Frontiers in Optics 2010/Laser Science XXVI

FiO/LS 2010 wrapped up in Rochester after a week of cutting-edge optics and photonics research presentations, powerful networking opportunities, quality educational programming and an exhibit hall featuring leading companies in the field. Headlining the popular Plenary Session and Awards Ceremony were Alain Aspect, speaking on quantum optics; Steven Block, who discussed single molecule biophysics; and award winners Joseph Eberly, Henry Kapteyn and Margaret Murnane.

Led by general co-chairs Karl Koch of Corning Inc. and Lukas Novotny of the University of Rochester, FiO/LS 2010 showcased the highest quality optics and photonics research—in many cases merging multiple disciplines, including chemistry, biology, quantum mechanics and materials science, to name a few. This year, highlighted research included using LEDs to treat skin cancer, examining energy trends of communications equipment, quantum encryption over longer distances, and improvements to biological and chemical sensors. Select recorded sessions are now available to all OSA members. Members should log in and go to "Recorded Programs" to view available presentations.

FiO 2010 also drew together leading laser scientists for one final celebration of LaserFest – the 50th anniversary of the first laser. In honor of the anniversary, the conference's Industrial Physics Forum brought together speakers to discuss *Applications in Laser Technology* in areas like biomedicine, environmental technology and metrology. Other special events included the Arthur Ashkin Symposium, commemorating Ashkin's contributions to the understanding and use of light pressure forces on the 40th anniversary of his seminal paper "Acceleration and trapping of particles by radiation pressure," and the Symposium on Optical Communications, where speakers reviewed the history and physics of optical fiber communication systems, in honor of 2009 Nobel Prize Winner and "Father of Fiber Optics" Charles Kao.

The annual meeting serves as the venue for the Optical Society to announce its board election results. Donna T. Strickland of the University of Waterloo was elected as the 2011 vice president. Strickland will become president-elect the following year and serve as president of OSA in 2013. Naomi J. Halas, Eric Mazur and Jannick P. Rolland were all elected to serve three-year terms as directors at large. Maser pioneer James Gordon was also named honorary member of OSA for his numerous high-impact, seminal contributions to quantum electronics and photonics, including the first demonstration of the maser.

With higher attendance in 2010—more than 1,700 attendees and 85 exhibiting companies—and more than 850 technical presentations, FiO 2010 was the place to be for researchers, businesspersons, educators and anyone with an interest in the optics and photonics field. Join us next year as we head back to San Jose, California, USA for FiO 2011, October 16 – 20.

About FiO/LS

FiO/LS Pre-Conference Schedule
The Optical Society (OSA)
The APS Division of Laser Science (DLS)
Archives
Frontiers in Optics 2007 Archive (PDF)
Frontiers in Optics 2008 Archive (PDF)
Frontiers in Optics 2009 Archive (PDF)
Future Dates

Join your colleagues at the Rochester Riverside Convention Center in Rochester, NY USA, for a variety of themes, topics, and invited speakers at the Frontiers in Optics (FiO) 2010/Laser Science (LS) XXVI conference.**:**

- FiO 1: Optical Design, Fabrication and Instrumentation
- FiO 2: Optical Sciences
- FiO 3: Optics in Biology and Medicine
- FiO 4: Optics in Information Science
- FiO 5: Photonics
- FiO 6: Quantum Electronics
- FiO 7: Vision and Color

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

Week of March 29, 2010	Call for Papers Submission Site Opens for FiO/LS 2010
May 25, 2010, 12:00 p.m. noon EDT (16.00 GMT)	FiO/LS Papers Submission Deadline
June 2010	Registration and Housing Open
July 2010	Authors of submitted papers are notified of acceptance/rejection
August 2010	FiO/LS 2010 Conference Program Available Online
September 28, 2010	Housing Deadline

September 28, 2010	Pre-registration deadline
October 1, 2010	Post deadline Paper Submission Deadline
October 12, 2010	Authors of post deadline papers are notified of acceptance/rejection
October 24–28, 2010	FiO/LS held at the Rochester Riverside Convention Center

The Optical Society (OSA)

FiO 2010—the 94th OSA Annual Meeting—and LS XXVI 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 2010 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 XXVI 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 2010/LS XXVI Plenary Session and Awards Ceremony is on Monday, October 25.

Plenary Session

Frederic Ives Medal/Jarus W. Quinn Endowment Winner Presentation

Arthur L. Schawlow Prize in Laser Science Winner Presentation

Awards Recipients Ceremony

Hanbury Brown and Twiss and other atom-atom correlations: from photon to atom quantum optics

Alain Aspect
Laboratoire Charles Fabry de l'Inst. d'Optique, France

Abstract: Fifty years ago, R. Hanbury Brown and R. Q. Twiss, invented a new method to measure the angular diameter of stars, based on the observation of correlations in light. The analysis of their experiment led to the development of modern quantum optics, based on photon-photon correlation experiments.

Similar quantum correlations can be observed with bosonic and fermionic atoms. I will present such experiments, after recalling the significance of the HBT landmark experiment.

Biography: Born in 1947, Alain Aspect studied at the Ecole Normale Supérieure de Cachan and

The Biophysics of Gene Regulation, Studied One Molecule at a Time

Steven M. Block
Stanford Univ., USA

Abstract: Advances have led to a new field, single molecule biophysics. Prominent among the enabling technologies is the laser-based optical trap, or optical tweezers. This lecture will focus on our current work on single biological macromolecules.

Biography: Steven M. Block is the S.W. Ascherman Chair of Sciences in the departments of Applied Physics and Biology at Stanford University. He holds degrees from Oxford University (B.A. 1974; M.A. 1978) and the California Institute of Technology (Ph.D. 1983).

After postdoctoral work at Stanford (1983-87), he served as staff scientist at the Rowland

Université d'Orsay. After a three years teaching assignment in Cameroon, he started in 1974, a series of experiments on the foundations of quantum mechanics. His "Experimental Tests of Bell's Inequalities with Correlated Photons", were the subject of his doctorate thesis presented in 1983. In 1983-86, with his student Philippe Grangier, he developed the first source of single photons and made fundamental experiments on wave-particle duality of light.

From 1985 to 1992 he worked with Claude Cohen-Tannoudji at the Laboratoire Kastler Brossel de l'ENS and Collège de France, on cooling atoms with lasers, in particular "cooling below the one photon recoil".
Since 1991, he is head of the group of Atom Optics that he has established at the Institut d'Optique, now in Palaiseau. Recent scientific production concerns mainly Bose Einstein Condensates, Atom Lasers, Quantum Atom Optics with metastable Helium, Anderson localization of ultracold atoms.

A CNRS senior scientist (”Directeur de recherché CNRS”) at Laboratoire Charles Fabry de l'Institut d'Optique, Alain Aspect is also professor at Institut d'Optique and Ecole Polytechnique, Palaiseau.

He is member of the French Académie des Sciences, and of the Académie des Technologies, as well as of foreign academies (USA, Austria). He is a fellow of the Optical Society of America, of the European Optical Society, of the American Physical Society, and has received several honorary doctorates (Ecole Polytechnique and University of Montreal, National Australian University at Canberra, Herriott Watt University at Glasgow). He is frequently invited as a distinguished lecturer, and has received major awards, among them: the OSA Max Born award (1999), the CNRS Gold Medal (2005), the Quantum Optics senior prize of the European Physical Society (2009), the Wolf prize in Physics (2010).

Institute for Science, Lecturer at Harvard University (1987-1993), and then Professor of Molecular Biology at Princeton University (1994-1999) prior to joining the Stanford faculty in 1999.

Block is a fellow of the National Academy of Sciences, the American Academy of Arts & Sciences, the American Association for the Advancement of Science, and the Biophysical Society.

He is a recipient of the Delbrück Prize in Biological Physics from the American Physical Society (2008), the Young Investigator (1994) and Outstanding Investigator in Single Molecule Biophysics Awards from the BPS (2008), and served as the Biophysical Society's National Program Chair (1999) and President (2005-2006).

Block's research lies at the interface of physics and biology, particularly in the study of molecular motors, such as kinesin and RNA polymerase, and the folding of nucleic acid-based structures. His laboratory has pioneered the use of laser-based optical traps, also known as 'optical tweezers,' to study the nanoscale motions of individual biomolecules.

APS Arthur L. Schawlow Prize in Laser Science

The Arthur L. Schawlow Prize recognizes outstanding contributions to basic research which uses lasers to advance our knowledge of the fundamental physical properties of materials and their interaction with light.

2010 Recipients: Henry C. Kapteyn of JILA, University of Colorado, USA and Margaret M. Murnane of JILA, University of Colorado, USA

Citation: For critical advances in the science and technology of high-harmonics generation, with particular relevance to sub-femtosecond pulse generation and related attosecond-scale physics.

Schawlow Prize Lecture Title: "Attosecond Light and Science at the Time-scale of the Electron - Coherent X-Rays from Tabletop Ultrafast Lasers"

Abstract: Using the extreme nonlinear process of high harmonic generation, light from an ultrafast laser can be coherently upshifted, generating bright ultrafast coherent beams extending into the soft and soon hard x-ray regions of the spectrum. Applications in molecular and materials dynamics, as well as nano- and attosecond science, will be discussed.

Biographies: Henry Kapteyn and Margaret Murnane have made important contributions to the development of coherent x-ray sources and have helped establish the foundations of attosecond science. In the 1990s, they led the development of new ultrafast laser technologies using

Ti:sapphire to generate unprecedented high peak power pulses only a few optical cycles in duration. They then did pioneering work in developing an understanding of extreme nonlinear optics to efficiently upshift femtosecond laser light into the soft X-ray region of the spectrum.

Henry Kapteyn is Professor of Physics and Fellow of JILA, University of Colorado, Boulder. He holds a B.S. from Harvey Mudd College, M.S. from Princeton University and a Ph.D. from the University of California, Berkeley. He previously held faculty positions at Washington State University and the University of Michigan. He is a Fellow of OSA, APS, and AAAS, and recipient of the OSA Adolph Lomb Medal, the ACS Ahmed Zewail Award, and the R.W. Wood Prize.

Margaret Murnane is Professor of Physics and Fellow of JILA, University of Colorado Boulder. She received her B.S. and M.S. degrees from University College Cork, Ireland, and her Ph.D. from the University of California, Berkeley. She previously held faculty positions at Washington State University and the University of Michigan. She is member of the NAS, a Fellow of OSA, APS and AAAS, and recipient of a MacArthur Foundation Fellowship, the ACS Ahmed Zewail Award and the R.W. Wood Prize.

OSA Frederic Ives Medal/Jarus W. Quinn Endowment

The Frederic Ives Medal/Jarus W. Quinn Endowment is OSA's highest award and recognizes overall distinction in optics.

2010 Recipient: Joseph H. Eberly, University of Rochester, U.S.A.

Citation: For many important research contributions to quantum optics and optical physics, his leadership as a teacher and educator, and his tireless and visionary service to the optics community

Ives Medal Address Title: "When Malus tangles with Euclid, who wins?"

Biography: Joseph Eberly has a B.S. degree from Pennsylvania State University and a Ph. D from Stanford University. Eberly has been teaching graduate and undergraduate classes in the department of physics and astronomy at the University of Rochester since the 1970s. He is currently the Andrew Carnegie Professor of Physics and also a Professor of Optics.

His long-time research interests in quantum optics and radiation physics have led to a number of discoveries and innovations; including the initial description of the spontaneous collapse and revival effect, the first observation of Bessel beams, predictions of the recently observed non-spreading localized states of electrons in atoms, and the sudden-death effect in quantum entanglement.

Eberly received the Charles Hard Townes Award from OSA, the Goergen Award for Creative Undergraduate Teaching from the University of Rochester and has been designated a Distinguished Alumnus of the Penn State College of Science. He was awarded the Smoluchowski Medal by the Polish Physical Society. Eberly has mentored more than 35 Ph.D. graduates and published more than 350 research papers, as well as three graduate texts: Optical Resonance and Two-Level Atoms with L. Allen; Lasers and Laser Physics, both with P.W. Milonni.

He is the founding editor of the journal Optics Express, and he has served as president of OSA and chair of the APS Division of Laser Physics, on the APS Council and the AIP Board of Governors, and as a member of the Advisory Boards of the Kavli Institute for Theoretical Physics and ITAMP-Harvard. He is a Fellow of OSA and APS and he is an elected Foreign Member of the Polish Academy of Science.

Honors to be presented during the Award Ceremony

APS/Division of Laser Science Awards AND HONORS

APS/Division of Laser Science Fellowships

Arthur L. Schawlow Prize
Recipients: Henry C. Kapteyn, JILA, University of Colorado and
Margaret M. Murnane, JILA, University of Colorado

OSA AWARDS AND HONORS

OSA Fellowships

OSA Honorary Member
Recipient: Arthur Ashkin, *Alcatel-Lucent Bell Labs, USA*

Frederic Ives Medal/Jarus W. Quinn Endowment
Recipient: Joseph H. Eberly, *University of Rochester, USA*

Esther Hoffman Beller Medal
Recipient: Eustace Dereniak, *University of Arizona, USA*

Distinguished Service Award
Recipient: Gary C. Bjorklund, *Bjorklund Consulting, USA*

Paul F. Forman Engineering Excellence Award
Recipient: Alan E. Willner, *Univ. of Southern California, USA*

Joseph Fraunhofer Award/Robert M. Burley Prize
Recipient: Shin-Tson Wu, *University of Central Florida, USA*

Edwin H. Land Medal
Recipient: Eli Peli, *Schepens Eye Research Institute, USA*

OSA Leadership Award
Recipient: Rod C. Alferness, *Bell Laboratories, Alcatel-Lucent,USA*

Emmett N. Leith Medal
Recipient: Juris Upatnieks, University of Michigan/Environmental Research Institute of Michigan (retired), USA

Adolph Lomb Medal
Recipient: Jeremy O' Brien, University of Bristol, U.K.

William F. Meggers Award
Recipient: Frédéric Merkt, ETH Zürich, Switzerland

FiO Invited Speakers

Check back often as speakers are still being confirmed and updated!

FiO 1: Optical Design, Fabrication and Instrumentation
FiO 2: Optical Sciences
FiO 3: Optics in Biology and Medicine
FiO 4: Optics in Information Science
FiO 5: Photonics
FiO 6: Quantum Electronics
FiO 7: Vision and Color

View Symposia Speakers

FiO 1: Optical Design, Fabrication and Instrumentation

1.1 Image-Based Wavefront Sensing

Wednesday, October 27, 2010

Invited Speakers:

10:30 AM, Measurement-Diverse Wavefront Sensing, Rick Paxman, *General Dynamics Corp., USA*

11:00 AM, Rays and Waves in Wavefront Sensing, Jim Fienup, *Univ. of Rochester, USA*

4:00 PM, Sequential Diversity Imaging: Phase Diversity with AO Changes as the Diversities, Bob Gonsalves, *Tufts Univ., USA*

4:30 PM, JWST Integrated System Modeling, Scott Knight, *Ball Aerospace and Technologies Corp., USA*

1.2 Diffractive and Holographic Optics

Thursday, October 28, 2010

Tutorial Speaker:

1:30 PM, What Is and Is Not a Hologram and Why it Matters, H. John Caulfield, *Alabama A&M Univ., USA*

Invited Speakers:

2:15 PM, 3-D Optics: From Diffractive to Subwavelength, George Barbastathis; *MIT, USA*

4:00 PM, Theoretical and Practical Implementation of Novel Nanostructured Diffractive and Micro-Optics, Mohammad R. Taghizadeh, **Andrew J. Waddie**; *Heriot-Watt Univ., UK*

4:30 PM, Plasmonic Diffractive Optics - Its Analogy to Classical Diffractive Optics and Use for Subwavelength Metallic Devices, Byoungho Lee[1], Junghyun Park[1], Seung-Yeol Lee[1], Hwi Kim[2], Seong-Woo Cho[1], Seyoon Kim[1]; *[1]Seoul Natl. Univ., Republic of Korea, [2]Korea Univ., Republic of Korea*

1.3 Three-Dimensional Structure Design, Fabrication and Nanopatterning

Wednesday, October 27, 2010

Invited Speakers:

1:30 PM, Active and Passive Nanophotonics for Information Systems Applications, Shaya Fainman, *Univ. of California at San Diego, USA*

2:00 PM, Nanopatterning Technology and the Future of Semiconductor Devices beyond 32nm, Bruce W. Smith, *Rochester Inst. of Technology, USA*

Thursday, October 28, 2010

Invited Speakers:

4:00 PM, Understanding Three-Dimensional Meta-Materials, from Refractive Index Concept to Rigorous Photonic Band Theory, Shanhui Fan, *Stanford Univ., USA*

4:30 PM, 3-D Integration of RF and Photonic Devices for High Frequency Operation, Dennis Prather, *Univ. of Delaware, USA*

1.4 Optical Design for Biomedical Systems (Joint with FiO 3: Optics in Biology and Medicine)

Tuesday, October 26, 2010

Invited Speakers:

10:30 AM, Degrees of Freedom in Computational Volume Optics, Rafael Piestun, *Univ. of Colorado, USA*
11:00 AM, Optical Ring Resonator Based Biological and Chemical Sensors, Xudong (Sherman) Fan, Jonathan D. Suter, Yuze Sun, Jing Liu, Hao Li, Karthik R. C. Balareddy; *Univ. of Michigan, USA*

Wednesday, October 27, 2010

Invited Speakers:

4:00 PM, High Resolution Optical Volumetric Imaging of Blood Perfusion with Microcirculation Tissue Beds, Ruikang Wang, *Oregon Health and Science Univ., USA*
4:30 PM, Breaking the Optical Diffusion Limit: Photoacoustic Tomography, Lihong Wang, *Washington Univ. in St. Louis, USA*

1.5 Optical Design with Unconventional Polarization

Wednesday, October 27, 2010

Tutorial Speaker:

8:00 AM, Some Applications of the Unified Theory of Coherence and Polarization of Light, Emil Wolf, *Univ. of Rochester, USA*

Invited Speakers:

8:45 AM, **Unconventional Polarization States Applied to Projection Imaging,** Thomas Brown, *Univ. of Rochester, USA*

1:30 PM, Polarization and the Focusing of Light, Colin Sheppard, *Natl. Univ. of Singapore, Singapore*

2:00 PM, Polarization and Modal Degrees of Freedom for Tight Confinement of Light, Uriel Levy, *The Hebrew Univ. of Jerusalem, Israel*

1.6 Astrophotonics (joint with FiO 5: Photonics) NEW!

Tuesday, October 26, 2010

Invited Speakers:

4:00 PM, Fibers Are Looking Up: Optical Fiber Transition Structures in Astrophotonics, Tim Birks[1], Antonio Diez[2], Jose L. Cruz[2], Sergio G. Leon-Saval[3], Dominic F. Murphy4; *[1]Univ. of Bath, UK, [2]Univ. of Valencia, Spain, [3]Univ. of Sydney, Australia, 4Univ. of Adelaide, Australia*

4:30 PM, Processing in Next Generation Telescope Arrays: Coherent Signal Combining, Pierre Kern, *Univ. of Grenoble, France*

Wednesday, October 27, 2010

Tutorial Speaker:

8:00 AM, Astrophophotonics: A New Generation of Astronomical Instruments, Joss Bland-Hawthorn, *Univ. of Sydney, Australia*

Invited Speaker:

9:00 AM, Coronagraphy for Exo-Planetary Detection, Richard Lyon, *NASA Goddard Space Flight Ctr., USA*

1.7 Adaptive Optics for the Eye (joint with FiO 7: Vision and Color)

Tuesday, October 26, 2010

Invited Speakers:

8:00 AM, Multifunctional Imaging Device for Adaptive Optics Compensation in Humans and Small Animals, Daniel X. Hammer[1], R. Daniel Ferguson[1], Mircea Mujat[1], Ankit H. Patel[1], Nicusor Iftimia[1], T. Y. P. Chui[2], J. D. Akula[2], A. B. Fulton[2]; *[1]Physical Sciences Inc., USA, [2]Children's Hospital and Harvard Medical School, USA.*

8:30 AM, Designing AO Retinal Imaging Systems for Real World Uses: Issues and Limitations, Steve Burns, *Indiana Univ., USA*

9:00 AM, Optical Design of Clinical Adaptive Optics Instruments for Retinal Imaging, Alf Dubra, *Univ. of Rochester, USA*

8:00 AM, Multifunctional Imaging Device for Adaptive Optics Compensation in Humans and Small Animals, Dan Hammer, *Physical Sciences Inc., USA*

View speakers for 5.6 Photonics and Optics for Energy Efficiency and Sustainability

FiO 2: Optical Sciences

2.1 Attosecond Optics and Technology

Tuesday, October 26, 2010

Tutorial Speaker:

4:00 PM, Carrier to Envelope Offset and Carrier to Envelope Phase—How Their Control Impacts Femtosecond and Attosecond Phenomena, Jean-Claude Diels, *Univ. of New Mexico, USA*

Invited Speakers:

5:00 PM, High-Order Harmonic Generation on Plasma Mirrors: Toward Attosecond Sources of Second Generation, Fabien Quere, *Inst. du CEA Saclay, France*

Wednesday, October 27, 2010

Invited Speakers:

8:00 AM, XUV Time-Domain Spectroscopy Using Isolated Attosecond Pulses from Double Optical Gating, Zenghu Chang; *Kansas State Univ., USA*

9:00 AM, Molecular Orbital Imaging Using Laser Driven Attosecond Emission, Bertrand Carre, *SPAM, Inst. du CEA Saclay, France*

2.2 Advances in High-Energy Ultrafast Laser Systems

Monday, October 25, 2010

Invited Speakers:

5:00 PM, Advances in Energetic Short-Pulse Fiber Lasers, Michael J. Messerly1, Jay W. Dawson[1], John K. Crane[1], David J. Gibson[1], Constantin Haefner[1], Miroslav Y. Shverdin[1], Henry H. Phan[1], Richard P. Hackel[1], Craig W. Siders[1], Christopher P. J. Barty[1], Matthew A. Prantil[2]; *[1]Photon Science and Applications Program, Lawrence Livermore Natl. Lab, USA, [2]Lawrence Berkeley Natl. Lab, USA.*

5:30 PM, Grating Development for High-Peak-Power CPA Laser Systems, Terrance J. Kessler*; Lab for Laser Energetics, Univ. of Rochester, USA.*

Tuesday, October 26, 2010

Invited Speakers:

10:30 AM, New Source of Ultra-Broadband Mid-IR Frequency Combs for Spectroscopic Applications, Konstantin Vodopyanov[1], Nick C. Leindecker[1], Alireza Marandi[1], Robert L. Byer[1], Vladimir Pervak[2]; [1]*Stanford Univ., USA,* [2]*Ludwig-Maximilians-Univ. München, Germany*

Tutorial Speaker:
1:30 PM, Optical Dispersion Management in Laser Amplifier Systems, Catherine LeBlanc, *LULI - École Polytechnique, France*

Invited Speakers:
3:00 PM, Development and Operation of Large-Aperture Tiled-Grating Compressors for High-Energy, Petawatt-Class Laser Systems, Jie Qiao, A. Kalb, T. Nguyen, D. Canning, J. Price; Lab for Laser Energetics, *Univ. of Rochester, USA*

2.3 Laser-Plasma Based Particle Acceleration

Wednesday, October 27, 2010

Tutorial Speaker:

10:30 AM, Laser Plasma Accelerators: Concepts, Progress and Dreams, Wim Leemans, *Lawrence Berkeley Natl. Lab, USA*

Invited Speakers:

11:15 AM, Acceleration of Electrons by A Laser Wakefield Accelerator (LWFA) Operating in the Self-Guided Regime, Chan Joshi, C. Clayton[1], D. Froula[2], K. Marsh[1], A. Pak[1], J. Ralph[1],[2]; [1]*Univ. of California at Los Angeles, USA,* [2]*Lawrence Livermore Natl. Lab, USA*

1:30 PM, Recent Advances in Proton Acceleration and Beam Shaping, Marcus Roth[1], V. Bagnoud[2], T. Burris[3], S. Busold[1], T. Cowan[3], O. Deppert[1], M. Geissel4, D. P. Grote5,6, K. Harres[1], G. Hoffmeister[1], G. Logan5, F. Nürnberg[1], G. Schaumann[1], M. Schollmeier4, D. Schumacher[1]; [1]*Technische Univ. Darmstadt, Germany,* [2]*Helmholtzzentrum für Schwerionenforschung, Germany,* [3]*Forschungszentrum Dresden-Rossendorf, Germany, 4Sandia Natl. Labs, USA, 5Lawrence Berkeley Natl. Lab, USA, 6Lawrence Livermore Natl. Lab, USA*

2:00 PM, Ion Acceleration with Ultra-Intense Lasers, Anatoly Maksimchuk, *Univ. of Michigan, USA*

2:30 PM, Particle Acceleration by the Light Pressure of High-Power Laser Pulses, Joerg Schreiber, *MPQ, Garching, Germany*

2.4 High-Peak-Power THz Field Generation and Applications

Thursday, October 28, 2010

Tutorial Speaker:

1:30 PM, High-Peak-Power THz Field Generation and Applications, Keith Nelson, *MIT, USA*

Invited Speakers:

4:00 PM, High Energy THz Pulse Generation by Tilted Pulse Front Excitation and Its Applications, János Hebling, József A. Fülöp, László Pálfalvi, Gábor Almási; *Dept. of Experimental Physics, Univ. of Pécs, Hungary*

4:30 PM, Ultrafast THz Studies of Electronic Dynamics and Correlations in Carbon Nanomaterials, Robert Kaindl, *Lawrence Berkeley National Lab., USA*

2.5 Laser Systems for Fusion and Fast Ignition

Thursday, October 28, 2010

Invited Speakers:

8:00 AM, Progress in Experiments for the National Ignition Campaign, Brian MacGowan, *Lawrence Livermore Nat'l Lab., USA*

8:30 AM, Inertial Confinement Fusion Research at the Laboratory for Laser Energetics, David Meyerhofer, *Lab. for Laser Energetics, Univ. of Rochester, USA*

9:00 AM, Fast Ignition Integrated Experiments Using Gekko-XII and LFEX Lasers, Hiroyuki Shiraga, *Inst. of Laser Engineering, Osaka Univ., Japan*

9:30 AM, Status of the HiPER Project, Chris Edwards, *Central Laser Facility, Rutherford Appleton Lab, UK*

FiO 3: Optics in Biology and Medicine

3.1 Optical Trapping and Manipulation

Tuesday, October 26, 2010

Invited Speakers:

10:30 AM, Suppression of Brownian Motion Explores Cooperativity for Single Multi-Subunit Enzymes in Solution, Yan Jiang[1],[2], Nick Douglas[3], Nick Conley&sup4;, Eric Miller[3], Judith Frydman[3], W.E. Moerner[1]; [1]*Chemistry Dept., Stanford Univ., USA,* [2]*Applied Physics Dept., Stanford Univ., USA,* [3]*Biology Dept., Stanford Univ., USA, &sup4;Radiology Dept., Stanford Univ., USA*

11:30 AM, Optical Sculpting: Changing the Shape of Micromanipulation, Kishan Dholakia, Janelle Shane, Michael Mazilu, Tomas Cizmar; *Univ. of St. Andrews, UK*

Wednesday, October 27, 2010

10:30 AM, High-Speed Holographic Tweezers and Imaging, Miles Padgett[1], Richard Bowman[1], Daryl Preece[1], Arran Curran[1], Graham Gibson[1], David Carberry[2], Mervyn Miles[2]; *[1]Univ. of Glasgow, UK, [2]Univ. of Bristol, UK*

11:30 AM, Applications of Spatial Light Modulators for Optical Trapping and Imaging, Monika Ritsch-Marte, *Medizinische Univ. of Innsbruck, Germany*

3.2 Microscopy and OCT

Monday, October 25, 2010

4:00 PM, Improving 2-Photon Microscopy by Beam Multiplexing and Extended Excitation Bandwidth, Thomas Pingel, *LaVision Biotec, Germany*

Tuesday, October 26, 2010

Invited Speakers:

8:00 AM, Nonlinear Optical Tools for Studying Small-Stroke at Microscopic Scales, Nozomi Nishimura, *Cornell Univ., USA*

Tutorial Speaker:

4:45 PM, Coherence Imaging, Adam Wax, *Duke Univ., USA*

3.3 Optics for Diagnostics and Therapy

Monday, October 25, 2010

1:30 PM, Monitoring Breast Cancer Tumor Response at Different Timepoints during Pre-Surgical Chemotherapy with Diffuse Optical Spectroscopic Imaging, **Albert Cerussi**[1], Vaya W. Tanamai[1], Darren Roblyer[1], Shigeto Ueda[1], Amanda F. Durkin[1], Rita S. Mehta[2], David Hsiang[2], John Butler[2], Bruce J. Tromberg[1]; *[1]Beckman Laser Inst., Univ. of California at Irvine, USA*, *[2]Chao Comprehensive Cancer Ctr., Univ. of California at Irvine, USA*

Tuesday, October 26, 2010

1:30 PM, Laser Speckle Imaging of Blood-Flow Dynamics During Laser Surgery of Vascular Birthmarks, Bernard Choi; *Univ. of California at Irvine, USA*

View speakers for 1.4 Optical Design for Biomedical Systems

View speakers for 6.3 Non-Linear Imaging

View speakers for7.2 Emerging *in vivo* Imaging Techniques for Ocular Imaging

FiO 4: Optics in Information Science

4.1 Encoding Optical Information—Nano-Photonics, Diffractive Optics and Refractive Optics for Shaping Optical Signals

Thursday, October 28, 2010

Invited Speakers:

1:30 PM, Fundamental Limits to Optical Components, David Miller, *Stanford Univ., USA*

2:00 PM, Progress towards Windows Performing Forbidden Light-Ray Direction Changes, Johannes Courtial, *Univ. of Glasgow, UK*

2:30 PM, On Breaking The Abbé Diffraction Limit In Optical Nanopatterning, Nicole Brimhall[1], Trisha Andrew[2], Rajakumar Manthena[1], Mohit Diwekar[1], Rajesh Menon[1]; [1]Univ. of Utah, USA, [2]MIT, USA.

4.2 Sensing in Higher Dimensions—Theory and Hardware for Computational Imaging

Wednesday, October 27, 2010

Invited Speakers:

10:30 AM, Computational Photography in 4-D, 6-D and 8-D, Ramesh Raskar, *MIT, USA*

Thursday, October 28, 2010

Invited Speakers:

10:30 AM, Spatio-Temporal Processing Methods for Mitigating Bandwidth Issues Associated with Advanced Infrared Sensors, Dean Scribner, *Northrop Grumman, USA*

4.3 Plasmonics and Metamaterials for Information Processing

Wednesday, October 27, 2010

Invited Speakers:

1:30 PM, Infrared Plasmonic Metamaterials for Slow-Light Applications, Gennady Shvets, *Univ. of Texas Austin, USA*

Thursday, October 28, 2010

Invited Speakers:

1:30 PM, Super-Resolution Imaging Based on Interfering Plasmon Waves, Peter So, *MIT, USA*

4:00 PM, Simple Demonstration of Visible Evanescent Wave Enhancement with Far-Field Detection, Rene Lopez, *Univ. of North Carolina at Chapel Hill, USA*

4.4 Structured Wavefields for Communications and Sensing

Monday, October 25, 2010

Invited Speakers:

1:30 PM, Effects of Type of Incidence on the Second and Fourth Order Moment Parameters Evaluated in Turbulent Atmosphere, Yahya Baykal, *Cankaya Univ., Turkey*

4:00 PM, Optical Coherence Microscopy Using Bessel Beam, Kye-Sung Lee, *Univ. of Rochester, USA*

5:30 PM, Advanced Studies of 'Non-Diffracting' Light Fields, Kishan Dholakia, Jörg Baumgartl, Tomas Cizmar, Xanthi Tsampoula, Frank Gunn-Moore, Michael Mazilu; *Univ. of St. Andrews, United Kingdom.*

4.5 Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing

Tuesday, October 26, 2010

Invited Speakers:

10:30 AM, Quantum Inspired Imaging with Compressive Sensing, Ori Katz, Yaron Bromberg, Yaron Silberberg; *Weizmann Inst. of Science, Israel.*

Wednesday, October 27, 2010

Invited Speakers:

4:15 PM, Infrared Spectroscopic Imaging for Label-Free and Automated Histopathology, Rohit Bhargava, Rohith K. Reddy, Jason Ip, Frances N. Pounder, Matthew V. Schulmerich, David Mayerich, Xavier Llora, Rong Kong, Michael J. Walsh; *Univ. of Illinois at Urbana-Champaign, USA*

Thursday, October 28, 2010

Invited Speakers:

10:30 AM, Spatial Light Interference Microscopy (SLIM), Zhuo Wang, Huafeng Ding, **Gabriel Popescu**; *Univ. of Illinois at Urbana-Champaign, USA*

FiO 5: Photonics

5.1 Novel Fiber Optical Devices

Tuesday, October 26, 2010

Invited Speakers:

10:30 AM, Self Assembled Periodicity in a Liquid Filled Hollow Optical Fiber, **Kyunghwan Oh**[1], Hojoong Jung[1], Sohee An[1], Yongmin Jung[2]; [1]*Yonsei Univ., Republic of Korea,* [2]*Optoelectronics Res. Ctr., Univ. of Southampton, UK*

10:30 AM, Short-Pulse Fiber Lasers Based on Dissipative Solitons, Frank Wise; *Cornell Univ., USA*

4:00 PM, Semiconductor Core Optical Fibers, John Ballato; *Clemson Univ., USA*

Wednesday, October 27, 2010

Invited Speakers:

10:30 AM, Fibers for Dispersion Management in fs Fiber Lasers, Lars Grüner-Nielsen, Kim G. Jespersen, Martin E. V. Pedersen, Bera Pálsdóttir; *OFS Denmark, Denmark*

4:00 PM, Manipulation of Pulse Duration and Wavelength Conversion in Optical Fibres, William Wadsworth; *Univ. of Bath, UK*

5.2 Optical Communication

Tuesday, October 26, 2010

Invited Speakers:

4:00 PM, Rate-Adaptive Transmission Techniques for Optical Fiber Systems, Joseph Kahn; *Stanford Univ., USA*

4:30 PM, Digital Compensation of Fiber Nonlinearities, Guifang Li; *CREOL, Univ. of Central Florida, USA*

Wednesday, October 27, 2010

Invited Speakers:

10:30 AM, Promising Technologies for Capacity Growth in Future Optical Networks, R. J. Essiambre; *Bell Labs, Alcatel-Lucent, USA*

11:15 AM, Next Generation 400 Gb/s Transmission, I. B. Djordjevic; *Univ. of Arizona, USA***5.3 Integrated Optics**

Monday, October 25, 2010

Invited Speakers:

4:00 PM, Monolithic Ge-on-Si Lasers, Lionel Kimerling, Jifeng Liu; *MIT, USA*

Tuesday, October 26, 2010

Invited Speakers:

8:00 AM, Noise, Broadband Gain, Inverse Stimulated Scattering, and Extreme Value Fluctuations; Recent Developments in Silicon Raman Amplifiers, Bahram Jalali; *Univ. of California at Los Angeles, USA*

9:00 AM, Nonlinear Mixing in Silicon Waveguides for Short Wave Infrared and Mid-Infrared Applications, Sanja Zlatanovic*; Univ. of California at San Diego, USA*

Wednesday, October 27, 2010

Invited Speakers:

2:00 PM, Theoretical Investigation of Attractive Optical Force in Periodically-Patterned Silicon Waveguides, Jing Ma, **Michelle Povinelli**; *Univ. of Southern California, USA*

5.4 Photonic Sensing Devices

Monday, October 25, 2010

Invited Speakers:

1:30 PM, Long-Term Monitoring of Local Temperature and Strain Changes in a Buried Fiber-Optic Cable Using Brillouin OTDR, Jon Nagel; *AT&T Labs, USA*

2:30 PM, Raman-Based Distributed Temperature Sensors, Arthur Hartog; *Schlumberger, UK*

4:30 PM, New Imaging and Sensing Techniques Base on Surface Plasmon Resonance, N. J. Tao, *Arizona State Univ., USA*

Wednesday, October 27, 2010

Invited Speakers:

8:00 AM, Sensor Challenges for Deep Tissue Imaging, Martin Leahy, *Univ. of Limerick, Ireland*

5.5 Novel Hybrid Integration NEW!

Tuesday, October 26, 2010

Invited Speakers:

1:30 PM, Hybrid Integration of III-V and Si for Photonic Integrated Circuits, John Bowers; *Univ. of California at Santa Barbara, USA*

2:30 PM, Active-Passive Photonic Integration with an Eye Toward Large Scale Integration, James Jaques; *LGS Innovations, LLC, USA*

3:00 PM, Hybrid Chalcogenide/Lithium Niobate, Christi Madsen; *Texas A&M Univ., USA*

Wednesday, October 27, 2010

Invited Speakers:

8:00 AM, Rare-Earth-Ion Doped Waveguide Amplifiers and Lasers in Alumina and Polymers, Markus Pollnau, *Univ. of Twente, Netherlands*

9:00 AM, Optimized Nonlinear Optical Molecules for Silicon-Organic-Hybrid Systems, Ivan Biaggio, *Lehigh Univ., USA*

5.6 Photonics and Optics for Energy Efficiency and Sustainability (joint with FiO 1: Optical Design, Fabrication and Instrumentation) NEW!

Monday, October 25, 2010

Invited Speakers:

1:30 PM, Luminescent Solar Concentrators: From Optical Heat Pumps to Solar Pumped Lasers, C. Rotschild[1], M. Tomes[2], H. Mendoza[1], T. Carmon[2], M. Baldo[1]; *[1]MIT, USA, [2]Univ. of Michigan, USA*

2:00 PM, Depleted Heterojunction Colloidal Quantum Dot Solar Cells, Illan Kramer, *Univ. of Toronto, Canada*

2:30 PM, Nanoscale Photon Management for Efficient Photovoltaic Energy Harvesting, Mark Brongersma, *Stanford Univ., USA*

Tuesday, October 26, 2010

Invited Speakers:

8:00 AM, Organic Semiconductors for Photovoltaic and Light-Emitting Devices: Status and Promise, Bernard Kippelen, *School of Electrical and Computer Engineering., Georgia Tech, USA*

8:30 AM, Optical Transmission Energy Consumption in the Internet, Dan Kilper, *Bell Labs, Alcatel-Lucent, USA*

9:00 AM, Photonics and Optics for Energy Efficiency and Sustainability – Is this Green Photonics?, Michael Lebby, *Optoelectronics Industry Development Association, USA*

View speakers for 1.6 Astrophotonics

View speakers for 6.6 Nonlinear Optics in Micro/Nano-Optical Structures

FiO 6: Quantum Electronics

6.1 Opto-Mechanics and Quantum Measurement

Tuesday, October 26, 2010

Invited Speakers:

10:30 AM, Quantum Back Action in Tabletop Interferometers, Jack Harris, *Yale Univ., USA*

11:30 AM, Silicon Monolithic Acousto-Optic Modulators, Sunil Bhave, *Cornell Univ. USA*

4:00 PM, The Engima of Optical Momentum, Stephen M. Barnett; *Univ. Strathclyde, UK*

4:45 PM, Testing Macroscopic Quantum Superpositions, Dirk Bouwmeester, *Univ. of California at Santa Barbara, USA*

6.2 Quantum Information and Communciations

Monday, October 25, 2010

Invited Speakers:

2:45 PM, Quantum Optics in Wavelength Scale Structures, John Rarity, *Univ. of Bristol*

4:00 PM, Interference of Photons from Remote Solid-State Sources, A. J. Bennett[1], R. B. Patel[1],[2], I. Farrer[2], C. A. Nicoll[2], D. A. Ritchie[2], Andrew Shields[1]; *[1]Toshiba Res. Europe Ltd., United Kingdom, [2]Cavendish Lab, Cambridge Univ., UK*

Tuesday, October 26, 2010

Invited Speakers:

2:00 PM, Quantum Limits to Lossy Optical Interferometry, Luiz Davidovich; *Univ. Federal do Rio de Janeiro, Brazil.*

6.3 Non-Linear Imaging (joint with FiO 3: Optics in Biology and Medicine)

Monday, October 25, 2010

Invited Speakers:

1:30 PM, Non-Linear Imaging with Ultrashort Shaped Pulses, Marcos Dantus, *Michigan State Univ., USA*

2:15 PM, Nonlinear Imaging of Coherent Fields Demetri Psaltis, *École Polytechnique Fédérale de Lausanne, Switzerland*

3:00 PM, Stimulated Raman Scattering Microscopy for Biology and Medicine, Sunney Xie, *Harvard University, USA*

6.4 Nonlinearities and Gain in Plasmonics and Metamaterials

Wednesday, October 27, 2010

Invited Speakers:

8:00 AM, Metamaterials and Symmetry, Xiang Zhang, *Univ. of California at Berkeley, USA*

9:30 AM, Switchable and Nonlinear Metamaterials: Controlling Light on the Nanoscale, Nikolay I. Zheludev, *Univ. of Southampton, UK*

Thursday, October 28, 2010

Invited Speakers:

10:30 AM, Active Plasmonic Metamaterials, Mikhail A. Noginov, *Norfolk State Univ., USA*

11:30 AM, Nonlinear Plasmonics, Lukas Novotny, *Univ. of Rochester, USA*

6.5 Transformation Optics and Cloaking with Metamaterials

Thursday, October 28, 2010

Invited Speakers:

8:00 AM, Transforming Integrated Optics, Jensen Li, *City Univ. of Hong Kong, China*

8:30 AM, Taming the Fields and Waves with Extreme Metamaterials, Nadar Engheta, *Univ. of Pennsylvania, USA*

9:00 AM, Active and Tunable Metamaterials, Vladimir M. Shalaev; *Purdue Univ., USA*

9:30 AM, Molding the Flow of Light with Artificial Optical Materials, Dentcho Genov, *Louisana Tech, USA*

6.6 Nonlinear Optics in Micro/Nano-Optical Structures (joint with FiO 5: Photonics)

Thursday, October 28, 2010

Invited Speakers:

8:45 AM, Nonlinear Optical Processes in Subwavelength Optical Waveguides—Revised Fundamentals and Implications, Shahraam Afshar, *Univ. of Adelaide, Australia*

10:30 AM, Nonlinear Silicon Photonics, Michal Lipson, *Cornell Univ., USA*

11:30 AM, Light Scattering in a Random but Non Diffusive Nonlinear Medium, Jordi Martorell, *Inst. de Ciències Fotòniques, Spain*

1:30 PM, CMOS Compatible All-Optical Chips, David Moss[1], A. Pasquazi[2], M. Peccianti[2], L. Razzari[2], D. Duchesne[2], M. Ferrera[2], S. Chu[3], B. E. Little[3], R. Morandotti[2]; *[1]Univ. of Sydney, Australia, [2]INRS-EMT, Canada, [3]Infinera Corp., USA*
Tutorial Speaker:

2:30 PM, Phonon Lasers in Cavity Optomechanics, Kerry Vahala, *Caltech, USA*

6.7 Disorder in Integrated Optical Devices and Circuits

Tuesday, October 26, 2010

Invited Speakers:

1:30 PM, Strong Localization by Disorder in Photonic Crystal Waveguides, Frank Vollmer, *Harvard Univ., USA*

3:00 PM, Disorder-Induced Multiple Scattering and Light Localization in Photonic Crystal Waveguides, Stephen Hughes, *Queen's Univ., Canada*

Wednesday, October 27, 2010

Invited Speakers:

1:30 PM, Evolution of Photonic Band-Gap and Lasing from Polycrystalline to Amorphous Photonic Structures, Hui Cao, *Yale Univ., USA*

3:00 PM, Ultrasensitive Raman Sensor Based on Highly Scattering Porous Structures, Vladislav Yakovlev, *Univ. of Wisconsin at Milwaukee, USA*

FiO 7: Vision and Color

7.1 Individualized Optical Correction of the Eye

Monday, October 25, 2010

Invited Speakers:

1:30 PM, The Use of Adaptive Optics to Study Optical and Neural Impact on Visual Performance, Geunyoung Yoon, *Univ. of Rochester, USA*

2:15 PM, Performance of Aspheric IOLs, Susana Marcos, *Inst. de Óptica, Spanish Council for Scientific Res., Spain*

Tutorial Speaker:

2:45 PM, The Role of the Eye's Aberrations in Vision, Pablo Artal, *Univ. de Murcia, Spain*

7.2 Emerging in vivo *Imaging Techniques for Ocular Imaging (joint with FiO 3: Optics in Biology and Medicine)*

Monday, October 25, 2010

Invited Speaker:

4:00 PM, Imaging the Development of Neural Circuits in the Mammalian Retina, Daniel Kerschensteiner; Washington Univ. in St. Louis, USA.

4:30 PM, Multimodal Retinal Imaging, Hao Zhang[1,2], Qing Wei[1], Tan Liu[1], Jing Wang[1], Dennis P. Han[3], Janice M. Burke[3], Shuliang Jiao&sup4;; *[1]Univ. of Wisconsin at Milwaukee, USA, [2]Northwestern Univ., USA, [3]Medical College of Wisconsin, USA, &sup4;Univ. of Southern California, USA*

View speakers for 1.7 Adaptive Optics for the Eye

LS Invited Speakers

Check back often as speakers are still being confirmed and updated!

View Symposia Speakers
View FiO Speakers

1. Frontiers in Cold Molecules

Tuesday, October 26, 2010

Invited Speakers:

4:00 PM, Tunable Excitons in Ordered Arrays of Ultracold Molecules of Optical Lattices, Roman Krems, *Univ. of British Columbia, Canada*

4:30 PM, Dipolar Effects in an Ultracold Gas of LiCs Molecules, Matthias Weidemeuller, *Heidelberg Univ., Germany*
Thursday, October 28, 2010

Invited Speakers:

8:00 AM, Manipulation of Ultracold Chemistry, John Bohn, *JILA, NIST, Univ. of Colorado, USA*

8:30 AM, Implementation of a New Method to Produce Ultracold Polar Molecular Ions, Wade Rellergert, Scott Sullivan, Kuang Chen, Steven Schowalter, Eric R. Huson; *Univ. of California at Los Angeles, USA*

9:30 AM, Sympathetic Heating Spectroscopy: Probing Molecular Ions with Laser-Cooled Atomic Ions, Ken Brown, *Georgia Tech, USA*

1:30 PM, Laser Cooling of a Diatomic Molecule, David DeMille, E. S. Shuman, J. F. Barry; *Yale Univ., USA*

2:00 PM, Testing the Time-Invariance of Fundamental Constants Using Cold, and Not So Cold, Molecules, Rick Bethlem, *Vrije Univ., Amsterdam*

2. Hybrid Quantum Systems

Wednesday, October 27, 2010

Invited Speakers:

8:00 AM, Hybrid Nanophotonic and Nanomechanical Interfaces for Spin Qubits, Mikhail Lukin, *Harvard Univ., USA*

8:30 AM, Optical Manipulation and Detection of the Collective Motion and Spin of an Ultracold Atomic Gas, Dan Stamper-Kurn, *Univ. of California at Berkeley, USA*

9:30 AM, Measurement of Nanomechanical Motion with Precision Sufficient to Detect Zero-Point Motion, K. W. Lehnert, JILA, *NIST, Univ. of Colorado, USA*

10:30 AM, Quantum Measurement of Phonon Shot Noise Using Optomechanical Systems, Aashish Clerk, *McGill Univ., Canada*

11:00 AM, Nonlinear Optomechanical Couplings: Tools for Dealing with Solid Mechanical Objects in the Quantum Regime, Jack Sankey, *Yale Univ., USA*

11:30 AM, Measuring the Quantum Harmonic Oscillator, Andrew Cleland, *Univ. of California at Santa Barbara, USA*

12:15 PM, Title to Be Announced, Tobias J. Kippenberg, *Max-Planck-Inst. fur Quantenoptik, Germany*

3. Metrology and Precision Measurements

Invited Speakers:

Wednesday, October 27, 2010

8:00 AM, Precise Determination of h/M(Rb) Using Bloch Oscillations and Atomic Interferometry: A Mean to Deduce the Fine Structure Constant, Francois Biraben, *Laboratoire Kastler Brossel, École Normale Supérieure, CNRS, France*

8:30 AM, Optical Clock with Lattice-Confined Sr Atoms, Jun Ye, *JILA, Univ. of Colorado*

9:15 AM, Al+ Optical Clocks for Fundamental Physics, Geodesy, and Quantum Metrology, Till Rosenband, *NIST, USA*

1:30 PM, New Limit on Lorentz and CPT Violation for Neutrons, Michael Romalis, *Princeton Univ., USA*

Thursday, October 28, 2010

Invited Speakers:

2:00 PM, Results of Table-Top Fundamental Physics Experiments at Berkeley, Dmitry Budker, *Univ. of California at Berkeley, USA*

2:45 PM, An Improved Limit on the Permanent Electric Dipole Moment (EDM) of 199Hg, Tom Loftus, *Univ. of Washington, USA*

4. Novel Imaging, Spectroscopy and Manipulation in Microstructures

Monday, October 25, 2010

Invited Speakers:

4:00 PM, Linear and Nonlinear Optical Nano-Crystallography, Markus Raschke, *Univ. of Washington, USA*

4:30 PM, 10 kHz Accuracy Spectroscopy in Acetylene-filled Hollow-Core Kagome Fiber and Improved Linewidths, Kristan Corwin *Kansas State Univ., USA*

Tuesday, October 26, 2010

Invited Speakers:

10:30 AM, Coherent Rydberg Excitation in Microscopic Thermal Vapor Cells, Tilman Pfau, *Univ. of Stuttgart, Germany*

11:15 AM, Single-Particle Spectroscopy and Manipulation in Optofluidic Devices, Holger Schmidt, *Univ. of Southern California*

5. Attosecond and Strong Field Physics

Tuesday, October 26, 2010

Invited Speakers:

1:30 PM, Attosecond Physics: Real-Time Tracking of Valence Electron Motion in Atoms, Eleftherios Goulielmakis, *Max-Planck-Inst. für Quantenoptik, Germany*

2:00 PM, Probing Electron Dynamics by High Harmonic Generation, Markus Guehr, *Stanford Univ., USA*

Wednesday, October 27, 2010

Invited Speakers:

2:45 PM, High Order Harmonics Driven by 1.5µm Parametric Source: A Tool for Attosecond Science, Caterina Vozzi, *Politecnico di Milano, Italy*

4:00 PM, Time-Resolved High-Harmonic Spectroscopy of Photochemical Dynamics, Hans Jakob Worner, *National Res. Council, Canada*

4:45 PM, Ultrafast Dynamics in Helium Nanodroplets Studied by Femtosecond EUV Photoelectron and Ion Imaging, Oliver Gessner, *Lawrence Berkeley Natl. Lab, USA*

6. Chemical Dynamics—Multi-Dimensional Ultrafast Spectroscopy

Wednesday, October 27, 2010

Invited Speakers:

1:30 PM, Advances in Ultrafast 2-D Spectroscopy, Chris T. Middleton, **Martin T. Zanni**; *Univ. of Wisconsin at Madison, USA*

2:00 PM, Multiply Resonant Coherent Multidimensional Spectroscopy, John Wright, *Univ. of Wisconsin at Madison, USA*

2:45 PM, Watching Chemical Reactions and Dynamics with Ultrafast Multidimensional Infrared Spectroscopy, Carlos R. Baiz, Jessica M. Anna, Robert McCanne, John T. King, **Kevin J. Kubarych**; *Univ. of Michigan, USA*

Thursday, October 28, 2010

Invited Speakers:

8:00 AM, Two Dimensional Ultraviolet Spectroscopy of Proteins and Amyloid Fibrils, Jun Jiang, Shaul Mukamel; *Univ. of California at Irvine, USA*

8:30 AM, Two-Dimensional Electronic Spectroscopy of the Photosystem II Reaction Center, J. A. Myers, K. L. M. Lewis, F. Fuller, P. F. Tekavec, **J. P. Ogilvie**; *Univ. of Michigan, USA*

7. Photophysics of Nanostructured Materials

Monday, October 25, 2010

Invited Speakers:

1:30 PM, Photophysical Consequences of Interactions Between Conjugated Chromophores, Lewis Rothberg, *Univ. of Rochester, USA*

2:00 PM, Effects of Aggregation on the Emission Spectra and Dynamics of Electrolumine Scent Materials, Linda Peteanu, *Carnegie Mellon Univ., USA*

2:30 PM, Transient Microwave Conductivity Studies of Poly (3-alkyl thiophene)s and Blends with PCBM, Garry Rumbles, *Natl. Renewable Energy Lab., USA*

Tuesday, October 26, 2010

Invited Speakers:

8:00 AM, Excitonic Dynamics of Quantum Dots Monitored by Near-Infrared Transient Absorption, Emily Weiss, *Northwestern Univ., USA*

8:30 AM, Quantum Dot Electron Transfer Probed by Transient Photoluminescence, Marcus Jones; *Univ. of North Carolina at Charlotte, USA.*

11:00 AM, Two-Dimensional Photon Echo Measurements on CdTe/CdSe Heterostructured Quantum Dots, Shun Shang Lo[1], Roman Vaxenburg[2], Cathy Y. Wong[1], Efrat Lifshitz[2], Gregory D. Scholes[1]; *[1]Univ. of Toronto, USA, [2]Russell Berrie Nanotechnology Inst. and Solid State Inst., Israel.*

10:30 AM, Mixed Quantum Classical Simulations of Vibrational Excitations in Peptide Helices, Anne Goj, Eric Bittner; *Univ. of Houston, USA.*

8. Photophysics of Energy Conversion

Wednesday, October 27, 2010

Invited Speakers:

8:00 AM, Multi-Exciton Dissociation Dynamics in CdSe Quantum Dots, Tianquan Lian, *Emory Univ., USA*

8:30 AM, Inter- and Intra-chain Electronic Coherence in Conjugated Polymers, Greg Scholes, *Univ. of Toronto, Canada*

9:00 AM, Transient Absorption Studies of Charge Photogeneration in Organic and Dye Sensitized Solar Cells, James Durrant, *Imperial College London, UK*

9:45 AM, Exciton Diffusion and Interfacial Charge Separation in Photovoltaic Materials Studied by Microwave Conductivity, Tom J. Savenije, Laurens D. A. Siebbeles; *Delft Univ. of Technology, Netherlands.*

1:30 PM, Spin Signatures of Light Induced Charge Separated States in Polymer-Fullerene Bulk-Heterojunctions: High-Frequency Pulsed EPR Spectroscopy, Oleg Poluektov[1], Salvatore Filippone[2], Nazario Martín[2], Andreas Sperlich[3], Carsten Deibel[3], Vladimir Dyakonov[3]; [1]*Argonne Natl. Lab, USA,* [2]*Univ. Complutense de Madrid, Spain,* [3]*Julius-Maximilians Univ. of Würzburg and Bavarian Ctr. for Applied Energy Res. e. V., Germany*

2:00 PM, Optically and Electrically Detected Magnetic Resonance Studies of Organic Light-Emitting Materials and Devices, Joe Shinar, *Iowa State Univ., USA.*

2:30 PM, Carrier Dynamics of Films of Zinc Phthalocyanine and C60 Measured by Terahertz Time Domain Spectroscopy, Paul Lane, *NRL, USA*

3:00 PM, Time-Resolved Microwave Conductivity, Nikos Kopidakis, *Natl. Renewable Energy Lab., USA*

9. Single Molecule Approaches to Biology-Inspired Problems

Wednesday, October 27, 2010

Invited Speakers:

10:30 AM, Optical Chirality and Superchiral Fields, Adam Cohen, *Harvard Univ., USA*

11:00 AM, Local Dynamics Probing by Real-Time Single-Particle Tracking Spectroscopy, Li Sun, *Princeton Univ., USA*

11:30 AM, Exploring Chromatin Biochemistry with Single-Molecule Fluorescence Diffusometry, Hideo Mabuchi, *Stanford Univ., USA*

4:00 PM, Bacteriophager Lambda Life Cycle: The View from the Single Virus, Ido Golding, *Baylor College of Medicine, USA*

4:30 PM, Imaging Dynamic Events Inside Living Cells: Intracellular Degradation of LDL, Christine Payne, *Georgia Tech, USA*

5:00 PM, Time-Resolved 3D Tracking of Individual Quantum Dot Labeled Proteins in Live Cells via Confocal Feedback, Jim Werner, *Los Alamos Natl. Lab, USA*

Thursday, October 28, 2010

Invited Speakers:

10:30 AM, Single Molecule Photon Trajectories and Transition Paths in Protein Folding, Bill Eaton, *NIH and Natl. Inst. of Diabetes and Digestive and Kidney Diseases, USA*

11:00 AM, Title to Be Announced, Norbert Scherer, *Univ. of Chicago, USA*

11:30 AM, Superresolution Optical Fluctuations Imaging (SOFI) , Shimon Weiss, *Univ. of California at Los Angeles, USA*

10. Optofluidics in the Near-Field

Tuesday, October 26, 2010

Invited Speakers:

1:30 PM, The *Reactive Sensing Principle (RSP)* in Optically Resonant Biosensing and Nanoparticle Trapping within a WGM Carousel, ***Stephen Arnold****, Siyka I. Shopova, Stephen Holler; Polytechnic Inst. of New York Univ., USA.*

2:00 AM, Title to Be Announced, Sudeep Mandal, *Cornell Univ., USA*

2:30 PM, Surface Optofluidics, Andreas E. Vasdekis[1], Wuzhou Song[1], Julien R. Cuennet[1], Luciano De Sio[2], Jae-Woo Choi[1], Demitri Psaltis[1]; *[1]École Polytechnique Fédérale de Lausanne, Switzerland, [2]Univ. of Calabria,, Italy.*

3:00 PM, Optofluidic Ring Resonator Lasers, **Xudong (Sherman) Fan**, Yuze Sun, Jonathan D. Suter, Chung-Shieh Wu, Wonsuk Lee, Balareddy Chinna Reddy Karthik; *Univ. of Michigan, USA.*

4:00 PM, Optofluidic Nano-Plasmonics for Biochemical Sensing, **Shaya Y. Fainman**, L. Pang, B. Slutsky, J. Ptasinski, L. Feng, M. Chen; *Univ. of California at San Diego, USA.*

4:30 PM, Plasmonics for Optical Manipulation and Enhanced Spectroscopy, Kenneth Crozier, *Harvard Univ., USA*

11. Quantum Enhanced Information Processing

Wednesday, October 27, 2010

Invited Speakers:

10:30 AM, Entanglement and Quantum Algorithms with Superconducting Circuits, Robert Schoelkopf, *Yale Univ., USA*

11:00 AM, Benchmarking Quantum Information Processing Devices, Raymond Laflamme, *Univ. of Waterloo, Canada*

11:30 AM, Coherent Splitting, Rocking and Blinding of Single Atoms in an Optical Lattice, Dieter Meschede, *Inst. für Angewandte Physik der Univ. Bonn Wegelerstr, Germany*

4:00 PM, Progress towards Scalable Quantum Information Processing with Trapped Ions, David Hanneke, *NIST, USA*

5:00 PM, Quantum Illumination for Improved Detection, Imaging, and Communication, Jeffrey Shapiro, *MIT, USA*

Thursday, October 28, 2010

Invited Speakers:

10:30 AM, Quantum Teleportation And Quantum Information Processing, Akira Furusawa, *Univ. of Tokyo, Japan*

11:00 AM, Integrated Quantum Photonics, Jeremy L. O'Brien; *Univ. of Bristol, UK*

12. Quantum Nonlinear Optics

Tuesday, October 26, 2010

Invited Speakers:

8:00 AM, Toward Single-Photon Nonlinear Optics via Self-Assembled Ultracold Atoms, Daniel J. Gauthier, *Duke Univ., USA*

8:30 AM, Prospects for Strong Cavity Free Single Atom Nonlinearity at the Few Photon Level, **Gerd Leuchs**; Max-Planck-Inst. for the Science of Light and Inst. of Optics, Univ. Erlangen-Nuremberg, Germany.

1:30 PM, Spatial Light Modulators, a Tool for Measuring the Quantum Entanglement of Transverse Modes, Miles Padgett, *Univ. of Glasgow, UK*

2:00 PM, Gas-Phase Integrated-Photonics Quantum Technologies, Andrew White, *Univ. of Queensland, Australia*

13. Nanophotonics, Photonic Crystals and Structural Slow Light

Thursday, October 28, 2010

Invited Speakers:

10:30 AM, Cavity Quantum Electrodynamics with Quantum Dots, Antonio Badolato, *Univ. of Rochester, USA*

8:00 AM, Spontaneous and Stimulated Emission of Light into Surface Plasmon Modes, Pierre Berini, *Univ. of Ottawa, Canada*

8:30 AM, Enhancing Light-Matter Interactions in Nanophotonic Structures by Slow Light, Jesper Moerk, *Technical Univ. of Denmark, Denmark*

11:00 AM, Novel Light-Guiding Properties in Photonic Crystals, R. Hamam, I. Celanovic, Z. Wang, Y. Chong, J.d. Joannopoulos, Marin Soljacic; *MIT, USA.*

Special Symposia at Frontiers in Optics 2010/Laser Science XXVI

Check back often as speakers are still being confirmed and updated!

Arthur Ashkin Honorary Symposium
Industrial Physics Forum
Laser Science Symposium on Undergraduate Research
Symposium on Optical Communications

Arthur Ashkin Honorary Symposium

Symposium organizers: Mihaela Dinu[1], Mara Prentiss[2], Steve Rolston[3]; [1]Bell Labs, Alcatel-Lucent, USA; [2]Harvard Univ., USA, [3]Univ. of Maryland at College Park, USA

This symposium commemorates Arthur Ashkin's contributions to the understanding and use of light pressure forces on the 40th anniversary of his seminal paper '"Acceleration and trapping of particles by radiation pressure." Light pressure forces have served as the foundation for many cutting-edge research fields, such as work with optical tweezers, trapping of neutral particles and Bose-Einstein condensation. It is not an overstatement to say that the discovery and understanding of light pressure forces has led to a renaissance in atomic and molecular physics as well as optical science. Several historical overviews as well as new research that rest upon Arthur Ashkin's foundational work will be presented. We invite all conference attendees to help us honor Art and gain a deeper understanding of the far-reaching impact of his work in light-matter interactions.

Read the OPN article by McGloin and Reid (March 2010) about the 40th anniversary of Ashkin’s seminal paper “Acceleration and trapping of particles by radiation pressure.”

Invited Speakers include:

Tuesday, October 26, 2010

1:30 PM, Optical Trapping and Manipulation of Small Neutral Particles Using Lasers, Arthur Ashkin; *Alcatel-Lucent Bell Labs, USA*

1:55 PM, The Biophysics of Gene Regulation, Studied One Molecule at a Time, Steven M. Block; *Stanford Univ., USA*

2:20 PM, Title to Be Announced, James Gordon P.; *Consultant, Bell Labs, USA*

2:45 PM, Non-conservative Forces in Optical Tweezers, David G. Grier; *New York Univ., USA*

3:05 PM, Torsional Studies Of Single Biological Molecules, Michelle Wang; *Cornell Univ., USA*

4:00 PM, The Man and His Science, John Bjorkholm; *Consultant, USA*

4:25 PM, A Subjective History of Laser Cooling, Hal Metcalf; *Stony Brook Univ., USA*

4:50 PM, Multi-Photon Laser Cooling, James (Trey) Porto, Saijun Wu, Roger Brown, *W. P. Phillips; NIST Res. Library, USA.*

5:15 PM, Laser Cooling and Trapping the Most Magnetic Atom, Dysprosium, Benjamin Lev, Mingwu Lu, Seo Ho Youn*; Univ. of Illinois at Urbana-Champaign, USA*

Industrial Physics Forum

LASERFEST
CELEBRATING 50 YEARS OF LASER INNOVATION
WWW.LASERFEST.ORG

Symposium organizers: OSA and AIP Corporate Associates

The Industrial Physics Forum (IPF) brings together invited speakers to address relevant and timely topics in the industrial sector. In celebration of LaserFest 2010, this 52nd IPF is themed "Applications of Laser Technology". Three themed sessions range in topic from biomedical applications to environmental applications to metrology. A special Frontiers in Physics session addresses the most exciting physics research going on today, regardless of field.

Invited Speakers Include:

Monday, October 25, 2010

Biomedical Applications of Lasers

1:30 PM, Laser Refractive Cataract Surgery with the LenSx Laser, Michael Karavitis, *Lens X, USA*

2:00 PM, Applications of Table Top Lasers Developed from the FEL, David Piston, *Vanderbilt Univ., USA*

2:30 PM, From Photonics to Genomics: Lasers and Imaging Technology Enables Next-Generation DNA Sequencing, Suzanne Wakelin; *Ilumina, USA.*

3:00 PM, Biomedical Imaging with Optical Coherence Tomography, James Fujimoto, *MIT, USA*
Environment Applications of Lasers

4:00 PM, NASA's Space Lidar Measurements of Earth and Planetary Surfaces, Jim Abshire, *NASA Goddard Space Flight Ctr., USA*

4:30 PM, The Physics and Technology of Quantum Cascade Lasers, Federico Capasso, *Harvard Univ., USA*

5:00 PM, Tunable Infrared Laser Measurements of Industrial Process and Product Emissions, Charles Kolb, *Aerodyne Res., USA*

5:30 PM, Laser Remote Sensing of the Earth: Calipso and beyond, Carl Weimer, *Ball Aerospace, USA*

Tuesday, October 26, 2010

Laser Applications in Metrology

8:00 AM, Use of Lasers in Time and Frequency Applications (or Metrology), Scott Diddams, *NIST, USA*

8:30 AM, Laser Fuse Processing for Advanced Memory Designs, Joohan Lee, *GSI Laser Systems, USA*

9:00 AM, Dynamic Interferometry for on-Machine Metrology, Michael North Morris, *4D Technology, USA*

9:30 AM, The Electronic Kilogram and Lasers, Richard Steiner, *NIST*, USA

Frontiers in Physics

10:30 AM, Viewing the High-Energy Universe with the Fermi Gamma-ray Space Telescope, Peter Michelson, *SLAC, USA*

11:30 AM, Epitaxial Graphene: Designing a New Electronic Material, Walter de Heer, *Georgia Tech, USA*

12:00 PM, The Status of the CERN Large Hadron Collider (LHC), Dan Green, *Fermilab, USA*

11:00 AM, Quantum Entanglement and Information, Chris Monroe, *Univ. of Maryland at College Park, USA*

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 10th 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 more than 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.

Click here to view the complete Laser Science Symposium on Undergraduate Research.

Symposium on Optical Communications

Symposium organizers: Karl Koch[1], Colin McKinstrie[2]; [1]Corning Inc., USA, [2]Bell Labs, Alcatel-Lucent, USA

In 2009, Charles Kuen Kao was awarded a Nobel Prize in Physics “for groundbreaking achievements concerning the transmission of light in fibers for optical communications.” (See http://nobelprize.org/nobel_prizes/physics/laureates/2009/press.html.)

In recognition of this honor, there will be a special symposium on optical communications. An illustrious collection of invited speakers will review the history and physics of optical fiber communication systems, from the first demonstration, in which a video signal was transmitted over 20 meters, to contemporary systems, which transmit information at rates of 10 gigabits per second and higher over distances of thousands of kilometers.

Invited Speakers include:

Wednesday, October 27, 2010

1:30 PM, Historical Overview of Optical Communications, Tingye Li; *AT&T Labs, USA*

2:00 PM, Development of Low-Loss Fibers, P. Schultz; *Corning, USA*

2:30 PM, Title to Be Announced, David Payne; *Univ. of Southampton, USA*

4:00 PM, Development of Semiconductor DFB Lasers and Modulators, T. Koch; *Lehigh Univ., USA*

4:30 PM, Solitons, Nonlinearities and Noise in Long-Haul Optical Transmission Systems, L. Mollenauer; *Bell Labs, USA*

5:00 PM, Integrated Optics in Optical Communication Systems, Hiroshi Takahashi; *NTT Photonics Labs, Japan*

5:30 PM, Capabilities of the Undersea Telecommunications Industry, Neal S. Bergano; *Tyco Telecommunications, USA*

Short Courses

Register Now!

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 28, 2010. 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.

2010 Courses

Sunday, October 24, 2010, 9:00 a.m.-12:30 p.m.

NEW **SC189. Photonic Quantum-Enhanced Technologies, Ian Walmsley**; *Univ. of Oxford, UK*

SC306. Exploring Optical Aberations, Virendra N. Mahajan [1,2]; [1]*Aerospace Corp., USA,* [2] *College of Optical Sciences, Univ. of Arizona, USA*

SC321. Principles of Far-Field Fluorescence Nanoscopy, Andreas Schoenle, *Stefan Hell; Max Planck Inst. for Biophysical Chemistry, Germany*

Sunday, October 24, 2010, 1:30 p.m.–5:00 p.m.

SC323. Latest Trends in Optical Manufacturing, Paul Dumas; *QED Technologies Inc., USA*

SC324. Plasmonics, Stefan Maier; *Experimental Solid State Group, Dept. of Physics, Imperial College London, UK*

NEW **SC354. Compressive Sensing, Kevin Kelly**; *Rice Univ., USA* - **CANCELLED**

NEW **SC355. Attosecond Science, Paul Corkum**; *Natl. Res. Council of Canada, Canada* - **CANCELLED**

2010 Exhibitor & Sponsor List

4D Technology Corporation
ALPAO
American Elements

American Institute of Physics
American Physical Society (APS)
ASE Optics, Inc.
Biophotonic Solutions, Inc.
Bond, Schoeneck & King, PLLC
Boston Micromachines Corporation
Cambridge University Press
Chroma Technology Corp.
Corning Tropel Corporation
CVI Melles Griot
Electronic Product Services LLC
Energetiq Technology, Inc.
Femtolasers, Inc.
Fianium Ltd.
Glass Fab, Inc.
G-S PLASTIC OPTICS
Hamamatsu Corporation
Idesta QE
IMRA America
Laser Focus World
LaserFest
Lumetrics, Inc.
Menlo Systems
Mildex, Inc.
Nature Publishing Group
Newport Corporation
New Scale Technologies, Inc.
NKT Photonic Inc.
Nufern
Ohara Corporation
Omega Optical, Inc.
OPN, A Publication of OSA
Optikos Corporation
Optimax Systems, Inc.
Opto Alignment Technology, Inc.
OSA
OSA Foundation
PHASICS
Photonics Media/Laurin Publishing
Physics Today
Princeton Instruments, Inc.
Society of Vacuum Coaters
Solid State Cooling Systems
Swamp Optics, LLC
Sydor Optics, Inc.
Syntec Optics

Taylor & Francis
TeachSpin, Inc.
Thorlabs
Toptica Photonics, Inc.
University of Arizona, College of Optical Sciences
University of Central Florida, CREOL
University of Rochester, The Institute of Optics
VisiMax Technologies, Inc.
Volpi USA
Wiley-Blackwell
Wordingham Technologies
Zygo Corporation

Special Events

OSA Divisional and Technical Groups Meetings

What’s Hot in Optics Today?

FiO/LS Welcome Reception

Plenary Session and Awards Presentation

Industrial Physics Forum

VIP Industry Leaders Networking Event: Connecting OSA Corporate Members and Young Professionals

Joint FiO/LS Poster Sessions

OSA Fellow Members Lunch

Meet the Editors of the APS Journals

Industrial Physics Forum Corporate Reception

OSA Member, Family and Friends Special Events

Minorities and Women in OSA (MWOSA) Tea

Division of Laser Science Annual Business Meeting

OSA’s Annual Business Meeting

OSA Member LaserFest Reception

Industrial Physics Forum

Laser Science Banquet

Science Educators Day

FiO Postdeadline Session

Young Professionals and Student Activities

Omega Laser Facility tour at the Laboratory for Laser Energetics of the University of Rochester

Young Professional and Student Activities

OSA Member, Family, & Friends Program Events

OSA Divisional and Technical Groups 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.

Saturday, October 23, 12:30 p.m. - 1:00 p.m.
Class of '62 Auditorium, Univ. of Rochester
Vision and Color Division Business Meeting

Monday, October 25, 12:00 p.m. -1:30 p.m.
Grand Ballroom F/G, Hyatt Regency Rochester
Biomedical Optics Division Meeting

The chief topic of conversation will be requesting input on the design and implementation of an online community that links the new Biomedical Optics Express journal with the Biomedical Optics technical division. Please RSVP to Mindy Halpert at mhalpert@osa.org if you are interested in attending.

Tuesday, October 26, 7:00 p.m. – 8:00 p.m.
Grand Ballroom D, Hyatt Regency Rochester
Joint meeting of the OSA **Fabrication, Design and Instrumentation Division** and the Rochester OSA Local Section

Better Specification of Aspheric Shapes, Greg Forbes, *QED Technologies, Inc., Australia*
Modifying a widely used convention is a real challenge. This is especially so when it impacts on multiple groups, in our case, on optical designers, fabricators, and metrologists. Aspheric optics are an evolving technology that is currently burdened by the increasingly inadequate convention of expressing a rotationally symmetric asphere's sag as the sum of a conic component and an additive polynomial. When more than just a few terms appear in the polynomial, this becomes problematic and ultimately unworkable. The associated coefficients are unintuitive and inefficient. This leads to error-prone communications and a lack of easy options to appreciate the difficulty of manufacturing any particular asphere. Thankfully, the design and manufacture of increasingly complex aspheres is facilitated by a modified representation that is also ideal for exploiting cost-effective shapes.
In particular, an orthogonalised representation gives a description that functions with fewer coefficients and fewer digits —typically using only one third the number of digits for current designs— and allows easy interpretations and sanity checks as well as more direct assessments of manufacturability. Examples are presented to motivate us to make this change sooner rather than later.

Greg Forbes was on the faculty of The Institute of Optics at the University of Rochester for about ten years until the mid 90's. He returned to Australia as a Research Professor in Physics at Macquarie

University in Sydney. For the last ten years he has been Senior Scientist at QED Technologies. He lives in Sydney but regularly comes to visit and work with his colleagues and friends in Rochester

What's Hot in Optics Today?

Sunday, October 24, 4:00 p.m.–6:00 p.m.
Lilac Ballroom North and South, Rochester Riverside Convention Center

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.

- **What's Hot in Bio-Medical Optics**, Adam Wax; *Duke Univ., USA*
- **The Role of Optics in "Optical Communications"**, Juerg Leuthold; *Univ. of Karlsruhe, Germany*
- **Fabrication, Design and Instrumentation: Bio-Optical Design**, R. John Koshel; *Photon Engineering LLC and College of Optical Sciences/Univ. of Arizona, USA*
- **What's Hot in Information Acquisition, Processing and Display**, David Brady; *Duke Univ., USA*
- **Extreme Light Sources: From Artificial Sun to New Planets**, Irina Sorokina; *Norwegian Univ. of Science & Technology, Norway*
- **Vision and Color: Mapping the Visual Cortex**, Alex Wade; *Smith-Kettlewell Eye Res. Inst., USA*

Welcome Reception

Sunday, October 24, 6:00 p.m.–7:30 p.m.
Riverside Court and Galleria Lobby, Rochester Riverside Convention Center

Free to all Technical Conference Attendees: Get the FiO 2010/LS XXVI meeting off to a great start by attending the welcome reception! Meet with colleagues from around the world and enjoy light hors d'oeuvres.

Plenary Session and Awards Presentation

Monday, October 25, 8:00 a.m.–12:00 p.m.
Lilac Ballroom North and South, Rochester Riverside Convention Center

The 2010 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.

Industrial Physics Forum

LASERFEST
CELEBRATING 50 YEARS OF LASER INNOVATION
WWW.LASERFEST.ORG

Monday, October 25, 1:30 p.m. - 6:00 p.m.
Tuesday, October 26, 8:00 a.m. - 12:00 p.m.
Highland J, Rochester Riverside Convention Center

Symposium organizers: OSA and AIP Corporate Associates

The Industrial Physics Forum (IPF) brings together invited speakers to address relevant and timely topics in the industrial sector. In celebration of LaserFest 2010, this 52nd IPF is themed "Applications of Laser Technology". Three themed sessions range in topic from biomedical applications to environmental applications to metrology. A special Frontiers in Physics session addresses the most exciting physics research going on today, regardless of field.

VIP Industry Leaders Networking Event: Connecting OSA Corporate Members and Young Professionals

Tuesday, October 26, 8:00 a.m.–9:30 a.m. - **Free of Charge** and includes a Hot Buffet Breakfast
Grand Ballroom E & F, Hyatt Regency Rochester

Join OSA Corporate Members for an event that puts Young Professionals in contact with highly successful OSA members. After an informal networking session, each participant will have the opportunity for a brief visit with each corporate member to discuss careers, industry trends or any other topic. Corporate member participants include companies such as CVI Melles Griot and Toptica.

Space is limited. Members of OSA's Young Professionals program will be given registration priority, but any recent graduate is welcome to RSVP.

To RSVP or to join the Young Professionals program, email April Zack at azack@osa.org.

Joint FiO/LS Poster Sessions

Tuesday, October 26, 12:00 p.m.–1:30 p.m.
Wednesday, October 27, 12:00 p.m.–1:30 p.m.
Empire Hall, Rochester Riverside Convention Center

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 exhibit hall to enjoy the poster sessions.

OSA Fellow Members Lunch

Tuesday, October 26, 12:00 p.m. – 1:30 p.m.
Grand Ballroom A & B, Hyatt Regency Rochester

(Sponsored by the OSA Foundation)

All Fellow members are welcome, please RSVP via email at rsvp@osa.org by October 8, 2010. A RSVP is needed to reserve your space.

Meet the Editors of the APS Journals

Tuesday, October 26, 3:30 p.m.–5:00 p.m.
Riverside Court, Rochester Riverside Convention Center

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.

Industrial Physics Forum Corporate Reception

Hosted by OSA and AIP Corporate Associates
Tuesday, October 26, 4:00 pm – 5:00 pm
Empire Hall, Rochester Riverside Convention Center

Join your colleagues for a special invitation only reception for conference and exhibit attendees in the corporate community. Exhibitors, OSA and AIP Corporate Members, Industrial Physics Forum attendees and others will have time to connect with company associates and meet new business partners during this hors d'oeuvre hour. RSVP required by October 8 to cam@osa.org.

Minorities and Women in OSA (MWOSA) Tea

Tuesday, October 26, 4:30 p.m. – 5:30 p.m.(Free of Charge)
Grand Ballroom E & F, Hyatt Regency Rochester

Every year OSA features a speaker who discusses current issues and trends in the field. Everyone is welcome to attend; refreshments will be served! Check back soon for details. Questions? Email mwosa@osa.org.

Division of Laser Science Annual Business Meeting

Tuesday, October 26, 6:00 p.m.–7:00 p.m.
Highland H, Rochester Riverside Convention Center

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 26, 6:00 p.m.–7:00 p.m.
Highland A, Rochester Riverside Convention Center

Learn more about OSA and join the OSA Board of Directors for the Society’s annual business meeting. The 2009 activity reports will be presented and the results of the Board of Directors election will be announced. View the slate of candidates and vote.

OSA Member LaserFest Reception

Tuesday, October 26, 7:00 p.m. - 8:30 p.m.- Free Event for all OSA Members
Lilac Ballroom North and South, Rochester Riverside Convention Center

OSA Members are invited to a special reception recognizing LaserFest, the celebration of the 50th anniversary of the laser. This free event 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 membership card. If you join OSA on-site, please bring your receipt.

Laser Science Banquet

Tuesday, October 26, 7:00 p.m.–10:00 p.m.
Grand Ballroom A & B, Hyatt Regency Rochester

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 25.

FiO Postdeadline Papers

Wednesday, October 27, 7:00 p.m. – 8:30 p.m.
TBD, Rochester Riverside Convention Center

The FiO 2010 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.

LaserFest: Celebrating 50 years of Laser Innovation

LASERFEST
CELEBRATING 50 YEARS OF LASER INNOVATION
WWW.LASERFEST.ORG

Tour the Omega Laser Facility at the Univ. of Rochester's Laboratory for Laser Energetics (LLE)

Friday, October 29, 9:00 a.m. – 10:30 a.m.
Free of Charge

Transportation provided:	Buses depart from Rochester Riverside Convention Center. 9:00 a.m. ***Space is limited!***
Duration of Tour:	The tour will take 1 ½ hours including travel time to and from Laboratory. Buses will return you to the Rochester Riverside Convention Center.
Registration Deadline:	**Limited seats are available – Register on-site until October 26, 2010**

All Frontiers in Optics (FiO) and Laser Science (LS) Conference attendees are invited to tour the internationally renowned **Omega Laser Facility at the University of Rochester's Laboratory for Laser Energetics (LLE)**.

About the facility: In a steady march toward thermonuclear ignition and achievement of energy gain, the Laboratory for Laser Energetics has conducted inertial confinement fusion experiments since the early 1970's. Inertial confinement fusion involves heating and compressing fusion fuel that is exposed to intense laser or particle beams. A small spherical target containing fusion fuel is subjected to intense irradiation by high-power-energy sources that implode the target, compressing the fuel while heating the central core to thermonuclear temperatures. During the fall of 2009 and into the spring of 2010, LLE successfully developed and tested a technique to fill room-temperature, glass targets with deuterium–tritium (DT) fuel to 10 atm as is required for diagnostic purposes at the National Ignition Facility (NIF).

See the two lasers: OMEGA and OMEGA EP

- OMEGA stands 10 meters tall and is approximately 100 meters in length. This system delivers pulses of laser energy to targets in order to measure the resulting nuclear and fluid dynamic events. OMEGA's 60 laser beams focus up to 40,000 joules of energy in approximately one billionth of a second onto a target that measures less than 1 millimeter in diameter.
- OMEGA EP (extended performance) is an addition to OMEGA and extends the performance and capabilities of the OMEGA Laser System. It provides pulses having multikilojoule energies, picosecond pulse widths, petawatt powers, and ultrahigh intensities exceeding 1020 W/cm2. These beams are delivered to targets within the OMEGA target chamber, as well as an

independent chamber within the OMEGA EP target area. The new laser supports a wide variety of target-irradiation conditions when coupled to OMEGA or operated in stand-alone mode.

- Please visit LLE's website for more detailed information.

Agenda of Sessions — Sunday, October 24

7:00 a.m.–4:00 p.m.	**OSA Student Chapter Leadership Meeting,** *Bausch, Carlson and Douglass, Radisson Hotel Rochester Riverside*
7:00 a.m.–6:00 p.m.	**Registration,** *Galleria, Rochester Riverside Convention Center*
9:00 a.m.–12:30 p.m.	**SC189. Photonic Quantum-Enhanced Technologies,** *Ian Walmsley;* **SC306. Exploring Optical Aberrations,** *Virendra N. Mahajan;* **SC321. Principles of Far-Field Fluorescence Nanoscopy,** *Andreas Schoenle,* *Locations will be provided at registration*
12:30 p.m.–1:30 p.m.	**Lunch Break** *(on your own)*
1:30 p.m.–5:00 p.m.	**SC323. Latest Trends in Optical Manufacturing,** *Paul Dumas;* **SC324. Plasmonics,** *Stefan Maier;* **SC354. Compressive Sensing,** *Kevin Kelly;* **SC355. Attosecond Science,** *Locations will be provided at registration*
4:00 p.m.–6:00 p.m.	**What's Hot In Optics?** *Lilac Ballroom North and South, Rochester Riverside Convention Center*
6:00 p.m.–7:30 p.m.	**FiO/LS Welcome Reception,** *Galleria Lobby/Riverside Court, Rochester Riverside Convention Center*
7:30 p.m.–8:30 p.m.	**OSA Divison and Technical Group Meetings,** *Exact times and locations are listed on the Update Sheet*

Key to Shading

☐ Frontiers in Optics

░ Laser Science

▒ Joint

Agenda of Sessions — Monday, October 25

	Highland A	Highland B	Highland C	Highland D	Highland E
7:00 a.m.–6:00 p.m.	**Registration,** *Galleria, Rochester Riverside Convention Center*				
8:00 a.m.–12:00 p.m.	**2010 Joint FiO/LS Awards Ceremony and Plenary Session,** *Lilac Ballroom North and South, Rochester Riverside Convention Center*				
10:00 a.m.–10:30 a.m.	**Coffee Break, Lilac Ballroom Foyer,** *Rochester Riverside Convention Center*				
12:00 p.m.–2:00 p.m.	**LSMA• Laser Science Symposium on Undergraduate Research Posters,** *Riverside Court, Rochester Riverside Convention Center*				
12:00 p.m.–1:30 p.m.	**Lunch** *(on your own)*				
1:30 p.m.–3:30 p.m.	**FMA • Photonics and Energy I**	**LSMB • Laser Science Symposium on Undergraduate Research I**	**FMB • Structured Wavefields for Communications and Sensing I** (ends at 3:15 p.m.)	**FMC • Photonic Sensor I**	**FMD • Individualized Optical Correction of the Eye**
3:30 p.m.–4:00 p.m.	**Coffee Break,** *Highland Ballroom Foyer, Rochester Riverside Convention Center*				
4:00 p.m.–6:00 p.m.	**FMH • Silicon Photonics**	**LSMC • Laser Science Symposium on Undergraduate Research II** (ends at 6:30 p.m.)	**FMI • Structured Wavefields for Communications and Sensing II**	**FMJ • Photonic Sensor II**	**FMK • Emerging in vivo Imaging Techniques for Retinal Imaging** (ends at 5:30 p.m.)
6:30 p.m.–8:30 p.m.	**OSA/SPS Student Member Welcome Reception,** *Temple Bar & Grille, 109 East Avenue, Rochester, NY, Phone: 585.232.6000*				

Key to Shading

☐	Frontiers in Optics
░	Laser Science
▒	Joint

Highland F	Highland G	Highland H	Highland J	Highland K
Registration, *Galleria, Rochester Riverside Convention Center*				
2010 Joint FiO/LS Awards Ceremony and Plenary Session, *Lilac Ballroom North and South, Rochester Riverside Convention Center*				
Coffee Break, Lilac Ballroom Foyer, *Rochester Riverside Convention Center*				
LSMA• Laser Science Symposium on Undergraduate Research Posters, *Riverside Court, Rochester Riverside Convention Center*				
Lunch *(on your own)*				
FME • Spectroscopy, Imaging and Detection	**FMF • Quantum Information and Communications I**	**FMG • Non-Linear Imaging**	**SMB • IPF-Biomedical Applications of Lasers**	**LMA • Photophysics of Nanostructured Materials I**
Coffee Break, *Highland Ballroom Foyer, Rochester Riverside Convention Center*				
FML • Microscopy I (ends at 5:30 p.m.)	**FMM • Quantum Information and Communications II**	**FMN • Advances in High Energy Ultrafast Laser Systems**	**SMD • IPF- Environment Applications of Lasers**	**LMB • Novel Imaging, Spectroscopy and Manipulation in Microstructures I** (ends at 5:30 p.m.)
OSA/SPS Student Member Welcome Reception, *Temple Bar & Grille, 109 East Avenue, Rochester, NY, Phone: 585.232.6000*				

Agenda of Sessions — Tuesday, October 26

	Highland A	Highland B	Highland C	Highland D	Highland E
7:00 a.m.–5:30 p.m.	**Registration,** *Galleria, Rochester Riverside Convention Center*				
8:00 a.m.–9:30 a.m.	**VIP Industry Leaders Networking Event: Connecting OSA Corporate Members and Young Professionals,** *Grand Ballroom E and F, Hyatt Regency Rochester*				
8:00 a.m.–10:00 a.m.	**FTuA • Photonics and Energy II**	**FTuB • Adaptive Optics for the Eye**	**FTuC • Nonlinear Integrated Optics**	**FTuD • General Optics in Information Science** (ends at 9:45 a.m.)	**FTuE • General Optics**
10:00 a.m.–12:00 p.m.	**Students and Young Professionals Forum on Public Policy,** *Carlson and Douglass, Radisson Hotel Rochester Riverside*				
10:00 a.m.–10:30 a.m.	**Coffee Break,** *Empire Hall, Rochester Riverside Convention Center*				
10:00 a.m.–4:00 p.m.	**Exhibit Open,** *Empire Hall, Rochester Riverside Convention Center*				
10:30 a.m.–12:00 p.m.	**FTuH • Novel Fiber Device**	**FTuI • Optical Design for Biomedical Systems I**	**FTuJ • Ultrafast Fiber Laser**	**FTuK • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing I**	**FTuL • Frequency Combs for Spectroscopy**
12:00 p.m.–1:30 p.m.	**Exhibit Only Time,** *Empire Hall, Rochester Riverside Convention Center*				
12:00 p.m.–1:30 p.m.	**Lunch** *(on your own)*				
12:00 p.m.–1:30 p.m.	**OSA Fellow Member Lunch,** *Grand Ballroom A and B, Hyatt Regency Rochester*				
12:00 p.m.–1:30 p.m.	**JTuA • Joint FiO/LS Poster Session,** *Empire Hall, Rochester Riverside Convention Center*				
1:30 p.m.–5:40 p.m.	**STuC • Ashkin Symposium I,** *Grand Ballroom D, Hyatt Regency Rochester*				
1:30 p.m.–3:30 p.m.		**FTuO • General Wavefront Issues** (ends at 3:15 p.m.)	**FTuP • Novel Hybrid Integration I**	**FTuQ • Disorder In Integrated Optical Devices and Circuits I**	**FTuR • Dispersion in Ultrafast Laser Amplifiers**
3:30 p.m.–5:00 p.m.	**Meet the Editors of APS Journals,** *Riverside Court, Rochester Riverside Convention Center*				
3:30 p.m.–4:00 p.m.	**Coffee Break,** *Empire Hall, Rochester Riverside Convention Center*				
4:00 p.m.–5:00 p.m.	**Industrial Physics Forum Corporate Reception,** *Empire Hall, Rochester Riverside Convention Center*				
4:00 p.m.–5:30 p.m.		**FTuU • Astrophotonics I**	**FTuV • Optical Communication I**	**FTuW • Novel Fibers**	**FTuX • Attosecond Optics and Technnology I**
4:30 p.m.–5:30 p.m.	**Minorities and Women in OSA (MWOSA) Tea,** *Grand Ballroom E and F, Hyatt Regency Rochester*				
6:00 p.m.–7:00 p.m.	**OSA Business Meeting,** *Highland A, Rochester Riverside Convention Center*				
6:00 p.m.–7:00 p.m.	**LS Business Meeting,** *Highland H, Rochester Riverside Convention Center*				
6:00 p.m.–7:00 p.m.	**OSA Graduation Party,** *Riverview Lounge, Radisson Hotel Rochester Riverside*				
7:00 p.m.–8:30 p.m.	**OSA LaserFest Member Reception,** *Lilac Ballroom North and South, Rochester Riverside Convention Center*				
7:00 p.m.–10:00 p.m.	**LS Banquet,** *Grand Ballroom A and B, Hyatt Regency Rochester*				
9:00 p.m.–11:00 p.m.	**OSA Student Member Party,** *Tavern 58 at Gibbs, 58 University Avenue, Rochester, NY, Phone: 585.546.5800*				

Key to Shading

☐ Frontiers in Optics ▨ Laser Science ■ Joint

<table>
<tr><th>Highland F</th><th>Highland G</th><th>Highland H</th><th>Highland J</th><th>Highland K</th></tr>
<tr><td colspan="5">Registration, <i>Galleria, Rochester Riverside Convention Center</i></td></tr>
<tr><td colspan="5">VIP Industry Leaders Networking Event: Connecting OSA Corporate Members and Young Professionals, <i>Grand Ballroom E and F, Hyatt Regency Rochester</i></td></tr>
<tr><td>FTuF • Microscopy II</td><td>FTuG • Quantum Information and Communications III</td><td>LTuA • Photophysics of Nanostructured Materials II</td><td>STuA • IPF-Laser Applications in Metrology</td><td>LTuB • Nonlinear Optics I</td></tr>
<tr><td colspan="5">Students and Young Professionals Forum on Public Policy, <i>Carlson and Douglass, Radisson Hotel Rochester Riverside</i></td></tr>
<tr><td colspan="5">Coffee Break, <i>Empire Hall, Rochester Riverside Convention Center</i></td></tr>
<tr><td colspan="5">Exhibit Open, <i>Empire Hall, Rochester Riverside Convention Center</i></td></tr>
<tr><td>FTuM • Trapping I</td><td>FTuN • Opto-Mechanics and Quantum Measurement I</td><td>LTuC • Photophysics of Nanostructured Materials III</td><td>STuB • IPF - Frontiers in Physics</td><td>LTuD • Novel Imaging, Spectroscopy and Manipulation in Microstructures II</td></tr>
<tr><td colspan="5">Exhibit Only Time, <i>Empire Hall, Rochester Riverside Convention Center</i></td></tr>
<tr><td colspan="5">Lunch <i>(on your own)</i></td></tr>
<tr><td colspan="5">OSA Fellow Member Lunch, <i>Grand Ballroom A and B, Hyatt Regency Rochester</i></td></tr>
<tr><td colspan="5">JTuA • Joint FiO/LS Poster Session, <i>Empire Hall, Rochester Riverside Convention Center</i></td></tr>
<tr><td colspan="5">STuC • Ashkin Symposium I, <i>Grand Ballroom D, Hyatt Regency Rochester</i></td></tr>
<tr><td>FTuS • Therapy</td><td>FTuT • Quantum Information and Communications IV</td><td>LTuE • Attosecond and Strong Field Physics I</td><td>LTuF • Optofluidics in the Near-Field I</td><td>LTuG • Nonlinear Optics II
(ends at 3:15 p.m.)</td></tr>
<tr><td colspan="5">Meet the Editors of APS Journals, <i>Riverside Court, Rochester Riverside Convention Center</i></td></tr>
<tr><td colspan="5">Coffee Break, <i>Empire Hall, Rochester Riverside Convention Center</i></td></tr>
<tr><td colspan="5">Industrial Physics Forum Corporate Reception, <i>Empire Hall, Rochester Riverside Convention Center</i></td></tr>
<tr><td>FTuY • Coherence Tomography</td><td>FTuZ • Opto-Mechanics and Quantum Measurement II
(ends 5:15 p.m.)</td><td>LTuH • Frontiers in Ultracold Molecules I
(ends at 5:15 p.m.)</td><td>LTuI • Optofluidics in the Near-Field II
(ends at 5:15 p.m.)</td><td>LTuJ • Laser Cooling and Trapping
(ends 4:45 p.m.)</td></tr>
<tr><td colspan="5">Minorities and Women in OSA (MWOSA) Tea, <i>Grand Ballroom E and F, Hyatt Regency Rochester</i></td></tr>
<tr><td colspan="5">OSA Business Meeting, <i>Highland A, Rochester Riverside Convention Center</i></td></tr>
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<tr><td colspan="5">OSA Graduation Party, <i>Riverview Lounge, Radisson Hotel Rochester Riverside</i></td></tr>
<tr><td colspan="5">OSA LaserFest Member Reception, <i>Lilac Ballroom North and South, Rochester Riverside Convention Center</i></td></tr>
<tr><td colspan="5">LS Banquet, <i>Grand Ballroom A and B, Hyatt Regency Rochester</i></td></tr>
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</table>

Agenda of Sessions — Wednesday, October 27

	Highland A	Highland B	Highland C	Highland D	Highland E
7:30 a.m.–5:00 p.m.	**Registration,** *Galleria, Rochester Riverside Convention Center*				
8:00 a.m.–10:00 a.m.	**FWA • Astrophotonics II** (ends at 9:45 a.m.)	**FWB • Biochemical Sensing**	**FWC • Optical Design with Unconventional Polarization I**	**FWD • Novel Hybrid Integration II**	**FWE • Attosecond Optics and Technnology II**
10:00 a.m.–10:30 a.m.	**Coffee Break,** *Empire Hall, Rochester Riverside Convention Center*				
10:00 a.m.–2:00 p.m.	**Exhibit Open,** *Empire Hall, Rochester Riverside Convention Center*				
10:30 a.m.–12:00 p.m.	**FWH • Sensing in Higher Dimensions — Theory and Hardware for Computational Imaging I** (ends at 11:45 a.m.)	**FWI • Optical Communication II**	**FWJ • Image-Based Wavefront Sensing I**	**FWK • Fiber Laser**	**FWL • Laser Based Particle Acceleration I**
12:00 p.m.–1:30 p.m.	**Exhibit Only Time,** *Empire Hall, Rochester Riverside Convention Center*				
12:00 p.m.–1:30 p.m.	**Lunch** *(on your own)*				
12:00 p.m.–1:30 p.m.	**JWA • FiO Poster Session,** *Empire Hall, Rochester Riverside Convention Center*				
1:30 p.m.–3:30 p.m.	**SWA • Optical Communications Symposium I**	**FWO • Plasmonics and Metamaterials for Information Processing I**	**FWP • Optical Design with Unconventional Polarization II**	**FWQ • Photonic Bandgap and Slow Light**	**FWR • Laser Based Particle Acceleration II**
3:30 p.m.–4:00 p.m.	**Coffee Break,** *Highland Ballroom Foyer Rochester Riverside Convention Center*				
4:00 p.m.–5:30 p.m.	**SWB • Optical Communications Symposium II**	**FWU • Plasmonics and Metamaterials for Information Processing IV**	**FWV • Image-Based Wavefront Sensing II**	**FWW • Nonlinear Fiber Optics**	**FWX • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing II**
4:30 p.m.–8:00 p.m.	**Science Educators' Day,** *Lilac Ballroom North and South, Rochester Riverside Convention Center*				
7:00 p.m.–8:30 p.m.	**FiO Postdeadline Paper Sessions,** *See the Postdeadline Papers Book in your registration bag for exact times and locations*				

Key to Shading

☐ Frontiers in Optics ░ Laser Science ▒ Joint

Highland F	Highland G	Highland H	Highland J	Highland K
Registration, *Galleria, Rochester Riverside Convention Center*				
FWF • Biosensing	**FWG • Nonlinearities and Gain in Plasmonics and Metamaterials I**	**LWA • Hybrid Quantum Systems I**	**LWB • Metrology and Precision Measurements I**	**LWC • Photophysics of Energy Conversion I** (ends at 10:15 a.m.)
Coffee Break, *Empire Hall, Rochester Riverside Convention Center*				
Exhibit Open, *Empire Hall, Rochester Riverside Convention Center*				
FWM • Trapping II	**FWN • Nonlinearities and Gain in Plasmonics and Metamaterials II**	**LWD • Hybrid Quantum Systems II** (ends at 12:45 p.m.)	**LWE • Quantum Enhanced Information Processing I** (ends at 12:30 p.m.)	**LWF • Single Molecule Approaches to Biology I**
Exhibit Only Time, *Empire Hall, Rochester Riverside Convention Center*				
Lunch *(on your own)*				
JWA • FiO Poster Session, *Empire Hall, Rochester Riverside Convention Center*				
FWS • Nanopatterning and Meta-materials	**FWT • Disorder In Integrated Optical Devices and Circuits II**	**LWG • General Laser Science**	**LWH • Chemical Dynamics I: Multi-Dimensional Ultrafast Spectroscopy**	**LWI • Photophysics of Energy Conversion II**
Coffee Break, *Highland Ballroom Foyer Rochester Riverside Convention Center*				
FWY • Optical Design for Biomedical Systems II	**FWZ • General Non-linear Optics**	**LWJ • Quantum Enhanced Information Processing II**	**LWK • Attosecond and Strong Field Physics II**	**LWL • Single Molecule Approaches to Biology II**
Science Educators' Day, *Lilac Ballroom North and South, Rochester Riverside Convention Center*				
FiO Postdeadline Paper Sessions, *See the Postdeadline Papers Book in your registration bag for exact times and locations*				

Agenda of Sessions — Thursday, October 28

	Highland A	Highland B	Highland C	Highland D	Highland E
7:30 a.m.–5:30 p.m.	**Registration,** *Galleria, Rochester Riverside Convention Center*				
8:00 a.m.–10:00 a.m.	**FThA • Nonlinear Optics in Micro/Nano-Optical Structures I**	**FThB • Plasmonics**	**FThC • Integrated Optics**	**FThD • Novel Measurement Techniques**	**FThE • Lasers for Fusion and Fast Ignition**
10:00 a.m.–10:30 a.m.	**Coffee Break,** *Highland Ballroom Foyer Rochester Riverside Convention Center*				
10:30 a.m. –12:00 p.m.	**FThH • Nonlinear Optics in Micro/Nano-Optical Structures II**	**FThI • Optical Signal Processing Device**	**FThJ • Photonic Crystal**	**FThK • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing III**	**FThL • Nonlinearities and Gain in Plasmonics and Metamaterials III** (ends at 12:15 p.m.)
12:00 p.m.–1:30 p.m.	**Lunch Break** *(on your own)*				
1:30 p.m.–3:30 p.m.	**FThO • Nonlinear Optics in Micro/Nano-Optical Structures III**	**FThP • General Optical Instrumentation**	**FThQ • Micro Resonators**	**FThR • Plasmonics and Metamaterials for Information Processing II**	**FThS • Strong THz Fields and Applications**
3:30 p.m.–4:00 p.m.	**Coffee Break,** *Highland Ballroom Foyer Rochester Riverside Convention Center*				
4:00 p.m.–6:00 p.m.	**FThW • Three-Dimensional Meta-materials**	**FThX • Fabrication and Testing**	**FThY • Plasmonics and Metamaterials for Information Processing III**	**FThZ • THz Fields and Nonlinear Optics**	**FThAA • Optics in Micro/nano Devices**

Agenda of Sessions

Key to Shading

□	Frontiers in Optics
▨	Laser Science
▩	Joint

Highland F	Highland G	Highland H	Highland J	Highland K
Registration, *Galleria, Rochester Riverside Convention Center*				
FThF • Transformation Optics and Cloaking with Metamaterials	**FThG • General Quantum Electronics I**	**LThA • Chemical Dynamics II: Multi-Dimensional Ultrafast Spectroscopy** (ends at 9:45 a.m.)	**LThB • Frontiers in Ultracold Molecules II**	**LThC • Nanophotonics, Photonic Crystals and Structural Slow Light I** (ends at 9:45 a.m.)
Coffee Break, *Highland Ballroom Foyer Rochester Riverside Convention Center*				
FThM • Sensing in Higher Dimensions — Theory and Hardware for Computational Imaging II	**FThN • General Quantum Electronics II**	**LThD • Single Molecule Approaches to Biology III**	**LThE • Quantum Enhanced Information Processing III**	**LThF • Nanophotonics, Photonic Crystals and Structural Slow Light II** (ends at 11:45 a.m.)
Lunch Break *(on your own)*				
FThT • Encoding Optical Information — Nano-photonics, Diffractive Optics and Refractive Optics for Shaping Optical Signals	**FThU • Lens Design**	**LThG • Metrology and Precision Measurements II** (ends at 3:45 p.m.)	**LThH • Frontiers in Ultracold Molecules III** (ends at 2:45 p.m.)	**FThV • Diffractive and Holographic Optics I**
Coffee Break, *Highland Ballroom Foyer Rochester Riverside Convention Center*				
FThBB • Difractive and Holographic Optics II				

Highland A	Highland B	Highland C	Highland D	Highland E
FiO	LS	FiO		

7:00 a.m.–6:00 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

8:00 a.m.–12:00 p.m. 2010 Joint FiO/LS Awards Ceremony and Plenary Session, *Lilac Ballroom North and South, Rochester Riverside Convention Center*

10:00 a.m.–10:30 a.m. Coffee Break, *Lilac Ballroom Foyer, Rochester Riverside Convention Center*

12:00 p.m.–2:00 p.m. LSMA: Laser Science Symposium on Undergraduate Research Posters, *Riverside Court, Rochester Riverside Convention Center*

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

1:30 p.m.–3:30 p.m.
FMA • Photonics and Energy I
Sylvain G. Cloutier; Univ. of Delaware, USA, Presider

FMA1 • 1:30 p.m. **Invited**

Luminescent Solar Concentrators: From Optical Heat Pumps to Solar Pumped Lasers, ***C. Rotschild***[1], *M. Tomes*[2], *H. Mendoza*[1], *T. Carmon*[2], *M. Baldo*[1]; [1]*MIT, USA,* [2]*Univ. of Michigan, USA.* Luminescent solar concentrators (LSCs) do not need to track the sun. We experimentally demonstrate non-resonant pumping of a high-quality factor lasers, with the promise of dramatic increases in the efficiency of LSCs.

2:00 p.m.–4:00 p.m.
LSMB • Laser Science Symposium on Undergraduate Research I

1:30 p.m.–3:15 p.m.
FMB • Structured Wavefields for Communications and Sensing I
Kevin Thompson; Optical Res. Associates, USA, Presider

FMB1 • 1:30 p.m. **Invited**

Effects of Type of Incidence on the Second and Fourth Order Moment Parameters Evaluated in Turbulent Atmosphere, ***Yahya K. Baykal***; *Çankaya Univ., Turkey.* Using a general type incidence, the second and fourth order moments are formulated in atmospheric turbulence. Received field and intensity correlations are evaluated and the behaviour of these correlations are compared for different beam types.

1:30 p.m.–3:30 p.m.
FMC • Photonic Sensor I
N. J. Tao; Arizona State Univ., USA, Presider

FMC1 • 1:30 p.m. **Invited**

Long-Term Monitoring of Local Temperature and Strain Changes in a Buried Fiber-Optic Cable Using Brillouin OTDR, ***Jonathan A. Nagel***; *AT&T Labs-Res., USA.* Abstract not available.

1:30 p.m.–3:30 p.m.
FMD • Individualized Optical Correction of the Eye
Jason Porter, Univ. of Houston, Presider

FMD1 • 1:30 p.m. **Invited**

The Use of Adaptive Optics to Study Optical and Neural Impact on Visual Performance, ***Geun-Young Yoon***; *Univ. of Rochester, USA.* Recent advances in adaptive optics enhanced our understanding of optics of the eye and its impact on visual performance. It was found with adaptive optics that long-term neural adaptation to their native higher order aberrations compensated for some of the detrimental impact of optical blur on visual performance in highly aberrated eyes.

Highland F	Highland G	Highland H	Highland J	Highland K
FiO			JOINT FiO/LS	LS

7:00 a.m.–6:00 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

8:00 a.m.–12:00 p.m. 2010 Joint FiO/LS Awards Ceremony and Plenary Session, *Lilac Ballroom North and South, Rochester Riverside Convention Center*

10:00 a.m.–10:30 a.m. Coffee Break, *Lilac Ballroom Foyer, Rochester Riverside Convention Center*

12:00 p.m.–2:00 p.m. LSMA: Laser Science Symposium on Undergraduate Research Posters, *Riverside Court, Rochester Riverside Convention Center*

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

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

Gregory R. Kilby; United States Military Acad., USA, Presider

FME1 • 1:30 p.m. Invited

Monitoring Breast Cancer Tumor Response at Different Timepoints During Pre-Surgical Chemotherapy with Diffuse Optical Spectroscopic Imaging, *Albert Cerussi*[1], *Vaya W. Tanamai[1], Darren Roblyer[1], Shigeto Ueda[1], Amanda F. Durkin[1], Rita S. Mehta[2], David Hsiang[2], John Butler[2], Bruce J. Tromberg[1]; [1]Beckman Laser Inst., USA, [2]Chao Comprehensive Cancer Ctr., USA.* Diffuse Optical Spectroscopic Imaging (DOSI) provides non-invasive functional biomarkers that correlate with final pathological response to pre-surgical (neoadjuvant) chemotherapy in breast cancer patients that are measured at various timepoints throughout the therapy

1:30 p.m.–3:15 p.m.
FMF • Quantum Information and Communications I

Luiz Davidovich; Univ. Federal do Rio de Janeiro, Brazil, Presider

FMF1 • 1:30 p.m.

Frequency Translation of Single-Photon States by Four-Wave Mixing in a Photonic Crystal Fiber, *Hayden J. McGuinness*[1], *Michael G. Raymer[1], Colin J. McKinstrie[2], Stojan Radic[3]; [1]Univ. of Oregon, USA, [2]Bell Labs, USA, [3]Univ. of California at San Diego, USA.* Frequency translation of single-photon states in optical fiber through use of the Bragg scattering four-wave mixing process is studied. We achieve 28 percent translation and verify the nonclassical nature of the involved light.

FMF2 • 1:45 p.m.

Quantum Transduction of Telecommunications-band Single Photons from a Quantum Dot by Frequency Upconversion, *Matthew T. Rakher*[1], *Lijun Ma[2], Oliver Slattery[2], Xiao Tang[2], Kartik Srinivasan[1]; [1]Ctr. for Nanoscale Science and Technology, USA, [2]Information Technology Lab, USA.* Single photon emission from an InAs quantum dot emitting at 1.3 µm is upconverted to 710 nm in a periodically-poled $LiNbO_3$ waveguide using a 1550 nm pump. The upconverted light exhibits photon anti-bunching with $g^{(2)}(0)=0.165$.

1:30 p.m.–3:30 p.m.
FMG • Non-Linear Imaging

Jason Fleischer; Princeton Univ., USA, Presider

FMG1 • 1:30 p.m. Invited

Non-Linear Imaging with Ultrashort Shaped Pulses, *Dmitry Pestov,* *Yair Andegeko, Vadim V. Lovozoy, Marcos Dantus; Michigan State Univ., USA.* Dispersion compensation of ultrashort pulses at the focal plane leads to significantly greater signal. Our presentation will focus on observed photobleaching and photoenhancement of two-photon fluorescent signal for long (200fs) and ultrashort (sub-15fs) pulses.

1:30 p.m.–3:30 p.m.
SMA • IPF-Biomedical Applications of Lasers

Michael Stanley; Chroma Technology Corp., USA, Presider

SMA1 • 1:30 p.m. Invited

Laser Refractive Cataract Surgery with the LenSx Laser, *Michael Karavitis*; *LenSx Lasers, Inc., USA.* At LenSx Lasers, we have developed a femtosecond laser for cataract surgery. The high precision of ultrashort laser pulse photodisruption in tissue results in a safer procedure with enhanced visual outcomes over tradition cataract surgery.

1:30 p.m.–3:30 p.m.
LMA • Photophysics of Nanostructured Materials I

Linda Peteanu; Carnegie Mellon Univ., USA, Presider

LMA1 • 1:30 p.m. Invited

Photophysical Consequences of Interactions Between Conjugated Chromophores, *Lewis Rothberg*[1], *S. Paquette[1], J. Rhinehart[1], D. McCamant[1], O. Kas[2], M. Charati[2], M. Galvin[2], K. Kiick[2]; [1]Univ. of Rochester, USA, [2]Univ. of Delaware, USA.* We study phenylenevinylene chromophore pairs whose spacing and orientation can be varied by coupling them to peptide backbones. Copious interchromophore excitations are observed and explain reduced fluorescence yields in conjugated polymer films relative to solutions.

Highland A

FiO

FMA • Photonics and Energy I—Continued

FMA2 • 2:00 p.m. Invited

Depleted Heterojunction Colloidal Quantum Dot Solar Cells Depleted Heterojunction Colloidal Quantum Dot Solar Cells Employing Low-Cost Metal Contacts, *Illan Kramer*[1], *Ratan Debnath[1], Andras G. Pattantyus-Abraham[1], Aaron R. Barkhouse[1], Xihua Wang[1], Larissa Levina[1], Jiang Tang[1], Armin Fischer[1], Gerasimos Konstantatos[1,2], Mark T. Greiner[1], Zheng-Hong Lu[1,3], Ines Raabe[4], Mohammad K. Nazeeruddin[4], Michael Grätzel[4], Edward H. Sargent[1]; [1]Univ. of Toronto, Canada, [2]ICFO, Spain, [3]Yunnan Univ., China, [4]Swiss Federal Inst. of Technology, Switzerland.* We present a solar cell architecture that simultaneously accentuates the benefits of lead chalcogenide colloidal quantum dots while addressing their shortcomings. The resulting 3-dimensional heterojunction exhibits over 5% power conversion efficiency.

FMA3 • 2:30 p.m. Invited

Nanoscale Photon Management for Efficient Photovoltaic Energy Harvesting, *Mark Brongersma*; *Stanford Univ., USA.* Plasmonics is gaining significant interest for its ability to boost the energy conversion efficiency of solar cells by directing and concentrating light in those regions of a cell where photogenerated carriers are effectively pulled apart.

Highland B

LS

LSMB • Laser Science Symposium on Undergraduate Research I—Continued

Highland C

FiO

FMB • Structured Wavefields for Communications and Sensing I—Continued

FMB2 • 2:00 p.m.

Using Transformation Optics to Measure Optical Orbital Angular Momentum, *Johannes K. Courtial*[1], *Martin P. J. Lavery[1], Gregorius C. G. Berkhout[2], Tomáš Tyc[3]; [1]Univ. of Glasgow, UK, [2]Leiden Univ., Netherlands, [3]Masaryk Univ., Czech Republic.* Transformation optics is used to image two planes into each other and at the same time distort them such that orbital angular momentum (OAM) becomes transverse momentum. This allows sorting of optical OAM components.

FMB3 • 2:15 p.m.

Measurement of Atmospheric Turbulence Strength by Vortex Beam, *Yalong Gu*, *Greg Gbur; Univ. of North Carolina at Charlotte, USA.* An approximate expression of radius of ring dislocation as a function of atmospheric turbulence strength parameter C_n^2 has been derived. It can be used to measure atmospheric turbulence strength, even in the strong turbulence regime.

FMB4 • 2:30 p.m.

Self-Similar Structured Fields in Coherent Diffusing Media, *Ofer Firstenberg*[1], *Paz London[1], Dimitry Yankelev[1], Rami Pugatch[2], Moshe Shuker[1], Nir Davidson[2]; [1]Technion-Israel Inst. of Technology, Israel, [2]Weizmann Inst. of Science, Israel.* We derive and measure self-similarly evolving fields under coherent diffusion, analogous to Gaussian modes of optical diffraction. We obtain a quasi-eigenmodes description of polariton dynamics in thermal vapor in the limit of dominating diffusion.

Highland D

FMC • Photonic Sensor I—Continued

FMC2 • 2:00 p.m.

Structural Damping-Induced Thermal Noise in Fiber Interferometric Systems, *Lingze Duan*; *Univ. of Alabama, Huntsville, USA.* Fiber thermal noise caused by structural damping is analyzed using a 1-D model based on the Fluctuation-Dissipation Theorem. The result provides a new perspective on the precision limit of fiber interferometric systems at low frequencies.

FMC3 • 2:15 p.m.

Rayleigh Backscattering from Optical Fibers - Could it Be Used to Identify Individual Fibers? *Misha Brodsky*[1], *Jungmi Oh[1], Moshe Tur[2], Paul Henry[1]; [1]AT&T Labs, USA, [2]Tel Aviv Univ., Israel.* We probe stochastic fluctuations in Rayleigh backscattering with a photon-counting OTDR apparatus. Surprisingly, the statistics of these fluctuations can be captured by a simple empirical model. The temporal stability of the data is discussed.

FMC4 • 2:30 p.m. Invited

Raman-Based Distributed Temperature Sensors, *Arthur Hartog*; *Schlumberger Fiber-Optic Technology Ctr., UK.* The paper reviews the technology, practical challenges and main applications of Raman distributed temperature sensing and discusses recent developments in system performance and reliability in harsh environments are also discussed.

Highland E

FMD • Individualized Optical Correction of the Eye—Continued

FMD2 • 2:00 p.m.

Reading Distance of Multifocal Intraocular Lenses, *Marrie van der Mooren*, *Henk Weeber, Patricia Piers; AMO Groningen BV, Netherlands.* Diffractive Multifocal intraocular lenses are currently a viable option for presbyopia correction. This paper describes reading distance in relation with refractive error and location of diffractive profile.

FMD3 • 2:15 p.m. Invited

Performance of Aspheric IOLs, *Susana Marcos*[1], *Sergio Barbero[1], Patricia Rosales[1], Alberto de Castro[1], Lourdes Llorente[1], Carlos Dorronsoro[1], Ignacio Jiménez-Alfaro[2]; [1]Inst. de Optica, CSIC, Spain, [2]Fundación Jiménez-Díaz, Spain.* Aspheric IOLs induce negative spherical aberration in order to emulate young crystalline lenses. We present optical aberrations in pseudophakic eyes, the effect of misalignment on optical performance, using customized eye models, and new aspheric designs.

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

Highland F

FiO

FME • Spectroscopy, Imaging and Detection—Continued

FME2 • 2:00 p.m.
Artifact Removal from Scanning Laser Ophthalmoscope Images Using Principal Component Analysis, *Matthew S. Muller*[1], *Ann E. Elsner*[2]; [1]*Aeon Imaging, LLC, USA*, [2]*Indiana Univ., USA*. The use of dynamic fixation targets in the Laser Scanning Digital Camera creates sufficient inter-frame image differences to rapidly remove central reflection artifacts in post-processing using Principal Component Analysis.

FME3 • 2:15 p.m.
Fluorescence of Influenza Hemagglutinin Surface Protein, *Alvin Katz*[1], *Alexandra Alimova*[1], *Paul Gottlieb*[1], *Jerry Keith*[2], *John Robbins*[2], *Rachel Schneerson*[2], *Swapan K. Gayen*[1]; [1]*City College of New York, USA*, [2]*Natl. Inst. of Child Health and Human Development, USA*. Spectroscopy of avian influenza hemagglutinin reveals changes in peak position and emission intensity of tryptophan fluorescence upon exposure to an acidic environment. These are attributed to conformational changes in the hemagglutinin induced by lower pH.

FME4 • 2:30 p.m.
Pulsed THz Radiation in near-Field Domain: Enhanced Scattering and Exceeding Diffraction Limitations, *Sergei Popov*[1], ***Srinivasan Iyer***[1], *Sergey Sergeyev*[2], *Ari T. Friberg*[1,3,4]; [1]*Royal Inst. of Technology, Sweden*, [2]*Waterford Inst. of Technology, Ireland*, [3]*Aalto Univ., Finland*, [4]*Univ. of Joensuu, Finland*. SNOM technique used in THz range demonstrates enhanced scattering in far-field region and increased resolution of the scanned image. We develop a rigorous numerical model which can properly describe both these phenomena.

Highland G

FMF • Quantum Information and Communications I—Continued

FMF3 • 2:00 p.m.
The Role of Pump Coherence in a Two-photon Interference Experiment, *Junlin Liang*, *Scott M. Hendrickson, Todd B. Pittman; Univ. of Maryland Baltimore County, USA*. We perform a parametric down-conversion two-photon interference experiment using two unbalanced Mach-Zehnder interferometers and a short-coherence-length continuous-wave pump. The experiment explores the role of the pump coherence in two-photon interferometry.

FMF4 • 2:15 p.m.
Photon Pairs with Tailored Spectral Properties Generated from Photonic Crystal Fiber, *Xiaoying Li*, *Liang Cui, Ningbo Zhao; Tianjin Univ., China*. Signal and idler photon pairs at about 0.8 and 1.4 µm, respectively, are generated from 1-meter-long photonic crystal fiber. By using pump pulses with different wavelengths, frequency positively correlated and de-correlated photon pairs are obtained.

FMF5 • 2:30 p.m.
Cluster State Generation Using Fibre Sources, *Alex Clark*[1], *Bryn Bell*[1], *Jérémie Fulconis*[1], *Matthäus M. Halder*[1], *John G. Rarity*[1], *Mark S. Tame*[2], *Myungshik S. Kim*[2]; [1]*Univ. of Bristol, UK*, [2]*Inst. for Mathematical Sciences, UK*. By pumping a birefringent photonic crystal fibre in opposite directions we generate time-bandwidth limited entangled photon pairs. Performing a fusion gate on photons from two independent sources we create and characterize a four-qubit cluster state.

Highland H

FMG • Non-Linear Imaging—Continued

FMG2 • 2:00 p.m.
Nonlinear Extensions of Abbe Theory, *Christopher Barsi*, *Jason W. Fleischer; Princeton Univ., USA*. Abbe theory describes imaging in terms of captured diffracted orders, with higher orders providing better resolution. We show, experimentally and numerically, that nonlinearity breaks down linear limits, as high-frequency spatial modes mix with low-frequency ones.

FMG3 • 2:15 p.m. Invited
Nonlinear Imaging of Coherent Fields, *Alexandre Goy*, ***Demetri Psaltis***; *École Polytechnique Fédérale de Lausanne, Switzerland*. The field generated through nonlinear propagation is holographically measured. Nonlinear reverse propagation is used to reconstruct the field throughout the nonlinear medium.

Highland J

JOINT FiO/LS

SMA • IPF-Biomedical Applications of Lasers—Continued

SMA2 • 2:00 p.m. Invited
Applications of Table Top Lasers Developed from the FEL, *David W. Piston*; *Vanderbilt Univ., USA*. Discoveries made with Free-Electron Lasers in the IR and x-ray spectra open a opportunities for dedicated table-top systems. Current developments and applications of such systems for monochromatic x-rays and IR will be described.

SMA3 • 2:30 p.m. Invited
From Photonics to Genomics: Lasers and Imaging Technology Enables Next-Generation DNA Sequencing, *Suzanne Wakelin*; *Illumina, USA*. Massive optical parallelism used in current Genome Analyzers means that "Next-Generation" Sequencing is a present-day reality. This presentation explores the key role of lasers and optics in enabling these types of DNA sequencing technologies.

Highland K

LS

LMA • Photophysics of Nanostructured Materials I—Continued

LMA2 • 2:00 p.m. Invited
Effects of Aggregation on the Emission Spectra and Dynamics of Electrolumine Scent Materials, *Linda Peteanu*[1], *Gizelle Sherwood*[1], *Jurjen Wildeman*[2], *James H. Werner*[3], *Peter M. Goodwin*[3], *Andrew P. Shreve*[3]; [1]*Carnegie Mellon Univ., USA*, [2]*Zernicke Inst. of Advanced Materials, Netherlands*, [3]*Ctr. for Integrated Nanotechnologies Los Alamos Natl. Labs, USA*. Chain aggregation in electroluminescent materials profoundly affects their emission and charge transport. Single aggregate time-resolved fluorescence imaging studies of shorter-chain MEH-PPV oligomer aggregates reveal morphological details that rationalize their unusual emission properties.

LMA3 • 2:30 p.m. Invited
Transient Microwave Conductivity Studies of Poly (3-alkyl thiophene)s and Blends with PCBM, *David Coffey*[1], *Nikos Kopidakis*[1], *Andrew Ferguson*[1], *D. Laird*[2], *E. Sheina*[2], *Garry Rumbles*[1]; [1]*Natl. Renewable Energy Lab, USA*, [2]*Plextronics, Inc., USA*. Using flash photolysis, transient microwave conductivity we report some preliminary results on two polythiophene derivatives and compare the results with the ubiquitous poly(3-hexylthiophene). The data provide an insight into the efficiency of exciton dissociation into free charge carriers; a result that is of importance to bulk heterojunction, photovoltaic solar cells that are a construct of a blend of polymers of this type with the soluble fullerene, [6,6]-phenyl-C61-butyric acid methyl ester, (PCBM).

Highland A

FiO

FMA • Photonics and Energy I—Continued

FMA4 • 3:00 p.m.
Understanding Scattering in Silver Nanoparticle Arrays for Improving Plasmon Enhanced Photovoltaic Cells, ***Jeffrey P. Clarkson****, Philippe M. Fauchet; Univ. of Rochester, USA.* Through the use of Mie theory, finite-difference time-domain (FDTD) modeling and spectrometer measurements, we identify fundamental plasmon resonant scattering behavior in Ag nanoparticles that is beneficial towards improving the performance of plasmon enhanced photovoltaic cells.

FMA5 • 3:15 p.m.
Nanostructured SiNPs-Er Codoped Al_2O_3 Films Showing High Potential for Amplification Under Low Photon Flux Conditions, ***Pablo Roque****, Sara Nuñez-Sanchez, Rosalia Serna; Inst. of Optics, CSIC, Spain.* Report an one-step preparation process of nanostructured films formed by Si nanoparticles and Er, followed by low temperature annealing, codoped films show low threshold efficient excitation of large fraction of indirectly excited Er ions (>50%)

Highland B

LS

LSMB • Laser Science Symposium on Undergraduate Research I—Continued

Highland C

FiO

FMB • Structured Wavefields for Communications and Sensing I—Continued

FMB5 • 2:45 p.m.
Sorting Optical Angular Momentum States Based on a Geometric Transformation, ***Gregorius C. G. Berkhout***[1,2]*, Martin P. J. Lavery*[3]*, Johannes Courtial*[3]*, Marco W. Beijersbergen*[1,2]*, Miles J. Padgett*[3]*;* [1]*Leiden Univ., Netherlands,* [2]*cosine Science & Computing BV, Netherlands,* [3]*Univ. of Glasgow, UK.* We present an efficient way to sort optical angular momentum states based on two custom optical components. Due to its straightforward design, this system could prove to be very useful in increased-bandwidth optical communication.

FMB6 • 3:00 p.m.
Quasi-1-D Bessel-Like Beam Generation Using Highly Directive Transmission through Sub-Wavelength Slit Embedded in Metallic Grooves, ***Sehun Kang****, Kyunghwan Oh; Yonsei Univ., Korea, Republic of.* We report unique quasi-1-D Bessel-like beam formation from a sub-wavelength slit embedded in 1-D periodic metallic grooves. Finite-difference time-domain analyses and composite diffractive evanescent wave model provided a good explanation of the unique beam-shaping phenomena.

Highland D

FMC • Photonic Sensor I—Continued

FMC5 • 3:00 p.m.
Portable Fiber Sensors Based on Surface-enhanced Raman Scattering (SERS), *Xuan Yang*[1,2]*, Bin Chen*[1,2]*, Shaowei Chen*[1]*, Jin Z. Zhang*[1]*,* **Claire Gu**[1,2]*;* [1]*Univ. of California at Santa Cruz, USA,* [2]*NASA Ames Res. Ctr., USA.* A portable molecular sensing system based on surface-enhanced Raman scattering is experimentally demonstrated using both a tip-coated multimode fiber and a liquid core photonic crystal fiber to achieve the high sensitivity.

FMC6 • 3:15 p.m.
Plastic Identification Sensor with Five Wavelength Laser Diodes Used in Recycling Robot, *Satoshi Kawata*[1]*,* ***Koji Inada***[2]*, Tadaetsu Hirao*[2]*, Toshihiro Fujita*[2]*;* [1]*Photonics Advanced Res. Ctr., Osaka Univ., Japan,* [2]*IDEC Corp., Japan.* Plastic identification is a key technology for recycling. Six different types of plastics are identified by a sensor with five wavelengths lasers. The new plastic recycling robots, which can sort plastics, are demonstrated at stores.

Highland E

FMD • Individualized Optical Correction of the Eye—Continued

FMD4 • 2:45 p.m. **Tutorial**
The Role of the Eye's Aberrations in Vision, ***Pablo Artal****; Univ. de Murcia, Spain.* Spatial vision is limited by the quality of the eye's optics. However, optical, retinal and neural factors interact to produce the final visual performance. The main optical properties of the human eye and its relevance for vision will be revised.

Pablo Artal is a professor of Optics at the University of Murcia, Spain. An optical and Vision scientist with interest in Visual Optics, Optical Instrumentation, Adaptive Optics, Biomedical Optics & Photonics. He was elected fellow member of the Optical Society of America (OSA) in 1999 and a fellow member (inaugural) of ARVO in 2009. Prof. Artal received a number of national and international research awards. He is the founder and director of the Laboratorio de Optica at the University of Murcia and has published more than 130 reviewed papers that received more than 4000 citations, presented more than 150 invited talks in international meetings and around 150 seminars in research institutions around the world. Inventor of a number of technologies applied in Vision research and Ophthalmology and mentor of many graduate students and post-docs. He is currently editor of the Journal of the Optical Society of America A and the Journal of Vision.

3:30 p.m.–4:00 p.m. Coffee Break, *Lilac Ballroom Foyer, Rochester Riverside Convention Center*

FiO

Highland F

FME • Spectroscopy, Imaging and Detection—Continued

FME5 • 2:45 p.m.
Nonlinear Recovery of Diffused Images by Seeded Instability, *Dmitry V. Dylov, Laura Waller,* ***Jason W. Fleischer****; Princeton Univ., USA.* We develop a method to recover diffused and noise-hidden images by using spatial nonlinearity to seed instability. Optimal recovery depends on signal content, scattering statistics, and nonlinear coupling strength.

FME6 • 3:00 p.m.
The Peptide Dynamical Transition, ***Deepu K. George****, Andrea Markelz; SUNY Buffalo, USA.* Using terahertz spectroscopy we show that "protein dynamical transition" has a critical size requirement. Poly-Alanine and Poly-Lysine have transition down to 5 peptides, but not below, suggesting the dynamics requires a larger scale hydration network.

FME7 • 3:15 p.m.
Steroid Induced Osteoporosis Detected by Raman Spectroscopy, ***Jason R. Maher***[1], *Masahiko Takahata*[2], *Hani A. Awad*[2], *Andrew J. Berger*[1]; [1]*Inst. of Optics, Univ. of Rochester, USA,* [2]*Ctr. for Musculoskeletal Res., Univ. of Rochester, USA.* A Raman spectroscopy system has been constructed to study the chemical perturbations to cortical bone associated with steroid induced osteoporosis. Transcutaneous measurements of bone are also discussed.

Highland G

FMF • Quantum Information and Communications I—Continued

FMF6 • 2:45 p.m. Invited
Quantum Optics in Wavelength Scale Structures, ***John G. Rarity***[1], *Andrew B. Young*[1], *Chengyong Hu*[1], *Arthur C. T. Thijssen*[1], *Ruth Oulton*[1], *Lucas Worschech*[2], *Christian Schneider*[2], *Sven Hofling*[2]; [1]*Univ. of Bristol, UK,* [2]*Univ. Würzburg, Germany.* We discuss interaction between light and matter in optical structures that are at the wavelength scale illustrating this with recent results from pillar microcavities containing single quantum dots.

Highland H

FMG • Non-Linear Imaging—Continued

FMG4 • 2:45 p.m.
Fiber OPO for Multimodal CARS Imaging, *Yan-Hua Zhai*[1], *Christiane Pailo*[1], *Mikhail Slipchenko*[2], *Delong Zhang*[2], *Huifeng Wei*[3], *Su Chen*[3], *Weijun Tong*[3], *Ji-Xin Cheng*[2], ***Jay E. Sharping***[1]; [1]*Univ. of California at Merced, USA,* [2]*Purdue Univ., USA,* [3]*Yangtze Optical Fibre and Cable Co.Ltd., China.* We report multimodal coherent anti-Stokes Raman scattering imaging with a fiber optical parametric oscillator which is based on a compact fiber laser and a photonic crystal fiber.

FMG5 • 3:00 p.m. Invited
Stimulated Raman Scattering Microscopy for Biology and Medicine, ***Sunney Xie****; Harvard Univ., USA.* Abstract not available.

JOINT FiO/LS

Highland J

SMA • IPF-Biomedical Applications of Lasers—Continued

SMA4 • 3:00 p.m. Invited
Biomedical Imaging with Optical Coherence Tomography, ***Jim Fujimoto****; MIT, USA.* OCT generates high resolution, cross-sectional and 3-D images of tissue pathology. It has become a standard diagnostic in ophthalmology and is making rapid advances in cardiovascular imaging. This presentation reviews the technology and its development.

LS

Highland K

LMA • Photophysics of Nanostructured Materials I—Continued

LMA4 • 3:00 p.m.
Organic Materials for All-Optical Signal Processing and Optical Limiting, ***Joseph W. Perry***[1], *Joel M. Hales*[1], *San-Hui Chi*[1], *Matteo Cozzuol*[1], *Thomas E. O. Screen*[2], *Harry L. Anderson*[2], *Jon Matichak*[1], *Stephen Barlow*[1], *Seth R. Marder*[1]; [1]*Georgia Tech, USA,* [2]*Univ. of Oxford, UK.* Third-order nonlinearities and optical switching and limiting figures of merit are reported for several conjugated organic materials. Polymethines with large real to imaginary hyperpolarizability ratios and conjugated polymers with strong nonlinear absorption will be discussed.

LMA5 • 3:15 p.m.
Solvent and Baking Effect on Polymer Morphology and PLED Device Performance, *Xin Ma*[1], *Fan Xu*[1], ***Sylvain G. Cloutier***[1,2]; [1]*Dept. of Electrical and Computer Engineering, Univ. of Delaware, USA,* [2]*Delaware Biotechnology Inst., USA.* We report on the polymer chain morphology in polymer LED structures fabricated using different kinds of solvents (aromatic and non-aromatic), the effect of baking, and their consequences on charge transport property and device performance.

3:30 p.m.–4:00 p.m. Coffee Break, *Lilac Ballroom Foyer, Rochester Riverside Convention Center*

Highland A

FiO

4:00 p.m.–6:00 p.m.
FMH • Silicon Photonics
Jifeng Liu; MIT, USA, Presider

FMH1 • 4:00 p.m. Invited

Monolithic Ge-on-Si lasers, ***Jifeng Liu***[1,2]*, Xiaochen Sun*[1]*, Rodolfo Camacho-Aguil*[1]*, Yan Cai*[1]*, Lionel Kimerling*[1]*, Jurgen Michel*[1]*;* [1]*MIT, USA,* [2]*Dartmouth College, USA.* We demonstrate monolithic Ge-on-Si lasers, band-engineered by tensile strain and n-type doing, that exhibit *direct* gap emission around 1600 nm at room temperature. *Direct* gap electroluminescence from heterojunction devices verifies the feasibility of electrical pumping.

FMH2 • 4:30 p.m.

Structural and Optical Characterization of Germanium-Rich Islands on Silicon Grown by Molecular Beam Epitaxy, *L. Nataraj*[1]*, N. Sustersic*[1]*, M. Coppinger*[1]*, F. Gerlein*[1]*, J. Kolodzey*[1]*,* ***S. G. Cloutier***[1,2]*;* [1]*Univ. of Delaware, USA,* [2]*Delaware Biotechnology Inst., USA.* We report on the structural and photo-emissive properties of Germanium-rich islands grown on Silicon by Molecular Beam Epitaxy and the improvement in their light-emission at optical-communication frequencies due to the effects of strain and doping.

Highland B

LS

4:30 p.m.–6:30 p.m.
LSMC • Laser Science Symposium on Undergraduate Research II

Highland C

FiO

4:00 p.m.–6:00 p.m.
FMI • Structured Wavefields for Communications and Sensing II
Jannick P. Rolland; Inst. of Optics, USA, Presider

FMI1 • 4:00 p.m. Invited

Optical Coherence Microscopy Using Bessel Beam, ***Kye-Sung Lee****, Sophie Vo, Jannick P. Rolland; Univ. of Rochester, USA.* We demonstrate that the side lobes of a Bessel function generated by an axicon are suppressed by more than 20 dB over 5 mm depth of focus in a confocal imaging system using a fiber.

FMI2 • 4:30 p.m.

Light Modulation in Collinear Acousto-Optic Filters of Resonance and Nonresonance Type, ***Alexander Yulaev****, Yuri Zyuryukin; Saratov State Technical Univ., Russian Federation.* We report experimental results of light modulation observed in a lithium niobate crystal under the collinear anisotropic acousto-optic diffraction by a standing longitudinal elastic wave.

Highland D

FiO

4:00 p.m.–6:00 p.m.
FMJ • Photonic Sensor II
Presider to Be Announced

FMJ1 • 4:00 p.m.

Photonic Crystal Waveguide Based Refractive Index Sensor, ***Murtaza Askari****, Sivasubramaniam Yegnanarayanan, Ali Adibi; Georgia Tech, USA.* We present a compact PCW based refractive index sensor. A high sensitivity is achieved by operating PCWs in their slow light regime. For ease of detection, PCWs have been used in an unbalanced MZI configuration.

FMJ2 • 4:15 p.m.

Compact Silicon Diffractive Sensor Performance, ***Jonathan S. Maikisch****, Thomas K. Gaylord; Georgia Tech, USA.* Simulation, fabrication, and experimental results for the compact silicon diffractive sensor platform are presented. This configuration is independent of interaction length and attenuation and capable of measuring refractive index changes of 10^{-8} without spectral measurement.

FMJ3 • 4:30 p.m. Invited

New Imaging and Sensing Techniques Base on Surface Plasmon Resonance, ***N. J. Tao****; Arizona State Univ., USA.* Methods to image local surface impedance and electrochemical current optically are developed. The principles of the new imaging techniques are based on the sensitive dependence of surface plasmon resonance (SPR) on local surface charge and current density. These imaging capabilities may be used as new detection platforms for DNA and protein microarrays, and new tools for imaging cells and tissues.

Highland E

4:00 p.m.–5:30 p.m.
FMK • Emerging in vivo Imaging Techniques for Retinal Imaging
Jungtae Rha; Medical College of Wisconsin, USA, Presider

FMK1 • 4:00 p.m. Invited

Imaging the Development of Neural Circuits in the Mammalian Retina, ***Daniel Kerschensteiner****; Washington Univ. in St. Louis, USA.* I will describe two ongoing studies that combine novel fluorescent markers of subcellular neuronal structures with confocal and multiphoton imaging to study the assembly of retinal circuits during development.

FMK2 • 4:30 p.m. Invited

Multimodal Retinal Imaging, ***Hao Zhang***[1,2]*, Qing Wei*[1]*, Tan Liu*[1]*, Jing Wang*[1]*, Dennis P. Han*[3]*, Janice M. Burke*[3]*, Shuliang Jiao*[4]*;* [1]*Univ. of Wisconsin at Milwaukee, USA,* [2]*Northwestern Univ., USA,* [3]*Medical College of Wisconsin, USA,* [4]*Univ. of Southern California, USA.* A multimodal retinal imaging system that combines the merits of photoacoustic ophthalmoscopy, optical coherence tomography, confocal laser scanning ophthalmoscopy, and autofluorescence imaging has been developed.

Highland F

FiO

4:00 p.m.–5:30 p.m.
FML • Microscopy I

Nozomi Nishimura; Cornell Univ., USA, Presider

FML1 • 4:00 p.m. Invited

Improving 2-Photon Microscopy by Beam Multiplexing and Extended Excitation Bandwidth, *Thomas Pingel*, *Volker Andresen, Heinrich Spiecker; LaVision BioTec GmbH, Germany.* We report technical improvements that increase frame rate, excitation bandwidth and penetration depth of 2-photon microscopes significantly by implementing a novel flat optics beam splitter and integrating an Optical Parametric Oscillator into the 2-photon microscope.

FML2 • 4:30 p.m.

Image Mapping Spectrometer (IMS) for Real Time Hyperspectral Fluorescence Microscopy, *Liang Gao[1], Amicia D. Elliott[2], Robert T. Kester[1], Noah Bedard[1], Nathan Hagen[1], David W. Piston[2], **Tomasz S. Tkaczyk**[1]; [1]Rice Univ., USA, [2]Vanderbilt Univ., USA.* Image Mapping Spectrometer is a non-scanning hyperspectral imaging technique providing a complete spectral-spatial information simultaneously. IMS acquires, analyzes and displays data at 5-10 frame/sec rates. Imaging results for cells expressing GFP/YFP/CFP are presented.

Highland G

FiO

4:00 p.m.–6:00 p.m.
FMM • Quantum Information and Communications II

Presider to Be Announced

FMM1 • 4:00 p.m. Invited

Interference of Photons from Remote Solid-State Sources, *A. J. Bennett*[1], *R. B. Patel[1,2], I. Farrer[2], C. A. Nicoll[2], D. A. Ritchie[2], Andrew Shields[1]; [1]Toshiba Res. Europe Ltd., UK, [2]Cavendish Lab, Cambridge Univ., UK.* We report a device in which the emission energy of single quantum dots can be Starkshifted 25meV. We tune transitions in remote quantum dots to the same energy and observe twophoton interference with their emission.

FMM2 • 4:30 p.m.

Experimental Demonstration of Quantum Spatial Superresolution by Optical Centroid Measurements, *Heedeuk Shin*[1], *Kam Wai Clifford Chan[2], Hye Jeong Chang[1,3], Robert W. Boyd[1]; [1]Univ. of Rochester, USA, [2]Rochester Optical Manufacturing Co., USA, [3]Korean Intellectual Property Office, Republic of Korea.* We demonstrate experimentally quantum spatial superresolution with two-photon *N00N* state by measuring the centroid positions of the entangled photons. The optical centroid measurement shows higher detection efficiency than the conventional scheme based on multiphoton absorption.

Highland H

FiO

4:00 p.m.–6:00 p.m.
FMN • Advances in High Energy Ultrafast Laser Systems

Igor Jovanovic; Penn State, USA, Presider

Catherine LeBlanc; École Polytechnique, France, Presider

FMN1 • 4:00 p.m.

High-Fidelity Injector for High-Intensity High-Contrast Few-Cycle Lasers, *Aurelie Jullien*[1], *Xiaowei Chen[1,2], Aurélien Ricci[1,3], Jean-Philippe Rousseau[1], Rodrigo Lopez-Martens[1], Lourdes Patricia Ramirez[4], Dimitris Papadopoulos[2,4], Alain Pellegrina[2,4], Frédéric Druon[4], Patrick Georges[4]; [1]Lab d'Optique Appliquée, École Polytechnique, France, [2]Inst. de la Lumière Extrême, Univ. Paris-Sud, France, [3]Thales Optronique S.A., France, [4]Lab Charles Fabry de l'Inst. d'Optique, Univ. Paris-Sud, France.* A 80µJ, 5fs, CEP-stable (0.3rad RMS) injector with high spectro-temporal quality is presented. The system, based on compression in a hollow-core fiber followed by XPW filtering, is an ideal seed for high-power high-contrast OPCPA systems.

FMN2 • 4:15 p.m.

Pulse Cleaning of Few-Cycle OPCPA Pulses by Cross-Polarized Wave Generation, *Alexander Buck*[1,2], *Karl Schmid[1], Raphael Tautz[1,3], Julia Mikhailova[1], Xun Gu[1], Chris M. S. Sears[1], Daniel Herrmann[1,4], Ferenc Krausz[1,2], Laszlo Veisz[1]; [1]Max-Planck-Inst. für Quantenoptik, Germany, [2]Ludwig-Maximilians-Univ. München, Germany, [3]LS für Photonik und Optoelektronik, Ludwig-Maximilians-Univ. München, Germany, [4]LS für BioMolekulare Optik, Ludwig-Maximilians-Univ. München, Germany.* We present the successful implementation of cross-polarized wave generation into our few-cycle Terawatt laser system, Light Wave Synthesizer - 20 leading to a contrast improvement by more than four orders of magnitude.

FMN3 • 4:30 p.m.

Temporal Contrast Improvement of Femtosecond Pulses by a Self-Diffraction Process in a Kerr Bulk Medium, *Jun Liu*[1,2], *Takayoshi Kobayashi[1,2,3,4]; [1]Univ. of Electro-Communications, Japan, [2]JST, Japan, [3]Natl. Chiao Tung Univ., Taiwan, [4]Osaka Univ., Japan.* We improved the temporal contrast of a femtosecond pulse to the value higher than the cubic of that of its incident pulse in a 0.5-mm-thick glass plate. The energy transform efficiency is about 12%.

Highland J

JOINT FiO/LS

4:00 p.m.–6:00 p.m.
SMB • IPF- Environmental Applications of Lasers

Herwig Kogelnik; Lucent Technologies, USA, Presider

SMB1 • 4:00 p.m. Invited

NASA's Space Lidar Measurements of Earth and Planetary Surfaces, *James B. Abshire*; *NASA Goddard Space Flight Ctr., USA.* This presentation will give an overview of history, ongoing work, and plans for using space lidar for measurements of planetary surfaces.

SMB2 • 4:30 p.m. Invited

The Physics and Technology of Quantum Cascade Lasers, *Federico Capasso*; *Harvard Univ., USA.* In the short space of fifteen-years since their first invention quantum cascade lasers have become the most useful sources of tunable mid-infrared laser radiation. The underlying science and the wide ranging applications will be discussed.

Highland K

LS

4:00 p.m.–5:30 p.m.
LMB • Novel Imaging, Spectroscopy and Manipulation in Microstructures I

Frank Wise; Cornell Univ., USA, Presider

LMB1 • 4:00 p.m. Invited

Linear and Nonlinear Optical Nano-Crystallography, *Markus B. Raschke*; *Univ. of Washington, USA.* The symmetry sensitivity of second-harmonic generation and k-vector selectivity of phonon Raman scattering in combination with tip-enhanced near-field microscopy allows for nanometer resolved imaging of ferroic domain order as demonstrated for selected ferroelectrics and multiferroics.

LMB2 • 4:30 p.m. Invited

10 kHz Accuracy Spectroscopy in Acetylene-filled Hollow-Core Kagome Fiber and Improved Linewidths, *Kristan L. Corwin*[1], *Kevin Knabe[1], Chenchen Wang[1], Shun Wu[1], Jinkang Lim[1], Natalie Wheeler[2], François Couny[2], Brian R. Washburn[1], Fetah Benabid[2]; [1]Kansas State Univ., USA, [2]Univ. of Bath, UK.* A CW fiber laser is stabilized to the P(13) v_1+v_3 transition of $^{12}C_2H_2$ inside large-core kagome fiber using FM spectroscopy techniques and characterized with a frequency comb. Improved line widths are explored.

Highland A

FiO

FMH • Silicon Photonics—Continued

FMH3 • 4:45 p.m.
Free-Standing Silicon-on-Insulator Strip Waveguides for Submilliwatt Thermo-Optic Switches, *Peng Sun,* ***Ronald M. Reano****; Ohio State Univ., USA.* A Mach-Zehnder interferometer thermo-optic switch using free-standing silicon-on-insulator strip waveguides is demonstrated. Measurements at 1550 nm result in a switching power of 540 microwatts, rise time of 141 microseconds, and extinction ratio of 25 dB.

FMH4 • 5:00 p.m.
Curved Waveguide Bragg Gratings on a Chip, ***Steve Zamek****, Dawn T. H. Tan, Mercedeh Khajavikhan, Maziar P. Nezhad, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* We demonstrate curved waveguide Bragg gratings on an SOI chip. Our approach allows long Bragg gratings to be fabricated on an extremely small area, avoiding write-field stitching errors, typically introduced in the fabrication process.

FMH5 • 5:15 p.m.
All-optical Amplitude-based Broadband Modulation In Submicron Silicon Waveguide, ***Ilya Goykhman****, Boris Desiatov, Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* We demonstrate an on-chip all-optical broadband modulation of light in submicron silicon waveguide based on linear free carriers absorption using side coupling configuration of a pump signal

Highland B

LS

LSMC • Laser Science Symposium on Undergraduate Research II—Continued

Highland C

FiO

FMI • Structured Wavefields for Communications and Sensing II—Continued

FMI3 • 4:45 p.m.
Phase-Matched Generation of Phase Conjugation Wave Based on Atomic Coherence in Solids, ***Zhaohui Zhai****, Guoquang Zhang, Yiling Dou, Jingjun Xu; Nankai Univ., China.* Phase conjugation wave was generated in a solid based on stored atomic coherence via electromagnetically induced transparency effect. The phase matching condition was characterized both theoretically and experimentally in detail. Simulations fit experimental data well.

FMI4 • 5:00 p.m.
W-Band Photonic Signal Generation Based on Frequency Doubling, ***Kiyotaka Sasagawa****, Toshihiko Noda, Takashi Tokuda, Jun Ohta; Nara Inst. of Science and Technology, Japan.* A two-tone W-band (96 GHz) photonic signal at a wavelength of 775 nm is generated from a modulated light at 1550 nm by frequency doubling. The carrier component is suppressed by destructive interference.

FMI5 • 5:15 p.m.
Hamiltonian Ray-Tracing with Wigner Distribution Function for Wave Propagation in Inhomogeneous Media, ***Hanhong Gao*****[1],** *Lei Tian[1], George Barbastathis[1,2]; [1]MIT, USA, [2]Singapore-MIT Alliance for Res. and Technology (SMART) Ctr., Singapore.* We present a novel method for simulating wave optics phenomena in an inhomogeneous medium simply through ray-tracing. We accomplish this by adapting Hamiltonian ray-tracing method to use the Wigner distribution function as its initial conditions.

Highland D

FMJ • Photonic Sensor II—Continued

FMJ4 • 5:00 p.m.
Scatterer Mediated Modal Coupling in Active Optical Microcavities, ***Lina He****, Şahin Kaya Özdemir, Jiangang Zhu, Lan Yang; Washington Univ. in St Louis, USA.* Scattering induced mode splitting is demonstrated in active microcavities which are optically pumped below and above the lasing threshold. We show that optical gain can enhance light-matter interactions and improve the sensitivity of nanoparticle detection.

FMJ5 • 5:15 p.m.
Ultra-sensitive Electric-field Detector Enabled by Micro Antenna and Transparent Conductor (TC) Enhanced Electro-optic (EO) Structure, ***Fei Yi****, Fang Ou, Boyang Liu, Yingyan Huang, Seng-Tiong Ho; Northwestern Univ., USA.* We propose a compact ultra-sensitive electric-field detector enabled by a T-shaped micro antenna and a transparent conductor enhanced GaAs electro-optic structure with a minimum detectable electric-field strength of 17μV/m*Hz$^{-1/2}$ and frequency response above 1GHz.

Highland E

FMK • Emerging in vivo Imaging Techniques for Retinal Imaging—Continued

FMK3 • 5:00 p.m.
Fundus Scattered Light in the Near Infrared and Changes with Aging not Associated with the Anterior Segment, ***Ann E. Elsner****, Tomothy Hobbs, Joel A. Papay, Dean A. VanNasdale, Bryan P. Haggerty; Indiana Univ., USA.* A confocal scanning laser polarimetry technique using near infrared light reveals an increase with aging in scattered light returning from the ocular fundus. The increase is not associated with dry eye or cataract.

FMK4 • 5:15 p.m.
Coherence-gated Shack-Hartmann Wavefront Sensor, ***Simon Tuohy,*** *Adrian Podoleanu; Univ. of Kent, UK.* We investigate the possibility of narrowing the depth range of a physical Shack - Hartmann wavefront sensor by using coherence gating. A low coherence interferometry (LCI) set-up is demonstrated capable of eliminating stray reflections.

NOTES

FiO

Highland F

FML • Microscopy I—Continued

FML3 • 4:45 p.m.
isoSTED - 3-D Optical Nanoscopy, *Roman Schmidt*, *Alexander Egner, Stefan W. Hell; Max-Planck-Inst. for Biophysical Chemistry, Germany.* We demonstrate the unique, non-invasive isoSTED imaging of sub-wavelength sized biological and manufactured nanostructures and report on recent advances in the field.

FML4 • 5:00 p.m.
Single Emitter Switching Based Multicolor Nanoscopy, *Andreas Schönle*, *Ilaria Testa, Christian Eggeling, Stefan W. Hell; Max-Planck-Inst. for Biophysical Chemistry, Germany.* By switching conventional dyes into long-lived dark states we can record their fluorescence time-sequentially even if they are closely packed. This allows for simultaneous nanoscale imaging of up to four dye species with minimal cross-talk.

FML5 • 5:15 p.m.
Computational Model of Photothermal Microscopy in Tissue, *Jason M. Kellicker*, *Gregory J. Kowalski, Charles A. DiMarzio; Northeastern Univ., USA.* This research, through a rigorous optical, thermal and mechanical computational analysis, demonstrates the use of Photothermal Microscopy to tag light from the focus, and thereby improve contrast and depth of imaging limited by out-of-plane scatter.

Highland G

FMM • Quantum Information and Communications II—Continued

FMM3 • 4:45 p.m.
Photonic Circuits for Quantum Information Processing in Two-Mode Integrated Diffused-Channel Waveguides, *Mohammed F. Saleh*[1], *Giovanni Di Giuseppe[2,3], Bahaa E. A. Saleh[1,3], Malvin C. Teich[1]; [1]Boston Univ., USA, [2]Univ. of Camerino, Italy, [3]Univ. of Central Florida, USA.* We present designs of photonic circuits for the generation, separation, and manipulation of modal, polarization, and spectral photonic qubits generated in two-mode diffused-channel Ti:LiNbO3 waveguides via spontaneous parametric downconversion.

FMM4 • 5:00 p.m.
Experimental Comparison of the Signal to Noise Ratio (SNR) of Ghost Images for Entangled and Thermal Light, *Barbara A. Capron*[1], *Claudio G. Parazzoli[1], Jeff C. Adams[2]; [1]Boeing Res. & Technology, USA, [2]SpectraNet, Inc., USA.* We show SNR comparisons of 4th order ghost images from PDC and 2nd order thermal images from single beams. Ghost imaging yields low background and shows improvement of the entangled light over thermal light SNR.

FMM5 • 5:15 p.m.
Experimental Violation of a Non-local Leggett-garg Inequality Using Non-local Weak Measurements, *Curtis J. Broadbent, **Justin Dressel**, Andrew N. Jordan, John C. Howell; Univ. of Rochester, USA.* We experimentally demonstrate the violation of a non-local Leggett-Garg inequality using non-local weak measurements on polarization entangled biphotons. Due to measurement degeneracy, multiple strange weak values are required to infer violation of the Leggett-Garg inequality.

Highland H

FMN • Advances in High Energy Ultrafast Laser Systems—Continued

FMN4 • 4:45 p.m.
Withdrawn

FMN5 • 5:00 p.m. **Invited**
Advances in Energetic Short-Pulse Fiber Lasers, *Michael J. Messerly*[1], *Jay W. Dawson[1], John K. Crane[1], David J. Gibson[1], Constantin Haefner[1], Miroslav Y. Shverdin[1], Henry H. Phan[1], Craig W. Siders[1], Christopher P. J. Barty[1], Matthew A. Prantil[2]; [1]Photon Science and Applications Program, Lawrence Livermore Natl. Lab, USA, [2]Lawrence Berkeley Natl. Lab, USA.* Energetic short-pulse fiber lasers feed or drive many applications at LLNL, including petawatt lasers and Compton-scattered gamma-ray sources. We present challenges and advances in scaling fiber lasers to the millijoule range.

JOINT FiO/LS

Highland J

SMB • IPF- Environmental Applications of Lasers—Continued

SMB3 • 5:00 p.m. **Invited**
Tunable Infrared Laser Measurements of Industrial Process and Product Emissions, *Charles E. Kolb*, *David D. Nelson, J. Barry McManus, Scott C. Herndon, Mark S. Zahniser; Aerodyne Res., USA.* Advances in tunable infrared lasers, detectors and signal processing allow real-time quantification of pollutants emitted during the manufacture, distribution and use of industrial products. Development and deployment of robust advanced pollutant sensors will be described.

LS

Highland K

LMB • Novel Imaging, Spectroscopy and Manipulation in Microstructures I—Continued

LMB3 • 5:00 p.m.
Optical Trapping and Manipulation of Micron-Sized Particles Using a Bright Tapered Optical Fiber, *Mary Frawley[1,2], Mark Daly[1,2], Jonathan Ward[2], **Sile Nic Chormaic**[1,2]; [1]Univ. College Cork, Ireland, [2]Tyndall Natl. Inst., Ireland.* In our work we aim to investigate the trapping and moving of microspheres on along an optical nanofiber. We will investigate the generation of standing waves within the fiber and exploit higher order mode interference.

LMB4 • 5:15 p.m.
Optical Measurement of the Phase-Breaking Length in Graphene, *Ryan Beams*[1], *Luiz Gustavo Cançado[2], Lukas Novotny[1]; [1]Univ. of Rochester, USA, [2]Univ. Federal de Minas Gerais, Brazil.* We present the first optical measurement of the phase-breaking length in graphene extracted from the Raman scattering originating at an edge in the lattice. The results are compared to electrical measurements.

NOTES

Highland A

FiO

FMH • Silicon Photonics—Continued

FMH6 • 5:30 p.m.
Realization Of Submicron-scale Square-like Silicon Waveguide Via Optimized Locos Process, *Boris Desiatov*, *Ilya Goykhman, Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* We demonstrate the design, fabrication and experimental characterization of submicron-scale silicon waveguide fabricated by local oxidation of silicon and provide guidelines for controlling its profile. Near field measurements shows submicron confinement of the optical mode.

FMH7 • 5:45 p.m.
Kerr and Carrier Based Nonlinearities in Hydrogenated Amorphous Silicon Waveguides, *Karthik Narayanan*, *Stefan F. Preble; Rochester Inst. of Technology, USA.* We experimentally measure the optical nonlinearities in hydrogenated-amorphous silicon waveguides through the transmission of ultra-short pulses. Enhanced nonlinear coefficients are reported in submicron waveguides with a free carrier lifetime of ~ 400 ps.

Highland B

LS

LSMC • Laser Science Symposium on Undergraduate Research II—Continued

Highland C

FiO

FMI • Structured Wavefields for Communications and Sensing II—Continued

FMI6 • 5:30 p.m. Invited
Advanced Studies of 'Non-Diffracting' Light Fields, *Kishan Dholakia*, *Jörg Baumgartl, Tomas Cizmar, Xanthi Tsampoula, Frank Gunn-Moore, Michael Mazilu; Univ. of St. Andrews, UK.* We explore the propagation and applications in optical trapping and biophotonics of 'non-diffracting' light fields. This includes studies using Bessel light modes and Airy light fields that exhibit parabolic trajectories.

Highland D

FMJ • Photonic Sensor II—Continued

FMJ6 • 5:30 p.m.
Electrophoretic Separation and Detection of a Few DNA Molecules in An Optofluidic Chip, *Chaitanya Dongre, Hugo J. W.M. Hoekstra, **Markus Pollnau**; Univ. of Twente, Netherlands.* After electrophoretic separation of dye-labeled DNA molecules of 17 different sizes, integrated-waveguide laser excitation and physical or numerical lock-in amplification enables a limit of detection down to 8-9 DNA molecules in an optofluidic chip.

FMJ7 • 5:45 p.m.
On-chip Tunable Micro-ring Resonator Based on Digital Microfluidics Platform, *Yoav Zuta*, *Ilya Goykhman, Boris Desiatov, Uriel Levy; Hebrew Univ., Israel.* We demonstrate the tunability of a silicon nitride micro-resonator using the concept of Digital Microfluidics. Our system allows driving micro-droplets on-chip, enabling the control of the effective refractive index at the vicinity of the resonator.

Highland E

6:30 p.m.–8:30 p.m. OSA Student Member Reception, *Temple Bar & Grille, 109 East Avenue, Rochester, NY, Phone: 585.232.6000*

NOTES

Highland F

Highland G

Highland H

Highland J

Highland K

FiO

JOINT FiO/LS

LS

FMM • Quantum Information and Communications II—Continued

FMM6 • 5:30 p.m.
Transport of OAM-based QuNits through Few-Mode Optical Fibers, *J. P. (Han) Woerdman*[1], *Wolfgang Loeffler[1], Eric Eliel[1], Tijmen Euser[2], Michael Scharrer[2], Philip St Russell[2]; [1]Univ. Leiden, Netherlands, [2]Max Planck Inst. for the Science of Light, Germany.* We report how entangled photons carrying a superposition of orbital angular momentum (OAM) eigenstates suffer de-coherence when transported through a few-mode optical fiber. We find that hollow-core Kagome fibers show by far the least de-coherence.

FMM7 • 5:45 p.m.
Measuring and Modifying the Spiral Spectrum of Entangled Photon Pairs, *Martin P. van Exter*, *Henrique Di Lorenzo Pires; Leiden Univ., Netherlands.* We have measured the complete probability distribution of the orbital angular momentum modes that are generated in spontaneous parametric down conversion. We show how on-purpose phase mismatching increases the spiral bandwidth and flattens the modal distribution.

FMN • Advances in High Energy Ultrafast Laser Systems—Continued

FMN6 • 5:30 p.m. Invited
Grating Development for High-Peak-Power CPA Laser Systems, *Terrance J. Kessler*; *Lab for Laser Energetics, Univ. of Rochester, USA.* Diffraction gratings have competing performance requirements when used in high-peak-power CPA laser systems. Diffraction efficiency, wavefront quality, and laser damage threshold are interdependent criteria for MLD gratings. Critical fabrication related artifacts will be discussed.

SMB • IPF- Environmental Applications of Lasers—Continued

SMB4 • 5:30 p.m. Invited
Laser Remote Sensing of the Earth: CALIPSO and Beyond, *Carl Weimer*; *Ball Aerospace, USA.* The CALIPSO satellite has been characterizing aerosols and clouds in the Earth's atmosphere using a dual wavelength lidar. Future missions will include lidars for measuring the Earth's forests' role in the carbon cycle.

6:30 p.m.–8:30 p.m. OSA Student Member Reception, *Temple Bar & Grille, 109 East Avenue, Rochester, NY, Phone: 585.232.6000*

NOTES

FiO

7:00 a.m.–5:30 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

10:00 a.m.–4:00 p.m. Exhibit Open, *Rochester Riverside Convention Center*

Highland A

8:00 a.m.–10:00 a.m.
FTuA • Photonics and Energy II

Markus Pollnau; Univ. of Twente, Netherlands, Presider

FTuA1 • 8:00 a.m. Invited

Organic Semiconductors for Photovoltaic and Light-Emitting Devices: Status and Promise, *Bernard Kippelen*; *Georgia Tech, USA*. This talk will provide an overview of recent advances in organic photovoltaic devices for power generation and organic light-emitting devices for solid-state lighting, two technological areas that are expected to impact energy efficiency and sustainability.

FTuA2 • 8:30 a.m. Invited

Optical Transmission Energy Consumption in the Internet, *Dan Kilper*, *G. W. Atkinson, S. K. Korotky; Bell Labs, Alcatel-Lucent, USA*. The relative contribution of optical transmission systems to the energy consumption of data communication networks is examined using models of networks today and projecting through the next decade.

Highland B

8:00 a.m.–10:00 a.m.
FTuB • Adaptive Optics for the Eye

Rongguang (Ron) Liang; Carestream Health, USA, Presider

FTuB1 • 8:00 a.m. Invited

Multifunctional Imaging Device for Adaptive Optics Compensation in Humans and Small Animals, *Daniel X. Hammer*[1], *R. Daniel Ferguson[1], Mircea Mujat[1], Ankit H. Patel[1], Nicusor Iftimia[1], T. Y. P. Chui[2], J. D. Akula[2], A. B. Fulton[2]; [1]Physical Sciences Inc., USA, [2]Children's Hospital and Harvard Medical School, USA*. A system was developed to simultaneously acquire high resolution adaptive opticscorrected scanning laser ophthalmoscopy and optical coherence tomography images from both humans and small animals. Device performance was characterized in a limited number of subjects.

FTuB2 • 8:30 a.m. Invited

Designing AO Retinal Imaging Systems for Real World Uses: Issues and Limitations, *Stephen A. Burns*; *Indiana Univ., USA*. Adaptive Optics retinal imaging systems are starting to reach a level of maturity that allows development of systems specialized for different purposes. In this talk I will present some of the issues that arise when considering systems research use with clinical patients, and compare and contrast three AO scanning systems we have developed.

Highland C

8:00 a.m.–10:00 a.m.
FTuC • Nonlinear Integrated Optics

Yoshitomo Okawachi; Cornell Univ., USA, Presider

FTuC1 • 8:00 a.m. Invited

Noise, Broadband Gain, Inverse Stimulated Scattering, and Extreme Value Fluctuations; Recent Developments in Silicon Raman Amplifiers, *Bahram Jalali*[1], *D. Solli[2], P. Koonath[2], D. Borlaug[3], S. Fathpour[4]; [1]Univ. of California at Los Angeles, USA, [2]Tanner Res. Inc., USA, [3]Booz-Allen-Hamilton, USA, [4]CREOL, College of Optics, Univ. of Central Florida, USA*. This talk will review recent progress in our laboratory Raman amplification in silicon, including the achievable noise figure and gain, creating broadband gain, inverse Raman scattering phenomenon, and extreme value fluctuations.

FTuC2 • 8:30 a.m.

Subpicosecond Ultra High Speed Soliton Laser Based on A C-MOS Compatible Integrated Microring Resonator, *Marco Peccianti[1,2], Alessia Pasquazi[1], Yongwoo Park[1], Brent E. Little[3], Sai T. Chu[3], Dave J. Moss[4], **Roberto Morandotti**[1]; [1]INRS-EMT, Canada, [2]Inst. for Chemical and Physical Processes, CNR, "Sapienza" Univ., Italy, [3]Infinera Ltd, USA, [4]CUDOS, School of Physics, Australia*. We present a subpicosecond, ultrahigh repetition rate, passively mode-locked laser based on four-wave mixing in an integrated CMOS-compatible high-Q nonlinear ring resonator.

Highland D

8:00 a.m.–9:45 a.m.
FTuD • General Optics in Information Science

Johannes K. Courtial; Univ. of Glasgow, UK, Presider

FTuD1 • 8:00 a.m.

Propagation through a Thick Diffuser with Small Particles, ***Nienan Chang**, Nicholas George, Wanli Chi; Inst. of Optics, Univ. of Rochester, USA*. For speckle in a thick diffuser, a theory has been developed with an emphasis on the wavelength decorrelation. Excellent agreement with experiments is obtained using a family of particulate diffusers.

FTuD2 • 8:15 a.m.

Hyperspectral THz Image Reconstruction, *Zhimin Xu, **Edmund Y. Lam**; Univ. of Hong Kong, Hong Kong.* Many existing methods for terahertz image processing treat the data at each spectral band independently. We show that by using the hyperspectral information across these spectral bands, the quality of the reconstruction can be improved.

FTuD3 • 8:30 a.m.

Experimental Demonstration of Adaptive Feature-Specific Spectroscopy, ***Ivan Rodriguez**, Dineshbabu V. Dinakarababu, Michael E. Gehm; Univ. of Arizona, USA*. Experimental validation of Adaptive Feature-Specific Spectroscopy (AFSS) is presented. The system achieves dramatically-shorter time-to-classification times than traditional architectures in low SNR scenarios.

Highland E

8:00 a.m.–10:00 a.m.
FTuE • General Optics

Robert A. Kaindl; Lawrence Berkeley Natl. Lab, USA, Presider
Richard D. Averitt; Boston Univ., USA, Presider

FTuE1 • 8:00 a.m.

Theory of Optical Coherence in the Space-Time and in the Space-Frequency Domains, ***Mayukh Lahiri**, Emil Wolf; Univ. of Rochester, USA*. The relationship between the theories of optical coherence in space-time and space-frequency domains is discussed. We show that the concept of cross-spectral purity, introduced many years ago, plays an important role in clarifying this relationship.

FTuE2 • 8:15 a.m.

Exceeding the Inherent Resolution Limit of Photo-Detectors in Pulse-Shape Measurements by Implementing Sparseness-Based Algorithms, *Pavel Sidorenko*, *Snir Gazit, Yoav Schechtman, Alexander Szameit, Yonina C. Eldar, Mordechai Segev, Oren Cohen; Technion - Israel Inst. of Technology, Israel.* We demonstrate experimentally pulse-shape reconstruction at resolution that significantly exceeds the photodiode inherent resolution limit. The knowledge that pulses are inherently sparse enables us to retrieve data that is otherwise hidden in the noise.

FTuE3 • 8:30 a.m.

Compressive Fourier Transform Spectroscopy, ***Ori Katz**, Jonathan M. Levitt, Yaron Silberberg; Weizmann Inst. of Science, Israel.* We describe a compressive-sensing approach for obtaining an *N*-point Fourier spectrum using much less than N time-domain measurements. We experimentally resolve sparse vibrational spectra using <30% of the Nyquist limit samples in single-pulse CARS experiments.

Highland F	Highland G	Highland H	Highland J	Highland K
FiO		LS	JOINT FiO/LS	LS

7:00 a.m.–5:30 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

10:00 a.m.–4:00 p.m. Exhibit Open, *Rochester Riverside Convention Center*

8:00 a.m.–10:00 a.m.
FTuF • Microscopy II
Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA, Presider

FTuF1 • 8:00 a.m. Invited

Nonlinear Optical Tools for Studying Small-Stroke at Microscopic Scales, ***Nozomi Nishimura****; Cornell Univ., USA*. Nonlinear optical interactions enable observation and manipulation of biological tissues with cellular resolution *in vivo*. We use multiphoton microscopy and femtosecond laser ablation to study health and function of brain cells after disruption of microvessels.

FTuF2 • 8:30 a.m.

Enhancing Coherent Anti-Stokes Raman Scattering Background Suppression with Phase Cycled Structured Femtosecond Laser Pulses, ***Baolei Li****, Warren S. Warren, Martin C. Fischer; Duke Univ., USA*. We demonstrate a homodyne coherent anti-Stokes Raman scattering technique based on femtosecond laser pulse shaping (phase-cycling). This technique utilizes a self-generated non-resonant background as a local oscillator to retrieve phase information of the Raman signal.

8:00 a.m.–10:00 a.m.
FTuG • Quantum Information and Communications III
Paul Voss; Georgia Tech, USA, Presider

FTuG1 • 8:00 a.m.

What Determines How Bosonic a Cooper Pair Is? Entanglement, ***Seyed Mohammad Hashemi Rafsanjani*****,***; Univ. of Rochester, USA*. By studying the algebra of creation and annihilation operators, we obtain theoretical evidence that emphasizes the role of entanglement in determining how ``bosonic” a composite system of two fermions (distinguishable or identical) is.

FTuG2 • 8:15 a.m.

Quantum Discord, Quantum Entanglement, and Linear Entropy, and the Relationship Between Them, ***Asma Al-Qasimi****, Daniel F. V. James; Dept. of Physics, Univ. of Toronto, Canada.* We study the properties of a general quantum correlation known as quantum discord, which has recently been studied as a resource for quantum computation. We investigate the relations between discord, entanglement and entropy.

FTuG3 • 8:30 a.m.

Strong Spectral Entanglement in Spontaneous Parametric Down-Conversion, ***Warren Grice***[1], *Ryan Bennink*[1], *Philip Evans*[1], *Travis Humble*[1], *Raphael Pooser*[1], *Jason Schaake*[1,2], *Brian Williams*[1,2]; [1]*Oak Ridge Natl. Lab, USA,* [2]*Univ. of Tennessee, USA*. Photon pairs with a high degree of spectral entanglement have a very large capacity for carrying information. We describe methods for generating this type of entanglement and discuss applications.

8:00 a.m.–10:00 a.m.
LTuA • Photophysics of Nanostructured Materials II
Lewis Rothberg; Univ. of Rochester, USA, Presider

LTuA1 • 8:00 a.m. Invited

Excitonic Dynamics of Quantum Dots Monitored by Near-Infrared Transient Absorption, ***Emily Weiss****, Eric A. McArthur, Adam J. Morris-Cohen, Kathryn E. Knowles; Northwestern Univ., USA*. This talk describes a global regression analysis of near-infrared (NIR, 900 nm - 1300 nm) transient absorptions (TA) of colloidal CdSe quantum dots (QDs) photoexcited to their first ($1S_e1S_{3/2}$) excitonic state.

LTuA2 • 8:30 a.m. Invited

Quantum Dot Electron Transfer Probed by Transient Photoluminescence, ***Marcus Jones****; Univ. of North Carolina at Charlotte, USA*. Opto-electronic applications of nanocrystals rely on generation and exploitation of mobile charge carriers. Understanding nanocrystal electron transfer processes is therefore important. Transient photoluminescence is a versatile technique that is helping to unravel this complex field.

8:00 a.m.–10:00 a.m.
STuA • IPF-Laser Applications in Metrology
Georg Nadorff; CVI Melles Griot, USA, Presider

STuA1 • 8:00 a.m. Invited

Use of Lasers in Time and Frequency Applications (or Metrology), ***Scott Diddams****; NIST, USA*. Abstract not available.

STuA2 • 8:30 a.m. Invited

Laser Fuse Processing for Advanced Memory Designs, ***Joohan Lee****, James Cordingley; GSI Laser Systems, USA*. Control of laser parameters such as wavelength, pulse shape, polarization, multiple pulses and ultra-short pulses improves the laser cutting reliability of various fine pitch fuses that are used for modern circuit redundancies.

8:00 a.m.–10:00 a.m.
LTuB • Nonlinear Optics I
Andrew G. White; Univ. of Queensland, Australia, Presider

LTuB1 • 8:00 a.m. Invited

Toward Single-Photon Nonlinear Optics via Self-Assembled Ultracold Atoms, ***Daniel Gauthier****, Joel A. Greenberg; Duke Univ., USA*. We observe spontaneous parametric oscillation in a laser-driven cloud of cold atoms. The threshold for this instability is lowered dramatically due to self-assembled atomic gratings that allow for self-phase matching of atom-field wave mixing processes.

LTuB2 • 8:30 a.m. Invited

Prospects for Strong Cavity Free Single Atom Nonlinearity at the Few Photon Level, ***Gerd Leuchs*****,***; Max-Planck-Inst. for the Science of Light and Inst. of Optics, Univ. Erlangen-Nuremberg, Germany*. The progress and prospect of non-linear photon-atom coupling at a few photon level is reviewed.

FiO

Highland A

FTuA • Photonics and Energy II—Continued

FTuA3 • 9:00 a.m. Invited

Photonics and Optics for Energy Efficiency and Sustainability - Is This Green Photonics? ***Michael Lebby***; *OIDA, USA.* Abstract not available.

Highland B

FTuB • Adaptive Optics for the Eye—Continued

FTuB3 • 9:00 a.m. Invited

Optical Design of Clinical Adaptive Optics Instruments for Retinal Imaging, ***Alfredo Dubra****, A. Gómez-Vieyra, Y. Sulai, Luis Díaz-Santana; Univ. of Rochester, USA.* Simple design rules can be used to reduce astigmatism in off-axis reflective ophthalmic adaptive optics instruments. These rules will be illustrated by presenting the design of such devices with footprints smaller than a square foot.

Highland C

FTuC • Nonlinear Integrated Optics—Continued

FTuC3 • 8:45 a.m.

Mid-infrared Broadband Continuous-wave Parametric-mixing in Silicon Nanowaveguides, ***Ryan K. W. Lau***[1]*, Michaël Ménard*[2]*, Yoshitomo Okawachi*[1]*, Mark A. Foster*[1]*, Amy C. Turner-Foster*[2]*, Reza Salem*[3]*, Michal Lipson*[2,4]*, Alexander L. Gaeta*[1]*;* [1]*School of Applied and Engineering Physics, Cornell Univ., USA,* [2]*School of Electrical and Computer Engineering, Cornell Univ., USA,* [3]*PicoLuz, USA,* [4]*Kavli Inst. at Cornell for Nanoscale Science, Cornell Univ., USA.* We demonstrate broadband continuous-wave frequency conversion to the mid-infrared region via four-wave mixing in silicon nanowaveguides. We measure a 3-dB conversion bandwidth of over 350 nm.

FTuC4 • 9:00 a.m. Invited

Nonlinear Mixing in Silicon Waveguides for SWIR and Mid-IR Applications, ***Sanja Zlatanovic***[1]*, J. S. Park*[1]*, S. Moro*[1]*, J. M. Chavez-Boggio*[1]*, F. Gholami*[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 present results on four-photon mixing in silicon-waveguides beyond 2μm using signals derived from ultra-compact telecom sources. This widely-tunable parametric silicon source can combine narrow linewidth and complex modulation offering great potential for Mid-IR applications.

Highland D

FTuD • General Optics in Information Science—Continued

FTuD4 • 8:45 a.m.

Generation and Characterization of Broadband Similariton, ***Aram Zeytunyan***[1]*, Anush Muradyan*[1]*, Garegin Yesayan*[1]*, Levon Mouradian*[1]*, Frédéric Louradour*[2]*, Alain Barthélémy*[2]*;* [1]*Yerevan State Univ., Armenia,* [2]*XLIM Inst. de Recherche, Univ. de Limoges, France.* We generate a 100 nm-bandwidth nonlinear-dispersive similariton in a passive fiber, and characterize it by means of its chirp measurement through the technique of frequency tuning and spectral compression in the sum-frequency generation process.

FTuD5 • 9:00 a.m.

Optical Design for Improving Matrix Condition-Experiment, ***Iftach Klapp****, David Mendlovic; Tel Aviv Univ., Israel.* We present preliminary experimental results of the "blurred trajectories" method. Results show improvement of the matrix condition and immunity to noise when using the proposed method.

FTuD6 • 9:15 a.m.

Shift and Rotation Invariant Double Random Phase Encoding Using Fingerprint Keys, ***Masafumi Takeda****, Hiroyuki Suzuki, Masahiro Yamaguchi, Takashi Obi, Nagaaki Ohyama; Tokyo Inst. of Technology, Japan.* We propose a method to eliminate the tags from the plain image for the purpose of decrypting an encrypted image appropriately without detecting the shifted position and correcting the rotation angle of the fingerprint.

Highland E

FTuE • General Optics—Continued

FTuE4 • 8:45 a.m.

Deflection Measurements with Weak Values, ***P. Ben Dixon****, David J. Starling, Nathan S. Williams, Praveen K. Vudyasetu, Andrew N. Jordan, John C. Howell; Univ. of Rochester, USA.* We report an interferometric weak-value technique to amplify transverse beam deflections. The utility is quantified through an investigation of the signal to noise ratio along with the experimental results.

FTuE5 • 9:00 a.m.

Demonstration of a Slow-Light Laser Radar (SLIDAR), ***Zhimin Shi****, Aaron Schweinsberg, Joseph E. Vornehm, Jr., Robert W. Boyd; Univ. of Rochester, USA.* We propose a multi-aperture slow-light laser radar (SLIDAR) and demonstrate a proof-of-concept system. Two slow-light mechanisms are demonstrated to control the relative group delay among various apertures while the relative phases among apertures remain locked.

FTuE6 • 9:15 a.m.

Three-Dimensional Self-Focusing of Laser Pulses in SBS-Active Media, ***Sarah Mauger***[1]*, Luc Bergé*[1]*, Stefan Skupin*[2,3]*;* [1]*CEA-DAM, DIF, France,* [2]*Max-Planck-Inst. for the Physics of Complex Systems, Germany,* [3]*Inst. of Condensed Matter Theory and Optics, Friedrich-Schiller-Univ., Germany.* The coupling between Kerr filamentation and stimulated Brillouin scattering (SBS) is numerically investigated for nanosecond laser pulses in silica. In self-focusing regime, phase-modulated broadband pumps may not weaken backscattering, which appropriate amplitude modulations can achieve.

Highland F

FiO

FTuF • Microscopy II—Continued

FTuF3 • 8:45 a.m.
Nonlinear High-Resolution Imaging of Eumelanin and Pheomelanin Distributions in Normal Skin Tissue and Melanoma, ***Thomas E. Matthews***[1], *Ivan Piletic*[1], *Maria A. Selim*[2], *Warren S. Warren*[1]; [1]*Duke Univ., USA*, [2]*Duke Univ. Hospital, USA*. Two-color two-photon spectroscopy allows us for the first time to image the distribution of eumelanin and pheomelanin in tissue slices, giving histology-like detail and highlighting chemical and morphological changes in melanoma compared to benign lesions.

FTuF4 • 9:00 a.m.
Epi-Detected Ratio of forward-Propagating to Back-Propagating Second Harmonic Signal, *Xiaoxing Han*, ***Edward Brown***; *Univ. of Rochester, USA*. In this paper, we present a method to determine, for the first time, the SHG F/B ratio in vivo on the surface of intact tissue samples without any biopsy or tissue sectioning, using only epi-detection.

FTuF5 • 9:15 a.m.
Antenna-Assisted Colocalization of Individual Ca^{2+}-Pumps in the Plasma Membrane of Erythrocytes, ***Christiane Höppener***[1,2], *Zachary Lapin*[2], *Lukas Novotny*[2]; [1]*Inst. of Physics, Univ. of Münster, Germany*, [2]*Inst. of Optics, Univ. of Rochester, USA*. High-Resolution Imaging with Single Protein Sensitivity holds promise for studies of the chemical organization of cellular structures. Such investigations are important to reveal abnormalities from the regular spatial distribution of specific membrane proteins.

Highland G

FTuG • Quantum Information and Communications III—Continued

FTuG4 • 8:45 a.m.
Qutrit Influence on Entanglement Dynamics, ***Shantanu Agarwal***, *Xu Wang*; *Univ. of Rochester, USA*. Following the entanglement dynamics of atoms and fields, we study how the entanglement dynamics of a bi-partite system is affected by its own dimensionality and the dimensionality of a model reservoir with which it interacts.

FTuG5 • 9:00 a.m.
Entangled Tangles of Phase Singularities, ***Mary Jacquiline Romero***[1], *Jonathan Leach*[1], *Barry Jack*[1], *Mark R. Dennis*[2], *Sonja Franke-Arnold*[1], *Steve Barnett*[3], *Miles J. Padgett*[1]; [1]*Univ. of Glasgow, UK*, [2]*Univ. of Bristol, UK*, [3]*Univ. of Strathclyde, UK*. We holographically measure entangled tangles of phase singularity lines in light generated via spontaneous parametric down-conversion. This type of entanglement is interesting because it is between topological features that extend over finite, macroscopic, isolated volumes.

FTuG6 • 9:15 a.m.
Entanglement from Longitudinal and Scalar Photons, ***James Franson***; *Univ. of Maryland, USA*. The quantization of the electromagnetic field in the Lorentz gauge produces longitudinal and scalar photons in addition to the usual transverse photons. It is shown that these additional photons can produce entanglement between distant atoms.

Highland H

LS

LTuA • Photophysics of Nanostructured Materials II—Continued

LTuA3 • 9:00 a.m.
Direct-Bandgap Emission from Hydrostatically Tensile-Strained Germanium Nanocrystals, *Latha Nataraj*, *Fan Xu*, ***Sylvain G. Cloutier***; *Univ. of Delaware, USA*. We report high room-temperature luminescence from Germanium nanocrystals synthesized by mechanical grinding. Optical spectroscopy measurements are consistent with HRTEM and electron diffraction, suggesting high tensile strains favoring direct band-to-band transitions.

LTuA4 • 9:15 a.m.
A Near-infrared Emitting Self-assembled Pbs-dendrimer Nanocomposite, ***Swapan K. Gayen***[1], *Mohammad Alrubaiee*[1], *Flory K. Wong*[2], *Andrew H. Byro*[2], *Valeria Balogh-Nair*[2]; [1]*Physics Dept.,CUNY, USA*, [2]*Chemistry Dept., CUNY,USA*. Optical spectroscopy of a nanocomposite of PbS quantum dots and poly(amido amine) dendrimer exhibits a 750-nm band-edge absorption peak, partially-polarized 820-1150 nm fluorescence with peak at 940 nm, and a fluorescence lifetime of 785 ns.

Highland J

JOINT FiO/LS

STuA • IPF-Laser Applications in Metrology—Continued

STuA3 • 9:00 a.m. Invited
Dynamic Interferometry for on-Machine Metrology, ***Michael North Morris***; *4D Technology Corp., USA*. A compact, vibration insensitive interferometer design that is well suited for measuring optics while mounted *in situ* on polishing equipment is presented. The system employs a single-frame-phase sensor that permits acquisition in tens of microseconds to mitigate the effects of vibration or relative-motion with the test-part. The theory of operation is presented along with experimental test results, which characterize repeatability and precision under static and high-vibration conditions.

Highland K

LS

LTuB • Nonlinear Optics I—Continued

LTuB3 • 9:00 a.m.
The Transition between Superluminal and Subluminal for Multiple Gain-assisted Microspheric Resonators, ***Yundong Zhang***, *Jing Zhang*, *Jinfang Wang*, *Xuenan Zhang*, *Dan Wu*, *Ping Yuan*; *Harbin Inst. of Technology, China*. We investigate the dispersion characteristics of coupled resonator induced transparency and absorption in the microspheres coupled with a fiber taper system. The switch between superluminal and subluminal could be realized by doping the gain.

LTuB4 • 9:15 a.m.
Spatial Optical Memory Based on Coherent Population Oscillations, *Asaf Eilam*, *Ido Azuri*, *Anton V. Sharypov*, ***Arlene D. Wilson-Gordon***; *Bar-Ilan Univ., Israel*. We show that a system characterized by long-lived coherent population oscillations (CPO), such as a two-level system that decays via a shelving state, can be used to construct a spatial optical memory.

FiO

Highland A

FTuA • Photonics and Energy II—Continued

FTuA4 • 9:30 a.m.
Power-over-Fiber Using an Optically Injected Semiconductor Laser in Chaotic Dynamics, *Xuelei Fu*[1], ***Sze-Chun Chan***[1], *Kenneth Kin-Yip Wong*[2]; [1]*Dept. of Electronic Engineering, City Univ. of Hong Kong, China,* [2]*Dept. of Electrical and Electronic Engineering, Univ. of Hong Kong, China.* Chaotic signal from an optically injected semiconductor laser is applied for power-over-fiber delivery. Stimulated Brillouin scattering is effectively suppressed by the broadband chaos such that transmission of 838mW through a 5-km single-mode fiber is demonstrated.

FTuA5 • 9:45 a.m.
Heterogeneously Integrated Silicon/III-V Evanescent Lasers with Micro-loop Mirror (MLM) Reflector, ***Yunan Zheng***[1]**,** *Yingyan Huang*[2], *Yadong Wang*[3], *Yongqiang Wei*[3], *Doris Ng*[3], *Chee Wei Lee*[3], *Boyang Liu*[2], *Yongming Tu*[1], *Seng-Tiong Ho*[1,3]; [1]*Northwestern Univ., USA,* [2]*Optonet Inc., USA,* [3]*Data Storage Inst., Singapore.*. An electrically-pumped heterogeneously integrated Si/AlGaInAs evanescent laser with micro-loop mirror as high reflectors at both ends is experimentally demonstrated. Single spatial mode CW lasing is achieved with a threshold current density of 2.5 kA/cm2.

Highland B

FTuB • Adaptive Optics for the Eye—Continued

FTuB4 • 9:30 a.m.
Dual of Shack-Hartmann Optometry Using Mobile Phones, *Vitor F. Pamplona*[1,2], *Ankit Mohan*[1], *Manuel M. Oliveira*[1,2], ***Ramesh Raskar***[1]; [1]*MIT Media Lab, USA,* [2]*Inst. de Informática, Univ. Federal do Rio Grande do Sul, Brazil.* We describe an optical design that retrofits a cell phone display and an interactive software for assessing refractive properties of human eyes. User evaluation revels an average error of ~0.5 diopters using currently available phones.

FTuB5 • 9:45 a.m.
Improving the Wavefront Boundary Condition for Adaptive Optics Retinal Imaging, ***Weiyao Zou***, *Stephen A. Burns; School of Optometry, Indiana Univ., USA.* Accurate wavefront control requires carefully handling the boundary condition of wavefront measurement. With our dual deformable-mirror Adaptive Optics Scanning Laser Ophthalmoscope, we have demonstrated improvement in imaging by reducing the adverse boundary effect.

Highland C

FTuC • Nonlinear Integrated Optics—Continued

FTuC5 • 9:30 a.m.
Broadband Self-phase Modulation, Cross-phase Modulation, and Four-wave Mixing in 1-cm-long AlGaAs Waveguides, ***Ksenia Dolgaleva***, *Wing Chau Ng, Li Qian, Stewart Aitchison; Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada.* We demonstrate self-phase modulation with a nonlinear phase shift of 5π, cross-phase modulation, and four-wave mixing tunable within a 14-nm range in waveguides written in an AlGaAs wafer with a specially designed composition.

FTuC6 • 9:45 a.m.
Efficient Interband Four-Wave Mixing in Semiconductor Optical Amplifiers with Fast Gain Recovery, ***Prashant P. Baveja***[1], *Drew N. Maywar*[2], *Govind P. Agrawal*[1]; [1]*Inst. of Optics, Univ. of Rochester, USA,* [2]*Telecommunications Engineering Technology, Rochester Inst. of Technology, USA.* We observe efficient interband four-wave mixing (with net gain) in semiconductor optical amplifiers at low pump powers and signal detunings exceeding 6.5 nm. The potential applications include all-optical signal regeneration and wavelength conversion

Highland D

FTuD • General Optics in Information Science—Continued

FTuD7 • 9:30 a.m.
Key-Space Analysis of Phase-Only Double Random Phase Encoding, ***Kazuya Nakano***, *Hiroyuki Suzuki, Masahiro Yamaguchi, Takashi Obi, Nagaaki Ohyama; Tokyo Inst. of Technology, Japan.* We analyzed the distribution of the key-space in the phase-only DRPE by means of calculating a Euclidean distance between the decryption key and the encryption key and counting the number of the correct decryption keys.

Highland E

FTuE • General Optics—Continued

FTuE7 • 9:30 a.m.
Modeling and Measuring Gouy Phase Anomaly in Astigmatic Beams, ***Jannick P. Rolland***[1,2], *Tobias Schmid*[2], *John Tamkin Jr.*[1], *Kye-Sung Lee*[1], *Kevin P. Thompson*[3], *Emil Wolf*[1,4]; [1]*Inst. of Optics, Univ. of Rochester, USA,* [2]*CREOL, College of Optics and Photonics, Univ. of Central Florida, USA,* [3]*Optical Res. Associates, USA,* [4]*Dept. of Physics and Astronomy, Univ. of Rochester, USA.* We simulate the predicted Gouy phase anomaly near astigmatic foci of Gaussian beams using a beam propagation algorithm integrated with lens design software and compare computational results with experimental data using a modified Mertz Interferometer.

FTuE8 • 9:45 a.m.
Experimental Evidence for Wolf Shifts of Cyclostationary Fields, ***Robert W. Schoonover***, *Roberto J. Lavarello, Michael L. Oelze, P. Scott Carney; Univ. of Illinois at Urbana-Champaign, USA.* Previously predicted shifts in the generalized spectra of cyclostationary fields are demonstrated experimentally. These results apply to stochastic fields with periodic statistics, e.g. the pulse trains of comb spectroscopy or fields produced by mode-locked lasers.

10:00 a.m.–10:30 a.m. Coffee Break, *Empire Hall, Rochester Riverside Convention Cente*r

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10:00 a.m.–12:00 p.m. Students and Young Professionals Forum on Public Policy, *Carlson and Douglass, Radisson Hotel Rochester Riverside*

NOTES

Highland F

FiO

FTuF • Microscopy II—Continued

FTuF6 • 9:30 a.m.
Development of Quantitative Metrics for Second-Harmonic Generation Imaging of Collagen-Based Structures, *Raghu Ambekar Ramachandra Rao,* ***Kimani Toussaint, Jr.****; Univ. of Illinois at Urbana-Champaign, USA.* We discuss the application of harmonic analysis in second-harmonic generation microscopy in developing useful quantitative metrics for assessing tissue morphology. A comparison between the information content in forward and backward SHG images is also presented.

FTuF7 • 9:45 a.m.
Confocal Raman Microspectroscopy of Streptococcus Sanguis and Mutans, ***Brooke D. Beier***[1], *Robert G. Quivey*[2], *Andrew J. Berger*[1]; [1]*Inst. of Optics, Univ. of Rochester, USA,* [2]*Ctr. for Oral Biology, Univ. of Rochester, USA.* Confocal Raman microscopy has been used to distinguish between biofilms of oral bacteria species *Streptococcus sanguis* and *mutans*. This capability has been applied to the study of mixed biofilms as a model for dental plaque.

Highland G

FiO

FTuG • Quantum Information and Communications III—Continued

FTuG7 • 9:30 a.m.
A Provably Secure Streamcipher Based on a High Speed Quantum Random Number Generator, ***Zheshen Zhang****, Paul L. Voss; Georgia Tech, France.* We propose a novel low-complexity streamcipher device based on random numbers from quantum sources with security from NP-complete problems. We demonstrate a generation rate of 20 Gbit/s.

FTuG8 • 9:45 a.m.
Time Averaged Density Matrix and the Effective Hamiltonian, ***Omar Gamel****,; Univ. of Toronto, Canada.* We find the effective Hamiltonian for the evolution of the time-averaged density matrix of a quantum system, along with nonunitary decoherence terms in Lindblad form. Theory applied to AC Stark Shift, and 3-level Raman Transitions.

Highland H

LS

LTuA • Photophysics of Nanostructured Materials II—Continued

LTuA5 • 9:30 a.m.
Photoluminescence Enhancement from an Axi-symmetric Zinc Sulfide Particle Illuminated with a Focused Laser Beam, ***Elsayed Esam M. Khaled***[1], *Hany L. Ibrahim*[2]; [1]*Electrical Engineering Dept., Assiut University Egypt,* [2]*Telecom Egypt Co., Egypt.* Analytical analysis of photoluminescence enhancements from a spheroidal or cylindrical zinc sulfide particle illuminated with a focused shifted laser beam is illustrated. This enhancement can also be obtained by doping such particles with copper cores.

LTuA6 • 9:45 a.m.
Control of Photoisomerization Quantum Efficiency by Metallic Nanostructures, *Jiong Shan, Shen Xu, Wei Shi, Liying Liu,* ***Lei Xu****; Fudan Univ., China.* We report that the *trans* to *cis* photo-isomerization yield of azobenzene molecule can be tuned in a range of 8% to 40% when the molecules are placed close to different gold nanostructures.

Highland J

JOINT FiO/LS

STuA • IPF-Laser Applications in Metrology—Continued

STuA4 • 9:30 a.m. Invited
The Electronic Kilogram and Lasers, ***Richard Steiner****; NIST, USA.* The best measurements of the Planck constant are from the electronic kilogram project at the National Institute of Standards and Technology. Precise laser position measurements are one of the many components of this system.

Highland K

LS

LTuB • Nonlinear Optics I—Continued

LTuB5 • 9:30 a.m.
Spatial Modes of Phase-Sensitive Image Amplifier with Elliptical Gaussian Pump, ***Muthiah Annamalai***[1], *Nikolai Stelmakh*[1], *Michael Vasilyev*[1], *Prem Kumar*[2]; [1]*Univ. of Texas at Arlington, USA,* [2]*Northwestern Univ., USA.* We develop the formalism to find the number of supported eigenmodes and their shapes for a spatially broadband frequency-degenerate optical parametric amplifier with elliptical Gaussian pump, where each eigenmode is independently squeezed.

LTuB6 • 9:45 a.m.
Towards Single-beam CARS Imaging of Reacting Flows, ***Paul Wrzesinski***[1], *Dmitry Pestov*[1], *Vadim Lozovoy*[1], *Sukesh Roy*[2], *James R. Gord*[3], *Marcos Dantus*[1,4]; [1]*Michigan State Univ., USA,* [2]*Spectra Energies LLC, USA,* [3]*Propulsion Directorate, USA,* [4]*Biophotonic Solutions Inc., USA.* Imaging of a CO_2 gas jet in ambient air via single-beam CARS technique is demonstrated. Binary phase shaping is used to provide the chemical contrast through selective excitation of one of the CO_2 Fermi dyads.

10:00 a.m.–10:30 a.m. Coffee Break, *Empire Hall, Rochester Riverside Convention Center*

10:00 a.m.–12:00 p.m. Students and Young Professionals Forum on Public Policy, *Carlson and Douglass, Radisson Hotel Rochester Riverside*

NOTES

FiO

Highland A

10:30 a.m.–12:00 p.m.
FTuH • Novel Fiber Device
Lars Grüner-Nielsen; OFS Denmark, Denmark, Presider

FTuH1 • 10:30 a.m. Invited

Self Assembled Periodicity in a Liquid Filled Hollow Optical Fiber, *Kyunghwan Oh*[1], *Hojoong Jung[1], Sohee An[1], Yongmin Jung[2]; [1]Yonsei Univ., Republic of Korea, , [2]Optoelectronics Res. Ctr., Univ. of Southampton, UK.* A novel route to form a periodic structure in a sefl-assembled manner was observed in a liquid-filled hollow-optical fiber. Highly reproducible liquid-air and polymer-air periodic structures were fabricated inside hollow-fiber by traversing a micro-heat-source, and irradiating UV light, respectively. Their photonic and optofluidic applications are explored.

FTuH2 • 11:00 a.m.

Ultra-Wide Tunable Coupling in Fused Taper Fiber Coupler by Locally Applying Torsional Stress over the Waist, ***Honggu Choi***, *Yunseop Jeong, Kyunghwan Oh; Yonsei Univ., Korea, Republic of.* Ultra-wide tunable light coupling in a fussed fiber coupler was experimentally achieved from 1000nm to 1700nm by applying torsion over the taper waist. Consistent spectral shifts in the transmission were analyzed for band rejection filter.

FTuH3 • 11:15 a.m.

Birefringence in Photonic Crystal Fibers: Cladding Lattice Shape Versus Unit-Cell Anisotropy, *Arash Mafi,* ***Parisa Gandomkar Yarandi****; Univ. of Wisconsin-Milwaukee, USA*. We report on the birefringence caused by the anisotropy of the refractive index profile of a PCF single lattice unit in comparison to the birefringence caused by the underlying lattice shape and core shape asymmetries.

Highland B

10:30 a.m.–12:00 p.m.
FTuI • Optical Design for Biomedical Systems I
Guoqiang Li; Univ. of Missouri at St. Louis, USA, Presider

FTuI1 • 10:30 a.m. Invited

Degrees of Freedom in Computational Volume Optics, *Rafael Piestun*; *Univ. of Colorado at Boulder, USA.* Abstract not available.

FTuI2 • 11:00 a.m. Invited

Optical Ring Resonator Based Biological and Chemical Sensors, *Xudong (Sherman) Fan*, *Jonathan D. Suter, Yuze Sun, Jing Liu, Hao Li, Karthik R. C. Balareddy; Univ. of Michigan, USA*. In this presentation various ring resonator structures will first be introduced, followed by their applications in biological and chemical sensing in aqueous and gas environment. Finally, future research and development directions will be discussed.

Highland C

10:30 a.m.–12:00 p.m.
FTuJ • Ultrafast fiber laser
Guifang Li; Univ. of Central Florida, USA, Presider

FTuJ1 • 10:30 a.m. Invited

Short-Pulse Fiber Lasers Based on Dissipative Solitons, *Frank Wise*; *Cornell Univ., USA*. Short-pulse fiber lasers based on dissipative-soliton formation offer major performance and practical advantages over prior fiber lasers. Recent developments will be reviewed.

FTuJ2 • 11:00 a.m.

Evidence of High-Order Vector Dissipative Soliton in a Fiber Laser, ***Xuan Wu***, *Dingyuan Tang, Luming Zhao, Han Zhang, Randall J. Knize; School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore.* High-order vector dissipative solitons, consiting of two orthogonal polarization components, one of which is a single-hump pulse and the other has a double-humped structure, was observed in a normal-dispersion fiber laser for the first time.

FTuJ3 • 11:15 a.m.

30 fs Level Pulse Generation Directly from an Er:fiber Laser, ***Ding Ma***, *Chun Zhou, Yue Cai, Weijian Zong, Zhigang Zhang; Peking Univ., China*. We report 30 fs level pulse generation directly from a mode locked Er:fiber laser at a repetition rate of 225 MHz.

Highland D

10:30 a.m.–12:00 p.m.
FTuK • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing I
Kevin Thompson; Optical Res. Associates, USA, Presider

FTuK1 • 10:30 a.m. Invited

Quantum Inspired Imaging with Compressive Sensing, *Ori Katz*, *Yaron Bromberg, Yaron Silberberg; Weizmann Inst. of Science, Israel.* We demonstrate depth-resolved computational ghost imaging using a single single-pixel detector and a spatially modulated beam. We further develop an advanced reconstruction algorithm based on compressive-sensing, demonstrating a 10-fold reduction in image acquisition time.

FTuK2 • 11:00 a.m.

Properties of Temporal Ghost Imaging with Classical Pulses, ***Tomohiro Shirai***[1], *Tero Setälä[2], Ari T. Friberg[2,3,4]; [1]AIST, Japan, [2]Aalto Univ., Finland, [3]Univ. of Eastern Finland, Finland, [4]Royal Inst. of Technology (KTH), Sweden.* Temporal ghost imaging with classical pulses is described as a temporal counterpart of conventional ghost imaging with thermal light. Effects of incident pulses on the imaging condition and the resultant image quality are discussed.

FTuK3 • 11:15 a.m.

Phase And Amplitude Imaging from Noisy Intensity Measurements Using A Kalman Filter, ***Laura Waller***, *Mankei Tsang, Sameera Ponda, George Barbastathis; MIT, USA*. We propose a method for complex-field retrieval from noisy intensity measurements in many planes, using an extended complex Kalman filter to model and predict light propagation.

Highland E

10:30 a.m.–12:00 p.m.
FTuL • Frequency Combs for Spectroscopy
Bertrand Carre; Inst. du CEA Saclay, France, Presider

Michael J. Messerly; Photon Science and Applications Program, Lawrence, USA, Presider

FTuL1 • 10:30 a.m. Invited

New Source of Ultra-Broadband Mid-IR Frequency Combs for Spectroscopic Applications, *Konstantin Vodopyanov*[1], *Nick C. Leindecker[1], Alireza Marandi[1], Robert L. Byer[1], Vladimir Pervak[2]; [1]Stanford Univ., USA, [2]Ludwig-Maximilians-Univ. München, Germany.* We implement a new approach for creating broadband mid-infrared frequency combs by using subharmonic optical parametric oscillator synchronously pumped by 1560-nm femtosecond Er-fiber laser pulses. The source produced > 1400-nm-wide frequency comb centered at 3.1µm.

FTuL2 • 11:00 a.m.

Spontaneous Phase Correlations in Raman Optical Frequency Comb Generation, ***Chunbai Wu***[1], *Erin Mondloch[1], Michael Raymer[1], Yingying Wang[2], Francois Couny[2], Fetah Benabid[2]; [1]Oregon Ctr. for Optics and Dept. of Physics,Univ. of Oregon, USA, [2]Dept. of Physics, Ctr. for Photonics and Photonic Materials, Univ. of Bath, UK.* We theoretically predict and experimentally observe strong phase correlations among multiple lines in a spontaneously generated Raman optical comb spectrum. The model treats the medium as a 125 THz phase modulator.

FTuL3 • 11:15 a.m.

High-Resolution Mid-Infrared Frequency Comb Fourier Transform Spectrometer, ***Florian Adler***[1], *Piotr Maslowski[1,2], Aleksandra Foltynowicz[1], Kevin C. Cossel[1], Travis C. Briles[1], Jun Ye[1]; [1]JILA, NIST and Univ. of Colorado, USA, [2]Instytut Fizyki, Uniwersytet Mikolaja Kopernika, Poland.* We present a frequency-comb-based Fourier transform spectrometer operating in the ~2200-3700-cm^{-1} range which allows rapid acquisition of broadband spectra with 0.01 cm^{-1} resolution, detecting ppb-level concentrations of various gases in <1 minute of acquisition time.

Highland F

FiO

10:30 a.m.–12:00 p.m.
FTuM • Trapping I
Monika Ritsch-Marte; Innsbruck Medical Univ., Austria, Presider

FTuM1 • 10:30 a.m. **Invited**
Suppression of Brownian Motion Explores Cooperativity for Single Multi-Subunit Enzymes in Solution, *Yan Jiang*[1,2], *Nick Douglas[3], Nick Conley[4,1], Eric Miller[3], Judith Frydman[3], W.E. Moerner[1]; [1]Chemistry Dept., Stanford Univ., USA, [2]Applied Physics Dept., Stanford Univ., USA, [3]Biology Dept., Stanford Univ., USA, [4]Radiology Dept., Stanford Univ., USA.* A high-speed Anti-Brownian ELectrokinetic trap enables extended observation of sub-10nm fluorescent objects in solution. For example, single chaperonin enzymes loaded with Cy3-ATP display stepwise photobleaching intensity traces corresponding to the ATP binding/hydrolysis stoichiometry and cooperativity.

FTuM2 • 11:00 a.m.
π - Phase Cylindrical Vector Beams in Optical Tweezers, *Brian J. Roxworthy*, *Kimani C. Toussaint, Jr.; Univ. of Illinois at Urbana-Champaign, USA.* The use of π - phase cylindrical vector beams in optical trapping is investigated. We find that tuning the relative phase between the eigenmodes comprising the beams can optimize the axial trapping forces.

FTuM3 • 11:15 a.m.
Controlled Rotation of Micro-Particles with Multi-Trap Rotating Tweezers Generated by Moiré Technique, ***Daniel Hernandez***[1], *Peng Zhang[1], Simon Huang[1], Yi Hu[1,2], Zhigang Chen[1,2]; [1]San Francisco State Univ., USA, [2]TEDA Applied Physics School, Nankai Univ., China.* We demonstrate controlled rotation of micro-particles with multi-trap rotating tweezers established with optical propelling beams. Such propelling beams contain rotating intensity blades generated by Moiré technique but with no mechanical movement or phase-sensitive interference.

Highland G

10:30 a.m.–12:00 p.m.
FTuN • Opto-Mechanics and Quantum Measurement I
Tal Carmon; Univ. of Michigan, USA, Presider

FTuN1 • 10:30 a.m. **Invited**
Quantum Back Action in Tabletop Interferometers, *Jack Harris*[1,2], *Kjetil Børkje[1], Steven M. Girvin[1,2], Nathan Flowers-Jacobs[1], Benjamin M. Zwickl[1], Cheng Yang[1]; [1]Yale Univ., USA, [2]Yale Univ., Dept. of Applied Physics, USA.* We present a scheme for measuring the shot noise of radiation pressure in a room temperature, table top interferometer, and discuss experimental progress towards this goal.

FTuN2 • 11:00 a.m.
Optical Trapping and Cooling of Glass Microspheres, *Tongcang Li*, *Simon Kheifets, David Medellin, Mark G. Raizen; Univ. of Texas at Austin, USA.* We report optical trapping of glass microspheres in air and vacuum, and measurement of Brownian motion of single microspheres at different pressures. We are working on cooling the center-of-mass motion of a trapped microsphere.

FTuN3 • 11:15 a.m.
Optomechanics of Unbound Nanoparticles Interacting with Whispering Gallery Modes of Microspheres, *Joel Rubin*, *Lev Deych; Dept. of Physics,CUNY, USA.* Dynamics of a free subwavelength particle interacting with an optical whispering gallery mode resonator are studied theoretically. We show that the optical forces can capture the particle in quasi-stationary orbital motion around the resonator.

Highland H

LS

10:30 a.m.–12:00 p.m.
LTuC • Photophysics of Nanostructured Materials III
Emily Weiss; Northwestern Univ., USA, Presider

LTuC1 • 10:30 a.m. **Invited**
Mixed Quantum Classical Simulations of Vibrational Excitations in Peptide Helices, *Anne Goj*, *Eric Bittner; Univ. of Houston, USA.* The theory of Davydov solitons largely has been been studied using semi-classical techniques that invoke an adiabatic approximation. We test for the soliton formation under conditions that include important features of a true biological system-300K temperature, a solvent, hydrogen bond breaking and reforming.

LTuC2 • 11:00 a.m. **Invited**
Two-Dimensional Photon Echo Measurements on CdTe/CdSe Heterostructured Quantum Dots, *Shun Shang Lo*[1], *Roman Vaxenburg[2], Cathy Y. Wong[1], Efrat Lifshitz[2], Gregory D. Scholes[1]; [1]Univ. of Toronto, USA, [2]Russell Berrie Nanotechnology Inst. and Solid State Inst., Israel.* Here we report results obtained using two-dimensional photon echo spectroscopy (2DPE) to study ultrafast dynamics in CdTe/CdSe heterostructured quantum dots.

Highland J

JOINT FiO/LS

10:30 a.m.–12:30 p.m.
STuB • IPF - Frontiers in Physics
Ben Snavely; American Inst. of Physics, USA, Presider

STuB1 • 10:30 a.m. **Invited**
Viewing the High-Energy Universe with the Fermi Gamma-ray Space Telescope, *Peter F. Michelson*; *Stanford Univ., USA.* The Fermi Gamma-ray Space Telescope has completed 2 years of observations of the entire sky from 10 keV to more than 300 GeV, providing a new view of the high-energy Universe.

STuB2 • 11:00 a.m. **Invited**
Quantum Entanglement and Information, *Christopher Monroe*; *Univ. of Maryland, USA.* Quantum systems can store entangled superpositions of information, offering the possibility of enhanced performance in many applications. This talk will outline hardware used to make large scale entangled states, using atoms and light.

Highland K

LS

10:30 a.m.–12:00 p.m.
LTuD • Novel Imaging, Spectroscopy and Manipulation in Microstructures I
Jay E. Sharping; Univ. of California at Merced, USA, Presider

LTuD1 • 10:30 a.m. **Invited**
Coherent Rydberg Excitation in Microscopic Thermal Vapor Cells, *Tilman Pfau*[1], *H. Kübler[1], T. Baluktsian[1], B. Huber[1], A. Kölle[1], J. P. Shaffer[1,2], R. Löw[1]; [1]Univ. Stuttgart, Germany, [2]Univ. of Oklahoma, USA.* We show that coherence times of ~ 100 ns are achievable with coherent Rydberg atom spectroscopy in micrometre-sized thermal vapour cells making them robust and promising candidates for scalable quantum devices like single-photon sources.

LTuD2 • 11:00 a.m.
High Bandwidth Optical Magnetometry with a Micromachined Vapor Cell, ***Ricardo Jimenez-Martinez,*** *W. Clark Griffith, Svenja Knappe, John Kitching; Time and Frequency Div., USA***.**We describe an optical magnetometer that retains its sensitivity within a bandwidth of 10 kHz. The device relies on laser spectroscopy of alkali atoms contained in a 2 mmX 1mmX 1mm micromachined vapor cell.

LTuD3 • 11:15 a.m. **Invited**
Single-Particle Spectroscopy and Manipulation in Optofluidic Devices, *Philip Measor[1], Brian S. Philips[2], Evan J. Lunt[2], Aaron R. Hawkins[2],* ***Holger Schmidt***[1]; *[1]Univ. of California at Santa Cruz, USA, [2]Brigham Young Univ., USA.* We review the state of the art of planar optofluidic devices using liquid-core waveguides for ultrasensitive particle detection and manipulation.

FiO

Highland A

FTuH • Novel Fiber Device—Continued

FTuH4 • 11:30 a.m.
Breaking the Two-fold Degeneracy in Eigen Modes of a Triangular-Core Hollow Optical Fiber, ***Sejin Lee***[1], *Woosung Ha*[1], *Jens Kobelke*[2], *Kay Schuster*[2], *S. Unger*[2], *Kyunghwan Oh*[1]; [1]*Inst. of Physics and Applied Physics, Yonsei Univ., Korea, Republic of,* [2]*Inst. of Photonic Technology, Germany.* A new micro-structured optical fiber is proposed and fabricated, which has a triangular core with a central air hole providing a unique 3-fold degeneracy of eigen-modes. The degeneracy evolution in the spectral domain was investigated.

FTuH5 • 11:45 a.m.
Profiling of Changes in Optical Fiber Stress and Refractive Index Due to Carbon-Dioxide Laser Irradiation, ***Michael R. Hutsel***, *Thomas K. Gaylord; Georgia Tech, USA.* Independent measurements of the 2D refractive index and axial stress distributions in CO_2-laser-induced long-period fiber gratings are performed. Physical mechanisms of fabrication are evaluated for the first time by direct measurement.

Highland B

FTuI • Optical Design for Biomedical Systems I—Continued

FTuI3 • 11:30 a.m.
Characterization of Ultimate Sensing Capability of Optical Ring Resonator Biosensors, ***Hao Li***[1,2], *Xudong Fan*[1]; [1]*Dept. of Biomedical Engineering, Univ. of Michigan, USA,* [2]*Dept. of Optical Science and Engineering, School of Information Science and Engineering, Fudan Univ., China.* The sensing capability of the optofluidic ring resonator in bulk refractive index detection and label-free small molecule detection is experimentally investigated near its detection limit. The results set the benchmark for ring resonator biosensors.

FTuI4 • 11:45 a.m.
Photorefractive Two-Wave Mixing for Adaptive Coherence Domain Detections, *Adam Drewery, Jeffrey LaCroix,* ***Ping Yu****; Univ. of Missouri, USA.* Photorefractive two-wave mixing based on either diffraction or photoelectromotive force has been tested for a low superluminescent light emitting diode. We demonstrate potential applications of two-wave mixing in photorefractive quantum wells for coherence domain detections.

Highland C

FTuJ • Ultrafast fiber laser—Continued

FTuJ4 • 11:30 a.m.
Noise-Like and Gain-Guided Pulses from a Dual-Mode Femtosecond Fiber Ring Laser, *Felipe Gerlein*[1], **Sylvain G. Cloutier**[1,2]; [1]*Univ. of Delaware, USA,* [2]*Delaware Biotechnology Inst., USA.* We report a mode-locked femtosecond erbium-doped fiber laser that can be tuned for stable operation in either the noise-like pulse generation mode or gain-guided soliton pulse generation regime. Detailed results and theory will be presented.

FTuJ5 • 11:45 a.m.
Modeling of Ultrafast Fiber Optical Parametric Oscillators, ***Jay E. Sharping***[1], *Wen Qi Zhang*[2], *Shahraam Afshar V.*[2]; [1]*Univ. of California at Merced, USA,* [2]*Univ. of Adelaide, Australia.* In this paper we introduce a straightforward nonlinear pulse propagation model for ultrafast fiber optical parametric oscillators. The simulations reveal interesting pulse dynamics within these systems, and give insight into optimal design strategies.

Highland D

FTuK • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing I—Continued

FTuK4 • 11:30 a.m.
Deterministic Phase Retrieval And The Fractional Talbot Effect, ***Markus E. Testorf****; Dartmouth College, USA.* Phase-space tomography and related deterministic phase retrieval methods are investigated in the context of coherent self-imaging. The periodicity of the complex signal is used to establish relationships for accurate and unique signal recovery.

FTuK5 • 11:45 a.m.
Ambiguity Function and Phase Space Tomography for Nonparaxial Fields, ***Seongkeun Cho****, Miguel A. Alonso; Univ. of Rochester, USA.* A nonparaxial generalization of the ambiguity function that retains the properties of its paraxial counterpart is presented and applied to the problem of coherence retrieval for nonparaxial fields.

Highland E

FTuL • Frequency Combs for Spectroscopy—Continued

FTuL4 • 11:30 a.m.
Saturated-Absorption Cavity Ring-Down Spectroscopy, ***Pablo Cancio Pastor***[1,2], *Iacopo Galli*[1,2], *Giovanni Giusfredi*[1,2], *Davide Mazzotti*[1,2], *Paolo De Natale*[1,2]; [1]*Inst. Nazionale di Ottica-CNR, Italy,* [2]*European Lab for Non-linear Spectroscopy, Italy.* A novel approach to cavity ring-down spectroscopy with the sample gas in saturated-absorption regime allows to decouple and simultaneously retrieve empty-cavity background and absorption signal, improving both measurement sensitivity and resolution.

FTuL5 • 11:45 a.m.
Delivery of Optical Frequency References through Atmosphere Using a Frequency Comb, ***Ravi P. Gollapalli****, Lingze Duan; Univ. of Alabama at Huntsville, USA.* Optical frequency references are transferred in the atmosphere over a 60-m round-trip propagation distance. Fractional instability ~10^{-14}-10^{-13} at 1s is observed and large phase modulation caused by air fluctuation leads to sizeable linewidth broadening.

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

12:00 p.m.–1:30 p.m. Exhibit Only Time, *Empire Hall, Rochester Riverside Convention Center*

12:00 p.m.–1:30 p.m. OSA Fellow Member Lunch, *Grand Ballroom A and B, Hyatt*

Highland F | Highland G

FiO

FTuM • Trapping I—Continued

FTuM4 • 11:30 a.m. Invited
Optical Sculpting: Changing the Shape of Micromanipulation, *Kishan Dholakia*, *Janelle Shane, Michael Mazilu, Tomas Cizmar; Univ. of St. Andrews, UK.* We explore how sculpting the phase and amplitude of light allows for optical trapping through turbid media using novel wavefront correction. Addtionally we explore the role of pulsed laser light on trapping.

FTuN • Opto-Mechanics and Quantum Measurement I—Continued

FTuN4 • 11:30 a.m. Invited
Silicon Monolithic Acousto-Optic Modulators, *Sunil A. Bhave*; *Cornell Univ., USA.* Abstract not available.

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

Highland H

LS

LTuC • Photophysics of Nanostructured Materials III—Continued

LTuC3 • 11:30 a.m.
Realization of Stable p-type Zno Thin Films Using a Li-N Dual Acceptor Doping for Optoelectronic Applications, ***Talakonda Prasad Rao***[1], *M. C. Santhosh Kumar*[2]; [1]*Dept. of Physics, Natl. Inst. of Tecnnology Tiruchirappalli, India,* [2]*Dept. of Physics, Natl. Inst. of Technology Tiruchirappalli, India.* P-type ZnO thin films were realized by dual-doping with lithium and nitrogen using spray pyrolysis. The *p*-type conductivity of (Li,N):ZnO is reproducible, stable and with acceptable crystal quality. The optical properties were studied using photoluminescence.

LTuC4 • 11:45 a.m.
Scattering of a Focused Gaussian Beam by a Dielectric Spheroidal Particle with a Nonconcentric Spherical Core, *Elsayed Esam M. Khaled*[1], *Medhat E. Aly*[2]; [1]*Assiut Univ., Egypt,* [2]*Telecom Egypt Co., Egypt.* Angular scattering intensities of a spheroidal particle with a nonconcentric core illuminated with a focused Gaussian beam are calculated using the T-matrix method. Effects of the core's offset are illustrated. Other particles shapes are applicable.

Highland J

JOINT FiO/LS

STuB • IPF - Frontiers in Physics—Continued

STuB3 • 11:30 a.m. Invited
Epitaxial Graphene: Designing a New Electronic Material, *Walter de Heer*; *Georgia Tech, USA.* Abstract not available.

STuB4 • 12:00 p.m. Invited
The Status of the CERN Large Hadron Collider (LHC), *Dan Green*; *Fermilab, USA.* The LHC is the highest energy particle accelerator in the world. The associated-experiments are the largest and most complex-scientific instruments ever built. Each detector is like a 100-megapixel camera which takes 40-million pictures per second.

Highland K

LS

LTuD • Novel Imaging, Spectroscopy and Manipulation in Microstructures I—Continued

LTuD4 • 11:45 a.m.
High-Resolution Spectroscopy of Ammonia in Hollow-Core Photonic Bandgap Fibers, *Jan C. Petersen*, *Jan Hald; Danish Fundamental Metrologi, Denmark.* High-resolution spectroscopy of ammonia in a hollow-core photonic bandgap fiber around 1.55 µm is discussed. The complex spectra in this wavelength region have been studied by saturated absorption, microwave-optical double resonance, and two-photon spectroscopy.

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

12:00 p.m.–1:30 p.m. Exhibit Only Time, *Empire Hall, Rochester Riverside Convention Center*

12:00 p.m.–1:30 p.m. OSA Fellow Member Lunch, *Grand Ballroom A and B, Hyatt*

JOINT FiO/LS

12:30 p.m.–1:30 p.m.
JTuA • Joint FiO/LS Poster Session I

JTuA01

Optical Measurement of the Deformation of a High-Speed Rotational Mirror, *Po-Hsuan Huang*[1], *Sheng-Tsong Chang*[1], *Jingshown Wu*[2], ***Ting-Ming Huang***[1]; [1]*Instrument Technology Res. Ctr., Natl. Applied Res. Labs, Taiwan*, [2]*Graduate Inst. of Communication Engineering and Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan.* Optical measurement of the deformation of a high-speed rotational mirror is investigated. Numerical finite element analysis on the deformation of the mirror is performed for better theoretical understanding. Better mirror configuration design is also proposed.

JTuA02

Multiplexed Plasmonic Nanostructures for Wide-band Optical Filters, ***Boyang Zhang***[1], *Junpeng Guo*[1], *Stuart Yin*[2]; [1]*Univerisity of Alabama in Huntsville, USA*, [2]*Pennsylvania State Univ., USA.* We investigated coupling effects of multiplexed plasmonic resonators in each unit cell of periodic structure metamaterial. Multiplexed periodic nanostructure metamaterial films have novel optical spectral properties which are quite different from simple periodic metallic structures.

JTuA03

Beam Steering in Anisotropic Metamaterials, ***Rajagopal Panchapakesan***, *Gayatri Venugopal, Kwang W. Oh, Natalia M. Litchinister; SUNY Buffalo, USA.* We propose tunable anisotropic metamaterials consisting of silver nanorods and dielectric medium for applications to beam steering and demultiplexing. The tunability is achieved by changing the fill fraction and the properties of the dielectric medium.

JTuA04

Geometric Phase and Poincare Sphere for Cylindrical Vector Beams, ***Giovanni Milione***, *Henry I. Sztul, Robert R. Alfano; Physics Dept., CUNY, USA.* Two Poincare spheres for cylindrical vector beams are described. The two spheres share circularly polarized LG modes as their eigenstates, i.e poles. A geometric phase is shown from evolution along the surface of these spheres.

JTuA05

Fabrication of Optical Active Polymeric Microstructures Connected with Silica Nanofibers, ***Vinicius Tribuzi***, *Rafael H. Pacheco, Daniel S. Corrêa, Marcos R. Cardoso, Cleber R. Mendonça; Inst. de Física de São Carlos, Univ. of São Paulo, Brazil.* We used femtosecond pulses to fabricate microscopic polymeric structures by using the two-photon absorption induced polymerization. By using doped samples we have fabricated optical active microstructures which were excited by external sources through silica nanofibers.

JTuA06

Implementation of a Diffusion Element Sensor in an Optical Oxygen Analyzer in a Refinery Heather, ***Eduardo Pérez-Careta***[1], *J. J. Sánchez-Mondragón*[2], *M. Torres-Cisneros*[1]; [1]*Univ. of Guanajuato, Mexico*, [2]*Photonics and Optical Physics Lab, INAOE, Mexico.* The implementation of a Hastelloy material sensor in a TDLS Oxygen Analyzer is discussed in this paper. Porosity, corrosion and high temperature affects the measurements of the analyzer are reduced notably with hastelloy sensors.

JTuA07

Imaging Based on Random Excitation of Fluorescence Localized by Metallic Nanoislands, *Kyujung Kim*[1], *Youngjin Oh*[2], *Wonju Lee*[2], *Donghyun Kim*[1,2]; [1]*Program for Nanomedical Science and Technology, Yonsei Univ., Korea, Republic of*, [2]*School of Electrical and Electronic Engineering, Yonsei Univ., Korea, Republic of.* We investigated localized surface plasmon imaging to improve spatial resolution in total internal reflection microscopy. The resolution increment is based on excitation by hotspots between nanoislands. The images were confirmed using fluorescent beads.

JTuA08

Silicon-Coated Deep Subwavelength Spoof Plasmonic Waveguides for THz Applications, ***Ruoxi Yang***, *Wangshi Zhao, Zhaolin Lu; Rochester Inst. of Technology, USA.* We numerically study the propagation of THz waves in spoof plasmonic devices, and show the possibility of using high-index top-coat material to further shrink the relative mode size for deep-subwavelength mode confinement.

JTuA09

Dual Gas Sensor Design Considering a Single Fabry-Perot Interferometer, ***Everardo Vargas-Rodriguez***[1], *Daniel May-Arrioja*[2], *Julian Estudillo-Ayala*[1], *Jose Andrade-Lucio*[1], *Roberto Rojas-Laguna*[1], *Monica Trejo-Duran*[1]; [1]*Univ. of Guanajuato, Mexico*, [2]*Autonomus Univ. of Tamaulipas, Mexico.* In this work we analyze the design of a dual gas sensor based on correlation spectroscopy using a single Fabry-Perot Interferometer. Simulations and experimental results will be provided.

JTuA10

Interrogation Method of a Bragg Gratings Based Laser Sensor Using FFT, ***Oscar Méndez Zepeda***, *Severino Muñoz Aguirre, Georgina Beltrán Pérez, Juan Castillo Mixcóatl; Benemérita Univ. Autónoma de Puebla, Mexico.* Multipoint laser sensors based on Bragg gratings usually identify the acting gratings. However they cannot quantify the signal change. In this work the Fourier discrete transform was used to identify and quantify such signal variations.

JTuA11

Implementation of Phase-Shift Patterns with Sub-diffraction- Limited Features by Use of Diffractive Optical Elements, *Yu-Wen Chen*[1], ***Wei-Feng Hsu***[2], *Sidney S. Yang*[1]; [1]*Natl. Tsing Hua Univ., Taiwan*, [2]*Natl. Taipei Univ. of Technology, Taiwan.* We present the experimental results of three consecutive studies in which the complex 2-D subdiffraction-limited images can be generated, and the methods to improve the image quality by decreasing the speckle noise.

JTuA12

Effect of Spherical Aberration on the Color Appearance of Small Red Dot, ***Huanqing Guo***, *Elie Delestrange, Alexander Goncharov, Chris Dainty; Natl. Univ. of Ireland, Galway, Ireland.* We used adaptive optics (AO) system to produce spherical aberration on the 4 mm pupil eye. A small red dot surrounded by a black ring and white background appeared to be whitish through the system.

JTuA13

Long Period Fiber Gratings to Detect Organic Vapor, ***Viterbo Epitacio Reyes***, *Georgina Beltrán Pérez, Severino Muñoz Aguirre, Juan Castillo Mixcoatl; Benemérita Univ. Autónoma de Puebla, Mexico.* An organic vapor sensor was fabricated by a PDMS film deposited on an LPFG. The response was measured as the transmission spectrum change. The sensor sensitivity was related to the sample molecular weight.

JTuA14

Reference Free Aspheric Wavefront Measurement, ***Wenjiang Guo***[1,2], *Liping Zhao*[1], *I-Ming Chen*[2]; [1]*Singapore Inst. of Manufacturing Technology, Singapore*, [2]*Nanyang Technological Univ., Singapore.* A novel reference-free wavefront sensing methodology is proposed to measure aspheric wavefront. It is demonstrated and proved theoretically and simulation results show that the form of the aspheric wavefront can be correctly reconstructed.

JTuA15

New Spectroscopic Evidence that H2 Molecules Present in the Gaseous Atmospheres of OB Stars Displaying the 2175A “Bump” are Coherently Photoexcited, ***Peter P. Sorokin***; *IBM Res. (Emeritus), USA.* I explain why the (999A - 1013A) FUSE spectra of 2175A “bump” stars invariably display intense sharp absorption bands at 1004.56A, 1007.29A, and 1011.53A, while these three bands are always absent in “non bump” stars.

JTuA16

Dynamic Response of Optical Feedback in Orthogonally Polarized Microchip Nd:YAG Laser Based on Optical Feedback Rate Equation, ***Zhou Ren***, *Xinjun Wan, Yidong Tan, Shulian Zhang; Tsinghua Univ., China.* We present an optical feedback rate equation model to explain the dynamic response phenomenon of optical feedback in orthogonally polarized microchip Nd:YAG lasers. The theoretical analysis is in good agreement with the experiment results.

JTuA17

Dissipative Soliton Generation and Compression in a Compact All-Fiber Laser System, ***Leiran Wang***, *Xueming Liu, Yongkang Gong, Dong Mao, Xiaohui Li; Xi’an Inst. of Optics and Precision Mechanics, Chinese Acad. of Sciences, China.* A compact all-fiber laser system is proposed to investigate the generation and compression of dissipative solitons. The original highly chirped picosecond pulses can be dechirped to femtosecond pulses by single-mode-fiber with optimal lengths.

JTuA18

Secondary Processes Induced by Femtosecond Laser Plasma X-Ray and Corpuscular Emission in External Target, ***Gregory Golovin***, *D. Uryupina, R. Volkov, A. Savel’ev; Moscow State Univ., Russian Federation.* Plasma created by the femtosecond laser pulse (I=10^{17} W/cm^2) was used as a source of electrons and x-rays to excite 14.4 keV nuclear state of ^{57}Fe. Conversional de-excitation of this state was observed.

JTuA19

Time-Resolved Fluorescence Spectroscopy of Contrast Agent, ICG, Influenced by Rotational Motion, *Yang Pu*, *Wubao Wang, Robert R. Alfano; CUNY, USA.* The time-resolved fluorescence polarization spectroscopy of ICG in a solvent is affected by its rotational motion and the polarization profiles can be fitted by a dipole model.

JTuA20

High Sensitivity Photothermal Lens Detection of Metallic Nanoparticles: Applications for Detection of Protein Biomarkers, ***Franz W. Delima***, *Aristides Marcano, Yuri Markushin, Chandran Sabanayagam, Noureddine Melikechi; Delaware State Univ., USA.* We report on a photothermal lens detection of metallic nanoparticles in water and serum samples. We demonstrate detection limits of 0.5 ppb. We discuss the use of metallic nanoparticles for detection of protein biomarkers.

JTuA21

Auto-Biosensing System for Early Detection, ***Zhou Xiao Qun***[1], *Han Ming Yong*[2], *Ng Soon Huat*[1], *Michelle Low*[2]; [1]*Inst. for Infocomm Res., Singapore*, [2]*Inst. of Materials Res. and Engineering, Singapore.* Photoluminescence based auto-biosensing system was invented for detecting the total protein in urine. The system consists of an auto sampling, analyzing system, and security information system. The measurable protein concentration is low to 0.01mg/ml.

JTuA22

Light-Diffusion Properties of Sulfurreducing Bacteria Desulfuromonas Acetoxidans under Influence of Heavy Metals, ***Oresta M. Vasyliv***[1], *Olexandr O. Bilyy*[2], *Vasyl B. Getman*[2], *Svitlana O. Hnatush*[1]; [1]*Biological Faculty, Ivan Franco Natl. Univ. of Lviv, Ukraine*, [2]*Faculty of Electronics, Ivan Franco Natl. Univ. of Lviv, Ukraine.* Relative content of different sizes cells of sulfurreducing bacteria Desulfuromonas acetoxidans under the influence of heavy metals has been investigated. Correlation between light-diffusion properties, growth and accumulation abilities of this bacterial cells has been shown.

JTuA • Joint FiO/LS Poster Session I—Continued

JTuA23

Improved fNIRS Using a Novel Brush Optrode, ***Chester Wildey***[1], *Duncan L. MacFarlane*[1], *Bilal Khan*[2], *Fenghua Tian*[2], *Hanli Liu*[2], *Georgios Alexandrakis*[2]; [1]*Univ. of Texas at Dallas, USA*, [2]*Univ. of Texas at Arlington, USA*. Functional Near Infrared Spectroscopy (fNIRS) may be impaired by absorption from the subject's hair. Improved sensitivity is achieved using a redesigned optrode with fiber tips designed to thread through the hair for better scalp contact.

JTuA24

Monitoring Photodynamic Therapy of Head and Neck Cancer with Optical Spectroscopy: Initial Results, ***Ulas Sunar***, *Daniel Rohrbach, Nestor Rigual, Erin Tracy, Ken Keymel, Michele T. Cooper, Heinz Baumann, Barbara H. Henderson; Roswell Park Cancer Inst., USA*. We present initial results obtained during photo-dynamic therapy (PDT) in a head and neck cancer patient. Our results showed PDT induced significant drug photobleaching assessed by noninvasive diffuse optical methods.

JTuA25

Measuring Dispersion in Metamaterials, ***Dean P. Brown***[1], *Augustine M. Urbas*[2]; [1]*UES, Inc., USA*, [2]*AFRL, USA*. We utilize a multiphoton intrapulse interference phase scan (MIIPS) technique to measure the group velocity dispersion (GVD) of metamaterials and find it to be four orders of magnitude larger than that of dispersive optical glasses.

JTuA26

Lensing Properties of Ultraslow Light in Bose-Einstein Condensate, ***Devrim Tarhan***[1], *Alphan Sennaroglu*[2], *Özgür Müstecaplıoğlu*[2,3]; [1]*Harran Univ., Turkey*, [2]*Koç Univ., Turkey*, [3]*ETH Zurich, Switzerland.* We have investigated lensing properties of ultraslow light in an atomic Bose-Einstein condensate by using an off-resonant electromagnetically induced transparency scheme.

JTuA27

Implementation and Development on Color Inkjet High Density Data Storage Technology, ***Samuel I En Lin****; Natl. Formosa Univ., Taiwan.* A high density optical disk storage concept using microholographic multiplexing method was demonstrated. Simultaneous readout of multiple bits in a single storage pit is accomplished with a D/ROE head using a white light source.

JTuA28

On Convergence of Fourier Modal Methods Used for Computing Scattering from Metallic Binary Gratings, ***Krishna Mohan Gundu***, *Arash Mafi; Univ. of Wisconsin-Milwaukee, USA*. We show that the convergence problems in Fourier modal methods also arise from the square truncation of boundary matching conditions and that by seeking minimum least squared solution of rectangular truncation, convergence can be achieved.

JTuA29

Dynamic Gain Spectrum Equalizer for EDFAs in Reconfigurable Optical Networks, *Vitor V. Nascimento*[1,2], **Julio C. R. F. Oliveira**[1], *Vitor B. Ribeiro*[1], *Aldario C. Bordonalli*[2]; [1]*CPqD Foundation, Brazil*, [2]*UNICAMP, Brazil.*A dynamic gain spectrum equalizer based on a cascade of sinusoidal optoceramic filters applied to EDFAs is demonstrated. A superior performance on power imbalance compensation and OSNR maintenance is obtained after different scenarios experimental evaluation.

JTuA30

Fast and Wide Wavelength-Swept Fiber Optical Parametric Oscillator Based on Dispersion-Tuning, ***Yue Zhou***, *Kim K. Y. Cheung, Qin Li, Sigang Yang, P. C. Chui, Kenneth K. Y. Wong; Univ. of Hong Kong, Hong Kong.* We demonstrate a fast and wide tuning wavelength-swept source based on a dispersion-tuned fiber optical parametric oscillator. We achieved the sweep rate of 40 kHz and the wavelength tuning range of 109 nm.

JTuA31

Wavelength Conversion Characterization of 2-14 Gb/s BPSK Channels Based on SOA-FWM Properties, *Eduardo C. Magalhães*[1], *Evandro Conforti*[2], **Aldårio C. Bordonalli**[2]; [1]*Univer. of Campinas - UNICAMP, Brazil*, [2]*Univ. of Campinas - UNICAMP, Brazil.*An empirical characterization of wavelength conversion of phase modulated channels based on SOA-FWM is presented. For a 3-nm range around a modulated carrier, the first FWM product in negative detuning showed the best conversion performance.

JTuA32

Capacity Achieving Signal Constellation Diagram of Fiber-Optic Channel, *Jianyong Zhang*[1], ***Ivan B. Djordjevic***[2], *Hussam G. Batshon*[2], *Shuisheng Jian*[3]; [1]*Beijing Jiaotong Univ., Institute of Lightwave Technology, China*, [2]*Univ. of Arizona,Dept. of Electrical and Computer Engineering, USA*, [3]*Beijing Jiaotong Univ., Key Lab of Alloptical Network & Advanced Telecommunication Network of EMC, China*. We describe a method to determine the optimum signal constellation diagram of arbitrary fiber-optic channel. The numerical results indicate that the optimized signal constellation has discrete amplitude and non-circular phase.

JTuA33

Anomalous Propagation of Luminescence through Bulk n-InP, *Serge Luryi*, ***Oleg Semyonov,*** *Arsen Subashiev, Zhichao Chen; State Univ. of NY at Stony Brook, USA*.Implementation of a semiconductor as a scintillator with a lattice-matched surface photo-diode for radiation detection requires efficient luminescence collection. Low and heavily doped bulk n-InP has been studied to optimize luminescence transmission via photon recycling.

JTuA34

50 km Ultralong Erbium Fiber Laser with Soliton Pulse Compression, ***Lucia A. M. Saito***, *Eunezio A. De Souza; Univ. Presbiteriana Mackenzie, Brazil.* We demonstrated a 50 km ultralong Erbium fiber laser actively mode locked with repetition rate varying from 1 to 10 GHz. The output pulse widths were determined by soliton regime at 1 and 2.5 GHz

JTuA35

Surface Plasmon Resonance (SPR) Based Indium Tin Oxide (ITO) Coated Tapered Optical Fiber Sensor for IR Region, ***Rajneesh Verma***, , *Banshi D. Gupta; Indian Inst. of Technology Delhi, India.* SPR based ITO coated tapered optical fiber sensor for detection in infrared region of the spectrum is presented. Sensitivity enhancement of about 5 times as compared to conventional gold coated fiber optic sensor is reported.

JTuA36

Analysis of Graded-Index Segmented Channel Waveguides with Application to Femtosecond Laser Written Waveguides, ***Ruchi Garg***, *M R Shenoy, K. Thyagarajan; Indian Inst. of Technology Delhi, India.* We present an analysis of graded-index segmented channel waveguides with z-dependent refractive index variation in the high-index segments, and explain the stability behavior of recently fabricated 'pearl chain waveguides' using femtosecond laser inscription.

JTuA37

Optical Packaging Design for Silicon Photonic Chips, ***Yoichi Taira***, *Hidetoshi Numata; IBM, Japan.* We evaluated packaging design options of silicon photonics chips with processors for achieving fan-out of the optical signal lines, maintaining mechanical robustness, and signal connection to the external signal paths like the conventional packaging.

JTuA38

Omnidirectional Band Gaps in a Ternary Metallo-Dielectric Stack, ***Adalberto Alejo-Molina***[1], *Jose J. Sanchez-Mondragon*[1], *Alvaro Zamudio-Lara*[2], *Daniel A. May-Arrioja*[3], *Miguel Torres-Cisneros*[4]; [1]*Inst. Nacional de Astrofisica Optica y Electronica, Mexico*, [2]*Ctr. for Res. in Engineering and Applied Sciences. UAEM, Mexico*, [3]*Univ. Autonoma de Tamaulipas, Mexico*, [4]*Univ. Autonoma de Guanajuato, Mexico.* We found the dispersion relation of a metallo-dielectric quarter-wave like stack for oblique incidence (transversal electric and magnetic modes). This structure has omnidirectional band gaps not only in the bottom but also at high frequencies.

JTuA39

Locomotive Analysis of C. Elegans through Diffraction, ***Jenny Magnes***[1], *Kathleen M. Raley-Susman*[2], *Alicia Sampson*[1], *Rebecca Eells*[1]; [1]*Vassar College, Box 745, USA*, [2]*Vassar College, Box 731, USA*. Here we present an alternative technique to observe physical and biological parameters of live *C. elegans* using diffraction of laser beams. We differentiate the locomotion of a swimming and a crawling *C. elegans*.

JTuA40

Nonlinear Absorption in Multimode Waveguides, ***Armand Rosenberg***, *Steven R. Flom, Richard G. S. Pong, James S. Shirk; NRL, USA*. The energy-dependent absorption of multimode waveguides with strongly nonlinear cores has been studied experimentally and numerically. The presence of a discrete set of waveguide modes is found to substantially lower the nonlinear threshold.

JTuA41

Tailoring the Beam Profile of an 808-nm Pump Laser Diode Using Lloyd's Mirror Interference, ***Takehiro Fukushima***, *Koichiro Sakaguchi, Yasunori Tokuda; Dept. of Communication Engineering, Okayama Prefectural Univ., Japan.* We demonstrate a method for tailoring the beam profile of a commercial 808-nm pump laser diode. An almost circular output beam with a vertical divergence of approximately 7.2° was obtained using Lloyd's mirror interference.

JTuA42

Sudden Death of Entanglement Between Coupled Quantum Dots in a Cavity, *Arnab Mitra*[1,2], *Hsiaoharng Shiau*[1], **Reeta Vyas**[1]; [1]*Univ. of Arkansas, USA*, [2]*California State Polytechnic Univ., USA*. We study generation and time evolution of entanglement between two coupled quantum dots inside a driven cavity. In the presence of dissipation the entanglement may remain stationary, decay asymptotically, or show sudden death.

JTuA43

Ultrafast Optics Used to Generate and Detect Longitudinal Acoustic Phonons in High Quality Silicon on Glass Sample, ***Omar S. Magaña-Loaiza***[1,2], *Roman Sobolewski*[2], *Jose J. Sanchez-Mondragon*[1], *Jie Zhang*[2], *Carlo Kosik-Williams*[3], *Adalberto Alejo-Molina*[1]; [1]*Natl. Inst. for Astrophysics Optics and Electronics, Mexico*, [2]*Univ. of Rochester, USA*, [3]*Corning Inc, USA.* We show the experimental generation and detection, as well as theoretical studies, of unusual coherent acoustic phonons on a high quality silicon-on-glass sample. We suggest a photonic crystal based on the studied sample.

JTuA44

Sub-nanoscale Resolution for Microscopy via Coherent Population Trapping, ***Kishor T. Kapale***[1], *Girish S. Agarwal*[2]; [1]*Western Illinois Univ., USA*, [2]*Oklahoma State Univ., USA*. We present a coherent population trapping based scheme to attain sub-nanoscale resolution for microscopy using three-level atoms coupled to two optical fields---amplitude modulated probe field and a spatially dependent coupling field.

JTuA45

GaAs Microdisks Cavities for Second-Harmonic Generation, ***Paulina S. Kuo***[1], *John Lawall*[1], *Glenn S. Solomon*[1,2]; [1]*Natl. Inst. of Standards and Technology, USA*, [2]*Joint Quantum Inst., USA*. We experimentally investigate quasi-phasematched, second-harmonic generation (SHG) in GaAs microdisks. We predict 0.1% conversion efficiency using 1 mW pump through doubly resonant SHG.

JTuA • Joint FiO/LS Poster Session I—Continued

JTuA46

Study of the Two-photon-induced Reduction of Gold Nanoparticles, ***Paulo Henrique D. Ferreira***, *Marcelo Gonçalves Vivas, Jonathas de Paula Siqueira, Leonardo de Boni, Lino Misoguti, Cleber Renato Mendonça; Inst. de Física de São Carlos - Univ. de São Paulo, Brazil.* In this work we study the production of gold nanoparticle via two-photon-induced reduction of $HAuCl_4$. The nanoparticle formation was monitored by measuring the plasmon absorption band as function of the pulse energy and spectral-phase mask.

JTuA47

Modeling of Ultrashort Pulse Propagation in Metamaterials with Cubic Nonlinearity, ***Ajit Kumar***, *Akhilesh Kumar Mishra; Indian Inst. of Technology Delhi, India.* We present a generalized nonlinear evolution equation in real electric field for sub- and few-cycle pulses in Kerr type nonlinear metamaterials with cubic nonlinearity. Further, we numerically solved it including the effect of self steepening.

JTuA48

Holographic LogMAR Chart at True Infinity to Test Vision, ***Nicholas H. Nguyen***, *Chitralekha S. Avudainayagam, Kodikullam V. Avudainayagam; Univ. of New South Wales, Australia.* A unique holographic LogMAR chart at infinity was used to test the vision of various subjects. Results indicate that multivergence targets caused a difference in the vision of myopes and hyperopes in our original study.

JTuA49

Active Contour Model for Detection of Ocular Image Components, ***Damber Thapa***, *Vasudevan Lakshminarayanan; Univ. of Waterloo, Canada.* The time-delayed discrete dynamic programming algorithm for active energy minimization was used to locate the features of interest in images such as lines and edges of the optical and retinal components of the eye.

JTuA50

Effects of Changing Duochrome's Foreground and Background on the End Point of Subjective Spherical Refraction, ***Mahalakshmi Ramamurthy***[1], *Srinivasa Varadharajan*[2], *Yamuna Devi*[2], *Sarasa Mohan*[2]; [1]*Univ. of Waterloo, Canada,* [2]*Elite School of Optometry, India.* The effect of interchanging the background and foreground colors of the Duochrome test on the end point of subjective spherical refraction was evaluated. No significant difference was found by reversing the background and foregrounds.

JTuA51

Using the RMS Time-frequency Structure for Multiple-image Optical Compression and Encryption, ***Ayman Alfalou***[1], *Chritian Brosseau*[2]; [1]*ISEN Brest, France,* [2]*UBO, France.* In this communication we show the good performance of a spectral criterion used for multiple-image optical compression and encryption even in the case where their spectra occupy same areas.

JTuA52

Absolute Distance Measurement Using High-frequency Repetition Modes of a Mode-locked Fiber Laser, ***Narin Chanthawong***, *Satoru Takahashi, Kiyoshi Takamasu, Hirokazu Matsumoto; Univ. of Tokyo, Japan.* We develop a Fabry-Perot etalon to select high-frequency parts of repetition frequency modes of a short pulsed. The modified optical pulses generated the interference signal between two pairs of pulse trains with different relative delays.

JTuA53

Amplitude-modulated Magneto-Optical Rotation in Paraffin-coated Cells snd Buffer Gas Cells, ***Byung Kyu Park***, *Afrooz Family, Szymon Pustelny, Victor M. Acosta, Dmitry Budker, Wojciech Gawlik; Joint Kraków-Berkeley Atomic Physics and Photonics Lab, Poland.* We compare AMOR signals in a paraffin-coated cell and buffer gas cells of same size. We present a density-matrix calculation and demonstrate a coherence time in buffer gas cells comparable to the paraffin-coated cell.

JTuA54

Laser Frequency Modulation Technique for Power-Broadening-Free Spectroscopy, , *Xiwei Xu*[1], *Pengxiong Li*[1], , ***Yanhong Xiao***[1]; [1]*Fudan Univ., China,* [2]*Nanjing Univ., China,* [3]*Univ. of Arkansas, USA.* We suggest a FM technique to achieve power-broadening-free resonance, and experimentally demonstrate it using a system of electromagnetically induced transparency. Theoretical model for a general approach to power-broadening-free resonance will also be presented.

JTuA55

High-Precision Small-Angle Measurement Based on Laser Self-Mixing Interference, ***Jingang Zhong***, *Pan Qi, Chun Chen, Zhen Chen; Jinan Univ., China.* A simple but effective method for high-precision small-angle measurement based on laser self-mixing interference is presented. This method can also achieve absolute angle measurement. The theory and experiment has proved the validity of this method.

JTuA56

Pressure Broadening and Shifts of Silver D1 Line by Nitrogen and Helium, ***Byung Kyu Park***[1], *Todor Karaulanov*[1], *Alex O. Sushkov*[2], *Dmitry Budker*[1]; [1]*Univ. of California, Berkeley, USA,* [2]*Dept. of Physics, Yale Univ., USA.* We report on the measurement of pressure broadening and shifts of silver D1 line. In MHz per torr, we measure 5.2 and 5.8 broadening and -2.5 and +1.2 shifts, by nitrogen and helium respectively.

JTuA57

Thermal Emission of Carbon Microparticles in Epoxy Resin under Pulsed Laser Excitation, ***Valentyn Stadnytskyi***, *Victor Garashchenko; Taras Shevchenko Natl. Univ. of Kyiv, Ukraine.* Laser-induced incandescence (LII) of carbon microparticles in epoxy matrixes is studied. Non-monotonical behaviour of LII from doze of laser irradiation is observed. The proposed model interprets the majority of the observed experimental data.

JTuA58

Polarization Anisotropies in Individual Quantum Dots and Correlation with Defocused Emission Patterns, ***Austin Cyphersmith,*** *A. Maksov, J. Graham, Y. Wang, M. D. Barnes; Univ. of Massachusetts Amherst, USA.* 2D and 2D+1D dipole models for predicting the optical properties of CdSe-ZnS quantum dots are considered. Observed defocused interference patterns and linear polarization anisotropies in emission suggest the 2D model may not be sufficient.

JTuA59

Spatiotemporal Measurement of Femtosecond Localized Plasmon by Spectral Interferometry Combined with NSOM for Adaptive Control, ***Keiichiro Matsuishi***, *Takuya Harada, Jun Oi, Yu Oishi, Fumihiko Kannari; Keio Univ., Japan.* We apply a novel method of a spectral interferometry combined with NSOM in the spatiotemporal characterization of femtosecond localized plasmon at metal nanostructures to control over localized plasmon spatiotemporally.

JTuA60

Simple GaAs and InP Colloidal Quantum Dots Synthesis Using Laser Ablation, ***Diogo B. Almeida***, *Vitor B. Pelegati, André A. de Thomaz, Carlos L. Cesar; UNICAMP, Brazil.* In this work we will present a simple synthesis route for obtaining both GaAs and InP colloidal quantum dots using the same laser ablation assembly.

JTuA61

Charge Dynamics Transfer in Donor-π-Bridge-Acceptor Side-Chain Polymers for Solar Cells, ***Felipe A. Vallejo***[1], *Paul D. Cunningham*[1], *L. Michael Hayden*[1], *Hin-Lap Yip*[2], *Alex K.-Y. Jen*[2]; [1]*Univ. of Maryland Baltimore County, USA,* [2]*Univ. of Washington, USA.* We report charge transfer dynamics as a function of decreasing HOMO-LUMO gap in donor-π-bridge-acceptor conjugated side-chain polymers PFDCNIO, PFDCN, and PFPDT blended with electron acceptor $PC_{70}BM$ measured using optical-pump THz-probe spectroscopy.

JTuA62

Field Fluctuations of the OPO in Wigner, Positive-P, and Q-representations, *William Rawlinson, Harish G. Puli, Surendra Singh,* ***Reeta Vyas***; *Univ. of Arkansas, USA.* Field quadrature and phase fluctuations of the optical parametric oscillators are studied using Wigner function and are compared with those in positive-P and Q-representation.

JTuA63

Grating Formation with Shaped Femtosecond Laser Pulses in Fe:LiNbO$_3$ for Two-wave Mixing Amplification, ***Md. Masudul Kabir***, *Yu Oishi, Fumihiko Kannari; Keio Univ., Japan.* We investigate grating formation in Fe:LiNbO$_3$ crystals by 800 nm femtosecond laser pulses for application of two-wave mixing amplification of shaped femtosecond laser pulses. Gratings were recorded by two-photon absorption and two-step excitation process.

JTuA64

Laser Cooled Strontium Ion Source, ***Mary Lyon***, *James L. Archibald, Christopher J. Erickson, Dallin S. Durfee; Brigham Young Univ., USA.* We present a cold strontium ion source consisting of a magneto-optical trap (MOT) modified to create a Low Velocity Intense Source (LVIS). The slow beam of atoms is photoionized to produce a velocity-tunable ion source.

JTuA65

Simple Diode Laser Frequency Locking Based on Doppler-Free Magnetically Induced Dichroism, ***David C. Hall***; *Goucher College, USA.* We present an optical system for frequency locking of a diode laser based on saturated absorption and magnetically induced dichroism in atomic vapor. The setup achieves stable locking and laser line width of ~300 kHz.

JTuA66

Dynamic Effects in Optical Forces Produced by Adiabatic Rapid Passage, ***Daniel Stack***, *John Elgin, Harold Metcalf; Stony Brook Univ., USA.* Numerical studies of large optical forces produced by adiabatic rapid passage on two-level atoms have been extended beyond our previous work and show strong sensitivity to sweep direction and relative optical phase.

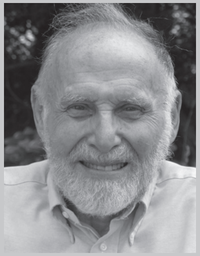
NOTES

Grand Ballroom D
Hyatt Regency Rochester

JOINT FiO/LS

1:30 p.m.–3:30 p.m.
STuC • Ashkin Symposium I
Presider to Be Announced

STuC1 • 1:30 p.m. Invited
Optical Trapping and Manipulation of Small Neutral Particles Using Lasers, *Arthur Ashkin*; *Alcatel-Lucent Bell Labs, USA.* This talk will give a brief survey of work on the subject of optical trapping and manipulation of small neutral particles using lasers. Recent work on highly efficient solar collectors will be mentioned.



STuC2 • 1:55 p.m. Invited
Title to Be Announced, *Steven M. Block*; *Stanford Univ., USA.* Abstract not available.

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FiO

Highland B

1:30 p.m.–3:15 p.m.
FTuO • General Wavefront Issues
Jannick P. Rolland; Inst. of Optics, USA, Presider

FTuO1 • 1:30 p.m.
Wavefront Correction through Suppression of Mirror-Based Aberration Modes, ***Feiling Wang***, *Christopher Spivey; Alethus LLC, USA.* A technique is presented for the measurement and correction of optical wavefronts in a multi-resolution approach through successive suppression of aberration modes that are defined by deformable mirrors of either segmented or continuous-surface types.

FTuO2 • 1:45 p.m.
Experimental Detection of Optical Vortices Using a Shack-Hartmann Wavefront Sensor, ***Kevin Murphy***, *Daniel Burke, Nicholas Devaney, Chris Dainty; Natl. Univ. of Ireland, Galway, Ireland.* Laboratory experiments are carried out to detect optical vortices, in atmospheric turbulence conditions, using a Shack-Hartmann wavefront sensor and an adapted vortex potential method of detection. Experimental results of vortex detection are shown.

FTuO3 • 2:00 p.m.
Radial Polarization Interferometer, ***Gilad M. Lerman***, *Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* We demonstrate a new interferometer based on interference of radially and azimuthally polarized beams. The spatially varying intensity pattern provides spatial and phase information improving displacement and phase-change measurements compared with a conventional Michelson interferometer.

Highland C

1:30 p.m.–3:30 p.m.
FTuP • Novel Hybrid Integration I
Inuk Kang; Bell Labs, Alcatel-Lucent, USA, Presider

FTuP1 • 1:30 p.m. Invited
Hybrid Integration of III-V and Si for Photonic Integrated Circuits, *Geza Kurczveil, Siddharth Jain, Di Liang, Hui Wen Chen, Martijn Heck,* ***John Bowers***; *Univ. of California at Santa Barbara, USA.* We review III-V on silicon-on-insulator (SOI) heterogeneous integration for the demonstration of lasers, suitable for inter-chip and intra-chip optical interconnects. A low temperature oxygen plasma enhanced bonding technology is used to realize the III-V/SOI integration. The realization of silicon AWG lasers, quantum well intermixed DFB lasers and micro ring lasers on the III-V/SOI material platform is discussed.

FTuP2 • 2:00 p.m.
Silicon/III-V Laser with Super-compact Grating for WDM Applications in Electronic-photonic Integrated Circuits, ***Yadong Wang***[1], *Yongqiang Wei*[1], *Yingyan Huang*[2], *Yongming Tu*[3], *Doris Ng*[1], *CheeWei Lee*[1], *Yunan Zheng*[3], *Boyang Liu*[2], *Seng-Tiong Ho*[1,3]; [1]*Data Storage Inst., Singapore,* [2]*OptoNet Inc, USA,* [3]*Northwestern Univ., USA.* We have demonstrated a heterogeneously integrated Si/III-V laser based on an ultra-large-angle super-compact curved diffraction grating suitable for WDM applications in EPICs The lasing threshold is 150mA giving a maximum output power of 2.35mW.

Highland D

1:30 p.m.–3:30 p.m.
FTuQ • Disorder in Integrated Optical Devices and Circuits I
Andrey A. Chabanov; Univ. of Texas at San Antonio, USA, Presider

FTuQ1 • 1:30 p.m. Invited
Strong Localization by Disorder in Photonic Crystal Waveguides, *Frank Vollmer*; *Harvard Univ., USA.* Abstract not available.

FTuQ2 • 2:00 p.m.
Photonic Band Gaps in Amorphous Waveguide Lattices, *Alexander Szameit*[1], *Mikael C. Rechtsman*[2], *Felix Dreisow*[3], *Matthias Heinrich*[3], *Robert Keil*[3], *Stefan Nolte*[3], *Mordechai Segev*[1]; [1]*Solid State Inst., Israel,* [2]*Courant Inst. of Mathematical Sciences, USA,* [3]*Inst. of Applied Physics, Germany.* We present, theoretically and experimentally, amorphous photonic lattices exhibiting band-gap and negative effective mass, yet lacking Bragg diffraction. Here, bands comprise of Anderson states, but defect states residing in the gap are always more localized.

Highland E

1:30 p.m.–3:30 p.m.
FTuR • Dispersion in Ultrafast Laser Amplifiers
Csaba Toth; Lawrence Berkeley Natl. Lab, USA, Presider

FTuR1 • 1:30 p.m. Tutorial
Optical Dispersion Management in Laser Amplifier Systems, *Catherine LeBlanc*; *École Polytechnique, France.* In this tutorial we will give an overview of different techniques for dispersion compensation in amplifiers. We will describe linear passive and active techniques and also non-linear techniques. Through different systems we will illustrate the advantages of these techniques and show several examples of high-intensity laser facilities that are using them.

Catherine Le Blanc was born in 1966 in Versailles, France. She graduated from the Université de Paris Sud Orsay. She received her Ph.D. from Ecole Polytechnique in 1993, in laser Physics, building one of the first Terawatt Ti:Sapphire laser systems, at the Laboratoire d'Optique Appliquée (LOA). After her Ph.D. she joined LOA as a Research scientist and worked on several ultrashort laser sources such as kHz, TW systems, OPAs, and 10-Hz, 100-TW Ti:S amplifiers. She also spent some time in the University of California at San Diego in the Kent Wilson group, working with Chris Barty on pulse shaping in Ti Sapphire amplifiers.In 1999 Catherine LE BLANC joined the LULI with a CNRS position and was the project leader of a PW class laser in Nd:Glass amplifiers and she worked on new gratings techniques for high energy compressors. Currently she works on the ILE project and is responsible for the stretcher and compressor part of the project and the associated diagnostics. She is also a consultant for Thales Laser Systems.

FiO

Highland F

1:30 p.m.–3:30 p.m.
FTuS • Therapy
Bernard Choi; Univ. of California at Irvine, USA, Presider

FTuS1 • 1:30 p.m. Invited
Optical Imaging and Spectroscopy in Photodynamic Therapy Research and Clinical Applications, ***Thomas Foster****, Benjamin R. Giesselman, Soumya Mitra; Univ. of Rochester, USA.* Optical methods are used widely in PDT. Spectroscopy of photosensitizer fluorescence and tissue optical properties has been integrated into human clinical trials. Molecular imaging enables visualization of gene expression and host cell responses *in vivo*.

FTuS2 • 2:00 p.m.
A LED Based Spatial Frequency Domain Imaging System for Optimization of Photodynamic Therapy of Basal Cell Carcinoma (BCC), ***Rolf B. Saager***[1], *David J. Cuccia[2], Steven Saggese[2], Kristen M. Kelly[1], Anthony J. Durkin[1]; [1]Beckman Laser Inst., Univ. of California at Irvine, USA, [2]Modulated Imaging, Inc., USA.* A LED based spatial frequency domain imaging (SFDI) system has been developed to provide personalized photodynamic therapy for BCC. We present the instrument design, validation of performance and initial characterization of wide-field properties of BCC.

Highland G

1:30 p.m.–3:30 p.m.
FTuT • Quantum Information and Communications IV
John G. Rarity; Univ. of Bristol, UK, Presider

FTuT1 • 1:30 p.m.
Engineering Nitrogen-vacancy Centers near the Surface of Diamond for Coupling to Optical Microcavities, ***Kai-Mei C. Fu,*** *Charles Santori, Paul E. Barclay, Raymond Beausoleil; Hewlett-Packard Labs, USA***.**The optical properties of nitrogen-vacancy centers created nanometers from the surface of diamond are investigated. Deterministic control of the charge state is demonstrated and recent progress toward coupling single centers to cavities is presented.

FTuT2 • 1:45 p.m.
Deterministic Nano-manipulation of Single Photon Sources for Integration, ***Chad Ropp****, Roland Probst, Zachary Cummins, Rakesh Kumar, Linjie Li, John T. Fourkas, Srinivasa R. Raghavan, Edo Waks, Benjamin Shapiro; Univ. of Maryland, USA.* Preselected single photon sources are positioned and immobilized to nanometer precision using flow control and local polymerization. This technique could find important applications in integration of single photon sources with nanophotonic structures for quantum devices.

FTuT3 • 2:00 p.m. Invited
Quantum Limits to Lossy Optical Interferometry, ***Luiz Davidovich****; Univ. Federal do Rio de Janeiro, Brazil.* We find an analytical lower bound for the phase shift estimation uncertainty in lossy optical interferometry, which implies that it scales asymptotically with the number of photons at best as the shot noise limit.

LS

Highland H

1:30 p.m.–3:30 p.m.
LTuE • Attosecond and Strong Field Physics I
Oliver Gessner; Lawrence Berkeley Natl. Lab, USA, Presider

LTuE1 • 1:30 p.m. Invited
Attosecond Physics: Real-Time Tracking of Valence Electron Motion in Atoms, ***Eleftherios Goulielmakis***[1], *A. Wirth[1], M. Th. Hassan[1], I. Grguras[1], M. Schultze[1,2], Z- H. Loh[3,4], R. Santra[5,6], N. Rohringer[7], V. Yakovlev[2], Z. Zherebtsov[1], T. Pfeifer[3,4], M. F. Kling[1], S. R. Leone[3,4], F. Krausz[1,2]; [1]Max-Planck-Inst. für Quantenoptik, Germany, [2]Ludwig-Maximilians-Univ., Germany, [3]Univ. of California at Berkeley, USA, [4]Lawrence Berkeley Natl. Lab, USA, [5]Argonne Natl. Lab, USA, [6]Univ. of Chicago, USA, [7]Lawrence Livermore Natl. Lab, USA.* We demonstrate triggering and real-time observation of valence-shell electron motion in atoms and we discuss the basic attosecond technologies that enable complete control of electron dynamics at the nanoscale.

LTuE2 • 2:00 p.m. Invited
Probing Electron Dynamics by High Harmonic Generation, ***Markus Guehr***[1,2], *Joe P. Farrell[1,2], Brian K. McFarland[1,2], Limor S. Spetor[1,2], Philip H. Bucksbaum[1,2]; [1]PULSE Inst., SLAC Nat. Acc. Lab and Stanford Univ., USA, [2]Dept.s of Physics and Applied Physics, Stanford Univ., USA.* High harmonic spectroscopy contains rich information about atomic and molecular electronic structure. The combination of multiple-orbital HHG studies with transient grating techniques allow for monitoring electronic structure change during chemically relevant processes.

Highland J

1:30 p.m.–3:30 p.m.
LTuF • Optofluidics in the Near-Field I
David Erickson; Cornell Univ., USA, Presider

LTuF1 • 1:30 p.m. Invited
The ***Reactive Sensing Principle (RSP)*** **in Optically Resonant Biosensing and Nanoparticle Trapping within a WGM Carousel,** ***Stephen Arnold****; Polytechnic Inst. of New York Univ., USA.* We will discuss our current understanding of the interaction of the near-field of a WGM resonator with nanoparticles and show how size, proximity, particle-resonator interaction-potentials, and plasmon enhancements are extracted from experiments using the *RSP.*

LTuF2 • 2:00 p.m. Invited
Title to Be Announced, ***Sudeep Mandal****; Cornell Univ., USA.* Abstract not available.

Highland K

1:30 p.m.–3:15 p.m.
LTuG • Nonlinear Optics II
Daniel Gauthier; Duke Univ., USA, Presider

LTuG1 • 1:30 p.m. Invited
Spatial Light Modulators: A Tool for Measuring the Quantum Entanglement of Spatial Modes, ***Miles Padgett***[1], *Jonathan Leach[1], Barry Jack[1], Jacquiline Romero[1], Sonja Franke-Arnold[1], Stephen Barnett[2]; [1]Univ. of Glagow, UK, [2]Univ. of Strathclyde, UK.* We show spatial light modulators (SLM) can be used to measure optical modes with a selectivity sufficient to reveal their quantum correlations. SLMs can be updated at video rates allowing rapid switching between measurement states.

LTuG2 • 2:00 p.m. Invited
Quantum Information and Nonlinear Optics: Together at Last? ***Andrew G. White****; Univ. of Queensland, Australia.* Controllably entangling single photons is the key requirement for photonic quantum information. We review solutions to this problem_which range from no nonlinearity through to full cavity-QED_and recent progress which suggests modest nonlinearities may be enough.

Grand Ballroom D
Hyatt Regency Rochester

JOINT FiO/LS

STuC • Ashkin Symposium I—Continued

STuC3 • 2:20 p.m. Invited
Title to Be Announced, ***James P. Gordon****; Consultant, Bell Labs, USA.* Abstract not available.

STuC4 • 2:45 p.m. Invited
Non-conservative Forces in Optical Tweezers, ***David G. Grier****; New York Univ., USA.* The force exerted by an optical trap includes a solenoidal component that can be harnessed to drive all-optical machines, and also has a surprising influence on the thermodynamics of optically trapped objects.

FiO

Highland B

FTuO • General Wavefront Issues—Continued

FTuO4 • 2:15 p.m.
Local Light-Ray Rotation around Arbitrary Axes, *Bhuvanesh Sundar, Alasdair C. Hamilton,* ***Johannes K. Courtial****; Univ. of Glasgow, UK.* METATOYs are transparent sheets that "refract" (change the direction of) light rays. Here we describe the structure of a METATOY that rotates the direction of light rays through an arbitrary angle around an arbitrary axis.

FTuO5 • 2:30 p.m.
Wave Optics of METATOYs, ***Johannes K. Courtial***[1], *Alasdair C. Hamilton*[1], *Tomáš Tyc*[2]; [1]*Univ. of Glasgow, UK,* [2]*Masaryk Univ., Czech Republic.* METATOYs are sheets that can create light-ray fields that appear to be wave-optically forbidden. Here we study the wave field behind METATOYs.

FTuO6 • 2:45 p.m.
A Geometric Optics Description of Airy Beams, ***Sophie Vo***[1], *Kyle Fuerschbach*[1], *Kevin Thompson*[2], *Miguel Alonso*[1], *Jannick Rolland*[1]; [1]*Inst. of Optics, Univ. of Rochester, USA,* [2]*Optical Res. Associates, USA.* We present a geometric optics description of the non-diffracting Airy beams: we unveil their exact relation to rays and geometrical wavefront aberrations and study their intensity shift and invariance through propagation with their 3-D caustic.

Highland C

FTuP • Novel Hybrid Integration I—Continued

FTuP3 • 2:15 p.m.
Silicon/ AlGaInAs Heterogeneouly Integrated Laser with High-reflectivity Right-Angled-wedge Retro-Reflector, ***Yongming Tu***[1], *Yunan Zheng*[1], *Yingyan Huang*[3], *Yadong Wang*[2], *Doris Ng*[2], *Yongqiang Wei*[2], *Cheewei Lee*[2], *Boyang Liu*[3], *Seng-Tiong Ho*[1]; [1]*Northwestern Univ., USA,* [2]*Data Storage Inst., Singapore,* [3]*OptoNet Incorporation, USA.* We report the design and experimental results of an electrically pumped Silicon/AlGaInAs evanescent laser with right-angled-wedge reflector defined in the silicon layer. A continuous-wave laser with a lasing threshold current density of 2.8kA/cm^2 is achieved.

FTuP4 • 2:30 p.m. Invited
Active-Passive Photonic Integration with an Eye toward Large Scale Integration, ***James Jaques****; LGS Innovations, LLC, USA.* Abstract not available.

Highland D

FTuQ • Disorder in Integrated Optical Devices and Circuits I—Continued

FTuQ3 • 2:15 p.m.
Anderson Localization as Position-dependent Diffusion in Disordered Waveguides, ***Ben Payne***[1], *Alexey G. Yamilov*[1], *Sergey E. Skipetrov*[2]; [1]*Missouri Univ. of Science and Technology, USA,* [2]*Universite Joseph Fourier, Lab de Physique et Modelisation des Milieux Condenses, CNRS, France.* Recently developed self-consistent theory of Anderson localization with position-dependent diffusion coefficient is shown to be in quantitative agreement with the results of abinitio simulations of wave transport in disordered waveguides, even in presence of absorption.

FTuQ4 • 2:30 p.m.
Frequency Correlation between Eigenmodes of Disordered Waveguides, *Ben Payne,* ***Alexey G. Yamilov****; Missouri Univ. of Science and Technology, USA.* Using numerical simulations we study the frequency bandwidth over which the transmission through a random medium can be optimized with the wave-front shaping technique.

FTuQ5 • 2:45 p.m.
Fabrication and Characterization of Controlled Disorder in the Core of the Optical Fibers, *N. P. Puente*[1], *Elena Chaikina*[2], *Sumudu Herath*[3], ***Alexey G. Yamilov***[3]; [1]*Facultad Ingenieria-Ensenada, Univ. Autonoma de Baja California, Mexico,* [2]*Div. de Fısica Aplicada, Ctr. de Investigacion Cientıfica y de Educacion Superior de Ensenada, Mexico,* [3]*Missouri Univ. of Science and Technology, USA.* Experimental and theoretical study of light transmission through optical fiber with controlled disorder is presented. The technique provides an easy way to fabricate different disorder configurations and is suitable for random fiber lasers applications.

Highland E

FTuR • Dispersion in Ultrafast Laser Amplifiers—Continued

FTuR2 • 2:15 p.m.
Quasi-Parabolic Pulses in the Far Field of Dispersion of Nonlinear Fiber, ***Sergii O. Yakushev***[1], *Oleksiy V. Shulika*[1], *Igor A. Sukhoivanov*[2], *Jose A. Andrade-Lucio*[2], *Arturo Garcia-Perez*[2]; [1]*Kharkov Natl. Univ. of Radio Electronics, Ukraine,* [2]*Univ. of Guanajuato, Mexico.* The deviation of the shape of quasi-parabolic pulses from the ideal parabolic was calculated using misfit parameter. Optimal conditions for soliton order and fiber length required for nearly parabolic shape formation is found.

FTuR3 • 2:30 p.m.
Description of Second Harmonic Generation with Ultraintense Lasers and Diffractive Optics Elements (DOE´s), ***Carolina Romero***[1], *Rocio Borrego-Varillas*[1], *Javier R. Vázquez de Aldana*[1], *Cruz Méndez*[2], *Benjamín Alonso*[1], *Gladys Mínguez-Vega*[3], *Omel Mendoza-Yero*[3], *Luis Roso*[2]; [1]*Univ. of Salamanca, Spain,* [2]*Ctr. de Láseres Pulsados, Spain,* [3]*Univ. Jaume I, Spain.* A study of second harmonic generation of femtosecond pulses focused with diffractive lenses is presented; the central wavelength of the SH can be tuned by changing the relative distance between the lens and the crystal.

FTuR4 • 2:45 p.m.
New Method for the Measurement of the Pulse-Front Distortion, ***Yanlei Zuo****, Mingzhong Li; China Acad. of Engineering Physics, China.* A new method based on spectral interferometry is presented. Three types of pulse-front distortion in a typical large-aperture short-pulse laser are measured by the method. Experimental results are in agreement with the theoretical calculation.

FTuS • Therapy—Continued

FTuS3 • 2:15 p.m.
A New Monte Carlo Model of Cylindrical Diffusing Fibers, ***Timothy M. Baran***, *Thomas H. Foster; Univ. of Rochester, USA*. We present a new Monte Carlo model of cylindrical diffusing fiber sources in tissue. Differences are shown between our model and simpler schemes, and the predictive ability of the model is demonstrated.

FTuS4 • 2:30 p.m.
Compact Low Energy Fiber Laser Femtosecond Deactivation of Viral Species, ***Vitor M. Schneider***, *Florence Verrier, Meenal P. Soni, Shawn M. O'Malley; Corning, Inc., USA*. A compact 1550 nm low pulse energy erbium doped femtosecond fiber laser is used to inactivate viruses via Impulse Stimulated Raman Scattering (ISRS). Inactivation using this method was selective to the virus and not cells.

FTuS5 • 2:45 p.m.
Design of a Lightpipe Device for Photodynamic Therapy of the Oral Cavity, ***Cristina Canavesi***[1], *Florian Fournier*[2,1], *Thomas H. Foster*[3,1], *Jannick P. Rolland*[1,2]; [1]*Inst. of Optics, Univ. of Rochester, USA*, [2]*Univ. of Central Florida, USA*, [3]*Univ. of Rochester Medical Ctr., USA*. The non-imaging methodology developed to design an efficient and compact lightpipe-based device for superficial photodynamic therapy of the oral cavity is reported, together with a study of the fabrication feasibility of the device.

FTuT • Quantum Information and Communications IV—Continued

FTuT4 • 2:30 p.m.
Quantum Correlations in Two-Dimensional Waveguide Arrays and Their Classical Simulation, ***Robert Keil***[1], *Felix Dreisow*[1], *Matthias Heinrich*[1], *Andreas Tünnermann*[1], *Stefan Nolte*[1], *Alexander Szameit*[2]; [1]*Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany*, [2]*Physics Dept. and Solid State Inst., Technion, Israel*. We theoretically analyse the propagation of photon pairs in two-dimensional photonic lattices by calculating their photon number correlation and perform classical intensity correlation experiments acting as a quantum simulator for the photon number correlation.

FTuT5 • 2:45 p.m.
Optical Nanofiber Cavity: a Novel Workbench for Cavity-QED, ***Kali Prasanna Nayak***[1], *Kiyomi Nakajima*[2], *Fam Le Kien*[1], *Hideki T. Miyazaki*[2], *Yoshimasa Sugimoto*[2], *Kohzo Hakuta*[1]; [1]*Univ. of Electro-Communications, Japan*, [2]*Natl. Inst. for Material Science, Japan*. We introduce the realization of optical nanofiber cavity by drilling periodic nano-grooves on a sub-wavelength-diameter silica-fiber using focused-ion-beam milling. The strong confinement of field in guided-mode makes such nanofiber cavity a promising workbench for cavity-QED.

LTuE • Attosecond and Strong Field Physics I—Continued

LTuE3 • 2:30 p.m.
Ellipticity Dependence of Nonsequential Double Ionization, ***Xu Wang***,; *Univ. of Rochester, USA*. Using a classical ensemble method, we predict that nonsequential double ionization (NSDI) probability can be much higher than one would expect from the recollision model [1] for highly elliptical and circular polarization.

LTuE4 • 2:45 p.m. **Invited**
High Order Harmonics Driven by 1.5µm Parametric Source: A Tool for Attosecond Science, ***Caterina Vozzi***[1], *M. Negro*[1], *F. Calegari*[1], *F. Frassetto*[2], *M. Nisoli*[1], *L. Poletto*[2], *G. Sansone*[1], *P. Villoresi*[2], *S. De Silvestri*[1], *S. Stagira*[1]; [1]*Politecnico di Milano, Italy*, [2]*Univ. di Padova, Italy*. We exploited a few-cycle, carrier-envelope-phase-stabilized IR parametric source for spectral extension of high-harmonics emission. We studied HOMO-related structures in HHG form impulsively aligned CO_2. We generated broadband continua above 150 eV in a two-color scheme.

LTuF • Optofluidics in the Near-Field I—Continued

LTuF3 • 2:30 p.m. **Invited**
Surface Optofluidics, *Andreas E. Vasdekis*[1], *Wuzhou Song*[1], *Julien R. Cuennet*[1], *Luciano De Sio*[2], *Jae-Woo Choi*[1], ***Demitri Psaltis***[1]; [1]*École Polytechnique Fédérale de Lausanne, Switzerland*, [2]*Univ. of Calabria,, Italy*. Surfaces -defined as interfaces between fluids and solids- can determine the function of optofluidic devices. Examples include monolayers for birefringence control and imaging in microfluidics, near field gain, diffractive or plasmonic structures and deformable membranes.

LTuG • Nonlinear Optics II—Continued

LTuG3 • 2:30 p.m.
Three-Photon Absorption in Semiconductors, *Claudiu M. Cirloganu, Peter D. Olszak, Lazaro A. Padilha,* ***Scott Webster***, *David J. Hagan, Eric W. Van Stryland; Univ. of Central Florida, USA*. Three-photon absorption of several semiconductors (ZnS, ZnSe, ZnO, CdS ZnTe CdSe, CdTe, GaAs, InAs) were measured using Z-scans. Comparisons to existing analytical formulas produced inconsistencies while good fits are obtained using a Kane 4-band model.

LTuG4 • 2:45 p.m.
Tunable Sub-13fs Pulse from Tandem Cascaded Four-wave Mixing in Simple Transparent Glass Media, *Jun Liu,* ***Takayoshi Kobayashi***; *Univ. of Electro-Communications, Japan*. Multicolored femtosecond pulses were generated in transparent glass media using cascaded four-wave mixing. Moreover, the sidebands can be simultaneously amplified and compressed in another transparent bulk media using four-wave optical parametric amplification.

Grand Ballroom D
Hyatt Regency Rochester

JOINT FiO/LS

STuC • Ashkin Symposium I—Continued

STuC5 • 3:05 p.m. **Invited**
Torsional Studies of Single Biological Molecules, ***Michelle Wang****; Cornell Univ., Howard Hughes Medical Inst., USA.* Abstract not available.

Highland B

FiO

FTuO • General Wavefront Issues—Continued

FTuO7 • 3:00 p.m.
Reconstructing Sub-Wavelength Features from the Optical Far-Field of Sparse Images, ***Alexander Szameit***[1]*, Yoav Shechtman*[1]*, Snir Gazit*[1]*, Yonina C. Eldar*[2]*, Mordechai Segev*[1]*;* [1]*Solid State Inst., Israel,* [2]*Dept. of Electrical Engineering, Technion - Israel Inst. of Technology, Israel.* We use compressed sensing to demonstrate the reconstruction of sub-wavelength features from the measured optical far-field of sparse images. The methods can be applied to non-optical microscopes, provided the information is sparse.

Highland C

FTuP • Novel Hybrid Integration I—Continued

FTuP5 • 3:00 p.m. **Invited**
Hybrid Chalcogenide/Lithium Niobate Waveguides, ***Christi Madsen****, Wee Chong Tan; Texas A&M Univ., USA.* We review recent work on a hybrid integrated optic platform consisting of lithium-niobate waveguides vertically coupled to high-index-contrast chalcogenide waveguides. This combination provides electro-optic control and tight bend radii needed for ring resonators.

Highland D

FTuQ • Disorder in Integrated Optical Devices and Circuits I—Continued

FTuQ6 • 3:00 p.m. **Invited**
Disorder-Induced Multiple Scattering and Light Localization in Photonic Crystal Waveguides, *M. Patterson*[1]*, S. Combrié*[2]*, G. Demand*[1]*, A. De Rossi*[2]*,* ***Stephen Hughes***[1]*;* [1]*Queen's Univ., Canada,* [2]*Thales Res. and Technology, France.* We describe our theory and analysis of disorder-induced multiple scattering in photonic crystal waveguides.We directly model experiments of light transmission and frequency-delay propagation maps, highlighting regimes of multiple coherent scattering and light localization.

Highland E

FTuR • Dispersion in Ultrafast Laser Amplifiers—Continued

FTuR5 • 3:00 p.m. **Invited**
Development and Operation of Large-Aperture Tiled-Grating Compressors for High-Energy, Petawatt-Class Laser Systems, ***Jie Qiao***[1]**,** *A. Kalb*[1]*, T. Nguyen*[1]*, D. Canning*[1]*, J. Price*[1,2]*;* [1]*Lab for Laser Energetics, Univ. of Rochester, USA,* [2]*Helicos BioSciences Corp., USA***.**Two 1.5-m grating compressors, each consisting of four tiled-grating assemblies (TGA's), have been developed and deployed for the OMEGA EP petawatt-class laser system. The tiling methods and results on high-energy shots will be presented.

3:30 p.m.–4:00 p.m. Coffee Break, *Empire Hall, Rochester Riverside Convention Center*

3:30 p.m.–5:30 p.m. Meet the Editors of the APS Journals, *Riverside Court, Rochester Riverside Convention Center*

NOTES

Highland F | Highland G

FiO

FTuS • Therapy—Continued

FTuS6 • 3:00 p.m.
Selective Near-UV Laser Ablation of Subgingival Dental Calculus at a 20° Irradiation Angle, ***Joshua E. Schoenly***[1,2], *Wolf Seka*[1,2], *Peter Rechmann*[3]; [1]*Inst. of Optics, Univ. of Rochester, USA,* [2]*Lab for Laser Energetics, Univ. of Rochester, USA,* [3]*Dept. of Preventive and Restorative Dental Sciences, Univ. of California at San Francisco, USA.* The average removal rates of subgingival dental calculus ablated at 400 nm and 20° are 11±6 μm/pulse and $2.4\pm0.8\times10^4$ μm^3/pulse. Large error bars on removal rates reflect biological and mechanical variability of the calculus.

FTuS7 • 3:15 p.m.
Tensile Strength Analysis of Laser Skin Welding Performed with Thulium Laser System, ***Temel Bilici***[1], *Nermin Topaloglu*[1], *Ozgur Tabakoglu*[1], *Hamit Kalaycioglu*[2], *Adnan Kurt*[3], *Alphan Sennaroglu*[2], *Murat Gulsoy*[1]; [1]*Biomedical Engineering Inst., Boğaziçi Univ., Turkey,* [2]*Dept. of Physics, Koç Univ., Turkey,* [3]*Teknofil Ltd. Şti., Turkey.* Laser skin welding was performed with a thulium laser system (35 W/cm^2). Tensile strength analysis shows that the thulium laser system at 1980 nm provided stronger welds than the closure by suture technique.

FTuT • Quantum Information and Communications IV—Continued

FTuT6 • 3:00 p.m.
Optimal Quantum Memory with Hot Rb Atoms, ***Nathaniel B. Phillips***, *Irina Novikova; College of William & Mary, USA.* We present an analysis of pulse propagation under conditions of electromagnetically induced transparency and four-wave mixing in hot Rb vapor. We experimentally and theoretically investigate the prospect of dual-mode light storage.

FTuT7 • 3:15 p.m.
Electron-Spin Single-Photon Interface in a Quantum Dot, ***Selman Tunc Yilmaz***, *P. Fallahi, A. Imamoglu; Inst. of Quantum Electronics, ETH Zurich, Switzerland.* Using resonance fluorescence from a single-electron charged quantum dot with 0.1% collection efficiency, we realize a single spin-photon interface where the detection of a scattered photon projects the electron spin to a definite spin eigenstate.

Highland H | Highland J | Highland K

LS

LTuE • Attosecond and Strong Field Physics I—Continued

LTuE5 • 3:15 p.m.
Double Ionization And Dissociation Of CO2 Molecule, ***Linsen Pei***, *Chunlei Guo; Inst. of Optics, USA.* Double ionization and dissociation of CO2 is studied in this work. Studies show that the electronic structure plays a key role for nonsequential double ionization of triatomic molecule, CO2, similar as the diatomic molecules.

LTuF • Optofluidics in the Near-Field I—Continued

LTuF4 • 3:00 p.m. Invited
Optofluidic Ring Resonator Lasers, ***Xudong (Sherman) Fan***, *Yuze Sun, Jonathan D. Suter, Chung-Shieh Wu, Wonsuk Lee, , Balareddy Chinna Reddy Karthik; Univ. of Michigan, USA.* Various optofluidic ring resonator lasers will be overviewed and their performance will be compared with other optofluidic lasers. Direct and indirect excitation schemes will be discussed, followed by possible applications and future research directions.

LTuG • Nonlinear Optics II—Continued

LTuG5 • 3:00 p.m.
Two Beam Coupling Using Solitons in Photo Refractive Media, *Parameswar Lakshmi*[1], ***Sreelatha K. Savithriamma***[2], *Joseph K. Babu*[2]; [1]*D.B.Pampa College, India,* [2]*Amrita Vishwa Vidyapeetham, India.* We study the possibility of using solitons for two beam coupling. This process can be modeled using the coupled nonlinear Schrodinger Equations. We also found the soliton solution for this equation under certain conditions.

3:30 p.m.–4:00 p.m. Coffee Break, *Empire Hall, Rochester Riverside Convention Center*

3:30 p.m.–5:30 p.m. Meet the Editors of the APS Journals, *Riverside Court, Rochester Riverside Convention Center*

NOTES

Grand Ballroom D
Hyatt Regency Rochester

JOINT FiO/LS

4:00 p.m.–6:00 p.m.
STuD • Ashkin Symposium II
Presider to Be Announced

STuD1 • 4:00 p.m. Invited
The Man and His Science, *John Bjorkholm*; *USA.* I am fortunate to have worked closely with Art Ashkin for many years. In this talk I will reminisce about the man and his many accomplishments.

STuD2 • 4:25 p.m. Invited
A Subjective History of Laser Cooling, *Harold Metcalf*; *Stony Brook Univ., USA.* Although the notion of optical forces comes from Maxwell, the modern era of cooling began with the advent of tunable lasers. After a brief introduction, I will present a personal view beginning in the 1980's.

FiO

Highland B

4:00 p.m.–5:30 p.m.
FTuU • Astrophotonics I
Nikola Alic; Univ. of California at San Diego, USA, Presider

FTuU1 • 4:00 p.m. Invited
Fibers are Looking Up: Optical Fiber Transition Structures in Astrophotonics, *Tim Birks*[1], *Antonio Diez[2], Jose L. Cruz[2], Sergio G. Leon-Saval[3,1], Dominic F. Murphy[4]; [1]Univ. of Bath, UK, [2]Univ. of Valencia, Spain, [3]Univ. of Sydney, Australia, [4]Univ. of Adelaide, Australia.* Recent developments in the astrophotonic applications of optical fibre taper transitions are discussed. For example, transitions between single multi-mode and multiple single-mode cores can help suppress the atmospheric OH emission that hampers ground-based IR astronomy.

FTuU2 • 4:30 p.m. Invited
Processing in Next Generation Telescope Arrays: Coherent Signal Combining, *Pierre Kern*, *Le Coarer Etienne; Lab d'Astrophysique de Grenoble, Observatoire de Grenoble, France.* Astrophotonics brings a new way to think instruments to combine the beams delivered by a network of telescopes. In addition to suitable multiplexing, it brings a convenient toolbox of powerful functions.

Highland C

4:00 p.m.–5:30 p.m.
FTuV • Optical Communication I
Inuk Kang; Bell Labs, Alcatel-Lucent, USA, Presider

FTuV1 • 4:00 p.m. Invited
Rate-Adaptive Transmission Techniques for Optical Fiber Systems, *Joseph Kahn*, *Gwang-Hyun Gho; Stanford Univ., USA.* Future networks may employ rate adaptation, extending reach where regeneration is unavailable. Transmission using fixed symbol rate, variable constellation (PM-16/8/4-QAM) and variable-rate FEC codes yields bit rates of 200/100/50 Gbit/s over distances of 650/2000/3000 km.

FTuV2 • 4:30 p.m. Invited
Digital Compensation of Fiber Nonlinearities, *Guifang Li*; *Univ. of Central Florida, USA.* Recent progress in nonlinearity compensation using coherent detection and digital signal processing will be presented. Efficient algorithms toward real-time implementation and polarization effects for polarization-multiplexed WDM transmission will be emphasized in this presentation.

Highland D

4:00 p.m.–5:30 p.m.
FTuW • Novel Fibers
Shahraam Afshar; Univ. of Adelaide, Australia, Presider

FTuW1 • 4:00 p.m. Invited
Semiconductor Core Optical Fibers, *John Ballato*[1], *Thomas Hawkins[1], Paul Foy[1], Colin McMillen[1], Laura Burka[1], Stephanie Morris[1], Roger Stolen[1], Robert Rice[2]; [1]Clemson Univ., USA, [2]Northrop Grumman Corp., USA.* This paper will review progress in the nascent field of glass-clad semiconductor core optical fibers. This new class of optical fibers may significantly advance the fields of nonlinear fiber optics and infrared power delivery.

FTuW2 • 4:30 p.m.
Solid Core Photonic Crystal Fiber with Ultra-wide Bandgap, *Martijn de Sterke*, *Thomas Grujic, Boris T. Kuhlmey, Alexander Argyros; Univ. of Sydney, Australia.* Using a simple model we argue that solid core microstructured optical fibers with high-index, ring-shaped, inclusions can have an uninterrupted bandwidth as large as an octave. We confirm this experimentally using a polymer optical fiber.

Highland E

4:00 p.m.–5:30 p.m.
FTuX • Attosecond Optics and Technnology I
Olivier Albert; LOA, France, Presider
Zenghu Chang; Kansas State Univ., USA, Presider

FTuX1 • 4:00 p.m. Tutorial
Carrier to Envelope Offset and Carrier to Envelope Phase_How Their Control Impacts Femtosecond and Attosecond Phenomena, *Jean-Claude Diels*; *Univ. of New Mexico, USA.* Femtosecond pulse trains combine high temporal and spectral resolution. Often confused concepts of Carrier to Envelope Offset (pulse trains) and Carrier to Envelope Phase (single pulse) impact the fields of ultrasensitive sensors and attosecond science.

Jean-Claude Diels, Ph.D., is Professor in the Department of Physics at the University of New Mexico (UNM) and staff member at the Center for High Technology Materials. He served as research scientist at UC Berkeley (Professor E..L.Hahn), and Research Associate Professor at USC, Los Angeles, scientific staff at Phillips Research Laboratories in Eindhoven, Netherlands, and at Max Planck Institute in Gottingen, Germany. Before joining UNM, Dr. Diels was Professor of Physics at the University of North Texas in Denton, Texas. He has 90 invited publications, 260 refereed papers, 14 patents, 5 book chapters, one textbook (Ultrashort Pulse Phenomena) and mentored 50 PhD students. Dr. Diels is the recipient of the 51st Annual Research Lecture Award of the University of New Mexico, and the recipient of the 2006 Excellence in Engineering Award of the Optical Society of America. He is Fellow of the Optical Society of America.

FiO

Highland F

4:00 p.m.–5:30 p.m.
FTuY • Coherence Tomography
Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA

FTuY1 • 4:00 p.m.
Power Enhanced and Fast Swept Source for Phase Conjugate Optical Coherence Tomography, ***Rui Zhu***[1], *Kyle H. Y. Cheng*[1], *Edmund Y. Lam*[1], *Franco N. C. Wong*[2], *Kenneth K. Y. Wong*[1]; [1]*Dept. of Electrical and Electronic Engineering, Univ. of Hong Kong, Hong Kong,* [2]*Res. Lab of Electronics, MIT, USA.* We have developed a wavelength-swept source based on fiber parametric amplification and Fourier domain mode locking with increased power and speed to take full advantage of 2x resolution enhancement and dispersion cancellation of phase-conjugate OCT.

FTuY2 • 4:15 p.m.
Substance Identification in Spectroscopic Optical Coherence Tomograhpy Using Pattern Recognition, ***Volker Jaedicke***[1,2], *Christoph Kasseck*[1], *Nils C. Gerhardt*[1], *Hubert Welp*[2], *Martin Hofmann*[1]; [1]*Ruhr-Univ. Bochum, Germany,* [2]*Georg Agricola Univ. of Applied Sciences, Germany.* We use a windowed Fourier transform in the spatial regime to calculate depth resolved spectra from multilayer absorbing samples. Depth resolved substance identification is performed based on a pattern recognition algorithm using spectral features.

FTuY3 • 4:30 p.m.
Variable Velocity Dynamic Range Doppler Optical Coherence Tomography, ***Panomsak Meemon***[1], *Jannick Rolland*[1,2]; [1]*CREOL, College of Optics and Photonics, Univ. of Central Florida, USA,* [2]*Inst. of Optics, Univ. of Rochester, USA.* We present a modified algorithm for phase-resolved DOCT that will extend the lower limit of the velocity dynamic range while maintaining the maximum detectable velocity, and hence increase the overall detectable velocity dynamic range.

Highland G

4:00 p.m.–5:15 p.m.
FTuZ • Opto-Mechanics and Quantum Measurement II
Jack Harris; Yale Univ., USA, Presider

FTuZ1 • 4:00 p.m. Invited
The Engima of Optical Momentum, ***Stephen M. Barnett***; *Univ. Strathclyde, UK.* There are eminently reasonable arguments that the momentum of a photon in a medium as greater than or less than its value in free space, but which is correct? Both, of course!

FTuZ2 • 4:30 p.m.
Gyroscopic Optomechanics, ***Xingyu Zhang***, *Matthew Tomes, Tal Carmon; Univ. of Michigan, USA.* We suggest the use of gyroscopic optical forces, originating from the angular momentum of circularly polarized light propagating inside a bent nano-waveguide, to facilitate mechanical deformation. Right-handed and left-handed circular polarizations induce opposite displacements.

LS

Highland H

4:00 p.m.–5:15 p.m.
LTuH • Frontiers in Ultracold Molecules I
Eric Hudson; UCLA, USA, Presider

LTuH1 • 4:00 p.m. Invited
Tunable Excitons in Ordered Arrays of Ultracold Molecules of Optical Lattices, ***Roman Krems***; *Univ. of British Columbia, Canada.* We consider collective excitations of internal energy in ordered arrays of ultracold polar molecules trapped in an optical lattice. We demonstrate that an external dc electric field can be used to modify the dynamics of rotational excitons in an ensemble of closed-shell molecules and magnetic excitons in an ensemble of open-shell molecules in optical lattices. The systems proposed here may thus be used for time-domain quantum simulation of localization phenomena and spin excitation transfer in disordered media.

LTuH2 • 4:30 p.m. Invited
Dipolar Effects in an Ultracold Gas of LiCs Molecules, ***Matthias Weidemüller***; *Heidelberg Univ., Germany.* We present recent results on the sphotoassociation and optical trapping of an ultracold gas of LiCs molecules in low rovibrational states. Inelastic atom-molecule collisions are analyzed, and state redistribution by vibrational relaxation is observed.

Highland J

4:00 p.m.–5:15 p.m.
LTuI • Optofluidics in the Near-Field II
Sudeep Mandal; Cornell Univ., USA, Presider

LTuI1 • 4:00 p.m. Invited
Optofluidic Nano-Plasmonics for Biochemical Sensing, ***Shaya Y. Fainman***, *L. Pang, B. Slutsky, J. Ptasinski, L. Feng, M. Chen; Univ. of California at San Diego, USA.* We explore metal-dielectric nanoplasmonic 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.

LTuI2 • 4:30 p.m. Invited
Plasmonics for Optical Manipulation and Enhanced Spectroscopy, ***Kenneth B. Crozier***; *Harvard Univ., USA.* Field enhancement from surface plasmon structures presents new opportunities for optical manipulation and surface enhanced Raman spectroscopy (SERS). We review recent work on nanoparticle propulsion using surface plasmons, and on high performance SERS substrates.

Highland K

4:00 p.m.–4:45 p.m.
LTuJ • Laser Cooling and Trapping
Dallin S. Durfee; Brigham Young Univ., USA, Presider

LTuJ1 • 4:00 p.m.
Transfer and Storage of Optical Information in a Spinor Bose-Einstein Condensate, ***Azure Hansen***, *L. Suzanne Leslie, Mishkatul Bhattacharya, Nicholas P. Bigelow; Univ. of Rochester, USA.* We demonstrate the transfer, storage and retrieval of optical information in a spinor condensate using a two-photon Raman technique. The stored information is read out by reapplying one of the two Raman beams.

LTuJ2 • 4:15 p.m.
Three Laser Recoil-induced Resonance in a Magneto-Optical Trap, ***Francesco A. Narducci***[1], *Jon P. Davis*[1], *Kyle H. Gordon*[2], *Sara A. DeSavage*[2], *Dwight L. Duncan*[2], *George R. Welch*[3]; [1]*Naval Air Systems Command, USA,* [2]*AMPAC, USA,* [3]*Inst. for Quantum Science and Engineering and Dept. of Physics and Astronomy, USA.* In this work we discuss our recent experiments to measure recoil-induced resonances that revealed, in addition to the expected narrow resonance, a much broader resonance that does not seem to fit current models.

LTuJ3 • 4:30 p.m.
Excitation Pathways in Four-level N-Scheme Atomic Systems, ***Francesco A. Narducci***[1], *Jon P. Davis*[1], *B. Henry*[2], *Tony AbiSalloum*[2]; [1]*Naval Air Systems Command, USA,* [2]*Widener Univ., USA.* In this work, we reveal the physical origin of three resonances that are at the root of observed characteristics of four-level N-Scheme atomic systems. Explicit excitation pathways are associated with the resonances of interest.

Grand Ballroom D
Hyatt Regency Rochester

JOINT FiO/LS

STuD • Ashkin Symposium II—Continued

STuD3 • 4:50 p.m. **Invited**
Multi-Photon Laser Cooling, ***James (Trey) Porto,*** *Saijun Wu, Roger Brown, W. P. Phillips; NIST Res. Library, USA.* We explore laser cooling using light scattering between electronically excited atomic states. In a MOT with the laser beams along z replaced with beams coupling two excited states, we demonstrate efficient 3-D cooling and trapping.

STuD4 • 5:15 p.m. **Invited**
Laser Cooling and Trapping the Most Magnetic Atom, Dysprosium, ***Benjamin Lev****, Mingwu Lu, Seo Ho Youn; Univ. of Illinois at Urbana-Champaign, USA.* We report the first laser cooling and trapping of 5x10^8 Dy atoms using a repumper-free magneto-optical trap (MOT). The MOT confines this electronically complex atom due to Dy's unsurpassed magnetic dipole moment.

Highland B

FiO

FTuU • Astrophotonics I—Continued

FTuU3 • 5:00 p.m.
How Sum Frequency Generation Can be Used for High Resolution Imaging, *D. Ceus, S. Brustlein, L. Del Rio, A. Tonello, L. Delage,* ***François Reynaud;*** *XLIM Dept. Photonique, UMR CNRS 6172, France.* We propose a new version of high angular resolution instrument taking advantage of the frequency conversion of astronomical light by SFG.

FTuU4 • 5:15 p.m.
Development of an Array-Waveguide Grating Astronomical Spectrograph, ***Jon Lawrence***[1,2]*, Chris Betters*[3]*, Joss Bland-Hawthorn*[3]*, Nick Cvetojovic*[2]*, Simon Ellis*[3]*, Roger Haynes*[4]*, Anthony Horton*[1]*, Nemanja Jovanovic*[1,2]*, Sergio Leon-Saval*[3]*, Gordon Robertson*[3]*;* [1]*Australian Astronomical Observatory, Australia,* [2]*Macquarie Univ., Australia,* [3]*Univ. of Sydney, Australia,* [4]*Astrophysics Inst. Potsdam, Germany.* Photonic devices offer many potential benefits for astronomy. Here we describe the results from a laboratory characterisation and designs for an on-telescope technology demonstrator using arrayed-waveguide grating devices for multiplexed astronomical spectroscopy.

Highland C

FTuV • Optical Communication I—Continued

FTuV3 • 5:00 p.m.
Disentanglement Due to Polarization Mode Dispersion in Optical Fibers: from Nonlocal Compensation to Entanglement Sudden Death, ***Misha Brodsky***[1]*, Cristian Antonelli*[2]*, Mark Shtaif*[3]*;* [1]*AT&T Labs, USA,* [2]*Univ. dell'Aquila, Italy,* [3]*Tel Aviv Univ., Israel.* We propagate pairs of polarization-entangled photons through optical fibers with polarization-mode dispersion (PMD). We observe non-local PMD compensation and the transition to sudden death of entanglement when the alignment of the compensating element is varied

FTuV4 • 5:15 p.m.
A Hybrid Hinge Model for Polarization Mode Dispersion of Installed Transmission Systems, *Gino Biondini, Zachary Marzec,* ***Jonathan Schuster;*** *SUNY at Buffalo, USA.* We propose a hybrid waveplate model to characterize anisotropic effects in the hinge model of PMD. The model reproduces previous PMD generation mechanisms, but can also simulate more general (and more realistic) hinge behavior.

Highland D

FTuW • Novel Fibers—Continued

FTuW3 • 4:45 p.m.
Microstructuring of Chalcogenide Glass Fiber and Spinel Ceramic Surfaces to Reduce Reflection Losses, ***Catalin Florea***[1]*, Fritz Miklos*[1]*, Jasbinder Sanghera*[2]*, Ishwar Aggarwal*[2]*, Brandon Shaw*[2]*, Lynda Busse*[2]*, Guillermo Villalobos*[2]*, Woohong Kim*[2]*, Fred Kung*[3]*, Jim Nole*[4]*, Douglas Hobbs*[4]*;* [1]*GTEC Inc, USA,* [2]*NRL, USA,* [3]*Univ. Res. Fundation, USA,* [4]*TelAztec LLC, USA.* We demonstrate enhanced transmission of spinel ceramics and chalcogenide glasses and fibers due to the antireflective properties of microstructured surfaces. In the case of multimode As_2S_3 fibers, transmission as high as 97% was demonstrated.

FTuW4 • 5:00 p.m.
Observation of the Rayleigh-plateau Instability in the Core of a Multi-material Optical Fiber during Tapering, *Soroush Shabahang, Joshua Kaufman,* ***Ayman F. Abouraddy;*** *CREOL, The College of Optics & Photonics, UCF, USA.* We study experimentally and theoretically the limits on size reduction of features in a multi-material optical fiber. We find that the Rayleigh-Plateau instability sets the minimum transverse size of an axially continuous feature.

FTuW5 • 5:15 p.m.
Conjugated Polymer Nanofibers: Novel Light Sources for Microfluidic Systems, ***Andrea Camposeo****, Stefano Pagliara, Alessandro Polini, Dario Pisignano; CNR-Inst. Nanoscienze, Italy.* In this work we demonstrate the integration of light-emitting polymer fibers produced by electrospinning as polarized light-sources in prototype microfluidic devices.

Highland E

FTuX • Attosecond Optics and Technnology I—Continued

FTuX2 • 4:45 p.m.
Towards CEP Stable Sub Two Cycle IR Pulse Compression with Bulk Material, ***François Légaré***[1]*, Bruno E. Schmidt*[1,2]*, Andrew D. Shiner*[2]*, Pierre Béjot*[3]*, Jean-Pierre Wolf*[4]*, David M. Villeneuve*[2]*, Jean-Claude Kieffer*[1]*, Paul B. Corkum*[2]*;* [1]*Ctr. Énergie Matériaux et Télécommunications, INRS, Canada,* [2]*Univ. of Ottawa, Canada,* [3]*CNRS, Univ. de Bourgogne, France,* [4]*Univ. de Genève, Switzerland.* We demonstrate both experimentally and numerically that self-steepening during propagation in a hollow-fiber followed by linear propagation through glass in the anomalous dispersion enables pulse compression down to 1.9 cycles at 1.8 micron wavelength.

FTuX3 • 5:00 p.m. **Invited**
High-Order Harmonic Generation on Plasma Mirrors: toward Attosecond Sources of Second Generation, ***Fabien Quere***[1]*, H. Vincenti*[1]*, H. George*[1]*, C, Thaury*[1]*, Ph. Martin*[1]*, A. Malvache*[2]*, R. Nuter*[3]*;* [1]*Inst. du CEA Saclay, France,* [2]*CNRS-Ecole Polytechnique, France,* [3]*Commissariat à l'Energie Atomique/DAM, France.* I will present the two mechanisms involved in high-order harmonic generation from plasma mirrors, and discuss the properties of the resulting attosecond light sources and the information they can provide on the laser-plasma interaction dynamics.

Highland F | **Highland G** | **Highland H** | **Highland J** | **Highland K**

FiO

FTuY • Coherence Tomography—Continued

FTuY4 • 4:45 p.m. **Tutorial**
Coherence Imaging, ***Adam Wax****; Dept. of Biomedical Engineering, Duke Univ., USA.* This tutorial reviews coherence imaging approaches for biomedical applications. Subjects will include digital holography and optical coherence tomography modalities with an emphasis on basis of image formation, functional extensions and biological applications.

Adam Wax received dual B.S. degrees in 1993, one in electrical engineering from Rensselaer Polytechnic Institute, Troy, NY and one in physics from the State University of New York at Albany, and the Ph.D. degree in physics from Duke University, Durham, NC in 1999. He joined the George R. Harrison Spectroscopy Laboratory at the Massachusetts Institute of Technology, as a postdoctoral fellow of the National Institutes of Health immediately after his doctorate. Dr. Wax joined the faculty of the Department of Biomedical Engineering at Duke University in the fall of 2002 and currently is appointed as an associate professor. His research interests are in the use of light scattering and interferometry to probe the biophysical properties of cells for both diagnosis of disease and fundamental cell biology studies.

FTuZ • Opto-Mechanics and Quantum Measurement II—Continued

FTuZ3 • 4:45 p.m. **Invited**
Testing Macroscopic Quantum Superpositions, ***Dirk Bouwmeester****; Univ. of California at Santa Barbara, USA.* Abstract not available.

LS

LTuH • Frontiers in Ultracold Molecules I—Continued

LTuH3 • 5:00 p.m.
Luminorefrigeration Of NaCs, ***Amy E. Wakim****, Patrick Zabawa, Amanda Neukirch, Nicholas P. Bigelow; Univ. of Rochester, USA.* We will report on an optical pumping method designed to transfer ultracold polar NaCs molecules from an initial distribution of deeply bound molecules in the $X1\Sigma+$ to enhance the $v=0$ population.

LTuI • Optofluidics in the Near-Field II—Continued

LTuI3 • 5:00 p.m.
Dispensing and Manipulation of Nano-drops in 2-D and 3-D by Pyro-EHD (electro-hydro-dynamic) Effect, *Sara Coppola, Veronica Vespini, Melania Paturzo, Simonetta Grilli,* ***Pietro Ferraro****; CNR - Isituto Nazionale di Ottica, Italy.* A new opto-nanofluidic approach named Pyro-EHD is presented for streaming liquid nano-pico-droplets through pyroelectric effect activated by IR laser. Manipulation in 2-D and 3-D of nano-drops and liquid printing with atto-Liter drops is demonstrated

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4:30 p.m.–5:30 p.m. Minorities and Women in OSA (MWOSA) Tea, *Grand Ballroom E and F, Hyatt Regency Rochester*

6:00 p.m.–7:00 p.m. OSA Annual Business Meeting, *Highland A, Rochester Riverside Convention Center*

6:00 p.m.–7:00 p.m. DLS Annual Business Meeting, *Highland H, Rochester Riverside Convention Center*

6:30 p.m.–8:00 p.m. OSA LaserFest Member Reception, *Lilac Ballroom North and South, Rochester Riverside Convention Center*

7:00 p.m.–10:00 p.m. LS Banquet, *Grand Ballroom A and B, Hyatt Regency Rochester*

7:00 a.m.–5:30 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

10:00 a.m.–4:00 p.m. Exhibit Open, *Rochester Riverside Convention Center*

8:00 a.m.–9:45 a.m.
FWA • Astrophotonics II
Tim Birks; Univ. of Bath, UK, Presider

FWA1 • 8:00 a.m. Tutorial
Astrophophotonics: A New Generation of Astronomical Instruments, *Joss Bland-Hawthorn*; *Univ. of Sydney, Australia.* Astrophotonics—which lies at the interface of photonics and astronomy—will revolutionize astornomical instrumentation in the coming decade. Recent developments include the PIMMS multimode photonic spectrograph which is arguably the most radical development in spectroscopy in almost a century.

Joss Bland-Hawthorn is a Federation Fellow at the University of Sydney where he is a Professor of Physics. Joss has over 200 research papers, and is world renowned for his breakthroughs in astrophysics and in instrumentation. In 1986, he obtained his PhD in astrophysics from the Royal Greenwich Observatory prior to taking up faculty appointments in Hawaii and Texas. In 1993, he moved to the Anglo-Australian Observatory where he was Head of a highly successful group that pioneered astronomical concepts with names like Nod & Shuffle, Dazle, Starbugs, Honeycomb. Joss has carried out pioneering work on tunable filters, gratings and interplanetary laser communications. In 2002, he proposed the new field of astrophotonics that sits at the interface of astronomy and photonics - in Feb 2009, this field was featured in the Focus Issue of Optics Express. Joss is a recipient of the 2008 Muhlmann Award

8:00 a.m.–10:00 a.m.
FWB • Biochemical Sensing
Jonathan A. Nagel; AT&T Labs-Res., USA, Presider

FWB1 • 8:00 a.m. Invited
Sensor Challenges for Deep Tissue Imaging, *Martin J. Leahy*; *Univ. of Limerick, Ireland.* Abstract not available.

FWB2 • 8:30 a.m.
Biosensing with Colorimetric Signatures of Deterministic Aperiodic Metal Nanoparticle Arrays, *Sylvanus Y. Lee*[1], *Jason J. Amsden[2], Svetlana V. Boriskina[1], Fiorenzo G. Omenetto[2], Luca Dal Negro[1]; [1]Boston Univ., USA, [2]Tufts Univ., USA.* A novel optical sensing technique based on distinctive colorimetric signatures and spectral shifts of deterministic aperiodic arrays is demonstrated by protein monolayer sensing in the visible spectral range using inexpensive dark-field spectroscopy and autocorrelation analysis.

8:00 a.m.–10:00 a.m.
FWC • Optical Design with Unconventional Polarization I
R. John Koshel; Photon Engineering LLC and College of Optical Sciences, Univ. of Arizona, USA, Presider

FWC1 • 8:00 a.m. Tutorial
Some Applications of the Unified Theory of Coherence and Polarization of Light, *Emil Wolf*; *Univ. of Rochester, USA.* The unified theory of coherence and polarization of light, formulated in 2003, is finding many useful applications. A review of some of them will be presented.

Emil Wolf is the Wilson Professor of Optical Physics and also Professor of Optics at the University of Rochester. His main researches are in physical optics. He published more than 400 papers. He is the co-author, with Max Born, of a well-known book Principles of Optics, now in its seventh edition, and with Leonard Mandel, of Optical Coherence and Quantum Optics. He is also the author of Introduction to the Theory of Coherence and Polarization of Light. He is the editor of Progress in Optics, an ongoing series of volumes of review articles on optics and related subjects. Professor Wolf is the recipient of numerous awards for his scientific contributions and is an honorary member of the Optical Societies of America (of which he was President in 1978), India, and Australia. He is the recipient of seven honorary degrees from universities around the world.

8:00 a.m.–10:00 a.m.
FWD • Novel Hybrid Integration II
James Jaques; LGS Innovations, LLC, USA, Presider

FWD1 • 8:00 a.m. Invited
Rare-earth-ion Doped Waveguide Amplifiers and Lasers in Alumina and Polymers, *Markus Pollnau*, *J. D. B. Bradley, J. Yang, E. H. Bernhardi, R. M. de Ridder, K. Wörhoff; Univ. of Twente, Netherlands.* 170 Gbit/s data transmission, microring lasers operating across the telecom C-band, and narrow-linewidth distributed-feedback lasers in Al_2O_3:Er waveguides on silicon, as well as amplifiers and continuous-wave lasers in Nd-doped polymer waveguides on silicon are presented.

FWD2 • 8:30 a.m.
High-Performance 1550 nm Polymer-based LEDs on Silicon Using Hybrid Polyfluorene-based Type-II Heterojunctions, *Xin Ma, Fan Xu,* ***Sylvain G. Cloutier****; Univ. of Delaware, USA.* We report on the optoelectronic properties of hybrid polymer-based light-emitting diodes integrated on silicon chip. Using a hybrid polyfluorene-based type-II heterostructure host with PbS quantum dots, we achieved efficient room-temperature electroluminescence at telecommunication wavelengths.

8:00 a.m.–10:00 a.m.
FWE • Attosecond Optics and Technnology II
Jean-Claude Diels; Univ. of New Mexico, USA, Presider

FWE1 • 8:00 a.m. Invited
XUV Time-Domain Spectroscopy Using Isolated Attosecond Pulses from Double Optical Gating, *Zenghu Chang*[1,2]; *[1]Kansas State Univ., USA, [2]Dept. of Physics and CREOL, Univ. of Central Florida, USA.* Temporally coherent XUV spectrum covering 20 to 600 eV was generated by an attosecond light switch. Transient absorption experiments using the supercontinuum were conducted that revealed correlated electron dynamics in noble gas atoms.

FWE2 • 8:30 a.m.
High-Order Harmonics of a Continuous-Wave Driving Laser, *Maxim Kozlov*[1], *Ofer Kfir[1], Avner Fleischer[1], Tal Carmon[2], Harald G. L. Schwefel[3], Oren Cohen[1]; [1]Technion-Israel Inst. of Technology, Israel, [2]Univ. of Michigan, USA, [3]Max-Planck-Inst. for the Science of Light, Germany.* We propose a device that emits ultra-narrow bandwidth high-order harmonics of a continuous-wave driving laser. The device consists of nano antennas that are coupled to a whispering gallery micro-resonator.

Highland F	Highland G	Highland H	Highland J	Highland K
FiO		LS		

7:00 a.m.–5:30 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

10:00 a.m.–4:00 p.m. Exhibit Open, *Rochester Riverside Convention Center*

8:00 a.m.–10:00 a.m.
FWF • Biosensing
Urs Utzinger, Univ. of Arizona, USA, Chair, Presider

FWF1 • 8:00 a.m.
Nanocavities in Photonic Crystal Waveguides for Label-Free Biosensing, *Sudeshna Pal*, *Elisa Guillermain, Benjamin L. Miller, Philippe M. Fauchet; Univ. of Rochester, USA.* We have investigated resonant nanocavities coupled to photonic crystal waveguides for biosensing. The devices are fabricated using electron beam lithography and reactive-ion-etching. Preliminary results demonstrate successful detection of human IgG molecules and refractive index sensing.

FWF2 • 8:15 a.m.
Optical Quantification of Label-Free DNA, *Kyuwan Lee*, *Joseph Irudayaraj; Purdue Univ., USA.* The designed gold nanoparticle dimer is employed to quantify label-free DNA. By using hyperspectral dark field spectroscopy, the measurement of characteristic spectra shows versatile quantification of label-free DNA up to atto molar concentration.

FWF3 • 8:30 a.m.
Demonstration of Microcantilever-Based Biological Sensor Array with in-Plane Photonic Transduction Mechanism, *Gregory P. Nordin*, *Seunghyun Kim, Ryan R. Anderson, Stanley J. Ness, Weisheng Hu, Jong W. Noh, William C. Dahlquist, Danny C. Richards; Brigham Young Univ., USA.* We demonstrate biological molecule detection with photonic microcantilever array and in-plane photonic detection using the biotin-streptavidin material system and integrated polydimethylsiloxane (PDMS)-based microfluidics.

8:00 a.m.–10:00 a.m.
FWG • Nonlinearities and Gain in Plasmonics and Metamaterials I
Stefan Linden; Univ. Karlsruhe, Germany, Presider

FWG1 • 8:00 a.m. **Invited**
Metamaterials and Symmetry, *Xiang Zhang*; *Univ. of California at Berkeley, USA.* I will discuss recent experimental demonstrations of intriguing phenomena associated with Metamaterials and plasmonics. These include new symmetries in metamaterials, negative refraction and Negative-index, cloaking at optical frequencies and sub-wavelength plasmonic lasers.

FWG2 • 8:30 a.m.
Analysis of Nonlinear Electromagnetic Metamaterials, *Ekaterina Poutrina*, *Da Huang, David R. Smith; Duke Univ., USA.* We derive the expressions for the effective nonlinear susceptibilities of a metacrystal formed from resonant elements that couple strongly to the magnetic field. We experimentally illustrate the accuracy and validity of our theoretical framework.

8:00 a.m.–10:00 a.m.
LWA • Hybrid Quantum Systems I
Aashish Clerk; McGill Univ., Canada, Presider

LWA1 • 8:00 a.m. **Invited**
Hybrid Nanophotonic and Nanomechanical Interfaces for Spin Qubits, *Mikhail Lukin*; *Harvard Univ., USA.* We will describe our recent theoretical and experimental work towards developing novel hybrid nanophotonic and nanomechanical quantum interfaces and quantum transducers for spin qubits in diamond. Possible applications of these techniques will be discussed.

LWA2 • 8:30 a.m. **Invited**
Optical Manipulation and Detection of the Collective Motion and Spin of an Ultracold Atomic Gas, *Dan Stamper-Kurn*[1,2]; *[1]Univ. of California at Berkeley, USA, [2]Lawrence Berkeley Natl. Lab, USA.* The interaction of an optical cavity field with the collective motion or spin of cold atoms allows investigations of cavity optomechanics and novel magneto-optical phenomena. I will present experimental and theoretical investigations of this idea.

8:00 a.m.–10:00 a.m.
LWB • Metrology and Precision Measurements I
Dmitri Budker; Univ. of California at Berkeley, USA, Presider

LWB1 • 8:00 a.m. **Invited**
Precise Determination of h/M(Rb) Using Bloch Oscillations and Atomic Interferometry: A Mean to Deduce the Fine Structure Constant, *Rym Bouchendira, Malo Cadoret, Estefania de Mirandes, Pierre Cladé, Saïda Guellati, François Nez,* ***François Biraben****; École Normale Supérieure, Univ. Pierre et Marie Curie, CNRS, France.* We report a measurement of the atomic recoil using atom interferometry and Bloch oscillations. Such a measurement yields to a determination of the fine structure constant with a relative uncertainty of 4.6 ppb.

LWB2 • 8:30 a.m. **Invited**
Optical Clock with Lattice-Confined Sr Atoms, *Jun Ye*; *JILA, NIST, Univ. of Colorado, USA.* We will discuss the latest development of an accurate optical atomic clock using ultracold Sr atoms confined in a magic wavelength optical lattice, focusing on the progress in the control of collisional frequency shift.

8:00 a.m.–10:15 a.m.
LWC • Photophysics of Energy Conversion I
Garry Rumbles; Natl. Renewable Energy Lab, USA, Presider

LWC1 • 8:00 a.m. **Invited**
Multi-Exciton Dissociation Dynamics in CdSe Quantum Dots, *Tianquan Lian*; *Emory Univ., USA.* We report studies of ultrafast exciton dissociation dynamics in quantum dots by electron transfer to adsorbed molecular acceptors. Up to three excitons per CdSe quantum dots (generated by multiple photon absorption) can be dissociated.

LWC2 • 8:30 a.m. **Invited**
Inter- and Intra-chain Electronic Coherence in Conjugated Polymers, *Gregory Scholes*, *Inchan Hwang, John Casey; Univ. of Toronto, USA.* Recent experimental studies of electronic coherence in chemical and biological systems are summarized. The role quantum-coherent energy transfer can play in long-range light-harvesting in organic solar cells is described.

FWA • Astrophotonics II—Continued

for experimental astronomy, and a recipient of the inaugural 2008 Group Achievement Award from the Royal Astronomical Society. In 2010, he is the Leverhulme Visiting Professor to Oxford and the Merton College Fellow.

FWA2 • 8:45 a.m.
Future Detectors for Astrophotonics, *Donald F. Figer*; *Rochester Inst. of Technology, USA.* Quantum-limited detectors extract all available information from each incoming photon. In this talk, I will summarize the state of the field and future prospects for using these detectors for Astrophotonic applications.

FWA3 • 9:00 a.m. Invited
Coronagraphy for Exo-Planetary Detection, *Richard Lyon*; *NASA Goddard Space Flight Ctr., USA.* Abstract not available.

FWB • Biochemical Sensing—Continued

FWB3 • 8:45 a.m.
Metallized Ultrathin Porous Membranes for Biological and Chemical Sensing, *Krishanu Shome*, *David Z. Fang, Philippe M. Fauchet; Univ. of Rochester, USA.* Metallized ultrathin porous silicon and oxidized silicon membranes provide a free standing platform for sensing using transmission mode SPR. Simulation results are supported by transmission experiments. SPR excitation is measured and used in sensing.

FWB4 • 9:00 a.m.
Nanoparticle Detection in Water by Mode Splitting in An Optical Microresonator, *Woosung Kim*, *Sahin Kaya Ozdemir, Jiangang Zhu, Lina He, Lan Yang; Washington university at St. Louis, USA.* We demonstrated detection of polystrene nanoparticles with radius of 50 nm in water using mode splitting in a microresonator in water. We observed different evolution of mode splitting spectra corresponding to different particle solution concentrations.

FWB5 • 9:15 a.m.
On-chip Plasmonic Nano-slits Array to Alleviate the Mass Transport Limitation in Microfluidic Biosensors, *Xin Zhao*[1], *Zheng Zheng[1], Wei Li[1], Jinsong Zhu[2], Tao Zhou[3], Jiangtao Cheng[4]; [1]Beihang Univ., China, [2]Natl. Ctr. for Nanoscience and Technology of China, China, [3]New Jersey Inst. of Technology, USA, [4]Pennsylvania State Univ., USA.* We propose on-chip plasmonic nano-slits array structures that can change the mass transport in a surface microfliudic biosensing system by providing additional optical gradient forces to targeted analytes. Both optical and fluidic effects are investigated.

FWC • Optical Design with Unconventional Polarization I—Continued

FWC2 • 8:45 a.m. Invited
Unconventional Polarization States Applied to Projection Imaging, *Thomas G. Brown*; *Inst. of Optics, Univ. of Rochester, USA.* Abstract not available.

FWC3 • 9:15 a.m.
Full Poincaré Beams, *Amber M. Beckley[1], Thomas G. Brown[1], **Miguel A. Alonso**[1,2]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Applied Physics, Aalto Univ., Finland.* We describe theoretically a family of beams whose polarizations span the entire Poincare sphere. The experimental production of these beams through the use of a stressed window is also discussed.

FWD • Novel Hybrid Integration II—Continued

FWD3 • 8:45 a.m.
Microstructured Channel Waveguide Lasers In $KY(WO_4)_2$:Gd^{3+}, Lu^{3+}, Yb^{3+}, *Dimitri Geskus, Shanmugam Aravazhi, Christos Grivas, Kerstin Wörhoff, **Markus Pollnau**; Univ. of Twente, Netherlands.* Laser operation was achieved in microstructured channel waveguides of $KY(WO_4)_2$:Gd^{3+}, Lu^{3+}, Yb^{3+}, resulting in a threshold of only 5 mW, a slope efficiency of 62% versus launched pump power, and 76 mW output power.

FWD4 • 9:00 a.m. Invited
Optimized Nonlinear Optical Molecules for Silicon-Organic-Hybrid Systems, *M. L. Scimeca[1], B. Breiten[2], F. Diederich[2], **Ivan Biaggio**[1]; [1]Lehigh Univ., USA, [2]Lab für Organische Chemie, Switzerland.* Small organic molecules with large third-order nonlinearity compared to their size create a high optical quality organic coating when vapor-deposited on any substrate, and deliver all-optical switching without two-photon absorption to the silicon photonics platform.

FWE • Attosecond Optics and Technnology II—Continued

FWE3 • 8:45 a.m.
Frequency Up-Conversion of Extreme Ultraviolet Attosecond Pulses: Producing Spatio-Spectral X-Rays Airy Beams, *Ofer Kfir*, *Maxim Kozlov, Avner Fleischer, Oren Cohen; Technion - Israel Inst. of Technology, Israel.* We propose to amplify the photon-energy of attosecond pulses to keV through wave-mixing with a mid-IR field. The generated X-ray emission exhibits intrigue characteristics, including attosecond square pulses, spatio-spectral Airy beams and focusing attosecond pulses.

FWE4 • 9:00 a.m. Invited
Molecular Orbital Imaging Using Laser Driven Attosecond Emission, S. Haessler[1], Z. Diveki[1], J. Caillat[2,3], W. Boutu[1], C. Giovanetti-Teixeira[2,3], T. Ruchon[1], T. Auguste[1], P. Breger[1], A. Maquet[2,3], **Bertrand Carre**[1], R. Taïeb[2,3], P. Salières[1]; [1]Inst. du CEA Saclay, France, [2]Lab de Chimie Physique-Matière et Rayonnement, UPMC Univ., France, [3]CNRS, France. Advanced characterization of the attosecond emission from small aligned molecules (CO_2, N_2) gives access to their structural and dynamical properties. In N_2, tomographic reconstruction of the bound electronic-wavepacket is performed with Ångström-spatial and attosecond-temporal resolution.

FiO

Highland F

FWF • Biosensing—Continued

FWF4 • 8:45 a.m.
Biosensor Fabrication by Direct Laser Microprinting, *Maria Kandyla*[1], *Christos Pandis[1], Georgios Tsekenis[2], Panagiotis Dimitrakis[3], Stavros Chatzandroulis[3], Ioanna Zergioti[1]; [1]Natl. Technical Univ. of Athens, Greece, [2]Biomedical Res. Foundation, Greece, [3]NCSR Demokritos, Greece.* We report the fabrication of microbiosensors by Laser Induced Forward Transfer. Two kinds of biosensors are discussed: capacitive biosensors and polyaniline amperometric biosensors. Laser fabrication allows for low-cost, maskless patterning with the potential of miniaturization.

FWF5 • 9:00 a.m.
Optical Microspherical Resonators for Biomedical Applications, *Simone Berneschi[1,2], Francesco Baldini[1], Franco Cosi[1], Maurizio Ferrari[3], Gualtiero Nunzi Conti[1], Stefano Pelli[1], Silvia Soria[1],* ***Giancarlo C. Righini*[1]**; *[1]IFAC CNR, Italy, [2]Ctr. Studi e Ricerche Enrico Fermi, Italy, [3]IFN CNR, Italy.* Microoptical devices based on Whispering Gallery Modes exhibit peculiar properties, the most notable being a very high quality factor. Here results are presented on the development of an immunosensor based on a microspherical glass resonator.

FWF6 • 9:15 a.m.
A Pyro-Electrohydrodynamic Nanodispenser for Biochemical Applications, *Sara Coppola*, *Veronica Vespini, Melania Paturzo, Simonetta Grilli, Pietro Ferraro; CNR Inst. Nazionale di Ottica, Unit of Napoli, Italy.* A new and simple method is presented here for dispensing liquid nano- and pico-droplets through a non-invasive electrode-less configuration using the electric field generated by the pyroelectric effect into a dielectric crystal.

Highland G

FWG • Nonlinearities and Gain in Plasmonics and Metamaterials I—Continued

FWG3 • 8:45 a.m.
Spontaneous Emission Near Hyperbolic Metamaterials, *Ji-young Kim*, *Zubin Jacob, Guru V. Naik, Evgenii E. Narimanov, Alexander Boltasseva, Vladimir M. Shalaev; Electrical and Computer Engineering/Purdue university, USA.* We present a hyperbolic metamaterial substrate for radiative decay engineering. The spontaneous emission lifetime of molecules is reduced due to near-field interaction with the metamaterial. This opens the route for metamaterial-based fluorescence sensing and detection.

FWG4 • 9:00 a.m.
Nonlinear PT-Symmetric Optical Diode, *Hamidreza Ramezani*[1], *Tsampikos Kottos[1], Ramy El-Ganainy[2], Demetrios N. Christodoulides[2]; [1]Wesleyan Univ., USA, [2]Univ. of Central Florida, USA.* We show that nonlinear parity-time symmetric optical structures, can act as unidirectional optical valves. This is possible, by exploiting the interplay between the nonreciprocal parity-time propagation , with self-trapping induced by Kerr nonlinearities.

FWG5 • 9:15 a.m.
Asymmetric Positive-Negative Index Nonlinear Waveguide Couplers, *Gayatri Venugopal*, *Natalia M. Litchinitser; Univ. at Buffalo, USA.* We discuss wave propagation in asymmetric couplers consisting of positive and negative index channels with different nonlinear coefficients. We find the dispersion relations, constants of motion and various regimes of wave interactions in such structures.

LS

Highland H

LWA • Hybrid Quantum Systems I—Continued

LWA3 • 9:00 a.m.
Tunable Broadband White-Light Cavity Using Anomalous Dispersion in Cold Atoms, *Jiepeng Zhang*[1,2], *Xiaogang Wei[2], Gessler Hernandez[2], Yifu Zhu[2]; [1]Physics Div., Los Alamos Natl. Lab, USA, [2]Dept. of Physics, Florida Intl. Univ., USA.* We report the demonstration of a broadband white-light cavity scheme based on a cavity QED system that consists of multiple cold atoms confined in an optical cavity and coherently driven by a free-space laser field.

LWA4 • 9:15 a.m.
Quantum Correlations Between Telecom Light and Memory, *Jacob Z. Blumoff*[1], *Alexander G. Radnaev[1], Yaroslav O. Dudin[1], Ran Zhao[1], Stewart Jenkins[2], Alex Kuzmich[1], Brian Kennedy[1]; [1]Georgia Tech, USA, [2]Southampton, UK.* Long-distance quantum information networks require information storage, retrieval and transmission at telecommunications wavelengths. We demonstrate conversion between 795 and 1367 nm light with efficiency 52% and measure non-classical correlations between telecom light and memory.

Highland J

LWB • Metrology and Precision Measurements I—Continued

LWB3 • 9:00 a.m.
Precision Metrology with a Strontium Ion Interferometer, *Christopher Erickson*, *James L. Archibald, Mary Lyon, Dallin S. Durfee; Brigham Young Univ., USA.* We present a strontium ion interferometer for use as an electromagnetic field sensor with unprecedented sensitivity. Applications include measurements of fringing fields, studies of image charge scattering in superconductors, and ultra-precise tests of electromagnetism.

LWB4 • 9:15 a.m. **Invited**
Al$^+$ Optical Clocks for Fundamental Physics, Geodesy, and Quantum Metrology, *Till Rosenband*, *C. W. Chou, D. B. Hume, D. J. Wineland; NIST, USA.* We compare the rates of two Al$^+$ optical clocks. Despite many differences, their rates agree to 1.8 +/- 0.7 x 10^{-17}, within the accuracy limit of the older clock. The newer clock has an accuracy of 8.6 x 10^{-18} and stability near 10^{-15} $(\tau/s)^{-1/2}$.

Highland K

LWC • Photophysics of Energy Conversion I—Continued

LWC3 • 9:00 a.m. **Invited**
Transient Absorption Studies of Charge Photogeneration in Organic and Dye Sensitized Solar Cells, *James R. Durrant*; *Imperial College London, UK.* My talk will address the use of transient optical techniques, primarily on the nano- to millisecond timescales, to interrogate photoinduced charge separation in dye sensitized and organic thin films and photovoltaic devices.

FiO

Highland A

FWA • Astrophotonics II—Continued

FWA4 • 9:30 a.m.
Mode Evolution in Photonic Lanterns, *Sergio G. Leon-Saval*, *Alexander Argyros, Joss Bland-Hawthorn; Univ. of Sydney, Australia.* The "photonic lantern" allows for a single-mode photonic function to take place within a multimode fibre. We study its modal behaviour for achieving low-loss between a multimode fibre and a "near-diffraction limited" single-mode system.

Highland B

FWB • Biochemical Sensing—Continued

FWB6 • 9:30 a.m.
Ultra-thin Silicon Nitride Microring Resonator for Biophotonic Applications at 970nm Wavelength, *Ilya Goykhman*, *Boris Desiatov, Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* We experimentally demonstrate an ultra-thin silicon nitride microring resonator operating at wavelength of 970nm that is favorable for large variety of biophotonic applications. Optimization parameters for improved sensitivity and light-mater interaction are presented

FWB7 • 9:45 a.m.
Integrated Nano-hole Array Surface Plasmon Resonance Biochemical Sensor, *Junpeng Guo*[1], *Hai-Sheng Leong[1], Robert G. Lindquist[1,2], David J. Brady[2]; [1]Univ. of Alabama in Huntsville, USA, [2]Duke Univ., USA.* We have demonstrated a super-periodic metallic nano-hole array surface plasmon device for integrated biochemical sensing. The super-periodic nano-hole array device combines functions of sensing and surface plasmon resonance spectral analysis on a single device.

Highland C

FWC • Optical Design with Unconventional Polarization I—Continued

FWC4 • 9:30 a.m.
Cylindrical Vector Beam Transformations and Hybrid Vector Beams, *Giovanni Milione*, *Robert R. Alfano; Physics Dept., CUNY, USA.* Transformations of the spin and orbital parts of cylindrical vector beams through conventional optical elements is analyzed with Jones calculus and experimentally measured by Stokes polarimetry. Generation of unique hybrid vector beams is discussed.

FWC5 • 9:45 a.m.
Polarization Aspects of Near-Field Radiation from Nanoscale Subwavelength Apertures, *Erdem Öğüt*, *Kürşat Şendur; Sabanci Univ., Turkey.* It is demonstrated that a square nanoaperture can mediate polarized diffraction-limited radiation into nanoscale optical spots with the same polarization. A rectangular nanoaperture can convert linearly-polarized diffraction-limited radiation into circularly and elliptically-polarized nanoscale optical spots.

Highland D

FWD • Novel Hybrid Integration II—Continued

FWD5 • 9:30 a.m.
High Fiber-coupled Output Power from Continuous-wave Photonic Crystal Band-edge Laser, *Sunghwan Kim*, *Jeongkug Lee, Heonsu Jeon; Seoul Natl. Univ., Korea, Republic of.* We demonstrate continuous-wave operation of surface-emitting photonic crystal band-edge laser wafer-bonded onto a substrate of efficient thermal dissipation. Using a butt-end fiber coupling scheme, high laser output power of ~200 µW is achieved.

FWD6 • 9:45 a.m.
On the Temperature Dependence of Monolithically Integrated Ga(NAsP)/(BGa)P/Si QW Lasers, *Nadir Hossain*[1], *Shirong R. Jin[1], Stephen J. Sweeney[1], Sven Liebich[2], Peter Ludewig[2], Martin Zimprich[2], Bernardette Kunert[3], Kerstin Volz[2], Wolfgang Stolz[2]; [1]Advanced Technology Inst., Univ. of Surrey, UK, [2]Material Sciences Ctr. and Faculty of Physics, Philipps-Univ., Germany, [3]NAsP III/V GmbH, Germany.* Lasing operation up to 120K is reported in novel direct band-gap Ga(NAsP)/(BGa)P lasers grown monolithically on a silicon substrate. A carrier leakage process is found to dominate the temperature dependence of the laser threshold current.

Highland E

FWE • Attosecond Optics and Technnology II—Continued

FWE5 • 9:30 a.m.
Extreme Ultraviolet Polarimetry Using Laser High Harmonics, *Nathan Heilmann*, *Nicole Brimhall, Nick Herrick, Michael Ware, Justin Peatross; Dept. of Physics and Astronomy, Brigham Young Univ., USA.* Laser high-order harmonics are used to measure the optical constants of materials in the EUV. The optical constants for uranium, copper, and other metals are characterized from the measured ratio of s- vs. p-polarized reflectance.

FWE6 • 9:45 a.m.
Light Waveform Control of Synthesized Attosecond Pulse Train by Multi-Colored Laser Fields, *Wei-Jan Chen*[1], *Chao-Kuei Lee[2], Ci-Ling Pan[1]; [1]Dept. of Physics, Natl. Tsing Hua Univ., Taiwan, [2]Dept. of Photonics, Natl. Sun Yat-Sen Univ., Taiwan.* In this work, an alternative approach of carrier-envelope-phase(CEP) and waveform controlled 10^{14} W/cm^2 peak power optical frequency pulse trains generation with duration around 500 attosecond is proposed and demonstrated based on cascade harmonic generation collinearly.

10:00 a.m.–10:30 a.m. Coffee Break, *Empire Hall, Rochester Riverside Convention Center*

NOTES

FiO

Highland F

FWF • Biosensing—Continued

FWF7 • 9:30 a.m.
Time-Lapsed Integrated Raman- and Angular-Scattering Microscopy of Immune Cells, *Dustin W. Shipp*, *Andrew J. Berger; Univ. of Rochester, USA.* Integrated Raman- and Angular-scattering Microscopy (IRAM) uses chemical and morphological data to differentiate between activated and resting immune cells. IRAM can now monitor these changes over time to study the immune cell activation process.

FWF8 • 9:45 a.m.
Analysis of Raman Spectral Evolution of HeLa Cells under Deep-Ultraviolet Exposure, *Yasuaki Kumamoto*[1,2], *Atsushi Taguchi*[2], *Satoshi Kawata*[1,2]; [1]*Osaka Univ., Japan,* [2]*RIKEN, Japan.* We analyzed deep-ultraviolet Raman spectral evolution of HeLa cells at varied exposure duration and excitation wavelengths of deep-ultraviolet light. We found that 244 and 257 nm can be better for probing DNA and protein, respectively.

Highland G

FWG • Nonlinearities and Gain in Plasmonics and Metamaterials I—Continued

FWG6 • 9:30 a.m. **Invited**
Switchable and Nonlinear Metamaterials: Controlling Light on the Nanoscale, *Nikolay Zheludev*; *Univ. of Southampton, UK.* We overview our recent results in nanostructured photonic metamaterials containing nonlinear and active media such as switchable chalcogenide glass, carbon nanotubes, graphene, semiconductor quantum dots and report on superconducting plasmonic metamaterials.

LS

Highland H

LWA • Hybrid Quantum Systems I—Continued

LWA5 • 9:30 a.m. **Invited**
Measurement of Nanomechanical Motion with Precision Sufficient to Detect Zero-Point Motion, *K. W. Lehnert*[1], *J. D. Teufel*[2], *T. Donner*[1], *J. W. Harlow*[1], *D. Li*[2], *R. W. Simmonds*[2]; [1]*JILA, NIST, Univ. of Colorado, USA,* [2]*NIST, USA.* We detect the motion of a suspended micro- and nano- mechanical elements, whose fundamental mode of motion has been cooled to within a few 10s of quanta of the ground-state using an ultra-low temperature cryostat.

Highland J

LWB • Metrology and Precision Measurements I—Continued

LWB5 • 9:45 a.m.
Ultra-sensitive Sensing with A Superluminal Ring Laser, *Honam Yum, Joshua Yablon, Ye Wang,* ***Selim M. Shahriar***; *Northwestern Univ., USA.* We show, theoretically and experimentally, how a ring laser can be tuned to a regime where the group velocity of light far exceeds the vacuum veocity, realizing a superluminal laser, with high sensitivity to perturbations.

Highland K

LWC • Photophysics of Energy Conversion I—Continued

LWC4 • 9:30 a.m.
Surface Enhanced Raman Study of the Interaction of Organic Solar Cell Components with Plasmonically Active Nanoparticles, *Marina Stavytska-Barba,* ***Anne M. Kelley***; *Univ. of California, Merced, USA.* Surface enhanced Raman spectroscopy is used to characterize the interaction of a common poly(thiophene) based component of organic polymer photovoltaic cells, PEDOT:PSS, with plasmonically active metal nanoparticles that are reported to enhance solar conversion efficiency.

LWC5 • 9:45 a.m. **Invited**
Exciton Diffusion and Interfacial Charge Separation in Photovoltaic Materials Studied by Microwave Conductivity, *Tom J. Savenije*, *Laurens D. A. Siebbeles; Delft Univ. of Technology, Netherlands.* It is demonstrated how the laser-induced Time-Resolved Microwave Conductivity Technique can be used to determine the singlet or triplet exciton diffusion length in organic dye layers, as well as the efficiency for electron injection into a semiconductor. Knowledge of these processes is of prime importance for optimization of (nanostructured) hybrid photovoltaics.

10:00 a.m.–10:30 a.m. Coffee Break, *Empire Hall, Rochester Riverside Convention Center*

NOTES

FiO

Highland A

10:30 a.m.–11:45 a.m.
FWH • Sensing in Higher Dimensions–Theory and Hardware for Computational Imaging I

Markus Testorf; Dartmouth College, USA, Presider

FWH1 • 10:30 a.m. Invited
Computational Photography in 4-D, 6-D and 8-D, ***Ramesh Raskar****; MIT, USA.* Geometric-dimensions of light-transport can be up to 8-D. They can be sensed, analyzed and synthesized using modern tools. Talk describes novel 4-D cameras, 6-D displays and 8-D probes being developed at the Camera Culture group, MIT Media Lab.

FWH2 • 11:00 a.m.
A Spatial Projection Analysis of Light Field Capture, ***Zhimin Xu****, Edmund Y. Lam; Dept. of Electrical and Electronic Engineering, Univ. of Hong Kong, Hong Kong.* By modeling the light field acquisition as a linear integration process, we derive an accurate projection relationship of the light field capture with plenoptic cameras as an example and demonstrate its generality in computational imaging.

Highland B

10:30 a.m.–12:00 p.m.
FWI • Optical Communication II

Xiang Liu; Alcatel-Lucent, USA, Presider

FWI1 • 10:30 a.m. Invited
Promising Technologies for Capacity Growth in Future Optical Networks, ***René-Jean Essiambre****; Bell Labs, Alcatel-Lucent, USA.* We present an analysis showing possible limitations imposed by fiber Kerr nonlinearity on the quantity of information that optical fibers can carry. We discuss advanced technologies that can be used to approach such limits.

FWI2 • 11:00 a.m.
Tapered Optical Fiber Quadruples Bandwidth of Multimode Silica Fibers Using Same Wavelength, ***Syed H. Murshid****, Abhijit Chakravarty; Florida Inst. of Technology, USA.* Four co-propagating optical channels of same wavelength have been spatially multiplexed and de-multiplexed over a step index multimode silica fiber to quadruple the bandwidth. This presents experimental setup and results for such a system.

Highland C

10:30 a.m.–12:00 p.m.
FWJ • Image-based Wavefront Sensing I

Bruce Dean; NASA Goddard Space Flight Ctr., USA, Presider

FWJ1 • 10:30 a.m. Invited
Measurement-Diverse Wavefront Sensing, ***Richard Paxman****; General Dynamics Corp., USA.* Phase diversity has been shown to be an effective image-based wavefront sensor. We examine other measurement-diverse mechanisms for wavefront sensing, including wavelength diversity, perspective diversity, and diversity in polarimetry.

FWJ2 • 11:00 a.m. Invited
Rays and Waves in Wavefront Sensing, ***James R. Fienup***[1]*, Alden S. Jurling*[1]*, Samuel T. Thurman*[1,2]*;* [1]*Inst. of Optics, Univ. of Rochester, USA,* [2]*Lockheed Martin Coherent Technologies, USA.* Image-based wavefront sensing using ray and wave optics are compared. Marriage of a new ray-based technique with phase retrieval combines speed, robustness, and accuracy.

Highland D

10:30 a.m.–12:00 p.m.
FWK • Fiber Laser

John Ballato; Clemson Univ., USA, Presider

FWK1 • 10:30 a.m. Invited
Fibers for Dispersion Management in fs Fiber Lasers, ***Lars Grüner-Nielsen****, Kim G. Jespersen, Martin E. V. Pedersen, Bera Pálsdóttir; OFS Denmark, Denmark.* All fiber devices with anomalous dispersion based on propagation in a higher order mode are described. Stretcher fibers with dispersion matching compressor gratings for use in chirped pulse amplifiers are also treated.

FWK2 • 11:00 a.m.
A Wavelength Tunable Single-Longitudinal-Mode Er-doped Fiber Laser with High-Birefringence PCF, ***Jooeun Im****, BongKyun Kim, Choi Lyong, Youngjoo Chung; Gwangju Inst. of Science and Technology, Republic of Korea.* We experimentally demonstrate a high-performance, tunable, single-longitudinal-mode Er-doped fiber ring laser with high-birefringence PCF. Stable SLM oscillation with side-mode suppression ratio up to 57 dB is achieved.

Highland E

10:30 a.m.–12:00 p.m.
FWL • Laser Based Particle Acceleration I

Csaba Toth; Lawrence Berkeley Natl. Lab, USA, Presider

FWL1 • 10:30 a.m. Tutorial
Laser Plasma Accelerators: Concepts, Progress and Dreams, ***Wim Leemans****; Lawrence Berkeley Natl. Lab, USA.* The basic principles, progress and future challenges in developing laser plasma accelerators will be discussed. GeV electron beams have been generated from structures that are cm-scale enabling development of compact hyperspectral radiation sources and colliders.

Dr. Leemans is a senior scientist, the Head of the LOASIS Program at LBNL, research physicist at UC Berkeley and an adjunct professor at the University of Nevada, Reno. He obtained an electrical engineering (EE) degree from the "Vrije Universiteit Brussel", Belgium in 1985, and a Ph.D. in EE from UCLA in 1991 and joined LBNL in 1991. His current research interests are in laser plasma based accelerator science and hyperspectral radiation sources. He received several awards, including the '92 American Physical Society Simon Ramo award for outstanding doctoral thesis research work in plasma physics, the 1996 Klaus Halbach Award for X-ray Instrumentation, the 2005 United States Particle Accelerator School Prize for Achievement in Accelerator Physics and Technology, and the 2009 E.O. Lawrence Award. He is an APS and IEEE Fellow. He has been research advisor for many PhD graduate students, including three that have received outstanding dissertation awards.

FiO

Highland F

10:30 a.m.–12:00 p.m.
FWM • Trapping II
Nicole Moore; Univ. of Rochester, USA, Presider

FWM1 • 10:30 a.m. Invited

High-Speed Holographic Tweezers and Imaging, ***Miles Padgett***[1], *Richard Bowman*[1], *Daryl Preece*[1], *Arran Curran*[1], *Graham Gibson*[1], *David Carberry*[2,3], *Mervyn Miles*[2,3]; [1]*Univ. of Glasgow, UK,* [2]*Univ. of Bristol, UK,* [3]*Dept. of Physics, Univ. of Bristol, UK.* Holographic optical tweezers, using the latest spatial light modulators and graphics-cards calculate holograms at 200Hz, fast enough to compensate the Brownian motion. Coupled with high-speed imaging of multiple particles, various new system configurations are possible

FWM2 • 11:00 a.m.

3-D Optical Trapping Inside a Hollow-Core Microstructured Optical Fiber, *Tiffany C. Y. Tang*[1], ***Sergio G. Leon-Saval***[2], *Maryanne C. J. Large*[2], *Alexander Argyros*[2], *Peter J. Reece*[1]; [1]*Univ. of New South Wales, Australia,* [2]*Univ. of Sydney, Australia.* We report the first demonstration of 3-D optical trapping of microparticles inside a hollow-core microstructured polymer optical fiber with an external tweezers beam. We map the trapping properties to determine the influence of the microstructure.

Highland G

10:30 a.m.–12:00 p.m.
FWN • Nonlinearities and Gain in Plasmonics and Metamaterials II
Mikhail Noginov; Norfolk State Univ., USA, Presider

FWN1 • 10:30 a.m.

Broadband Enhancement of Two-Photon Emission from Semiconductors by Plasmonic Nano-Antennas, ***Amir Nevet***, *Nikolai Berkovitch, Alex Hayat, Pavel Ginzburg, Shai Ginzach, Ofir Sorias, Meir Orenstein; Technion, Israel.* We demonstrate experimentally and theoretically a broadband enhancement of the spontaneous two-photon emission from AlGaAs by plasmonic nano-antennas. Plasmonic structures with inherently low quality-factors but very small effective volumes are shown to be optimal.

FWN2 • 10:45 a.m.

Khz-driven High Harmonic Generation From Overdense Plasmas, ***Antonin Borot***[1], *Arnaud Malvache*[1], *Xiaowei Chen*[1,2], *Denis Douillet*[1], *Grégory Iaquaniello*[1,2], *Patrick Audebert*[3], *Jean-Paul Geindre*[4], *Gérard Mouro*[2], *Rodrigo Lopez-Martens*[1]; [1] *ENSTA-ParisTech-Ecole Polytechnique-CNRS,, France,* [2]*Inst. de la Lumière Extrême, CNRS, Ecole Polytechnique, ENSTA ParisTech, Inst. d'Optique, Univ. Paris-Sud, France,* [3]*Lab pour l'Utilisation des Lasers Intenses, Ecole Polytechnique-CNRS, France,* [4]*Myhalong, , Portugal.* We report high-harmonic generation from overdense plasmas driven at 1kHz repetition rate by milliJoule laser pulses at intensities <1018 W/cm2. We observe characteristic coherent wake emission spectra with reproducible CEP-dependent features in the few-cycle regime.

FWN3 • 11:00 a.m.

Better Than Gold: Plasmonic Materials for Telecom Wavelengths, ***M. A. Noginov***[1], *Lei Gu*[1], *J. E. Livenere*[1], *G. Zhu*[1], *A. K. Pradhan*[1], *R. Mundle*[1], *M. Bahoura*[1], *Yu. A. Barnakov*[1], *V. A. Podolskiy*[2]; [1]*Norfolk State Univ., USA,* [2]*Univ. of Massachusetts Lowell, USA.* Surface plasmon polaritons (SPPs) at telecom wavelengths have much better confinement in degenerate wide-gap semiconductors than in silver or gold. For the same confinement, the SPP loss in semiconductors is lower than that in gold.

LS

Highland H

10:30 a.m.–12:15 p.m.
LWD • Hybrid Quantum Systems II
Jack Harris; Yale Univ., USA, Presider

LWD1 • 10:30 a.m. Invited

Quantum Measurement of Phonon Shot Noise Using Optomechanical Systems, ***Aashish Clerk***; *McGill Univ., Canada.* I will discuss theoretical work describing how optomechanical systems can be used to measure quantum energy fluctuations of a driven mechanical resonator, and how the higher moments of such fluctuations possess unusual properties.

LWD2 • 11:00 a.m. Invited

Nonlinear Optomechanical Couplings: Tools for Dealing with Solid Mechanical Objects in the Quantum Regime, ***Jack Sankey***, *Cheng Yang, Benjamin M. Zwickl, Andrew M. Jayich, Jack G. E. Harris; Yale Univ., USA.* We demonstrate several different forms of the optomechanical coupling (linear, quadratic, and quartic) realized at avoided crossings in the spectrum of an optical cavity containing a flexible dielectric membrane. Each coupling is tunable *in situ.*

Highland J

10:30 a.m.–12:00 p.m.
LWE • Quantum Enhanced Information Processing I
Mark Saffman; Univ. of Wisconsin at Madison, USA, Presider

LWE1 • 10:30 a.m. Invited

Entanglement and Quantum Algorithms with Superconducting Circuits, ***Robert J. Schoelkopf***; *Yale Univ., USA.* I will describe experiments in which superconducting quantum bits are entangled, including violation of classical bounds for two (CHSH) and three (Mermin) qubit inequalities, and the demonstration of quantum algorithms with an electronic, solid-state system.

LWE2 • 11:00 a.m. Invited

Benchmarking Quantum Information Processing Devices, ***Raymond Laflamme***; *Univ. of Waterloo, Canada.* I will describe benchmarking of quantum information processors in the light of quantum error correction and the accuracy threshold theorem which says that if noise sufficently low it is still possible to quantum compute efficiently.

Highland K

10:30 a.m.–12:00 p.m.
LWF • Single Molecule Approaches to Biology I
Haw Yang; Univ. of California at Berkeley, USA, Presider

LWF1 • 10:30 a.m. Invited

Optical Chirality and Superchiral Fields, ***Adam E. Cohen***, *Yiqiao Tang; Harvard Univ., USA.* We introduce a measure of the chirality of the electromagnetic field. There exist simple solutions to Maxwell's Equations with much greater chirality than that of circularly polarized light.

LWF2 • 11:00 a.m. Invited

Local Dynamics Probing by Real-Time Single-Particle Tracking Spectroscopy, ***Li Sun***; *Princeton Univ., USA.* Abstract not available.

FiO

Highland A

FWH • Sensing in Higher Dimensions–Theory and Hardware for Computational Imaging I—Continued

FWH3 • 11:15 a.m.
Is Super-Resolution from a Single Image Possible? ***Adrian Stern****, Yair Rivenson, Gil Paz, Oleg Avremko; Ben-Gurion Univ. of the Negev, Israel.* We discuss the meaning of super resolution from single image. We distinguish between two approaches: 1) image reconstruction that infers high resolution details, 2) imaging process that indirectly captures information about the fine details.

FWH4 • 11:30 a.m.
Image Refocus in Geometrical Optical Phase Space, ***Aaron C. W. Chan****, Edmund Y. Lam; Univ. of Hong Kong, Hong Kong.* We introduce matrix optics and phase space methods as general modeling methods to analyze problems involving 4-D light field imaging systems. Specifically we demonstrate the use of these methods for analyzing the image refocus process.

Highland B

FWI • Optical Communication II—Continued

FWI3 • 11:15 a.m. Invited
Next Generation 400 Gb/s Transmission, ***Ivan Djordjevic****, Hussam G. Batshon; Univ. of Arizona, USA.* Different strategies for enabling beyond 400 Gb/s serial optical transport will be described in this invited paper: (i) single-carrier multidimensional coded-modulation, (ii) optimum signal constellations based optical transmission, and (iii) multi-band coded-OFDM.

FWI4 • 11:45 a.m.
Spatial Diversity Measurements In A Multiple-Transmitter Terrestrial FSO Link, ***Jaime A. Anguita****, Jaime E. Cisternas; Univ. of the Andes, Chile.* We experimentally analyze the performance of a laser communication link using spatial diversity. For various system settings we quantify the cross-correlation between received signals and establish key elements in the design of efficient multiple-transmitter links.

Highland C

FWJ • Image-based Wavefront Sensing I—Continued

FWJ3 • 11:30 a.m.
Determination of the Sampling Factor in a Phase-Diverse Phase Retrieval Algorithm, ***Thomas P. Zielinski***[1]*, Bruce H. Dean*[1]*, Jeffrey S. Smith*[1]*, David L. Aronstein*[1]*, James R. Fienup*[2]*;* [1]*NASA Goddard Space Flight Ctr., USA,* [2]*Inst. of Optics, Univ. of Rochester, USA.* The sampling factor (Q) determines the scale relationship between the pupil and image plane. Knowledge of this quantity is essential for obtaining accurate retrieval results. We present a method for determining Q from image data.

FWJ4 • 11:45 a.m.
An Analytic Expression for the Field Dependence of Zernike Coefficients in Optical Systems without Symmetry, ***Kevin P. Thompson***[1]*, Jannick P. Rolland*[2]*;* [1]*Optical Res. Associates, USA,* [2]*Inst. of Optics, Univ. of Rochester, USA.* We present an analytic form for the field dependence of terms in the FRINGE Zernike polynomial expansion for optical systems that are not rotationally symmetric, but, contain optical surfaces are that are rotationally symmetric.

Highland D

FWK • Fiber Laser—Continued

FWK3 • 11:15 a.m.
Direct Measurement of Bend-Induced Mode Deformation Using a Helical-core Fiber, ***Richard C. Smith***[1]*, John R. Marciante*[1]*, Andrew M. Sarangan*[2]*;* [1]*Lab for Laser Energetics, Inst. of Optics, Univ. of Rochester, USA,* [2]*Electro-Optics Program, Univ. of Dayton, USA.* The Marcuse equivalent index model that is used to predict mode deformation in bent fibers is directly verified for the first time. The rms difference between model and measurement is 3.4%.

FWK4 • 11:30 a.m.
Power Extraction Efficiency in High-Order Mode Fiber Lasers, ***Richard S. Quimby***[1]*, Roman Shubochkin*[2]*, Theodore F. Morse*[2]*;* [1]*Worcester Polytechnic Inst., USA,* [2]*Boston Univ., USA.* Numerical simulations are used to study the effect of mode intensity nulls on power extraction efficiency in Yb and Er HOM fiber lasers. The efficiency approaches the quantum defect limit at kW power levels.

FWK5 • 11:45 a.m.
The Stability of the Active Mode-Locked Erbium-Doped Fiber Laser and Its Application in a Novel Electro-Optic Sampling System, ***Limin Ji***[1]*, William Donaldson*[2,1]*, Thomas Hsiang*[1]*;* [1]*Univ. of Rochester, USA,* [2]*Lab for Laser Energetics, USA.* The relationship of high-harmonic modulation and the pulse width is observed during the process of stabilizing an active mode-locked erbium-doped fiber laser. A novel electro-optic sampling system is proposed with actively mode-locked fiber lasers.

Highland E

FWL • Laser Based Particle Acceleration I—Continued

FWL2 • 11:15 a.m. Invited
Acceleration of Electrons by A Laser Wakefield Accelerator (LWFA) Operating in the Self-Guided Regime, ***Chan Joshi***[1]*, C. Clayton*[1]*, D. Froula*[2]*, K. Marsh*[1]*, A. Pak*[1]*, J. Ralph*[1,2]*;* [1]*Univ. of California at Los Angeles, USA,* [2]*Lawrence Livermore Natl. Lab, USA.* The so-called “self-guided” regime of laser wakefield acceleration has been experimentally explored. It is shown that short but intense laser-pulses can be self-guided by the wake-over tens of Rayleigh length by creating a bubble-like wakefield-structure.

FWL3 • 11:45 a.m.
Electron Injection into Plasma Waves at Sharp Density Transitions, ***Karl Schmid***[1]*, Alexander Buck*[1]*, Christian M. S. Sears*[1]*, Julia Mikhailova*[1]*, Raphael Tautz*[1,2]*, Daniel Herrmann*[1,2]*, Michael Geissler*[3]*, Ferenc Krausz*[1,2]*, Laszlo Veisz*[1]*;* [1]*Max-Planck-Inst. of Quantum Optics, Germany,* [2]*Ludwig-Maximilians-Univ. München, Germany,* [3]*Queen's Univ. Belfast, UK.* We present a novel method of controlled electron injection from the background plasma into a laser driven plasma wave using a μm-scale density transition. Substantial quality improvements on the monoenergetic electron beam are demonstrated.

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

12:00 p.m.–1:30 p.m. Exhibit Only Time, *Empire Hall, Rochester Riverside Convention Center*

FiO

Highland F

FWM • Trapping II—Continued

FWM3 • 11:15 a.m.
The Generation of Bessel Beam Based on all-Fiber Device and Its Optical Trapping of Dielectric Particles, ***Sung Rae Lee***[1], *Jongki Kim*[1], *Jun Ki Kim*[2], *Kyunghwan Oh*[1]; [1]*Yonsei Univ., Korea, Republic of,* [2]*Wellman Ctr. for Photomedicine, Harvard Medical School, Massachusetts General Hospital, USA.* The generated Bessel beam from all-fiber structure composed of single mode fiber, coreless silica fiber, and micro-lens formed on the fiber facet showed a good performance for optical trapping confirming its non-diffracting and self-reconstructing nature.

FWM4 • 11:30 a.m. Invited
Applications of Spatial Light Modulators for Optical Trapping and Imaging, ***Monika Ritsch-Marte****; Innsbruck Medical Univ., Austria.* We present applications of spatial light modulators for optical trapping with low (¡0.2) NA and large field of view, creation of freely designable force fields, and for contrast enhancement methods in optical microscopy.

Highland G

FWN • Nonlinearities and Gain in Plasmonics and Metamaterials II—Continued

FWN4 • 11:15 a.m.
Superconducting Plasmonics and Extraordinary Transmission, *Anagnostis Tsiatmas*[1], *Roger Buckingham*[1], *Vassili Fedotov*[1], *Shaowei Wang*[2], *Yifang Chen*[3], *P.A.J. de Groot*[4], ***Nikolay Zheludev***[1]; [1]*Optoelectronics Res. Ctr., Univ. of Southampton, UK,* [2]*Shangai Inst. of Technical Physics, Chinese Acad. of Sciences, China,* [3]*Rutherford Appleton Lab, UK,* [4]*School of Physics and Astronomy, Univ. of Southampton, UK.* Negative dielectric constant and dominant kinetic resistance make superconductors intriguing plasmonic media. Here we report on the effect of extraordinary transmission through an array of sub-wavelength holes in a perforated film of high-temperature YBCO superconductor.

FWN5 • 11:30 a.m.
Third Harmonic Generation Using Surface Plasmon Polaritons at Nonlinear Interfaces, ***Yan Guo****, Miriam Deutsch; Univ. of Oregon, USA.* We show that a third harmonic electromagnetic wave is generated by surface plasmons propagating at a nonlinear metal-dielectric interface. The angular- and intensity dependence of the generated wave are calculated and analyzed.

FWN6 • 11:45 a.m.
Field Enhancement By Efficient Nano-coupling To Plasmonic Conical Needle, ***Pavel Ginzburg***[1], *Nikolai Berkovitch*[1], *Alexander Normatov*[1], *Gilad M. Lerman*[2], *Avner Yanai*[2], *Uriel Levy*[2], *Meir Orenstein*[1]; [1]*Technion, Israel,* [2]*Hebrew Univ., Israel.* Local power concentration of efficiently coupled radially-polarized light in conical plasmonic needle is presented. Radial plasmonic DBR with needle as defect was fabricated for NSOM and nonlinear conversion experiments. Needle length dependent resonances are calculated.

LS

Highland H

LWD • Hybrid Quantum Systems II—Continued

LWD3 • 11:30 a.m. Invited
Measuring the Quantum Harmonic Oscillator, ***Andrew Cleland****; Univ. of California at Santa Barbara, USA.* By coupling a superconducting quantum bit to microwave electromagnetic and mechanical resonators, we can demonstrably achieve the resonators' quantum ground states, and create photon and phonon Fock states, and arbitrary superpositions of photon Fock states.

LWD4 • 12:00 p.m.
Spectrum Measurement Of The Cavity-QED Microlaser: Deviation From The Schawlow-Townes Linewidth, ***Hyun-Gue Hong***[1], *Wontaek Seo*[1], *Moonjoo Lee*[1], *Younghoon Song*[1], *Wonshik Choi*[2], *Christopher Fang-Yen*[2], *Ramachandra Dasari*[2], *Michael Feld*[2], *Jai-Hyung Lee*[1], *Kyungwon An*[1]; [1]*Seoul Natl. Univ., Korea, Republic of,* [2]*G. R. Harrison Spectroscopy Lab, MIT, USA.* We report the measurement of the cavity-QED microlaser linewidth near threshold by using the photon-counting-based second-order correlation spectroscopy. The abrupt rise-and-fall of the linewidth near thereshold is observed.

Highland J

LWE • Quantum Enhanced Information Processing I—Continued

LWE3 • 11:30 a.m. Invited
Coherent Splitting, Rocking and Blinding of Single Atoms in an Optical Lattice, ***Dieter Meschede****; Univ. of Bonn, Germany.* We show that a single trapped Caesium atom trapped can coherently be split and recombined, An efficient sideband cooling method will be described and a method to control the refractive index of a single atom.

LWE4 • 11:00 a.m. Invited
Integrated Quantum Photonics, *D. Bonneau, P. Kalasuwan, A. Laing, T. Lawson, Jcf Matthews, A. Peruzzo, K. Poulios, P. Shadbolt, JP Hadden, JP Harrison, A. C. Stanley-Clark, L. Marseglia, Y- Ld Ho, B. R. Patton, J. G. Rarity, P. Jiang, M. Halder, M. Lobino, A. L. Politi, M. Rodas Verde, X-q Zhou, Mg Thompson,* ***Jeremy L. O'Brien****; Univ. of Bristol, United Kingdom.* We describe recent developments in integrated quantum photonics, including waveguide circuits to implement quantum logic operations, quantum metrology and quantum walks.

Highland K

LWF • Single Molecule Approaches to Biology I—Continued

LWF3 • 11:30 a.m. Invited
Exploring Chromatin Biochemistry with Single-Molecule Fluorescence Diffusometry, *Charles B. M. Limouse, Colin J. Fuller, Aaron F. Straight,* ***Hideo Mabuchi****; Stanford Univ., USA.* We utilize real-time feedback to track individual dye-labeled chromatin fibers undergoing Brownian motion in aqueous buffer, enabling simultaneous recording of fluorescence and hydrodynamic data, providing new insight into conformational dynamics and self-association of nucleosome arrays.

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

12:00 p.m.–1:30 p.m. Exhibit Only Time, *Empire Hall, Rochester Riverside Convention Center*

Empire Hall, Rochester Riverside Convention Center

JOINT FiO/LS

12:00 p.m.–1:30 p.m.
JWA • FiO Poster Session II

JWA01

Singular Optics and Structurally Stable Beam, ***Rahul Mandal***, *Ajay Ghosh; Univ. of Calcutta, India.* A structurally stable beam has been generated containing numerous singularities in various positions. The singularities have been produced in a predetermined manner by modifying the azimuthal coordinate term of the circular cylindrical coordinate.

JWA02

Volume Phase Plates for Optical Beam Control, ***Marc SeGall***, *Vasile Rotar, Julien Lumeau, Leonid Glebov; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Permanent binary phase plates with high tolerance to laser radiation are recorded in the volume of photo-thermo-refractive glass using binary amplitude masks. Conversion of a Gaussian beam to higher order modes is shown.

JWA03

Optical Manipulation with Counter Propagating Helical Beams, ***Lisa Dixon***, *David Grier; New York Univ., USA.* We present a novel method for using multiple beams to exert optical forces using holographically generated phase masks. Here we use counter propagating helical modes with opposite charge to manipulate mesoscopic particles.

JWA04

Rapid Projector Display Based Characterization of Large Reflectors, *Deepthi Chakilam*[1], ***Duncan MacFarlane***[1], *Cristian Penciu*[2], *Victor Penciu*[2]; *[1]Univ. of Texas at Dallas, USA, [2]Pulsar Energy, USA.* A projector display is used to provide rapid feedback on the focusing performance and the curvature of large mirrors for use as solar collectors.

JWA05

Nonscanning Method for Measuring Gaussian Laser Beam Diameters Using Photodiode Array, ***Abdallah Cherri***; *Kuwait Univ., Kuwait.* A novel method that eliminates mechanical translation of knife edges and/or precise alignment of gratings is proposed to measure Gaussian laser beam diameters. The proposed technique facilitates integrating photodiode arrays with laser beam tracking in instruments.

JWA06

Computer-Generated Volume Holograms in the THz, ***Wei-Ren Ng***, *Andrew Pyzdek, Ziran Wu, Hao Xin, Michael E. Gehm; Univ. of Arizona, USA.* Recent advances in rapid prototyping provide the promise of direct, rapid fabrication of volumetric optical components in the terahertz. We are investigating use of this new technology for fabrication of a Bragg-selective computer-generated volume hologram.

JWA07

Simple Technique for Experimental Synthesis and Characterization of Partially Coherent and Partially Polarized Source, ***Miguel A. Olvera-Santamaría***, *Esteban Juárez-Velez, Andrey S. Ostrovsky; Autonomous Univ. of Puebla, Mexico.* Two coupled Mach-Zehnder interferometers are used for the experimental synthesis and characterization of a partially coherent and partially polarized source. We show that the results of the experiments are in good agreement with theoretical predictions.

JWA08

Laser-Induced Magnetization Precession in Thin Films of Fe/MgO and Py/Si, ***Douglas L. P. Lacerda***, *Carlos A. C. Bosco, A. Azevedo, Lúcio H. Acioli; Univ. Federal de Pernambuco, Brazil.* We study the role of the anisotropy field in the laser-induced magnetization dynamics on thin films of Fe/MgO and Py/Si. We also characterize the local anisotropy and the Gilbert damping constant.

JWA09

Widely Tunable, Narrow Linewidth, Ytterbium Fiber Laser, ***Keith G. Petrillo***, *Jin U. Kang; Johns Hopkins Univ., USA.* An ytterbium fiber ring laser was demonstrated by utilizing a Fabry-Perot filter and a sagnac loop in the fiber ring with a linewidth of less than 2MHz and a tuning range spanning 50nm.

JWA10

Polarization-Dependent Two-Photon Absorption of π-Conjugated Molecules, ***Marcelo G. Vivas***, *Leonardo De Boni, Cleber R. Mendonca; Inst. de Física de São Carlos, Univ. de São Paulo, Brazil.* In this report, we present a broadband analysis of the circular linear dichroism (CLD) effect on two-photon absorption (2PA) cross-section of organic molecules employing an extension white-light continuum Z-scan technique (WLC).

JWA11

Stable Optical Lift, *Timothy J. Peterson*, ***Alexandra Artusio-Glimpse***, *Grover A. Swartzlander; Rochester Inst. of Technology, USA.* When placed in a uniform stream of light, an airfoil shaped refractive object may experience a transverse lift force having a large lift angle with respect to the forward scattering force.

JWA12

Measurement of the Optical Properties of Nanorose, ***Tianyi Wang***[1], *Li L. Ma*[1], *Jinze Qiu*[1], *Xiankai Li*[2], *Keith P. Johnston*[1], *Marc D. Feldman*[2], *Thomas E. Milner*[1]; *[1]Univ. of Texas at Austin, USA, [2]Univ. of Texas Health Science Ctr. at San Antonio, USA.* Nanorose is used to target macrophages in atherosclerotic plaques. Experimental measurement and simulation of nanorose absorption (σ_a) and scattering (σ_s) cross-sections give, respectively, $\sigma_a = (3.1\pm0.5)\times10^{-14}$ m^2 and $\sigma_a/\sigma_s = 10.5$.

JWA13

Optical Sensing of Bacteria by Means of Light Diffraction, ***Igor Buzalewicz***, *Halina Podbielska; Inst. of Biomedical Engineering and Instrumentation, Wroclaw Univ. of Technology, Poland.* The novel sensor based on Fourier transform optical system with converging spherical wave illumination is proposed for bacteria species characterization. Examination of the individual bacteria colony diffraction pattern can be used to distinguish bacteria species.

JWA14

Manipulating IR Surface Plasmon Polaritons on Graphene, ***Ashkan Vakil***, *Nader Engheta; Univ. of Pennsylvania, USA.* Exploiting the dependence of graphene conductivity on the electric bias field, we theoretically investigate the manipulation, routing, waveguiding and scattering of surface-plasmon polaritons along graphene at IR wavelengths, proposing a “flatland” paradigm for optical metamaterials.

JWA15

A Near-IR Frequency Comb for Astronomical Calibration, *Giulia Schettino*[1,2], ***Pablo Cancio Pastor***[3,4], *Carlo Baffa*[2], *Elisabetta Giani*[2], *Massimo Inguscio*[1,4], *Ernesto Oliva*[2], *Andrea Tozzi*[2]; *[1]Dept. di Fisica e Astronomia, Univ. di Firenze, Italy, [2]INAF-Osservatorio Astrofisico di Arcetri, Italy, [3]Inst. Nazionale di Ottica-CNR, Italy, [4]LENS, Italy.* We present here the planned setup for the wavelenght calibrator of the IR astronomical spectrograph GIANO. We describe the required performances of the optimal calibrator source and how we will realize them using a laser-comb.

JWA16

A Simple Calibration Method for Liquid Crystal Pulse Shaper, ***Jonathas de Paula Siqueira***, *Paulo Henrique Dias Ferreira, Sérgio Carlos Zílio, Cleber Renato Mendonça, Lino Misoguti; Univ. de São Paulo, Brazil.* We present a simple method to calibrate spatial light modulator (SLM) employed for pulse shaper. Such method is based on light scattering induced by abrupt index refraction change instead of traditional interferometric methods.

JWA17

Backscattering Technology of Cerebral Oxygenation Measurements, ***Yuri A. Chivel***; *Inst. of Applied Physical Problems, Belarus.* A technology of cerebral oxygenation measurements based on time resolved registration of backscattered radiation of probing picosecond laser pulse are developed.

JWA18

Far-Field Analysis of Spectral Shifts in Stochastic Beams Propagating through Media with Arbitrary Refractive Properties, ***Zhisong Tong***, *Olga Korotkova; Univ. of Miami, USA.* We will demonstrate the far-field spectral shift in the paraxial region does not depend either on the degree of coherence of the source or on its spatial extent, or on the refractive index.

JWA19

Characterization of Phonons in Molecular Crystals, ***Rohit Singh***, *Deepu George, A. G. Markelz; Dept. of Physics, SUNY Buffalo, USA.* We demonstrate a new technique for characterizing the phonons in molecular crystals, Modulated Orientation Sensitive Terahertz Spectroscopy (MOSTS). The technique suppresses crystal defects and solvent contributions, and enhances contributions due to molecular structure and anisotropy.

JWA20

Design and Fabrication for Diffractive Optics in Multi Force Optical Tweezers, ***Samuel I En Lin***, *Hung Wen Hsu, S. L. Chang; Natl. Formosa Univ., Taiwan.* The laser beam passes through a diffractive device to form a multi Gaussian laser spots with 100μm of separation. Demonstration on the cell trap and optical element design are included in this work.

JWA21

Ultra-sensitive Acclerometry Using Anomalous Dispersion in a Sagnac Laser, *Joshua Yablon, Honam Yum*, ***Selim M. Shahriar***; *Northwestern Univ., USA.* We show that a zero-area Sagnac ring laser, configured in an L-shape, can perform as an ultrasensitive accelerometer when operated in the so-called superluminal regime by inducing anomalous dispersion with a dipin the gain profile

JWA22

Simulation Algorithm of Near-Middle Distance in Target and Jamming Infrared Simulator, ***Chong Huang***, *Haiqing Chen, Binbing Liu, Shuang Zhao; Wuhan Natl. Lab for Optoelectronics, College of Optoelectronic Science and Engineering, Huazhong Univ. of Science and Technology, China.* Infrared simulation algorithm of near-middle distance and motion state of target and jamming relative to the field diaphragm aperture is demonstrated. Meanwhile, the simulation algorithm of jamming dropping controlled by a scanning mirror is presented.

JWA23

Classification Of Motion Blurred Images By Means A Discriminative Feature Selection Method Based On Circular Moments, ***Carina Toxqui-Quitl***, *Alfonso Padilla-Vivanco; Univ. Politecnica de Tulancingo, Mexico.* Circular moments along with a discriminative feature selection method are considered for the invariant classification of motion blurred images. With a minimum resolution in the image, only one descriptor is available to discriminate between shapes.

JWA24

Gray Scale E-Beam Lithography to Fabricate 3-D Micro-Sized Waveguide and Grating Coupler in SU-8, *Lin Dong*[1], ***Srinivasan Iyer***[1], *Sergei Popov*[1], *Ari T. Friberg*[1,2,3]; *[1]Royal Inst. of Technology, Sweden, [2]Aalto Univ., Finland, [3]Univ. of Joensuu, Finland.* Gray scale electron beam lithography is applied to prototype 3-D waveguides and grating output couplers in SU-8 with simple and accurate method. The lag effect in reactive ion etching of Silicon-on-insulator gratings is avoided here.

JWA25

Tight Focusing of Polarized Ulrashort Light Pulses, ***Jixiong Pu***, *Limin Hua, Baosuan Chen, Ziyang Chen; Huaqiao Univ., China.* We investigate the tight focusing of polarized ultrashort light pulses. It is found that near the focus the slow light and fast light phenomena occur, depending on the numerical aperture of the focusing objective system.

JWA • FiO Poster Session II—Continued

JWA26

Detection of Subsurface Objects and Coherence Analysis, *Markus Testorf*; *Dartmouth College, USA.* The cross-Wigner distribution function is introduced as a measure for the mutual coherence of electromagnetic signals. The averaged cross-Wigner distribution function is applied to the detection of subsurface objects with radar.

JWA27

Optodigital Protocol To Avoid An External Reference Beam In A Jtc Encrypting Processor, *Carlos A. Rios*[1], *Edgar Rueda[1], John F. Barrera[1], Rodrigo Henao[1], Roberto Torroba[2,3]; [1]Grupo de Óptica y Fotónica, Inst. de Física, Univ. de Antioquia, Colombia, [2]Ctr. de Investigaciones Ópticas (CONICET-CIC), Argentina, [3]UID OPTIMO, Facultad de Ingeniería, Univ. Nacional de la Plata, Argentina.* We use a JTC optodigital approach, but avoiding an external reference beam to record the encoded information. We only encode a master key in a Mach-Zehnder arrangement, leading to a corresponding simpler encrypting procedure.

JWA28

Microscope Multifocus Image Fusion based on a Zernike Moment Algorithm, *Alfonso Padilla-Vivanco*, *Carina Toxqui-Quitl; Univ. Politecnica de Tulancingo, Mexico.* A novel technique of microscope multifocus image fusion using Zernike moments is presented. The test images are obtained by both the bright field and DIC techniques. Numerical and experimental results are presented.

JWA29

Discrete Solitons in Novel Two Dimensional Waveguide Arrays, *Angel Vergara Betancourt*, *Erwin A. Martí Panameño, Gregorio Mendoza González, Luz del Carmen Gomez Pavón; Benemerita Univ. Autonoma de Puebla, Mexico.*Based on the numerical experiment techniques we demonstrate the existence of bi-dimensional discrete solitons in novel waveguide arrays, for which the required generation energies lower than in the honeycomb array.

JWA30

Active and Passive Photonics Devices Produced by Direct Writing with Femtosecond Laser Pulses in Novel Transparent Materials, *Thiago B. N. Lemos*[1], *Davinson M. Silva[2], Luciana R. P. Kassab[3], Anderson S. L. Gomes[1]; [1]UFPE, Brazil, [2]Dept. of Electronic Systems Engineering, Brazil, [3]Faculty of Technology of São Paulo (FATEC-SP), Brazil.* Active and passive waveguides fabricated in tellurite and GeO2-PbO-Ga2O3 (GPG) glasses using direct femtosecond laser (at 800 nm, 1 kHz, 130 fs) writing is demonstrated. Internal gain of 2.7dB/cm is obtained at 1535 nm.

JWA31

SPR Based Fiber Optic Sensor for Gas Sensing in Visible Range Using Nanocomposites Thin Film, *Sarika Singh*, *Banshi D. Gupta; Indian Inst. of Technology Delhi, India.* Surface plasmon resonance based nanocomposite coated fiber optic sensor for gas sensing is analyzed. Performance of the sensor is evaluated for different nanocomposite films. The sensor operates in the visible region of the spectrum.

JWA32

Spatial Combination of Optical Channels in a Multimode Waveguide, *Syed H. Murshid*, *Jamil Iqbal; Florida Inst. of Technology, USA.* Spatial domain multiplexing allows co-propagation of multiple channels of same wavelength over a single strand of optical fiber. Spatial multiplexer in multimode waveguides is presented and contrasted with spatial multiplexers in the branching waveguides.

JWA33

Coherence-Converting Plasmonic Hole Arrays, *Greg Gbur*[1], *Yalong Gu[1], Choon How Gan[2], Taco D. Visser[3]; [1]Univ. of North Carolina at Charlotte, USA, [2]Lab Charles Fabry de l'Inst. d'Optique, Univ. Paris-Sud, France, [3]Delft Univ. of Technology and Free Univ. Amsterdam, Netherlands.* Simulations are presented that demonstrate that the global state of coherence of a wavefield can be altered on transmission through a hole array in a metal plate that supports surface plasmons.

JWA34

Transmission Characteristics of Silver Nano-Apertures, *Lei Zhu*, *Sarath Samudrala, Mutiah Annamalai, Nikolai M. Stelmakh, Michael Vasilyev; UTA, USA.* The polarization-dependent transmission spectra of silver nanoapertures are investigated. A strong transmission loss in the region of plasmonic resonance and a suppression of cut-off attenuation in the donut aperture are observed.

JWA35

FDTD Simulation of Photonic Crystal Vertical-Cavity Surface-Emitting Lasers, *Gregory R. Kilby*, *Lisa Shay; United States Military Acad., USA.* Photonic crystal vertical-cavity surface-emitting lasers have potential applications in optical interconnects, extended area coherent sources, and steerable beams. Full three-dimensional FDTD simulations are used to understand the effects of fabrication variances in these devices.

JWA36

Intrinsic Fiber Optic Pressure Sensor Based on Multimode Interference Device as Sensitive Element, *Victor I. Ruiz-Perez*[1], *Miguel A. Basurto-Pensado[2], Daniel May-Arrioja[3], Jose J. Sánchez-Mondragón[1], Patrick LiKamWa[4]; [1]Inst. Nacional de Astrofísica,, Mexico, [2]Univ. Autónoma del Estado de Morelos, Mexico, [3]Univ. Autónoma de Tamaulipas, Mexico, [4]CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA.* Experimental results of applications in a novel intrinsic Fiber-Optic Pressure-Sensor based on a Multimode Interference are presented. The sensitive element consists in a single-mode - multimode - single-mode fiber structure embedded in a membrane pressure.

JWA37

Fiber Bragg Grating Strain Sensor Array Based on Multi-Wavelength Tunable Fiber Laser, *Satoshi Tanaka*, *Atsushi Wada, Nobuaki Takahashi; Natl. Defense Acad., Japan.* A fiber-optic strain sensor array using a multi-wavelength laser is proposed, in which FBGs are used as wavelength selection components. In the experiment, simultaneous multi-point strain measurements are demonstrated with higher resolution and S/N ratio.

JWA38

Index Contrast Measurement Using Scanning Optical Frequency Domain Reflectometry, *Eric D. Moore*, *Robert R. McLeod; Univ. of Colorado, USA.* We demonstrate direct measurements of local refractive index contrast using a scanning optical frequency domain reflectometer. Measurement results for step index fiber, gradient index fiber, and a volume holographic grating are presented.

JWA39

Transmission OoThree Co-propagating Channels of Same Wavelength in Step Index Multimode Fibers for Lan Applications, *Syed H. Murshid*, *Abhijit Chakravarty; Florida Inst. of Technology, USA.* Spatial domain multiplexing (SDM) allows co-propagation of multiple spatially separated channels over a single strand of step index multimode fiber. Three such SDM channels for LAN applications are reported.

JWA40

On Absorption Properties of GaAs/AlGaAs Nanowire Arrays, *Zongquan Gu*[1], *Bahram Nabet[1], Paola Prete[2], Fabio Marzo[3], Ilio Miccoli[4], Nico Lovergine[4]; [1]Drexel Univ., USA, [2]IMM-CNR, Italy, [3]Dept. of innovation Engineering, Italy, [4]Univ. of Salento, Italy.* Arrays of well-aligned GaAs/AlGaAs core-shell nanowires have strong potential for photovoltaic applications. We analyze simulated reflection, transmission and absorption spectra of periodic arrays of these nanostructures, showing high absorption that compares favorably with experimental data.

JWA41

Colorimetric and SERS Detection of Explosives using Plasmonic-Photonic Coupled Arrays, *Alyssa J. Pasquale*, *Linglu Yang, Bo Yan, Bjoern Reinhard, Luca Dal Negro; Boston Univ., USA.* Detection of 2,4-Dinitrotoluene in part-per-billion sensitivity is demonstrated utilizing plasmonic-photonic scattering in gold nano-particle arrays with different lattice constants. We show that plasmonic-photonic resonances of nanoparticle arrays can be utilized in SERS sensing of DNT.

JWA42

Development of a System to Detect Ethanol Vapor Using a CCD Camera in an Interferometer, *Carlos Martinez-Hipatl*, *Severino Muñoz-Aguirre, Juan Castillo-Mixcoatl, Georgina Beltran-Perez; Benemerita Univ. Autonoma de Puebla, Mexico.* The response of a polydimethylsiloxane sensor was measured using an interferometer and a CCD camera. The advantage is to have a great amount of sensors. From ethanol responses was found that the system works appropriately.

JWA43

Generation of a Narrowband Biphoton in a Two-Level System with an Intermediate Metastable State, *Anton V. Sharypov*, *Arlene D. Wilson-Gordon; Bar-Ilan university, Israel.* We show that, due to four-wave mixing, narrowband biphotons with a controllable waveform can be produced in a pumped two-level system that decays via an intermediate metastable state.

JWA44

Speckle Statistics of Localized Waves in Random Media, *Abe Pena*[1], *Andrey Chabanov[1], Azriel Genack[2]; [1]Univ. of Texas at San Antonio, USA, [2]Queens College of CUNY, USA.* We discuss remarkably simple statistics of speckle patterns of localized waves. The speckles brightness and structure are associated, respectively, with coupling into and out of the sample, while the speckle statistics reveals the conductance distribution.

JWA45

Creation of Entanglement of Two Atoms Coupled to Two Distant Cavities with Losses, *Victor A. Montenegro*, *Miguel A. Orszag; Pontificia Univ. Catolica de Chile, Chile.* We consider two microwave cavities connected with an optical fiber, we find that for different coupling constants and atom-cavity detuning a wide plateau in time is generated in the concurrence.

JWA46

Au Nanoparticle-Assisted Random Lasing from GaN Powder, *Toshihiro Nakamura*, *Tomohiro Hosaka, Sadao Adachi; Gunma Univ., Japan.* We demonstrate random lasing from powdered GaN assisted by Au nanoparticles. GaN band edge emission is enhanced by depositing Au. The enhancement is caused by surface plasmon. We find lasing lines appear in this sample.

JWA47

Fano Resonances and Electromagnetically Induced Absorption and Transparency-like Effects in Single Silica Microspheres, *Sile Nic Chormaic*[1,2], *Yuqiang Wu[2,1], Jonathan Ward[2], Amy Watkins[2,1]; [1]Univ. College Cork, Ireland, [2]Tyndall Natl. Inst., Ireland.* Fano resonances and electromagnetically induced absorption and transparency-like effects have been observed in a microsphere coupled with a tapered fiber. Applications lie in enhancing the sensitivity of biosensors and controlling the group velocity of light.

JWA48

Bases for Focused Waves in Two Dimensions, *Krista Lombardo*[1], *Miguel A. Alonso[2,3]; [1]Dept. of Physics and Astronomy, Univ. of Rochester, USA, [2]Inst. of Optics, Univ. of Rochester, USA, [3]Dept. of Applied Physics, Aalto Univ., Finland.* We present a new family of closed-form solutions to the two-dimensional Helmholtz equation, which form a complete basis and are nonparaxial analogs of the Hermite-Gauss beams. Their scattering off circular obstacles is also discussed.

JWA • FiO Poster Session II—Continued

JWA49
Image-Plane Reflection-Type Alcove Multiplex Hologram, *Yih-Shyang Cheng*, *Zen-Yuan Lei, Chih-Hung Chen; Dept. of Optics and Photonics, Natl. Central Univ., Taiwan.* A three-step holographic process, which enables the incorporation of the image-plane technique in the fabrication of the reflection alcove multiplex hologram, is described. Experimental result demonstrating the feasibility of this method is presented.

JWA50
Characterization of a Low Voltage Micro-Electron-Column for Scan Field Size and Visibility of Current Image, *Won K. Jang*[1], *Jun Ho Park[1], Ho Seob Kim[2]; [1]Hanseo Univ., Korea, Republic of, [2]Sunmoon Univ., Korea, Republic of.* The optical technology for focusing and manipulating electron beam was applied for the optimal operation for many applications such as large area scanning LCD panel and aberration compensated beam shaping for fine scanning communication devices.

JWA51
Observation of Soliton-based Image Transmission Through Self-Defocusing Photonic Lattices, *Yi Hu[1,2], **Peng Zhang**[1], Masami Yoshihara[1], Jianke Yang[3], Zhigang Chen[1,2]; [1]San Francisco State Univ., USA, [2]Nankai Univ., China, [3]Univ. of Vermont, USA.* We demonstrate that self-defocusing photonic lattices support various shapes of soliton clusters (such as Y-shape and H-shape) which remain robust during propagation. We propose soliton-based image transmission through photonic structures induced in bulk materials.

JWA52
Ultrafast Optics Used to Study Carrier Dynamics of High Quality Silicon on Glass Sample, *Omar S. Magaña-Loaiza*[1], *Roman Sobolewski[2], Jose J. Sanchez-Mondragon[1], Carlo Kosik-Williams[3], Jie Zhang[2]; [1]Natl. Inst. for Astrophysics Optics and Electronics, Mexico, [2]Univ. of Rochester, USA, [3]Corning Inc, USA.* We study, experimentally and theoretically, the carrier dynamics in high quality silicon on glass sample by a model that relates the reflectance time dependence with the carrier dynamics.

JWA53
Role of Nonlinearity and Transverse Localization of Light in a Disordered Coupled Optical Waveguide Lattice, *Somnath Ghosh[1], **Bishnu P. Pal**[1], R. K. Vrshney[1], Govind P. Agrawal[2]; [1]Indian Inst. of Technology Delhi, India, [2]Inst. of Optics, USA.* We report a numerical investigation on the transverse localization of light in a lattice of disordered coupled waveguides. The interplay of disorder with medium's nonlinearity in localization from application point of view is studied.

JWA54
Temperature Dependence Of Closed Mode Q-Factor In Terahertz Metamaterial Superlattice, *J. H. Woo*[1], *E. S. Kim[1], Boyoung Kang[1], E. Y. Choi[1], Hyun-Hee Lee[1], J. Kim[1], Y. U. Lee[1], Tae Y. Hong[2], Jae H. Kim[2], J. W. Wu[1]; [1]Ewha Womans Univ., Korea, Republic of, [2]Yonsei Univ., Korea, Republic of.* Terahertz metamaterial superlattice is fabricated with double-split ring resonators oriented alternately. By cooling down to cryogenic temperature 4K, changes in Q-factor of closed mode resonance originating from coherent coupling in metamaterial superlattice is investigated.

JWA55
Versatile 780-nm Pump Source for High-Repetition Rate Entanglement Generation, *Jemellie Galang*, *Joshua C. Bienfang, Charles W. Clark; NIST, USA.* We demonstrate a tunable pump source based on frequency-doubled EDFA-amplified pulses carved from a narrow-line CW laser at rates up to 1.25 GHz. We find self-phase modulation in the EDFA limits the peak output-pulse power.

JWA56
Modal Gain Analysis of GaNAsP Heterostructures on Silicon, *Nektarios Koukourakis*[1], *Dominic A. Funke[1], Nils C. Gerhardt[1], Martin R. Hofmann[1], Bernardette Kunert[2], Sven Liebich[3], S. Zinnkann[3], M. Zimprich[3], A. Beyer[3], S. Chatterjee[3], C. Bückers[3], S. W. Koch[3], K. Volz[3], W. Stolz[3]; [1]Ruhr-Univ. Bochum, Germany, [2]NAsP III/V, Germany, [3]Philipps-Univ. Marburg, Germany.* We present modal gain measurements of GaNAsP multiple quantum well structures grown lattice-matched on silicon using the stripe-length method. High modal gain values of up to 80 cm-1 are observed at room temperature.

JWA57
Capabilities of Trapping in Single Gratings and Switching in Double-Sided Gratings for Normal Incident Light, *Hideo Iizuka*[1], *Nader Engheta[2], Hisayoshi Fujikawa[3], Kazuo Sato[3], Yasuhiko Takeda[3]; [1]Toyota Res. Inst., USA, [2]Univ. of Pennsylvania, USA, [3]Toyota Central R&D Labs, Japan.* We present a technique for light trapping into the SiO_2 substrate using a TiO_2 grating, and the switching capability of the double-sided gratings with the horizontal quarter-period shift between the top and bottom gratings.

JWA58
Mimicking an Amplitude Damping Channel for Laguerre Gaussian Modes, *Angela Dudley*[1,2], *M. Nock[1], T. Konrad[1], F. S. Roux[2], A. Forbes[1,2]; [1]School of Physics, Univ. of KwaZulu-Natal, South Africa, [2]CSIR Natl. Laser Ctr., South Africa.* An amplitude damping channel for Laguerre-Gaussian (LG) modes is presented. Experimentally the action of the channel on LG modes is in good agreement with that predicted theoretically.

JWA59
Spectroscopic Ellipsometry Study of a Swiss Cross Metamaterial, *M.L. Miranda- Medina*[1,2], *B. Dastmalchi[2], H. Schmidt[3], E.-B. Kley[3], I. Bergmair[4], K. Hingerl[2], J.J. Sanchez-Mondragon[1]; [1]INAOE, Mexico, [2]Johannes Kepler Univ., Austria, [3]Inst. of Applied Physics, Friedrich-Schiller-Univ., Germany, [4]PROFACTOR GmbH, Austria.* We present spectroscopic ellipsometry measurements of a metamaterial, taken under different incidence-angles and compared with calculations based on the RCWA method. We find that resonances for (Psi, Delta) do not disappear changing the incidence angle.

JWA60
Directional Etching Methods for Realizing Woodpile Photonic Crystal with Different Crystal Orientations, *Lingling Tang*, *Shu-Yu Su, Ozlem Senlik, Tomoyuki Yoshie; Duke Univ., USA.* High-precision three-dimensional woodpile photonic crystal and high-quality-factor nanocavities in various crystal orientations are fabricated with two types of directional etching methods in a simple two-patterning process.

JWA61
Wavefront Sensing, *Melquiades Soto Garcia*, *Fermin A. Granados, Alejandro R. Cornejo; INAOE, Mexico.* Wavefront. The irradiance transport equations express the relation between wavefront and its intensity. We propose to solve the ITE using the approximation of derivatives by finite differences instead to get the wavefront for optical testing.

JWA62
Interferometric Measurement of Thickness and Refraction Index on Transparent Thin Films
***Carlos A. Vargas*[1,2],** *Edwin Tangarife[1]; [1]Inst. de Física, Univ. de Antioquia, Colombia, [2]Facultad de Ingenieria, Univ. Católica de Oriente, Colombia.* A Mach-Zenhder interferometer is proposed with a thin film on one of its arms, the sample can be rotated, measuring the pattern fringes for each incidence angle, sample thickness and refraction index are calculated.

JWA63
Phase Diversity Selection Using Spatial Light Modulator, *Norihide Miyamura*; *Univ. of Tokyo, Japan.* We used a spatial light modulator to generate phase diversities (PD). The laboratory experimental results show that the estimation accuracy of the wavefront aberration is improved using the optimal PD instead of conventional defocus PD.
Please add:

JWA64
Physics of Light and Optics: A Free Online Textbook, *Justin Peatross, Michael Ware; Dept. of Physics and Astronomy, Brigham Young Univ., USA.* We highlight an electronic textbook available free of charge in PDF format at optics.byu.edu. The target audience is upper-division physics undergraduates.

JWA65
Radiation Scattering by Localized Electron Wave Packets, *John P. Corson, Michael Ware, Scott Glasgow, Justin Peatross; Brigham Young Univ., USA.* We examine the role of wave-packet localization in the dynamics of radiation scattering by free electrons. The applicability of classical field assumptions is discussed.

NOTES

FiO

Highland A

1:30 p.m.–3:30 p.m.
SWA • Optical Communications Symposium I
Herwig Kogelnik; Lucent Technologies, USA, Presider

SWA1 • 1:30 p.m. Invited
Historical Overview of Optical Communications, *Tingye Li*; *AT&T Labs, USA.* Abstract not available.

SWA2 • 2:00 p.m. Invited
Development of Low-Loss Fibers, *P. Schultz*; *Corning, USA.* Abstract not available.

Highland B

1:30 p.m.–3:30 p.m.
FWO • Plasmonics and Metamaterials for Information Processing I
Presider to Be Announced

FWO1 • 1:30 p.m. Invited
Infrared Plasmonic Metamaterials for Slow-Light Applications, *Gennady Shvets*, *Chih-Hui Wu, Alexander Khanikaev; Univ. of Texas at Austin, USA.* A new approach to slowing light in plasmonic structures is proposed. We utilize the phenomenon of double-Fano resonance. Specific implementations of spectrally broad slow-light structures based on plasmonic antennas are presented.

FWO2 • 2:00 p.m.
Mid-Infrared Direct Coupling of Surface-Plasmon Polaritons, *Adel Bousseksou*[1], *Jean-Philippe Tetienne[1], Daniele Costantini[1], Raffaele Colombelli[1], Arthur Babuty[2], Ioana Moldovan-Doyen[2], Yannick De Wilde[2], Grégoire Beaudoin[3], Isabelle Sagnes[3]; [1]Inst. d'Electronique Fondamentale, Univ. Paris Sud, France, [2]Inst. Langevin, ESPCI ParisTech, France, [3]Lab de Photonique et de Nanostructures, France.* We demonstrate a compact device for surface plasmon(SP)generation. A SP mode is directly excited on a metal/air interface using a dry etched facet of a mid-infrared quantum-cascade laser. We probe the SSP via mid-infrared imaging.

Highland C

1:30 p.m.–3:30 p.m.
FWP • Optical Design with Unconventional Polarization II
Thomas G. Brown; Inst. of Optics, Univ. of Rochester, USA, Presider

FWP1 • 1:30 p.m. Invited
Polarization and the Focusing of Light, *Colin Sheppard*; *Div. of Bioengineering, Natl. Univ. of Singapore, Singapore.* The field on the Gaussian reference sphere can be expressed as a sum of electric and magnetic multipole components. The electric field at the focus can be maximized by maximizing the electric dipole term.

FWP2 • 2:00 p.m. Invited
Polarization and Modal Degrees of Freedom for Tight Confinement of Light, *Uriel Levy*, *Gilad Lerman, Avner Yanai, Ilya Goykhman, Boris Desiatov; Hebrew Univ. of Jerusalem, Israel.* We describe our work on tight confinement of light using plasmonic structures. Polarization and modal degrees of freedom are shown to have a crucial effect on the nanoscale focusing properties of the optical field.

Highland D

1:30 p.m.–3:30 p.m.
FWQ • Photonic Bandgap and Slow Light
Bahram Jalali; Univ. of California at Los Angeles, USA, Presider

FWQ1 • 1:30 p.m.
Fiber-coupled Suspended GaAs Waveguides for Efficient Broadband Spectroscopy of Single InAs Quantum Dots, *Marcelo I. Davanco*[1,2], *Matthew T. Rakher[1], Antonio Badolato[3], Kartik Srinivasan[1]; [1]CNST - NIST, USA, [2]Maryland Nanocenter, USA, [3]Dept. of Astronomy and Physics, USA.* Fiber-coupled waveguides are realized for broadband spectroscopy of InAs quantum dots. Above-band and p-shell excitation of individual dots is performed, with fluorescence collection into the fiber exceeding free-space collection by one order of magnitude.

FWQ2 • 1:45 p.m.
Observation of Linewidth Narrowing in Erbium-doped Silicon Nitride Coupled to Photonic Crystal Nanobeam Cavities, *Yiyang Gong*[1], *Maria Makarova[1], Selcuk Yerci[2], Rui Li[2], Luca Dal Negro[2], Jelena Vuckovic[1]; [1]Stanford Univ., USA, [2]Boston Univ., USA.* One-dimensional nanobeam photonic crystal cavities are fabricated in an Er-doped amorphous silicon nitride layer. Photoluminescence from the cavities is studied at cryogenic and room temperatures at different optical pump powers.

FWQ3 • 2:00 p.m. Invited
Theoretical Investigation of Attractive Optical Force in Periodically-Patterned Silicon Waveguides, *Jing Ma, **Michelle L. Povinelli**; Univ. of Southern California, USA.* We investigate the attractive optical force between a periodically-patterned silicon waveguide and a substrate. We show that the force is enhanced by mode delocalization and slow light effects.

Highland E

1:30 p.m.–3:30 p.m.
FWR • Laser Based Particle Acceleration II
Chan Joshi; Univ. of California at Los Angeles, USA, Presider

FWR1 • 1:30 p.m. Invited
Recent Advances in Proton Acceleration and Beam Shaping, *Markus Roth*[1], *V. Bagnoud[2], T. Burris[3], S. Busold[1], T. Cowan[3], O. Deppert[1], M. Geissel[4], D. P. Grote[5,6], K. Harres[1], G. Hoffmeister[1], G. Logan[5], F. Nürnberg[1], G. Schaumann[1], M. Schollmeier[4], D. Schumacher[1]; [1]Technische Univ. Darmstadt, Germany, [2]Helmholtzzentrum für Schwerionenforschung, Germany, [3]Forschungszentrum Dresden-Rossendorf, Germany, [4]Sandia Natl. Labs, USA, [5]Lawrence Berkeley Natl. Lab, USA, [6]Lawrence Livermore Natl. Lab, USA.* A report on recent-developments will be given with focus on experiments to control and combine laser-accelerated ion-beams with beam-transport structures and new targets and results using geometries for ion-driven fast-ignition and the generation of warm-dense-matter.

FWR2 • 2:00 p.m. Invited
Ion Acceleration with Ultra-Intense Lasers, *Anatoly Maksimchuk*; *Univ. of Michigan, USA.* An overview of the performed theoretical work and the experimental efforts in laser-driven ion acceleration at the Hercules and the T-cubed laser facilities at the University of Michigan will be presented.

FiO

Highland F

1:30 p.m.–3:30 p.m.
FWS • Nanopatterning and metamaterials

Zhaolin Lu; Univ. of Delaware, USA, Presider

FWS1 • 1:30 p.m. Invited

Active and Passive Nanophotonics for Information Systems Applications, *Shaya Y. Fainman*, *A. Simic, O. Bondarenko, B. Slutsky, A. Mizrahi, M. P. Nezhad; Univ. of California at San Diego, USA.* We present new nanophotonic paradigms using a combination of dielectric, metal, and semiconductor composite nanostructures and devices for optical communications, information and signal processing, and sensing.

FWS2 • 2:00 p.m. Invited

Nanopatterning Technology and the Future of Semiconductor Devices beyond 32nm, *Bruce Smith*; *Dept. of Microelectronic Engineering, Rochester Inst. of Technology, USA.* Abstract not available.

Highland G

1:30 p.m.–3:30 p.m.
FWT • Disorder In Integrated Optical Devices and Circuits II

Presider to Be Announcedr

FWT1 • 1:30 p.m. Invited

Evolution of Photonic Band-Gap and Lasing from Polycrystalline to Amorphous Photonic Structures, *Hui Cao*, *Jin-Kyu Yang, Heeso Noh, Seng-Fett Liew, Carl Schreck, Corey O'Hern; Yale Univ., USA.* We map out a transition in the gap of photonic density of states from polycrystalline to amorphous structures. Lasing has been realized in both polycrystalline and amorphous photonic structures with distinct characteristic.

FWT2 • 2:00 p.m.

Anderson Surface Waves in Disordered Photonic Lattices, *Alexander Szameit*[1], *Yaroslav V. Kartashov[2], Peter Zeil[3], Felix Dreisow[3], Matthias Heinrich[3], Robert Keil[3], Stefan Nolte[3], Andreas Tünnermann[3], Victor A. Vysloukh[4], Lluis Torner[2]; [1]Solid State Inst., Israel, [2]ICFO, Spain, [3]Inst. of Applied Physics, Germany, [4]Dept. de Fisica y Matematicas, Mexico.* We experimentally demonstrate disorder-induced localization near a boundary of truncated one-dimensional disordered photonic lattices and uncover that localization near the boundary requires a higher disorder level than in bulk lattices.

LS

Highland H

1:30 p.m.–3:00 p.m.
LWG • General Laser Science

Francesco A. Narducci; Naval Air Systems Command, USA, Presider

LWG1 • 1:30 p.m.

Phase Locking a Fiber Laser Array Via Diffractive Coupling, *Eitan Ronen*, *Amiel A. Ishaaya; Ben Gurion Univ., Israel.* We demonstrate phase locking of a linear array of seven fiber lasers via diffractive coupling. Fringe contrast of 82% was measured at the far field for anti-phase locking with very high efficiencies.

LWG2 • 1:45 p.m.

Multiplexed Reflective Volume Bragg Grating for Passive Coherent Beam Combining, *Sergiy Mokhov*[1], *Apurva Jain[1], Christine Spiegelberg[2], Vadim Smirnov[2], Oleksiy Andrusyak[1], George Venus[1], Boris Zeldovich[1], Leonid Glebov[1]; [1]CREOL, The College of Optics and Photonics, USA, [2]OptiGrate Corp., USA.* Multiplexed Bragg grating recorded in photo-thermo-refractive glass can be efficient combiner for coherent locking of high-power lasers. Spectral properties of two-channel combiner are studied theoretically and experimentally. Multi-channel scaling of this approach is discussed.

LWG3 • 2:00 p.m.

Phase Locked Clusters in Laser Arrays and a Novel Method For Detecting Them, *Eitan Ronen*, *Amiel A. Ishaaya; Ben Gurion Univ., Israel.* We investigate phase locked clusters in a diffractively coupled linear fiber aser array. We experimentally observe distinct phase locked laser clusters and demonstrate a novel method for measuring the spatial coherence of the array.

Highland J

1:30 p.m.–3:45 p.m.
LWH • Chemical Dynamics I: Multi-Dimensional Ultrafast Spectroscopy

Jennifer P. Ogilvie; Univ. of Michigan, USA, Presider

LWH1 • 1:30 p.m. Invited

Advances in Ultrafast 2-D Spectroscopy, *Chris T. Middleton, **Martin Zanni**; Univ. of Wisconsin at Madison, USA.* This talk will cover recent developments in the use of femtosecond pulse shaping technology for collecting 2-D IR and 2-D Vis spectra and their applications to biophysical and energy related topics.

LWH2 • 2:00 p.m. Invited

Multiply Resonant Coherent Multidimensional Spectroscopy, *John Wright*; *Univ. of Wisconsin at Madison, USA.* Multiply resonant methods create frequency domain measurement of multidimensional spectra using multiple quantum coherences involving individual electronic and vibrational quantum states and time domain measurement of their coherent and incoherent dynamics. We discuss many examples.

Highland K

1:30 p.m.–3:30 p.m.
LWI • Photophysics of Energy Conversion II

Tianquan Lian; Emory Univ., USA, Presider

LWI1 • 1:30 p.m. Invited

Spin Signatures of Light Induced Charge Separated States in Polymer-Fullerene Bulk-Heterojunctions: High-Frequency Pulsed EPR Spectroscopy, *Oleg Poluektov*[1], *Salvatore Filippone[2], Nazario Martín[2], Andreas Sperlich[3], Carsten Deibel[3], Vladimir Dyakonov[3]; [1]Argonne Natl. Lab, USA, [2]Univ. Complutense de Madrid, Spain, [3]Julius-Maximilians Univ. of Würzburg and Bavarian Ctr. for Applied Energy Res. e. V., Germany.* Charged polarons in thin films of polymer-fullerene composites are investigated by light-induced electron paramagnetic resonance. Comparative analysis of photogenerated charge separation states in organic photovoltaic cells and natural photosynthetic proteins are given.

LWI2 • 2:00 p.m. Invited

Optically and Electrically Detected Magnetic Resonance Studies of Organic Light-Emitting Materials and Devices, *Joseph Shinar*; *Iowa State Univ., USA.* Optically and electrically detected magnetic resonance studies of luminescent π-conjugated thin films and organic light-emitting devices (OLEDs) have provided striking insight into their various excitations.

FiO

Highland A

SWA • Optical Communications Symposium I—Continued

SWA3 • 2:30 p.m. Invited
Title to Be Announced, *David Payne*; *Univ. of Southampton, UK.* Abstract not available.

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

Highland B

FWO • Plasmonics and Metamaterials for Information Processing I—Continued

FWO3 • 2:15 p.m.
Beating the Diffraction Limit Using a 3-D Nanowires Metamaterials Nanolens, *Bernard Didier Frederic Casse*, *Wentao T. Lu, Yongjian Huang, Evin Gultepe, Latika Menon, Srinivas Sridhar; Northeastern Univ., USA.* Super-resolution imaging using a three-dimensional metamaterials nanolens has been recently reported [B. D. F. Casse *et al.* Appl.Phys. Lett.**96**,023114(2010)]. Here, we present validation of the superresolution imaging by the nanolens through extensive control experiments.

FWO4 • 2:30 p.m.
Excitation of Individual Gold Plasmonic Nanoparticles in an Integrated Hybrid Photonic-Plasmonic Platform, *Maysamreza Chamanzar*, *Ehsan Shah Hosseini, Siva Yegnanarayanan, Ali Adibi; Georgia Tech, USA.* Efficient and controlled excitation of individual plasmonic nanorods using integrated Si3N4 structures is theoretically and experimentally demonstrated. Transmission amplitude and phase responses are used to extract nanoparticle coupling ratios. Large field enhancements are achieved on-chip.

FWO5 • 2:45 p.m.
Experimental Verification of the Concept of Optical Lumped Circuit Elements at IR Wavelengths, *Yong Sun[1], Brian Edwards[1], Andrea Alù[1,2],* ***Nader Engheta***[1]; *[1]Univ. of Pennsylvania, USA, [2]Univ. of Texas at Austin, USA.* Using FTIR spectrometry, we experimentally verify that arrays of Si_3N_4 nanorods with deep subwavelength cross sections may operate as two-dimensional optical lumped circuit elements connected in series or parallel depending on polarization of incident field.

Highland C

FWP • Optical Design with Unconventional Polarization II—Continued

FWP3 • 2:30 p.m.
Optical Nanoprobing via Spin-Orbit Interaction of Light, *Konstantin Y. Bliokh*[1], *Oscar G. Rodriguez-Herrera[1], David Lara[2], Elena A. Ostrovskaya[3], Chris Dainty[1]; [1]Applied Optics Group, School of Physics, Natl. Univ. of Ireland Galway, Ireland, [2]Blackett Lab, Imperial College London, UK, [3]Nonlinear Physics Ctr., Australian Natl. Univ., Australia.* Optical microscopy of a nanoparticle is accompanied by spin-orbit interaction of light which translates subwavelength information to the polarization distribution of the output light. We observe sensitive angular momentum conversion and spin-Hall effect of light.

FWP4 • 2:45 p.m.
Angular Momenta and Spin-Orbit Interaction of Nonparaxial Light in Free Space, *Konstantin Y. Bliokh*[1], *Miguel A. Alonso[2,3]; [1]Applied Optics Group, School of Physics, Natl. Univ. of Ireland, Galway, Ireland, [2]Inst. of Optics, Univ. of Rochester, USA, [3]Dept. of Applied Physics, Aalto Univ., Finland.* We calculate the spin and orbital angular momenta of a non-paraxial monochromatic electromagnetic field. The orbital angular momentum has a polarization-dependent contribution describing the spin-orbit interaction. This can be observed via fine splitting of caustics.

Highland D

FWQ • Photonic Bandgap and Slow Light—Continued

FWQ4 • 2:30 p.m.
Slow Light Effect in Distributed Feedback (DFB) for Dimension Reduction of Electro-optic Modulators, *Shengling Deng*, *Z.Rena Huang; Rensselaer Polytechnic Inst., USA.* A length reduction of 3-fold is shown for MZI-based EO modulator by utilizing slow light effect at 1.55 micron wavelength in sub-micron DFB-incorporated slab-waveguide. Transmission spectrum can be enhanced and smoothed by multi-segment DFB configuration.

FWQ5 • 2:45 p.m.
Dynamic Frequency Shifts in Photonic Structures, ***Yuzhe Xiao***[1], *Drew N. Maywar[2], Govind P. Agrawal[1]; [1]Univ. of Rochester, USA, [2]Rochester Inst. of Technology, USA.* We develop a simple systems-theory approach to study the dynamic frequency shift occurring in linear photonic structures. This method can be applied to study a broad range of integrated photonic structures.

Highland E

FWR • Laser Based Particle Acceleration II—Continued

FWR3 • 2:30 p.m. Invited
Particle Acceleration by the Light Pressure of High-Power Laser Pulses, *Joerg Schreiber*; *MPI für Quantenoptik, Germany.* Radiation Pressure Acceleration is poised to revolutionize laser ion acceleration - with GeV energies predicted at intensities beyond 10^{21}W/cm^2. First experimental results reveal the beginning of this novel era for efficient particle acceleration.

FiO

Highland F

FWS • Nanopatterning and metamaterials—Continued

FWS3 • 2:30 p.m.
Constrained Parametric Optimization of Point Geometries in Multi-Beam-Interference Lithography, *Guy M. Burrow*, *Thomas K. Gaylord; Georgia Tech, USA.* Multi-beam-interference lithography parameters are systematically analyzed and optimized. High absolute contrast and a variety of point geometries ranging from elliptical to rectilinear or rhombic intensity profiles are demonstrated.

FWS4 • 2:45 p.m.
Permanent Holographic Waveguide Arrays, *Eric D. Moore*, *Robert R. McLeod; Univ. of Colorado, USA.* Permanent two-dimensional optical waveguide arrays are demonstrated by exposing diffusion-mediated photopolymer with a multiple-beam interference pattern. A fiber-based phase control system ensures a stable interference pattern during exposure.

Highland G

FWT • Disorder In Integrated Optical Devices and Circuits II—Continued

FWT3 • 2:15 p.m.
Lasing Actions of Extended and Localized Modes in Mixed Photonic Crystals, *Sunghwan Kim, Jeongkug Lee,* ***Heonsu Jeon****; Seoul Natl. Univ., Korea, Republic of.* By employing band-edge laser platforms, we produced randomly mixed photonic crystals in binary format, a photonic analogy to mixed semiconductors. Lasing actions of both extended and localized modes were achieved using the mixed photonic crystals.

FWT4 • 2:30 p.m.
Measuring Transmission Eigenchannels of Wave Propagation through Random Media, *zhou shi*, *Jing Wang, Azriel Z. Genack; Queens College of the City Univ. of New York, USA.* We measured the transmission matrix for localized and diffusive waves in a quasi-1D waveguide filled with randomly positioned scatterers and compare the results to predictions of random matrix theory.

FWT5 • 2:45 p.m.
Dynamics of Fluctuations of Localized Waves, *Andrey Chabanov*[1], *Jing Wang[2], Azriel Genack[2], D. Y. Lu[3], Zhaoqing Zhang[3]; [1]Univ. of Texas at San Antonio, USA, [2]Queens College of CUNY, USA, [3]Hong Kong Univ. of Science and Technology, Hong Kong.* Dynamics of mesoscopic fluctuations of localized waves reflect the evolving contributions of short- and long-lived electromagnetic modes of the random medium. Complex transport phenomena for localized waves can be clarified by applying a modal analysis.

LS

Highland H

LWG • General Laser Science—Continued

LWG4 • 2:15 p.m.
Experimental and Theoretical Studying of Generation and Amplification in Yb:YAG Disc Crystals, *Evgeniy Perevezentsev*, *Ivan Mukhin, Oleg Palashov, Efim Khazanov; Inst. of Applied Physics of the Russian Acad. of Sciences (IAP RAS), Russian Federation.* Self-consistent calculation carried out to obtain the amount of storied energy and temperature in Yb:YAG disks taking into account amplified spontaneous emission. Studied the generation and amplification in active elements for continuous and pulse-periodic mode.

LWG5 • 2:30 p.m.
Comparison of Spontaneous Behavior in a Synchronously and Asynchronously Mode-Locked EDFL, *Camila C. Dias*, *Eunézio A. de Souza; Univ. Presbiteriana Mackenzie, Brazil.* We investigated the spontaneous behavior of an Erbium-doped-fiber-laser synchronously and asynchronously mode-locked operating at 10GHz. We observed that the central wavelength shifts to a lower one. This knowledge is necessary to achieve the mode-locking stabilization.

LWG6 • 2:45 p.m.
Imitating the Cherenkov Radiation in Backward Directions, *Tetsuyuki Ochiai*; *Natl. Inst. for Materials Science, Japan.* A novel radiation emission from traveling charged particles in vacuum is demonstrated theoretically. This radiation is conical as in the Cherenkov radiation, but can be emitted in backward directions of particle trajectories.

Highland J

LWH • Chemical Dynamics I: Multi-Dimensional Ultrafast Spectroscopy—Continued

LWH3 • 2:30 p.m.
Two Dimensional Femtosecond Stimulated Raman Spectroscopy: A New Technique to Probe Vibrational Coupling, *David W. McCamant*, *Kristina C. Wilson, Randy D. Mehlenbacher, Brendon Lyons; Univ. of Rochester, USA.* Two-dimensional femtosecond stimulated Raman spectroscopy (2D-FSRS) can potentially quantify vibrational coupling. However, our results indicate that all signals measured thus far are attributable to a 3rd-order cascade and not the intended 5th-order mechanism.

LWH4 • 2:45 p.m. Invited
Watching Chemical Reactions and Dynamics with Ultrafast Multidimensional Infrared Spectroscopy, *Carlos R. Baiz, Jessica M. Anna, Robert McCanne, John T. King,* ***Kevin J. Kubarych****; Univ. of Michigan, USA.* Using equilibrium and non-equilibrium multidimensional infrared spectroscopy, we can track chemical reactions with exquisite detail. Examples we will discuss include: ultrafast chemical exchange, bimolecular recombination, charge transfer and solvation dynamics.

Highland K

LWI • Photophysics of Energy Conversion II—Continued

LWI3 • 2:30 p.m. Invited
Carrier Dynamics of Films of Zinc Phthalocyanine and C60 Measured by Terahertz Time Domain Spectroscopy, *Paul Lane*[1], *Joseph S. Melinger[1,2], Okan Esenturk[2], Edwin J. Heilweil[2]; [1]NRL, USA, [2]Optical Technology Div., Physics Lab, NIST, USA.* We studied photocarrier dynamics in organic photovoltaics by terahertz time domain spectroscopy. Transient THz absorption decays in C60 and zinc phthalocyanine span a wide range of timescales and reveal how to optimize photocarrier yields.

FiO

FWO • Plasmonics and Metamaterials for Information Processing I—Continued

FWO6 • 3:00 p.m.
Metamaterial Optical Diodes for Linearly and Circularly Polarized Light, *Eric Plum, Vassili A. Fedotov,* ***Nikolay Zheludev****; Univ. of Southampton, UK.* Total intensity of light transmitted at non-normal incidence thorough planar metamaterials can be different for forward and backward propagation. For metamaterial patterns of different symmetries we observe this effect for circularly or linearly polarized light.

FWO7 • 3:15 p.m.
Resonance Cones in Cylindrically Anisotropic Metamaterials: A Green's Function Analysis, ***Huikan Liu****, Kevin J. Webb; Purdue Univ., USA.* A Green's function analysis for cylindrically anisotropic media is presented. Resonance cones result from the Green's function singularity when the permittivity tensor elements have opposite sign. This model will facilitate the design of various components.

FWP • Optical Design with Unconventional Polarization II—Continued

FWP5 • 3:00 p.m.
Demonstration of an Elliptical Plasmonic Lens Illuminated with Radially-Like Polarized Field, ***Gilad M. Lerman****, Avner Yanai, Nissim Ben-Yosef, Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* We demonstrate an elliptical plasmonic lens illuminated by a TM "radially-like" polarized field. The surface plasmons interference generates a wavelength dependent structured pattern that can be used in structured illumination microscopy, particles trapping and sensing.

FWP6 • 3:15 p.m.
Imaging Atomic States Using Radially-Polarized Light, ***Fredrik K. Fatemi****, G. Beadie; NRL, USA.* We have used cylindrical vector beams to probe an optically pumped warm rubidium vapor. Optical pumping produces a spatial modulation of the vector beam according to the spin state of the atoms.

FWQ • Photonic Bandgap and Slow Light—Continued

FWQ6 • 3:00 p.m.
Adiabatic Perfectly Matched Layer for Absorbing Slow Group Velocity Modes in Numerical Simulation of Photonic Crystal Waveguides, ***Murtaza Askari****, Babak Momeni, Charles M. Reinke, Ali Adibi; Georgia Tech, USA.* We show why some of the previously reported PMLs do not work well in absorbing slow group velocity modes in PCWs. We also present a unique method to efficiently absorb these modes for PCW simulations.

FWQ7 • 3:15 p.m.
Impact of Slow Light on Nonlinear Effects in Silicon-on-Insulator Photonic Crystal Waveguide with Device Application, ***Swati Rawal****, Ravindra K. Sinha; Delhi Technological Univ. (Formerly Delhi College of Engineering), India.* The effect of slow light on two photon absorption and self phase modulation process in silicon-on-insulator (SOI) photonic crystal waveguide. It is observed that in slow light regime, these two nonlinear effects are enhanced.

FWR • Laser Based Particle Acceleration II—Continued

FWR4 • 3:00 p.m.
Photoemission by Large Electron Wave Packets Emitted out the Side of a Relativistic Laser Focus, ***Eric Cunningham****, Jacob Johansen, Grayson Tarbox, Justin Peatross, Michael Ware; Bigham Young Univ., USA.* We provide an update on an experimental effort to measure the radiation from individual electron wave packets that are spread over an area on the scale of an optical wavelength.

FWR5 • 3:15 p.m.
Atomic and Nuclear Coherence Excited by Optical Pulses: CEP Effects and Generation of X-Ray and Nuclear Radiation, ***Yuri Rostovtsev****; Deaprtment of Physics, Univ. of North Texas, USA.* We study population transfer and excitation of quantum coherence in atomic and nuclear systems interacting with strong ultra-short laser pulses. We discuss CEP effects and possible applications to cooperative generation of XUV and nuclear radiation.

3:30 p.m.–4:00 p.m. Coffee Break, *Highland Ballroom Foyer Rochester Riverside Convention Center*

NOTES

Highland F

FiO

FWS • Nanopatterning and metamaterials—Continued

FWS5 • 3:00 p.m.
Azimuthally Varying Graded Reflectivity Mirrors, *Zachary A. Roth*, *Menelaos K. Poutous, Pradeep Srinivasan, Aaron Pung, Eric G. Johnson; Ctr. for Optoelectronics and Optical Communication, Univ. of North Carolina at Charlotte, USA.* Space variant optics have novel and useful spatial and spectral properties. In this paper, we present a novel optical component that exploits the properties of resonant structures to make an azimuthally varying spectral filter.

FWS6 • 3:15 p.m.
Dispensing Nanolitre Droplets for Liquid Nanoprinting and Nanopatterning, *Sara Coppola*, *Veronica Vespini, Melania Paturzo, Simonetta Grilli, Pietro Ferraro; CNR Inst. Nazionale di Ottica, Italy.* Nano- and pico-droplets have been extracted and dispensed from sessile drop or liquid film reservoirs through pyroelectric effect activated by a hot tip or an IR laser source on polar dielectric substrates.

Highland G

FWT • Disorder In Integrated Optical Devices and Circuits II—Continued

FWT6 • 3:00 p.m. **Invited**
Ultrasensitive Raman Sensor Based on Highly Scattering Porous Structures, *Vladislav V. Yakovlev*; *Univ. of Wisconsin at Milwaukee, USA.* A substantially improved performance of a Raman sensor based on enhanced light scattering in porous structures is demonstrated.

Highland H

LS

Highland J

LWH • Chemical Dynamics I: Multi-Dimensional Ultrafast Spectroscopy—Continued

LWH5 • 3:15 p.m.
Coherent Linewidths of Interfacial GaAs Quantum Dot Excitons and Incoherent Coupling from Quantum Well Excitons, *Alan D. Bristow*[1], *Galan Moody[1], Mark E. Siemens[1], Xingcan Dai[1], Denis Karaiskaj[1], Allan S. Bracker[2], Daniel Gammon[2], Steven T. Cundiff[1]; [1]JILA, Natl. Inst. of Standards and Technology and Univ. of Colorado, USA, [2]NRL, USA.* Optical two-dimensional Fourier-transform spectroscopy is used to study interfacial GaAs quantum dots (QDs). We extract the temperature dependence of the QD homogeneous linewidth and energy relaxation from quantum well excitons to the lower energy QDs.

LWH6 • 3:30 p.m.
Ultrafast Fourier Transform with a Femtosecond-Laser-Driven Molecule, *Kenji Ohmori*; *Inst. for Molecular Science, Japan.* We have experimentally demonstrated a new logic gate based on the temporal evolution of a molecular wave function. An optically tailored vibrational wave-packet implements 4- and 8-element discrete Fourier-transform with arbitrary real and imaginary inputs.

Highland K

LWI • Photophysics of Energy Conversion II—Continued

LWI4 • 3:00 p.m. **Invited**
Time-Resolved Microwave Conductivity, *Nikos Kopidakis*; *Natl. Renewable Energy Lab, USA.* The pump-probe Time-Resolved Microwave Conductivity technique under pulsed laser excitation is increasingly being used to study the photophysics of nanostructured photovoltaics. Its principles of operation and applications to various material systems will be discussed.

3:30 p.m.–4:00 p.m. Coffee Break, *Highland Ballroom Foyer Rochester Riverside Convention Center*

NOTES

FiO

Highland A

4:00 p.m.–5:30 p.m.
SWB • Optical Communications Symposium II
Colin J. McKinstrie; Bell Labs, Alcatel-Lucent, USA, Presider

SWB1 • 4:00 p.m. **Invited**
Development of Semiconductor DFB Lasers and Modulators, *T. Koch*; *Lehigh Univ., USA.* Abstract not available.

SWB2 • 4:30 p.m. **Invited**
Solitons, Nonlinearities and Noise in Long-Haul Optical Transmission Systems, *L. Mollenauer*; *Bell Labs, Lucent Technologies, USA.* In this talk, I shall describe some surprising (but important!) results from interaction of the dispersive and nonlinear terms in the NLS (Non-Linear Schrödinger) equation with each other and in some cases, with noise.

Highland B

4:00 p.m.–5:15 p.m.
FWU • Plasmonics and Metamaterials for Information Processing IV
Taco D. Visser; Delft Univ. of Technology, Netherlands, Presider

FWU1 • 4:00 p.m.
A Plasmonic Waveguide with Subwavelength Mode Confinement, *Md M. Hossain*[1], *Mark D. Turner[1,2], Baohua Jia[1], Min Gu[1]; [1]Swinburne Univ. of Technology, Australia, [2]CRC for Polymers, Australia.* We report on a new kind of plasmonic waveguides in metallic nano-shelled cylindrical dielectric cores. The excitation of propagating plasmon modes in the nanoshells can effectively guide light with subwavelength confinement.

FWU2 • 4:15 p.m.
Loss Measurement in Plasmonic Modes in Metal-Insulator-Metal Waveguides by Attenuated Total Reflection, *Chien-I Lin*, *Thomas K. Gaylord; Georgia Tech, USA.* We report experimental characterization of plasmonic modes in metal-insulator-metal waveguides based on the attenuated total reflection (ATR) configuration. The loss is measured without physically changing the waveguide length as in conventional methods.

FWU3 • 4:30 p.m.
One-Way Waveguides and Impedance Matching of Loads, *Olli Luukkonen*, *Nader Engheta; Univ. of Pennsylvania, USA.* We theoretically investigate interaction of propagating waves in one-way waveguides with terminal loads and cavities, showing that the impedance mismatch between the load and the waveguide has no effect on energy propagation through the structure.

Highland C

4:00 p.m.–5:30 p.m.
FWV • Image-based Wavefront Sensing II
Richard Paxman; General Dynamics Corp., USA, Presider

FWV1 • 4:00 p.m. **Invited**
Sequential Diversity Imaging: Phase Diversity with AO Changes as the Diversities, *Robert A. Gonsalves*; *Tufts Univ., USA.* A digital camera with an Adaptive Optic (AO) can be a phase-diversity imager if the frame-rate is about 10 times faster than the changing optical medium. Sequential images are the diverse images and the AO changes are the phase diversities.

FWV2 • 4:30 p.m. **Invited**
JWST Integrated System Modeling, *J. Scott Knight*, *D. Scott Acton, Paul A. Lightsey; Ball Aerospace and Technologies Corp., USA.* The JWST Integrated System Model is a high fidelity photon-in to images-out model of the Observatory. This paper describes the model and its role in the analysis of the on-orbit alignment process.

Highland D

4:00 p.m.–5:15 p.m.
FWW • Nonlinear Fiber Optics
Marcelo I. Davanco; CNST - NIST, USA, Presider

FWW1 • 4:00 p.m. **Invited**
Manipulation of Pulse Duration and Wavelength Conversion in Optical Fibres, *William J. Wadsworth*, *Laure Lavoute, Peter J. Mosley, James M. Stone, Jonathan C. Knight; Univ. of Bath, UK.* The possibilities, and some limits, of photonic crystal fibres as a platform for transforming laser pulses, from supercontinuum or parametric generation in solid core fibre, to high energy pulse compression in hollow-core fibre are discussed.

FWW2 • 4:30 p.m.
Two-Pump Fiber-Optic Parametric Amplifier with 66dB Gain and Errorless Performance, *Ana Peric*[1], *Slaven Moro[1], Nikola Alic[1], Arthur J. Anderson[1], Colin J. McKinstrie[2], Stojan Radic[1]; [1]Univ. of California - San Diego, USA, [2]Bell Labs, Alcatel-Lucent, USA.* We demonstrate a 66dB-gain two-pump fiber-optic parametric amplifier with an errorless performance measured for a 10.7-Gb/s non-return-to-zero differential phase-shift-keyed signal. A radio-frequency noise source was used for the pumps' stimulated Brillouin scattering threshold enhancement.

Highland E

4:00 p.m.–5:30 p.m.
FWX • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing II
Andrey V. Kanaev; Global Strategies Group Inc., USA, Presider

FWX1 • 4:00 p.m.
Thermal-Lens Spectroscopy in Binary Liquids Mixtures, *Indrajit Bhattacharyya, **Pardeep Kumar**, Debabrata Goswami; Indian Inst. of Technology, Kanpur, India.* Using femtosecond pump-probe thermal-lens (TL) spectroscopy, experiments in binary-mixtures are presented where trends in TL are modulated by physical and molecular properties. Deviations of experimental results from phenomenological models indicate possible underestimation of molecular interactions.

FWX2 • 4:15 p.m. **Invited**
Infrared Spectroscopic Imaging for Label-Free and Automated Histopathology, *Rohit Bhargava*, *Rohith K. Reddy, Jason Ip, Frances N. Pounder, Matthew V. Schulmerich, David Mayerich, Xavier Llora, Rong Kong, Michael J. Walsh; Univ. of Illinois at Urbana-Champaign, USA.* Infrared spectroscopic imaging is used to classify tissue into cell types and diseases without stains or human supervision. Human-competitive performance in cancer detection is achieved by combining infrared imaging, chemometrics, image analysis and optical theory.

FiO

Highland F

4:00 p.m.–5:30 p.m.
FWY • Optical Design for Biomedical Systems II
Presider to Be Announced

FWY1 • 4:00 p.m. Invited

High Resolution Optical Volumetric Imaging of Blood Perfusion with Microcirculation Tissue Beds, *Ruikang K. Wang*; *Oregon Health and Science Univ., USA.* The basic principle for optical microangiography is presented, and its potential applications in a number of animal models will discussed, including stroke, hemorrhage, and traumatic brain injury.

FWY2 • 4:30 p.m. Invited

Breaking the Optical Diffusion Limit: Photoacoustic Tomography, *Lihong Wang*, *Gene K. Beare; Washington Univ. in St. Louis, USA.* Photoacoustic tomography combines optical (endogenous or exogenous, fluorescent or non-fluorescent) contrast and ultrasonic resolution for *in vivo* functional and molecular imaging. Super-depths beyond the optical diffusion limit have been reached with high spatial resolution.

Highland G

4:00 p.m.–5:30 p.m.
FWZ • General Non-linear Optics
Neil Broderick; Univ. of Southampton, UK, Presider

FWZ1 • 4:00 p.m.

Observation of Classical Optical Wave Condensation, *Can Sun*[1], *Shu Jia[1], Christopher Barsi[1], Antonio Picozzi[2], Sergio Rica[3], Jason W. Fleischer[1]; [1]Princeton Univ., USA, [2]Inst. Carnot de Bourgogne, France, [3]Ecole Normale Superieure, France.* We demonstrate the nonlinear condensation of classical optical waves. The condensation is observed directly, as a function of nonlinearity and wave kinetic energy, in a self-defocusing photorefractive crystal.

FWZ2 • 4:15 p.m.

Self-Phase Matched Four-Wave Mixing in Cold Vapor, *Joel A. Greenberg*, *Daniel J. Gauthier; Duke Univ., USA.* We demonstrate novel four-wave mixing processes in a cold vapor that arise due to atomic spatial self-organization. This leads to a reduced parametric oscillation threshold and a more rapid increase of gain with pump power.

FWZ3 • 4:30 p.m.

All-Optical Switching in a Coupled Cavity-Atom System, *Jiepeng Zhang*[1,2], *Xiaogang Wei[1,3], Yifu Zhu[1]; [1]Physics Div., Los Alamos Natl. Lab, USA, [2]1Dept. of Physics, Florida Intl. Univ., USA, [3]College of physics, Jilin Univ., China.* We report an experimental demonstration of all-optical switching in a cavity QED system consisting of multiple three-level atoms confined in a cavity mode.

LS

Highland H

4:00 p.m.–5:30 p.m.
LWJ • Quantum Enhanced Information Processing II
Robert J. Schoelkopf; Yale Univ., USA, Presider

LWJ1 • 4:00 p.m. Invited

Quantum Illumination for Improved Detection, Imaging, and Communication, *Jeffrey H. Shapiro*; *MIT, USA.* Quantum illumination transmits part of an entangled state, retaining the rest for subsequent joint measurement in detection, imaging, or communication. It outperforms classical-state systems of the same average transmitted energy over entanglement-breaking channels.

LWJ2 • 4:30 p.m.

Deterministic Entanglement of Two Neutral Atoms Using Rydberg Blockade, *Xianli L. Zhang, Larry Isenhower, Alex T. Gill, Thad G. Walker, **Mark Saffman**; Univ. of Wisconsin, USA.* We demonstrate a neutral atom CNOT gate using Rydberg state mediated interactions. The gate is used to deterministically create entangled Bell states with a fidelity of F=0.71, without correcting for loss of atoms.

Highland J

4:00 p.m.–5:30 p.m.
LWK • Attosecond and Strong Field Physics II
David Villeneuve; Natl. Res. Council Canada, Canada, Presider

LWK1 • 4:00 p.m. Invited

Time-Resolved High-Harmonic Spectroscopy of Photochemical Dynamics, *Hans Jakob Wörner*, *Julien B. Bertrand, Paul B. Corkum, David M. Villeneuve; Joint Lab for Attosecond Science, Natl. Res. Council Canada and Univ. of Ottawa, Canada.* We use high-harmonic spectroscopy to observe the evolution of the electronic structure of molecules undergoing ultrafast photochemical reactions. Using the transient grating technique allows us to determine amplitude and phase of the excited state emission.

LWK2 • 4:30 p.m.

Magnetic-Bottle Electron Spectrometer for Measuring Isolated 25 as Pulses, *Kun Zhao*[1], *Qi Zhang[1], Steve Gilbertson[1], Michael Chini[1], Sabih Khan[1], Zenghu Chang[1,2]; [1]Kansas State Univ., USA, [2]Univ. of Central Florida, USA.* A magnetic-bottle electron energy spectrometer was designed and constructed to measure a 25 as XUV pulse. Numerical simulations and experimental results showed the spectrometer is capable to meet the energy resolution required by such measurements.

Highland K

4:00 p.m.–5:30 p.m.
LWL • Single Molecule Approaches to Biology II
William A. Eaton; Natl. Inst. of Health and Natl. Inst. of Diabetes and Digestive and Kidney Diseases, USA, Presider

LWL1 • 4:00 p.m. Invited

Bacteriophager Lambda Life Cycle: The View from the Single Virus, *Ido Golding*; *Baylor College of Medicine, USA.* We study the life-cycle of bacteriophage lambda at the resolution of individual viruses and cells. I will present some of our recent findings with regards to long-standing open questions in the lambda system.

LWL2 • 4:30 p.m. Invited

Imaging Dynamic Events Inside Living Cells: Intracellular Degradation of LDL, *Christine Payne*; *Georgia Tech, USA.* The intracellular degradation of LDL was probed with single particle tracking fluorescence microscopy. LDL particles were labeled such that enzymatic degradation leads to an increase in fluorescence allowing us to relate endosomal dynamics to degradation.

FiO

Highland A

SWB • Optical Communications Symposium II—Continued

SWB3 • 5:00 p.m. Invited

Integrated Optics in Optical Communication Systems, *Hiroshi Takahashi*; *NTT Photonics Labs, Japan.* Optical waveguide devices are widely used in access, metro and long-haul optical communication systems. This talk reviews commercialized devices such as wavelength multi/demultiplexers and optical switches, and state-of-the-art integrated devices for coherent transmission.

SWB4 • 5:30 p.m. Invited

Capabilities of the Undersea Telecommunications Industry, *Neal S. Bergano*; *TE SubCom, USA.* Undersea transoceanic telecommunications cables are routinely installed with multiple terra-bit capacity. In this presentation I will give an overview of these state-of-the-art systems, discuss key technologies, and speculate on what's to come in future builds.

Highland B

FWU • Plasmonics and Metamaterials for Information Processing IV—Continued

FWU4 • 4:45 p.m.

Experimental Demonstration of Deep Subwavelength Waveguiding Based on Designer Surface Plasmons, *Omar M. Eldaiki, **Wangshi Zhao**, Ruoxi Yang, Zhaolin Lu; Rochester Inst. of Technology, USA.* We experimentally demonstrate squeezing and guiding electromagnetic (EM) waves in a designer surface plasmonic waveguide with mode cross section down to 0.04λ-by-0.03λ.

FWU5 • 5:00 p.m.

Dipole Antenna Couplers for Subwavelength Metal-Insulator-Metal Waveguides, *Mehmet Cengiz Onbasli*[1], *Ali K. Okyay[2,3]; [1]MIT, USA, [2]Bilkent Univ., Turkey, [3]UNAM, Natl. Inst. for Materials Science and Nanotechnology, Turkey.* Near-infrared light (λ=1550 nm) was coupled into a 100-nm-core Ag/SiO2/Ag waveguide using dipole antennas. We demonstrate that using antennas, the field intensity inside the waveguide can be enhanced by changing the antenna size and location.

Highland C

FWV • Image-based Wavefront Sensing II—Continued

FWV3 • 5:00 p.m.

Phase and Pupil Amplitude Recovery for JWST Space-Optics Control, *Bruce H. Dean*[1], *Thomas P. Zielinski[1], Jeff S. Smith[1], Matthew R. Bolcar[1], David L. Aronstein[1], James R. Fienup[2]; [1]NASA Goddard Space Flight Ctr., USA, [2]Inst. of Optics, Univ. of Rochester, USA.* Phase and pupil amplitude recovery are presented for the JWST NIRCam using OMA test data. Two algorithm approaches are considered to establish error bars and to provide an optical characterization of the NIRCam.

FWV4 • 5:15 p.m.

Improved Method for Solving the Capture Range Problem in Focus-Diverse Phase Retrieval for Segmented Systems, *Alden S. Jurling*, *James R. Fienup; Univ. of Rochester, USA.* A new method of image-based wavefront sensing is introduced. It solves the capture range problem for segment tip-tilt in segmented or multi-aperture systems with focus-diverse phase retrieval.

Highland D

FWW • Nonlinear Fiber Optics—Continued

FWW3 • 4:45 p.m.

All-Fiber Tunable SWIR Parametric Source at 2.4 µm, *Faezeh Gholami*, *Jose M. Chavez Boggio, Sanja Zlatanovic, Nikola Alic, Stojan Radic; Univ. of California- San Diego, USA.* We report a record long-wavelength silica fiber optic source, capable of reaching 2.4µm, based on cascaded four-wave-mixing. The source is tunable over a spectral range of more than 130nm, with a peak power exceeding 10mW.

FWW4 • 5:00 p.m.

Supercontinuum Adjustment Via the Optical Feedback Phase, *Nicoletta Brauckmann*, *Michael Kues, Petra Groß, Carsten Fallnich; Inst. of Applied Physics, Germany.* Optical feedback in a supercontinuum generating system creates new possibilities for supercontinuum manipulation. The influence of the feedback phase on spectrum and temporal pulse train evolution is demonstrated experimentally and numerically.

Highland E

FWX • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing II—Continued

FWX3 • 4:45 p.m.

An Automated Stokesmetric Imaging Laser Radar, *Shih Tseng[1,2], Xue Liu[1], **Selim M. Shahriar**[1]; [1]Northwestern Univ., USA, [2]Digital Optics Technologies, USA.* We report an automated Stokesmetric imaging eye safe laser radar that can detect all four components of the Stokse parameters in the reflected signal, with a variable input polarization state, capable of full Mueller-metric imaging.

FWX4 • 5:00 p.m.

Optical Monitoring of Industrial Processes, *Yuri A. Chivel*[1], *I. Smurov[2], D. Zatiagin[1]; [1]Inst. of Applied Physical Problems, Belarus, [2]Ecole Natl.e d'Ingenieurs, France.* Optical systems for monitoring of some advanced technological processes have been developed. A new approach has been made in diagnostics of the spraying processes.

FWX5 • 5:15 p.m.

Mid-IR Image Acquisition Using a Standard CCD Camera, *Jeppe Seidelin Dam*, *Knud Palmelund Sørensen, Christian Pedersen, Peter Tidemand-Lichtenberg; Technical Univ. of Denmark, DTU Fotonik, Denmark.* Direct image acquisition in the 3-5 µm range is realized using a standard CCD camera and a wavelength up-converter unit. The converter unit transfers the image information to the NIR range were state-of-the-art cameras exist.

4:00 p.m.–9:00 p.m. Science Educators' Day, *Lilac Ballroom North and South, Rochester Riverside Convention Center*

7:00 p.m.–8:30 p.m. FiO Postdeadline Paper Sessions

See the Postdeadline Papers Book in your registration bag for exact times and locations.

FiO

Highland F

FWY • Optical Design for Biomedical Systems II—Continued

FWY3 • 5:00 p.m.
Enhancement of Penetration Depth for Backscattering-Mode Nonlinear-Absorption Imaging in Turbid Media, *Liping Cui*, *Wayne Knox; Inst. of Optics, Univ. of Rochester, USA.* Using only ~5 mw laser power, we imaged in backscattering mode a nonlinear absorbing object at 2.5 mm depth, which is five times the mean-free-path-length in a turbid medium, by optimizing the detection.

FWY4 • 5:15 p.m.
Parallel 3-D Confocal Imaging with Varifocal Lens, *Guoqiang Li*, *Hongbing Fang; Univ. of Missouri at St. Louis, USA.* A novel parallel 3-D confocal optical imaging system equipped with an electro-optic varifocal lens for rapid depth scanning and digital micromirror device for parallel transverse confocal scanning and hence fast image acquisition is presented.

Highland G

FWZ • General Non-linear Optics—Continued

FWZ4 • 4:45 p.m.
Electromagnetically-Induced Phase Grating, *Luis de Araujo*; *Univ. Estadual de Campinas, Brazil.* An atomic phase grating, based on the giant Kerr nonlinearity under electromagnetically induced transparency, is described. The grating is highly efficient and diffracts close to 30% of a probe beam into the first diffraction order.

FWZ5 • 5:00 p.m.
Four-Wave-Mixing Between the Upper-Excited States in a Cascade Configuration, *Utsab Khadka*, *Huaibin Zheng, Min Xiao; Univ. of Arkansas, USA.* Two-color resonant four-wave-mixing radiation is generated between the $^5D_{5/2}$ and $^5P_{3/2}$ excited states in atomic rubidium vapor using atomic coherence via Doppler-free EIT and two-photon absorption mechanisms, and studied in the frequency domain.

FWZ6 • 5:15 p.m.
All-Band Bragg Solitons and CW Eigenmodes, *Alexander E. Kaplan*; *Johns Hopkins Univ., USA.* We found an amazingly simple "all-band" intensity profile of any bandgap or Bragg solitons for arbirary parameters of the system; we also found nonlinear eigen-modes of the system propagating without energy exchange between waves.

LS

Highland H

LWJ • Quantum Enhanced Information Processing II—Continued

LWJ3 • 4:45 p.m.
EPR Entanglement Using BEC and Beam Splitter Interactions, *Peter D. Drummond*, *Qiongyi He, Margaret D. Reid; Swinburne Univ. of Technology, Australia.* We develop strategies for generating spatial EPR entanglement in a trapped double-well atomic BEC with multiple spin eigenstates. By applying appropriate entanglement criteria, we show how spatial entanglement can be generated and detected.

LWJ4 • 5:00 p.m. Invited
Progress Towards Scalable Quantum Information Processing with Trapped Ions, *David Hanneke*; *NIST, USA.* Recent advances in trapped-ion quantum information processing include the combination of a complete set of scalable techniques as well as development of scalable trap technologies, high-fidelity operations, quantum networks, and quantum simulation.

Highland J

LWK • Attosecond and Strong Field Physics II—Continued

LWK3 • 4:45 p.m. Invited
Ultrafast Dynamics in Helium Nanodroplets Studied by Femtosecond EUV Photoelectron and Ion Imaging, *Oliver Bünermann[1], Oleg Kornilov[1], Stephen R. Leone[1,2], Daniel M. Neumark[1,2],* ***Oliver Gessner***[1]; *[1]Lawrence Berkeley Natl. Lab, USA, [2]Univ. of California Berkeley, USA.* Femtosecond time resolved EUV photoelectron and ion imaging studies of pure helium nanodroplets (~2x10^6) reveal rich electronic and nuclear dynamics. Inter-band relaxation in the superfluid clusters and emission of Rydberg atoms are monitored in real-time.

LWK4 • 5:15 p.m.
Langmuir-Trojan Two-Electron Configurations in Harmonic Spherical Quantum Dots with Displaced Impurity in Magnetic Fields, *Matt K. Kalinski*; *Utah State Univ., USA.* We discover an enormous sensitivity of 3-dimensional harmonic spherical quantum dots in the static electric and magnetic fields or with the displaced impurity being loaded with two electrons per dot in the static Langmuir configuration.

Highland K

LWL • Single Molecule Approaches to Biology II—Continued

LWL3 • 5:00 p.m. Invited
Time-Resolved 3D Tracking of Individual Quantum Dot Labeled Proteins in Live Cells via Confocal Feedback, *Jim Werner*[1], *M. Lisa Phipps[1], Peter M. Goodwin[1], Patrick J. Cutler[2], Diane S. Lidke[2], Bridget S. Wilson[2]; [1]Los Alamos Natl. Lab, USA, [2]Univ. of New Mexico, USA.* We have developed a microscope system that uses active feed-back to follow individual quantum dot labeled proteins moving in three dimensions in live cells at um/s transport velocities with 100 picoseconds temporal resolution.

4:00 p.m.–9:00 p.m. Science Educators' Day, *Lilac Ballroom North and South, Rochester Riverside Convention Center*

7:00 p.m.–8:30 p.m. FiO Postdeadline Paper Sessions
See the Postdeadline Papers Book in your registration bag for exact times and locations.

7:30 a.m.–5:30 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

8:00 a.m.–10:00 a.m.
FThA • Nonlinear Optics in Micro/Nano-Optical Structures I
Jordi Martorell; Univ. Politecnica de Catalunya, Spain, Presider

FThA1 • 8:00 a.m.
Second Harmonic Generation of Airy Beams in Quadratic Nonlinear Photonic Crystals, *Ido Dolev*, *Ady Arie; Tel Aviv Univ., Israel.* We study three wave mixing processes of accelerating Airy beams in quadratic periodically poled nonlinear crystal. Experiments of second harmonic generation of 1-D and 2-D Airy beams were performed and analyzed.

FThA2 • 8:15 a.m.
Quasi-Phase-Matched Second-Harmonic Generation in High-Quarity Algaas Waveguides Pumped at 1.55 µm, *Tomonori Matsushita*, *Junya Ota, Ikuma Ohta, Takashi Kondo; Univ. of Tokyo, Japan.* We have fabricated high-quality periodically-inverted AlGaAs ridge waveguides by introducing the low temperature MBE growth process, and achieved relatively low propagation losses and highly efficient quasi-phased matched second-harmonic generation pumped at 1.55 um.

FThA3 • 8:30 a.m.
Integrated, Continuous Wave Second Harmonic Source Using AlGaAs Photonic Wire Waveguides, *David Duchesne[1], Katarzyna Rutkowska[1,2], Maite Volatier[3], Francois Legare[1], Sebastien Delprat[1], Mohamed Chaker[1], Daniele Modotto[4], Andrea Locatelli[4], Constantino De Angelis[4], Demetrios Christodoulides[5], Marc Sorel[6], Gregory J. Salamo[7], Richard Ares[3], Vincent Aimez[3],* ***Roberto Morandotti****[1]; [1]INRS-EMT, Canada, [2]Warsaw Univ. of Technology, Poland, [3]Univ. of Sherbrooke, Canada, [4]Univ. di Brescia, Italy, [5]CREOL, Univ. of Central Florida, USA, [6]Univ. of Glasgow, UK, [7]Univ. of Arkansas, USA.* Using modal phase matching, a continuous wave, wavelength tunable second harmonic source is experimentally demonstrated at telecommunication wavelengths. The sub-micron AlGaAs waveguide device offers a robust fabrication process making it ideal for integrated wavelength conversion.

8:00 a.m.–10:00 a.m.
FThB • Plasmonics
Mark L. Brongersma; Stanford Univ., USA, Presider

FThB1 • 8:00 a.m.
Extraordinary Transmission Resonance due to Near-field Effect in Periodic U-shaped Metal Nanostructures, *Srinivasan Iyer*[1], *Sergei Popov[1], Ari T. Friberg[1,2,3]; [1]Royal Inst. of Technology, Sweden, [2]Aalto Univ., Finland, [3]Univ. of Joensuu, Finland.* The far-field transmission spectrum of crescent-like metallic nanostructures on a glass substrate at normal incidence is studied numerically. The interpretation of transmission resonances arising from a periodic subwavelength U-shaped metal nanostructure is revisited.

FThB2 • 8:15 a.m.
Fabrication and Dark-Field Scattering Characterization of Deterministic Aperiodic Plasmonic Spirals, *Jacob Trevino*, *Nate Lawrence, Luca Dal Negro; Boston Univ., USA.* Plasmonic aperiodic spirals with various geometries have been designed, fabricated and characterized for the first time. These new structures could result in the engineering of novel plasmonic devices for plasmonic-enhanced, polarization-insensitive broadband photo-detectors.

FThB3 • 8:30 a.m.
Depolarization of Scattered Radiation by Diffractively Coupled Plasmonic Nano-Arrays, *Gary Walsh*, *Luca Dal Negro; Boston Univ., USA.* We experimentally investigate the role of long-range diffractive coupling in close packed plasmonic particle clusters through the depolarization of the scatted fields. We found that the quasistatic coupling regime strongly enhances depolarization.

8:00 a.m.–10:00 a.m.
FThC • Integrated Optics
Sanja Zlatanovic; Univ. of California at San Diego, USA, Presider

FThC1 • 8:00 a.m.
Three-Cornered-Hat Measurement of a Whispering Gallery Mode Stabilized Laser, *Benjamin Sprenger,* ***Harald G. L. Schwefel****, Z. H. Lu, Sergiy Svitlov, L. J. Wang; Max Planck Inst. for the Science of Light, Germany.* We present a compact stabilization technique for ring lasers using a CaF2 whispering gallery mode resonator. The resulting linewidth is measured to be 13 kHz using the self-heterodyne technique and the three-cornered hat method.

FThC2 • 8:15 a.m.
Design of High Efficiency Elliptical Reflector for Strongly Guiding Waveguide, *Zhenyu Hou*, *Xiangyu Li, Yingyan Huang, Seng-Tiong Ho; Northwestern Univ., USA.* Elliptical reflectors used as on-chip lens are studied. Beam waist positions of reflected beams are estimated via Near-Field and Far-Field methods. FDTD simulation shows that this methodology predicts the beam waist position and mode accurately.

FThC3 • 8:30 a.m.
A polarization Independent Hybrid Coupler for Silicon on Insulator Waveguides, *Muhammad Z. Alam*, *J. S. Aitchision, Mohammad Mojahedi; Univ. of Toronto, Canada.* The polarization dependence of a hybrid waveguide consisting of a high index medium adjacent to a metal with a low index spacer is described. We present the design of a polarization independent hybrid waveguide coupler.

8:00 a.m.–10:00 a.m.
FThD • Novel Measurement Techniques
Olivier Albert; LOA, France, Presider
Jie Qiao; Lab for Laser Energetics, Univ. of Rochester, USA, Presider

FThD1 • 8:00 a.m.
Single-Beam Multiphoton Sonogram Technique for Dispersion Measurement and Pulse Compression, *Dmitry Pestov*, *Vadim V. Lozovoy, Marcos Dantus; Michigan State Univ., USA.* We demonstrate all-shaper-based sonogram technique for spectrometer-free measurement and compensation of laser pulse phase distortions. Phase-and-amplitude shaping is used to both generate an internal reference and scan the time delay between isolated spectral bands.

FThD2 • 8:15 a.m.
Two-Beam Spider for Dual-Pulse Single-Shot Characterization, *Doug French[1], Christophe Dorrer[2],* ***Igor Jovanovic****[1]; [1]Purdue Univ., USA, [2]Univ. of Rochester, USA.* A novel ultrashort pulse characterization device is presented, optimized for simultaneous measurement of two pulses. The device is particularly useful for experimental characterization at low repetition rates, with high laser fluctuations.

FThD3 • 8:30 a.m.
Highly Simplified Device for Measuring the Intensity and Phase of Picosecond Pulses, *Jacob Cohen*[1], *Dongjoo Lee[2], Vikrant Chauhan[1], Rick Trebino[1]; [1]Georgia Tech, USA, [2]Swamp Optics, USA.* We demonstrate an extremely simple high-spectral-resolution frequency-resolved-optical-gating (GRENOUILLE) device for measuring relatively long pulses. We report complete intensity-and-phase measurements of pulses up to 15ps long with time-bandwidth products over 100.

8:00 a.m.–10:00 a.m.
FThE • Lasers for Fusion and Fast Ignition
Igor Jovanovic; Purdue Univ., USA, Presider
Wim Leemans; Lawrence Berkeley Natl. Lab, USA, Presider

FThE1 • 8:00 a.m. Invited
Progress in Experiments for the National Ignition Campaign, *Brian MacGowan*; *Lawrence Livermore Natl. Lab, USA.* An update will be provided on progress of experiments that will lead to ignition and fusion gain in capsules containing cryogenic DT, compressed by the high power National Ignition Facility laser.

FThE2 • 8:30 a.m. Invited
Inertial Confinement Fusion Research at the Laboratory for Laser Energetics, *David Meyerhofer*; *Lab for Laser Energetics, Univ. of Rochester, USA.* Inertial confinement fusion research using the OMEGA Laser has demonstrated the highest deuterium-tritium areal density ever measured, ~0.3 g/cm^2, and a Lawson's performance parameter, $P\tau$, comparable to that obtained on the Joint European Torus.

Highland F | Highland G | Highland H | Highland J | Highland K

FiO | **LS**

7:30 a.m.–5:30 p.m. Registration, *Galleria, Rochester Riverside Convention Center*

Highland F

8:00 a.m.–10:00 a.m.
FThF • Transformation Optics and Cloaking with Metamaterials
Xiang Zhang; Univ. of California at Berkeley, USA, Presider

FThF1 • 8:00 a.m. **Invited**
Transforming Integrated Optics, *Jensen Li*[1], *Thomas Zentgraf[2], Jason Valentine[2], Nicholas Tapia[2], Xiang Zhang[2]; [1]City Universtiy of Hong Kong, China, [2]Univ. of California, Berkeley, USA*. By extending the transformation optics scheme and the materials developed for optical cloaking, we demonstrate integration of multiple functions into a single transformation optical device. It can be useful in designing compact integrated optical systems.

FThF2 • 8:30 a.m. **Invited**
Taming the Fields and Waves with Extreme Metamaterials, *Nader Engheta*; *Univ. of Pennsylvania, USA*. Metamaterials with extreme parameter values can manipulate electromagnetic fields and waves at various length scales, providing a platform for metatronic circuits, optical wires, plasmonic cloaking, enhanced emission at extended regions, and supercoupling in narrow channels

Highland G

8:00 a.m.–10:00 a.m.
FThG • General Quantum Electronics I
Presider to Be Announced

FThG1 • 8:00 a.m.
Two-Color Fiber Chirped Pulse Amplifier for Mid-Infrared Generation, *Mojtaba Hajialamdari*, *Alaa M. Al-Kadry, Donna Strickland; Univ. of Waterloo, Canada.* We have demonstrated the generation of 200 µW of power at ~18 µm by mixing the output from a two-color Yb:fiber system. The modelled optimal amplifier fiber lengths are in reasonable agreement with experimental results.

FThG2 • 8:15 a.m.
Femtosecond Laser Pulse Shaping Improves Self-Phase Modulation Measurements in Scattering Media, *Prathyush Samineni*, *Zachary Perret, Warren S. Warren, Martin C. Fischer; Duke Univ., USA.* We demonstrate that our recently developed spectral re-shaping technique improves the accuracy and precision of self-phase modulation measurements in scattering media over the conventional Z-scan method.

FThG3 • 8:30 a.m.
Diode Edge-Pumped, Composite Ceramic Nd:YAG/Sm:YAG Microchip Lasers, *Masaki Tsunekane*, *Takunori Taira; Inst. for Molecular Science, Japan.* Diode edge-pumped, composite microchip lasers consisting of a ceramic Nd:YAG core and a ceramic Sm:YAG pump waveguide were demonstrated. A passively Q-switched, output energy of 1.76mJ with a pulse width of 1.5ns was obtained.

Highland H

8:00 a.m.–9:45 a.m.
LThA • Chemical Dynamics II: Multi-Dimensional Ultrafast Spectroscopy
David McCamant; Univ. of Rochester, USA, Presider

LThA1 • 8:00 a.m. **Invited**
Two Dimensional Ultraviolet Spectroscopy of Proteins and Amyloid Fibrils, *Jun Jiang*, *Shaul Mukamel; Univ. of California at Irvine, USA*. Two dimensional ultraviolet (2DUV) spectra of protein backbone and side chains are simulated. The signals provide new insights into the structure and dynamics of proteins and Amyloid Fibrils.

LThA2 • 8:30 a.m. **Invited**
Two-Dimensional Electronic Spectroscopy of the Photosystem II Reaction Center, *J. A. Myers, K. L. M. Lewis, F. Fuller, P. F. Tekavec,* ***J. P. Ogilvie****; Univ. of Michigan, USA*. We present two-dimensional electronic spectroscopy studies on the dynamics of D1-D2 cyt.b559 reaction center complexes from plant photosystem II at 77 K. We compare our two-dimensional spectra with current exciton models.

Highland J

8:00 a.m.–10:00 a.m.
LThB • Frontiers in Ultracold Molecules II
David DeMille; Yale Univ., USA, Presider

LThB1 • 8:00 a.m. **Invited**
Manipulation of Ultracold Chemistry, *John L. Bohn*; *JILA, NIST, Univ. of Colorado, USA*. I will discuss the molecular physics underlying recent experimental observations of, and control over, chemical reactions at JILA. For these polar species, possible handles for control include the quantum statistics of the molecules, the temperature, applied electric fields, and confinement in reduced-dimensional geometry. These aspects of control are described remarkably well by simple theoretical ideas.

LThB2 • 8:30 a.m. **Invited**
Implementation of a New Method to Produce Ultracold Polar Molecular Ions, *Wade Rellergert*, *Scott Sullivan, Kuang Chen, Steven Schowalter, Eric R. Huson; Univ. of California at Los Angeles, USA*. We present recent data from our experimental effort to produce ultracold, internal ground-state polar molecular ions via sympathetic cooling with a Ca MOT.

Highland K

8:00 a.m.–9:45 a.m.
LThC • Nanophotonics, Photonic Crystals and Structural Slow Light I
Antonio Badolato; Univ. of Rochester, USA, Presider

LThC1 • 8:00 a.m. **Invited**
Spontaneous and Stimulated Emission into Surface Plasmons, *Pierre Berini*, *Israel De Leon; Univ. of Ottawa, Canada.* Spontaneous and stimulated emission into long-range surface plasmons is discussed. Of interest is the interaction of a dipolar gain medium with plasmons on thin metal stripes, where amplification and suppressed spontaneous emission were simultaneously observed.

LThC2 • 8:30 a.m. **Invited**
Enhancing Light-Matter Interactions in Nanophotonic Structures by Slow Light, *Jesper Moerk*, *Torben R. Nielsen; Technical Univ. of Denmark, Denmark.* We discuss the conditions under which photonic crystal dispersion can be used to enhance light-matter interactions, e.g. by increasing the absorption sensitivity or the degree of light-speed control obtained via electromagnetically induced transparency.

FiO

Highland A

FThA • Nonlinear Optics in Micro/Nano-Optical Structures I—Continued

FThA4 • 8:45 a.m. Invited

Nonlinear Optical Processes in Subwavelength Optical Waveguides—Revised Fundamentals and Implications, *Shahraam Afshar*, *Wen Qi Zhang, Tanya M. Monro; Univ. of Adelaide, Australia.* Subwavelength-waveguides have opened a new era in the nonlinear waveguides field. The fundamental theory of nonlinear processes in these waveguides, including Kerr, Raman, and nonlinear polarization is presented. Experimental results and possible applications are discussed.

FThA5 • 9:15 a.m.

Observation of Forward Stimulated Brillouin Scattering in a Standard Highly-Nonlinear Fiber, *Yunhui Zhu*[1], *Jing Wang[1,2], Rui Zhang[1], Daniel Gauthier[1]; [1]Physics Dept., Duke Univ., USA, [2]Inst. of Lightwave Technology, Key Lab of All Optical Network & Advanced Telecommunication Network of EMC,Beijing Jiaotong Univ., China.* We observe forward stimulated Brillouin scattering (FSBS) in a standard highly-nonlinear optical fiber a numerous acoustic resonance frequencies that occur between ~30 MHz to beyond the detection limit of 1.5 GHz.

Highland B

FThB • Plasmonics—Continued

FThB4 • 8:45 a.m.

Double Nanoholes in a Metal Film as Refractive Index Sensors, *Srinivasan Iyer*[1], *Sergei Popov[1], Ari T. Friberg[1,2,3]; [1]Royal Inst. of Technology, Sweden, [2]Aalto Univ., Finland, [3]Univ. of Joensuu, Finland.* The transmission of light through a thin Au film with subwavelength double nanoholes is modeled using vectorial three-dimensional finite element method. The performance of such perforated films as a potential refractive index sensor is discussed.

FThB5 • 9:00 a.m.

Plasmonic Dimers as Planar Chiral Meta-Atoms, *Sergei V. Zhukovsky*[1,2], *Christian Kremers[2], Dmitry N. Chigrin[2]; [1]Univ. of Toronto, Canada, [2]IHCT, Univ. of Wuppertal, Germany.* Electromagnetic response of planar metallic nanorod dimers is determined analytically and numerically. Asymmetric dimers are shown to act as “atoms” in planar chiral metamaterials. Relations between the dimer’s geometry and its chiral properties are established.

FThB6 • 9:15 a.m.

Plasmonic IR Emitters on Flexible Polyimide Substrates, *Ismail E. Araci*[1], *Veysi Demir[1], Alexandr Kropachev[2], Terje Skotheim[2], Robert A. Norwood[1], Nasser Peyghambarian[1]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]Intex Corp, USA.* We have fabricated plasmonic infrared (IR) emitters on flexible polyimide membranes. The low heat conductivity and low thermal mass of thin free standing substrates enables IR emitters with low power consumption and fast switching time.

Highland C

FThC • Integrated Optics—Continued

FThC4 • 8:45 a.m.

Fabrication and Characterization of On-chip Chalcogenide Nano-waveguide Devices, *Qiming Zhang, Xiang Wu, ming Li,* ***Liying Liu****, Lei Xu; Fudan Univ., China.* Buried As_2S_3 nano-waveguides with size down to 200 nm on silicon wafer are prepared. The fabricated waveguide and micro-ring cavity show excellent optical properties. Optical nonlinearity of the nano-waveguides is characterized as well.

FThC5 • 9:00 a.m.

Non-Adiabatically Tapered Multimode Interference Coupler for High-Power Single-Mode Semiconductor Lasers, *Jordan P. Leidner*, *John R. Marciante; Univ. of Rochester, USA.* A 1 x 8 tapered multimode interference coupler has been designed and simulated for use in a self-organizing semiconductor laser-array system. The taper allows for a broad area, single-mode output with 98% one-way efficiency.

FThC6 • 9:15 a.m.

Guided Mode Resonances in Grating Superstructures, *Michael J. Theisen*[1], *Jason D. Neiser[2], Thomas G. Brown[1]; [1]Inst. of Optics, USA, [2]Ctr. College, USA.* We analyze and test a guided-mode-resonance filter fabricated with periodic defects. The guided mode excitation mediates a resonant transfer of energy between the zeroth-order specular reflection and the first-order diffracted order of the defect structure.

Highland D

FThD • Novel Measurement Techniques—Continued

FThD4 • 8:45 a.m.

Near Quantum Limited Optical Phase Measurements on a Dark Fringe, *David J. Starling*, *P. Ben Dixon, Nathan S. Williams, Andrew N. Jordan, John C. Howell; Univ. of Rochester, USA.* We describe an optical experiment that makes use of weak value inspired amplification. We show that the signal-to-noise ratio of a phase measurement using this method rivals modern techniques, even on a dark fringe.

FThD5 • 9:00 a.m.

The Influence of the Degree of Cross-Polarization on the Hanbury Brown-Twiss Effect, *Asma Al-Qasimi*[1], *Mayukh Lahiri[2], David Kuebel[2,3], Daniel F. V. James[1], Emil Wolf[2,4]; [1]Dept. of Physics, Univ. of Toronto, Canada, [2]Dept. of Physics and Astronomy, Univ. of Rochester, USA, [3]Dept. of Physics, St. John Fisher College, USA, [4]Inst. of Optics, Univ. of Rochester, USA.* We show by example that correlations between intensity fluctuations at two detectors generated by two beams may be different, even if the beams have the same degree of coherence and the same degree of polarization.

FThD6 • 9:15 a.m.

High Spatial Resolution and Large Field Intensity by a Set of Two Modified Zone Plates, *Zhan-Yu Liu, Yao-Jen Tsai,* ***Jia-Han Li****, Kuen-Yu Tsai; Natl. Taiwan Univ., Taiwan.* The focal properties of a set of two modified zone plates are studied by Fresnel-Kirchhoff diffraction formula, and it can give high spatial resolution and large field intensity for extreme ultraviolet and soft X-ray applications.

Highland E

FThE • Lasers for Fusion and Fast Ignition—Continued

FThE3 • 9:00 a.m. Invited

Fast Ignition Integrated Experiments Using Gekko-XII and LFEX Lasers, *Hiroyuki Shiraga*; *Inst. of Laser Engineering, Osaka Univ., Japan.* Implosion and heating experiments of Fast Ignition (FI) targets for FIREX-1 project have been performed with Gekko-XII and LFEX lasers at Osaka University. Enhancement of the neutron generation due to fast heating havs been achieved.

FiO

Highland F

FThF • Transformation Optics and Cloaking with Metamaterials—Continued

FThF3 • 9:00 a.m. Invited

Active and Tunable Metamaterials, *Vladimir M. Shalaev*, *Shumin Xiao, Vladimir P. Drachev, X. Ni, Alexander V. Kildishev; Purdue Univ., USA.* Tunable and active metamaterials can enable a new powerful paradigm of engineering space for light with transformation optics, leading to a family of new applications ranging from a planar hyperlens to optical black hole.

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

Highland G

FThG • General Quantum Electronics I—Continued

FThG4 • 8:45 a.m.

New Time Reversal Parities and Optimal Control of Dielectrics for Free Energy Manipulation, *Scott A. Glasgow*, *Chris Verhaaren, John Corson; Brigham Young Univ., USA.* A dielectric's ultra-wide band *time-reversal spectrum* dictates optimal control of "in-and-out" real-time energy flows in dispersive media.

FThG5 • 9:00 a.m.

The THz Frequency Hall Conductivity of a High-Mobility Two-Dimensional Electron Gas, *Jeremy A. Curtis*[1], *Jon D. Moore[2], Takahisa Tokumoto[3], Judy G. Cherian[3], Xiangfeng Wang[4], Junichiro Kono[4], Alexey Belyanin[5], Stephan McGill[3], David Hilton[1]; [1]Univ. of Alabama-Birmingham, USA, [2]Hendrix College, USA, [3]Natl. High Magnetic Field Lab, USA, [4]Rice Univ., USA, [5]Texas A&M Univ., USA.* We use ultrafast terahertz spectroscopy to study the magnetoconductivity tensor of a 2DEG as a function of temperature (0.4 K-100 K). The magnetoconductivity line width decreases monotonically with temperature.

FThG6 • 9:15 a.m.

Nature of Spin Hall Effect of Light, *Chun-Fang Li*; *Dept. of Physics, Shanghai Univ., China.* Spin Hall effect of light is shown to result from the polarization dependence of transverse orbital angular momentum for light beams that have global polarization, where the previously observed characteristic vector plays an essential role.

LS

Highland H

LThA • Chemical Dynamics II: Multi-Dimensional Ultrafast Spectroscopy—Continued

LThA3 • 9:00 a.m.

Resonance Lineshapes In Two-dimensional Fourier Transform Spectroscopy, *Mark E. Siemens*, *Galan Moody, Hebin Li, Alan D. Bristow, Steven T. Cundiff; JILA, USA.* We derive analytical forms for resonance lineshapes in two-dimensional Fourier transform spectroscopy. Applying the projection-slice theorem of 2D Fourier transforms provides diagonal and cross-diagonal lineshapes in the 2D frequency data for arbitrary inhomogeneity.

LThA4 • 9:15 a.m.

Structure and Energy Transport in Membrane-Bound Porphyrin Aggregates by Fluorescence Detected 2-D Electronic Coherence Spectroscopy, *Andrew Marcus*[1], *Geoffrey A. Lott[1], James K. Utterback[1], Alejandro Perdomo-Ortiz[2], Alan Aspuru-Guzik[2]; [1]Oregon Ctr. for Optics, Univ. of Oregon, USA, [2]Harvard Univ., USA.* We studied the electronic coupling and excited state dynamics of magnesium meso tetraphenylporphyrin dimers, which self-assemble in room temperature lipid bilayer vesicles. This was accomplished using fluorescence detected two-dimensional electronic coherence spectroscopy.

Highland J

LThB • Frontiers in Ultracold Molecules II—Continued

LThB3 • 9:00 a.m.

Coherent Control Of Long Range Rydberg Molecules, *Tilman Pfau*[1], *V. Bendkowsky[1], B. Butscher[1], J. Nipper[1], J. Balewski[1], J. p. Shaffer[1,2], R. Löw[1]; [1]Univ. Stuttgart, Germany, [2]Homer L. Dodge Dpt. of Physics and Astronomy, The Univ. of Oklahoma, USA.*Molecular spectra of ultralong-range Rydberg molecules are compared to theoretical models. Coherent superposition states between free and bound states are studied by an echo and Ramsey methods. Coherence times in the microsecond regime are found.

LThB4 • 9:15 a.m.

Ultracold Cs Rydberg Molecules, *James Shaffer*; *University of Oklahoma, USA.* Cold Rydberg gases are interesting because the Rydberg atoms can interact at distances of 3-10 microns. We describe Rydberg atom interactions that lead to molecule formation where the internuclear separations are 3-7 microns.

Highland K

LThC • Nanophotonics, Photonic Crystals and Structural Slow Light I—Continued

LThC3 • 9:00 a.m.

Observation of Evanescent Modes in Slow Light Photonic Crystal Waveguides, *Thomas P. White*[1], *Sangwoo Ha[1], Marko Spasenovic[2], Andrey A. Sukhorukov[1], Kobus Kuipers[2], Martijn de Sterke[3], Thomas F. Krauss[4], Yuri S. Kivshar[1]; [1]Australian Natl. Univ., Australia, [2]FOM Inst. for Atomic and Molecular Physics (AMOLF), Netherlands, [3]Univ. of Sydney, Australia, [4]Univ. of St Andrews, UK.* We report the measurement of slowly propagating and weakly evanescent modes close to dispersion inflection points of photonic crystal waveguides. Evanescent modes play a key role in coupling light to slow modes of photonic crystals

LThC4 • 9:15 a.m.

Superluminal and Slow Light Propagation in a Nested Fiber Ring Resonator, *Yundong Zhang*, *Jinfang Wang, Jing Zhang, Yuanxue Cai, Xuenan Zhang, Ping Yuan; Harbin Inst. of Technology, China.* We observe both superluminal and slow light propagation simultaneously in a nested fiber ring resonator. The two outputs of the resonator exhibit different absorption characteristics that produce opposite dispersion performance.

FiO

Highland A

FThA • Nonlinear Optics in Micro/Nano-Optical Structures I—Continued

FThA6 • 9:30 a.m.
High Threshold Fiber Fuse Effect in a Hollow Optical Fiber, *Woosung Ha*, *Yoonseob Jeong, Kyunghwan Oh; Yonsei Univ., Korea, Republic of.* We report fiber fuse effect in a hollow optical fiber for the first time, where tadpole-like voids were observed at much higher threshold power in contrast to bullet-like voids in conventional optical fibers.

FThA7 • 9:45 a.m.
Developing Whispering Gallery Mode Resonators for Quantum Optics Applications, *Matt T. Simons*, *Eugeniy E. Mikhailov, Irina Novikova; College of William & Mary, USA.* We have achieved non-critically phase matched frequency conversion at 1064nm in a polished $LiNbO_3$ whispering gallery mode resonator disk. This is the first step towards a low-threshold, narrow-band non-classical light source.

Highland B

FThB • Plasmonics—Continued

FThB7 • 9:30 a.m.
On-Chip Focusing of Light by Metallic Nanotip, *Boris Desiatov*, *Ilya Goykhman, Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* We investigate numerically and experimentally the on-chip nanoscale focusing of surface plasmon polaritons (SPPs) in metallic nanotip coupled to the silicon waveguide. Strong field enhancement is observed at the apex of the tip.

FThB8 • 9:45 a.m.
Frequency Conversion of Surface Plasmon-Polariton in a Metal-Nonlinear Dielectric Boundary, *Michael Volodarsky*[1], *Ido Dolev[1], Yonatan Sivan[2], Tal Ellenbogen[3], Ady Arie[1]; [1]Tel Aviv Univ., Israel, [2]Imperial College London, UK, [3]Harvard Univ., USA.* Frequency doubling of a surface plasmon-polariton in the metal-nonlinear dielectric boundary is analyzed. Phase matching can be achieved either by varying the metal thickness or periodically modulating the nonlinear coefficient of the crystal.

Highland C

FThC • Integrated Optics—Continued

FThC7 • 9:30 a.m.
Light Scattering, Field Localization and Local Density of States in Co-Axial Plasmonic Nanowires, *Nate Lawrence*, *Luca Dal Negro; Boston Univ., USA.* We systematically investigate the near-field enhancement, scattering and LDOS in concentric circular MIM structures using analytical scattering theory. We find unique confined plasmon modes and large, three orders of magnitude, enhancement of LDOS.

FThC8 • 9:45 a.m.
Deep-Subwavelength Coplanar Plasmonic Laser Based an an Edge-Coupled Hybrid Plasmon Waveguide, *Yusheng Bian[1], **Zheng Zheng**[1], Ya Liu[1], Jinsong Zhu[2], Tao Zhou[3]; [1]Beihang Univ., China, [2]Natl. Ctr. for Nanoscience and Technology of China, China, [3]New Jersey Inst. of Technology, USA.* A novel coplanar plasmonic laser based on an edge-coupled hybrid plasmon waveguide is proposed. The easy-to-fabricate structure could enable deep-subwavelength lasing with low pump thresholds and be readily integrated with other plasmonic structures.

Highland D

FThD • Novel Measurement Techniques—Continued

FThD7 • 9:30 a.m.
Measuring Ultrashort Pulses with Time-Bandwidth Products Exceeding 65,000 Using Multiple-Delay Crossed-Beam Spectral Interferometry, *Jacob Cohen*, *Pamela Bowlan, Vikrant Chauhan, Rick Trebino; Georgia Tech, USA.* We introduce a new interferometric pulse-measurement technique, MUD TADPOLE, for measuring the full temporal field of very complex arbitrary optical waveforms and, using it, measure waveforms with ~40 fs temporal resolution and time-bandwidth products >250,000.

FThD8 • 9:45 a.m.
Retrieving Two Pulses Simultaneously and Robustly Using Double-Blind FROG, *Antonio Consoli*[1], *Vikrant Chauhan[2], Jacob Cohen[2], Lina Xu[2], Peter Vaughan[2], Francisco J. Lopéz-Hernández[1], Rick Trebino[2]; [1]Univ. Politécnica de Madrid, Spain, [2]Georgia Tech, USA.* We demonstrate theoretically and experimentally that two arbitrary unknown pulses can be reliably retrieved in a novel single-shot polarization-gating "double-blind" FROG set up.

Highland E

FThE • Lasers for Fusion and Fast Ignition—Continued

FThE4 • 9:30 a.m. Invited
Status of the HiPER Project, *Mike Dunne*; *Rutherford Appleton Lab, UK.* Abstract not available.

10:00 a.m.–10:30 a.m. Coffee Break, *Highland Ballroom Foyer Rochester Riverside Convention Center*

NOTES

Highland F | Highland G | Highland H | Highland J | Highland K

FiO

LS

FThF • Transformation Optics and Cloaking with Metamaterials—Continued

FThF4 • 9:30 a.m. Invited

Molding the Flow of Light with Artificial Optical Materials, *Dentcho A. Genov*[1], *Shuang Zhang*[2], *Xiang Zhang*[2]; *[1]Louisiana Tech Univ., USA, [2]NSF, NSEC, Univ. of California at Berkeley, USA.* We propose to link the fields of optical metamaterials and celestial mechanics, opening the way to investigate light phenomena reminiscent of orbital motion, strange attractors and chaos, in a controlled laboratory environment.

FThG • General Quantum Electronics I—Continued

FThG7 • 9:30 a.m.

Modes in Random Media, *Azriel Z. Genack*, *Jing Wang; CUNY Queens College, USA.* The transmitted speckle pattern of localized microwave radiation is decomposed into the underlying modes. Strong correlation is found between neighboring modes.

FThG8 • 9:45 a.m.

Phase Locking Multiple Fibers by a Talbot Mirror Fiber Device, *Renjie Zhou*[1,2], *Qiwen Zhan*[1], *Peter E. Powers*[1], *Baldemar Ibarra-Escamilla*[2], ***Joseph W. Haus***[1]; *[1]Univ. of Dayton, USA, [2]Inst. Nacional de Astrofisica, Optica y Electronica, Mexico.* We numerically demonstrate that periodically placed fibers can be phased together using a large mode area fiber element. The LMA fiber element is a Talbot mirror that images the reflected beams at the fibers' input.

LThB • Frontiers in Ultracold Molecules II—Continued

LThB5 • 9:30 a.m. Invited

Sympathetic Heating Spectroscopy: Probing Molecular Ions with Laser-Cooled Atomic Ions, *Ken Brown*; *Georgia Tech, USA.* Sympathetic heating spectroscopy measures atomic and molecular ion spectra by observing the heating of a laser-cooled control ion. Limits of the method are tested using two isotopes of calcium. Applications for molecular ions are discussed.

LThC • Nanophotonics, Photonic Crystals and Structural Slow Light I—Continued

LThC5 • 9:30 a.m.

Peculiar Discrete Diffraction Characteristic of Two-Dimensional Backbone Lattice, *Yiling Qi*, *Guoquan Zhang; MOE Key Lab of Weak Light Nonlinear Photonics, Nankai Univ., China.* A peculiar discrete diffraction pattern in two-dimensional backbone lattice is illustrated through numerical simulations when the light is injected into a low-index site of the backbone lattice. The corresponding formation mechanism is also discussed.

10:00 a.m.–10:30 a.m. Coffee Break, *Highland Ballroom Foyer Rochester Riverside Convention Center*

NOTES

10:30 a.m.–12:00 p.m.
FThH • Nonlinear Optics in Micro/Nano-Optical Structures II
Presider to Be Announced

FThH1 • 10:30 a.m. Invited

Nonlinear Silicon Photonics, *Michal Lipson*; *Cornell Univ., USA*. Abstract not available.

FThH2 • 11:00 a.m.

Controlling the Acceleration Direction and Peak Location of Airy Beams by Nonlinear Optical Process, *Ido Dolev*, *Tal Ellenbogen, Ady Arie; Tel Aviv Univ., Israel.* Nonlinear generation of an accelerating Airy beam in an asymmetrically poled nonlinear photonic crystal enables to all-optically control the sign and magnitude of the acceleration direction and to change the location of its peak intensity.

10:30 a.m.–12:00 p.m.
FThI • Optical Signal Processing Device
Presider to Be Announced

FThI1 • 10:30 a.m.

Ultra-Fast On-Chip All-Optical Integration, *Marcello Ferrera[1], Yongwoo Park[1], Luca Razzari[1,2], Brent E. Little[3], Sai T. Chu[3], **Roberto Morandotti**[1], Dave J. Moss[4], Jose Azana[1]; [1]INRS-EMT, Canada, [2]Dept. di Elettronica, Univ. di Pavia, Italy, [3]Infinera Ltd, USA, [4]CUDOS, School of Physics, Australia.* We report about ultra-high speed temporal-integration of arbitrary optical complex waveforms by using an integrated and fully CMOS compatible micro-ring resonator. The device offers an unprecedented time bandwidth product approaching the remarkable value of 100.

FThI2 • 10:45 a.m.

16-Channel On-Chip Programmable Radio Frequency Arbitrary Waveform Generation, *Li Fan*, *Hao Shen, Leo T. Varghese, Minghao Qi; Purdue Univ., USA.* A 16-channel microring based spectral shaper for on-chip radio frequency arbitrary waveform generation (RFAWG) is designed, fabricated and demonstrated. Sixteen resonators with tunable heaters are cascaded to generate various RF waveforms like chirping and pi-phase-shift.

FThI3 • 11:00 a.m.

Doubling the Spectral Efficiency of Photonic Time-Stretch Analog-to-Digital Converter by Polarization Multiplexing, *Ali Fard*, *Brandon Buckley, Bahram Jalali; Univ. of California, Los Angeles, USA.* Spectral efficiency improvement via polarization multiplexing in photonic time-stretch analog-to-digital converter (TSADC) is proposed and experimentally demonstrated. This technique improves the time-bandwidth product and reduces the demand on optical bandwidth.

10:30 a.m.–12:00 p.m.
FThJ • Photonic Crystal
Michelle L. Povinelli; Univ. of Southern California, USA, Presider

FThJ1 • 10:30 a.m.

Transport, Curvature, and Geometric Potential in Photonic Topological Crystals, *Alexander Szameit*[1], *Felix Dreisow[2], Matthias Heinrich[2], Robert Keil[2], Stefan Nolte[2], Andreas Tünnermann[2], Stefano Longhi[3]; [1]Solid State Inst., Israel, [2]Inst. of Applied Physics, Germany, [3]Dept. di Fisica, Politecnico di Milano, Italy.* We report on the first experimental realization of topological crystals, solely formed by a geometric potential of an undulated slab waveguide. Transport mechanisms like Bloch oscillations and Zener tunneling are demonstrated.

FThJ2 • 10:45 a.m.

Engineering Cavity Modes in Photonic Crystal Double-Heterostructures, *Sahand Mahmoodian[1], Kokou B. Dossou[2], **Christopher G. Poulton**[2], Ross C. McPhedran[1], Lindsay C. Botten[2], C. Martijn de Sterke[1]; [1]CUDOS, School of Physics, Univ. of Sydney, Australia, [2]CUDOS, Dept. of Mathematical Sciences, Univ. of Technology Sydney, Australia.* We present a new method for designing mode fields of 3D photonic crystal heterostructure cavities. The method is several orders of magnitude faster than existing numerical methods and enables rapid design of heterostructure cavity resonances.

FThJ3 • 11:00 a.m.

Coupled Photonic Crystal Waveguide in Hexagonal Lattices, *J. Scott Brownless[1], Sahand Mahmoodian[1], Kokou B. Dossou[2], Felix J. Lawrence[1], Lindsay C. Botten[2], **C. Martijn de Sterke**[1]; [1]CUDOS, IPOS, School of Physics, Univ. of Sydney, Australia, [2]CUDOS, School of Mathematical Sciences, Univ. of Technology, Australia.* We investigate dispersion curves of coupled waveguides in hexagonal lattices. We find that their coupling coefficients change magnitude and sign along the BZ and that the modes here are no longer odd and even modes.

10:30 a.m.–12:00 p.m.
FThK • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing III
Jie Qiao; Lab for Laser Energetics, Univ. of Rochester, USA, Presider

FThK1 • 10:30 a.m. Invited

Spatial Light Interference Microscopy (SLIM), *Zhuo Wang, Huafeng Ding, **Gabriel Popescu**; Univ. of Illinois at Urbana-Champaign, USA.* We present SLIM, a new optical method measuring optical pathlength changes of 0.3 nm spatially and 0.03nm temporally. SLIM combines two classic ideas in light imaging: Zernike's phase contrast microscopyand Gabor's holography.

FThK2 • 11:00 a.m.

Improved Aperture Synthesis for Digital Holography, *Abbie E. Tippie*, *Sapna A. Shroff, James R. Fienup; Univ. of Rochester, USA.* We demonstrated aperture synthesis for digital holography in the laboratory by mosaicking an array of single frames. We developed improved focus correction, frame-to-frame sub-pixel registration, and piston phase-error correction.

10:30 a.m.–12:00 p.m.
FThL • Nonlinearities and Gain in Plasmonics and Metamaterials III
Nikolay Zheludev; Univ. of Southampton, UK, Presider

FThL1 • 10:30 a.m. Invited

Active Plasmonic Metamaterials, *M. A. Noginov*; *Norfolk State Univ., USA.* Optical loss and a need for active control are among major challenges of nanoplasmonic systems and plasmonic metamaterials. We will review recent efforts aimed at the reduction of loss and stimulated emission in nanoplasmonic systems.

FThL2 • 11:00 a.m.

FDTD Simulation of Semiconductor Plasmonic Nano-Lasers at 1550nm Based on Realistic Semiconductor Gain Model: Square Resonators and Waveguide Coupled Rings, *Xi Chen*[1], *Bipin Bhola[2], Yingyan Huang[3], Seng-Tiong Ho[1]; [1]Northwestern Univ., USA, [2]Data Storage Inst., Agency for Science, Technology, and Res. (A*STAR), Singapore, [3]OptoNet Inc, USA.* Two new nano-scale plasmonic-semiconductor laser resonator designs are simulated by multi-level multi-electron FDTD model, including a "square resonator" and a "waveguide coupled ring". Both achieved stable lasing at 1550nm. Low temperature operation is also explored.

FiO

Highland F

10:30 a.m.–11:45 a.m.
FThM • Sensing in Higher Dimensions—Theory and Hardware for Computational Imaging II
Presider to Be Announced

FThM1 • 10:30 a.m. Invited
Spatio-Temporal Processing Methods for Mitigating Bandwidth Issues Associated with Advanced Infrared Sensors, *Dean Scribner*; *Northrop Grumman Corp., USA*. Abstract not available.

FThM2 • 11:00 a.m.
Compressive Sensing Approach for Reducing the Number of Exposures in Multiple View Projection Holography, *Yair Rivenson*, *Adrian Stern, Joseph Rosen; Ben-Gurion Univ. of the Negev, Israel.* Compressive imaging enables the reconstruction of images from far fewer number of measurements predicted by classical sampling theorem. Here we demonstrate how this approach can dramatically reduce the number of exposures in multi-view projection holography.

Highland G

10:30 a.m.–12:00 p.m.
FThN • General Quantum Electronics II
Jensen Li; City Universtiy of Hong Kong, China, Presider

FThN1 • 10:30 a.m.
The Effects of Spatial Coherence on the Angular Distribution of Radiant Intensity Generated by Scattering on a Sphere, *Taco D. Visser*[1], *Thomas van Dijk[2], Dave G. Fischer[3], Emil Wolf[4]; [1]Delft Univ. of Technology, Netherlands, [2]Free Univ., Netherlands, [3]NASA, USA, [4]Univ. of Rochester, USA.* We study the effects of spatial coherence of the incident beam on the scattering by a sphere. Strong modifications of the radiant intensity are predicted.

FThN2 • 10:45 a.m.
Diffraction Free Stokes Distributions in a Full Poincare Beam, *Amber M. Beckley*, *Miguel A. Alonso, Thomas G. Brown; Univ. of Rochester, USA.* A full Poincare beam is one that comprises all possible states on the surface of the Poincare sphere. We demonstrate a beam whose Stokes parameters remain stationary under propagation.

FThN3 • 11:00 a.m.
Mie Scattering of Arbitrary Focused Fields, *Nicole J. Moore*[1], *Miguel A. Alonso[2,3]; [1]Beloit College, USA, [2]Univ. of Rochester, USA, [3]Aalto Univ., Finland.* An efficient model of Mie scattering for arbitrary incident fields with high numerical aperture is presented. Several simple test cases are shown, including monochromatic fields with linear, radial and azimuthal polarization.

LS

Highland H

10:30 a.m.–12:00 p.m.
LThD • Single Molecule Approaches to Biology III
Andrea Lee, University of Rochester

LThD1 • 10:30 a.m. Invited
Single Molecule Photon Trajectories and Transition Paths in Protein Folding, *Hoi Sung Chung, **William A. Eaton**; Natl. Inst.s of Health, USA.* Photon trajectories of immobilized single protein molecules labeled with donor and acceptor fluorophores have been measured to locate transitions between folded and unfolded states, with the goal of measuring transition path times.

LThD2 • 11:00 a.m. Invited
Driving and Controlling Biological Function by Chemical Perturbation Spectroscopy, *Norbert Scherer*; *Univ. of Chicago, USA.* This talk concerns experiment and simulation studies of periodic pulsed chemical perturbations to synchronize the cell cycle of C. crecentus and to drive novel nonlinear calcium dynamics of coupled beta insulin cells in islets.

Highland J

10:30 a.m.–11:30 a.m.
LThE • Quantum Enhanced Information Processing III
Raymond Laflamme; Univ. of Waterloo, Canada, Presider

LThE1 • 10:30 a.m. Invited
Quantum Teleportation and Quantum Information Processing, *Akira Furusawa*; *Univ. of Tokyo, Japan.* Teleportation-based quantum information processing is reviewed.

LThE3 • 11:00 a.m.
Calculation of Tripartite Entangled States Generated by Spontaneous Two-Photon Cascade Emission, *Emily A. Alden*, *Aaron E. Leanhardt; Univ. of Michigan, USA.* Tripartite entangled states are generated from spontaneous two-photon cascade emission in three-level systems with spin-1/2 ground states. Prototypical W and GHZ states are produced for certain initial conditions and photon emission directions.

Highland K

10:30 a.m.–11:45 a.m.
LThF • Nanophotonics, Photonic Crystals and Structural Slow Light II
Robert W. Boyd; Univ. of Rochester, USA, Presider

LThF1 • 10:30 a.m. Invited
Cavity Quantum Electrodynamics with Quantum Dots, *Antonio Badolato*; *Univ. of Rochester, USA.* Cavity quantum electrodynamics effects in semiconductor quantum dots coupled to photonic crystals nanocavities are presented. In this framework, the single photon nonlinear regime is explored for implementation of strongly correlated quantum-optical systems.

LThF2 • 11:00 a.m. Invited
Novel Light-Guiding Properties in Photonic Crystals, *R. Hamam, I. Celanovic, Z. Wang, Y. Chong, J.d. Joannopoulos, **Marin Soljacic**; MIT, USA.* We present two photonic crystal enabled platforms, exhibiting novel light-guiding properties: a system exhibiting angular photonic bandgap, and a system exhibiting uni-directional light propagation.

FiO

Highland A

FThH • Nonlinear Optics in Micro/Nano-Optical Structures II—Continued

FThH3 • 11:15 a.m.
Broadband Slow Light with a Swept-Frequency Source, *Rui Zhang*[1], *Yunhui Zhu[1], Jing Wang[1,2], Daniel Gauthier[1]; [1]Duke Univ., USA, [2]Key Lab of All Optical Network & Advanced Telecommunication Network of EMC, Beijing Jiaotong Univ., China.*
We demonstrate a pulse delay of 1.5 ns over a wide bandwidth via stimulated Brillouin scattering in an optical fiber pumped by a swept source with a sweep rate of 20 MHz/μs.

FThH4 • 11:30 a.m. Invited
Light Scattering in a Random but Non Diffusive Nonlinear Medium, *Francisco Rodríguez[1], Jorge Bravo-Abad[2,3], Jorge L. Dominguez-Juarez[1], Can Yao[1], Xavier Vidal[1], **Jordi Martorell**[1,4]; [1]ICFO, Spain, [2]MIT, USA, [3]Univ. Autónoma de Madrid, Spain, [4]Univ. Politècnica de Catalunya, Spain.* The second-harmonic generation from transparent strontium-barium niobate crystals is experimentally studied and explained from the emission patterns of randomly scattered nonlinear domains and the far field interference of the light generated from such domains.

Highland B

FThI • Optical Signal Processing Device—Continued

FThI4 • 11:15 a.m.
Demonstration of a White Light Cavity for High-Speed Data Buffer Using Bi-Frequency Pumped Brillouin Gain, *Honam Yum[1], May Kim[1], Philip Hemmer[2], **Selim M. Shahriar**[1]; [1]Northwestern Univ., USA, [2]Texas A&M Univ., USA.* We demonstrate a white-light-cavity (WLC) using a fiber resonator, pumped by two frequencies for two Brillouin gain peaks. Such a WLC is suitable for trap-door data buffering with a high delay-bandwidth product and negligible distortion

FThI5 • 11:30 a.m.
Optical Frequency Comb Generation via a Heterostructure Cavity Embedded within a Photonic Crystal Ring Resonator, *Amin Khorshidahmad*, *Andrew G. Kirk; McGill Univ., Canada.* Optical comb generation, by intermodal transitions induced via dynamically reconfiguring a heterostructure cavity embedded within a photonic crystal ring resonator, is proposed. Tailoring the structure, 13 generated frequencies spanning the S-L bands are demonstrated numerically.

FThI6 • 11:45 a.m.
Optical Time Division Multiplexer on Silicon Chip, *Abdelsalam A. Aboketaf*, *Ali W. Elshaari, Stefan F. Preble; Rochester Inst. of Technology, USA.* We demonstrate a novel broadband OTDM that generate 20Gb/s and 40Gb/s signals from a 5Gb/s input signal. It has a small footprint with a bandwidth of over 100nm making it suitable for high-speed optical networks.

Highland C

FThJ • Photonic Crystal—Continued

FThJ4 • 11:15 a.m.
Emission Control of One-Dimensional Parabolic-Beam Photonic Crystal Laser, *Ju-Hyung Kang*[1], *Byeong-Hyeon Ahn[2], Myung-Ki Kim[2], Hong-Gyu Park[1], Yong-Hee Lee[2]; [1]Korea Univ., Korea, Republic of, [2]KAIST, Korea, Republic of.* We experimentally control the emission properties of one-dimensional parabolic-beam photonic crystal fundamental mode lasers by changing the position of tapering end.

FThJ5 • 11:30 a.m.
Giant Goos-Hänchen Effect at Photonic Crystals Surfaces, *Irina V. Soboleva*[1,2], *Valentina V. Moskalenko[1], Andrey A. Fedyanin[1]; [1]Faculty of Physics, Lomonosov Moscow State Univ., Russian Federation, [2]A.N. Frumkin Inst. of Physical Chemistry and Electrochemistry RAS, Russian Federation.* Giant Goos-Hänchen effect is directly observed in surface electromagnetic waves at one-dimensional photonic crystals surfaces using far-field optical microscopy visualization and achieves one order of magnitude in comparison with total internal reflection from dielectric surface.

FThJ6 • 11:45 a.m.
Leaky Modes of Two-Dimensional Photonic Crystals Transferred to a Low Refractive Index Substrate, *Michiel J. de Dood*, *Ljubisa Babic; Leiden Univ., Netherlands.* We present a method to transfer free standing photonic crystal membranes to a low refractive index substrate. These structures are optically flat and we compare the optical properties with the properties of free standing membranes.

Highland D

FThK • Generalized Imaging and Non-Imaging Techniques for Diagnostics and Sensing III—Continued

FThK3 • 11:15 a.m.
Speckle Imaging with Correlations over Object Position, *Jason A. Newman*, *Zhenyu Wang, Kevin J. Webb; Purdue Univ., USA.* Speckle imaging in heavily scattering media based on correlations over the object position is demonstrated for example apertures. Comparison of theory with experimental results shows sensitivity to aperture shape and orientation relative to scanning direction.

FThK4 • 11:30 a.m.
Empirical Study on Optimal Pinhole Focal Distance for Broadband Infrared Illumination in Thermal Hartmann Wavefront Sensing, *Kelvin J. A. Ooi*[1], *Liping Zhao[2], Xiang Li[2], Ricky L. K. Ang[1]; [1]Nanyang Technological Univ., Singapore, [2]Singapore Inst. of Manufacturing Technology, Singapore.* We conducted an empirical study on the optimal pinhole focal distance using infrared illumination. Results show major deviation from the classical Rayleigh formula.

FThK5 • 11:45 a.m.
The Effect of Calibration Error on Polarimetric Reconstruction in Microgrid Polarimetric Imagery, *Charles F. LaCasse*, *J. Scott Tyo; Univ. of Arizona, USA.* We explore the effect of expected deviations from ideal components of microgrid imaging polarimeters using simulation and perform a calibration on an implementation of these errors from data taken by a specific instrument.

Highland E

FThL • Nonlinearities and Gain in Plasmonics and Metamaterials III—Continued

FThL3 • 11:15 a.m.
Mid-IR Laser Oscillation In Cr:ZnSe Planar Waveguide Structures And In Cr:ZnSe/As_2S_3:As_2Se_3 Composite Materials, *Jonathan Williams[1], Jonathan Goldstein[2], Dmitri Martyshkin[1,3], Vladimir Fedorov[1,3], Igor Moskalev[3], Renato Camata[1], **Sergey Mirov**[1,3]; [1]Univ. of Alabama at Birmingham, USA, [2]Air Force Res. lab, Materials and Manufacturing Directorate, USA, [3]Photonics Innovations, Inc, USA.* New transition metal doped ZnSe/As_2S_3:As_2Se_3 composite materials are proposed for mid-IR fiber-lasers. Mid-IR room-temperature lasing of Cr:ZnSe/As_2S_3:As_2Se_3 micro-composite material and Cr:ZnSe planar waveguide structures is demonstrated at 2.6 and 2.4 μm.

FThL4 • 11:30 a.m. Invited
Nonlinear Plasmonics, *Lukas Novotny*; *Univ. of Rochester, USA.* Noble metals exhibit strong optical-nonlinearities, with coefficients as high as $\chi^{(3)} = 1 nm^2/V^2$. Metal-nanostructures can be employed for efficient index modulation, two-photon excited luminescence, harmonic-generation, and wave-mixing. We discuss and review recent results and applications.

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

FiO

Highland F

FThM • Sensing in Higher Dimensions — Theory and Hardware for Computational Imaging II—Continued

FThM3 • 11:15 a.m.
Light Field Imaging Spectrometer: Conceptual Design and Simulated Performance, *Zhiliang Zhou*[1], *Yan Yuan[2], Bin Xiangli[1,3]; [1]Univ. of Science and Technology of China, China, [2]Beihang Univ., China, [3]Chinese Acad. of Sciences, China.* We present a snapshot imaging spectrometer using a light field camera combined with an array of narrow-band spectral filters. Simulation results demonstrate its post-processing performance, including spectrum acquisition, digital refocusing and correction of chromatic aberrations.

FThM4 • 11:30 a.m.
Compressive Measurements for Target Tracking, *Tariq Osman*[1], *Daniel J. Townsend[2], Adrian V. Mariano[2], Michael D. Stenner[2], Michael E. Gehm[1]; [1]Univ. of Arizona, USA, [2]MITRE Corp., USA.* We present an imaging system for target tracking with compressive measurements for large area persistent surveillance. Multiplexed sensing with a mask-based optical system and signal retrieval from underdetermined measurements using l-1 minimization are explored.

Highland G

FThN • General Quantum Electronics II—Continued

FThN4 • 11:15 a.m.
Electromagnetically Induced Vector-Potential for Slow Light, *Ofer Firstenberg*[1], *Dimitry Yankelev[1], Paz London[1], Moshe Shuker[1], Amiram Ron[1], Nir Davidson[2]; [1]Technion-Israel Inst. of Technology, Israel, [2]Weizmann Inst. of Science, Israel.* Slow-light polaritons in a thermal vapor experience abnormal diffraction when detuned from a pump laser. Diffraction manipulation is demonstrated for a uniform pump, and a Schrödinger-like dynamics with induced vector-potential is demonstrated for structured pumps.

FThN5 • 11:30 a.m.
Fast Reconfigurable Slow Light System based on Off-resonant Raman Absorption Scheme, *Praveen K. Vudyasetu*[1], *Ryan M. Camacho[2], John Howell[1]; [1]Univ. of Rochester, USA, [2]Caltech, USA.*We present an off-resonant slow light system with fast switching dynamics based on Raman absorption. This scheme combines the low dispersion broadening of double absorption system and all optical control of Raman absorption.

FThN6 • 11:45 a.m.
Simultaneous Two-Channel Control of Light Speed in a Single Delay Element, *Anil K. Patnaik*[1,2], *Paul S. Hsu[1,2], Sukesh Roy[3], James R. Gord[1]; [1]Wright-Patterson AFB, USA, [2]Wright State Univ., USA, [3]Spectral Energies, LLC, USA.* Simultaneous two-channel control of light speed in a single delay element of a Rb cell is demonstrated using a homogeneous magnetic field in conjunction with a single elliptically polarized resonant laser containing two signals.

LS

Highland H

LThD • Single Molecule Approaches to Biology III—Continued

LThD3 • 11:30 a.m. Invited
Superresolution Optical Fluctuations Imaging (SOFI), *T. Dertinger[1], R. Colyer[1], R. Vogel[1], M. Heilemann[2], G. Iyer[1], M. Sauer[3], J. Enderlein[4], **Shimon Weiss**[1]; [1]Univ. of California at Los Angeles, USA, [2]Bielefeld Univ., Germany, [3]Julius-Maximilians-Univ. Würzburg, Germany, [4]Georg August Univ., Germany.* We demonstrate a novel, simple, and fast superresolution imaging method that is based on blinking of fluorescence emitters and high order statistical analysis.

Highland J

LThE • Quantum Enhanced Information Processing III—Continued

LThE4 • 11:15 a.m.
Phase Jumps in Electro-Magnetically Induced Transparency, *Francesco A. Narducci*[1], *Jon P. Davis[1], Jon H. Noble[2], George R. Welch[3]; [1]Naval Air Systems Command, USA, [2]AMPAC, USA, [3]Insitute for Quantum Science and Engineering and Dept. of Physics, USA.* In this work, we study the underlying physics in the dynamics of an electro-magnetically induced transparency system when the phase of one field with respect to the other is abruptly changed.

Highland K

LThF • Nanophotonics, Photonic Crystals and Structural Slow Light II—Continued

LThF3 • 11:30 a.m.
Differential Reflection Spectroscopy of Photonic Crystal Cavities Containing Coupled InAs Quantum Dots, *Erik D. Kim*[1], *Arka Majumdar[1], Hyochul Kim[2], Pierre Petroff[2], Jelena Vuckovic[1]; [1]Stanford Univ., USA, [2]Univ. of California, Santa Barbara, USA.* We obtain differential optical reflectivity spectra from a photonic crystal nanocavity containing coupled quantum dots (QDs). Our technique employs Coulomb shifts in QD optical transition energies and is not restricted to linearly polarized cavities.

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

FiO

Highland A

1:30 p.m.–3:30 p.m.
FThO • Nonlinear Optics in Micro/Nano-Optical Structures III

Presider to Be Announced

FThO1 • 1:30 p.m. Invited

CMOS Compatible All-Optical Chips, ***David Moss***[1], *A. Pasquazi*[2], *M. Peccianti*[2], *L. Razzari*[2], *D. Duchesne*[2], *M. Ferrera*[2], *S. Chu*[3], *B. E. Little*[3], *R. Morandotti*[2]; [1]*Univ. of Sydney, Australia,* [2]*INRS-EMT, Canada,* [3]*Infinera Corp., USA.* We demonstrate a wide range of novel functions in integrated, CMOS compatible, devices. This platform has promise for telecommunications and on-chip WDM optical interconnects for computing.

FThO2 • 2:00 p.m.

Resonance Enhancement of the Two-Photon Absorption in PbS Quantum Dots, *Gero Nootz*[1], *Lazaro A. Padilha*[1], *Scott Webster*[1], ***David J. Hagan***[1], *Eric W. Van Stryland*[1], *Larissa Levina*[2], *Vlad Sukhovatkin*[2], *Edward H. Sargent*[2]; [1]*College of Optics and Photonics - CREOL & FPCE - Univ. of Central Florida, USA,* [2]*Univ. of Toronto, Canada.* The degenerate and nondegenerate two-photon absorption (2PA) spectra of PbS quantum dots are measured and compared to our earlier studies of CdSe. We observe >5x intermediate state resonance enhancement for PbS over the degenerate 2PA

Highland B

1:30 p.m.–3:30 p.m.
FThP • General Optical Instrumentation

Presider to Be Announced

FThP1 • 1:30 p.m.

Indentation Size Effects in Multilayer Hafnia-Silica Thin Films, ***Karan Mehrotra***, *John C. Lambropoulos; Univ. of Rochester, USA.* An experimental study of indentation size effect (ISE) on HfO_2-SiO_2 multilayer thin films is presented. Decrease in hardness with increasing loads is observed using cube corner tip. Data is discussed using the model of Nix-Gao.

FThP2 • 1:45 p.m.

Ultrasound Detection Using Dispersion Due to Spectral Holes, ***Jian Wei Tay***, *Patrick M. Ledingham, Jevon J. Longdell; Univ. of Otago, New Zealand.* Detection of ultrasound requires high efficiency phase to amplitude conversion. We demonstrate detection using dispersive effects in hole-burning materials which have large étendue compared to conventional methods. We show high sensitivity using modest hole parameters.

FThP3 • 2:00 p.m.

Geometric Calibration of Omnidirectional Images for Panoramic Total Internal Reflection Lens, ***Po-Hsuan Huang***, *Ming-Fu Chen, Yung-Hsinag Chen, Ting-Ming Huang, Chia-Yen Chan; Instrument Technology Res. Ctr., Natl. Applied Res. Labs, Taiwan.* We present an omnidirectional imager which the image is composed of front and lateral fields of view regions, adopting the OcamCalib toolbox to obtain the geometric parameters of the images and refine the optical design.

Highland C

1:30 p.m.–3:30 p.m.
FThQ • Micro Resonators

Gregory R. Kilby; United States Military Acad., USA, Presider

FThQ1 • 1:30 p.m.

Photonic Band-Edge Circular Polarized Microcavity Resonances in Glassy Chiral Liquid Crystals under CW-Irradiation, ***Svetlana G. Lukishova***, *Luke J. Bissell, Carlos R. Stroud, Jr.; Inst. of Optics, USA.* A circularly-polarized, 3 nm width microcavity resonance was observed in the fluorescence at a band-edge of a chiral glassy photonic bandgap liquid crystal irradiated by a 532 nm, cw-laser beam in a confocal fluorescence microscope.

FThQ2 • 1:45 p.m.

Ultra-low Energy Modulation Using High-Q SiO2-Clad Silicon Photonic Crystal Microcavities, ***Sean P. Anderson***, *Philippe M. Fauchet; Univ. of Rochester, USA.* We show that k-space engineering can be used to achieve Q values above 100,000 in SiO2-clad silicon photonic crystal microcavities, enabling modulation energies of 1 fJ/bit or less.

FThQ3 • 2:00 p.m.

Analysis and Design of a Microring Inline Single Wavelength Reflector, ***Amir Arbabi***, *Young Mo Kang, Lynford L. Goddard; Univ. of Illinois at Urbana-Champaign, USA.* We present simulation and design of an inline single wavelength reflector based on engineered coupling between two degenerate microring resonator modes. The proposed structure may find applications as mirrors for tunable single mode lasers.

Highland D

1:30 p.m.–3:30 p.m.
FThR • Plasmonics and Metamaterials for Information Processing II

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

FThR1 • 1:30 p.m. Invited

Super-Resolution Imaging Based on Interfering Plasmon Waves, ***Peter T. So****; MIT, USA.* Abstract not available.

FThR2 • 2:00 p.m.

Plasmonic Monopole Antenna at Optical Frequency Range, ***Jingjing Li***, *Lars Thylén, R. Stanley Williams; Hewlett-Packard Labs, USA.* Optical monopole antenna is designed by extending the inner metal of a plasmonic coaxial cable out of the ground. The transmitting property is studied with the similarity and difference to the conventional microwave version addressed.

Highland E

1:30 p.m.–3:00 p.m.
FThS • Strong THz Fields and Applications

Janos Hebling; Univ. of Pecs, Hungary, Presider
Robert A. Kaindl; Lawrence Berkeley Natl. Lab, USA, Presider

FThS1 • 1:30 p.m. Tutorial

High-Peak-Power THz Field Generation and Applications, ***Keith Nelson****; MIT, USA.* Methods for generation of intense terahertz pulses and high terahertz fields will be reviewed. Nonlinear THz spectroscopy will be discussed and THz coherent control objectives will be outlined.

Keith A. Nelson received his B.S. and Ph.D. at Stanford University in 1976 and 1981 respectively, and was a postdoctoral scholar at UCLA before joining the faculty of the MIT Department of Chemistry in 1982. His research includes ultrafast spectroscopy of condensed phase structural and chemical rearrangements and the collective degrees of freedom that mediate them. Recent work includes the development of terahertz and optical pulse shaping methods that enable coherent control over collective modes including acoustic phonons, optic phonons and phonon-polaritons, and excitons.

Highland F

FiO

1:30 p.m.–4:00 p.m.
FThT • Encoding Optical Information — Nano-photonics, Diffractive Optics and Refractive Optics for Shaping Optical Signals
P. Scott Carney; Univ. of Illinois at Urbana-Champaign, USA, Presider

FThT1 • 1:30 p.m. Invited

Fundamental Limits to Optical Components, *David Miller*; *Stanford Univ., USA.* Analysis with "communications modes" between volumes allows rigorous general limits on imaging and communications channels. Together with a new multiple scattering theorem, this approach also leads to fundamental limits to optical components.

FThT2 • 2:00 p.m. Invited

Progress Towards Windows Performing Forbidden Light-Ray Direction Changes, *Johannes K. Courtial*[1], *Alasdair C. Hamilton*[1], *Eric Logean*[2], *Tomáš Tyc*[3], *Toralf K. Scharf*[2]; [1]*Univ. of Glasgow, United Kingdom,* [2]*EPFL IMT OPT, Switzerland,* [3]*Masaryk Univ., Czech Republic.*We summarize recent work on METATOYs, transparent sheets that perform unusual light-ray-direction changes. We concentrate on the classification of laws describing light-ray-direction changes as (un)natural, and on our experimental realization of confocal lenslet arrays.

Highland G

1:30 p.m.–3:30 p.m.
FThU • Lens Design
Rongguang Liang; Carestream Health, USA, Presider

FThU1 • 1:30 p.m.

Adaptive Liquid Lens Actuated by Electromagnetic Solenoid, *Hongbing Fang*, *Guoqiang Li; Univ. of Missouri at St. Louis, USA.* Adaptive lens has wide applications in industry and medicine. A compact, low-cost adaptive liquid lens actuated by electromagnetic solenoids is presented. The lens shows large tunable power and high performance.

FThU2 • 1:45 p.m.

Modeling and Design of a Tunable Refractive Lens Based on Liquid Crystals, *Lei Shi*[1], ***Liwei Li***[1], *Doug Bryant*[1], *Dwight Duston*[2], *Philip J. Bos*[1]; [1]*Liquid Crystal Inst., Kent State Univ., USA,* [2]*eVision Inc., USA.* A tunable refractive lens is modeled, designed, and fabricated with proper electrode structure and liquid crystal material. The modeling calculates ideal phase profile and correct voltage applied on each electrode, for the desired focal length.

FThU3 • 2:00 p.m.

Effects of Diffraction and Partial Reflection in Multilayered Gradient Index Polymer Lenses, *G. Beadie*, *James S. Shirk; NRL, USA.* Multilayered gradient index polymer lenses are fabricated with many layers of polymers with different refractive indices. It is shown that, in principle, diffractive and reflective losses are <4 x 10^{-4} for a typical lens.

Highland H

LS

1:30 p.m.–3:45 p.m.
LThG • Metrology and Precision Measurements II
Aaron E. Leanhardt; Univ. of Michigan, USA, Presider

LThG1 • 1:30 p.m. Invited

New Limit on Lorentz and CPT Violation for Neutrons, *Michael Romalis*; *Princeton Univ., USA.* We use a K-^{3}He co-magnetometer to constrain neutron spin coupling to a Lorentz and CPT violating background field arising in many models of quantum gravity, $|b_n|<3.7\times10^{-33}$ GeV, improving previous limit by a factor of 30.

LThG2 • 2:00 p.m. Invited

Results of Table-Top Fundamental Physics Experiments at Berkeley, *Dmitry Budker*; *Univ. of California at Berkeley, USA.* Ongoing experiments will be discussed: measurement of parity violation in ytterbium and dysprosium, search for variation of the fine-structure "constant" in dysprosium, and tests of Bose-Einstein statistics for photons in two-photon transitions in barium.

Highland J

1:30 p.m.–2:45 p.m.
LThH • Frontiers in Ultracold Molecules III
John L. Bohn; JILA, Univ. of Colorado, USA, Presider

LThH1 • 1:30 p.m. Invited

Laser Cooling of a Diatomic Molecule, *David DeMille*, *E. S. Shuman, J. F. Barry; Yale Univ., USA.* We report experiments demonstrating the laser cooling of a diatomic molecule. A cryogenic molecular beam of strontium monofluoride (SrF) is subjected to one-dimensional transverse laser cooling. We observe both Doppler and Sisyphus-type cooling mechanisms.

LThH2 • 2:00 p.m. Invited

Testing the Time-Invariance of Fundamental Constants Using Cold, and Not So Cold, Molecules, *Hendrick L. Bethlem*; *Vrije Univ., Netherlands.* I will discuss the status of two experiments ultimately aimed at testing the time-invariance of the proton-to-electron mass using a thermal beam of CO molecules and using cold ammonia molecules in a fountain.

Highland K

FiO

1:30 p.m.–3:30 p.m.
FThV • Diffractive and Holographic Optics I
Andrew J. Waddie; Heriot-Watt Univ., UK, Presider

FThV1 • 1:30 p.m. Tutorial

What Is and Is Not a Hologram and Why it Matters, *H. John Caulfield*; *Alabama A&M Univ., USA.* Debating definitions is usually foolish. But the word "holography" is more abused than most and has come to stand for nonsense. Brilliant cosmologists, TV editors, and "New Age" devotees all believe that holograms are magic.

Dr. H. John Caulfield works in various capacities for two universities (Fisk and Alabama A&M) and in many capacities (Director, CTO, President, etc.) with about ten companies. John is editor of two journals, past editor of one, and now or in the past on the editorial boards of a dozen journals. He is widely honored (e.g. a record five major awards from SPIE), written about in newsstand and airline magazine, published (many books, book chapters, dozens of patents, and over 250 refereed journal articles. His most widely read article is the 1984 National Geographic cover story in holography. Professor Caulfield received a BA in Physics from Rice in 1958 and a PHD in Physics from Iowa State University in 1962. He did research in big companies (Texas Instruments, Raytheon, and Sperry-Rand), small R&D companies (Block Engineering and Aerodyne Research) and universities (UAH and Alabama A&M) before his current "retirement."

FiO

Highland A

FThO • Nonlinear Optics in Micro/Nano-Optical Structures III—Continued

FThO3 • 2:15 p.m.

Measurement of Two-Photon Gain in Electrically Pumped AlGaAs, ***Amir Nevet****, Alex Hayat, Meir Orenstein; Technion, Israel.* We report the first observation of two-photon gain in solids, specifically in electrically-pumped room-temperature semiconductor devices. Structures optimized to enhance the nonlinear two-photon interaction and reduce parasitic effects yielded gain in excellent agreement with theory.

FThO4 • 2:30 p.m. Tutorial

Phonon Lasers in Cavity Optomechanics, ***Kerry Vahala****; Caltech, USA.* Cavity enhancement of optical fields is providing a new way to couple light and mechanical motion. Its application to mechanical cooling and amplification, example implementations, and prospects for new science and technology are reviewed.

Biography not available.

Highland B

FThP • General Optical Instrumentation—Continued

FThP4 • 2:15 p.m.

R&D and the Optics Manufacturing Shop Floor, ***Andrew A. Haefner****, Robert R. Wiederhold, Michael P. Mandina, Jessica De Groote Nelson; Optimax Systems Inc., USA.* Historically, the research and development department and the optical manufacturing shop floor have been independent entities. Optimax has been able to integrate the two departments for faster deployment and practical utilization.

FThP5 • 2:30 p.m.

Optical Pulse Packet Generation by Using a Novel Fiber Stacker, ***Li Mingzhong****, Lin Honghuan, Wang Jianjun, Wang Mingzhe; Res. Ctr. of Laser Fusion, China Acad. of Engineering Physics, China.* We developed a novel fiber stacker for pulse packet generation. Featuring a reflection geometry, the fiber stacker could be controlled to generate arbitrarily shaped packet pulse with uniform sub-pulse polarization states.

FThP6 • 2:45 p.m.

1319 nm MOPA for a Guidestar Laser System, ***Zachary W. Prezkuta****, Munib P. Jalali, Nicholas W. Sawruk, Ian Lee, William J. Alford; Lockheed Martin Coherent Technologies, USA.* This paper describes a 1319 nm master oscillator/power amplifier (MOPA) subsystem which produces 90 W of linearly polarized, near diffraction-limited mode-locked output.

FThP7 • 3:00 p.m.

First Experiment on THz Beam Multiplexers Based on Reflection Phase Gratings, *Vishal S. Jagtap*[1], ***Annick F. Dégardin***[1], *Geoffroy Klisnick*[2], *Michel Redon*[2], *Alain J. Kreisler*[1]; [1]*Univ Paris-Sud, France,* [2]*UPMC Univ. Paris, France.* To generate high efficiency 1-D beam multiplexers, reflection phase gratings with continuous profiles were fabricated and tested at terahertz frequencies. The first experimental results are reported and compared with results of simulation using phase-retrieval algorithm.

Highland C

FThQ • Micro Resonators—Continued

FThQ4 • 2:15 p.m.

A CMOS Compatible Microring-Based On-Chip Isolator with 18db Optical Isolation, ***Li Fan****, Jian Wang, Hao Shen, Leo T. Varghese, Ben Niu, Jing Ouyang, Minghao Qi; Purdue Univ., USA.* We demonstrate strong optical nonreciprocity in microring add-drop filters with asymmetric input and output coupling coefficients. Up to 18dB isolation was achieved with a silicon-on-insulator high-Q microring of 5 micrometer radius.

FThQ5 • 2:30 p.m.

High-Q Etchless Silicon Ring Resonators, ***Lian-Wee Luo****, Gustavo S. Wiederhecker, Jaime Cardenas, Michal Lipson; Cornell Univ., USA.* We demonstrate high-Q silicon ring resonators fabricated by selective oxidation without any silicon etching. We achieve an intrinsic quality factor of 480,000 in 50 µm radii rings with ring losses of 0.9 dB/cm.

FThQ6 • 2:45 p.m.

Athermal Performance In Titania-clad Microresonators On SOI, ***Payam Alipour****, Amir Hossein Atabaki, Ali Asghar Eftekhar, Ali Adibi; Georgia Tech, USA.* We propose the use of titanium dioxide as cladding material to reduce the temperature sensitivity of silicon-based microresonators. The advantages of using titanium dioxide over the conventional alternatives are discussed, and experimental results are presented.

FThQ7 • 3:00 p.m.

Polymer Coated Silica Ultra-High-Q Microresonators, ***Hong Seok Choi****, Xiaomin Zhang, Andrea M. Armani; Univ. of Southern California, USA.* Hybrid polymer-silica microcavities with Q factors over 1E7 using both polymethymethacrylate and polystyrene coatings are shown. A theoretical model based on FEM simulations was developed to explain the relationship between Q degradation and film thickness.

Highland D

FThR • Plasmonics and Metamaterials for Information Processing II—Continued

FThR3 • 2:15 p.m.

Room Temperature Plasmon Laser, ***Ren-Min Ma****, Rupert F. Oulton, Volker J. Sorger, Guy Bartal, Xiang Zhang; UC Berkeley, USA.* We report plasmon lasers with strong cavity feedback and optical confinement to 1/20th wavelength. Strong feedback arises from total internal reflection of plasmons, while confinement enhances the spontaneous emission rate by up to 18 times.

FThR4 • 2:30 p.m.

Measurement of the Optical Properties of Gold at Cryogenic Temperatures, ***Maziar P. Nezhad****, Aleksandar Simic, Yeshaiahu Fainman; UCSD, USA.* Optical constants of gold are measured at cryogenic temperatures. The imaginary part of epsilon exhibits a drop at longer wavelengths. This directly demonstrates that performance of metal-based optical devices can be improved by cryogenic cooling.

FThR5 • 2:45 p.m.

Pairs of Optical Nanoantennas for Enhancing Second-Harmonic Generation, ***Uday Chettiar****, Nader Engheta; Univ. of Pennsylvania, USA.* By properly designing pairs of nanoantennas, we theoretically show that the second-harmonic generation in nonlinear media can be enhanced by combining field enhancement at the fundamental frequency and the Purcell effect at the second harmonics.

FThR6 • 3:00 p.m.

Control of the Interactions of Plasmonic and Photonic Modes and Tunability of Transmission and Reflection, *Avner Yanai, Meir Grajower,* ***Uriel Levy****; Hebrew Univ. of Jerusalem, Israel.* We study the interactions of plasmonic and photonic modes within a novel two corrugated plates metallic structure for tunable filtering applications. The device is tuned by applying a relative shift between the plates.

Highland E

FThS • Strong THz Fields and Applications—Continued

FThS2 • 2:15 p.m.

Femtosecond Cross-Correlation Spectroscopy of Resonantly Enhanced Surface Plasmons in Planar Plasmonic Crystals, ***Vladimir O. Bessonov****, Polina P. Vabishchevich, Fedor Yu. Sychev, Maxim R. Shcherbakov, Tatyana V. Dolgova, Andrey A. Fedyanin; Lomonosov Moscow State Univ., Russian Federation.* Significant reshaping of femtosecond pulse reflected from one-dimensional plasmonic crystal is observed using time-resolved cross-correlation technique. Surface plasmon-polaritons with Fano-type lineshape strongly disturbs reflected pulse on picosecond timescale.

FThS3 • 2:30 p.m.

Femtosecond Laser-Induced Nanostructure-Covered Large Scale Wave Formation on Metals, ***Taek Yong Hwang****, Chunlei Guo; Univ. of Rochester, USA.* Using femtosecond laser irradiation, we create a unique large-scale-wave surface structure densely covered by nanostructures. The formation mechanism of this structure is also discussed in this work.

FThS4 • 2:45 p.m.

Energy-Momentum Tensor for the Electromagnetic Field in a Dielectric, ***Michael E. Crenshaw****, Thomas B. Bahder; US Army RDECOM, USA.* The total momentum of a thermodynamically closed system is unique. The Gordon total momentum of a propagating electromagnetic field and negligibly reflecting dielectric is used to construct a traceless, diagonally symmetric energy—momentum tensor.

FiO

Highland F

FThT • Encoding Optical Information — Nano-photonics, Diffractive Optics and Refractive Optics for Shaping Optical Signals—Continued

FThT3 • 2:30 p.m. **Invited**

On Breaking the Abbé Diffraction Limit in Optical Nanopatterning., *Nicole Brimhall*[1], *Trisha Andrew*[2], *Rajakumar Manthena*[1], *Mohit Diwekar*[1], ***Rajesh Menon***[1]; [1]*Univ. of Utah, USA,* [2]*MIT, USA.* We report on a novel method of optical nanopatterning, where wavelength-selective photochemical transformations are exploited to achieve deep sub-wavelength spatial resolution with near-UV and visible photons.

FThT4 • 3:00 p.m.

Approximate Diffraction Model for Optical Free Form Surfaces, ***Markus Testorf***[1], *Stefan Sinzinger*[2]; [1]*Dartmouth College, USA,* [2]*Technical Univ. Illmenau, Germany.* Optical free form surfaces implement elements with potentially large surface gradients and large modulation depths. An approximate diffraction model is developed as a tool for analyzing and designing optical surfaces.

Highland G

FThU • Lens Design—Continued

FThU4 • 2:15 p.m.

Refractive Index Dispersion Curves Measured for Several Polymer Films, ***G. Beadie***, *A. Rosenberg, James S. Shirk; NRL, USA.* We use interference fringes measured in transmission spectra combined with high-accuracy index measurements at point wavelengths to construct dense, high-accuracy refractive index curves across the visible for several polymer films.

FThU5 • 2:30 p.m.

Gradient Index Polymer Optics: Achromatic Singlet Lens Design, ***G. Beadie***, *E. Fleet, James S. Shirk; NRL, USA.* We have developed an analytic approximation useful for designing achromatic singlet lenses. The designs are based on gradient index lenses fabricated from nanolayered polymer materials. Ray-traced results confirm the achromatic performance of the designs.

FThU6 • 2:45 p.m.

Implementing Lens Design Software in a Distributed Computing Environment, *Stan Szapiel,* ***Catherine Greenhalgh***; *Raytheon ELCAN Optical Technologies, Canada.* A state-of-the-art lens design software (CodeV®) is deployed and enabled in the distributed computing environment. Impact on statistical tolerancing, global optimization, and other lens design practices is discussed.

FThU7 • 3:00 p.m.

Optical Performance of Airborne Multi-Spectral Camera Lens, ***Cheng-Fang Ho***, *Wei-Cheng Lin, Shenq-Tsong Chang, Ting-Ming Huang; Instrument Technology Res. Ctr., Natl. Applied Res. Labs, Taiwan.* This research provides a method about opto-mechanical design and assembly of ITRC airborne camera lens. The optical performance parameters of camera lens such as Modulation translation function and filed curvature are measured and presented.

LS

Highland H

LThG • Metrology and Precision Measurements II—Continued

LThG3 • 2:30 p.m.

High Resolution Fabry-Perot Displacement Interferometry: A Bridge Between the Meter and the Farad, ***Mathieu Durand***, *John Lawall, Yicheng Wang; NIST, USA.* A high resolution Fabry-Perot interferometer system is designed to measure displacement. We achieve a fractional uncertainty of $\delta L/L \sim 1.25x10^{-9}$ without any optical frequency standard, and resolve hysteresis in a piezoelectric actuator over 7 nm.

LThG4 • 2:45 p.m. **Invited**

An Improved Limit on the Permanent Electric Dipole Moment (EDM) of ^{199}Hg, ***Tom Loftus***; *Univ. of Washington, USA.* We describe the ^{199}Hg EDM search recently completed by W. C. Griffith *et al* [Phys. Rev. Lett. **102**, 101601 (2009)] which gives a new upper bound: $|d(^{199}\mathrm{Hg})| < 3.1 \text{ x } 10^{-29}\ e$ cm (95% C.L.).

Highland J

LThH • Frontiers in Ultracold Molecules III—Continued

LThH3 • 2:30 p.m.

Laser Cooling of Molecules by Zero Velocity Selection, ***Raymond Ooi***; *Univ. of Malaya, Malaysia.* We present laser cooling scheme for molecules using repeated Raman zero velocity selection, STIRAP deceleration and accumulation by single spontaneous emission which circumvents the multilevels in molecules. Smulations with OH show practicality of the scheme.

FiO

Highland K

FThV • Diffractive and Holographic Optics I—Continued

FThV2 • 2:15 p.m. **Invited**

3-D Optics: From Diffractive to Subwavelength, ***George Barbastathis***; *MIT, USA.* We present a sequence of devices where 3-D refractive index modulation at different scales – from several wavelengths to fraction of a wavelength — results in unique and useful optical behavior, e.g. confocal-like slicing with multiplex focus at several planes simultaneously, and arbitrary gradient index definition for aberration correction. Fabrication and manufacturing methods and challenges will also be discussed.

FThV3 • 2:45 p.m.

The Origin of the Gouy Phase Anomaly and Its Generalization to Astigmatic Wavefields, ***Emil Wolf***[1], *Taco Visser*[2]; [1]*Univ. of Rochester, USA,* [2]*Delft Univ. of Technology, Netherlands.* An explanation of the Gouy phase anomaly near focus is presented and it is shown there is a generalization of this effect near each of the focal lines of an astigmatic pencil of rays.

FThV4 • 3:00 p.m.

Integral Polarization-Holographic Element for Real-Time Complete Analysis of the Polarization State of Light, ***Barbara Kilosanidze***, *George Kakauridze; Inst. of Cybernetics, Georgia.* Integrated polarization-holographic element based on the diffraction gratings of the different type for complete analysis of polarization state of light and working in wide spectral range 500 - 4200 nm is suggested.

FiO

Highland A

FThO • Nonlinear Optics in Micro/Nano-Optical Structures III—Continued

FThO5 • 3:15 p.m.
Two-Photon Absorption at Milliwatt Powers with Rb in Photonic Bandgap Fibers, ***Vivek Venkataraman***, *Kasturi Saha, Pablo Londero, Alexander L. Gaeta; School of Applied and Engineering Physics, USA.* We observe large enhancement of Doppler-free two-photon absorption on the $5S_{1/2}$ to $5D_{5/2}$ transition in Rb vapor confined to a photonic bandgap fiber. We estimate ~1% absorption with ~1 mW of power in the fiber.

Highland B

FThP • General Optical Instrumentation—Continued

FThP8 • 3:15 p.m.
Effect of Substrate Impurities on the Q Factor of Toroidal Microcavities, ***Xiaomin Zhang***, *Hong Seok Choi, Andrea M. Armani; Univ. of Southern California, USA.* We have experimentally demonstrated that the quality (Q) factor of the silica microtoroid depends on the silicon substrate dopant concentration. This dependence agrees well the theoretical prediction and calculation.

Highland C

FThQ • Micro Resonators—Continued

FThQ8 • 3:15 p.m.
Extraction of Light from Microdisk Lasers by Radial Direction Coupling Waveguide, ***Xiangyu Li***[1], *Fang Ou*[1], *Yingyan Huang*[2], *Seng-Tiong Ho*[1]; [1]*Dept. of Electrical Engineering and Computer Science, USA,* [2]*OptoNet Inc., USA.* Extraction of light from microdisk lasers using radial direction coupling waveguide is investigated numerically. FDTD simulation demonstrates higher coupling efficiency into a single-port output compared to the conventional tangential direction waveguide coupling scheme.

Highland D

FThR • Plasmonics and Metamaterials for Information Processing II—Continued

FThR7 • 3:15 p.m.
Birefringent and Dichroic Behaviour of Plasmonic Nano-Antennas, ***Erdem Ogut***, *Kursat Sendur; Sabanci Univ., Turkey.* Birefringence and dichroism of plasmonic nano-antennas are investigated. We demonstrated that birefringent and dichroic behaviour of a cross-dipole nanoantenna is due to a length difference, and a relative plasmonic enhancement of the antenna particles, respectively.

Highland E

3:30 p.m.–4:00 p.m. Coffee Break, *Highland Ballroom Foyer, Rochester Riverside Convention Center*

FThT • Encoding Optical Information — Nano-photonics, Diffractive Optics and Refractive Optics for Shaping Optical Signals—Continued

FThT5 • 3:15 p.m.
Optical Cavity Mode Standing in the Free Space from Non-Periodic Dielectric Gratings, *Jingjing Li*, *David Fattal, Marco Fiorentino, Raymond G. Beausoleil; Hewlett-Packard Labs, USA.* We present the method of designing optical cavities of high quality factors and small mode volumes with most of the optical field standing in the free space, supported by non-periodic dielectric gratings.

FThT6 • 3:30 p.m.
Transparent Format Conversion of 10 Gb/s NRZ-OOK Data to RZ-OOK in a Si Photonic-Wire Waveguide Using XPM, *Jeffrey B. Driscoll*[1], *W. Astar[2,3], Xiaoping Liu[1], Jerry I. Dadap[1], William M. J. Green[4], Yurii A. Vlasov[4], Gary M. Carter[2,3,5], Richard M. Osgood, Jr.[1]; [1]Microelectronics Sciences Labs, Columbia Univ., USA, [2]Lab for Physical Sciences, USA, [3]Ctr. for Advanced Studies in Photonics Res., USA, [4]IBM T. J. Watson Res. Ctr., USA, [5]Dept. of Computer Science and Electrical Engineering, Univ. of Maryland, Baltimore County, USA.* We present format conversion of 10-Gb/s NRZ-OOK to RZ-OOK via XPM in a Si Photonic-Wire with a 2.5-dB 10^{-9} BER-receiver-sensitivity enhancement for the converted signal. Scalability of the technique beyond 160 Gb/s is shown theoretically.

FThT7 • 3:45 p.m.
Experimental Validation of Exact Optical Transfer Function of Cubic Phase Mask Wavefront Coding Imaging Systems, *Manjunath Somayaji*, *Vikrant R. Bhakta, Marc P. Christensen; Southern Methodist Univ., USA.* The spatial frequency response of cubic phase mask wavefront coding imagers under extreme defocus conditions is experimentally measured. The results are compared against analytically derived expressions for optical transfer functions of these computational imaging systems.

FThU • Lens Design—Continued

FThU8 • 3:15 p.m.
Design and Fabrication of the Progressive Addition Lens, *Wei-Yao Hsu*[1], *Yen-Liang Liu[2], Yuan-Chieh Cheng[1], Guo-Dung Su[2]; [1]Instrument Technology Res. Ctr., Natl. Applied Res. Labs, Taiwan, [2]Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan.* This paper focuses on the design and fabrication technologies of the PAL. The PAL surface is described by B-spline parameters. After the optimization of B-spline parameters, the surface is fabricated using CXZ diamond turning technology.

LThG • Metrology and Precision Measurements II—Continued

LThG5 • 3:15 p.m.
Continuous Supersonic Beams for an Electron Electric Dipole Moment Search, *Jeongwon Lee*, *Jinhai Chen, Aaron Leanhardt; Univ. of Michigan, USA.* A continuous tungsten carbide (WC) molecular beam is being developed to probe for the existence of a possible permanent electric dipole moment (EDM) of the electron. The flux and divergence of the beam are characterized.

LThG6 • 3:30 p.m.
Towards Metrological Grade Mid-IR Quantum Cascade Laser Sources, *Pablo Cancio Pastor*[1,2], *Saverio Bartalini[1,2], Simone Borri[1,2], Paolo De Natale[1,2]; [1]Inst. Nazionale di Ottica-CNR, Italy, [2]European laboratory for Non-linear Spectroscopy, Italy.* For the first time, the intrinsic QCL linewidth is measured and compared with the theory. The narrow linewidth, well beyond the “classical” Schawlow-Townes limit, opens new scenarios for the molecular-based clocks and mid-IR metrology.

FThV • Diffractive and Holographic Optics I—Continued

FThV5 • 3:15 p.m.
A Novel Electro-Optic Beam Switch in 5mol% Magnesium-Oxide Doped Congruent Lithium Niobate, *Jonathan W. Evans*[1], *Kenneth L. Schepler[1], Peter E. Powers[2], Andrew Sarangan[2]; [1]AFRL, USA, [2]Univ. of Dayton, USA.* An electro-optic beamswitch was designed to switch between two discrete optical paths. The switch was optimized for maximum beam translation using ray analysis techniques. Simulation using a finite-difference beam propagation method verified the ray analysis.

3:30 p.m.–4:00 p.m. Coffee Break, *Highland Ballroom Foyer, Rochester Riverside Convention Center*

4:00 p.m.–6:00 p.m.
FThW • Three-dimensional Metamaterials
Zhaolin Lu; Univ. of Delaware, USA, Presider

FThW1 • 4:00 p.m. Invited

Understanding Three-Dimensional Meta-Materials, from Refractive Index Concept to Rigorous Photonic Band Theory, *Shanhui Fan*; *Stanford Univ., USA*. We review our recent works in the theory of nanophotonic structures. Examples include a photonic band theory for plasmonic meta-materials, a sub-wavelength super-scatterer, and a photon-based thermal rectifiers.

FThW2 • 4:30 p.m. Invited

3-D Integration of RF and Photonic Devices for High Frequency Operation, *Dennis Prather*; *Univ. of Delaware, USA*. Nanomembranes are crystalline semiconductor materials that have been released from their substrates and redeposited on foreign substrates, enabling the placement of flexible, deformable, and conformable crystalline semiconductor layers with properties of the bulk semiconductor material.

4:00 p.m.–6:00 p.m.
FThX • Fabrication & Testing
Marty Valente; Univ. of Arizona, USA, Presider

FThX1 • 4:00 p.m.

A Radial Basis Function Method for Freeform Optics Surfaces, *Ilhan Kaya*[1], *Jannick P. Rolland*[1,2]; [1]*Univ. of Central Florida, USA,* [2]*Inst. of Optics, Univ. of Rochester, USA*. Explicit formulation of a radial basis function method, RBF-QR, to describe optical freeform surfaces is given. Method extends use of RBFs for freeform surfaces to minimize number of basis required for a level of accuracy.

FThX2 • 4:15 p.m.

Design and Fabrication of Free-Form Shaped Lens for Laser Leveler Instrument, *Yuan-Chieh Cheng*[1,2], *Wei-Yao Hsu*[1], *Yi-Hsien Chen*[3], *Guo-Dung Su*[3], *Pei Jen Wang*[2]; [1]*Instrument Technology Res. Ctr., Natl. Applied Res. Labs, Taiwan,* [2]*Dept. of Power Mechanical Engineering, Natl. Tsing Hua Univ., Taiwan,* [3]*Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan.* This paper focuses on the design and fabrication of the free-form shaped lens for green laser leveler instrument. We design a novel free-form shaped lens with two aspheric-cylindrical surfaces to solve the energy concentrate problem.

FThX3 • 4:30 p.m.

Specifying More than Peak to Valley, *Michael G. Martucci*; *Optimax Systems Inc., USA*. This paper is an introduction to specifications and tolerances intended to more thoroughly define figure and form of precision optical elements. Specifications that will be outlined here include Mid-Spatial Frequency Wavefront Error, Slope, and PVr.

4:00 p.m.–5:30 p.m.
FThY • Plasmonics and Metamaterials for Information Processing III
Presider to Be Announced

FThY1 • 4:00 p.m. Invited

Simple Demonstration of Visible Evanescent Wave Enhancement with Far-Field Detection, *Emily A. Ray*[1], *Meredith J. Hampton*[2], ***Rene Lopez***[1]; [1]*Univ. of North Carolina at Chapel Hill, USA,* [2]*Univ. of North Carolina at Chapel Hill, Dept. of Chemistry, USA.*We demonstrate the fabrication of a simple metamaterial-diffraction grating device that both amplifies and converts evanescent waves into propagating ones while operating in the visible and being probed in a simple total internal reflection configuration.

FThY2 • 4:30 p.m.

Geometric Resonances Imposed by Destructive Interferences in Heterogeneous Ag/Au Nanoparticle Arrays, *Ying Gu*, *Jia Li, Qihuang Gong; Peking Univ., China*. In a newly proposed binary array composed of silver and gold spherical nanoparticles alternatively, the spectrum is characterized by additional geometric resonances near diffraction orders originating from the periodicity twice of the interparticle spacing.

4:00 p.m.–5:45 p.m.
FThZ • THz Fields and Nonlinear Optics
Richard D. Averitt; Boston Univ., USA, Presider
Keith Nelson; MIT, USA, Presider

FThZ1 • 4:00 p.m. Invited

High Energy THz Pulse Generation by Tilted Pulse Front Excitation and its Applications, *János Hebling*, *József A. Fülöp, László Pálfalvi, Gábor Almási; Dept. of Experimental Physics, Univ. of Pécs, Hungary.* Nowadays, highest energy (up to 30 [[Unsupported Character - Symbol Font μ]]J) single-cycle THz pulses from table-top systems can be generated by velocity-matching using tilted-pulse-front-excitation (TPFE). THz pulse generation using TPFE, and present and possible future applications will be reviewed.

FThZ2 • 4:30 p.m. Invited

Ultrafast THz Studies of Electronic Dynamics and Correlations in Carbon Nanomaterials, *Robert A. Kaindl*; *Lawrence Berkeley Natl. Lab, USA*. This talk will review applications of tunable THz and mid-infrared pulses for studies of carbon nanomaterials, yielding insight into the dynamics of quasi-2-D Dirac fermions in graphene and quasi-1-D intraexcitonic resonances in single-walled carbon nanotubes.

4:00 p.m.–6:00 p.m.
FThAA • Optics in Micro/nano Devices
David Moss; Univ. of Sydney, Australia, Presider

FThAA1 • 4:00 p.m.

Two-Quantum Many-Body Coherences in Two-Dimensional Fourier-Transform Spectra of Exciton Resonances in Semiconductor Quantumwells, *Denis Karaiskaj*[1], *Alan D. Bristow*[2], *Xingcan Dai*[2], *Lijun Yang*[2], *Shaul Mukamel*[3], *Richard P. Mirin*[4], *Steven T. Cundiff*[2]; [1]*Univ. of South Florida, USA,* [2]*JILA, Univ. of Colorado and Natl. Inst. of Standards and Technology, USA,* [3]*Chemistry Dept., Univ. of California, USA,* [4]*Natl. Inst. of Standards and Technology, USA*. Two-quantum coherences in two-dimensional Fourier-transform (2DFT) spectra are attributed to many-body interactions. 2DFT spectroscopy allows two-quantum coherences in semiconductors to be isolated. As a result, many-body coherences can be separated from bound biexciton coherences.

FThAA2 • 4:15 p.m.

Prolonged Raman Lasing in Size-Stabilized Salt-Water Microdroplets on a Superhydrophobic Surface, *Yasin Karadag*, *Mustafa Gündoğan, Mehdi Yavuz Yüce, Hüseyin Cankaya, Alphan Sennaroglu, Alper Kiraz; Koç Universty, Turkey.* We show prolonged Raman lasing from individual salt-water microdroplets located on a superhydrophobic surface using a self-stabilization mechanism based on the absorption heating of an infrared laser and resonant heating of a green laser.

FThAA3 • 4:30 p.m.

Highly Efficient Near-infrared Electroluminescence Devices Based On PbS Nanocrystals, *Fan Xu, Xin Ma,* ***Sylvain G. Cloutier***; *Univ. of Delaware, USA*. We report on the structural and optoelectronic properties of low-cost near infrared light-emitting diodes using dip-coated lead-sulfide nanocrystal films as the active layer. We achieved efficient room-temperature electroluminescence using this facile fabrication scheme.

4:00 p.m.–6:00 p.m.
FThBB • Difractive and Holographic Optics II

George Barbastathis; MIT, USA, Presider

FThBB1 • 4:00 p.m. Invited

Theoretical and Practical Implementation of Novel Nanostructured Diffractive and Micro-Optics, *Mohammad R. Taghizadeh, **Andrew J. Waddie**; Heriot-Watt Univ., UK.* We present a nanostructured micro-optical design technology, compatible with the stack-and-draw photonic crystal fibre fabrication technique, which allows the fabrication of high NA microlenses and sub-wavelength diffraction gratings.

FThBB2 • 4:30 p.m. Invited

Plasmonic Diffractive Optics - Its Analogy to Classical Diffractive Optics and Use for Subwavelength Metallic Devices, *__Byoungho Lee__[1], Junghyun Park[1], Seung-Yeol Lee[1], Hwi Kim[2], Seong-Woo Cho[1], Seyoon Kim[1]; [1]Seoul Natl. Univ., Korea, Republic of, [2]Korea Univ., Korea, Republic of.* We show various analogies of plasmonic diffractive optics to classical diffractive optics and distinguished characteristics of plasmonic diffractive optics. Novel subwavelength metallic devices based on those properties are also presented.

NOTES

FiO

Highland A

FThW • Three-dimensional Metamaterials—Continued

FThW3 • 5:00 p.m.
Phase Compensated Metamaterial Superlenses, *Changbao Ma*, *Zhaowei Liu; Univ. of California at San Diego, USA*. We introduce two types of phase compensation mechanisms to metamaterials for superlensing. Such superlenses not only have super resolving power, but also have the basic functions of a conventional optical lens - Fourier transform.

FThW4 • 5:15 p.m.
Anomalous Diffraction, Negative Refraction, and Image Transmission Based on Coherent Destructive Tunneling in 3-D Photonic Lattices, *Alexandra Miller*[1], *Peng Zhang[1], Yi Hu[1,2], Zhigang Chen[1,2], Nikolaos Efremidis[3]; [1]San Francisco State Univ., USA, [2]Nankai Univ., China, [3]Univ. of Crete, Greece*. We report on the first experimental demonstration of anomalous diffraction, negative refraction and image transmission via coherent-destructive-tunneling in optically-induced three-dimensional photonic lattices, in good agreement with our theoretical predictions.

Highland B

FThX • Fabrication & Testing—Continued

FThX4 • 4:45 p.m.
Asphere Manufacturing Considerations for the Designer, *Mark Schickler*, *Robert Wiederhold, Michael Mandina; Optimax Systems Inc., USA*. This paper will present designers with topics to consider during aspheric lens design. There are geometrical restrictions that hinder producing particular aspheric shapes. Understanding these restrictions will help drive cost out of the design.

FThX5 • 5:00 p.m.
Fabrication of Singulated Micro-Retro-Reflecting Elements, *Menelaos K. Poutous*[1], *Michael J. Maston[2], Stephen Leibholz[2], Eric G. Johnson[1]; [1]Ctr. for Optoelectronics and Optical Communications, Univ. of North Carolina at Charlotte, USA, [2]VizorNet, Inc., USA*. The fabrication and testing of singulated micro-retro-reflecting optical elements using conventional photolithography is presented. The elements consist of dielectric skeletons coated with a metallic thin film, and are optimized for retro-reflectivity in the near infrared.

FThX6 • 5:15 p.m.
Simple Manufacturability Estimates for Optical Aspheres, *Greg W. Forbes*, *P. E. Murphy; QED Technologies Inc., USA*. The difficulty of fabricating an asphere is typically related to the difference between the local principal curvatures over its surface. Manufacturability estimates are derived by tailoring methods for estimating the rms of this difference.

Highland C

FThY • Plasmonics and Metamaterials for Information Processing III—Continued

FThY3 • 4:45 p.m.
Optimization of a Surface Plasmon Enhanced Metal-Semiconductor-Metal Photodetector on Gallium Arsenide, *Richard R. Grote*[1], *Richard M. Osgood, Jr.[1], Jonathan E. Spanier[2], Bahram Nabet[2]; [1]Microelectronics Sciences Labs, Columbia Univ., USA, [2]Drexel Univ., USA*. The effects of grating geometry on a Surface Plasmon enhanced planar Metal-Semiconductor-Metal photodetector on GaAs are investigated via Finite-difference Time-domain simulations. Substrate absorption is increased by a factor greater than 10 without compromising time response.

FThY4 • 5:00 p.m.
Array of Carbon Nanotubes Integrated with Plasmonic Particles Offering Enhanced Characteristics, *Babak Memarzadeh, Zhengwei Hao,* ***Hossein Mosallaei****; Northeastern Univ., USA*. The performance of array of carbon nanotubes antenna integrated with plasmonic materials is investigated. It is shown that using plasmonic particles inside CNT dipoles gaps one can enhance the current distribution of the composite system.

FThY5 • 5:15 p.m.
Plasmoically Enhanced Optical Transmission through a Metalized Nano-Structured Photonic Crystal Fiber Taper, *Hesam Arabi*, *Marzieh Pournoury, Minkyu Park, Ji Hoon Park, Seongil Im, Kyunghwan Oh; Yonsei Univ., Korea, Republic of.* Transmission of light through arrays of sub-wavelength holes in the thin silver film was numerically investigated for various arrangements. We also experimentally investigated metalized nano-structured photonic crystal fiber taper to observe an enhanced transmission .

Highland D

FThZ • THz Fields and Nonlinear Optics—Continued

FThZ3 • 5:00 p.m.
Photo-Thermal Mirror Method for Determination of Thermal Diffusivity of Nontransparent Samples, *Aristides Marcano*, *Franz Delima, Gabriel Gwanmesia, Noureddine Melikechi; Delaware State Univ., USA*. We determine the thermal diffusivity of nontransparent samples by measuring the reflectivity changes of a collimated probe light beam generated by the absorption of a focused pump beam. Good agreement with previous measurements is reported.

FThZ4 • 5:15 p.m.
Nonlinear Absorption in the Blue: Photophysics of a New Ruthenium-Based Phthalocyanine, *San-Hui Chi*[1], *Sang Ho Lee[1], Mason A. Walok[1], Raghunath Dasari[2], Seth R. Marder[2], Guy Beadie[1], Steve R. Flom[1], James S. Shirk[1]; [1]NRL, USA, [2]Georgia Tech, USA*. The photophysics of novel ruthenium-based phthalocyanines are reported. These materials undergo rapid intersystem crossing with yield ~1. Large excited-state-absorption cross-sections with intensity-independent kinetics demonstrate their potential as effective nonlinear absorber in the blue spectral region.

Highland E

FThAA • Optics in Micro/nano Devices—Continued

FThAA4 • 4:45 p.m.
Spontaneous Emission Lifetimes of CdSe/ZnSe Core-Shell Quantum Dots at Air-Material Interface, *Lei Zhu*, *Sarath Samudrala, Nikolai M. Stelmakh, Michael Vasilyev; UTA, USA*. We experimentally show that the spontaneous lifetime of a CdSe/ZnS quantum dot can be reduced to the value of 600 ps by surrounding the quantum dot with a material of high permittivity.

FThAA5 • 5:00 p.m.
Thermo-Optic Tuning of Whispering Gallery Modes in Microspheres to the ^{85}Rb Cooling Transition in a Vapor Cell, *Amy Watkins[1,2], Jonathan Ward[2],* ***Sile Nic Chormaic****[1,2]; [1]Univ. College Cork, Ireland, [2]Tyndall Natl. Inst., Ireland*. We demonstrate a method for tuning whispering gallery modes in microspheres to the cooling transition of ^{85}Rb in vacuum. The ability of this device as a sensitive atom-optic sensing tool is presented for bio-sensing applications.

FThAA6 • 5:15 p.m.
Observation of a Frequency-Shift in Rb Absorption Spectrum using an Optical Nanofiber in a Vapor Cell, *Amy Watkins[1,2], Kieran Deasy[2], Jonathan Ward[2],* ***Sile Nic Chormaic****[1,2]; [1]Univ. College Cork, Ireland, [2]Tyndall Natl. Inst., Ireland*. We present results obtained using a tapered optical fiber to observe the atom-surface interactions of a hot rubidium vapor. A frequency shift in the absorption spectrum as a function of rubidium vapor density is investigated.

FThBB • Difractive and Holographic Optics II—Continued

FThBB3 • 5:00 p.m.
Generation of Modulated Vortices with a Femtosecond Laser and a Programmable Pulse Shaper, *Antonio Talamantes,* ***Matt E. Anderson****; San Diego State Univ., USA.* Femtosecond optical vortices are created with a reflective programmable pulse shaper. Patterns include the spiral phase mask, blazed fork grating, and modulated spiral phase. The authors will discuss these results and present their latest work.

FThBB4 • 5:15 p.m.
Bayesian Reconstruction in Optical Scanning Holography, ***Xianglin Li****, Jun Ke, Xin Zhang, Edmund Y. Lam; Univ. of Hong Kong, Hong Kong.* Optical Scanning Holography (OSH) is a technique that scans 3-D objects onto a 2-D hologram. Here, we analyze the OSH object reconstruction process from a Bayesian perspective and provide an appropriate solution.

NOTES

FiO

Highland A

FThW • Three-dimensional Metamaterials—Continued

FThW5 • 5:30 p.m.
The Homogeneous 3-D Microfabrication by the Hologram, *Masahiro Yamaji*, *Hayato Kawashima, Jun'ichi Suzuki, Shuhei Tanaka; New Glass Forum, Japan.* For the 3-D microfabrication using the femtosecond laser pulse and the hologram, all fabricated elements must be homogeneous especially in terms of shape, which is realized by controlling the light intensity distribution of each element.

FThW6 • 5:45 p.m.
Single Step Fabrication of Scalable Complex Photonic Chiral Structures, *Jolly Xavier*, *Joby Joseph; Indian Inst. of Technology Delhi, India.* We present a versatile single step fabrication approach for scalable complex photonic chiral structures with engineered phase shifts. By optical phase engineering, we experimentally investigate for the first time the complex quasicrystallographic photonic chiral structures.

Highland B

FThX • Fabrication & Testing—Continued

FThX7 • 5:30 p.m.
Specifying and Modeling as-Built Centration Errors for Singlets and Cemented Doublets, *Brandon Light*; *Optimax Systems, USA*. This presentation will look at sources of lens centration manufacturing errors in singlets and cemented doublets, how manufacturing errors can be modeled in lens design software and how to specify centration tolerances on lens drawings.

FThX8 • 5:45 p.m.
The Effect of Phase Distortion on Interferometric Measurements of Thin Film Coated Optical Surfaces, *Jonathan T. Watson*, *Daniel Savage; Optimax Systems, Inc., USA*. The effect of phase distortion on reflection due to thin-film interference coatings of interferometric measurements is examined. This paper discusses difficulty in accurately interpreting surface form data from a PSI measurement of a coated surface.

Highland C

Highland D

FThZ • THz Fields and Nonlinear Optics—Continued

FThZ5 • 5:30 p.m.
Self Phase Modulation of Chirped Ultrashort Pulses in Gas Filled Hollow Core Photonic Bandgap Fibers, *Amir Gilad*, *Amiel Ishaaya, Ilana Bar; Ben-Gurion Univ. of the Negev, Israel.* Self-phase-modulation (SPM) of femtosecond pulses in gas-filled photonic bandgap fibers was studied. SPM was observed at significantly lower powers compared to free-space focused-beams, and its dependence on initial chirp and gas pressure was measured.

Highland E

FThAA • Optics in Micro/nano Devices—Continued

FThAA7 • 5:30 p.m.
Optical Admittance Model of Semiconductor Quantum Wells for Optoelectronic Devices, *Thomas Szkopek*; *McGill Univ., Canada.* The optical admittance of interband and intersubband transitions in semiconductor quantum wells is set by the fine structure constant. Compact models for free-space and guided wave properties of quantum wells using optical admittance are presented.

FThAA8 • 5:45 p.m.
Study of Radiation Coupling to Cavity Modes Using Dipole Feeds and Patch Antenna, *Vishal S. Jagtap*[1], *Christophe Minot[2,1]; [1]Lab of Photonics and Nanostructures, CNRS-LPN, France, [2]Inst. TELECOM, TELECOM ParisTech, France.* When the dipole is placed inside a sub-wavelength cavity, its radiation properties are modified significantly. Here, we studied the fundamental physics of this problem using a novel technique of electromagnetic patch antenna model.

FThBB • Difractive and Holographic Optics II—Continued

FThBB5 • 5:30 p.m.
Photorefractive Two-Wave Mixing for Image Amplification in Digital Holography, ***Nektarios Koukourakis***[1]*, Nils C. Gerhardt*[1]*, Martin R. Hofmann*[1]*, Yiu Wai Lai*[2]*;* [1]*Photonics and Terahertz Technology, Ruhr-Univ. Bochum, Germany,* [2]*Res. Dept., Integrity of Small-Scale Systems/High-Temperature Materials, Ruhr-Univ. Bochum, Germany.* We use photorefractive two-wave mixing gain for coherent amplification in digital holography. This enables the reconstruction of amplitude and phase images that are not detectable otherwise, leading to an enhanced dynamic range.

FThBB6 • 5:45 p.m.
Phase Compression Technique to Suppress the Zero-Order Diffraction from a Pixelated Spatial Light Modulator (SLM), ***Jinyang Liang***[1]*, Zhangjie Cao*[1,2]*, Michael F. Becker*[1]*;* [1]*Univ. of Texas at Austin, USA,* [2]*Southwest Jiaotong Univ., China.* A phase compression technique is demonstrated that creates a peak to destructively interfere with the undesired zero-order diffracted beam in a hologram produced by a pixelated, phase-only SLM. Image precision and diffraction efficiency are simulated.

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Key to Authors and Presiders

(**Bold** denotes Presider or Presenting Authors)