction dynamics.

For Fall Congress presentations on Wednesday, see pages 125-131.

JOINT FiO/LS

FiO

JWD • Entanglement Generation and Measurement III—Continued

JWD6 • 3:00 p.m. Invited

Measurement-Based Entanglement and Quantum Information Processing with Remote Ions, *Peter Maunz, Steven Olmschenk, David Hayes, Dzmitry N. Matsukevich, Christopher Monroe; Joint Quantum Inst., Univ. of Maryland and NIST, USA.* We implement a probabilistic entangling gate between two remote trapped ytterbium ions and measure an average gate fidelity of 89%. The entangled state of the ions violates a Bell inequality.

FWO • OSA Topical Meeting Highlights I—Continued

FWO4 • 3:00 p.m. Invited

Fourier Domain Mode Locking (FDML): A New Laser Operating Regime and Applications for Biomedical Imaging, Profilometry, Ranging and Sensing, *Robert Huber; Ludwig-Maximilians-Univ. München, Germany.* Fourier Domain Mode Locking (FDML) is a new stationary operating regime of lasers, generating narrowband, rapidly wavelength swept output waveforms. The FDML mechanism and applications for biomedical imaging, coherent sensing and spectroscopy are discussed. (Advanced Solid-State Photonics, 2009)

FWP • Metamaterials III—Continued

FWP5 • 3:00 p.m.

High Sensitive Optical Displacement Sensor by Using Surface Plasmons, *Zhaogang Dong[1,2], Ying Zhang[1], Yeng Chai Soh[2]; [1]Singapore Inst. of Manufacturing Technology, Singapore, [2]School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore.* We present a new optical-displacement sensor, using surface plasmons, that measures the displacement using the resonant incident angle. An analytical expression relating the displacement and the resonant-incident-angle is derived, and the sensitivity is studied.

FWP6 • 3:15 p.m.

Creation of Hybridized Plasmonic Excitations in Nanocavities through Surface Propagating Plasmons, *Ahmet A. Yanik, Ronen Adato, Shyamsunder Erramilli, Hatice Altug; Boston Univ., USA.* We experimentally demonstrate that hybridized plasmonic excitations can be created in nanocavities in metal films through surface propagating plasmons. We show that nanocavities radiate in coherence and act as an efficient nanoantenna array.

FWQ • Phase Space Optics—Optical System Theory for the 21st Century—Continued

FWR • Novel Optical Architectures in Emerging Technologies I—Continued

FWR5 • 3:00 p.m.

Ring-Down Absorption Spectroscopy in an Integrating Cavity, *Michael T. Cone[1], Edward S. Fry[1], Joseph A. Musser[2]; [1]Texas A&M Univ., USA, [2]Dept. of Physics and Astronomy, Stephen F. Austin State Univ., USA.* A new diffuse reflector has been developed whose reflectivity in the 250 nm to 1 micron spectral region is so high that ring-down spectroscopy of scattering aerosols in an integrating cavity is now possible.

FWR6 • 3:15 p.m.

Design of an Optimal LED Coupler, *Anurag Gupta; Optical Res. Associates, USA.* A design procedure for LED couplers is described that uses initial layout, parameterization, and optimization to create a design that achieves the theoretical maximum coupling. Performance limitations imposed by manufacturing and packaging constraints are included.

3:30 p.m.–4:00 p.m. Coffee Break/Exhibits, *Imperial Ballroom, Fairmont Hotel*

NOTES

For Fall Congress presentations on Wednesday, see pages 125-131.

FiO

FWS • Optical Trapping and Micromanipulation II—Continued

FWS5 • 3:00 p.m.
Optical Manipulation of Hydrosomes, *Carlos López-Mariscal, Kristian Helmerson; NIST, USA.* We present a novel implementation of optical tweezers and microfluidics that allow for the controlled production and manipulation of monodisperse water droplets in an immiscible phase - hydrosomes.

FWS6 • 3:15 p.m.
Controlling Fluorescent Proteins by Manipulating the Local Density of Photonic States, *Allard P. Mosk[1], Christian Blum[1], Yanina Cesa[1], Johanna M. van den Broek[1], Willem L. Vos[1,2], Vinod Subramaniam[1]; [1]Univ. Twente, Netherlands, [2]FOM Inst. AMOLF, Netherlands.* We demonstrate nanophotonic control of the emission rate of fluorescent proteins by variation of the local density of states. The observed strong variations of the emission rate allow us to determine the emission dipole moment.

FWT • Plasmonic Sensors—Continued

FWT6 • 3:00 p.m.
Periodic Plasmonic/Dielectric Structures for SERS Applications, *Jingjing Li, David Fattal, Zhiyong Li; Hewlett-Packard Res. Lab, USA.* We discuss a rational design towards amplifying the local electromagnetic (EM) filed by integrating plasmonic optical antennas with periodic dielectric structures. The radiation process of an excited molecule on such devices is also studied.

LS

LSWG • Ultrafast Spectroscopy I—Continued

LSWG5 • 3:00 p.m. Invited
Ultrafast Hybrid Plasmonics: New Routes to Nanoscale Imaging and Energy Propagation, *Gary Wiederrecht; Argonne Natl. Lab, USA.* Efforts in our group for the imaging and ultrafast spectroscopy of hybrid plasmonic nanostructures are discussed, specifically applied to plasmonic continuum spectroscopy, metal nanoparticle photoluminescence, and the unique optical states that arise from coupled nanostructures.

LSWH • Second-Order Nonlinear Optics III—Continued

LSWH4 • 3:00 p.m.
Record Second-Harmonic Conversion Efficiency in Improved $Al_xGa_{1-x}As$ Bragg Reflection Waveguides, *Payam Abolghasem, Junbo Han, Bhavin J. Bijlani, Arghavan Arjmand, Amr S. Helmy; Univ. of Toronto, Canada.* We report the observation of second-harmonic generation with a conversion efficiency of 1.14×10^4 $\%W^{-1}cm^{-2}$ in type-II monolithic matching layer-enhanced Bragg reflection waveguides for a 2 picosecond pump with 3.3 mW average power.

3:30 p.m.–4:00 p.m. Coffee Break/Exhibits, *Imperial Ballroom, Fairmont Hotel*

NOTES

For Fall Congress presentations on Wednesday, see pages 125-131.

FiO | FiO | JOINT | FiO | FiO

4:00 p.m.–5:30 p.m.
FWU • Coherence and Fundamental Optics II
Jason Fleischer; Princeton Univ., USA, Presider

FWU1 • 4:00 p.m.
Coupling of Stochastic Electromagnetic Beams into Optical Fibers, *Mohamed F. Salem[1], Govind P. Agrawal[1,2]; [1]Dept. of Physics and Astronomy, Univ. of Rochester, USA, [2]Inst. of Optics, Univ. of Rochester, USA*. A general expression for the coupling efficiency is derived for the case when a partially coherent electromagnetic beam is coupled into an optical fiber. We illustrate the result with a numerical example.

FWU2 • 4:15 p.m.
Evolution of Singularities in a Partially Coherent Vortex Beam, *Thomas van Dijk[1], Hugo F. Schouten[1], Taco D. Visser[1,2]; [1]Free Univ., Netherlands, [2]Delft Univ. of Technology, Netherlands.* We study the evolution of singularities in a vortex beam. The beam starts off with a phase singularity that gradually disappears on propagation. At the same time coherence singularities are found to develop.

FWU3 • 4:30 p.m.
The Concept of Statistical Similarity of Light Vibrations and Its Role in the Theories of Coherence and Polarization of Light, *Emil Wolf; Univ. of Rochester, USA*. It will be shown that the notion of statistical similarity between light vibrations reveals a close analogy between coherence and polarization.

FWU4 • 4:45 p.m.
Spatial Coherence Properties of Monochromatic Electromagnetic Beams and of Laser Modes, *Mayukh Lahiri, Emil Wolf; Univ. of Rochester, USA*. We show that, contrary to common belief, monochromatic light beams may not be spatially completely coherent. We cite experiments with laser modes which confirm this result.

4:00 p.m.–5:30 p.m.
FWV • OSA Topical Meeting Highlights II
Michael Duncan; NRL, USA, Presider

FWV1 • 4:00 p.m. Invited
Deflectometry Challenges Interferometry: 3-D-Metrology from Nanometer to Meter, *Gerd Häusler[1,2], M. C. Knauer[1], C. Faber[1], C. Richter[1], S. Peterhänsel[1], C. Kranitzky[1], K. Veit[2]; [1]Univ. of Erlangen-Nuremberg, Germany, [2]3D-Shape GmbH, Germany.* We will discuss deflectometry from the physicist's and from the information theoretical point of view. The intrinsic features of deflectometry -incoherence, source encoding, high dynamical range, simplicity, and scalability- enable new sensors and unexpected applications. (Digital Holography and Three-Dimensional Imaging, 2009)

FWV2 • 4:30 p.m. Invited
Manipulating Slow Light by Ultrahigh-Q Nanocavities and Their Coupled Arrays, *Masaya Notomi, T. Tanabe, E. Kuramochi, H. Taniyama; NTT Basic Res. Labs, Japan*. We investigate ultrahigh-*Q* nanocavities in photonic crystals for manipulating slow light. First, we study applicability of coupled nanocavities for realizing ultimate slow-light waveguides. Second, we exploit dynamic tuning of slow-light media for read/write processes. (Slow and Fast Light, 2009)

4:00 p.m.–6:00 p.m.
JWE • Entanglement Generation and Measurement IV
Warren Grice; Oak Ridge Natl. Lab, USA, Presider

JWE1 • 4:00 p.m. Invited
Hyperentangled Photons for Communication and Metrology, *Paul Kwiat[1], Julio Barreiro[1,2]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Univ. Innsbruck, Austria.* Photons from spontaneous downconversion may be simultaneously entangled in multiple degrees of freedom ("hyperentangled"), enabling new capabilities in quantum communication and metrology. We present one example-remote preparation of entangled polarization/spatial-mode states-and discuss possible applications.

JWE2 • 4:30 p.m.
Efficient Entanglement Distribution over 200 Kilometers Fiber Using Self-Differencing InGaAs Avalanche Photodiodes, *James F. Dynes[1], Hiroki Takesue[2], Zhiliang Yuan[1], Andrew W. Sharpe[1], Ken-Ichi Harada[2], Toshimori Honjo[2], Hidehiko Kamada[2], Osamu Tadanaga[3], Yoshiki Nishida[3], Masaki Asobe[3], Andrew J. Shields[1]; [1]Toshiba Res. Europe Ltd., Cambridge Res. Lab, UK, [2]NTT Basic Res. Labs, NTT Corp., Japan, [3]NTT Photonics Labs, NTT Corp., Japan.* Practical and low-cost self-differencing InGaAs avalanche photodiodes have been successfully applied to ultra-long distance and efficient entanglement distribution over 200 kilometers of optical fiber.

JWE3 • 4:45 p.m.
Defeating Passive Eavesdropping with Quantum Illumination, *Jeffrey H. Shapiro; MIT, USA*. Quantum illumination permits Alice and Bob to communicate at 50 Mbit/s over 50 km of low-loss fiber with error probability less than 10^{-6} while the optimum passive eavesdropper's error probability must exceed 0.28.

4:00 p.m.–5:30 p.m.
FWW • Phase Space Optics—Optical System Theory for the 21st Century II
Miguel A. Alonso; Inst. of Optics, Univ. of Rochester, USA, Presider

FWW1 • 4:00 p.m. Invited
Wigner Cross-Terms in Sampled and Other Periodic Signals, *William T. Rhodes[1], John J. Healy[2], John T. Sheridan[2]; [1]Florida Atlantic Univ., USA, [2]Univ. College Dublin, Ireland.* A sampled wave field is periodic in frequency. We examine the cross-terms that occur between the periodic replicas in the Wigner-Ville distribution function of such a signal and present analytic results for Gaussian signals.

FWW2 • 4:30 p.m. Invited
The Radon-Wigner Transform and Its Application to First-Order Optical Systems, *Genaro Saavedra, Walter D. Furlan; Univ. de València, Spain*. The Radon-Wigner transform is presented as a tool for the description of 1st-order optical systems. The input/output relationships for this phase-space representation are obtained and their application in analysis and design tasks is pointed out.

4:00 p.m.–5:30 p.m.
FWX • Novel Optical Architectures in Emerging Technologies II
Arthur Gmitro; Univ. of Arizona, USA, Presider

FWX1 • 4:00 p.m. Invited
Miniaturization of Adaptive Optics Scanning Laser Ophthalmoscope, *Austin Roorda[1], David Merino[1], Kaccie Y. Li[1], Yuhua Zhang[2]; [1]Univ. of California at Berkeley, USA, [2]Univ. of Alabama, Birmingham, USA*. An important step to facilitate dissemination of adaptive optics systems for ophthalmoscopy is to design and demonstrate robust and compact systems. We will present the design and results from a MEM-based AO scanning laser ophthalmoscope.

FWX2 • 4:30 p.m.
Fabrication of GHz/THz Volumetric Optics via Rapid Prototyping, *Wei-Ren Ng, Ziran Wu, Hao Xin, Michael E. Gehm; Univ. of Arizona, USA*. Rapid prototyping technology is now capable of high-resolution fabrication suitable for producing volumetric optics in the GHz/THz range. We will report on our successful fabrication of photonic crystal structures and discuss other components under study.

FWX3 • 4:45 p.m.
An Instrument to Measure the Backscattering Coefficient b_b for Arbitrary Phase Functions, *David Haubrich[1], Edward S. Fry[1], Joseph A. Musser[2]; [1]Dept. of Physics, Texas A&M Univ., USA, [2]Dept. of Physics and Astronomy, Stephen F. Austin State Univ., USA*. We present the ocean optics community with the first instrumentation to directly measure the backscattering coefficient of natural waters for arbitrary phase functions. It is suitable for *in situ* applications and has the requisite resolution.

For Fall Congress presentations on Wednesday, see pages 125-131.

FiO

4:00 p.m.–5:30 p.m.
FWY • Optical Trapping and Micromanipulation III
Kenneth B. Crozier; Harvard Univ., USA, Presider

FWY1 • 4:00 p.m. Invited
Multimode Light in Action, *Roberta Zambrini; IFISC (UIB-CSIC), Univ. Illes Balears, Spain.* Mechanical properties of beams resulting from superposition and interference of different modes are studied. Local energy and angular momenta of such multimode beams can be tuned. We propose some experiments and an interferometric measurement scheme.

FWY2 • 4:30 p.m.
Brownian Vortex Induced by Optical Tweezers, *Bo Sun, Alexander Grosberg, David Grier; New York Univ., USA.* Previously overlooked non-conservative force exerted by optical tweezers drives a trapped particle into a Brownian vortex. When continuously changing power or temperature, the Brownian vortex reverse its flux.

FWY3 • 4:45 p.m.
Integrated Coupling to Whispering Gallery Modes of Microspheres in a Microfluidic Platform, *Arthur Nitkowski, Michal Lipson; Cornell Univ., USA.* We demonstrate excitation of whispering gallery modes in dielectric microspheres using optical trapping with silicon nitride waveguides. Resonances are measured from waveguide transmission thus providing an integrated platform for using microspheres in lab-on-a-chip biosensing applications.

4:00 p.m.–5:30 p.m.
FWZ • Silicon Photonics III
Mario Paniccia; Intel Corp., USA, Presider

FWZ1 • 4:00 p.m. Invited
Green Integrated Photonics, *Sasan Fathpour; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Harvesting the optical energy lost to two-photon absorption in integrated photonic devices offers two advantages: reduced optical loss and simultaneous electrical power generation. This nonlinear photovoltaic effect may pave the path towards green integrated photonics.

FWZ2 • 4:30 p.m.
Athermal Operation in Polymer-Clad Silicon Microdisk Resonators, *Payam Alipour, Ehsan Shah Hosseini, Ali Asghar Eftekhar, Babak Momeni, Ali Adibi; Georgia Tech, USA.* A method for thermal-stabilization of silicon microdisk resonators, based on thermo-optic polymer coatings, is proposed. Two orders of magnitude improvement in thermal stability is observed. Effects on Q and major fabrication challenges are discussed.

FWZ3 • 4:45 p.m.
Maximization of Phase and Group Birefringence of Single-Mode Silicon-on-Insulator Waveguides, *Tarek A. Ramadan; Kuwait Univ., Kuwait.* The parameters of silicon-on-insulator waveguides are optimized for maximum phase and group birefringence under single-mode condition. Two strip-loaded designs are reported with phase and group birefringence of 1.03 and 1.64, respectively.

LS

4:00 p.m.–6:15 p.m.
LSWJ • Ultrafast Spectroscopy II
Hrvoje Petek; Univ. of Pittsburgh, USA, Presider

LSWJ1 • 4:00 p.m. Invited
Visualization of Nuclear and Electron Motion by Ultrafast Electron Diffraction, *Peter Baum[1,2]; [1]Max-Planck-Inst. of Quantum Optics, Germany, [2]Ludwig-Maximilians-Univ. München, Germany.* Ultrashort electron pulses allow visualizing atomic-scale motions in all four dimensions of space and time. We report on structural pathways during ultrafast phase-transformations and present concepts for reaching into the domain of attosecond electron motion.

LSWJ2 • 4:30 p.m. Invited
Ultrafast Laser-Induced Magnetization Dynamics, *Bert Koopmans; Eindhoven Univ. of Technology, Netherlands.* Recent developments in ultrafast laser-induced magnetization dynamics will be presented. Particular emphasis will be on efforts aiming at a fundamental understanding of microscopic processes, and laser-induced spin momentum transfer in especially engineered magnetic multilayers.

4:00 p.m.–5:45 p.m.
LSWK • Second-Order Nonlinear Optics IV
Keng Chang Chou; Univ. of British Columbia, USA, Presider

LSWK1 • 4:00 p.m. Invited
Vibrationally-Electronically Doubly-Resonant Sum-Frequency Generation Spectroscopy of Molecular Thin Films, *Taka-aki Ishibashi; Hiroshima Univ., Japan.* Vibrationally-electronically doubly-resonant sum-frequency generation (DR-SFG) is a powerful technique for studying structures of molecular thin films. Electronic resonance enhances the sensitivity and selectivity. Our instrumentation and some applications of DR-SFG spectroscopy will be presented.

LSWK2 • 4:30 p.m. Invited
Measurement of Surface Chirality with Nonlinear Spectroscopy: A Quantitative Approach, *Yan-yan Xu, Feng Wei, Yuan Guo, Hongfei Wang; Inst. of Chemistry, Chinese Acad. of Sciences, China.* Quantitative measurement on enantiomer states and degree of chiral excess (DCE) of chiral surfaces can be achieved in surface second order nonlinear spectroscopy. Examples are given with second harmonic and sum-frequency surface studies.

JOINT FiO/AO

4:00 p.m.–5:30 p.m.
JWF • Advances in Adaptive Optics Imaging of the Living Retina II
Jungtae Rha; Medical College of Wisconsin, USA, Presider

JWF1 • 4:00 p.m. Invited
Adaptive Optics Instrumentation, *Stephen A. Burns[1], Zhangyi Zhong[1], Weiyao Zou[1], Cong Deng[1], Daniel Ferguson[2], Xiaofeng Qi[1]; [1]Indiana Univ., USA, [2]Physical Sciences Inc., USA.* Adaptive optics imaging of the retina presents unusual design challenges. AO instruments allowing steering of the beam across the retina, large amounts of defocus, and variable pupil sizes will be discussed.

JWF2 • 4:30 p.m.
A New Ferrofluid Mirror for Vision Science Applications, *Denis Brousseau[1], Ermanno F. Borra[1], Anna M. Ritcey[1], Melanie C. Campbell[2,3], Simon Thibault[1], Julie Drapeau[1], Azadeh Naderian[1]; [1]Univ. Laval, Canada, [2]Univ. of Waterloo, Canada, [3]Guelph Waterloo Physics Inst., Canada.* We present a novel ferrofluid mirror design which will result in an inexpensive adaptive optics element with large stroke for use in ophthalmic imaging.

JWF3 • 4:45 p.m. Invited
Adaptive Optics-OCT Imaging of the Retina, *Donald T. Miller; Indiana Univ., USA.* Ultrahigh resolution OCT with adaptive optics provides unprecedented 3-D resolution of the cellular retina *in vivo*. Here we investigate the utility of this instrument for imaging individual retinal nerve fiber bundles, retinal capillaries, and photoreceptors.

For Fall Congress presentations on Wednesday, see pages 125-131.

FiO | JOINT | FiO

FWU • Coherence and Fundamental Optics II—Continued

FWU5 • 5:00 p.m.
Properties of Quasihomogeneous Isotropic Electromagnetic Sources, *Asma Al-Qasimi, Daniel F. V. James; Univ. of Toronto, Canada.* We study the properties of quasihomogeneous isotropic electromagnetic sources, a model for partially-coherent secondary light sources beyond the scalar and paraxial approximations. Our results include polarization properties in the far zone and the realizability condition.

FWU6 • 5:15 p.m.
Scattering of a Focused Shifted Laser Beam by a Lossy Spheroidal Particle, *Elsayed Esam M. Khaled[1], Hany L. Ibrahim[2]; [1]Electrical Engineering Dept., Assiut Univ., Egypt, [2]Telecom Egypt, Egypt.* Scattering intensities of elongated spheroidal particles illuminated with an arbitrary laser beam are calculated using the T-matrix and plane waves spectrum methods. Absorption and beam shift effects on angular scattering intensities are illustrated.

FWV • OSA Topical Meeting Highlights II—Continued

FWV3 • 5:00 p.m. Invited
Wide Field, Minimally Invasive OCT: Recent Advances and Clinical Implications, *Ben Vakoc, Brett E. Bouma; Massachusetts General Hospital, USA.* Recent advances in minimally-invasive probes and illumination and detection strategies for optical coherence tomography have enabled dramatically faster imaging speeds and open the possibility of high-resolution diagnostic imaging of entire organ epithelial and endothelial surfaces. (Novel Techniques in Microscopy, 2009; originally presented by *Brett Bouma; Harvard Medical School and Massachusetts General Hospital, USA*)

JWE • Entanglement Generation and Measurement IV—Continued

JWE4 • 5:00 p.m. Invited
Quantum Field State Control and Measurement in a Cavity, *J. M. Raimond, S. Deléglise, C. Sayrin, X. Zhou, I. Dotsenko, S. Gleyzes, M. Brune, S. Haroche; École Normale Supérieure, France.* We realize a Quantum Non Demolition measurement of the photon number in a cavity. We evidence quantum jumps of light, Zeno effect and we reconstruct the field's state. This tool is promising for quantum feedback.

JWE5 • 5:30 p.m.
Cavity-Enhanced Two-Photon Processes in Quantum Dots and Applications to Quantum Information Science, *Ziliang Lin, Jelena Vučković; Stanford Univ., USA.* We present two-photon transition rate enhancement in quantum dots coupled to photonic crystal cavities. We show that cavity-assisted two-photon absorption and emission are efficient methods to coherently excite quantum dots and generate indistinguishable single photons.

JWE6 • 5:45 p.m.
Decoherence and Disentanglement for Two Qubits in a Common Squeezed Reservoir, *Maritza Hernandez, Miguel Orszag; Pontificia Univ. Católica de Chile, Chile.* We study the relation between the sudden death and revival of the entanglement of two qubits in a common squeezed bath and the decoherence.

FWW • Phase Space Optics—Optical System Theory for the 21st Century II—Continued

FWW3 • 5:00 p.m. Invited
Design of Rotating Beams, *Tatiana Alieva[1], Eugeny Abramochkin[2]; [1]Univ. Complutense de Madrid, Spain, [2]PN Lebedev Physical Inst., Samara Branch, Russian Federation.* Based on the ray transformation matrix formalism, a simple method for generation of paraxial beams anisotropically rotating in phase space during their propagation through isotropic optical systems is proposed.

FWX • Novel Optical Architectures in Emerging Technologies II—Continued

FWX4 • 5:00 p.m.
Range Resolved, Sub-Millimeter Resolution Lidar Using Temporally Stretched, Frequency Chirped Pulses, *Mohammad Umar Piracha[1], Dat Nguyen[1], Dimitrios Mandridis[1], Ibrahim Ozdur[1], Tolga Yilmaz[2], Sarper Ozharar[1], Peter J. Delfyett[1]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Radiance, Inc., USA.* A temporally stretched, frequency chirped pulsed lidar system employing a phase modulation heterodyne scheme for range resolved measurements with sub-millimeter resolution at a range of 4.65km with 30dB dynamic range is demonstrated.

FWX5 • 5:15 p.m.
Analytic Theory of Light Reflection from a Chirped Volume Bragg Grating, *Leonid B. Glebov[1], Sergiy V. Mokhov[1], Vadim I. Smirnov[2], Boris Ya. Zeldovich[1]; [1] CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]OptiGrate, USA.* We present and study solutions of the equations for counter-propagating waves coupled by Chirped Bragg Gratings (CBG). Analytic expression for amplitude and phase of reflection is found, confirming the results of numerical modeling of CBG.

6:30 p.m.–8:00 p.m. FiO Postdeadline Paper Sessions, *See the Postdeadline Papers Book in your registration bag for exact times and locations*

For Fall Congress presentations on Wednesday, see pages 125-131.

FWY • Optical Trapping and Micromanipulation III—Continued

FWY4 • 5:00 p.m.
Effects of Polarization in Optical Binding, *David P. Haefner, Sergey Sukhov, Aristide Dogariu; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We investigate the influence of incident field polarization on dynamics of optically bound particles. The existence of torques due to optical interaction in the multi-particle system is demonstrated and applications to nano-rotator machines are discussed.

FWY5 • 5:15 p.m.
Development of Dynamic Phase Demodulation Technique to Investigate Live-Cell Dynamics, Using Heterodyne Mach-Zehnder Interferometer, *Shiju Joseph[1], Jean-Michel Gineste[2], Maurice Whelan[2], David Newport[1]; [1]Stokes Res. Inst., Univ. of Limerick, Ireland, [2]Inst. for Health and Consumer Protection, European Commission DG Joint Res. Ctr., Italy.* A Heterodyne Mac-Zehnder interferometer to extract phase images of cells and demodulation method to retrieve instantaneous frequency of a phase object, undergoing sinusoidal modulation (amplitude-200 nm and frequency-30 Hz and mimicking cell vibration) is presented.

FWZ • Silicon Photonics III—Continued

FWZ4 • 5:00 p.m.
Subwavelength Silicon Microdisks with High Quality Factors, *Jeffrey M. Shainline, Gustavo Fernandes, Zhijun Liu, Jimmy Xu; Brown Univ., USA.* We present a study of the first subwavelength silicon micro-cavities and to our knowledge the smallest micro-cavities to be probed with tapered fiber spectroscopy or directly coupled to a waveguide.

FWZ5 • 5:15 p.m.
Slot Waveguide Incorporating a Sub-Core, *Yinying Xiao-Li[1], Lin Zhang[1], Yang Yue[1], Raymond G. Beausoleil[2], Alan E. Willner[1]; [1]Univ. of Southern California, USA, [2]HP Labs, USA.* We propose a slot waveguide in which a sub-core is incorporated into the slot itself. We numerically simulate the waveguide under various conditions and show that the guided-wave can exhibit highly enhanced two-dimensional confinement.

LSWJ • Ultrafast Spectroscopy II—Continued

LSWJ3 • 5:00 p.m.
Ultrafast THz Studies of Few-Layer Epitaxial Graphene, *Hyunyong Choi[1], Ferenc Borondics[1], David A. Siegel[1,2], Shuyun Zhou[1,2], Michael C. Martin[1], Alessandra Lanzara[1,2], Robert A. Kaindl[1]; [1]Lawrence Berkeley Natl. Lab, USA, [2]Univ. of California at Berkeley, USA.* We report the broadband optical conductivity and ultrafast THz dynamics of few-layer epitaxial graphene, revealing electrodynamics consistent with a dense Dirac electron plasma and a transient THz response dominated by recombination of excess hole carriers.

LSWJ4 • 5:15 p.m. Invited
Dynamic Signatures of Exciton-Plasmon Interactions in Hybrid Semiconductor-Metal Nanostructures, *Marc Achermann; Univ. of Massachusetts at Amherst, USA.* We study the coupling between excitons and surface plasmons (SPs) in assemblies of semiconductor nanocrystals and metal nanostructures. We will discuss SP-coupled emission dynamics, SP-mediated energy transfer in donor-acceptor systems, and SP-induced radiative rate enhancements.

LSWJ5 • 5:45 p.m. Invited
One-Dimensional Exciton Dynamics in Carbon Nanotubes, *Tobias Hertel, Zipeng Zhu, Dominik Stich, Jared Crochet; Univ. of Wurzburg, Germany.* We discuss femtosecond time-resolved pump-probe investigations of exciton dynamics in structurally sorted carbon nanotubes and carbon nanotube aggregates.

LSWK • Second-Order Nonlinear Optics IV—Continued

LSWK3 • 5:00 p.m.
Highly Efficient Second Harmonic Generation of Super Strong Femtosecond Laser Pulses, *Sergey Mironov, Vladimir Lozhkarev, Vladislav Ginzburg, Efim Khazanov; Inst. of Applied Physics, Russian Acad. of Sciences, Russian Federation.* The 60% energy conversion efficiency of second harmonic generation process in 1mm KDP crystal at input peak intensity 0.6TW/cm^2 has been experimentally achieved.

LSWK4 • 5:15 p.m.
Microchip Green Laser Source Based on Second-Harmonic Generation in Periodically Poled, MgO-Doped Lithium Niobate, *Andrei Shchegrov[1], John Khaydarov[1], Stepan Essaian[1], Greg Nemet[1], Suren Soghomonyan[2], Hakob Danielyan[2], Gevorg Gabrielyan[2]; [1]Spectralus Corp., USA, [2]Spectralus CJSC, Armenia.* We present a microchip green laser source based on PPMgOLN crystal. This architecture achieves wall-plug efficiency of 12% for output power levels of 50-150mW and fits into a small package suitable for pico-projectors.

LSWK5 • 5:30 p.m.
Coupled Dipole Model for Nonlinear Scattering, *Naveen K. Balla[1], Peter T. C. So[2], Colin J. R. Sheppard[1]; [1]Natl. Univ. of Singapore, Singapore, [2]MIT, USA.* We address the problem of nonlinear scattering by scatterers of irregular shapes. Our approach assumes the scatterer to be made up of coupled dipoles which interact among themselves and with the incident field.

JWF • Advances in Adaptive Optics Imaging of the Living Retina II—Continued

JWF4 • 5:15 p.m.
First-Order Design of Off-Axis Reflective Ophthalmic Adaptive Optics Systems Using Afocal Telescopes, *Alfredo Dubra[1], Armando Gómez-Vieyra[2], Daniel Malacara-Hernández[2], David R. Williams[1]; [1]Univ. of Rochester, USA, [2]Ctr. de Investigaciones en Optica AC, Mexico.* Expressions for minimal astigmatism in image and pupil planes in off-axis reflective afocal telescopes formed by pairs of spherical mirrors are presented and evaluated for small angles of incidence.

6:30 p.m.–8:00 p.m. FiO Postdeadline Paper Sessions, *See the Postdeadline Papers Book in your registration bag for exact times and locations*

For Fall Congress presentations on Wednesday, see pages 125-131.

LS

FiO

8:00 a.m.–10:00 a.m.
LSThA • X-Ray Imaging I
Aymeric Robert; SLAC Natl. Accelerator Lab, Stanford Univ., USA, Presider

LSThA1 • 8:00 a.m. Invited

What Kind of Data Do We Expect in Single-Molecule Imaging Experiments and How Do We Process It? *Veit Elser, Duane Ne-Te Loh; Cornell Univ., USA.* The proposed experiments to image single molecules with X-ray free-electron lasers present an unprecedented challenge in data processing. We describe for non-experts the computational tasks and some recent progress in solving them.

LSThA2 • 8:30 a.m. Invited

The Coherent X-Ray Imaging Instrument at LCLS, *Sébastien Boutet; SLAC Natl. Accelerator Lab, Stanford Univ., USA.* The LCLS will be the first hard X-ray free-electron laser in the world. I will describe the capabilities and the scientific program of the Coherent X-Ray Imaging instrument utilizing the unique source properties of LCLS.

8:00 a.m.–10:00 a.m.
FThA • Nanofocusing Optics I
Ian McNulty; Argonne Natl. Lab, USA, Presider

FThA1 • 8:00 a.m. Tutorial

Introduction to Diffraction Limited X-Ray Optics, *David Attwood; Lawrence Berkeley Natl. Lab, USA.* We discuss the ability of X-ray optics to form images at or near the diffraction limit. These include diffractive optics and zone plates for soft X-rays, and reflective optics for the extreme ultraviolet.

David Attwood received his Ph.D. in Applied Physics from New York University in 1972. He has been a Professor in Residence at University of California at Berkeley since 1989. He was co-founder of the Applied Science and Technology Ph.D. program and serves on its Executive Committee. His research interests center on the use of short wavelength electromagnetic radiation, soft X-rays and extreme ultraviolet radiation in the 1-30nm range. Applications of particular interest include element specific soft X-ray microscopy and EUV lithography. He and his students are also active in the use of novel Fourier optics, image contrast techniques, and the development and use of coherent sources at these short wavelengths. At the contiguous Lawrence Berkeley National Laboratory, he is founding Director of the Center for X-Ray Optics (CXRO), and was first (1985–1988) Scientific Director of the Advanced Light Source (ALS). He is a Fellow Member of the American Physical Society and The Optical Society. He is author of *Soft X-Rays and Extreme Ultraviolet Radiation: Principles and Applications* (Cambridge University Press, 2000). His lectures are regularly broadcast live over the Internet and electronically archived, at youtube.com and at www.coe.berkeley.edu/AST/sxreuv and www.coe.berkeley.edu/AST/srms.

FThA2 • 8:45 a.m.

Sculpting Nanostructures with Light, *Rajesh Menon[1,2]; [1]MIT, USA, [2]LumArray, Inc., USA.* We show that it is possible to pattern nanostructures with long-wavelength photons, effectively breaking the far-field diffraction barrier. We also present approaches to single-molecule spatial resolution with light in 3 dimensions.

8:00 a.m.–10:00 a.m.
FThB • Diffractive and Holographic Optics III
Yunlong Sheng; Univ. Laval, Canada, Presider

FThB1 • 8:00 a.m.

Bubble Size Measurement in High-Density Air-Water Mixture Flows with Wide Size Distributions Using Digital Holography, *Lei Tian[1], Nick Loomis[1], Jose A. Dominguez-Caballero[1], George Barbastathis[1,2]; [1]MIT, USA, [2]Singapore-MIT Alliance for Res. and Technology (SMART) Ctr., Singapore.* We present experimental results of using in-line digital holography to measure bubble sizes in high-density air-water mixture flows with a wide size distribution.

FThB2 • 8:15 a.m.

Confocal Fluorescence Microscopy Using a Microfabricated Zone Plate, *Ethan F. Schonbrun, Kenneth B. Crozier; Harvard Univ., USA.* We demonstrate a compact confocal fluorescence microscope using a microfabricated zone plate. Using a single fluorescent sphere, we measure the transverse and axial resolution to be below 1.6 and 2.2 micron, respectively.

FThB3 • 8:30 a.m. Invited

Live Cell Imaging with Field-Based 3-D Microscopy, *Michael Feld, Wonshik Choi; MIT, USA.* We report field-based 3-D microscopy for high resolution 3-D mapping of refractive index in live cells and tissues. The technique features simultaneous detection of phase and amplitude of light at multiple incident angles of illumination.

8:00 a.m.–10:00 a.m.
FThC • Micro-Cavity Devices I
Presider to Be Announced

FThC1 • 8:00 a.m. Invited

Crystalline Whispering Gallery Mode Resonators: Recent Advances and Future Trends, *Lute Maleki, Andrey B. Matsko, Anatoliy A. Savchenkov, Vladimir S. Ilchenko, David Seidel; OEwaves, Inc., USA.* We review a variety of optical phenomena recently observed in ultra-high-Q crystalline whispering gallery mode resonators, and speculate on the future trends in the development of the field. Practical applications of these resonators are discussed.

FThC2 • 8:30 a.m.

Thermo-Optical Tuning of Whispering Gallery Modes in Microspheres around the ^{85}Rb Cooling Transition, *Laura Russell[1,2], Sile Nic Chormaic[1,2], Jonathan M. Ward[2,3], Michael J. Morrissey[2,3]; [1]Univ. College Cork, Ireland, [2]Tyndall Natl. Inst., Ireland, [3]Cork Inst. of Technology, Ireland.* We present a method for tuning whispering gallery modes in microspheres and demonstrate tuning to the cooling transition of ^{85}Rb. The tuning method can be used in UHV and is of interest for cavity-QED experiments.

FThC3 • 8:45 a.m.

Spectral Characteristics of Coupled Silica Disc Micro Resonators, *Carsten Schmidt[1], Arkadi Chipouline[1], Thomas Käsebier[1], Lev Deych[2], Ernst-Bernhard Kley[1], Andreas Tünnermann[1,3], Thomas Pertsch[1]; [1]Friedrich-Schiller-Univ. Jena, Germany, [2]Queens College, CUNY, USA, [3]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* Coupled optical microresonators are of great interest due to their potential applications and unique optical characteristics. For coupled disc microresonators the results of rigorous universal theoretical model are in good agreement with experimental data.

For Fall Congress presentations on Thursday, see pages 132-136.

California — FiO

8:00 a.m.–10:00 a.m.
FThD • High-Power Fiber Lasers I
Presider to Be Announced

FThD1 • 8:00 a.m. Invited

High Power CW and Pulsed Fiber Lasers with Double Cladding Fiber Made in China, *Qihong Lou, Jun Zhou, Bin He, Songtao Du; Shanghai Inst. of Optics and Fine Mechanics, China.* 1640W CW high power output and 150W high repetition rate pulsed output are obtained with China-made multimode core fibers. The laser structure and pulse amplifier technology are given in detail.

FThD2 • 8:30 a.m. Invited

100-kW Coherently Combined Nd:YAG MOPA Laser Array, *Stuart J. McNaught, Charles P. Asman, Hagop Injeyan, Andrew Jankevics, Adam M. F. Johnson, Gina C. Jones, Hiroshi Komine, Jason Machan, Jay Marmo, Michael McClellan, Randy Simpson, Jeff Sollee, Marcy M. Valley, Mark Weber, S. Benjamin Weiss; Northrop Grumman Aerospace Systems, USA.* We have demonstrated the world's first 100-kW solid-state laser system with good beam quality. Seven 15-kW MOPA (master oscillator-power amplifier) laser chains are coherently combined to achieve a single output beam.

Glen Ellen — FiO

8:00 a.m.–10:00 a.m.
FThE • Integrated Optics
Amy C. Sullivan; Univ. of Colorado, USA, Presider

FThE1 • 8:00 a.m.

Low Insertion Loss SOI Microring Resonator Integrated with Nano-Taper Couplers, *Minhao Pu[1], Lars Hagedorn Frandsen[2], Haiyan Ou[1], Kresten Yvind[1], Jørn Märcher Hvam[1]; [1]Technical Univ. of Denmark, Denmark, [2]Koheras A/S, Denmark.* We demonstrate a microring resonator working at TM mode integrated with nano-taper couplers with 3.6dB total insertion loss. The measured insertion loss of the nano-taper coupler was only 1.3dB for TM mode.

FThE2 • 8:15 a.m.

Achieving Uniform Chromatic Dispersion over a Wide Wavelength Range in Highly Nonlinear Slot Waveguides, *Lin Zhang[1], Yang Yue[1], Yinying Xiao-Li[1], Jian Wang[1], Raymond G. Beausoleil[2], Alan E. Willner[1]; [1]Univ. of Southern California, USA, [2]HP Labs, USA.* We show dispersion-flattened silicon slot waveguides with high nonlinearity for on-chip signal-processing applications, which exhibits a flat near-zero dispersion within ±0.12ps/nm/m over a 302-nm wavelength range with nonlinear coefficient γ up to 4300/m/W at 1550nm.

FThE3 • 8:30 a.m.

Compact Organic Electro-Optic (EO) Modulator with Ultra Low Switching Voltage and Large Bandwidth Using Transparent Conducting Oxides (TCO) Bridge Electrodes, *Fei Yi[1], Fang Ou[1], Boyang Liu[1], Yingyan Huang[1], Seng-Tiong Ho[1], Yiliang Wang[2], Jun Liu[2], Tobin J. Marks[2], Jingdong Luo[3], Alex Jen[3], Dan Jin[4], Raluca Dinu[4]; [1]Dept. of Electrical Engineering and Computer Science, Northwestern Univ., USA, [2]Dept. of Chemistry, Material Res. Ctr., Northwestern Univ., USA, [3]Dept. of Material Science and Engineering, Univ. of Washington, USA, [4]Lumera Corp., USA.* We report a new promising voltage-size performance record (0.6V-cm) of the organic EO modulator using transparent conducting oxides as the bridge electrodes. The comprehensive theoretical analysis predicts large electrical bandwidth (>40GHz) is achievable.

FThE4 • 8:45 a.m.

All-Order Waveguide-Type Dispersion Compensator Using Arrayed Waveguide Gratings, *Koichi Kato[1], Hiroshi Takahashi[2], Seiji Fukushima[2], Hiroyuki Tsuda[1]; [1]Graduate School of Science and Technology, Keio Univ., Japan, [2]NTT Photonics Labs, NTT Corp., Japan.* We have proposed an all-order waveguide-type dispersion compensation method using arrayed waveguide gratings (AWGs). We have estimated the dispersion compensation performances for a given diffraction order and number of arrayed waveguides in each AWG.

Atherton — LS

8:00 a.m.–10:00 a.m.
LSThB • Single-Molecule Biophysics III
Chris Fecko; Univ. of North Carolina at Chapel Hill, USA, Presider

LSThB1 • 8:00 a.m. Invited

Investigating Amyloid Nucleation and Growth Using Single Molecule Fluorescence Microscopy, *Keith Berland, David G. Lynn, Yan Liang; Emory Univ., USA.* Nucleation and growth mechanisms in amyloid materials are resolved using single molecule fluorescence imaging and spectroscopy. Results identify an intermolecular molten globule state as a key intermediate of the nucleation pathway.

LSThB2 • 8:30 a.m. Invited

3-D Localization in Fluorescence Photoactivation Localization Microscopy and Particle Tracking, *Joerg Bewersdorf[1,2], Michael J. Mlodzianoski[1,2], Stefanie E. K. Kirschbaum[2,3,4,5], Manuel F. Juette[1,2,4,5]; [1]Yale Univ. School of Medicine, USA, [2]Inst. for Molecular Biophysics, The Jackson Lab, USA, [3]Dept. of Physics and Astronomy, Univ. of Maine, USA, [4]Dept. of Biophysical Chemistry, Univ. of Heidelberg, Germany, [5]Dept. of New Materials and Biosystems, Max-Planck-Inst. for Metals Res., Germany.* Particle localization at the nanometer scale plays a central role in particle tracking and localization-based super-resolution microscopy. We compare the experimental performance of two three-dimensional (3-D) localization methods. Additionally, we characterize different photoactivatable fluorescent proteins.

Sacramento — FiO

8:00 a.m.–10:00 a.m.
FThF • Polarization and Birefringence in Optical Design I
Russell Chipman; Univ. of Arizona, USA, Presider

FThF1 • 8:00 a.m. Invited

Photoaligned Liquid Crystal Polymers for Space Variant Polarization Control, *Scott McEldowney[1], David M. Shemo[2], Russell A. Chipman[3]; [1]Microsoft Corp., USA, [2]JDS Uniphase, USA, [3]Univ. of Arizona, USA.* We present photo-aligned liquid crystal polymer devices for creating space variant polarization control. We demonstrate components creating systematic and random polarization orientation profiles. Theoretical and experimental properties of vortex retarders and speckle control are presented.

FThF2 • 8:30 a.m. Invited

Optical Imaging Instrumentation with Spatially Engineered Polarization, *Qiwen Zhan; Univ. of Dayton, USA.* Latest developments of spatial polarization engineering that can benefit optical imaging instrumentation are presented. Applications of spatially variant optical polarization in nonlinear optical imaging, plasmonic focusing and focal field 3-D polarization control will be discussed.

For Fall Congress presentations on Thursday, see pages 132-135.

LSThA • X-Ray Imaging I—Continued

LSThA3 • 9:00 a.m. Invited

Femtosecond Dynamic Diffraction Imaging with Free Electron Lasers: X-Ray Snapshots of Ultra-Fast Nanoscale Phenomena, *Anton Barty[1], Henry N. Chapman[2], Michael J. Bogan[1], Sébastien Boutet[1,3,4], Matthias Frank[1], Stefan P. Hau-Riege[1], Stefano Marchesini[1,5], Bruce W. Woods[1], Saša Bajt[1], W. Henry Benner[1], Richard A. London[1], Elke Plönjes[6], Marion Kuhlmann[6], Rolf Treusch[6], Stefan Düsterer[6], Thomas Tschentscher[6], Jochen R. Schneider[6], Eberhard Spiller[7], Thomas Möller[8], Christoph Bostedt[8], Matthias Hoener[8], David A. Shapiro[5], Keith O. Hodgson[3], David van der Spoel[4], Magnus Bergh[4], Carl Caleman[4], Gösta Huldt[4], Bianca Iwan[4], M. Marvin Seibert[4], Filipe R. N. C. Maia[4], Abraham Szöke[1,4], Nicusor Timneanu[4], Janos Hajdu[3,4]; [1]Lawrence Livermore Natl. Lab, USA, [2]Ctr. for Free Electron Laser Science, Univ. Hamburg, Germany, [3]Stanford Synchrotron Radiation Lab, Stanford Linear Accelerator Ctr., USA, [4]Uppsala Univ., Sweden, [5]Univ. of California at Davis, USA, [6]Deutsches Elektronen-Synchrotron, DESY, Germany, [7]Spiller X-Ray Optics, USA, [8]Inst. für Atomare Physik, Technische Univ. Berlin, Germany.* The ultrafast, ultrabright X-ray pulses offered by a new generation of free-electron lasers is ushering in extraordinary new capabilities in X-ray science, with a wide range of applications in fundamental atomic-physics, ultrafast-chemistry and materials science.

LSThA4 • 9:30 a.m. Invited

Title to Be Announced, *Stefan Hau-Riege; Lawerence Livermore Natl. Lab, USA.* Abstract not available.

FThA • Nanofocusing Optics I—Continued

FThA3 • 9:00 a.m. Invited

Singular and Other Novel X-Ray Diffractive Optics, *Anne Sakdinawat; Lawrence Berkeley Natl. Lab, Univ. of California at Berkeley, USA.* Singular and other novel X-ray diffractive optics have been developed for X-ray microscopy. These optics enhance contrast and resolution by enabling phase contrast, extended depth of field, and other imaging capabilities.

FThA4 • 9:30 a.m. Invited

Laboratory X-Ray Micro- and Nano-Imaging, *Hans M. Hertz, M. Bertilson, E. Chubarova, O. Hemberg, O. v Hofsten, A. Holmberg, M. Lindblom, U. Lundström, D. Nilsson, M. Otendal, J. Reinspach, P. Skoglund, P. Takman, T. Tuohimaa, U. Vogt; Royal Inst. of Technology, Sweden.* We summarize recent progress in laboratory X-ray imaging systems based on compact high-brightness liquid-jet sources, including <25 nm soft X-ray zone-plate microscopy and <10 μm (lens-free) hard X-ray phase-contrast imaging.

FThB • Diffractive and Holographic Optics III—Continued

FThB4 • 9:00 a.m.

Heterodyne Holographic Microscopy for 3-D Imaging of Live Cells Labeled with Gold Nanoparticles, *Nilanthi Warnasooriya[1], Fadwa Joud[2], Philippe Bun[3], Sarah Suck[1], Michel Gross[2], Maité Coppey-Moisan[3], Gilles Tessier[1]; [1]Inst. Langevin, CNRS UMR 7587, ESPCI, France, [2]Lab Kastler Brossel de l'ENS, France, [3]Département de Biologie Cellulaire, Inst. Jacques Monod, France.* Heterodyne holographic microscopy in total internal reflection is used for 3-D imaging of live cells labeled with 40nm gold particles, with shot-noise limited sensitivity. Fast acquisition times enable selective localization of tens of particles simultaneously.

FThB5 • 9:15 a.m.

Determination of Sidewalls in Transparent Media, *Monika Leniec, Jan Masajada; Wroclaw Univ. of Technology, Poland.* The new method for characterization of sidewalls transparent media is presented. The authors introduce optical system based on optical vortex interferometer. Analytical calculation as well as experimental results are shown.

FThB6 • 9:30 a.m.

Generating Superpositions of Higher Order Bessel Beams, *Ruslan Vasilyeu[1], Angela Dudley[2,3], N. Khilo[1], Andrew Forbes[2,3]; [1]B.I. Stepanov Inst. of Physics, Natl. Acad. of Sciences of Belarus, Belarus, [2]Univ. of KwaZulu-Natal, South Africa, [3]CSIR Natl. Laser Ctr., South Africa.* An experimental setup to generate a superposition of higher-order Bessel beams by means of a spatial light modulator and ring aperture is presented. The experimentally produced fields are in good agreement with those calculated theoretically.

FThB7 • 9:45 a.m.

Second Harmonic Generation of Femtosecond Vortex Beams with a Programmable Pulse Shaper, *Nicolas Cusnir, Matt E. Anderson; San Diego State Univ., USA.* We have used a liquid crystal spatial light modulator (SLM) to produce optical vortices (OVs) with 50 fs pulses. The second harmonic generation of these vortex beams has been investigated both theoretically and experimentally.

FThC • Micro-Cavity Devices I—Continued

FThC4 • 9:00 a.m. Invited

Applications of High-Q Optical Microresonators in Communication, *Mani Hossein-Zadeh; Ctr. for High Technology Materials, Univ. of New Mexico, USA.* This talk summarizes various applications of high-Q resonance in optical and RF-photonic communication systems. We highlight recent advances and future challenges in high-Q microring/microdisk based photonic communication devices.

FThC5 • 9:30 a.m.

Absorption-Controlled Resonator for All-Optical Memory, *Yingyan Huang[1], Vivek Krishnamurthy[2], Seng-Tiong Ho[3]; [1]OptoNet Inc., USA, [2]Data Storage Inst., Agency for Science, Technology and Res., Singapore, [3]Dept. of Electrical Engineering and Computer Science, Northwestern Univ., USA.* Bistability induced in an absorption-controlled resonator is explored with a semi-analytical analysis. A sub-mW power requirement along with a maximum speed of ~100 Gbps is demonstrated, making the device apt for high-speed, power-efficient all-optical memory.

FThC6 • 9:45 a.m.

Thermal and Free Electron Nonlinearities in Silica and Hybrid Silica/Silicon Disc Micro Resonators, *Carsten Schmidt[1], Arkadi Chipouline[1], Thomas Käsebier[1], Ernst-Bernhard Kley[1], Andreas Tünnermann[1,2], Lev Deych[3], Thomas Pertsch[1]; [1]Friedrich-Schiller-Univ. Jena, Germany, [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany, [3]Queens College, CUNY, USA.* Bistability effects in silica and hybrid silca-silicon microdisc resonators are investigated experimentally and numerically. The opposite signs of nonlinear responses promise a way to design disc microresonators less sensitive to higher optical powers.

10:00 a.m.–10:30 a.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

For Fall Congress presentations on Thursday, see pages 132-136.

FThD • High-Power Fiber Lasers I—Continued

FThD3 • 9:00 a.m.
Experimental Demonstration of Reduced Path-Length Sensitivity in Coherent Beam Combining Architectures, *Mercedeh Khajavikhan, James Robert Leger; Univ. of Minnesota, USA.* Proper exploitation of spatial supermodes in Michelson-type cavities reduces the sensitivity to path-length variations. The radiance improvement is experimentally demonstrated in a common-path generalized Michelson cavity formed by polarization multiplexing the two gain arms.

FThD4 • 9:15 a.m.
Wavelength-Tunable Figure-Eight Erbium-Doped Fiber Laser with a Sagnac Fiber Filter, *Baldemar Ibarra-Escamilla[1,2], Olivier Pottiez[3], Evgeny A. Kuzin[1], Joseph W. Haus[2], Miguel A. Bello-Jiménez[1], Ariel Flores-Rosas[1]; [1]INAOE, Mexico, [2]Univ. of Dayton, USA, [3]Ctr. de Investigaciones en Optica, Mexico.* A passively mode-locked Erbium-doped figure-eight fiber laser is continuously wavelength-tunable over a range from 1525 to 1555 nm using a fiber interferometer, with an autocorrelation trace of 3.1 ps and pulse spectrum of 1.5 nm.

FThD5 • 9:30 a.m. Invited
Spatial Filtering Properties of Large-Mode-Area Fibers with Confined Gain Dopants, *John R. Marciante; Univ. of Rochester, USA.* Simulations and experiments will be used to reveal the spatial filtering properties of large-mode-area gain-tailored fibers, where the overlap of the gain with the various modes provides preferential modal discrimination even at high saturation levels.

FThE • Integrated Optics—Continued

FThE5 • 9:00 a.m.
Nanoimprinted Polysiloxane Optical Devices, *Ting Han[1], Steve Madden[1], Mathew Zhang[1], Barry Luther-Davies[1], Robbie Charters[2]; [1]Australian Natl. Univ., Australia, [2]RPO Inc., Australia.* UV-Nanoimprint lithography is demonstrated to be a low cost and high throughput technique to replicate complicated optical devices. We present high quality nanoimprinted Polysiloxane optical waveguides and waveguide grating devices for WDM system.

FThE6 • 9:15 a.m.
Characterization of Guided Modes of Ti: $LiNbO_3$ Channel Waveguide in Comparison with Beam Propagation Method, *Jieda Li, Jay Kirk, Marc P. Christensen; Southern Methodist Univ., USA.* Optical properties of Ti: $LiNbO_3$ waveguide have been related to the structural properties by SIMS and BPM. The comparison of the mode diameters between the experiment and the BPM method have been performed.

FThE7 • 9:30 a.m.
Fabrication of Rib Waveguides in Germanium-Selenium Chalcogenide Glass through Electron Beam Direct Writing, *Galen B. Hoffman, Wei Zhou, R. Sooryakumar, Ronald M. Reano; Ohio State Univ., USA.* We report the fabrication of direct write rib waveguides in $Ge_{0.2}Se_{0.8}$ chalcogenide glass films on thermally oxidized silicon substrates using electron beams. Numerical modeling of the fundamental TE mode yields an effective index of 2.0.

FThE8 • 9:45 a.m.
Asymmetric Waveguide Writing Modeled with GAFFE, *Edward J. Grace; Imperial College London, UK.* For the first time to our knowledge we numerically demonstrate the effect of simple self-focusing on the generation of the characteristic "bite-mark" pattern in transverse waveguide writing.

LSThB • Single-Molecule Biophysics III—Continued

LSThB3 • 9:00 a.m. Invited
Single Molecule Imaging of Axonal Transport in Live Neurons, *Harsha V. Mudrakola, Chengbiao Wu, Kai Zhang, Bianxiao Cui; Stanford Univ., USA.* We report a single molecular imaging method that tracks axonal transport in live neurons, and a super-resolution method, dynamic object tracking that resolves individual microtubules in live neurons below the diffraction barrier.

LSThB4 • 9:30 a.m. Invited
Probing Cellular Events with Single Quantum Dot Imaging, *Maxime Dahan; Lab Kastler Brossel, École Normale Supérieure, France.* Quantum dots (QDs) are fluorescent inorganic probes that enable the visualization of single molecules in live cells. The state-of-the art in QD tracking will be presented as well as some important remaining challenges.

FThF • Polarization and Birefringence in Optical Design I—Continued

FThF3 • 9:00 a.m.
Enhancement of Polarization Rotation in Azobenzene Films, *Chandra S. Yelleswarapu, Devulapalli V. Rao; Univ. of Massachusetts Boston, USA.* We observed enhancement of photoinduced polarization rotation, as much as 24°, when the input laser beam propagates through azobenzene doped polymer thin films that were placed in tandem.

FThF4 • 9:15 a.m.
Snapshot Imaging Polarimeter for Polychromatic Light Using Savart Plates and Diffractive Lenses, *Kazuhiko Oka[1], Ryosuke Suda[1], Masayuki Ohnuki[1], Darren Miller[2], Eustace L. Dereniak[2]; [1]Hokkaido Univ., Japan, [2]Univ. of Arizona, USA.* The imaging polarimeter using the Savart plates is modified for use with the polychromatic light by incorporating an imaging system utilizing diffractive lenses. Its feasibility is numerical simulated for the visible light with 50nm-bandwidth.

FThF5 • 9:30 a.m.
Large Tuning of Birefringence in Two Strip Silicon Waveguides via Optomechanical Motion, *Jing Ma, Michelle Povinelli; Univ. of Southern California, USA.* Adjusting the separation between two strip waveguides by an optical force, we obtain widely tunable birefringence dependent on the separation. The maximum difference of phase birefringence before and after tuning is calculated to be 0.026.

FThF6 • 9:45 a.m.
Magneto-Optical Control of Nonlinear Light Collapse, *Katarzyna A. Rutkowska[1,2], Yoav Linzon[1], Boris A. Malomed[3], Roberto Morandotti[1]; [1]INRS-Énergie et Matériaux, Univ. du Québec, Canada, [2]Faculty of Physics, Warsaw Univ. of Technology, Poland, [3]Faculty of Engineering, Tel Aviv Univ., Israel.* We present the theoretical and experimental demonstration of light collapse control in nonlinear magneto-optical Kerr media. The required management of the birefringence is achieved via a combination of the Cotton-Mouton and Faraday effects.

10:00 a.m.–10:30 a.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

For Fall Congress presentations on Thursday, see pages 132-135.

10:30 a.m.–12:00 p.m.
LSThC • X-Ray Photon Correlation Spectroscopy

Sébastien Boutet; SLAC Natl. Accelerator Lab, Stanford Univ., USA, Presider

LSThC1 • 10:30 a.m. Invited

The X-Ray Photon Correlation Spectroscopy Instrument at LCLS, *Aymeric Robert; Linac Coherent Light Source, SLAC Natl. Accelerator Lab, Stanford Univ., USA*. The X-ray Photon Correlation Spectroscopy Instrument (XCS) will probe dynamical phenomena in condensed matter systems down to nanometric lengthscales using the LCLS. The design, status and capabilities of XCS will be presented.

LSThC2 • 11:00 a.m. Invited

Title to Be Announced, *Simon Mochrie; Yale Univ., USA*. Abstract not available.

10:30 a.m.–12:00 p.m.
FThG • Nanofocusing Optics II

Lahsen Assoufid; Argonne Natl. Lab, USA, Presider

FThG1 • 10:30 a.m. Invited

X-Ray Nano-Tomography at HZB, *Gerd Schneider[1], Peter Guttmann[1], Stefan Heim[1], Waltraud Müller[2], Jim McNally[2]; [1]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Elektronenspeicherring BESSY II, Germany, [2]Lab of Receptor Biology and Gene Expression, Natl. Cancer Inst., Natl. Inst. of Health, USA*. We developed a new full-field transmission X-ray microscope (TXM) for automated cryo-tomography and spectroscopy. The system operates at the BESSY undulator U41 at a focusing spherical grating monochromator beamline, which provides an energy resolution up to 104. In the talk, we present the new TXM and selected applications.

FThG2 • 11:00 a.m. Invited

X-Ray Refractive Optics for Nanofocusing, *Anatoly Snigirev; European Synchrotron Radiation Facility, France.* The paper covers the latest status of X-ray refractive optics which become standard elements in synchrotron beamlines instrumentation. The main emphasis will be put on those methods which aim to produce submicron and nanometer resolution.

10:30 a.m.–11:45 a.m.
FThH • Aspheric and Freeform Optical Surfaces: Design, Characterization and Alignment I

Marty Valente; Univ. of Arizona, USA, Presider

FThH1 • 10:30 a.m. Invited

Can You Make/Measure this Asphere for Me? *Greg Forbes; QED Technologies Inc., USA*. The conventional characterization of an asphere's shape is problematic: its coefficients hold many unnecessary digits and are unintelligible at first sight. There are related-complications in design, fabrication, and testing. Solutions are demonstrated for these shortcomings.

FThH2 • 11:00 a.m.

Extending Stavroudis's Solution of the Eikonal Equation to Multi-Element Optical Systems, *John A. Hoffnagle[1], David L. Shealy[2]; [1]John A. Hoffnagle, USA, [2]Univ. of Alabama at Birmingham, USA*. We show how Stavroudis's solution to the eikonal equation in terms of the k-function can be continued across an arbitratry reflecting or refracting surface, allowing it to be applied to multi-element optical systems.

FThH3 • 11:15 a.m.

Orthogonal Field-Dependent Aberrations for Misaligned Optical Systems, *Anastacia M. Manuel[1], James H. Burge[1], Régis Tessieres[2]; [1]Univ. of Arizona, USA, [2]DxO Labs, France*. We present a set of orthogonal field-dependent aberrations, useful for describing optical systems with tilted and decentered elements, derived from combinations of Zernike polynomials in both field space and pupil space.

10:30 a.m.–12:00 p.m.
FThI • Novel Nonlinear Optical Phenomena

Nathaniel Phillips; College of William & Mary, USA, Presider

FThI1 • 10:30 a.m.

The Effect of Domain Distribution on Second Harmonic Generation in Disordered Nonlinear Media, *Vito Roppo[1,2], Solomon Saltiel[2,3], Wenjie Wang[2], Ksawery Kalinowski[2], Jose F. Trull[1], Crina M. Cojocaru[1], Dragomir N. Neshev[2], Wieslaw Krolikowski[2], Ramon Vilaseca[1], Kestutis Staliunas[1], Yuri S. Kivshar[2]; [1]Univ. Politécnica de Catalunya, Spain, [2]Australian Natl. Univ., Australia, [3]Sofia Univ., Bulgaria.* We study theoretically and experimentally the second harmonic generation in nonlinear crystal with random distribution of ferroelectric domains. We show that the specific features of disordered domain structure greatly affect emission pattern of second harmonic.

FThI2 • 10:45 a.m.

Harnessing Self-Focusing: Direct Writing of Periodic Structures, *Andrew W. Norfolk, Edward J. Grace; Imperial College London, UK.* We investigate the exploitation of self-focusing for the composition of periodic integrated nanostructures using nonparaxial Bessel-Gauss beams. We elegantly relate the nonlinear period to experimentally controllable quantities using a numerical model for the first time.

FThI3 • 11:00 a.m.

Self-Trapping of Light Due to Balance between Saddle-Shaped Diffraction and Hybrid Nonlinearity, *Yi Hu[1], Cibo Lou[1], Peng Zhang[1,2,3], J. Zhao[2], J. Xu[1], J. Yang[4], Zhigang Chen[1,3]; [1]Nankai Univ., China, [2]Northwestern Polytechnical Univ., China, [3]San Francisco State Univ., USA, [4]Univ. of Vermont, USA*. Saddle-shaped diffraction and hybrid nonlinearity in a two-dimensional ionic-type photonic lattice leads to self-trapping of a new type of discrete spatial gap solitons, with phase and spectrum characteristics different from all previously observed gap solitons.

FThI4 • 11:15 a.m.

Interaction of Few-Cycle Optical Solitons in a Two-Component Medium, *Herve Leblond[1], Igor V. Mel'nikov[2,3], Dumitru Michalache[4]; [1]Univ. of Angers, France, [2]Optolink Ltd., Russian Federation, [3]High Q Labs, Inc., Canada, [4]Horia Hulubei Natl. Inst. for Physics and Nuclear Engineering, Romania.* The interaction of few-cycle optical pulses in a two-component nonlinear medium is studied within the framework of the modified Korteweg-de Vries - sine Gordon equation. The pulse envelopes, temporal and phase shifts are calculated explicitly.

For Fall Congress presentations on Thursday, see pages 132-136.

California — FiO

10:30 a.m.–12:00 p.m.
FThJ • High-Power Fiber Lasers II
Stuart J. McNaught; Northrop Grumman Space Technology, USA, Presider

FThJ1 • 10:30 a.m. Invited
Title to Be Announced, *Valentin Gapontsev; IPG Photonics Corp., USA.* Abstract not available.

FThJ2 • 11:00 a.m.
Power Scaling of Single-Frequency Hybrid Brillouin/Ytterbium Fiber Lasers, *Weihua Guan, John R. Marciante; Lab for Laser Energetics and Inst. of Optics, Univ. of Rochester, USA.* The proposed dual-clad fiber laser can generate 80 W of single-frequency output with a side-mode suppression ratio (SMSR) greater than 50 dB. Beyond this limit, multi-order stimulated Brillouin scattering affects the laser efficiency and SMSR.

FThJ3 • 11:15 a.m.
Far-Field Splitting in Broad Area Quantum Dot Lasers via Thermo-Optic Cavity Detuning, *Jayanta Mukherjee[1], Harendra N. J. Fernando[1], Brian Corbett[2], John G. McInerney[1]; [1]Optoelectronics Group, Dept. of Physics, Univ. College Cork, Ireland, [2]Photonics Sources Group, Tyndall Natl. Inst., Ireland.* We experimentally demonstrate the collapse of a single lobed far-field into multiple lobes via thermo-optic detuning of the cavity in broad area quantum dot laser under CW operation, in accordance with our recent Maxwell-Bloch analysis.

Glen Ellen — FiO

10:30 a.m.–12:00 p.m.
FThK • Optoelectronics
Fei Yi; Northwestern Univ., USA, Presider

FThK1 • 10:30 a.m.
Cavity Design of Monolithic Long-Wavelength InAs/InP Quantum Dash Passively Mode-Locked Lasers, *Chang-Yi Lin[1], Yongchun Xin[2], Yan Li[1], Furqan L. Chiragh[1], Luke F. Lester[1]; [1]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [2]IBM Systems and Technology Group, Semiconductor Solutions, USA.* A theory for the cavity design of quantum dash passively mode-locked lasers is reported based on a microwave photonics perspective. It is a valuable tool for realizing monolithic InAs/InP quantum dash passively mode-locked lasers.

FThK2 • 10:45 a.m.
Analysis of the Relative Intensity Noise Characteristics of the Strained AlGaInN LDs under High Frequency Modulation, *Hyung Uk Cho, Jong Chang Yi; Electronic Engineering Dept., Hongik Univ., Republic of Korea.* The RIN characteristics in AlGaInN LDs were investigated using the rate equations with the quantum Langevin noise model. The device parameters were extracted by using the self-consistent multiband Hamiltonian for the strained wurtzite crystal.

FThK3 • 11:00 a.m.
High-Spatial-Resolution Quantum Well Intermixing Technique for All-Optical Nano-Device Fabrications, *Chee Wei Lee[1], Yicheng Lai[1], Yingyan Huang[2], Boyang Liu[2], Seng-Tiong Ho[3]; [1]Data Storage Inst., Agency for Science, Technology and Res., Singapore, [2]OptoNet Inc., USA, [3]Dept. of Electrical Engineering and Computer Science, Northwestern Univ., USA.* We present technique of achieving high-spatial-resolution quantum well intermixing in InP/InGaAsP-based quantum well structures. It utilizes submicron-width deeply-etched trench as diffusion-stopper during the intermixing. Results indicate <0.4 μm spatial control with >100 nm bandgap blueshift.

FThK4 • 11:15 a.m.
UPML for Gain Medium in FDTD Simulation with Multi-Level Multi-Electron Model, *Qian Wang[1], Seng-Tiong Ho[2]; [1]Data Storage Inst., Singapore, [2]Northwestern Univ., USA.* Perfect matched layer with un-split field for gain medium in FDTD simulation incorporating multi-level multi-electron model is presented. Numerical validation indicates the boundary derived can absorb the wave effectively under different carrier densities (injection currents).

Atherton — LS

10:30 a.m.–12:00 p.m.
LSThD • Single-Molecule Biophysics IV
Joerg Bewersdorf; Jackson Lab, USA, Presider

LSThD1 • 10:30 a.m. Invited
Imaging Gene Transcription, *Christopher J. Fecko; Univ. of North Carolina at Chapel Hill, USA.* Multiphoton microscopy can resolve actively transcribed genes within live polytene cells of *Drosophila* larval salivary gland tissues. We are exploring the utility of multiphoton photoactivation to observe the three-dimensional movement of proteins involved in transcription.

LSThD2 • 11:00 a.m. Invited
Total Internal Reflection with Fluorescence Correlation Spectroscopy, *Nancy Thompson; Univ. of North Carolina at Chapel Hill, USA.* Recent advances in combining total internal reflection illumination with fluorescence correlation spectroscopy will be described. If time permits, combining total internal reflection illumination with continuous photobleaching will also be presented.

Sacramento — FiO

10:30 a.m.–11:45 a.m.
FThL • Polarization and Birefringence in Optical Design II
Scott McEldowney; Microsoft, USA, Presider

FThL1 • 10:30 a.m. Invited
Polarization Aberration Functions in Three Dimensions, *Russell Chipman; Univ. of Arizona, USA.* A generalization of the Jones calculus avoids difficulties in applying the Jones calculus to polarization ray tracing, eliminating a notorious minus sign, and clarifying the description of non-polarizing optical systems.

FThL2 • 11:00 a.m.
Polarimetry Using Stress-Engineered Optical Elements, *Amber M. Beckley, Thomas G. Brown; Univ. of Rochester, USA.* We describe a method of polarimetry using stress-engineered optical elements. By using the deterministic, space-variant nature of retardance due to stress birefringence, the Stokes parameters can be deduced from a single camera frame.

FThL3 • 11:15 a.m.
Nonparaxial Polarization Vortex Illumination Described Using a 2x2 Correlation Matrix, *Dean P. Brown, Thomas G. Brown; Inst. of Optics, Univ. of Rochester, USA.* Vector fields in three dimensions generally require a 3x3 correlation matrix to describe (second-order) statistics of the field. We describe a class of nonparaxial fields that can be described using a two-dimensional correlation matrix.

For Fall Congress presentations on Thursday, see pages 132-135.

LSThC • X-Ray Photon Correlation Spectroscopy—Continued

LSThC3 • 11:30 a.m. Invited

Using X-Ray Correlation Spectroscopy to Test Dynamical Scaling, *Mark Sutton; McGill Univ., Canada.* X-ray correlation spectroscopy is used to study non-equilibrium fluctuations in Cu3Au. In particular, measuring two-time correlation functions after a temperature quench gives a new test of dynamical scaling.

FThG • Nanofocusing Optics II—Continued

FThG3 • 11:30 a.m. Invited

10nm-Level Focusing of Hard X-Rays by KB Mirrors, *Kazuto Yamauchi; Osaka Univ., Japan.* 10nm-level line focusing of hard X-ray of the wavelength of 0.06nm was achieved by using an elliptically figured and multilayer coated mirror with an on-site wavefront correction system.

FThH • Aspheric and Freeform Optical Surfaces: Design, Characterization and Alignment I—Continued

FThH4 • 11:30 a.m.

Separating Astigmatic Mirror Figure Error from Alignment Induced Misalignment Aberrations Using Nodal Aberration Theory, *Tobias Schmid[1], Andrew Rakich[2], Jannick P. Rolland[1,3], Kevin P. Thompson[4]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Large Binocular Telescope Observatory, USA, [3]Inst. of Optics, Univ. of Rochester, USA, [4]Optical Res. Associates, USA.* Nodal aberration theory (NAT) has revealed that misalignment astigmatism displays a different signature field dependence than signature nodal positions caused by astigmatic mirror figure error. These differences will be derived and demonstrated for astronomical telescopes.

FThI • Novel Nonlinear Optical Phenomena—Continued

FThI5 • 11:30 a.m.

Soliton Interaction and Bound States in Dissipative Fiber Systems, *Sofia C. V. Latas, Mário F. Ferreira; Univ. of Aveiro, Portugal.* Pulse interaction and the formation of multisoliton bound states in dissipative fiber systems described by the complex Ginzburg-Landau equation are investigated. The impact of intrapulse Raman scattering in such processes is also discussed.

FThI6 • 11:45 a.m.

Photonic Crystals Acting on Instabilities and Squeezed States in OPOs, *M. Moreno, M. A. García March, D. Gomila, R. Zambrini; IFISC (UIB-CSIC), Campus Univ. Illes Balears, Spain.* Optical parametric oscillators (OPOs) are known to induce non-classical spatial correlations in the transverse profile of emitted light. We show how intracavity photonic crystals modify their stability as well as quantum fluctuations improving squeezed states.

12:00 p.m.–1:30 p.m. Lunch Break *(on your own)*

NOTES

For Fall Congress presentations on Thursday, see pages 132-136.

FiO

FThJ • High-Power Fiber Lasers II—Continued

FThJ4 • 11:30 a.m. Invited

High-Power Fiber Lasers and Amplifiers, *Andreas Tünnermann[1,2], Thomas Schreiber[1,2], Jens Limpert[1,2]; [1]Friedrich-Schiller Univ. Jena, Germany, [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We report on the current status of our developments in high power fiber laser and amplifiers for continuous wave and pulsed operation as well as their components, which is the basis for further performance scaling.

FThK • Optoelectronics—Continued

FThK5 • 11:30 a.m.

A Computationally Efficient Finite Difference Time Domain (FDTD) Model for Incorporating Quantum Well Gain in Optoelectronic Devices, *Koustuban Ravi[1], Yicheng Lai[1], Yingyan Huang[2], Seng-Tiong Ho[3]; [1]Data Storage Inst., Agency for Science, Technology and Res., Singapore, [2]Optonet Inc., USA, [3]Northwestern Univ., USA.* A new computationally efficient FDTD model for quantum wells is proposed using a multi-level, multi-electron system. Gain simulation results concur with standard theory. This scheme is useful for the simulation of devices with complex geometries.

FThK6 • 11:45 a.m.

Observation of Injection Locking in a Long-Cavity InAs/InP 1.56 µm Quantum Dash Laser, *Ehsan Sooudi[1,2], Herendra N. J. Fernando[1,2], John G. McInerney[1,2]; [1]Optoelectronics Group, Physics Dept., Natl. Univ. of Ireland, Univ. College Cork, Ireland, [2]Tyndall Natl. Inst., Univ. College Cork, Ireland.* We report CW injection locking of a Fabry-Perot InAs/InP quantum dash laser. Injection power (~0.1 mW) at 1.5 Ith is sufficient to obtain 30 dB SMSR of single mode locked output.

LS

LSThD • Single-Molecule Biophysics IV—Continued

LSThD3 • 11:30 a.m. Invited

DNA Repair Protein Dynamics through Single-Molecule Fluorescence, *Keith R. Weninger[1], Lauryn E. Sass[2], Vanessa C. DeRocco[2], Trevor Anderson[1], Dorothy A. Erie[2]; [1]North Carolina State Univ., USA, [2]Univ. of North Carolina at Chapel Hill, USA.* Crystal structures of mismatch repair proteins bound to mismatched DNA reveal kinked DNA. With single molecule FRET we observed dynamic switching among different bent states, which suggests the dynamics of bending may influence mismatch repair.

FiO

FThL • Polarization and Birefringence in Optical Design II—Continued

FThL4 • 11:30 a.m.

Stroboscopic Illumination Mueller Matrix Image Polarimetry, *Hsiu-Ming Tsai, Tsung-Han Tsai, Yu-Faye Chao; Dept. of Photonics, Natl. Chiao Tung Univ., Taiwan.* Utilizing stroboscopic illumination technique, we present a Mueller matrix imaging polarimetry with Photoelastic modulator. The figure of merit of this methodology will be discussed, and its results will be compared with others.

12:00 p.m.–1:30 p.m. Lunch Break *(on your own)*

NOTES

For Fall Congress presentations on Thursday, see pages 132-135.

LS

1:30 p.m.–2:45 p.m.
LSThE • X-Ray Imaging II
Veit Elser; Cornell Univ., USA, Presider

LSThE1 • 1:30 p.m. Invited

Ankylography: Three-Dimensional Structure Determination from a Single View, *Jianwei Miao; Univ. of California at Los Angeles, USA.* I will present a novel 3-D imaging modality, denoted ankylography, enabling complete 3-D structure determination from a single exposure using a monochromatic incident beam. We demonstrate ankylography with theoretical analysis, numerical simulations and experimental data.

LSThE2 • 2:00 p.m. Invited

Imaging of Domain Structures by Coherent X-Ray Diffraction, *Ian Robinson; Univ. College London, UK.* Following successful ab-initio imaging small objects by Coherent X-ray Diffraction using their three-dimensional diffraction patterns, comes the harder problem of domain structures. This talk summarises progress solving them using the new method of X-ray ptychography.

FiO

1:30 p.m.–3:30 p.m.
FThM • Nanoscale Methods and Instruments I
Gene Ice; Oak Ridge Natl. Lab, USA, Presider

FThM1 • 1:30 p.m. Invited

Intracellular Nanoscale Imaging with Fluorescence Photoactivation Localization Microscopy, *Samuel Hess; Univ. of Maine, USA.* Abstract not available.

FThM2 • 2:00 p.m. Invited

Nanoscale X-Ray Focusing with Reflective Optics, *Gene E. Ice[1], Jonathan Z. Tischler[1], Jae-Young Choi[2], Wenjun Liu[3], Ali Khounsary[3], Lahsen Assoufid[3], Deming Shu[3], Chian Liu[3]; [1]Oak Ridge Natl. Lab, USA, [2]Pohang Accelerator Lab, Republic of Korea, [3]Advanced Photon Source, Argonne Natl. Lab, USA.* Achromatic mirror optics offer important advantages for nanospectroscopy and nanodiffraction. We describe efforts to develop stable hard X-ray nanofocusing optics for practical studies of local crystal structure and elemental composition.

1:30 p.m.–3:30 p.m.
FThN • Aspheric and Freeform Optical Surfaces: Design, Characterization and Alignment II
Peter Blake; NASA Goddard Space Flight Ctr., USA, Presider

FThN1 • 1:30 p.m. Tutorial

Fabrication and Testing of Large Free-Form Surfaces, *James Burge; Univ. of Arizona, USA.* Modern computer-controlled grinding and polishing equipment, combined with advances in mechanical and optical metrology, now allow fabrication of large diameter free-form aspherical surfaces to optical precision.

Dr. Burge has led the development of metrology systems and implementation of computer controlled manufacturing methods for making large mirrors for astronomical telescopes. Dr. Burge also teaches optomechanics and optical engineering at the College of Optical Sciences, University of Arizona. Prior to joining the faculty at the College of Optical Sciences, he worked as project scientist at the Steward Observatory Mirror Lab. Dr. Burge is a member of OSA, ASME, and a fellow of SPIE. He received his B.S. from Ohio State University and his M.S. and Ph.D. from The University of Arizona.

FThN2 • 2:15 p.m. Invited

Application of Radial Basis Functions to the Design of a Freeform Single Element See-through Head-Worn Display, *Ozan Cakmakci[1], Jannick Rolland[2]; [1]Optical Res. Associates, USA, [2]Inst. of Optics, Univ. of Rochester, USA.* This paper presents the impact of a change of basis from polynomials to radial basis functions for describing free-form optical surfaces. A design example of a single free-form element see-through head-worn display is presented.

1:30 p.m.–3:30 p.m.
FThO • Micro-cavity Devices II
Tomoyuki Yoshie; Duke Univ., USA, Presider

FThO1 • 1:30 p.m.

Microscale Lasers Based on Patterned Electrospun Polymer Nanofibers, *Andrea Camposeo, Stefano Pagliara, Francesca Di Benedetto, Elisa Mele, Luana Persano, Roberto Cingolani, Dario Pisignano; Univ. del Salento, Italy.* In this work we demonstrate cavity effects in single light-emitting polymer nanofibers. The single nanofiber emit single mode laser light at visible wavelengths, with a linewidth of a few Å and Q-factor of about 1000.

FThO2 • 1:45 p.m.

Spherical Microcavity Stabilization of a Fiber Loop Laser, *Benjamin Sprenger, Harald G. L. Schwefel, L. J. Wang; Max-Planck-Inst. for the Science of Light, Germany.* We present a compact method of stabilizing an Erbium fiber loop laser using a whispering gallery mode microsphere as an etalon. Single-mode lasing is demonstrated and the laser is precisely tuned using temperature control.

FThO3 • 2:00 p.m. Invited

Simultaneous Oscillation of Wavelength-Tunable Singlemode Lasers Using Er:ZBLALiP Whispering Gallery Mode Resonator, *Patrice Féron[1], Lei Xiao[1,2], Stéphane Trébaol[1], Yannick Dumeige[1], Yann G. Boucher[1], ZhiPing Cai[2], Michel Mortier[3]; [1]Univ. de Rennes 1, France, [2]Xiamen Univ., China, [3]Lab de Chimie Appliquée de l'Etat Solide-LCAES, CNRS-UMR, France.* The coupling by two half tapers on the same micro-spherical resonator in Er:ZBLALiP allows two independent single mode laser emissions to be obtained simultaneously. We study the emission characteristics and the resulting beat note signal.

For Fall Congress presentations on Thursday, see pages 132-136.

FiO

1:30 p.m.–3:30 p.m.
FThP • Optics in Interventional Medicine
Presider to Be Announced

FThP1 • 1:30 p.m. Invited

Photodynamic Therapy: A Bridge between Technology and Medicine, *Tayyaba Hasan; Massachusetts General Hospital, Harvard Medical School, USA.* Photodynamic therapy (PDT) is an interventional treatment modality for the destruction of cancerous and non-neoplastic pathologies. An overview of PDT and its impact on therapy and diagnostics will be presented.

FThP2 • 2:00 p.m.

Tissue-Specific Laser Surgery: Hard Tissue Differentiation by Diffuse Reflectance Spectroscopy *ex vivo*, *Azhar Zam[1], Florian Stelzle[2], Emeka Nkenke[2], Katja Tangermann-Gerk[3], Michael Schmidt[3], Werner Adler[4], Alexandre Douplik[1]; [1]Erlangen Graduate School in Advanced Optical Technologies, Friedrich-Alexander Univ. of Erlangen-Nuremberg, Germany, [2]Dept. of Oral and Maxillofacial Surgery, Friedrich-Alexander Univ. of Erlangen-Nuremberg, Germany, [3]Bavarian Laser Ctr., Germany, [4]Dept. of Medical Informatics, Biometry and Epidemiology, Friedrich-Alexander Univ. of Erlangen-Nuremberg, Germany.* Diffuse reflectance spectroscopy provides a straightforward and simple approach for optical tissue differentiation. The results obtained show a potential for differentiating hard tissues as guidance for tissue-specific laser surgery.

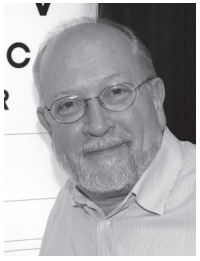
FThP3 • 2:15 p.m.

Design and Prototype Fabrication of a Neonatal Video Laryngoscope, *Katherine A. Baker, Wade Rich, Neil Finer, Joseph E. Ford; Univ. of California at San Diego, USA.* We describe a prototype miniaturized video laryngoscope for extremely low birth weight infants, where a curved acrylic blade acts as a tongue depressor, light guide for an LED illuminator, and holds a 1.8mm CCD imager.

1:30 p.m.–3:30 p.m.
FThQ • Molecular Imaging in the Eye
Austin Roorda; Univ. of California at Berkeley, USA, Presider

FThQ1 • 1:30 p.m. Tutorial

Molecular Imaging in the Eye, *Frederick Fitzke; Univ. College London, UK.* Optical imaging of the eye has considerable advantages for molecular imaging compared to non-optical techniques of molecular imaging for autofluorescence, Green Fluorescence Protein and Annexin V apoptosis confocal imaging in the living eye.



Fred Fitzke is Professor of Visual Optics and Psychophysics in the Department of Visual Neuroscience of University College London Institute of Ophthalmology (UCL IoO). He holds a B.A. in Natural Sciences from The Johns Hopkins University and a Ph.D. in Biophysics from the University of London. He is Director of the Foundation Fighting Blindness Research Center for the Study of Retinal Degenerative Diseases at the UCL IoO and Moorfields Eye Hospital and founding Investigator for the National Institute for Health Research Biomedical Research Centre for Ophthalmology. He has been a member of OSA beginning in the 1970s and has been at UCL IoO since 1982 where he heads the Laboratory of Physiological Optics. His research covers two broad areas: the development of novel techniques for imaging the eye and investigations of visual function using psychophysical methods.

FThQ2 • 2:15 p.m.

Fundus Autofluorescence at 594 nm and Comparison with Near Infrared Reflectance and Fluorescence Imaging, *Ann E. Elsner, Stephen A. Burns, Dean A. VanNasdale, Bryan P. Haggerty, Benno L. Peetrig, Matthew S. Muller; Indiana Univ., USA.* A scanning laser autofluorescent technique at 594 nm reveals features at retinal locations seen with near infrared reflectance and polarization imaging techniques. The autofluorescence from melanin is too weak to account for 594 nm autofluorescence.

LS

1:30 p.m.–3:00 p.m.
LSThF • Single-Molecule Biophysics V
Keith Berland; Emory Univ., USA, Presider

LSThF1 • 1:30 p.m. Invited

Non-Scanning Two-Photon Microscopy for Imaging in Live Cells, *Christine Payne; Georgia Tech, USA.* Live cell imaging with two-photon microscopy is limited by the scanning necessary to construct an image. We describe the application of two-photon excitation used in a total internal reflection configuration that does not require scanning.

LSThF2 • 2:00 p.m. Invited

Tracking Single Quantum Dots in Three Dimensions: Following Cell Receptor Traffic and Membrane Topology, *Nathan P. Wells[1], Diane S. Lidke[2], M. Lisa Phipps[1], Peter M. Goodwin[1], Bridget S. Wilson[2], James Werner[1]; [1]Los Alamos Natl. Lab, USA, [2]Univ. of New Mexico, USA.* We have designed a fluorescence microscope that uses a unique spatial filter geometry and active feedback to follow the three dimensional motion of individual quantum dots at biologically relevant transport rates (microns/second).

FiO

1:30 p.m.–3:30 p.m.
FThR • Computational Imaging and Photography I
Anat Levin; MIT, USA, Presider

FThR1 • 1:30 p.m. Invited

Emerging Integrated Computational Imaging Systems, *Nicholas George, Wanli Chi; Univ. of Rochester, USA.* We illustrate the achievements of ICIS in extended depth of field as well as in an emerging new correlation-based camera system.

FThR2 • 2:00 p.m. Invited

Multi-Channel Incoherent Digital Holography, *Joseph Rosen, Barak Katz; Ben Gurion Univ. of the Negev, Israel.* We present a new holographic system operating in a synthetic aperture mode. Spatial resolution exceeding the Rayleigh limit is obtained by digital tiling several Fresnel elements into a complete hologram of the observed object.

For Fall Congress presentations on Thursday, see pages 132-135.

LSThE • X-Ray Imaging II—Continued

LSThE3 • 2:30 p.m.
Holographic Image Reconstruction Using a Reference of a Pair of Crossed Wires, *Manuel Guizar-Sicairos[1], Diling Zhu[2,3], James R. Fienup[1], Benny Wu[2,3], Andreas Scherz[3], Joachim Stöhr[3]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Stanford Univ., USA, [3]SSRL, Stanford Synchrotron Radiation Lightsource, USA.* We introduce a novel closed-form image reconstruction technique for x-ray coherent diffractive imaging. The overlap region of a pair of crossed wires serves as an off-axis holographic reference structure and allows a direct, non-iterative reconstruction.

FThM • Nanoscale Methods and Instruments I—Continued

FThM3 • 2:30 p.m. Invited
Fabrication of Freeform Mirrors: Metrology and Figuring, *Helge Thiess, H. Lasser; Carl Zeiss Laser Optics GmbH, Germany.* Application of mirror manufacturing and its appropriate metrology at Carl Zeiss Laser Optics shall be illustrated by recent examples. Specifications and achieved results of finalized mirrors with different geometries and sets of specifications are discussed.

FThM4 • 3:00 p.m. Invited
The Hard X-Ray Nanoprobe Beamline at Argonne National Laboratory, *Jörg Maser, Martin V. Holt, Robert P. Winarski, Volker Rose, Gregory Brian Stephenson, Peter Fuesz; Argonne Natl. Lab, USA.* The hard X-ray nanoprobe at the Advanced Photon Source provides characterizing of composition and structure of nanoscale materials and devices with high spatial-resolution using X-ray fluorescence, diffraction and Bragg coherent diffraction, and full-field transmission imaging.

FThN • Aspheric and Freeform Optical Surfaces: Design, Characterization and Alignment II—Continued

FThN3 • 2:45 p.m.
Deterministic Approach for Aspheric Fabrication: SPDT Processing Parameters vs. Surface Quality, *Rama Gopal V. Sarepaka, Vinod Mishra, Dole Ram, Amandeep Singh, Amrinder Kumar, Ganga Sharan Singh, Pawan Kapur; Central Scientific Instruments Organisation, India.* A systematic compensation procedure to minimize aspheric surface waviness during Single Point Diamond Turning (SPDT) is discussed. This method combines SPDT processing parametric space exploration and tool path compensation deployed in deep and shallow profiles.

FThN4 • 3:00 p.m.
A Virtual-Interferometer Technique for Surface Metrology, *Scott M. Jobling[1], Paul G. Kwiat[2]; [1]Dept. of Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA, [2]Dept. of Physics, Univ. of Illinois at Urbana-Champaign, USA.* We have demonstrated a novel technique for performing surface metrology within wavefront-feedback systems. By using wavefront sensing to measure surface gradients via displacements of an optic, we have reconstructed several surfaces with 40-nm RMS error.

FThN5 • 3:15 p.m.
Tailored Freeform Reflectors for Extended Non-Lambertian Sources, *Florian R. Fournier[1], Jannick P. Rolland[1,2], William J. Cassarly[3]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Inst. of Optics, Univ. of Rochester, USA, [3]Optical Res. Associates, USA.* We propose a design method for tailored freeform reflectors. This method uses a shape generation algorithm that is embedded into an iterative algorithm in order to account for the source extent and emission pattern.

FThO • Micro-cavity Devices II—Continued

FThO4 • 2:30 p.m.
Radial-Waveguide-Coupled Micro-Resonator Lasers with Unidirectional Output, *Fang Ou[1], Xiangyu Li[1], Boyang Liu[1], Yingyan Huang[2], Eng-Huat Khoo[3], Er-Ping Li[3], Iftikhar Ahmed[3], Qian Wang[4], Seng-Tiong Ho[1]; [1]Northwestern Univ., USA, [2]OptoNet Inc., USA, [3]Inst. of High Performance Computing, Singapore, [4]Data Storage Inst., Singapore.* We demonstrate single-directional output coupling of light from micro-resonator laser using a radially placed waveguide based on a new enhanced-radiation-loss output coupling mechanism. The 20μm-diameter electrically pumped laser has 11.5mA lasing threshold with >0.2mW output.

FThO5 • 2:45 p.m.
Hybrid Diode-Microresonator Laser, *Tianhe Yang[1], Matthew Tomes[1], Carl C. Aleksoff[2], Tal Carmon[1]; [1]Univ. of Michigan, USA, [2]Coherix Corp., USA.* We present a new technology allowing on-chip integration of a micro-resonator and its energy source for fundamental studies and commercial applications. As a proof-of-concept we demonstrate four-wave mixing and Raman lines.

FThO6 • 3:00 p.m.
Dynamics of Face-to-Face Coupled Lasers: Effects of a Small Gap, *Hartmut Erzgräber[1], Sebastian Wieczorek[1], Bernd Krauskopf[2]; [1]Univ. of Exeter, UK, [2]Univ. of Bristol, UK.* Locking characteristics of two face-to-face coupled lasers change drastically when they are separated by a gap with size on the order of the wavelength. The results are explained with the gap-induced modifications in composite-mode coupling.

FThO7 • 3:15 p.m.
InGaAsP/InP QW Microdisk Laser Fabricated by Focused Ion Beam, *Luis A. M. Barea, Felipe Vallini, David S. L. Figueira, Newton C. Frateschi; Univ. Estadual de Campinas (UNICAMP), Brazil.* InGaAsP/InP quantum wells microdisk lasers were fabricated for the evaluation of Ga^+ focused ion beam milling of mirrors. Electrical and optical proprieties were investigated and the effects of the milling in the sidewalls were investigated.

3:30 p.m.–4:00 p.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

For Fall Congress presentations on Thursday, see pages 132-136.

FThP • Optics in Interventional Medicine—Continued

FThP4 • 2:30 p.m. Invited
User-Friendly, Open-Source Computational Tools for Biophotonics, *Vasan Venugopalan; Univ. of California at Irvine, USA.* This talk will introduce the Virtual Photonics Technology Initiative which aims to develop and disseminate open-source computational tools for the simulation of biophotonic processes in cells and tissues via a user-friendly, graphical user interface.

FThP5 • 3:00 p.m.
FCS Measurement of Von Willebrand Factor Multimer Distributions for Coagulation Disorder Subtyping, *Richard Torres, Michael J. Levene; Yale Univ., USA.* We present measurement of von Willebrand Factor (vWF) multimer distributions using FCS as an early example of its applicability to clinical laboratory diagnostics.

FThP6 • 3:15 p.m.
Measurement of 1210nm Laser Induced Thermo-Elastic Expansion in Tissue Phantoms with Nanoparticles Using Swept Source Phase-Sensitive OCT, *Oscar D. Ayala, Amit S. Paranjape, Tianyi Wang, Li L. Ma, Keith P. Johnston, Roman Kuranov, Thomas E. Milner; Univ. of Texas at Austin, USA.* We demonstrate experimental results for measurement of thermo-elastic expansion of laser excited tissue phantoms containing near-infrared absorbing nanoparticles we call nanorose. Our technique uses excitation at 1210nm and PhS-OCT at 1328nm.

FThQ • Molecular Imaging in the Eye—Continued

FThQ3 • 2:30 p.m. Invited
***In vivo* Cellular Imaging of the Rodent Retina**, *Jason Porter; Univ. of Houston, USA.* Developing *in vivo* imaging techniques in rodent models will enhance our understanding of disease mechanisms and treatments. We review a fluorescence adaptive optics scanning laser ophthalmoscope that can resolve sub-cellular features in living rat retinae.

FThQ4 • 3:00 p.m. Invited
Molecular Imaging with OCT, *Joseph Izatt; Dept. of Biomedical Engineering, Duke Univ., USA.* Abstract not available.

LSThF • Single-Molecule Biophysics V—Continued

LSThF3 • 2:30 p.m. Invited
Dissecting the Molecular Mechanism of Kinesin with Single Molecule Imaging, *Ahmet Yildiz; Univ. of California at Berkeley, USA.* Single molecule assays on kinesin bipedal-motor showed that it moves by alternating movement of its two motor-domains. Such coordination is mediated by intramolecular tension generated by the neck-linkers, mechanical elements that span between the motor-domains.

FThR • Computational Imaging and Photography I—Continued

FThR3 • 2:30 p.m.
Phase from Defocused Color Images, *Laura Waller[1], George Barbastathis[1,2]; [1]MIT, USA, [2]Singapore-MIT Alliance for Res. and Technology (SMART) Ctr., Singapore.* We introduce a method for recovering-phase information inspired by transport of intensity (TIE). Instead of images at multiple planes, we use defocused images at a single plane with multiple wavelengths, obtained using standard Bayer filters.

FThR4 • 2:45 p.m.
Enhanced Background Rejection in In-Phase Focal Modulation Microscopy, *Ke Si[1], Wei Gong[2], Nanguang Chen[2], Colin J. R. Sheppard[1,2,3]; [1]NUS Graduate School for Integrative Sciences and Engineering (NGS), Natl. Univ. of Singapore, Singapore, [2]Div. of Bioengineering, Natl. Univ. of Singapore, Singapore, [3]Dept. of Biological Sciences, Natl. Univ. of Singapore, Singapore.* We present the in-phase focal modulation microscopy (IPFMM). Compared with the conventional confocal microscopy, IPFMM can more effectively reject background signal, thus can achieve greater imaging penetration depth.

FThR5 • 3:00 p.m.
Incoherently Combining Logarithmic Aspheres for Extended Depth of Field, *Kaiqin Chu, Nicholas George, Wanli Chi; Inst. of Optics, Univ. of Rochester, USA.* Images from concentric logarithmic lenses are combined incoherently to extend the depth of field as much as 14 times the Rayleigh limit for a conventional lens. Diffraction limited resolution is also obtained after digital processing.

FThR6 • 3:15 p.m.
2-D Nonlinear Image Up-Conversion and Filtering Using Enhanced Sum Frequency Generation, *Christian Pedersen[1], Emir Karamehmedović[1], Jeppe D. Seidelin[1], Preben Buchhave[2], Peter L. Tidemand-Lichtenberg[2]; [1]DTU Fotonik, Technical Univ. of Denmark, Denmark, [2]DTU Physics, Technical Univ. of Denmark, Denmark.* Based on continous-wave enhanced up-conversion we demonstrate a novel and highly efficient method for converting a full image from one part of the electromagnetic spectrum into a new desired wavelength region.

3:30 p.m.–4:00 p.m. Coffee Break, *Regency and Imperial Ballroom Foyer, Fairmont Hotel*

For Fall Congress presentations on Thursday, see pages 132-135.

FiO

4:00 p.m.–5:45 p.m.
FThS • Optical Nonlinear Properties of Materials
Muzammil A. Arain; Dept. of Physics, Univ. of Florida, USA, Presider

FThS1 • 4:00 p.m.
Third-Order Nonlinearity of Nickel Nanocolloids, *Tâmara R. Oliveira[1], Gemima Barros[1], André Galembeck[1], Luis A. Gómez[2], Cid B. de Araújo[1]; [1]Univ. Federal de Pernambuco, Brazil, [2]Univ. de Pernambuco, Brazil.* Colloids containing nickel nanoparticles were synthesized and the behavior of their nonlinear refractive index and nonlinear absorption coefficient was explained with basis on a quantum model, correlating their values with the nanoparticles' sizes.

FThS2 • 4:15 p.m.
Four-Wave Mixing in a Stored Light Regime, *Nathaniel B. Phillips[1], Irina Novikova[1], Alexey V. Gorshkov[2]; [1]College of William & Mary, USA, [2]Harvard Univ., USA.* We experimentally and theoretically analyze the propagation of weak optical signal pulses under the conditions of electromagnetically induced transparency in hot Rb vapor, and study the effects of resonant four-wave mixing on light storage.

FThS3 • 4:30 p.m.
Resonant Nonlinear Optical Transmission in Pure Water at 1445 nm, *David Lukofsky[1], Ulf Österberg[1], Marc Currie[2]; [1]Dartmouth College, USA, [2]NRL, USA.* We present the results of an experiment investigating the transmission of intense femtosecond pulses on the 1445 nm resonance of water. Up to 500% increase in relative transmission was observed for 5 mm path lengths.

FThS4 • 4:45 p.m.
Dielectric Analysis on Optical Properties of Silver Nano Particles in ZrO_2 Thin Film Prepared by Sol-Gel Method, *Eisuke Yokoyama, Hironobu Sakata, Moriaki Wakaki; Tokai Univ., Japan.* ZrO_2 thin films containing silver nanoparticles in wide molar ratio were prepared using the sol-gel methods. The films were analyzed by XRD and TEM. Optical absorption spectra were analyzed using Maxwell-Garnett and Bruggeman theory.

4:00 p.m.–5:15 p.m.
FThT • Nanoscale Methods and Instruments II
David Attwood; Lawrence Berkeley Natl. Lab, USA, Presider

FThT1 • 4:00 p.m. Invited
Multi-Modal Scanning X-Ray Microscopy, *Andreas Menzel[1], Pierre Thibault[1], Martin Dierolf[2], Cameron M. Kewish[1], Franz Pfeiffer[2], Oliver Bunk[1]; [1]Paul Scherrer Inst., Switzerland, [2]École Polytechnique Fédérale de Lausanne, Switzerland.* Scanning X-ray microscopy offers a wide variety of contrast modes. The combination with coherent diffractive imaging allows image resolution to be increased beyond the size of the X-ray probe.

FThT2 • 4:30 p.m.
At-Wavelength and Optical Metrology of Bendable X-Ray Optics for Nanofocusing at the ALS, *Sheng Yuan, Kenneth Goldberg, Valeriy V. Yashchuk, Richard Celestre, Tony Warwick, Wayne R. McKinney, Gregory Morrison, Senajith B. Rekawa, Iacopo Mochi, Howard A. Padmore; Lawrence Berkeley Natl. Lab, USA.* We describe a new R&D program at the Advanced Light Source, LBNL, directed to establish both at-wavelength and conventional optical-metrology techniques suitable to characterize the surface profile of super-high-quality X-ray optics with sub-microradian precision.

FThT3 • 4:45 p.m. Invited
Future Developments for Hard X-Ray Zone Plates, *Wenbing Yun; XRADIA Inc., USA.* Abstract not available.

NOTES

FiO

4:00 p.m.–6:00 p.m.
FThU • Micro-Cavity Devices III
Mani Hossein-Zadeh; Univ. of New Mexico, USA, Presider

FThU1 • 4:00 p.m.
On-Chip Microcavities Coupled to Diamond NV Centers, *Paul E. Barclay, Kai-Mei C. Fu, Charles Santori, Raymond G. Beausoleil; Hewlett-Packard Labs, USA.* High-*Q* gallium phosphide (GaP) whispering gallery mode microcavities optically coupled to nitrogen vacancy centers in a single crystal diamond substrate are demonstrated experimentally with $Q > 20000$.

FThU2 • 4:15 p.m.
On-Chip Woodpile Photonic Crystal for Light Localization and 3-D Integrated Optics, *Lingling Tang, Tomoyuki Yoshie; Duke Univ., USA.* Simple fabrication method, which consists of two lithography and two etching processes, is utilized to construct woodpile photonic crystals in GaAs wafers. The developed resonator and waveguide designs enable 3-D optical integration in semiconductor wafer.

FThU3 • 4:30 p.m. Invited
Quantum Computing with Rydberg Atoms in Cavities, *M. Everitt, J. Dunningham, B. T. H. Varcoe; Univ. of Leeds, UK.* Microwave cavity QED has a long history of fundamental measurements, in this talk new directions of Rydberg interactions, ranging from quantum information to quantum gravity, will be presented.

For Fall Congress presentations on Thursday, see pages 132-136.

NOTES

FiO

4:00 p.m.–6:00 p.m.
FThV • Microscopy and OCT II
Vasan Venugopalan; Univ. of California at Irvine, USA, Presider

FThV1 • 4:00 p.m. Invited
Advances in High-Speed Imaging by Objective-Coupled Planar Illumination Microscopy, *Timothy Holy, Diwakar Turaga; Washington Univ. in St. Louis, USA.* For measuring neuronal activity, planar illumination microscopy possesses advantages of speed and low phototoxicity. I will describe optical strategies to improve resolution as well as applications measuring neuronal function.

FThV2 • 4:30 p.m.
Early Mammalian Embryonic Imaging at Different Developmental Stages with Optical Coherence Tomography, *Kirill Larin[1], Irina V. Larina[2], Mary E. Dickinson[2]; [1]Univ. of Houston, USA, [2]Baylor College of Medicine, USA.* Live imaging of mammalian embryos is important for many biomedical applications including early assessment of cardiovascular abnormalities. Here we demonstrate capability of OCT for high-resolution structural imaging of live mouse embryos at different developmental stages.

FThV3 • 4:45 p.m.
Complete Two-Dimensional Muellermetric Imaging of Biological Tissue Using Heterodyned Optical Coherence Tomography, *Selim M. Shahriar, Xue Liu, Shih Tseng; Northwestern Univ., USA.* A polarization-sensitive, heterodyned optical coherence tomography system is used to measure partially-polarized reflections from a porcine tendon sample. The complete 4×4 Mueller-metric images of a layer within the sample is produced using such a system.

4:00 p.m.–5:45 p.m.
FThW • Plasmonic Waveguides and Devices
Arash Mafi; Univ. of Wisconsin-Milwaukee, USA, Presider

FThW1 • 4:00 p.m.
IPP Waveguides: Experimental Results and Integrated Devices, *Michelle Y.-C. Xu, J. Stewart Aitchison; Univ. of Toronto, Canada.* We demonstrate a waveguide structure to confine interface plasmon polaritons. We characterized the loss, dispersion of the waveguides, as well as demonstrated functional y-junction power splitters.

FThW2 • 4:15 p.m.
Phase-Locked Second Harmonic Generation in Sub-Wavelength Channels, *Domenico de Ceglia, Maria Antonietta Vincenti, Vito Roppo, Neset Akozbek, Mark J. Bloemer, Michael Scalora; Charles M. Bowden Res. Ctr. AMSRD-AMR-WS-ST, RDECOM, USA.* The phase-locked second harmonic generation process has been investigated for extremely thin, sub-wavelength channels. The possibility to circumvent resolution exploiting the trapping and dragging mechanisms between the fundamental and the phase-locked SH pulse is discussed.

FThW3 • 4:30 p.m.
Dispersion and Polarization Dependence on the Geometry of Non-Ideal Stripe Plasmonic Waveguides, *Michelle Y.-C. Xu, J. Stewart Aitchison; Univ. of Toronto, Canada.* We simulate the effective indices and the polarizations of the guided surface plasmon modes as a function of the silver stripe waveguide shapes, at both 1550 nm and 633 nm wavelengths.

FThW4 • 4:45 p.m.
Mach-Zehnder Interferometer Based on a Metal-Insulator-Silicon Waveguide Mode and a Surface Plasmon Polariton, *Min-Suk Kwon; Dept. of Optical Engineering, Sejong Univ., Republic of Korea.* An integrated-optical Mach-Zehnder interferometer, which is shorter than 5 μm and has extinction larger than 60 dB, is proposed and investigated theoretically. It is based on a metal-insulator-silicon waveguide mode and a surface plasmon polariton.

4:00 p.m.–6:00 p.m.
FThX • Computational Imaging and Photography II
Joseph Rosen; Ben Gurion Univ., Israel, Presider

FThX1 • 4:00 p.m. Invited
4-D Frequency Analysis of Computational Cameras for Depth of Field Extension, *Anat Levin; Weizmann Inst. of Science, Israel.* We study extended depth of field systems in the 4-D lightfield space and derive bounds on the maximal frequency content they can preserve. We propose a new lens extending the DOF of all known designs.

FThX2 • 4:30 p.m. Invited
Optimization and Application of Hybrid Optical-Digital Imaging Systems, *Andrew Harvey, Mads Demenikov, Gonzalo D. Muyo, Tom Vettenburg; Heriot-Watt Univ., UK.* Whereas previous reported wavefront coding research has emphasised constancy of the PSF, we show that optimal image quality normally occurs for systems in which the PSF varies significantly; placing increased demands on image restoration algorithms.

For Fall Congress presentations on Thursday, see pages 132-135.

FiO

FThS • Optical Nonlinear Properties of Materials—Continued

FThS5 • 5:00 p.m.
Size Dependence of Two-Photon Absorption in Lead Salt Quantum Dots, *Gero Nootz[1,2], Lazaro A. Padilha[1], Scott Webster[1], David J. Hagan[1,2], Eric W. Van Stryland[1,2], Larissa Levina[3], Vladimir Sukhovatkin[3], Edward H. Sargent[3]; [1]CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Physics Dept., Univ. of Central Florida, USA, [3]Edward S. Rogers Sr. Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada.* Two-photon absorption (2PA) is measured for different sizes of lead-salt quantum dots, a slight increasing of the 2PA for smaller quantum-dots is observed and the results is discussed based on a four-band envelop function formalism.

FThS6 • 5:15 p.m.
The Creation of Metallic and Silicon Nanoclusters at the Surface of Silicates by Action of CO_2 Laser Radiation, *Anel F. Mukhamedgalieva, Anatolii M. Bondar', Igor M. Swedov; Moscow States Mining Univ., Russian Federation.* The continuous and pulsed CO_2 laser irradiation (10^5-10^7 W/cm^2) of silicates (quartz-SiO_2, nepheline - $Na[AlSiO_4]$, rodonite - $CaMn_4[Si_5O_{15}]$, zircon - $ZrSiO_4$ etc.) lead to the creation of metallic and silicon nanoclusters at the surface.

FThS7 • 5:30 p.m.
Modifications in the Optical Properties of Thin Film Oxides with Annealing, *Peter Langston[1], Dinesh Pate[1], A. Markosyan[2], Erik Krous[1], D. Nguyen[2], L. Emmert[2], W. Rudolph[2], R. Route[3], M. Fejer[3], M. Shinn[4], Carmen Menoni[1]; [1]Colorado State Univ., USA, [2]Univ. of New Mexico, USA, [3]Stanford Univ., USA, [4]Thomas Jefferson Natl. Accelerator Facility, USA.* Post-annealing of HfO_2 and SiO_2 thin films affects the absorption loss at 1 μm, and the subpicosecond laser breakdown. These effects are explained by modifications in the density of intrinsic defects and photo-induced defects respectively.

FThT • Nanoscale Methods and Instruments II—Continued

Thank you for attending FiO/LS/Fall Congress. Look for your post-conference survey via email and let us know your thoughts on the program.

NOTES

FiO

FThU • Micro-Cavity Devices III—Continued

FThU4 • 5:00 p.m.
Active Optical Isolator Using Adiabatic Wavelength Conversion in Microcavities, *Ali W. Elshaari, Stefan F. Preble; Rochester Inst. of Technology, USA.* We present an integrated optical isolator based on adiabatic wavelength conversion in microcavities. The isolator uses a time-division sampling method to ensure complete isolation of optical pulses with an extinction of 24 dB.

FThU5 • 5:15 p.m.
High-Q Resonance in Subwavelength High Contrast Gratings, *Vadim Karagodsky, Connie Chang-Hasnain; Univ. of California at Berkeley, USA.* A simple analytic formalism is presented to explain the resonance phenomenon in subwavelength high contrast gratings. This unique resonance does not require distributed reflections, and it relies on neither gain medium nor highly reflective mirrors.

FThU6 • 5:30 p.m.
Direct Measurement of High Q-Factors in Individual Salt-Water Microdroplets by Photothermal Tuning Spectroscopy, *Mustafa Gündogan, Michael Mestre, Saime C. Yorulmaz, Alper Kiraz; Koç Univ., Turkey.* We present measurements of high quality (Q) factors in liquid microdroplets standing on a superhydrophobic surface using the new photothermal tuning spectroscopy technique. Q-factors up to ~10^5 are observed from degenerate whispering gallery modes.

FThU7 • 5:45 p.m.
Reversible Photothermal Tuning of Single Salt-Water Microdroplets on a Superhydrophobic Surface, *Yasin Karadag, Saime Cigdem Yorulmaz, Michael Mestre, Metin Muradoglu, Alper Kiraz; Koç Univ., Turkey.* We demonstrate large (up to 15 nm) and reversible spectral tuning of the whispering gallery modes of single NaCl-water microdroplets standing on a superhydrophobic surface by local heating with an infrared laser.

5:30 p.m.–8:00 p.m. Science Educators' Day, *McCaw Hall, Frances C. Arrillaga Alumni Center, Stanford Univ., 326 Galvez Street, Stanford, California 94305, Phone: 650.723.2021*

For Fall Congress presentations on Thursday, see pages 132-136.

NOTES

FThV • Microscopy and OCT II—Continued

FThV4 • 5:00 p.m.
Cornea Microstructural and Mechanical Response Measured Using Optical Coherence and Nonlinear Optical Microscopy with Sub-10-fs Pulses, *Qiaofeng Wu, Brian E. Applegate, Alvin T. Yeh; Texas A&M Univ., USA.* Co-registered nonlinear optical microscopy (NLOM) and Fourier domain optical coherence microscopy (OCM) are integrated using sub-10-fs laser pulses. This NLOM-OCM setup is used to characterize cornea microstructure and mechanical response as a function of depth.

FThV5 • 5:15 p.m.
Trimodal Optical Microscopy, *Chandra S. Yelleswarapu, Alexey Veraksa, Devulapalli V. G. L. N. Rao; Univ. of Massachusetts Boston, USA.* We present a microscope that uses single source and single detector, and capable of imaging multiple features like brightfield+fluorescence, phase+fluorescence, and edge enhanced+fluorescence of the biological specimen without the need of image registration and fusion.

FThV6 • 5:30 p.m. Invited
Title to Be Announced, *Max Diem; Northeastern Univ., USA.* Abstract not available.

FThW • Plasmonic Waveguides and Devices—Continued

FThW5 • 5:00 p.m.
All-Optical Absorption Switches in Subwavelength Metal-Dielectric-Metal Plasmonic Waveguides, *Changjun Min, Georgios Veronis; Louisiana State Univ., USA.* We introduce extremely compact all-optical absorption switches for subwavelength metal-dielectric-metal plasmonic waveguides. The switches consist of a cavity either directly-coupled or side-coupled to the waveguide, and filled with an active material with tunable absorption coefficient.

FThW6 • 5:15 p.m.
Coupling Characteristics of Directional Couplers Utilizing Long Range Surface Plasmon Polaritons, *Triranjita Srivastava, Arun Kumar; Indian Inst. of Technology, Delhi, India.* We examine the coupling characteristics of lateral and vertical directional couplers utilizing long range surface plasmon polaritons. In both the cases optimum thickness of the metal stripes is found to exhibit minimum coupling lengths.

FThW7 • 5:30 p.m.
Design of Novel Plasmonic Waveguide, *Michelle Y.-C. Xu, J. Stewart Aitchison; Univ. of Toronto, Canada.* We present effective index method analysis and experimental demonstrations of a novel interface plasmon polariton waveguide structure.

FThX • Computational Imaging and Photography II—Continued

FThX3 • 5:00 p.m.
Ghost Imaging via Compressed Sensing, *Ori Katz, Yaron Bromberg, Yaron Silberberg; Weizmann Inst. of Science, Israel.* We describe an advanced image reconstruction algorithm for pseudothermal ghost imaging, based on compressed sensing. Utilizing this algorithm, we experimentally demonstrate a 10-fold reduction in the required acquisition times for faithful image reconstruction.

FThX4 • 5:15 p.m.
Digital Reconstruction of Optically Induced Potentials, *Christopher Barsi, Jason W. Fleischer; Princeton Univ., USA.* The holographic reconstruction of objects in nonlinear media is experimentally verified. We demonstrate a simple approach for axially thick, optically induced potentials in a photorefractive crystal and compare results with a scattering experiment.

FThX5 • 5:30 p.m.
Efficient Propagation of Highly Aspheric Wavefronts for Computational Imaging, *James R. Fienup; Inst. of Optics, Univ. of Rochester, USA.* Efficient computation of the propagation of wavefronts needed to analyze some computational imaging systems is accomplished by a divide-and-conquer approach.

FThX6 • 5:45 p.m.
Modulation of Polarization and Phase of Beams in a Tight Focusing System, *Jixiong Pu, Baosuan Chen, Ziyang Chen; Huaqiao Univ., China.* In the tightly focusing system, the modulation of polarization and phase of beams have been used to generate desired sub-wavelength focused spots, such as sub-wavelength bottle beams, and top-hat beams etc.

5:30 p.m.–8:00 p.m. Science Educators' Day, *McCaw Hall, Frances C. Arrillaga Alumni Center, Stanford Univ., 326 Galvez Street, Stanford, California 94305, Phone: 650.723.2021*

For Fall Congress presentations on Thursday, see pages 132-135.