Frontiers in Optics 2007
Laser Science XXIII

FiO/LS 2007 Highlights

Frontiers in Optics 2007, the longest-standing meeting in optics and photonics, closed Sept. 20 after a week of top-quality research presentations, symposium and special events.

Consisting of 157 sessions and nearly 800 technical presentations, talks honed in on some of the most innovative research in the field.

More than 1,300 attendees convened during the meeting's keynote sessions, technical talks, exhibition and networking events. In addition, 50 companies participated in the exhibition, showcasing some of the newest technologies available.

For more information, view the 2007 conference press release.

- Award Winning Plenary Speakers
  John L. Hall, JILA, Univ. of Colorado, USA
  Eli Yablonovitch, Univ. of California at Berkeley, USA
- Cutting-Edge Presentations
- Expert Invited Speakers
- Special Events
- Networking Events
- Short Courses
- Special Symposia
- Student Activities
- An Exhibit Featuring Leading Optics and Photonics Companies
- TOUR: The National Ignition Facility at Lawrence

Livermore National Laboratory

Technical Conference: September 16–20, 2007
Exhibit: September 18–19, 2007
Fairmont Hotel, San Jose, California, USA

Collocated With:

- Organic Materials and Devices for Displays and Energy Conversion (OMD)
- OSA Fall Vision Meeting 2007

2007 Frontiers in Optics Chairs

Connie J. Chang-Hasnain, Univ. of California at Berkeley, USA
Gregory J. Quarles, VLOC, USA

Laser Science XXIII Chairs

Frederick J. Raab, LIGO Hanford Observatory, USA
Charles A. Schmuttenmaer, Yale Univ., USA

Sponsors

JK Consulting
Nature Publishing Group
Newport
Optikos
Swamp Optics
Thorlabs Inc.

About The Meeting

Frontiers in Optics (FiO) 2007—the 91st OSA Annual Meeting—and Laser Science (LS) XXIII unite the Optical Society of America (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 2007 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 LS XXIII meeting serves as the annual meeting of the Division of Laser Science of the APS and provides an important forum for the latest work on laser applications and development,

spanning a broad range of topics in physics, biology and chemistry. The conference will continue to be held in conjunction with OSA's annual meeting.

Program Highlights

In This Section

Conference Program

This program for Frontiers in Optics 2007/Laser Science XXIII/Organic Materials and Devices for Displays and Energy Conversion will be available onsite in your registration bags.

Plenary Speakers

John L. Hall, JILA, Univ. of Colorado and NIST, USA
The Optical Frequency Comb: A Remarkable Tool with Many Uses

Climaxing more than 20 awards from his employer and major professional societies, Dr. Hall was awarded the 2005 Nobel Prize in Physics, sharing this honor with Theodor W. Hänsch of the Max-Planck-Institute and Roy J. Glauber of Harvard University. The Nobel was awarded for their contributions to the development of laser-based precision spectroscopy, including the optical frequency comb technique. The optical frequency comb can measure the frequency of another laser with extraordinarily high precision.

Eli Yablonovitch Univ. of California at Berkeley, USA
Nanophotonics: From Photonic Crystals to Plasmonics

Eli Yablonovitch graduated with the Ph.D. degree in Applied Physics from Harvard University in 1972. He worked for two years at Bell Telephone Laboratories and then became a professor of

applied physics at Harvard. In 1979 he joined Exxon to do research on photovoltaic solar energy. Then in 1984, he joined Bell Communications Research, where he was a Distinguished Member of Staff, and also Director of Solid-State Physics Research. In 1992 he joined the University of California, Los Angeles, where he was The Northrop Grumman Opto-Electronics Chair, Professor of Electrical Engineering. Now he Professor in the Electrical Engineering & Computer Sciences Dept., University of California, Berkeley.

His work has covered a broad variety of topics: nonlinear optics, laser-plasma interaction, infrared laser chemistry, photovoltaic energy conversion, strained-quantum-well lasers and chemical modification of semiconductor surfaces. Currently his main interests are in optoelectronics, high-speed optical communications, high-efficiency light-emitting diodes and nanocavity lasers, photonic crystals at optical and microwave frequencies, quantum computing and quantum communication.

Special Symposia at Frontiers in Optics 2007/Laser Science XXIII

- **Laser Science Symposium on Undergraduate Research**
  Monday, September 17, 12:00 p.m.–6:00 p.m.
  Fairmont Hotel, Empire Room

- **Joint FiO/Stanford Photonics Research Center (SPRC) Symposium**
  Monday, September 17, 1:00 p.m.–4:30 p.m.
  Fairmont Hotel, Club Regent

- **Optics for Energy**
  Monday, September 17, 1:30 p.m.–5:30 p.m.
  Fairmont Hotel, Empire Room

- **Joint FiO/LS Symposium: Optics and the Second "Magic Decade" of Quantum Mechanics**
  Wednesday, September 19, 8:30 a.m.–12:00 p.m.
  Fairmont Hotel, Belvedere Room

- **Special International Symposium on Optical Materials**
  Wednesday, September 19 and Thursday, September 20, various times
  Fairmont Hotel, Crystal Room

- **Organic Thin Films for Photonic Applications (OTF) Symposium**
  Wednesday, September 19, 12:00 p.m.–1:30 p.m. (posters) and 1:30 p.m.–6:00 p.m. (oral

sessions)
Fairmont Hotel, Atherton Room

- **(Guarded) Rational Exuberance: Renaissance after the Telecom Boom?!**
  Thursday, September 20, 8:00 a.m.–12:30 p.m.
  Fairmont Hotel, Gold Room

- **Best of Topicals**
  Thursday, September 20, 8:00 a.m.–12:30 p.m.
  Fairmont Hotel, Empire Room

Frontiers in Optics 2007/Laser Science XXIII Tutorials

- **FMA1, High-Power Fiber Sources: Recent Advances and Future Prospects**
  W. Andrew Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, United Kingdom.

  Strategies for scaling output power and brightness from rare-earth doped fiber lasers and amplifiers will be reviewed and the prospects for further improvement in performance will be considered.
- **FMB1, Engineering Nonlinearities in Optical Nanosystems**
  Richard Osgood; Columbia Univ., USA.

  This tutorial reviews the use of nanopatterning of materials to achieve enhanced optical nonlinear response and conversion. Nonlinear propagation in Si-wire waveguides and optical frequency conversion in metallic nanoarrays are used as illustrations.
- **JMC1, Single-Molecule Biophysical Imaging, Nanophotonics and Trapping**
  W. E. Moerner; Stanford Univ., USA.

  Single-molecule fluorescence imaging provides a powerful tool to explore individual biophysical systems, even in cells. Metallic nanoantennas improve the interaction between light and molecules, and a new electrokinetic trap improves single-molecule observation times in solution.
- **FTuB1, Silicon Photonics**
  Tom Koch; Lehigh Univ., USA.

  Silicon photonics has recently received heightened interest as a powerful vehicle for low-cost, high performance active integrated optical subsystems. This tutorial will review fundamental concepts, building blocks, and recent progress in the field.
- **FTuF1, Advances in Time Resolved Ultrafast X-Ray Science**
  Philip H. Bucksbaum; Stanford Univ., USA.

X-rays have probed atomic-scale structure for a century, but new ultrafast x-rays can record atomic motion as well. The sources, techniques, and science applications are discussed in this tutorial.

- **FTuO1, CARS Microscopy: Biomedical Imaging by Nonlinear Vibrational Spectroscopy**
  Sunney Xie; Harvard Univ., USA.

  Coherent anti-Stokes Raman scattering (CARS) microscopy is a noninvasive imaging technique using vibration spectroscopy as a contrast mechanism. Recent advances have allowed significant improvements in sensitivity, robustness, and cost, opening a range of biomedical applications.
- **FWP1, Advances in Single Molecule Biophysics: Breaking the Nanometer Barrier with Optical Tweezers**
  Steven M. Block; Stanford Univ., USA.

  Recent advances in optical trapping instrumentation for use in biophysical applications have reached atomic-level resolution for the motions of individual biomolecules. This tutorial will describe how it's done and some of what we've learned.
- **FWW1, Mountain Tops and Wilderness: A New Vision**
  Jannick P. Rolland; CREOL, USA.

  In this tutorial, we will focus on emerging deployable displays and displays worn on the body to support mobile users. Designs suitable for integration into the eyeglasses form factor will also be discussed.
- **FThB1, Confocal Microscopy without a Pinhole**
  Jerome Mertz; Boston Univ., USA.

  New fluorescence imaging techniques have been developed that provide confocal-like out-of-focus background rejection by simple widefield imaging with a CCD camera. I will review various techniques including structured illumination microscopy and dynamic speckle illumination microscopy.
- **FThH1, Devices for Optical Interconnects to Chips**
  David A. B. Miller; Stanford Univ., USA.

  This tutorial will discuss the requirements for devices for optical interconnects to chips, and recent progress in devices that are integrable with silicon technology, including germanium quantum wells.
- **FThS1, Review of Progress in Photonic Band-Gap Fibers**
  Karl Koch; Corning, Inc., USA.

  The unique properties of air-core photonic band-gap fibers and their underlying principles of operation are reviewed. In addition, applications and other opportunities for these fibers are reviewed.
- **FThU1, Optical Metamaterials: From Magnetics with Rainbow Colors to Negative-Index and Cloaking**
  Vladimir M. Shalaev; Purdue Univ., USA.

Metamaterials are expected to open a gateway to unprecedented electromagnetic properties and functionality unattainable from naturally occurring materials. We review this new emerging field and recent progress in demonstrating metamaterials in the optical range.

- **SThB1, Qualification and Lessons Learned with Space Flight Fiber Optic Components**
  Melanie Ott; Sigma Res. and Engineering, USA.

  This tutorial will focus on qualification methods and guidelines, examples of hardware development challenges and lessons learned from the past ten years of development and testing of optical fiber components for space flight programs.

FiO 2007 Short Courses

SC235 Nanophotonics: Materials, Fabrication and Characterization

Joseph W. Haus, Andrew Sarangan, Qiwen Zhan; Univ. of Dayton, USA

Course Level
Advanced beginner (basic understanding of topic is necessary to follow course material)

Benefits and Learning Objectives
This course should enable you to:

- Explain the basic linear and nonlinear optical properties of photonic crystals and metals.
- Learn how nanoscale effects are exploited in photonic devices.
- Discuss nanofabrication and design tools.
- Learn the principles of nanocharacterization tools.
- Describe computational and modeling techniques used in nanophotonics.
- Identify the latest advances in the field of nanophotonics.

Intended Audience
This course is intended for optics professionals who are interested in learning the fundamentals of nanoscale light-matter interactions, nanophotonic devices, fabrication, synthesis and nanocharacterization techniques.

Course Description
Nanophotonics is an emerging multidisciplinary field that deals with optics on the nanoscale. Recent progress in nanophotonics has created new and exciting technological opportunities. The interaction of light with nanoscale matter can provide greater functionality for photonic devices and render unique information about their structural and dynamical properties.

This nanophotonics course examines the key issues of optics on the nanometer scale. The course covers novel materials, such as photonic crystals, quantum dots, plasmonics, and metamaterials and their applications; it then identifies and explains selected fabrication and synthesis techniques. Photonic devices that exploit nanoscale effects, such as nonlinear optical effects and quantum confinement, will be discussed. Finally, various nanocharacterization techniques used in metrology, nondestructive evaluation and biomedical applications will be explained.

Biography
Joseph W. Haus is professor and director of the Electro-Optics Program at the Univ. of Dayton. His current research is concentrated on the linear and nonlinear optical properties of photonic crystals, especially novel photonic sensors, modulators and coherent light sources from THz to UV based on electromagnetic resonance effects. Andrew M. Sarangan is an associate professor of the Electro-Optics Graduate Program at the Univ. of Dayton. His research interests are in the general area of semiconductor devices, integrated optics and computational electromagnetics. His current research is focused on photonic crystals devices, specifically on novel nanophotonic resonator structures for applications in diode lasers and detectors. Qiwen Zhan is an assistant professor of the Electro-Optics Graduate Program at the Univ. of Dayton. He received his M.S. and Ph.D. in electrical engineering from the Univ. of Minnesota. Dr. Zhan's research interests are in the general area of physical optics, including nanophotonics, optical metrology and sensors techniques. His current research focuses on developing new polarization sensing and manipulation techniques for nanotechnology applications.

SC252 The Phase-Space Diagram: A New Paradigm for Analyzing Optical Signals and Systems

Markus Testorf[1], Jorge Ojeda-Castañeda[2]; [1]Dartmouth College, USA, [2]Univ. de Guanajuato, Mexico

Course Level
Advanced beginner (basic understanding of topic is necessary to follow course material)

Benefits and Learning Objectives
This course should enable you to:

- Translate conventional signal representations into phase-space and particularly into phase-space diagrams.
- Associate simple optical elements with the corresponding phase-space transform.
- Know the phase-space representation of signals which are important in optics.
- Summarize the limitations of phase-space optics.
- Analyze paraxial optical systems and their response in terms of phase-space diagrams.
- List at least five applications for which phase-space diagrams are beneficial.
- Derive the phase-space diagram for a composite optical system from its generic components.
- Describe the relationship between signal descriptions in optics based phase-space concepts.

Intended Audience
The course is intended for graduate students and professionals who have some optics background and who want to familiarize themselves with the concepts of phase-space optics and diagrams. The content should be comprehensible for anybody working on optics-related research and development projects. While the course is largely designed without prerequisites, basic knowledge of Fourier optics or signal and systems theory is recommended. The course is not recommended for a non-technical audience.

Course Description
The terms joint time-frequency transformation and local frequency spectrum refer to mathematical tools for dealing with the inevitable tradeoff between two physical variables that form a Fourier transform pair. The first term is commonly used in signal processing; the latter term is employed for analyzing physical systems. For applications in optical sciences, we denote this type of tools as a phase-space representation, or as the Wigner distribution function. We show the signal representation in the phase-space domain not only facilitates the separation of different signal components, but also contains information about the evolution of the optical wave as it propagates through an optical system. Fundamental properties, such as geometrical optics invariants, which are useful when describing the light gathering power of optical instruments, as well as the space bandwidth-product, are intimately related to the phase-space representation of optical signals and systems.

This Short Course introduces optical phase space as a natural representation of optical rays. Based on heuristic arguments, the phase-space representation of optical signals is modified in several steps to incorporate the terminologies of radiometry and Fourier optics. From this exploration the Wigner distribution function emerges as central joint transform, which is subsequently used to develop a signal and system theory based on phase-space representations. We also discuss an alternative motivation for a phase-space description which takes Fourier optics as its starting point and which leads to the signal representation in terms of the Ambiguity function. A significant part of the course is devoted to applications of phase-space optics, including the design of novel imaging devices extending the depth of field of an imaging system, as well as phase retrieval and signal recovery.

Biography
Markus Testorf received his doctorate in physics from the Univ. of Erlangen in Germany. He has worked at the Natl. Inst. of Astrophysics, Optics and Electronics in Puebla, Mexico; at the Univ. of Hagen in Germany; and at the Univ. of Massachusetts-Lowell. Testorf is currently an assistant professor at the Thayer School of Engineering at Dartmouth College. He has written or co-authored more than 130 articles and conference proceedings, including numerous articles related to phase-space concepts in optics and electromagnetism. Testorf has taught undergraduate- and graduate-level optics courses for a number of years, which has allowed him to gain experience with the use of phase-space concepts for optics education. Jorge Ojeda-Castañeda earned his doctorate in applied optics, under the supervision of H. H. Hopkins, F.R.S., at Univ. of Reading, UK. He has written more than 200 papers in academic journals and conference proceedings. He has acted as invited speaker at more than 30 international meetings on optics. For more than 25 years, he has been teaching courses in physics and mathematics at both graduate and

undergraduate levels. In many of his oral and written contributions, he has pioneered the use of phase-space representations for extending the field of view of optical systems.

SC274 Polarization Engineering

Russell Chipman; Univ. of Arizona, USA

Course Level
Advanced beginner (basic understanding of topic is necessary to follow course material)

Benefits and Learning Objectives
This course should enable you to:

- Understand how to follow the polarization changes along a ray path through a series of lenses, mirrors, polarization elements and anisotropic materials.
- Learn to calculate the Jones matrices for ray paths through sequences of thin film coated optical elements and interpret the “instrumental polarization” or polarization aberrations associated with ray paths.
- Understand how polarization state dependent point spread functions and modulation transfer functions are calculated.
- Visualize the Maltese cross, linear polarization tilt, and other fundamental polarization aberration pattern which occur in many systems and picture configurations like the crossed folding mirror which reduce polarization aberrations.
- Develop appropriate polarization specifications for optical systems.

Intended Audience
This class is intended for optical engineers, scientists and managers who need to understand and apply polarization concepts to optical systems. Some prior exposure to optical design programs and to linear algebra would be helpful.

Course Description
This course provides a survey of issues associated with calculating polarization effects in optical systems using optical design programs. Many optical systems are polarization critical and require careful attention to polarization issues. Such systems include liquid crystal projectors, imaging with active laser illumination, very high numerical aperture optical systems in microlithography and data storage, DVD players, imaging into tissue and turbid media, optical coherence tomography and interferometers. Polarization effects are complex: Retardance has three degrees of freedom; diattenuation (partial polarization) has three degrees of freedom; and depolarization, the coupling of polarized into partially polarized light, has nine degrees of freedom. Due to this complexity, polarization components and the polarization performance of optical systems are rarely completely specified.

The polarization aberrations introduced by thin films and uniaxial crystals can be readily evaluated in several commercial optical design codes. These routines are complex and most optical engineers are unfamiliar with the capabilities and the forms of output, but these polarization ray tracing routines provide better methods to communicate polarization

performance and specifications between different groups teamed on complex optical problems. Better means of technical communication speed the development of complex systems.

The course emphasizes the practical aspects of polarization elements and polarization measurements. The basic mathematics of the Poincare sphere, Stokes vectors and Mueller matrices are presented and applied to describe polarized light and polarization elements. Polarizers and retarders are introduced and their principal uses explained. The nonideal characteristics of polarization elements, liquid crystals and birefringent films are discussed with examples.

Biography
Russell Chipman is a professor of optical sciences at the Univ. of Arizona in Tucson. He runs the Polarization Laboratory, which performs measurements and simulations of polarization elements, liquid crystals and polarization aberrations. He managed optics departments at JDS Uniphase and Johnson & Johnson and was also a physics professor at the Univ. of Alabama at Huntsville. He has developed many unique spectropolarimeters and imaging polarimeters and conducted studies into polarization in fiber components, waveguides, liquid crystals, polarization elements and natural polarization signatures. He holds 12 patents in optics. He received his B.S. from MIT and Ph.D. in optical science from the Univ. of Arizona. Chipman is a Fellow of OSA and SPIE and a topical editor for *Applied Optics*. He chairs the Polarization Engineering group within OSA.

SC303 Lighting and Illumination

William Cassarly; Optical Res. Associates, USA

Course Level
Advanced beginner (basic understanding of topic is necessary to follow course material)

Benefits and Learning Objectives
This course should enable you to:

- Define the meaning of luminance, intensity, illuminance and etendue.
- Compare the output characteristics of commonly used incoherent sources.
- Describe the principles for obtaining uniformity using mixing rods.
- Discuss the use of simulations to quantify the output of illumination systems.
- Compare different approaches used to obtain uniformity in lighting systems.

Intended Audience
Individuals who design illumination systems or need to interface with those designers will find this course appropriate. Previous exposure to optical fundamentals (reflection, refraction, lenses, reflectors) is expected.

Course Description
Lighting and illumination have received much attention in recent years because of advances in sources, especially LEDs. The design of lighting and illumination systems requires balancing

uniformity, collection efficiency and packaging requirements. Some of the fundamental building blocks for illumination system design include an understanding of etendue and the design principles behind lightpipes, lens arrays, faceted optics and diffusers. In this Short Course, these building blocks are discussed through a combination of compute simulations, hardware demonstrations and in-depth discussions.

Biography
William Cassarly is a driving force in the movement to develop the field of computer-aided illumination engineering. His efforts include illumination optimization, illumination engineering consulting, papers, talks and educational course development. Some highlights of his efforts include two SPIE illumination courses, submitting the winning solution for the 2006 IODC Illumination Design Problem, and authoring a chapter in the *OSA Handbook of Optics on Illumination Engineering.* In addition, William Cassarly is the inventor on 34 U.S. patents and 15 patents pending.

SC306 Exploring Optical Aberrations

Virendra Mahajan; Aerospace Corp, USA

Course Level
Advanced beginner (basic understanding of topic is necessary to follow course material)

Benefits and Learning Objectives
This course should enable you to:

- Acquire a working knowledge of aberrations and their effect on energy on detector, line of sight error and MTF.
- Determine aberration tolerance based on Strehl ratio and Rayleigh's quarter wave rule.
- Specify fabrication and assembly errors based on a certain aberration tolerance.
- Understand the significance and use of the Zernike polynomials in optical design and testing.
- Develop effective working interface between system engineers/engineering managers and optical designers.
- Communicate effectively with optical engineers and designers.

Intended Audience
Anyone interested in acquiring a working knowledge of aberrations. Those who have a background in lens and optical system design or optical testing will also benefit from this course. Managers and system engineers will learn to communicate effectively with optical engineers and designers.

Course Description
The quality of an optical system is determined by its aberrations. This Short Course will explore the effect of aberrations on image quality. Starting with basic aberrations of optical systems, attendees will discuss how they affect central irradiance on a target, energy on a detector, and line of sight and resolution of a system. The importance of the use of Zernike polynomials in

optical testing and design, spot diagrams in optical system analysis and Strehl ratio for aberration tolerance will be covered. The chromatic aberrations and the polychromatic PSF and OTF will be explained.

Biography
Virendra (Vini) Mahajan is a graduate of the Optical Science Ctr., Univ. of Arizona, where he is an adjunct professor teaching courses on aberrations. He has 32 years of experience working on space optical systems, the last 23 with the Aerospace Corp. He is a Fellow of OSA, SPIE and the Optical Society of India. He is the author of *Aberration Theory Made Simple* (1991), the editor of *Selected Papers on Effects of Aberrations in Optical Imaging* (1993), and the author of *Optical Imaging and Aberrations, Part I: Ray Geometrical Optics* (1998), *Part II: Wave Diffraction Optics* (2001), all published by SPIE Press. He is also an Associate Editor of OSA's *Handbook of Optics* in the area of classical optics.

Frontiers in Optics/Laser Science Special Events

Fall Vision Meeting

Sunday, September 16–Wednesday, September 19
Doubletree Marina, Berkeley, California
The Optical Society of America Fall Vision Meeting is a small, high-quality scientific meeting focused on all aspects of vision research. Talks are organized so that there is plenty of time for discussion. Additional meeting details can be found at *http://www.osavisionmeeting.org/2007_new/*.

Annual OSA Student Chapter Leadership Meeting

Sunday, September 16, 8:00 a.m.–5:00 p.m.
Stanford University, Room AP 200
Chapter leaders from 108 student chapters attend this invitation-only event. This meeting focuses on leadership training, chapter management issues, and education outreach opportunities.

Optics Overviews: What's Hot in Optics Today?

Sunday, September 16, 4:00 p.m.–6:00 p.m.
Regency Ballroom
Find out what scientific and technical advances are being made over the entire field of optics. The OSA Technical Division Chairs will be presenting trends in their respective technical areas. The overviews highlight recent developments in optics and are designed to be informative and accessible even to the non-technical attendee.

- **What's Hot in Optical Design and Instrumentation,** Scott A. Lerner, *Hewlett-Packard, USA*

- **What's Hot in Optical Sciences,** Barry C. Walker, *Univ. of Delaware, USA*
- **What's Hot in Optics in Biology and Medicine,** Greg Faris, *SRI Intl., USA*
- **What's Hot in Optics in Information Science,** Eric Johnson, *Univ. of North Carolina at Charlotte, USA*
- **What's Hot in Photonics,** Jay Wiesenfeld, *Bell Labs, Alcatel-Lucent, USA*
- **What's Hot in Quantum Electronics,** Joseph W. Haus, *Univ. of Dayton, USA*
- **What's Hot in Vision and Color,** Ione Fine, *Univ. of Washington, USA*

Participants' presentations will also be placed on the OSA website (*www.osa.org)* for viewing by the general public. Go to the technical groups areas of the membership section of OSA's website to view the technical overviews from this conference as well as those presented during the OSA Leadership Conference in February 2007.

Welcome Reception and Joint FiO/LS Poster Session I

Sunday, September 16, 6:00 p.m.–7:30 p.m.
St. Claire Hotel, Ballroom
Kick off the FiO 2007/LS XXIII meeting by attending the welcome reception and opening poster session! Meet with your colleagues, kick off the technical program with close to 50 poster presentations, network with your peers and make new acquaintances. Light hors d'oeuvres will be served.

FiO/LS Poster Presentations

Sunday, September 16, 6:00 p.m.–7:30 p.m.
St. Claire Hotel, Ballroom

Wednesday, September 19 12:00 p.m.–1:30 p.m.
Regency and Imperial Ballroom Foyer, Fairmont Hotel

This year there are 95 FiO and nine LS posters scheduled for presentation. 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.

OSA Division and Technical Group Meetings

Network with peers, meet group leaders and get involved in planning future group activities by attending division meetings during FiO. The following divisions have planned group meetings at FiO:

Sunday, September 16, 3:00 p.m.–3:30 p.m.
Vision and Color, Doubletree Marina, Berkeley

Sunday, September 16, 7:30 p.m.–8:30 p.m.
Optical Sciences, Fairmont Hotel, Empire Room
Optics in Biology and Medicine, Fairmont Hotel, Crystal Room

Optics in Information Science, Fairmont Hotel, Gold Room
Photonics, Fairmont Hotel, Valley Room
Quantum Electronics, Fairmont Hotel, California Room

Monday, September 17, 7:30 p.m.–8:30 p.m.
Optical Design and Instrumentation, Fairmont Hotel, Empire Room

These 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 division chair with your input.

2007 Joint FiO/LS Awards Ceremony and Plenary Session

Monday, September 17, 8:30 a.m.–12:00 p.m.
Regency Ballroom
The 2007 Joint FiO/LS Awards Ceremony and Plenary Session will feature three world-renowned speakers. See the plenary page for detailed descriptions of the speakers and their presentations.

Symposium on Undergraduate Research

Monday, September 17, 12:00 p.m.–6:00 p.m. (or later)
Glen Ellen Room (oral papers) and Fairfield Room (posters)
This special DLS annual symposium is rapidly becoming one of the most successful DLS traditions (this year's is the seventh of a series that began at the Long Beach meeting in 2001). During the past three years the number of undergraduates presenting papers has grown from fewer than 20 to more than 30, 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, preceded by lunch for the presenters. 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. See the separate Symposium on Undergraduate Research program in your registration bag for speaker information.

Going for the Goal Workshop! (sponsored by the OSA Foundation)

Monday, September 17, 1:00 p.m.–3:00 p.m.
St. Claire Hotel, Ballroom
This session is ideal for students that are charting their professional course. The program will focus on strategies for defining and achieving career goals. This event is free of charge and open to all student attendees.

Speaker: Mitzi Weinman, President, TimeFinder, USA

OSA's Annual Business Meeting

6:30 p.m.–7:30 p.m.
Monday, September 17
Fairmont Hotel, Belvedere Room

Learn more about OSA and join the OSA Board of Directors for the Society's annual business meeting on Monday, September 17. The 2006 Activity Reports will be presented and the results of the Board of Directors election will be announced.

I. Welcome 2007 OSA President, Joseph H. Eberly
II. 2006 Activity Reports from Society Representatives
    Treasurer, Stephen Fantone
    Chair, Board of Editors, Tony F. Heinz
    Chair, Publications Council, James R. Fienup
    Co-Chair, Science & Engineering Council, Robert W. Boyd and
    Co-Chair, Science & Engineering Council, Edward A. Watson
    Chair, Membership/Education Services Council, Adam P. Wax
    Chair, Corporate Associates Committee, Paul M. Crosby
    Chair, International Council, Jonathan P. Marangos
    Chair, OSA Foundation, Gary C. Bjorklund
III. Election Results: Vice President and Directors at Large, Joseph H. Eberly

OSA Student Member Welcome Reception

Monday, September 17, 7:30 p.m.–9:30 p.m.
Smoke Tiki Lounge
OSA Student Members are invited to attend this social event that provides a perfect opportunity to meet new friends and have a good time. The reception is free of charge for OSA student members.

Minorities and Women in OSA (MWOSA) Networking Breakfast

You are invited to attend the Minorities and Women in OSA Networking Breakfast to meet and network with others in the optics industry.

This year's event will feature Kate Pickle, Science Technology Engineering and Math (STEM) Project Manager for the Girl Scouts of the USA (GSUSA), who will discuss the approach the Girl Scouts have taken to help girls meet the growing need for skilled science and technology professionals. She will also highlight the partnership between the GSUSA and the OSA Foundation and the role professional societies and their members can play in engaging girls in science at an early age.

When: Tuesday, September 18, 8:00 a.m.– 9:30 a.m.
Where: Fairmont Hotel, Club Regent

There is limited space. RSVP for this event by September 5 to KiKi L'Italien at klital@osa.org.

OSA Member Reception and JOSA 90th Anniversary Celebration

Tuesday, September 18, 6:30 p.m.–8:00 p.m.
St. Claire Hotel, Ballroom
The OSA Member Reception is a special tradition; it's a time when members gather for great conversation, and lots of good cheer! This year's reception includes a special 90th anniversary celebration for the *Journal of the Optical Society of America* (JOSA). All OSA members are encouraged to attend. Delicious refreshments will be served, admittance is free.

Division of Laser Science Annual Business Meeting

Tuesday, September 18, 6:30 p.m.–7:00 p.m.
Fairfield Room
All members and interested parties are invited to attend the Annual Business Meeting of the Division of Laser Science. 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 LS Conference.

Laser Science Banquet

Tuesday, September 18, 7:30 p.m.–10:00 p.m.
Gordon Biersch Brewery
Join your colleagues for the annual LS Banquet. Tickets are required for this event and can be purchased at registration for $50. Tickets must be purchased by 12:00 noon on Monday, September 17.

Meet the Editors of the APS Journals

Wednesday, September 19, 3:30 p.m.–5:30 p.m.
Fairmont Hotel, Bamboo Lounge

The Editors of the APS journals cordially invite you to join them for conversation and refreshments on Wednesday, September 19, 3:30 p.m.–5:30 p.m. in the Bamboo Lounge. Your questions, criticisms, compliments and suggestions about the journals are welcome. We hope you will be able to join us.

FiO Postdeadline Papers

Wednesday, September 19, 6:00 p.m.–7:00 p.m.
Rooms to Be Announced

Science Educators' Day

Thursday, September 20, 5:30 p.m.–9:00 p.m.
Regency Ballroom
Sponsored by OSA, the Northern California Local Section, and the OSA Student Chapters at Stanford and Berkeley, Educator's Day is designed to provide middle and high school science teachers with optics teaching resources. This event features hand-on classroom experiment demonstrations lead by optics experts.

TOUR: The National Ignition Facility at Lawrence Livermore National Laboratory

FiO/LS Attendees are invited to participate in a tour of the Lawrence Livermore National Laboratory 's National Ignition Faciltiy (NIF) on Thursday, September 20. Space is limited to 46 persons so sign up today. ***Please note that participants must meet requirements.*** *For a list of requirements and to sign up email Bonnie McDonald at mcdonald39@llnl.gov*. For Visitor Badging/Non DOE personnel, you must also send Bonnie your Social Security Number, Date of Birth, and Place of Birth. DOE Personnel, if you have a DOE Standard Badge, that will get you access onto the LLNL site. You must sign up for the tour no later than Close of Business on Thursday, September 13, 2007. The tour will depart from the San Jose Fairmont Hotel at 7:30 a.m. on Thursday, September 20 and return to the Fairmont at approximately 2:00 p.m. Transportation is provided by LLNL. All those interested must sign up by September 13 as tour participants must be confirmed in advance of the FiO Conference.

All tour participants must bring a valid U.S. issued driver's license.

Exhibitor List

4D Technology Corporation
Breault Research Organization
Cambridge University Press
Chroma Technology Corp.
Coherent Inc.
CVI Melles Griot
Del Mar Photonics
Femtolasers, Inc.
Hamamatsu Corporation
Institute of Optics, University of Rochester
IOP Publishing
Laser Focus World
Materials Research Society
Micro Laser Systems Inc.
Nature Publishing Group
New Focus
Newport Corporation
Novawave Technologies

OFS - Specialty Photonics Division
OP-TEC
Ophir-Spiricon
OPN
Optical Society of America
Optikos Corporation
Optosigma Corporation
Photonics Spectra
Physics Today
Polymicro Technologies LLC
Precision Asphere LLC
Santec USA Corporation
Society of Vacuum Coaters
Stanford Photonics Research Center (SPRC)
Swamp Optics, LLC
Taylor & Francis
TeachSpin, Inc.
Thorlabs
Universal Photonics, Inc.
University of Arizona - College of Optical Sciences
University of Central Florida
Wiley
Zygo Corporation

SCIENCE EDUCATORS' DAY

Register Now!
Thursday, September 20, 2007 5:30 p.m.-9:00 p.m.
Regency Ballroom, Fairmont Hotel
170 South Market Street, San Jose, California

- Attend this free event for middle and high school science teachers sponsored by the Optical Society of America (OSA), the Northern California Local Section of OSA, and the OSA Student Chapters at Stanford and Berkeley
- Come see hands-on experiments and demonstrations on optical phenomena:
    - Fluorescence: Viewing Glowing Colors and Invisible Ink

    - Splitting White Light: Prisms, Soap Bubbles and Rainbows
    - Creating Colors from Polarization
    - Waveguides: Water and Jell-O Light Pipes, Fiber Optics
    - And Much More!
- Receive a participant packet of educational resources and lesson plans for replicating demonstrations in the classroom
- Meet Stanford and Berkeley graduate students, staff, and local educators interested in science outreach
- Enjoy a dinner with other local science educators

Corporate Sponsors:

Agenda of Sessions — Sunday, September 16, 2007

8:00 a.m.–5:00 p.m.	OSA Student Chapter Leadership Meeting, *Stanford University, Room AP200*
9:00 a.m.–12:30 p.m.	**Short Courses,** *Locations will be provided at registration* **SC235:** Nanophotonics: Design, Fabrication and Characterization **SC252:** The Phase-Space Diagram: A New Paradigm for Analyzing Optical Signals and Systems **SC253:** Medical Imaging and Beyond **SC304:** Free-Form Optics Design for Illuminarion
1:30 p.m.–5:00 p.m.	**Short Courses,** *Locations will be provided at registration* **SC274:** Polarization Engineering **SC303:** Lighting and Illumination **SC305:** Optical Materials for Advanced Photonic Applications **SC306:** Exploring Optical Aberrations
3:00 p.m.–3:30 p.m.	OSA Vision and Color Business Meeting, *Doubletree Marina, Berkeley*
4:00 p.m.–6:00 p.m.	Optics Overviews: What's Hot in Optics Today? *Fairmont Hotel, Regency Ballroom*
6:00 p.m.–7:30 p.m.	**JSuA:** Welcome Reception and Joint FiO/LS Poster Session, *Sainte Claire Hotel, Ballroom*
7:30 p.m.–8:30 p.m.	OSA Division and Technical Group Meetings Optical Sciences, *Fairmont Hotel, Empire Room* Optics in Information Science, *Fairmont Hotel, Gold Room* Photonics, *Fairmont Hotel, Valley Room* Quantum Electronics, *Fairmont Hotel, California Room*

KEY TO SHADING:

Frontiers in Optics | Laser Science | Joint FiO/LS | OMD

Agenda of Sessions — Monday, September 17, 2007

	Empire	Crystal	Gold	Valley	California
8:30 a.m.–10:00 a.m.	**JMA:** 2007 Joint FiO/LS Awards Ceremony, *Fairmont Hotel, Regency Ballroom*				
10:00 a.m.–10:30 a.m.	Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*				
10:30 a.m.–12:00 p.m.	**JMB:** 2007 Joint FiO/LS Plenary Session, *Fairmont Hotel, Regency Ballroom*				
12:00 p.m.–1:30 p.m.	Lunch Break				
12:00 p.m.–6:00 p.m.	**SMA:** Symposium on Undergraduate Research Posters, *Fairmont Hotel, Fairfield Room*				
1:00 p.m.–4:30 p.m.	**SMB:** Joint FiO/SPRC Symposium, *Fairmont Hotel, Club Regent*				
1:00 p.m.–3:00 p.m.	Student Event: Going for the Goal! Workshop, *Sainte Claire Hotel, Ballroom*				
1:30 p.m.–3:30 p.m.	**SMC:** Optics for Energy I	**FMA:** Fiber Lasers	**FMB:** NLO in Engineered Materials I	**FMC:** Silicon Photonic Systems of Information Processing	**FMD:** Integrated Optic Devices I
3:30 p.m.–4:00 p.m.	Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*				
4:00 p.m.–6:00 p.m.	**SME:** Optics for Energy II (ends at 5:30 p.m.)	**FMF:** Ultrashort-Pulse Fiber Lasers	**FMG:** NLO in Engineered Materials II	**FMH:** Computational Imaging I	**FMI:** Integrated Optic Devices II
6:30 p.m.–7:30 p.m.	OSA's Annual Business Meeting, *Fairmont Hotel, Belvedere Room*				
7:30 p.m.–8:30 p.m.	OSA Optical Design and Instrumentation Division Meeting, *Fairmont Hotel, Empire Room*				
7:30 p.m.–9:30 p.m.	OSA Student Member Welcome Reception, *Smoke Tiki Lounge, 152 Post St.*				

Hillsborough	Sacramento	Piedmont	Glen Ellen	Atherton
JMA: 2007 Joint FiO/LS Awards Ceremony, *Fairmont Hotel, Regency Ballroom*				
Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*				
JMB: 2007 Joint FiO/LS Plenary Session, *Fairmont Hotel, Regency Ballroom*				
Lunch Break				
SMA: Symposium on Undergraduate Research Posters, *Fairmont Hotel, Fairfield Room*				
SMB: Joint FiO/SPRC Symposium, *Fairmont Hotel, Club Regent*				
Student Event: Going for the Goal! Workshop, *Sainte Claire Hotel, Ballroom*				
FME: Optical Design and Applications in General Lighting and Illumination	**JMC:** Imaging and Microscopy—Biological I	**LMA:** Gravitational Wave Detectors (starts at 1:45 p.m.)	**SMD:** Symposium on Undergraduate Research	**OMA:** Organic Semiconductor Devices (ends at 3:15 p.m.)
Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*				
FMJ: Data Reduction Methods and Computational Imaging (ends at 5:45 p.m.)	**JMD:** Imaging and Microscopy—Biological II	**LMB:** Space-Based Tests of Relativity (ends at 5:45 p.m.)	**SMF:** Symposium on Undergraduate Research	**OMB:** Materials and Devices for OLEDs I (ends at 5:45 p.m.)
OSA's Annual Business Meeting, *Fairmont Hotel, Belvedere Room*				
OSA Optical Design and Instrumentation Division Meeting, *Fairmont Hotel, Empire Room*				
OSA Student Member Welcome Reception, *Smoke Tiki Lounge, 152 Post St.*				

Agenda of Sessions — Tuesday, September 18, 2007

	Empire	Crystal	Gold	Valley	California
8:00 a.m.–10:00 a.m.	**FTuA:** Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources I (ends at 9:45 a.m.)	**FTuB:** Silicon Photonics	**FTuC:** Propagation in Disordered Media	**JTuA:** Quantum Information	**FTuD:** Biosensors I
8:00 a.m.–9:30 a.m.	Minorities and Women in OSA (MWOSA) Networking Breakfast, *Fairmont Hotel, Club Regent*				
10:00 a.m.–10:30 a.m.	Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
10:00 a.m.–5:00 p.m.	Exhibit Hall Open				
10:30 a.m.–12:30 p.m.	**FTuF:** Ultrafast Dynamics: THz to X-Rays	**FTuG:** Silicon Nanophotonics	**FTuH:** Coherence and Polarization I	**FTuI:** Quantum Sensing and Imaging I (ends at 12:15 p.m.)	**FTuJ:** Biosensors II (ends at 12:15 p.m.)
12:30 p.m.–2:00 p.m.	Exhibit-Only Time Lunch Break				
2:00 p.m.–4:00 p.m.	**FTuL:** Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources II	**FTuM:** Active Photonic Devices in Silica	**FTuN:** Coherence and Polarization II (ends at 3:45 p.m.)	**JTuB:** Quantum Sensing and Imaging II (ends at 3:45 p.m.)	**FTuO:** Nonlinear Microscopy in Biology I
4:00 p.m.–4:30 p.m.	Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
4:30 p.m.–6:30 p.m.	**FTuQ:** Ultrafast Science: X-Rays and Accelerators	**FTuR:** Short Pulse Fiber Lasers and Amplifiers (ends at 6:00 p.m.)	**FTuS:** Coherence and Polarization III	**FTuT:** Photonic Crystals and Emission	**FTuU:** Nonlinear Microscopy in Biology II
6:30 p.m.–7:00 p.m.	Division of Laser Science Annual Business Meeting, *Fairmont Hotel, Glen Ellen Room*				
6:30 p.m.–8:00 p.m.	OSA Member Reception and JOSA 90th Anniversary Celebration, *Sainte Claire Hotel, Ballroom*				
7:30 p.m.–10:00 p.m.	Laser Science Banquet, *Gordon Biersch Brewery, 33 E. San Fernando St.**				

*Tickets must be purchased in advance. See Special Events section for more information.

Hillsborough	Sacramento	Piedmont	Glen Ellen	Atherton
FTuE: Precision Engineering in Optics	**LTuA:** Time-Resolved X-Ray and Electron Diffraction (starts at 8:30 a.m.)	**LTuB:** Precision Techniques at High Laser Power I	**LTuC:** Properties and Dynamics of Interfaces and Surfaces I (starts at 8:45 a.m.)	**OTuA:** OTFT Materials and Devices
Minorities and Women in OSA (MWOSA) Networking Breakfast, *Fairmont Hotel, Club Regent*				
Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
Exhibit Hall Open				
FTuK: Photonic Crystals	**LTuD:** Optical Probes of Nanomaterials	**LTuE:** Precision Techniques at High Laser Power II	**LTuF:** Properties and Dynamics of Interfaces and Surfaces II (ends at 11:45 a.m.)	**OTuB:** Organic Laser and Other New Devices (ends at 12:00 p.m.)
Exhibit-Only Time Lunch Break				
FTuP: Aberration Theory in Optical Testing	**LTuG:** Precision Techniques on Short Time Scales I	**LTuH:** Clocks, Navigation and Magnetometers	**LTuI:** Imaging and Microscopy—Non-Biological I (starts at 2:30 p.m.)	**OTuC:** Materials and Devices for Organic Photovoltaics (ends at 3:45 p.m.)
Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
FTuV: General Optical Design and Instrumentation I	**LTuJ:** Precision Techniques on Short Time Scales II (ends at 5:45 p.m.)	**LTuK:** Laser-Based Space Missions	**LTuL:** Imaging and Microscopy—Non-Biological II	**OTuD:** Materials and Devices for OLEDs II (ends at 6:15 p.m.)
Division of Laser Science Annual Business Meeting, *Fairmont Hotel, Glen Ellen Room*				
OSA Member Reception and JOSA 90th Anniversary Celebration, *Sainte Claire Hotel, Ballroom*				
Laser Science Banquet, *Gordon Biersch Brewery, 33 E. San Fernando St.**				

Agenda of Sessions — Wednesday, September 19, 2007

	Empire	Crystal	Gold	Valley	California
8:00 a.m.–10:00 a.m.	**FWA:** Ultrafast Dynamics of Biological and Chemical Systems I	**FWB:** High Power Fiber Lasers and Amplifiers	**FWC:** Complex Light Fields	**FWD:** Metamaterials I	**FWE:** Clinical and Preclinical Imaging and Therapeutics
8:30 a.m.–12:00 p.m.	**SWA:** Joint FiO/LS Symposium: Optics and the Second "Magic Decade" of Quantum Mechanics, *Fairmont Hotel, Belvedere Room*				
10:00 a.m.–10:30 a.m.	Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
10:00 a.m.–4:00 p.m.	Exhibit Hall Open				
10:30 a.m.–12:00 p.m.	**FWG:** Ultrafast Pulse Measurements I	**FWH:** Diffractive Micro- and Nanostructures for Sensing and Information Processing I	**FWI:** Light Interaction with Engineered Materials	**FWJ:** Metamaterials II	**FWK:** Optical Coherence Tomography
12:00 p.m.–1:30 p.m.	**JWC:** Joint FiO/LS Poster Session II, *Fairmont Hotel, Regency Ballroom*				
1:30 p.m.–3:30 p.m.	**FWM:** RF Photonics I	**SWB:** Photonic Materials I	**FWN:** Quantum Light-Matter Interface	**FWO:** Plasmonic Metamaterials and Waveguides	**FWP:** Advances in Optical Trapping
1:30 p.m.–3:30 p.m.	**FWR:** Diffractive Micro- and Nanostructures for Sensing and Information Processing II, *Fairmont Hotel, Belvedere Room*				
3:30 p.m.–4:00 p.m.	Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
4:00 p.m.–6:00 p.m.	**FWS:** RF Photonics II	**SWC:** Photonic Materials II and Structured Nonlinear Crystals	**FWT:** EIT and Quantum Information	**FWU:** Near Field Optics (ends at 5:45 p.m.)	**FWV:** Diffuse Imaging and Spectroscopy (ends at 6:15 p.m.)
6:00 p.m.–7:30 p.m.	FiO Postdeadline Papers, *Locations are listed in Postdeadline Papers program in registration bag*				

Hillsborough	Sacramento	Piedmont	Glen Ellen	Atherton
FWF: Light-Confining Micro- and Nano-Structures	**LWA:** Cavity Ringdown Spectroscopy I (starts at 8:15 a.m.)	**JWA:** Radiation Pressure, Cooling and Quantum Cantilevers I	**LWB:** Time-Resolved Photoemission, Photoionization and Photodetachment I (starts at 8:30 a.m.)	**OWA:** Device Physics
SWA: Joint FiO/LS Symposium: Optics and the Second "Magic Decade" of Quantum Mechanics, *Fairmont Hotel, Belvedere Room*				
Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
Exhibit Hall Open				
FWL: Spectral Imaging and Holographic Storage	**LWC:** Cavity Ringdown Spectroscopy II	**JWB:** Radiation Pressure, Cooling and Quantum Cantilevers II	**LWD:** Time-Resolved Photoemission, Photoionization and Photodetachment II	**OWB:** Solution-Processed Organic Electronic Devices (ends at 12:15 p.m.)
JWC: Joint FiO/LS Poster Session II, *Fairmont Hotel, Regency Ballroom*				
FWQ: Optical Vortices and Imaging Complex Media	**LWE:** Slow and Stored Light (starts at 1:45 p.m.)	**LWF:** Beyond the Simple Quantum Limit in Gravitational Wave Detectors (starts at 2:30 p.m.)	**LWG:** 2-Dimensional Spectroscopy I	**TWA:** Organic Thin Films for Photonic Applications I (ends at 3:15 p.m.)
FWR: Diffractive Micro- and Nanostructures for Sensing and Information Processing II, *Fairmont Hotel, Belvedere Room*				
Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*				
FWW: Virtual/Mixed Environments and Interactivity (ends at 5:45 p.m.)	**LWH:** Cold Atom and Molecule Systems (ends at 5:45 p.m.)	**LWI:** Chip-Scale Atomic Devices	**LWJ:** 2-Dimensional Spectroscopy II (ends at 6:15 p.m.)	**TWB:** Organic Thin Films for Photonic Applications II
FiO Postdeadline Papers, *Locations are listed in Postdeadline Papers program in registration bag*				

Agenda of Sessions — Thursday, September 20, 2007

	Empire	Crystal	Gold	Valley	California
8:00 a.m.–10:00 a.m.	**SThA:** Best of Topicals I (ends at 10:10 a.m.)	**SThB:** Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments I	**SThC:** (Guarded) Rational Exuberance: Renaissance after the Telecom Boom?	**FThA:** Ultrafast Dynamics of Biological and Chemical Systems II (ends at 9:30 a.m.)	**FThB:** Advanced Biological Microscopy and Tissue Ablation
10:00 a.m.–10:30 a.m.	Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*				
10:30 a.m.–12:30 p.m.	**SThD:** Best of Topicals II (ends at 12:10 p.m.)	**SThE:** Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments II and Ceramic Materials I	**SThF:** (Guarded) Rational Exuberance: Renaissance after the Telecom Boom?	**FThD:** Ultrafast Pulse Measurements II (ends at 12:15 p.m.)	**FThE:** Seeing the Invisible: Strategies for Imaging Transparent Cell Types I
12:30 p.m.–2:00 p.m.	Lunch Break				
2:00 p.m.–4:00 p.m.	**FThH:** Silicon and III-V Based Optoelectronics for Optical Interconnects	**SThG:** Ceramic Materials II	**FThI:** Nanoscale Concentration of Light I	**FThJ:** Microstructured and Novel Optical Fibers	**FThK:** Seeing the Invisible: Strategies for Imaging Transparent Cell Types II (ends at 2:45 p.m.); **FThP:** Engineering the Eye: Advances in Retinal Prostheses I (starts at 3:00 p.m.)
4:00 p.m.–4:30 p.m.	Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*				
4:30 p.m.–6:30 p.m.	**FThQ:** Computational Imaging II	**SThH:** Nanocrystals and Quantum Dots (ends at 6:45 p.m.)	**FThR:** Nanoscale Concentration of Light II	**FThS:** Microstructured, Nonlinear and Novel Optical Fibers (ends at 6:15 p.m.)	**FThT:** Engineering the Eye: Advances in Retinal Prostheses II (ends at 5:45 p.m.)
5:30 p.m.–9:00 p.m.	Science Educators' Day, *Fairmont Hotel, Regency Ballroom*				

Hillsborough	Sacramento	Piedmont	Glen Ellen
FThC: Metamaterials-Based Devices	**LThA:** Cold Atoms and Degenerate Gases I (ends at 9:45 a.m.)	**LThB:** General Techniques	**LThC:** Terahertz Spectroscopy I
Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*			
FThF: Optical Antennae	**LThD:** Cold Atoms and Degenerate Gases II (ends at 12:00 p.m.)	**FThG:** General Optical Design and Instrumentation II	**LThE:** Terahertz Spectroscopy II
Lunch Break			
FThL: Plasmonics and Nanocrystals (ends at 3:30 p.m.)	**FThM:** Diffractive Micro- and Nanostructures for Sensing and Information Processing III	**FThN:** Coherence and Polarization IV	**FThO:** Random Lasers and Disordered Media (ends at 3:45 p.m.)
Coffee Break, *Fairmont Hotel, Regency and Imperial Ballroom Foyers*			
FThU: Cloaking	**FThV:** Diffractive Micro- and Nanostructures for Sensing and Information Processing IV	**FThW:** Coherence and Polarization V	
Science Educators' Day, *Fairmont Hotel, Regency Ballroom*			

8:00 a.m.–5:00 p.m., Student Chapter Leadership Meeting, *Stanford University, Room AP200*

9:00 a.m.–12:30 p.m. **Short Courses,** *Locations will be provided at registration*
SC235: Nanophotonics: Materials, Fabrication and Characterization
SC252: The Phase-Space Diagram: A New Paradigm for Analyzing Optical Signals and Systems
SC253: Medical Imaging and Beyond
SC304: Free-Form Optics Design for Illumination

1:30 p.m.–5:00 p.m. **Short Courses,** *Locations will be provided at registration*
SC274: Polarization Engineering
SC303: Lighting and Illumination
SC305: Solid-State Optical Materials for Advanced Photonic Applications
SC306: Exploring Optical Aberrations

3:00 p.m.–3:30 p.m., OSA Vision and Color Business Meeting, *Doubletree Marina, Berkeley*

4:00 p.m.–6:00 p.m., Optics Overviews: What's Hot in Optics Today? *Fairmont Hotel, Regency Ballroom*

Sainte Claire Hotel, Ballroom

Joint

6:00 p.m.–7:30 p.m.
JSuA • Welcome Reception and Joint FiO/LS Poster Session I

Optical Design and Instrumentation Posters

JSuA1
Experimental Investigation of Freedericksz Transition in Square Electric Pulse Sequence Field, *Vardan Margaryan, R. B. Alaverdyan, A. L. Aslanyan, L. S. Aslanyan, G. S. Gevorgyan, E. A. Santrosyan; Yerevan State Univ., Armenia.* Freedericksz transition is theoretically and experimentally investigated in square pulse sequence. The dependence of storage effect on filling coefficient of pulse is shown. The results of experiment confirm to the conclusions of numerical analysis.

JSuA2
A Liquid-Crystal-Based Terahertz Polarizer, *Cho-Fan Hsieh[1], Yu-Chien Lai[1], Ru-Pin Pan[1], Ci-Ling Pan[2]; [1]Dept. of Electrophysics, Natl. Chiao Tung Univ., Taiwan, [2]Dept. of Photonics and Inst. of Electro-optical Engineering, Natl. Chiao Tung Univ., Taiwan.* We demonstrate a Feussner-type terahertz polarizer using nematic liquid crystal (NLC). The polarization factor of the device exceeds 0.95 from 0.2 to 0.9 THz.

JSuA3
Mode Shape Analysis in Square Plate Using DSPI, *Saba Mirza[1], Chandra Shakher[1], Safia Akhtar Kazmi[2]; [1]Indian Inst. of Technology Delhi, India, [2]Aligarh Muslim Univ., Aligarh, India.* In this paper, the study of transverse vibrations, mode shape analysis in square plate free at all ends and wavelet-filtering scheme for the removal of speckle noise in speckle interferograms are presented using DSPI.

JSuA4
Terahertz Beam Splitting by Tunable Liquid Crystal Phase Grating, *Chia-Jen Lin[1], Yu-Tai Li[2], Cho-Fan Hsieh[1], Ru-Pin Pan[1], Ci-Ling Pan[2]; [1]Dept. of Electrophysics, Natl. Chiao Tung Univ., Hsinchu, Taiwan, [2]Dept. of Photonics and Inst. of Electro-optical Engineering, Natl. Chiao Tung Univ., Hsinchu, Taiwan.* We demonstrate a liquid crystal phase grating as a beam splitter for the terahertz wave. The beam splitting ratio can be tuned from 11:1 to 1:1.

JSuA5
Optical Fabrication of a Micro-Electron Column and Large Area Scanning Application, *Won K. Jang[1], Sung-soon Park[2], Ho-Seob Kim[2]; [1]Hanseo Univ., Republic of Korea, [2]Sunmoon Univ., Republic of Korea.* Basic components of micro-electron column were assembled with optical alignment and laser bonding. Source and Einzel lenses were aligned with the diffraction method of laser beam and bonded simultaneously by laser welding.

JSuA6
The Single-Angle Plane-Wave Spectral Response of One-Dimensional Photonic Crystal Structures, *Gregory R. Kilby[1], James J. Raftery, Jr.[1], Thomas K. Gaylord[2]; [1]United States Military Acad., USA, [2]Georgia Tech, USA.* The multiple-incident-angle transmittances or reflectances of fabricated 1-D photonic crystal (PC) structures are measured. Regularization methods are applied to these measurements to determine the single-angle plane-wave spectral response of the structure.

JSuA7
Complete Polarization Conversion Using One Crystal Exhibiting Dual Transverse Pockels Effect, *Changsheng Li; Beihang Univ., China.* The complete polarization conversion, which converts one arbitary state of polarization into another arbitary one, can be achieved by controlling only two voltages applied to one electrooptic crystal exhibiting dual transverse Pockels effect.

JSuA8
Design of a Photon-Counting System for Raman Spectroscopy, *F. R. Pérez[1], C. Del Valle[1], L. Reyes[2], J. Tobón[2], C. Barrero[2], A. Velásquez[2]; [1]Univ. Pontificia Bolivariana, Colombia, [2]Univ. de Antioquia, Colombia.* This system uses a photo-multiplier. The counting photon system is conformed by 5 stages, which are: the detector, a pre-amplifier, a pulse comparator, a pulses counter and a communications interface in PC.

JSuA9
Alignment of Segmented Mirror with the Stitched Method, *Fermín S. Granados-Agustín, Fausto Escobar-Romero, Alejandro Cornejo-Rodríguez; INAOE, Mexico.* A segmented parabolic mirror is aligned using the stitched method. The method considered the focusing, piston, and tilt's. Experimental results are presented for a mirror with diameter of 10 cm, and r.c. of 59.66 cm.

JSuA10
Data Fitting on a Semisphere, *J. J. Sanchez-Mondragon[1], Abundio Davila[2], M. Torres Cisneros[3], D. A. May-Arrioja[1], J. Escobedo-Alatorre[4]; [1]Inst. Nacional de Astrofísica Optica y Electrónica, Mexico, [2]Ctr. de Investigaciones en Óptica, Mexico, [3]Electronics Dept., FIMEE, Univ. of Guanajuato, Mexico, [4]Ctr. for Res. in Engineering and Applied Sciences, UAEM, Mexico.* We obtain the semispherical polynomial data fitting and compare it with the Zernike polynomials fitting of the projection on a circle. We show the matrices that relate them and the one with the spherical harmonics.

JSuA11
Optical System to Measure and Record 3D Profiles the Architectural Heritage Relief in Historic Buildings of Puebla City, *Juan Castillo-Mixcóatl, Severino Muñoz-Aguirre, Georgina Beltrán Pérez; Benemérita Univ. Autónoma de Puebla, Mexico.* The results of an optical-system using the fringes-projection technique to measure the historic building relief are shown. This system will be used to get an historic memory of ours historic buildings.

JSuA • Welcome Reception and Joint FiO/LS Poster Session I—Continued

JSuA12
Optical Non-Contact Electric Field Mapping by LIF in Cs Vapor, *Marcis Auzinsh, Kaspars Bluss, Ruvin Ferber, Florian Gahbauer, Andrey Jarmola, Maris Tamanis; Physics Dept., Univ. of Latvia, Latvia.* We present experimental and theoretical studies of the possibility of using cesium vapor as a tracer gas for optical non-contact electric field mapping. Optical images of electric field distributions have been obtained.

JSuA13
Polarization Imaging in Shadow and Glare, *Shih-Schön Lin[1], Edward N. Pugh[2], Nader Engheta[1]; [1]Electrical and Systems Engineering Dept., Univ. of Pennsylvania, USA, [2]F. M. Kirby Ctr. for Molecular Ophthamology and Inst. of Neurological Science, Univ. of Pennsylvania, USA.* In shadow and glare regions traditional imaging methods may yield inaccurate polarization information due to dynamic range limit, noise, and black-level fluctuation. This new method solves these issues and yields accurate polarization information.

JSuA14
Azimuth or Radial Polarized Beams from Axially Sampled Circularly Polarized Vortex Beams, *Jonathan K. Moh, Bu Jing, Xiaocong Yuan; Nanyang Technological Univ., Singapore.* A laser beam with circular polarization can be converted into cylindrical vector beams by a micro-fabricated spiral phase plate (SPP) and an azimuthal-type linear analyzer. This provides simple polarization conversion via a compact optical path.

JSuA15
Signal Analysis of Optical Frequency-Modulated Continuous-Wave Interference, *Jesse Zheng; PhotonTech, Canada.* I analyze the signal of optical frequency-modulated continuous-wave (FMCW) interference. A general equation of optical FMCW interference is derived, and three common versions of optical FMCW interference (sawtooth-wave, triangular-wave and sinusoidal-wave FMCW interferences) are discussed.

JSuA16
Passive Alignment Method for Micro Optical Connectors Using Lithographically Defined Features, *Yoichi Taira, Fumiaki Yamada, Hidetoshi Numata, Masaki Hasegawa; IBM, Japan.* We demonstrated the feasibility of high precision alignment method using mechanically defined structures and lithographically patterned features. This method can be used for fabrication of high density optical connectors using polymer optical waveguides.

Optics in Information Science Posters

JSuA17
Flat-Top 16-Channels AWG Multiplexer with a New Alignment Method, *Jian Li, Hejun Yao, Zhixin Zhang, Limin Xiong; Natl. Inst. of Metrology (NIM), China.* A 16-channel 50GHz spaced flat-top AWG with our innovative configuration has been designed and fabricated. The performance of the device has been enhanced effectively and the difficulty in alignment process has been decreased obviously.

JSuA18
Correction of Discontinuous Phase Maps in Structured Light Perfilometry, *J. Garzón, J. Galeano, C. López, D. Duque; Univ. Pontificia Bolivariana, Colombia.* This work presents a comparative study between the methods of spatial unwrapping by means of reliability parameter and modified temporal unwrapping as a solution to the phase discontinuities presents in surface perfilometry by fringe projection.

JSuA19
Phase Contribution to the Dynamic Population Gratings Recorded in Rare-Earth Doped Optical Fibers, *Serguei Stepanov[1], Eliseo Hernández[1], Patrice Mégret[2], Andrei Fotiadi[2,3]; [1]CICESE, Mexico, [2]Faculté Polytechnique de Mons, Belgium, [3]A. F. Ioffe Physico-Technical Inst., Russian Federation.* Phase contributions to population dynamic gratings in Er-doped (in spectral region 1480-1570nm) and Yb-doped (at wavelength 1064nm) single-mode optical fibers were detected and characterized using two-wave mixing of phase modulated cw mW-scale recording waves.

JSuA20
Alternative Coherent-Mode Representation of a Planar Source in Computational Imaging, *Andrey S. Ostrovsky, Alexandre M. Zemliak, Mario V. Rodriguez Solís, Paulo C. Romero Soria; Univ. Autonoma de Puebla, Mexico.* The alternative coherent-mode representation of a planar source with unknown cross-spectral density function is defined from the results of radiometric measurements. The example of such a representation of the Lambertian source is given.

JSuA21
A Novel Method of Blind De-Blurring for Consecutive Frames of a Motion Picture, *Nobuhito Ishihara, Shinichi Komatsu; Waseda Univ., Japan.* A novel blind recovery method suitable for the motion pictures was proposed. Using dynamic masking for the images and the neural network, we are able to obtain PSF of each frame, to recover the images.

JSuA22
Blue Sensitive Mixtures for Holographic Optical Data Storage, *Riccardo Castagna, Luigino Criante, Daniele E. Lucchetta, Francesco Vita, Francesco Simoni; Univ. Politecnica delle Marche, Dip. FIMET and CNISM, Italy.* High resolution holographic gratings were obtained through blue laser irradiation on different multi-component mixtures in which contextual cationic and free radical polymerization occur. We obtained sensitivity values up to 4000 and a virtually un-measurable shrinkage.

JSuA23
Tunable 3-dB Multimode Interference Coupler, *Daniel A. May-Arrioja[1], Patrick LiKamWa[2], Miguel Torres-Cisneros[3], Jose J. Sanchez-Mondragon[1]; [1]INAOE, Mexico, [2]CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA, [3]Univ. de Guanajuato, Mexico.* An electrically tunable multimode interference (MMI) coupler/splitter is demonstrated. The device operates by modifying the phase of the multiple images in the MMI to fine-tune the 50:50 output power split ratio or other arbitrary ratio.

JSuA24
Zinc In-Diffusion Process for the Integration of InP-Based Photonic Devices, *Daniel A. May-Arrioja[1], Patrick LiKamWa[2], Adalberto Alejo-Molina[1], Jose J. Sanchez-Mondragon[1]; [1]INAOE, Mexico, [2]CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA.* A selective area zinc in-diffusion process was characterized to integrate several Mach-Zehnder based photonic switch/modulators, which make it ideal for the development of Photonic Integrated Devices (PIC's).

JSuA25
Reflection Disk-Type Image-Plane Multiplex Holography with Increased Vertical Viewing Window, *Yih-Shyang Cheng, Tien-Long Chien; Inst. of Optical Sciences, Natl. Central Univ., Taiwan.* A conical multiplex hologram is first fabricated. Then, the information is read out to form an image-plane disk-type hologram. The location of the original hologram acts as the final viewing window.

JSuA26
Structures of Iron Centers in Congruent and Stoichiometric Lithium Niobate and Tantalate for Optical Data Storage, *Valentin Grachev[1], Robert Petersen[1], Christoph Bäuman[2], Galina Malovichko[1]; [1]Physics Dept., Montana State Univ., USA, [2]Physics Dept., Univ. of Osnabrück, Germany.* The impurity locations, surrounding and spectroscopic characteristics of iron centers in congruent and stoichiometric lithium niobate and tantalate were determined with the help of the Electron Paramagnetic Resonance and Electron Nuclear Double Resonance.

Photonics Posters

JSuA27
Waveguiding in Photonic Crystal Slab with Variable Thickness, *Mark Herrera, Alexey G. Yamilov; Univ. of Missouri-Rolla, USA.* We demonstrate optical waveguiding in photonic crystal slab (PhCS) with a trench. This enables optical circuitry on PhCS prefabricated with holographically, eliminating the need for slow electron-beam lithography.

JSuA28
Silicon Nitride Planar Tapered Transitions for Broad-Area Laser Diodes, *Nikolai Stelmakh[1], Geeta Tewani[1], Frederick McCormick[2], Allen Vawter[2], Michael Shaw[2]; [1]Univ. of Texas at Arlington, USA, [2]Sandia Natl. Labs, USA.* 80nm-core Si_3N_4 tapered waveguide transitions for broad-area laser diodes were designed, fabricated and measured. High optical losses were found in the wide waveguides. Optical loss model due to Si_3N_4 recrystallization under high stress is proposed.

JSuA29
Multi-Channel Reflective Binary Phase Modulator Simultaneously Satisfying Phase Shift and Anti-Reflection Conditions, *Veronika Stelmakh, Nikolai Stelmakh; Univ. of Texas at Arlington, USA.* Two conditions must be simultaneously satisfied for effective reshaping of broad area multi-mode laser diode beam: phase shift condition and anti-reflection condition. We theoretically and experimentally analyzed phase modulator efficiency and evaluated its temporal limit.

JSuA30
Wavelength Selective Auxiliary C-Band ASE Pumping for L-Band EDFA, *Vishnu Priye, Shubhendu Bhardwaj, Subhash C. Arya; Indian School of Mines Dhanbad, India.* The effect of wavelength selective auxiliary ASE pumping on L band EDFA signal gain is investigated. It is shown that, gain increases by 14 dB when wavelength selective pumping of 55 nm bandwidth is used.

JSuA31
Investigation of Multichannel Characteristics of Raman/EDFA Hybrid Amplifiers, *Umesh Tiwari, Krishnan Rajan, Krishna Thyagarajan; Indian Inst. of Technology, Delhi, India.* Gain and noise figure characterization of multichannel Raman/EDFA hybrid amplifier is presented. It is shown that the characteristics are different from those obtained by single channel measurements.

JSuA • Welcome Reception and Joint FiO/LS Poster Session I—Continued

JSuA32
Improvement of Raman Amplification Gain Tilt Using Incoherent Pump Sources, *Paulo S. André[1], Ana M. Rocha[1], Berta Neto[1], Margarida Facão[2]; [1]Inst. de Telecomunicações, Univ. de Aveiro, Portugal, [2]Dept. de Física, Univ. de Aveiro, Portugal.* We report a Raman amplifier implemented with incoherent pumping. The experimental gain profile is compared with that of coherent pumping, showing a decrease of 0.028 dB/nm on the gain spectra tilt.

JSuA33
Evaluation of Launch-Dependent Frequency Response of Multimode Fibers for Subcarrier-Multiplexing (SCM), *Christian-Alexander Bunge[1], Winfried Lieber[2], Dan Curticapean[2]; [1]Technische Univ. Berlin, Germany, [2]Univ. of Applied Sciences, Germany.* In this paper we present a measurement technique for the assessment of the launch-dependent frequency response of multimode fibers in subcarrier-multiplexed systems. Due to their irregular and launch-dependent behavior, we propose SCM with adaptive carrier-frequencies.

JSuA34
Transient Two-Wave Mixing in Linear Interferometer Based on Er-Doped Optical Fiber with Saturable Absorption, *Serguei Stepanov[1], Fernando Pérez Cota[1], Daniel García Casillas[1], Marcos Plata Sánchez[2]; [1]CICESE, Mexico, [2]INAOE, Mexico.* Transient two-wave mixing in Er-doped optical fibers with saturable absorption was shown to be nearly two times more efficient in linear interferometric configuration with significantly different powers of recording waves than in symmetric recording arrangement.

JSuA35
Fabrication and Characterization of Er-Doped ZnO Films Grown by Pulsed E-Beam Deposition, *Zhengda Pan[1], S. H. Morgan[1], A. Ueda[1], R. Aga[1], A. Steigerwald[1], Richard Mu[1], A. B. Hmelo[2], L. Feldman[2]; [1]Fisk Univ., USA, [2]Vanderbilt Univ., USA.* Erbium-doped ZnO thin films with nano-size grains were grown on silicon substrate by pulsed e-beam deposition. The luminescence provides evidence that the Er ions have been incorporated inside the crystalline ZnO grains in film.

JSuA36
Fattened Fiber Filter, *Alejandro Martínez-Ríos, I. Torres-Gomez, R. I. Mata-Chavez; Ctr. de Investigaciones en Optica, Mexico.* A method to fabricate optical fiber rejection-band filters based on optical fiber fattening is presented. Using this approach we have been able to fabricate fiber filters <3mm length and notch depths >20 dB.

JSuA37
2-D Thermal Imaging of VCSEL Arrays by Thermoreflectance Microscopy, *Kathryn J. Greenberg, Maryam Farzaneh, Reja Amatya, Dietrich Luerssen, Janice A. Hudgings; Mount Holyoke College, USA.* High resolution thermoreflectance microscopy is used to profile thermal effects in single VCSELs and arrays. Relative thermal resistance, thermal lensing, and thermal coupling effects are reported.

JSuA38
Accurate Sensitivity Evaluation of Microring Resonators for Biochemical Sensing, *Deepak Gupta, Arun Kumar; Indian Inst. of Technology Delhi, India.* We examine the dependence of sensitivity of microring resonator based biochemical sensors on ring radius and input polarization state, and show that the predictions available in this regard (IEEE JLT, 24, 1395 (2006)) are incorrect.

JSuA39
Polysiloxane Thermo-Optic Side-Polished Fiber Variable Attenuator, *Diego R. Yankelevich[1], Asaf Vainsencher[1], Carl M. Arft[1], Andre Knoesen[1], Behzad Moslehi[2]; [1]Dept. of Electrical Engineering, Univ. of California at Davis, USA, [2]IFOS Corp., USA.* Polysiloxane and conductive polymers were integrated onto a side-polished optical fiber to implement a variable optical attenuator. A conductive polymer thermo-optically altered the refractive index of elastomer placed in close proximity to a fiber core.

JSuA40
Modeling Optical Micro-Ring Cavities with MMIs, *Hung-Wen Chang[1], Nai-Hsiang Sun[2]; [1]Natl. Sun Yat-sen Univ., Taiwan, [2]I-Shou Univ., Taiwan.* We combine FEMET (full eigen-mode expansion technique), frequency-domain FD method and a one-way, multi-mode theory to study optical micro-ring cavities with MMI (multi-mode interferometer) couplers. Improved tolerance of MRC parameters is demonstrated.

Special International Symposium on Optical Materials Posters

JSuA41
DOPA-Mediated Self-Assembled Biocompatible Plasmonic Nanocrystals, *Kvar C. Black, Zhongqiang Liu, Phillip B. Messersmith; Northwestern Univ., USA.* Biocompatible plasmonic nanocrystals provide scattering, absorptive, and luminescent contrast for bioimaging, and act as photothermal therapeutic agents. We report DOPA-mediated self-assembly and surface stabilization of gold and silver nanoparticles with potentially functionalized PEG polymers.

JSuA42
Whispering Gallery Modes in Nanosized Silicon Triangular Resonators Fabricated Using Nanosphere Lithography, *Andrey Grunin[1], V. V. Moskalenko[1], I. V. Soboleva[1], Akihiro A. Fedyanin[1], C.- M. Lai[2], L.- H. Peng[2]; [1]M. V. Lomonosov Moscow State Univ., Russian Federation, [2]Natl. Taiwan Univ., Taiwan.* Excitation means of whispering gallery modes in nanosized silicon triangular resonators is studied. Nanosphere lithography technique with self-assembled polystyrene spheres as shadow masks is used for fabricating periodic arrays of nanosized silicon resonators.

JSuA43
Optical and Electronic Properties of Diatoms, *Jonathan JongWah[1], Scott Butcher[1], Marie Wintrebert-Fouquet[1], Judith M. Dawes[1], John Ferris[2]; [1]Dept of Physics, Macquarie Univ., Australia, [2]Australian Nuclear Science and Technology Organisation, Australia.* The photoluminescence spectra and dielectric properties of diatoms, a biogenic source of porous silica, have been characterised. Results are compared with pure synthetic silica, and show low dielectric constants due to the porosity.

Laser Science Posters

JSuA44
Interferometric Birefringent-Fiber Strain Sensor, *Jesse Zheng; PhotonTech, Canada.* This paper introduces a practical interferometric birefringent-fiber strain sensor, which is based on optical frequency-modulated continuous-wave (FMCW) interference and have the advantages of long gauge length, long leading fibers, and immunity from the environmental influence.

JSuA45
Thermal Loading of Optical Resonators for Future Gravitational-Wave Detectors, *Amber L. Bullington, Robert L. Byer; Stanford Univ., USA.* Illuminating a Fabry-Perot ring cavity with high-power laser light demonstrates the effects of thermal distortion of the cavity's optics, allowing estimations of power handling limitations of resonators for future gravitational-wave detectors.

JSuA46
Enhancement of Dynamic Range of Evanescent Wave Fiber-Optic Oxygen Sensor, *Rani D. Venkata, Chun-Wei Wang, Kailiang Sun, Rakesh Kapoor; Univ. of Alabama at Birmingham, USA.* A fiber-optic oxygen sensor with enhanced dynamic range is reported. The quenchable fluorophore is coated on the probe surface in such a way that the more than 95% molecules should be exposed to the analyte.

JSuA47
Effects of Laser Parameters on Rate of Hydrolysis of Proteins, *Jagdish R. Luthra[1], Daniel Pérez[1], Suranjana Rai Luthra[2], Jerald R. Izatt[2]; [1]Univ. de Los Andes, Colombia, [2]Univ. of Alabama, USA.* We investigate effects of laser parameters like power, beam size, profile and mode structure on the heat and temperature distribution in a cylindrical sample of dipeptide solution and relate them to the amount of hydrolysis.

JSuA48
Surface Enhanced Raman Optical Activity of Biomolecules, *Rajan S. Gurjar, Noah J. Kolodziejski, Richard A. Myers; Radiation Monitoring Devices, Inc., USA.* We will present recent laboratory measurements of Raman Optical Activity (ROA) in biomolecules. Using surfaced-enhanced techniques and advanced instrumentation, the detection sensitivity was increased by several orders of magnitude over traditional ROA measurements.

7:30 p.m.–8:30 p.m. **OSA Division and Technical Group Meetings**
Optical Sciences, *Fairmont Hotel, Empire Room*
Optics in Information Science, *Fairmont Hotel, Gold Room*
Photonics, *Fairmont Hotel, Valley Room*
Quantum Electronics, *Fairmont Hotel, California Room*

8:30 a.m.–10:00 a.m., JMA: 2007 Joint FiO/LS Awards Ceremony, *Fairmont Hotel, Regency Ballroom*
APS/DLS Award and Honor Presentations
Schawlow Prize Lecture: A New Method for Generation of Ultra-Intensive and Ultra-Short Laser Pulses, *Szymon Suckewer, Princeton Univ., USA*
OSA Award and Honor Presentations

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

10:30 a.m.–12:00 p.m., JMB: 2007 Joint FiO/LS Plenary Session, *Fairmont Hotel, Regency Ballroom*
Nanophotonics: From Photonic Crystals to Plasmonics, *Eli Yablonovitch, Univ. of California at Berkeley, USA*
The Optical Frequency Comb: A Remarkable Tool with Many Uses, *John L. Hall, JILA, Univ. of Colorado and NIST, USA*

12:00 p.m.–1:30 p.m., Lunch Break

12:00 p.m.–6:00 p.m., SMA • Symposium on Undergraduate Research Posters, *Fairmont Hotel, Fairfield Room*
See Undergraduate Research Symposium program in registration bag.

1:00 p.m.–4:30 p.m., SMB • Joint FiO/SPRC Symposium, *Fairmont Hotel, Club Regent*
See Page 13.

1:00 p.m.–3:00 p.m., Student Event: Going for the Goal Workshop, *Sainte Claire Hotel, Ballroom*

The Monday abstracts are continued on Page 62.

Frontiers in Optics

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

SMC1 • 1:30 p.m. Invited
From Microwatts to Gigawatts: What's New Under the Sun, *Greg P. Smestad; Solar Energy Materials and Solar Cells, USA.* The current interest in solar energy should be self-sustaining due to economies of scale, new materials and processes, and an understanding of the requirements for economical, efficient solar converters. A brief history will be presented.

SMC2 • 2:00 p.m. Invited
"Plastic" Electronics and Optoelectronics, *Alan Heeger; Univ. of California at Santa Barbara, USA.* Semiconducting polymers are important as active materials in electronic and optoelectronic devices. I will focus on progress in two areas: a. "Plastic" Solar Cells fabricated from semiconducting polymers, b. Light Emitting Field Effect Transistors.

1:30 p.m.–3:30 p.m.
FMA • Fiber Lasers
Andreas Tünnermann; Fraunhofer Inst. Optik Feinmechanik, Germany, Presider

FMA1 • 1:30 p.m. Tutorial
High-Power Fiber Sources: Recent Advances and Future Prospects, *W. Andrew Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* Strategies for scaling output power and brightness from rare-earth doped fiber lasers and amplifiers will be reviewed and the prospects for further improvement in performance will be considered.

W. Andrew Clarkson received a B.Sc. (first class) degree in Physics from the Univ. of Manchester in 1984 and a Ph.D. degree from the Univ. of Southampton in 1991. He joined the Optoelectronics Research Ctr. (Univ. of Southampton) in 1990, where he currently holds the position of Professor and leads the Advanced Solid-State Sources group. His principal research interest is the development of novel coherent light sources with particular emphasis on power-scaling and brightness-scaling of fiber and solid-state laser sources. Professor Clarkson has given a number of invited and plenary conference presentations in this research area and has published over 200 conference and journal papers. He has served on the technical program committees of a number of international conferences, including CLEO, CLEO-Europe and Advanced Solid-State Photonics. He has also served as a Topical Editor for Optics Letters from 2000 to 2006 and is a Fellow of the Optical Society of America.

1:30 p.m.–3:30 p.m.
FMB • NLO in Engineered Materials I
David Hagan; CREOL, Univ. of Central Florida, USA, Presider

FMB1 • 1:30 p.m. Tutorial
Engineering Nonlinearities in Optical Nanosystems, *Richard Osgood; Columbia Univ., USA.* This tutorial reviews the use of nanopatterning of materials to achieve enhanced optical nonlinear response and conversion. Nonlinear propagation in Si-wire waveguides and optical frequency conversion in metallic nanoarrays are used as illustrations.

Richard Osgood, Jr. is Higgins Professor of Applied Physics and Electrical Engineering at Columbia Univ. His research has been in the development of integrated photonics, new infrared and ultraviolet lasers, applications of laser-induced chemistry to materials preparation, and fundamental optical surface physics and chemistry. Dr. Osgood is a Fellow of IEEE, OSA, and APS. He was appointed Distinguished Traveling Lecturer of the APS for 1991-1993 and of IEEE-CLEOS for 1986. In 1990, he was honored with the Japanese OITDA Lectureship. In 1991, Dr. Osgood received the R.W. Wood Prize from the Optical Society of America. He has served as a member of the DARPA Defense Sciences Res. Council, the DOE Basic Energy Sciences Advisory Committee, and the Los Alamos Chemical-Sciences Division Advisory Committee. Dr. Osgood served as an Associate Lab Director at Brookhaven National Lab from 2000-2002 and its acting Nanocenter Director in 2002. He and his group have authored 375 journal publications.

1:30 p.m.–3:30 p.m.
FMC • Silicon Photonic Systems of Information Processing
David Plant; McGill Univ., Canada, Presider

FMC1 • 1:30 p.m. Invited
Nanophotonics for Information Systems Integration, *Yeshaiahu Fainman; Univ. of California at San Diego, USA.* We describe nanophotonics process of creating components and devices utilized with metamaterials such as birefringent dielectrics, photonic crystals, and metal-dielectric composites. This approach enhances monolithic integration needed for realization of information systems for various applications.

FMC2 • 2:00 p.m.
Waveguide Electroabsorption Modulator on Si Employing Ge/SiGe Quantum Wells, *Onur Fidaner, Ali K. Okyay, Jonathan E. Roth, Yu-Hsuan Kuo, Krishna C. Saraswat, James S. Harris, David A. B. Miller; Stanford Univ., USA.* We report the first waveguide optical modulator on Si that employs the quantum-confined Stark effect. For a 6 V swing, the contrast ratio is 7.72 dB at 1476nm, and exceeds 3 dB over 14nm bandwidth.

1:30 p.m.–3:30 p.m.
FMD • Integrated Optic Devices I
Presider to Be Announced

FMD1 • 1:30 p.m. Invited
Recent Progress in Quantum-Dot Semiconductor Optical Amplifiers for Optical Signal Processing, *Tomoyuki Akiyama, Y. Maeda, N. Yasuoka, K. Kawaguchi, H. Ebe, M. Sugawara; Fujitsu Labs Ltd., Japan.* Regeneration of 40-Gb/s signal with limiting amplification in a quantum-dot semiconductor optical amplifier is demonstrated. Polarization insensitivity we have realized recently is now ready to be combined to yield a high-speed polarization-insensitive regenerative amplifier.

FMD2 • 2:00 p.m.
Ultrafast Nonlinear Group Index in Semiconductor Optical Amplifiers for Slow and Fast Light, *Alexander V. Uskov[1,2], Forrest G. Sedgwick[2], Bala Pesala[2], Connie J. Chang-Hasnain[2]; [1]P.N. Lebedev Physical Inst., Russian Federation, [2]Univ. of California at Berkeley, USA.* The change in group index in a semiconductor optical amplifier due to carrier heating and spectral hole burning dominates in short pulse shaping, resulting in fast/slow light.

Hillsborough

Frontiers in Optics

1:30 p.m.–3:30 p.m.
FME • Optical Design and Applications in General Lighting and Illumination
Anurag Gupta; Optical Res. Associates, USA, Presider

FME1 • 1:30 p.m. Invited
Lit-Appearance Modeling, *R. John Koshel[1,2]; [1]Lambda Res. Corp., USA, [2]College of Optics, Univ. of Arizona, USA.* Lit-appearance allows inspection of the appearance of an illumination system for position and angle. An overview is presented including perception issues. A new method called luminance modeling uses the BSDF and importance sampling.

FME2 • 2:00 p.m.
Illustration of Ambient Intelligence with Room Illumination, *Roshy M. John; Natl. Inst. of Technology, India.* This paper deals with ultra bright LEDs of different colors for lighting applications. The mood of the lighting will change dramatically according to a context shown in a hand held device or a computer.

Sacramento

Joint

1:30 p.m.–3:30 p.m.
JMC • Imaging and Microscopy — Biological I
Linda Peteanu; Carnegie Mellon Univ., USA, Presider

JMC1 • 1:30 p.m. Tutorial
Single-Molecule Biophysical Imaging, Nanophotonics and Trapping, *W. E. Moerner; Stanford Univ., USA.* Single-molecule fluorescence imaging provides a powerful tool to explore individual biophysical systems, even in cells. Metallic nanoantennas improve the interaction between light and molecules, and a new electrokinetic trap improves single-molecule observation times in solution.

Harry S. Mosher, Professor of Chemistry and Professor, by courtesy, of Applied Physics (b. 1953); B.S., A.B., B.S., 1975, Washington Univ.; M.S., 1978; Ph.D., 1982, Cornell Univ.; IBM Research Staff Member, 1981-1995; Manager, 1988-1989, Project Leader, 1989-1995; Roger I. Wilkinson National Outstanding Young Electrical Engineer, 1984; IBM Outstanding Technical Achievement Awards for photon-gated spectral hole burning, 1988, and for single-molecule detection and spectroscopy, 1992; Fellow, American Physical Society, 1992; Fellow, Optical Society of America, 1992; Guest Professor, Swiss Federal Inst. of Technology (ETH-Zurich), 1993-1994; Robert Burns Woodward Visiting Professor, Harvard Univ., 1997-1998; Professor, Distinguished Chair in Physical Chemistry, Univ. of California, San Diego, 1995-98; Professor of Chemistry, Stanford Univ., 1998 - ; Earle K. Plyler Prize, 2001; Fellow, American Acad. of Arts and Sciences, 2001; Harry S. Mosher Professor, Stanford Univ., 2002; Geoffrey Frew Fellow, Australian Acad. of Sciences, 2003; Fellow, American Association for the Advancement of Science, 2004.

Piedmont

Laser Science

1:45 p.m.–3:30 p.m.
LMA • Gravitational Wave Detectors
Slava Tureshev; JPL, USA, Presider

LMA1 • 1:45 p.m. Invited
Review of Operating Terrestrial Gravitational Wave Detectors, *Gabriela González; Dept. of Physics and Astronomy, Louisiana State Univ., USA.* Several km-long interferometric gravitational wave detectors are now in operation, including the LIGO detectors in the US. I will describe their configurations and show their sensitivities, better than 10^{-18}m/√Hz in a 50Hz-2kHz frequency band.

Glen Ellen

Laser Science

1:30 p.m.–3:30 p.m.
SMD • Symposium on Undergraduate Research
Presider to Be Announced
See Undergraduate Research Symposium program in registration bag.

Atherton

OMD

1:30 p.m.–3:15 p.m.
OMA • Organic Semiconductor Devices
Chun-Sing Lee; Ctr. of Super-Diamond and Advanced Films, City Univ. of Hong Kong, Hong Kong, Presider

OMA1 • 1:30 p.m. Plenary
Progress in Light-Emitting and Photovoltaic Organic and Hybrid Materials and Devices, *Ghassan Jabbour; Arizona State Univ., USA.* The talk will cover advances in novel blue emitters, highly efficient excimer structures, macromolecular approaches, and near infrared OLEDs. If time permits, results on solar cells using novel materials will be presented.

Frontiers in Optics

SMC • Optics for Energy I—Continued

SMC3 • 2:30 p.m. Invited

High Efficiency Solar Cells for Large-Scale Electricity Generation, *Sarah Kurtz; Natl. Renewable Energy Lab, USA.* The photovoltaic industry has been growing exponentially at an average rate of about 35%/year since 1979. Recently, multijunction concentrator cell efficiencies have surpassed 40%. Combined with concentrating optics, these can be used for electricity generation.

FMA • Fiber Lasers—Continued

FMA2 • 2:15 p.m. Invited

Lasers and Amplifiers with Ultra-Large Mode Area Higher Order Mode Fibers, *Siddharth Ramachandran; OFS Labs, USA.* We review the performance and applications of a recently demonstrated platform that utilises higher-order modes in few-moded fibers to facilitate robust, bend-resistant, long-length light-propagation in ultra-large modal areas.

FMA3 • 2:45 p.m. Invited

Gain Guided, Index Antiguided Fiber Lasers, *Anthony Siegman; Stanford Univ., USA.* Index antiguided optical fibers with large diameter cores having a negative index step and a moderate but realistic gain coefficient have demonstrated great promise for robustly single mode fiber lasers with very large mode areas.

FMB • NLO in Engineered Materials I—Continued

FMB2 • 2:15 p.m.

Simultaneous Multiple-Color Light Generation Based on Broadband Optical Parametric Generation, *Hwan Hong Lim, Oc Yeub Jeon, Byeong Joo Kim, Krishnamoorthy Pandiyan, Myoungsik Cha; Pusan Natl. Univ., Republic of Korea.* Simultaneous red, green and blue lights were generated from periodically poled lithium niobate pumped with single picosecond laser. This process was realized by a broadband design of the optical parametric generation of participating infrared frequencies.

FMB3 • 2:30 p.m.

Efficient On-Chip Second Harmonic Generation Using a Critically Coupled Resonator, *Charles M. Reinke[1], Ali Adibi[1], Yong Xu[2]; [1]Georgia Tech, USA, [2]Virginia Tech, USA.* We present studies of second harmonic generation in planar waveguides using critically coupled resonators. Using the finite-difference time-domain method, large second harmonic conversion efficiencies are demonstrated when the coupling coefficient equals the second harmonic strength.

FMB4 • 2:45 p.m.

All-Optical Switching between Two Claddings of a Nonlinear Optical Layer, *Pengfei Wu[1], Sarfaraz A. Baig[2], Michael R. Wang[2]; [1]New Span Opto-Technology Inc., USA, [2]Univ. of Miami, USA.* Probe field coupled out of glass claddings that sandwiches a photosensitive layer has interesting nonlinear optical dynamics, providing the device with an attractive feature of both positive and negative optical switchings.

FMC • Silicon Photonic Systems of Information Processing—Continued

FMC3 • 2:15 p.m.

Material Properties in SiGe/Ge Quantum Wells, *Rebecca K. Schaevitz, Jonathan E. Roth, Onur Fidaner, David A. B. Miller; Stanford Univ., USA.* Photocurrent measurements in Ge quantum wells and quantum tunneling resonance simulations give the first measurements of effective masses and other parameters for design of high-performance SiGe/Ge quantum well optoelectronics on silicon.

FMC4 • 2:30 p.m. Invited

Designing Multicore Chips with Light, *José Martinez; Cornell Univ., USA.* Multicore chips attempt to translate Moore's Law into performance growth via continual increases in core count. I'll discuss some important architectural challenges of this approach, as well as opportunities for optical interconnects in this context.

FMD • Integrated Optic Devices I—Continued

FMD3 • 2:15 p.m.

Modulation of Multilayer InAs Quantum Dot Waveguides under Applied Electric Field, *Imran B. Akca[1], Aykutlu Dana[1], Atilla Aydinli[1], Marco Rossetti[2], Lianhe Li[2], Andrea Fiore[2], Nadir Dagli[3]; [1]Bilkent Univ., Turkey, [2]Inst. of Quantum Electronics and Photonics, Ecole Polytechnique Fédérale de Lausanne EPFL, Switzerland, [3]Univ. of California at Santa Barbara, USA.* Electric field dependence of optical modulation in self assembled InAs quantum dot waveguides have been studied at 1300 and 1500 nm. Electro-absorption and electro-optic coefficients of these waveguides have been obtained at both wavelengths.

FMD4 • 2:30 p.m.

Very Large Fabrication Tolerance of VCSELs Using High-Contrast Subwavelength Grating, *Ye Zhou, Michael C. Y. Huang, Johannes Kern, Connie J. Chang-Hasnain; Univ. of California at Berkeley, USA.* A very large fabrication tolerance for the high-index-contrast subwavelength grating (HCG) integrated VCSELs is experimentally demonstrated, with similar performance over as large as ±20% variation in the HCG critical dimension.

FMD5 • 2:45 p.m.

Optical Switching by Parametric Amplification in Nonlinear Photonic Crystal Microcavities, *Mohammed F. Saleh, Luca Dal Negro, Bahaa E. A. Saleh; Boston Univ., USA.* A parametric optical amplifier in a 1-D nonlinear photonic crystal microcavity can be used as a switch. We developed a generalized transfer matrix method to study the device gain/loss switching characteristics.

FME • Optical Design and Applications in General Lighting and Illumination—Continued

FME3 • 2:15 p.m. Invited

Optical Design for LED Using Total Reflection, *Edward Yuan; Fudan Univ., China.* Progresses in LED regenerated the optical design technique for luminaires. The author found a way to using total reflection of transparent materials in optical design of LED lighting system.

FME4 • 2:45 p.m.

Optimization of Freeform Non-Imaging Components for LED-Based Projector Light Engines, *Florian R. Fournier, Jannick P. Rolland; College of Optics and Photonics, CREOL, Univ. of Central Florida, USA.* Standard non-imaging components used to collect and integrate light in LED-based projector light engines such as tapered rods and compound parabolic concentrators are compared to optimized freeform shapes in terms of various application-driven metrics.

JMC • Imaging and Microscopy — Biological I—Continued

JMC2 • 2:15 p.m. Invited

Time-Dependent Spectroscopy of a Nanoparticle Freely Moving in 3-D, *Haw Yang; Univ. of California at Berkeley, USA.* To date, the powerful time-dependent single-particle spectroscopy can only be conducted on substrate-immobilized nanostructures. The new technique reported herein lifts this limitation and allows real-time correlation of the particle's spectroscopic signatures with its spatial location.

JMC3 • 2:45 p.m. Invited

Tracking Single Quantum Dots in Three Dimensions, *Jim Werner, Guillaume Lessard, Peter M. Goodwin; Los Alamos Natl. Lab, USA.* We describe new instrumentation developed in our lab (essentially a confocal microscope with feedback) capable of following 3-dimensional motion of single quantum dots moving at rates comparable to intracellular protein traffic (microns/sec).

LMA • Gravitational Wave Detectors—Continued

LMA2 • 2:15 p.m.

Noise Couplings in the Laser Interferometer Gravitational Wave Observatory (LIGO), *Stefan W. Ballmer; Caltech, LIGO, USA.* The commissioning of LIGO required the mitigation of technical noise couplings to the GW readout. Of particular interest were RF oscillator Phase Noise and Thermal Compensation Laser Intensity Noise. Both couplings were larger than anticipated.

LMA3 • 2:30 p.m. Invited

Second Generation Gravitational Wave Detectors, *Rana Adhikari; Caltech, USA.* I will describe the latest in laser interferometers for gravitational wave detection. These instruments are being designed to have CW circulating power levels of ~1 megawatt and sense mirror motions at the 10^{-20} meters/rHz level.

SMD • Symposium on Undergraduate Research—Continued

OMA • Organic Semiconductor Devices—Continued

OMA2 • 2:15 p.m. Invited

AFOSR Interests on Organic Photonics, *Charles Y-C Lee; Air Force Office of Scientific Res., USA.* An overview of the Organic Materials Chemistry Program at AFOSR will be presented. The Program includes photonic polymers, electronic polymers, materials with controlled magnetic permeability and dielectric permittivity and other structural applications.

OMA3 • 2:45 p.m. Invited

Molecularly Engineered Interfaces for Organic Optoelectronics, *Zakya Kafafi; NRL, USA.* The role that organic/metal (organic) interfaces play in optoelectronic devices is key to achieving high efficiency and stability. An overview is given on molecularly engineered surfaces/interfaces, and how their electronic structures affect device characteristics.

Frontiers in Optics

SMC • Optics for Energy I—Continued

SMC4 • 3:00 p.m. Invited

Optical Properties of Microalgae for Enhanced Biofuels Production, *Tasios Melis; Univ. of California at Berkeley, USA.* Research seeks to alter the optical properties of microalgae in order to improve solar-to-biofuels energy conversion efficiency in mass cultures under bright sunlight conditions.

FMA • Fiber Lasers—Continued

FMA4 • 3:15 p.m.

Study of Coreless Fibers for In-Phase Supermode Selection in Multicore Fiber Lasers, *Hongbo Li, Moysey Brio, Li Li, Axel Schülzgen, Nasser Peyghambarian, Jerome V. Moloney; Univ. of Arizona, USA.* Coreless fibers as extra cavities for multicore fiber lasers are analyzed for their capabilities of mode selection. The difference between the mode-selection properties of coreless fibers and Talbot cavities is discussed and confirmed by experiments.

FMB • NLO in Engineered Materials I—Continued

FMB5 • 3:00 p.m. Invited

Nanoscale Nonlinear Optics Coupling Plasmonics to the Metal-Insulator Transition in Vanadium Dioxide, *Richard Haglund, E. U. Donev, L. C. Feldman, R. Lopez, J. Y. Suh; Vanderbilt Univ., USA.* Nanostructured vanadium dioxide and oxide-metal composites exhibit unusual nonlinear optical and plasmonic effects, including size- and shape-dependent optical switching and extraordinary optical transmission controlled by either thermal or ultrafast laser-initiated metal-insulator transition in vanadium dioxide.

FMC • Silicon Photonic Systems of Information Processing—Continued

FMC5 • 3:00 p.m. Invited

Optics to the Chip: Enabling Standard IC Packaging Using Modular Optical Components, *David Rolston, Robert Varano; Reflex Photonics, Canada.* An IC packaging technology that integrates parallel optical sub-assemblies will be described for next generation computing and switching applications. Design and assembly methods for low-cost and volume production are demonstrated.

FMD • Integrated Optic Devices I—Continued

FMD6 • 3:00 p.m.

Systematic Design and Demonstration of Flat-Band Finite-Size Coupled Resonator Optical Waveguides, *Qing Li, Siva Yegnanarayanan, Mohammad Soltani, Ali Adibi; Georgia Tech, USA.* Using techniques in LC circuit filters, a systematic method for the design of flat-band finite-size coupled-resonator-optical-waveguides (CROWs) are developed. Based on this theory, finite-size CROWs with flat-band spectrum on silicon-on-insulator platform are fabricated and demonstrated.

FMD7 • 3:15 p.m.

Local Dispersion in 2-D Photonic Crystals Using Filter Diagonalization Method, *Babak Dastmalchi[1], Abbas Mohtashami[2], Kurt Hingerl[2], Javad Zarbakhsh[2]; [1]Dept. of Physics, Azarbaijan Univ. of Tarbiat Moallem, Iran, [2]Johannes Kepler Univ. Linz, Austria.* Local dispersion in Photonic Crystals (PC) is calculated using the advanced filter diagonalization method and compared to the traditional spatial Fourier transform of the field distribution.

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

FME • Optical Design and Applications in General Lighting and Illumination—Continued

FME5 • 3:00 p.m.
Implementation of a Programmable Field and Custom Coherence Illuminator for Extreme Ultraviolet Microlithography, *Christopher N. Anderson[1], Patrick P. Naulleau[2]; [1]Univ. of California at Berkeley, USA, [2]Lawrence Berkeley Natl. Lab, USA.* Here we summarize recent upgrades to the existing Fourier-synthesis custom coherence Sematech Berkeley Micro Exposure Tool illuminator that provide increased illumination field uniformity and enable dual-domain control of illumination field size and spatial coherence.

FME6 • 3:15 p.m.
White-Light Single-Shot Digital Hologram Recording, *Natan Tzvi Shaked, Joseph Rosen, Adrian Stern; Ben-Gurion Univ. of the Negev, Israel.* A new technique, designated as integral holography, for recording holograms of three-dimensional objects under spatially incoherent white-light illumination, and in a single camera shot, is presented. Experimental results validate the correctness of the new technique.

JMC • Imaging and Microscopy — Biological I—Continued

JMC4 • 3:15 p.m.
Extracting Intrinsic Synchronous Fluorescence for Spectral Imaging, *Quan Liu, Tuan Vo-Dinh; Duke Univ., USA.* A ratio-metric method was proposed to extract intrinsic fluorescence from synchronous fluorescence spectra distorted by absorption and scattering. Its applicable range was investigated using Monte Carlo simulations and the accuracy was tested with phantom experiments.

LMA • Gravitational Wave Detectors—Continued

LMA4 • 3:00 p.m. Invited
Techniques for Third-Generation Gravitational-Wave Observatories, *Harald Lueck; Leibniz Univ. Hannover, Germany.* Third generation detectors aim to improve the sensitivity roughly by another order of magnitude beyond the second or advanced generation. This talk presents difficulties and possible solutions that may be used to reach this goal.

SMD • Symposium on Undergraduate Research—Continued

OMA • Organic Semiconductor Devices—Continued

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

Frontiers in Optics

4:00 p.m.–5:30 p.m.
SME • Optics for Energy II
Greg P. Smestad; Solar Energy Materials and Solar Cells, USA, Presider

SME1 • 4:00 p.m. Invited
Recent Developments in Optics for Concentrator Photovoltaic (CPV) Systems, *Patrick Y. Meada; Xerox Palo Alto Res. Ctr., USA.* No abstract available.

SME2 • 4:30 p.m. Invited
Multiple Exciton Generation in Silicon Nanocrystals, *Matthew C. Beard[1], Kelly P. Knutsen[1], Pingrong Yu[1,2], Qing Song[1], Joseph M. Luther[1], Randy J. Ellingson[1], Arthur J. Nozik[1,3]; [1]Natl. Renewable Energy Lab, USA, [2]Innovalight Inc., USA, [3]Univ. of Colorado, USA.* We report the threshold for multiple exciton generation (MEG) in silicon nanocrystals is approximately 2.5 times the effective bandgap, Eg, and 2.7 excitons are produced per absorbed photon at 3.3 Eg.

4:00 p.m.–6:00 p.m.
FMF • Ultrashort-Pulse Fiber Lasers
Johan Nilsson; Univ. of Southampton, UK, Presider

FMF1 • 4:00 p.m. Invited
Status and Perspectives of Fiber Lasers and Amplifiers, *Andreas Tünnermann[1,2], Jens Limpert[1], Thomas Schreiber[2]; [1]Friedrich Schiller Univ. Jena, Germany, [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* Fiber lasers have entered the regime of multi-kW output power in a diffraction-limited beam. In pulsed operation high average and peak power output are reported. Status and perspectives of fiber lasers and amplifiers are reviewed.

FMF2 • 4:30 p.m. Invited
Advances in Femtosecond Fiber Lasers, *Frank Wise; Cornell Univ., USA.* Pulse-shaping based on filtering of chirped pulses enables construction of femtosecond lasers without intracavity dispersion control. The operation and performance of all-normal-dispersion fiber lasers will be described.

4:00 p.m.–6:00 p.m.
FMG • NLO in Engineered Materials II
Richard Osgood; Columbia Univ., USA, Presider

FMG1 • 4:00 p.m.
Low-Power All-Optical Switching in Near-Resonant Enhanced Nonlinear Photonic Crystals, *Qihuang Gong, Xiaoyong Hu, Ping Jiang, Hong Yang; Peking Univ., China.* An ultrafast low-power all-optical switching is realized in a near-resonant enhanced nonlinear photonic crystal made of polystyrene doped with Coumarin 153. The operating energy is only 521 fJ and the response time is 1.2 ps.

FMG2 • 4:15 p.m.
Nonlinear Optical Characterization of Organic Molecules Using a White-Light Continuum Z-Scan, *Lazaro A. Padilha[1], Gero Nootz[1], Mihaela Balu[2], David J. Hagan[1], Eric W. Van Stryland[1], S. Zheng[3], Stephen Barlow[3], Seth R. Marder[3]; [1]College of Optics and Photonics, CREOL and FPCE, Univ. of Central Florida, USA, [2]Beckman Laser Inst., Univ. of California at Irvine, USA, [3]School of Chemistry and Biochemistry, Georgia Tech, USA.* We report measurements of nonlinear refraction and nonlinear absorption spectra for organic molecules, in a range from 450nm to 800nm using a white-light-continuum Z-scan. The results show the nonlinear refraction changes sign.

FMG3 • 4:30 p.m.
Two-Photon Absorption in Core-Shell and Core-Only Semiconductor Quantum-Dots, *Gero Nootz, Lazaro Padilha, David Hagan, Eric Van Stryland; College of Optics and Photonics, CREOL and FPCE, Univ. of Central Florida, USA.* We report experimental studies of two-photon absorption spectra of CdSe and CdSe/ZnS core/shell quantum-dots. The influence of the ZnS shell on the two-photon absorption is observed and discussed.

4:00 p.m.–6:00 p.m.
FMH • Computational Imaging I
Mark Allen Neifeld; Univ. of Arizona, USA, Presider

FMH1 • 4:00 p.m.
Adaptive Steering of Field of View Using Analog Micro-Mirror Arrays in an Adaptive Flat Computational Imaging Sensor Architecture, *Vikrant R. Bhakta, Michael Buynak, Marc P. Christensen; Southern Methodist Univ., USA.* An adaptive multi-resolution computational imaging system utilizing analog micro-mirror arrays at the pupil of an imaging sensor to steer low resolution multiplexed sub-imagers is presented.

FMH2 • 4:15 p.m.
Efficient Rotating Point Spread Functions for 3-D Imaging, *Sri Rama Prasanna Pavani, Rafael Piestun; Univ. of Colorado at Boulder, USA.* Approximate rotating beams for 3-D imaging can be engineered with high diffraction efficiency using phase only on-axis diffractive optical elements. We compare approximate and exact rotating point spread functions in the Gauss-Laguerre modal plane.

FMH3 • 4:30 p.m.
Chirped Pulse Optical Ranging, *Robert E. Saperstein, Steve Zamek, Kazuhiro Ikeda, Boris Slutsky, Nikola Alic, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* An approach for time bandwidth product maximization in chirped pulse optical ranging systems is treated theoretically and accompanied by experimental demonstrations. Signal processing offers a route to a straight-forward, low-cost implementation.

4:00 p.m.–6:00 p.m.
FMI • Integrated Optic Devices II
Federico Capasso; Harvard Univ., USA, Presider

FMI1 • 4:00 p.m. Invited
Polarization-Insensitive 40G-NRZ Wavelength Conversion Using SOA-MZI, *Yasunori Miyazaki[1,2], Kazuhisa Takagi[1,2], Keisuke Matsumoto[1,2], Toshiharu Miyahara[1,2], Satoshi Nishikawa[1,2], Tatsuo Hatta[1,2], Toshitaka Aoyagi[1,2], Kuniaki Motoshima[1,2]; [1]Mitsubishi Electric Corp., Japan, [2]OITDA, Japan.* The dimensions of the bulk InGaAsP SOA active region were optimized for fast gain recovery in polarization-independent SOA-MZI all-optical wavelength converters for full C-band 40Gbps-NRZ operation.

FMI2 • 4:30 p.m.
All Optical Switch Based on Nonlinear Directional Coupler with Saturable Absorber, *Yingyan Huang, Seng-Tiong Ho; Northwestern Univ., USA.* All-optical switch based on nonlinear coupler with saturable absorber is proposed. FDTD simulation shows that this compact (15μm) device is capable of low-power (14μW), high-speed (100GHz) switching with 10-100x switching gain using realistic semiconductor materials.

Hillsborough

Frontiers in Optics

4:00 p.m.–5:45 p.m.
FMJ • Data Reduction Methods and Computational Imaging
Virendra Mahajan; Aerospace Corp., USA, Presider

FMJ1 • 4:00 p.m. Invited
Wavefront Coding, *W. Thomas Cathey; Univ. of Colorado, USA.* Wavefront coding has been used in imaging systems to extend the depth of field or focus and to make the systems more tolerant to aberrations in cytology, cell-phone cameras, and telescopes.

FMJ2 • 4:30 p.m.
Wide-Field Feature-Specific Imaging, *Michael D. Stenner, Premchandra Shankar, Mark A. Neifeld; Univ. of Arizona, USA.* We present a computational sensor design for high-resolution wide-angle imaging by multiplexing multiple sub-fields-of-view onto a single image sensor using feature-specific imaging techniques.

Sacramento

Joint

4:00 p.m.–6:00 p.m.
JMD • Imaging and Microscopy — Biological II
Jim Werner; Los Alamos Natl. Lab, USA, Presider

JMD1 • 4:00 p.m. Invited
Integrated Imaging Techniques Applied to Live Cell Biophysics, *Andreea Trache; Texas A&M Univ., USA.* A novel hybrid imaging system that integrates Atomic Force Microscopy (AFM) with optical imaging methods such as TIRF (Total Internal Reflection Fluorescence) and IRM (Interference Reflection Microscopy) will be presented.

JMD2 • 4:30 p.m. Invited
Raman Microscopy of Individual Cells and Cellular Components, *Thomas Huser; Univ. of California at Davis, USA.* I will present our most recent results in non-invasively characterizing and distinguishing individual cells, subcellular structures, and intracellular chemical concentrations by laser-tweezers Raman spectroscopy (LTRS) and coherent Anti-Stokes Raman scattering (CARS) microscopy.

Piedmont

Laser Science

4:00 p.m.–5:45 p.m.
LMB • Space-Based Tests of Relativity
Gabriela Gonzalez; Louisiana State Univ., USA, Presider

LMB1 • 4:00 p.m. Invited
LISA: A Space-Based Gravitational Wave Detector, *Guido Mueller; Univ. of Florida, USA.* The space-base detector LISA uses three spacecraft separated by 5Gm in a triangular formation to measure gravitational waves at sub Hz frequencies. LISA science and technology with an emphasis on laser interferometry will be discussed.

LMB2 • 4:30 p.m.
Laser Stabilization Using Diffractive Grating Angular Sensors, *Ke-Xun Sun, Patrick Lu, Robert Byer; Stanford Univ., USA.* Grating angle magnification enhanced angular sensor can be used for laser frequency stabilization. This robust method provides adequate frequency stability for numerous applications, such as absolute frequency stabilization for Laser Interferometric Space Antenna.

Glen Ellen

Laser Science

4:00 p.m.–6:00 p.m.
SMF • Symposium on Undergraduate Research
Presider to Be Announced
See Undergraduate Research Symposium program in registration bag.

Atherton

OMD

4:00 p.m.–5:45 p.m.
OMB • Materials and Devices for OLEDs I
Chun-Sing Lee; Ctr. of Super-Diamond and Advanced Films, Hong Kong, Presider

OMB1 • 4:00 p.m. Invited
High-Performing Electron-Injecting and Transporting Layers for OLED Devices, *William J. Begley, Tukaram K. Hatwar; Eastman Kodak Co., USA.* A new electron-injecting layer for increasing the luminance efficiency while lowering the drive voltage of OLED devices has been developed. The performance of the new EIL, in combination with new electron-transporting layers, will be discussed.

OMB2 • 4:30 p.m. Invited
High Efficiency Phosphorescent OLEDs, *Jason Brooks, Julie J. Brown; Universal Display Corp., USA.* Highly efficient phosphorescent organic devices are demonstrated. Direct charge trapping on the dopant and exciton confinement with adjacent charge transport layers are discussed as important mechanisms.

SME • Optics for Energy II—Continued

SME3 • 5:00 p.m. Invited

Optically Powered Video Camera Link, *Gunnar Böttger[1], Michael Dreschmann[1], Christos Klamouris[1], Michael Hübner[1], Moritz Röger[1], T. Kueng[1], Jürgen Becker[1], Wolfgang Freude[1], Jürg Leuthold[1], Andreas W. Bett[2]; [1]Univ. of Karlsruhe, Germany, [2]Fraunhofer-Inst. for Solar Energy Systems, Germany.* We implemented an optically powered video camera connected to a base station at 200 m distance. Power and 100-Mbps data-channel are multiplexed at 810 nm and 1310 nm into a standard 62.5 µm multimode fiber.

FMF • Ultrashort-Pulse Fiber Lasers—Continued

FMF3 • 5:00 p.m.

52 fs Fiber Laser with a Fiber-Based Dispersion Control at 1 µm, *Michael Schultz[1], Oliver Prochnow[1], Axel Ruehl[1], Siddharth Ramachandran[2], Samir Ghalmi[2], Dieter Wandt[1], Dietmar Kracht[1]; [1]Laser Zentrum Hannover e.V., Germany, [2]OFS Labs, USA.* We present a mode-locked ytterbium fiber laser with a higher-order mode fiber compensating the GVD and partially the TOD of the SMF. The pulse duration is 52 fs with a spectral FWHM of 57 nm.

FMF4 • 5:15 p.m.

High Power Subpicosecond Pulse Generation From a Yb^{3+}-Doped Fiber Laser Using Only Frequency Shifted Feedback, *Alexander M. Heidt[1,2], Johan P. Burger[1], Jean-Noel Maran[1], Hubertus M. von Bergmann[1], Nicholas Traynor[3]; [1]Laser Res. Inst., Univ. of Stellenbosch, South Africa, [2]Physics Dept., Univ. of Konstanz, Germany, [3]PERFOS (Plate-forme d'Etudes et de Recherches sur les Fibres Optiques Spéciales), France.* A frequency-shifted feedback fiber modelocked laser with 120 nJ pulse energy, increasing to 1µJ with simultaneous Q-switching, is demonstrated. The pulses were compressed to < 1 ps duration.

FMG • NLO in Engineered Materials II—Continued

FMG4 • 4:45 p.m.

Optical Switching through Nonlinearity of Nanoparticle Arrays, *Rebecca Sainidou[1], Tatiana V. Teperik[2], Franscisco Javier Garcia de Abajo[1,2]; [1]Inst. de Optica - CSIC, Spain, [2]Donostia Intl. Physics Ctr., Spain.* We propose to use nanosphere arrays for all-optical transmission-switching based on the nonlinearity of the particles driven by field enhancement at a lattice resonance of the array.

FMG5 • 5:00 p.m.

Optical Studies of Gel Grown Magnesium Phosphate - An Inorganic NLO Crystal, *S. Franklin, K. P. Bhuvana, T. Balasubramanian; Natl. Inst. of Technology, India.* Gel grown titled crystal has been characterized by FTIR and UV-Visible spectral studies. Band gap (2eV) is determined. The study reveals the suitability of the crystal for fabrication of optoelectronic devices.

FMG6 • 5:15 p.m.

Nonlinear Absorption in Glass-Ceramics Containing Sodium Niobate Nanocrystals, *Tâmara P. R. Oliveira[1], Leonardo S. Menezes[1], Cid B. Araújo[1], Andrei A. Lipovskii[2]; [1]Univ. Federal de Pernambuco, Brazil, [2]St. Petersburg State Technical Univ., Russian Federation.* The nonlinear optical absorption of glass-ceramics containing sodium niobate nanocrystals was investigated in the visible range. The dispersion properties due to two-photon and excited-state absorptions are analyzed for samples presenting distinct concentrations of nanocrystals.

FMH • Computational Imaging I—Continued

FMH4 • 4:45 p.m.

Estimation of Phase Shifts in Structured Illumination for High Resolution Imaging, *Sapna A. Shroff, James R. Fienup, David R. Williams; Univ. of Rochester, USA.* The application of structured illumination for enhanced resolution requires accurate knowledge of phase shifts in the sinusoidal illumination. This work proposes a method to estimate random, unknown phase shifts and subsequent image reconstruction.

FMH5 • 5:00 p.m.

Measurement of Surface Profiles of an Objective Lens by Using Fine Projection Moire Method, *Seong-Su Park, Kewseung Lee, Eungjang Lee, Seung-Han Park; Yonsei Univ., Republic of Korea.* We present a 3-D image measuring technology base to obtain surface profiles of objects using projection Moire method, and demonstrate its performance by obtaining surface profiles of a lens with 40µm and 80µm fringe patterns.

FMH6 • 5:15 p.m.

Fabrication of a Robust Phase-Shifting Moire Interferometer against Vibration, *Dae-Geun Kim, Hong-Gyu Ahn, Jae-Hyuk Kim, Kyung Hwan Kim, Seung-Han Park; Nonlinear Optics Lab, Yonsei Univ., Republic of Korea.* We present a robust phase-shifting Moire interferometer against vibrations using PZT and camera synchronization module. The 3-D image of objects can be reconstructed from its Moire fringes.

FMI • Integrated Optic Devices II—Continued

FMI3 • 4:45 p.m. Invited

Quantum Dot and Semiconductor Nanostructures for Photonic Signal Processing Devices, *Osamu Wada; Kobe Univ., Japan.* This paper covers recent development of nanostructured semiconductors, in particular, quantum dots for the application to photonic communication devices including semiconductor optical amplifiers and all-optical signal processing devices.

FMI4 • 5:15 p.m.

Thue-Morse Quasi-Crystals Made of Porous Silicon, *Antigone Marino[1,2], Giancarlo Abbate[1,2], Vladimir Tkachenko[1,2], Ilaria Rea[1,3], Luca De Stefano[3], Michele Giocondo[4,5]; [1]Dept. of Physical Sciences, Univ. of Naples Federico II, Italy, [2]CNR-INFM Lab Coherentia, Italy, [3]CNR, Inst. for Microelectronics and Microsystems, Italy, [4]Physics Dept., Univ. of Calabria, Italy, [5]CNR-INFM Liquid Crystal Lab, Italy.* Quasi-periodic Thue-Morse structures up to 128 layers have been fabricated by using porous silicon technology. Their photonic band gap have been experimentally investigated by means of variable angle reflectivity measurements.

FMJ • Data Reduction Methods and Computational Imaging—Continued

FMJ3 • 4:45 p.m.
Singular Beam Microscopy for Nanoscale Feature Analysis, *Boris Spektor, Alexander Normatov, Joseph Shamir; Technion, Israel.* Theoretical, numerical, and experimental investigations indicate that the high sensitivity, presented by the interaction of laser beams containing singularities with nanoscale objects, can mitigate classical diffraction limitations. Experimental sensitivity of 20 nm will be presented.

FMJ4 • 5:00 p.m.
Compressive Measurements for Video, *Mohan Shankar, Nikos Pitsianis, Xiaobai Sun, David Brady; Fitzpatrick Inst. for Photonics, Duke Univ., USA.* Redundancies present in video streams could be used to implement compressive sampling to achieve low power video sensors. We explore the possibilities of using this in the design of compressive video sensors and corresponding algorithms.

FMJ5 • 5:15 p.m.
Dynamic Range Compression Deconvolution, *Bahareh Haji-saeed[1], William D. Goodhue[2], Jed Khoury[3], Charles L. Woods[3], John Kierstead[4]; [1]Electrical and Computer Engineering Dept., Univ. of Massachusetts at Lowell, USA, [2]Physics Dept., Univ. of Massachusetts at Lowell, USA, [3]AFRL, Sensors Directorate, Hanscom Air Force Base, USA, [4]Solid State Scientific Corp., USA.* In this paper a generic nonlinear dynamic range compression deconvolver (DRCD) is proposed. The DRCD outperforming well-established image restoration filters such as the inverse and the Wiener filters is demonstrated.

JMD • Imaging and Microscopy — Biological II—Continued

JMD3 • 5:00 p.m. Invited
Two-Photon Standing Wave Microscopy to Measure Small Scale Motions, *Chris Bardeen, Kerry M. Hanson, Sara K. Davis; Univ. of California at Riverside, USA.* A two-photon standing wave fluorescence experiment is used to look at the small-scale motions of fluorescently-labeled DNA in live cells and biological systems. Both photobleaching and fluorescence correlation spectroscopy versions of this experiment are presented.

LMB • Space-Based Tests of Relativity—Continued

LMB3 • 4:45 p.m. Invited
Shooting the Moon: Laser Ranging Pushes Tests of Einstein's Gravity, *Tom Murphy[1], E. L. Michelsen[1], H. E. Swanson[2], C. W. Stubbs[3], J. E. Battat[3], K. Nordtvedt[4], R. McMillan[5]; [1]Univ. of California at San Diego, USA, [2]Univ. of Washington, USA, [3]Harvard Univ., USA, [4]Northwest Analysis, USA, [5]Apache Point Observatory, USA.* Decades of lunar laser ranging have produced superlative tests of Einstein's general relativity. A new effort (APOLLO) seeks to extend these tests another order-of-magnitude via millimeter range accuracy between Earth and Moon.

LMB4 • 5:15 p.m. Invited
Laser-Enabled Tests of Relativistic Gravity in Space, *Slava G. Turyshev; JPL, Caltech, USA.* Existing capabilities in laser ranging, optical interferometry, precision frequency standards allow for major advances in space-based tests of relativistic gravity. We discuss recent experimental proposals relying on these technologies to address important fundamental physics questions.

SMF • Symposium on Undergraduate Research—Continued

OMB • Materials and Devices for OLEDs I—Continued

OMB3 • 5:00 p.m. Invited
Material and Interface Engineering for High Efficiency Light-Emitting Devices, *Alex Jen; Univ. of Washington, USA.* We have employed an integrated interface engineering and materials development approach to produce bright, very efficient and stable light-emitting devices demonstrated for applications in displays and solid-state lighting.

FMF • Ultrashort-Pulse Fiber Lasers—Continued

FMF5 • 5:30 p.m.
An Analytical Model Describing Multipeak Pulse Structure in Actively Q-Switched Fiber Lasers, *François Brunet[1], Mathieu Drolet[1], Yves Taillon[1], Pierre Galarneau[1], Sophie LaRochelle[2]; [1]INO, Canada, [2]Ctr. d'Optique, Photonique et Laser, Univ. Laval, Canada.* We present a simple analytical model describing the detailed structure of actively Q-switched fiber ring laser pulses. The predicted pulse shapes match experimental data with an accuracy comparable with a numerical traveling-wave model.

FMF6 • 5:45 p.m.
All-Fluoride Fiber Laser at 1480 nm Based on Fiber Bragg Gratings, *Dominic Faucher, Guillaume Androz, Martin Bernier, Réal Vallée; COPL, Univ. Laval, Canada.* We report an all-fluoride fiber laser cavity using a fiber Bragg grating. The thulium-doped fiber laser yields a maximum output power of 350 mW at 1480 nm with a slope efficiency of 40%.

FMG • NLO in Engineered Materials II—Continued

FMG7 • 5:30 p.m.
Experimental and Theoretical Study of the Nonlinear Optical Properties of III-V Ternary Semiconductor Alloy Crystals, *Joel M. Murray[1], Vince Cowan[2], Leonel P. Gonzalez[1], Partha S. Dutta[3], Geeta Rajagopalan[4], Srinivasan Krishnamurthy[5], Zhi-Gang Yu[5], Shekhar Guha[6]; [1]General Dynamics Information Technology, USA, [2]Univ. of Dayton, USA,,[3]Rensselaer Polytechnic Inst., USA, [4]United Semiconductors, LLC, USA, [5]SRI Intl., USA, [6]AFRL, USA.* Nonlinear optical properties of novel ternary semiconductor crystals were determined at several wavelengths between 1 and 2 micrometers using a wavelength tunable, picosecond duration laser. Measured values were compared to theoretical calculations.

FMG8 • 5:45 p.m.
Plasmonic Laser Nanostructuring of Solid Materials, *Daniel S. Eversole[1], Boris Luk'yanchuk[2], Adela S. Ben-Yakar[1]; [1]Univ. of Texas at Austin, USA, [2]Data Storage Inst., Singapore.* We report on the fabrication of nanoscale structures ablated on solid materials by the plasmonic scattering of 780 nm femtosecond laser pulses in the near-field of gold nanoparticles.

FMH • Computational Imaging I—Continued

FMH7 • 5:30 p.m.
Fast Algorithm for Computational Imaging with Partially Coherent Illumination, *Andrey S. Ostrovsky, Paulo C. Romero-Soria; Univ. Autonoma de Puebla, Mexico.* The fast algorithm for calculating the image in optical system with partially coherent illumination is proposed. The algorithm is based on the coherent-mode representation of cross-spectral density function of illumination. The corresponding example is given.

FMH8 • 5:45 p.m.
Beam Mode and Diffraction Control by Conservation of Orbital Angular Momentum, *Sabino Chávez-Cerda[1], Victor Arrizon[1], Dilson P. Caetano[2], Jandir M. Hickmann[2]; [1]INAOE, Mexico, [2]Inst. de Física, Brazil.* We show that the propagation of Laguerre-Gauss and Bessel "forbidden" beams is dictated by the principle of conservation of optical orbital angular momentum that modifies their initial diffraction and mode properties.

FMI • Integrated Optic Devices II—Continued

FMI5 • 5:30 p.m.
Novel Vacuum Assisted Microfluidic Technique for Fabrication of Guided Wave Devices, *Sangyup Song[1], Angel Flores[2], Sarfaraz Baig[2], Michael R. Wang[2]; [1]New Span Opto-Technology Inc., USA, [2]Univ. of Miami, USA.* A novel vacuum-assisted-microfluidic (VAM) fabrication technique is presented. The method results in lower propagation losses and improved waveguide structures. The technique is employed to develop optical interconnect ribbon couplers and a color filter for OLED.

FMI6 • 5:45 p.m.
Performance of Hadamard Transform Spectrometer Based on MEMS Technology, *Sachin Singh[1], Banmali S. Rawat[1], Moncef B. Tayahi[1], Marian Hanf[1], Steffen Kurth[2], Thomas Gessner[2]; [1]Univ. of Nevada, USA, [2]Chemnitz Univ. of Technology, Germany.* The MEMS technology has been used to fabricate Hadamard Transform Spectrometer (HTS) using 48 micromirror array actuated by a digital signal. The transmission factor, Q-factor, resonance frequency and cross-talk effects have been thoroughly investigated.

6:30 p.m.–7:30 p.m., OSA's Annual Business Meeting, *Fairmont Hotel, Belvedere Room*

7:30 p.m.–8:30 p.m., Optical Design and Instrumentation Division Meeting, *Fairmont Hotel, Empire Room*

7:30 p.m.–9:30 p.m., OSA Student Member Welcome Reception, *Smoke Tiki Lounge, 152 Post St.*

Hillsborough	Sacramento	Piedmont	Glen Ellen	Atherton
Frontiers in Optics	**Joint**	**Laser Science**		**OMD**

FMJ • Data Reduction Methods and Computational Imaging—Continued

FMJ6 • 5:30 p.m.
Towards 4-D+ Imaging, *Volker Sick; Univ. of Michigan, USA.* High-repetition rate solid-state lasers and CMOS camera technology allow simultaneous multi-dimensional measurements of scalar distributions and velocity fields at rates higher than 10 kHz. Extensions to three spatial dimensions are within reach.

JMD • Imaging and Microscopy — Biological II—Continued

JMD4 • 5:30 p.m.
On the Digital Holography Microscopy of Translucent Objects, *Alejandro Restrepo-Martínez, Roman Castañeda; Univ. Nacional de Colombia Sede Medellin, Colombia.* Some of the most important features present in digital holography microscopy of translucent objects are shown. Therefore, the phase reconstruction requires special procedures in this case, whose developments constitute an actual challenge in this field.

JMD5 • 5:45 p.m.
Compact Semiconductor Bioluminescence Biosensors, *Thomas D. O'Sullivan, Alfred Wechselberger, Ofer Levi, James S. Harris; Stanford Univ., USA.* We present design of bioluminescence detection systems using semiconductor detectors for rapid parallel diagnostic assays. Bioluminescence emission detection of 109 photons/sec was demonstrated using Silicon detectors. Improved GaAs-based bio-sensors were designed for improved detection sensitivity.

LMB • Space-Based Tests of Relativity—Continued

SMF • Symposium on Undergraduate Research—Continued

OMB • Materials and Devices for OLEDs I—Continued

OMB4 • 5:30 p.m.
Synthesis and Characterization of Organic Materials for Near Infrared Applications, *Zixing Wang, Xiaohui Yang, Sijesh Madakuni, Ghassan E. Jabbour, Jian Li; School of Materials, Arizona State Univ., USA.* This presentation will highlight the development of novel heavy-metal complexes as phosphorescent emitters for efficient near infrared OLEDs.

6:30 p.m.–7:30 p.m., OSA's Annual Business Meeting, *Fairmont Hotel, Belvedere Room*

7:30 p.m.–8:30 p.m., Optical Design and Instrumentation Division Meeting, *Fairmont Hotel, Empire Room*

7:30 p.m.–9:30 p.m., OSA Student Member Welcome Reception, *Smoke Tiki Lounge, 152 Post St.*

Frontiers in Optics

8:00 a.m.–9:45 a.m.
FTuA • Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources I
Lahsen Assoufid; Argonne Natl. Lab, USA, Presider

FTuA1 • 8:00 a.m. Invited
Challenges for the First Experiments at LCLS: The First Hard X-Ray Free Electron Laser, *Jerome Hastings; Stanford Linear Accelerator Ctr., USA.* No abstract available.

FTuA2 • 8:30 a.m. Invited
Status and Applications of Super-Conducting X-Ray Free-Electron Lasers, *Harald Sinn, Thomas Tschentscher; HASYLAB/DESY, Germany.* The current status of the European XFEL project and the planed experiments are presented. Requirements on X-ray optics in peak heat load capability, mechanical stability and on slope errors of mirrors will be discussed.

8:00 a.m.–10:00 a.m.
FTuB • Silicon Photonics
Presider to Be Announced

FTuB1 • 8:00 a.m. Tutorial
Silicon Photonics, *Tom Koch; Lehigh Univ., USA.* Silicon photonics has recently received heightened interest as a powerful vehicle for low-cost, high performance active integrated optical subsystems. This tutorial will review fundamental concepts, building blocks, and recent progress in the field.

Thomas L. Koch is a joint Professor in ECE and Physics at Lehigh Univ., and holds the Daniel E. '39 and Patricia M. Smith Endowed Chair of Director, Ctr. for Optical Technologies. Previously he held Vice President positions at SDL, Lucent, and most recently at Agere Systems. Thomas received his A.B. in Physics from Princeton Univ. and his Ph.D. in Applied Physics from Caltech in 1982 working under Prof. Amnon Yariv. Joining Bell Labs Res. in that year, his contributions in optoelectronic technologies enabled key advances in high-capacity optical fiber communications. Tom has chaired numerous major international conferences, and authored more than 300 conference and journal publications, book chapters, and books. He has received the William Streifer Award for Scientific Achievement and the Distinguished Lecturer Award from the IEEE LEOS, is a Fellow of Bell Labs, the OSA, and the IEEE, and a member of the National Academy of Engineering.

8:00 a.m.–10:00 a.m.
FTuC • Propagation in Disordered Media
Aristide Dogariu; College of Optics & Photonics, CREOL and FPCE, USA, Presider

FTuC1 • 8:00 a.m. Invited
Avoided Resonance Crossings in Optical Microcavities: Unidirectional Light Emission and Scar Formation, *Jan Wiersig[1], Martina Hentschel[2]; [1]Inst. for Theoretical Physics, Univ. of Bremen, Germany, [2]Max-Planck-Inst. für Physik Komplexer Systeme, Germany.* Utilizing avoided resonance crossings we achieve unidirectional light emission from high-quality modes and give an explanation of the scarring phenomenon in deformed microdisks.

FTuC2 • 8:30 a.m.
Mesoscopic Correlations in Disordered Waveguide: Dependence on Channel Indexes, *Alexey G. Yamilov; Univ. of Missouri-Rolla, USA.* Numerical simulation in quasi-1D disordered waveguide demonstrate that spacial field correlations strongly deviate from expectation based on random matrix theory (RMT). We relate the descrepancy to invalidity of RMT assumption of equivalence of different transmission channels.

Joint

8:00 a.m.–10:00 a.m.
JTuA • Quantum Information
Alexander Lvovsky; Univ. of Calgary, Canada, Presider

JTuA1 • 8:00 a.m.
Efficient Quantum-Logic Circuits: Or, How I Learned to Stop Worrying and Love Hilbert Space, *Andrew G. White[1], Marcelo Pereira de Almeida[1], Marco Barbieri[1], Devon N. Biggerstaff[1], Rohan B. Dalton[1], Alexei Gilchrist[1], Geoffrey Gillett[1], Daniel F. V. James[2], Nathan K. Langford[1], Benjamin N. Lanyon[1], Kevin J. Resch[3], Till J. Weinhold[1]; [1]Univ. of Queensland, Australia, [2]Univ. of Toronto, Canada, [3]Univ. of Waterloo, Canada.* We demonstrate significantly compacted quantum algorithms and demonstrate a Fock-state filter by going outside the qubit corner of Hilbert space. We obtain a complete error budget for an entangling gate when driven with independent photons.

JTuA2 • 8:15 a.m.
Experimental Demonstration of Quantum Leader Election in Linear Optics, *Yuta Okubo[1,2], Xiang-Bin Wang[2], Akihisa Tomita[2]; [1]Dept. of Frontier Science, Univ. of Tsukuba, Japan, [2]ERATO-SORST Quantum Computation and Information Project, Japan Science and Technology Agency, Japan.* We propose and demonstrate a new implementation of a quantum protocol which can operate deterministically only with linear optics. This protocol, which is called quantum leader election, exhibits the quantum advantages over classical protocol.

JTuA3 • 8:30 a.m. Invited
Universal Control of Optical Quantum Information, *Stephen D. Bartlett; Univ. of Sydney, Australia.* We present a simple scheme for performing any quantum operation on a photonic qubit using weak measurement and feedback control. This scheme includes generalized measurements which balance the trade-off between information gain and disturbance.

Frontiers in Optics

8:00 a.m.–10:00 a.m.
FTuD • Biosensors I
Presider to Be Announced

FTuD1 • 8:00 a.m. Invited
Molecular Imaging and Microspectroscopy of Live Cells Using Immunotargeted Nanoparticles, *Adam Wax, Matthew Crow; Duke Univ., USA.* We compare the expression of EGFR by epithelial carcinoma and neuroepithelial tumor cell lines using hyperspectral darkfield microscopy to measure the scattering spectra of immunolabeled plasmonic nanoparticles bound by cell surface receptors.

FTuD2 • 8:30 a.m.
Label-Free Detection of Cytokines, *Andrea M. Armani, Scott E. Fraser, Kerry J. Vahala; Caltech, USA.* Interleukin-2 (IL2) is a cytokine that regulates T-cell growth and is used in cancer therapies. By sensitizing the microcavity sensor surface with anti-IL2 and monitoring the resonant frequency, IL2 can be detected at therapeutic levels.

Frontiers in Optics

8:00 a.m.–10:00 a.m.
FTuE • Precision Engineering in Optics
Peter Blake; NASA Goddard Space Flight Ctr., USA, Presider

FTuE1 • 8:00 a.m.
Precision Centering of Lenses, *Robert E. Parks; Optical Perspectives Group, LLC, USA.* We describe the alignment of centered lens systems using a precision rotary table and two autostigmatic microscopes plus auxiliary optics to extend the working distances to simultaneously view the centers of curvature of each lens.

FTuE2 • 8:15 a.m.
Volumetric Interferometry for Absolute Coordinate Measurements, *Jiyoung Chu[1,2], Quandou Wang[1], Ulf Griesmann[1], Johannes Soons[1]; [1]NIST, USA, [2]Korea Advanced Inst. of Science and Technology, Republic of Korea.* A fiber point-diffraction interferometer is under development as a volumetric interferometer to measure x, y and z coordinates simultaneously in free space with the goal to calibrate Coordinate Measuring Machines.

FTuE3 • 8:30 a.m. Invited
Precision Motion and Control for Scanning Beam Interference Lithography, *Andre Sharon; Fraunhofer Ctr. for Manufacturing Innovation, Boston Univ., USA.* Precision motion and control is crucial in patterning nanometer-scale diffraction gratings over large optical substrates with sub-wave errors using scanning beam interference lithography. Innovative design and integration of commercial technologies can meet the strict requirements.

Laser Science

8:30 a.m.–10:00 a.m.
LTuA • Time-Resolved X-Ray and Electron Diffraction
Soren Keiding; Aarhus Univ., Denmark, Presider

LTuA1 • 8:30 a.m. Invited
Ultrafast Molecular Dynamics with High-Harmonic Soft X-Rays, *Stephen R. Leone; Depts. of Chemistry and Physics, Univ. of California at Berkeley, USA.* High order harmonics of a Ti:Sapphire laser are used for molecular dynamics studies by time-resolved photoelectron spectroscopy and transient absorption. With few cycle carrier-envelope stabilized pulses the formation of attosecond pulses is investigated.

8:00 a.m.–10:00 a.m.
LTuB • Precision Techniques at High Laser Power I
Shailendhar Saraf; Rochester Inst. of Technology, USA, Presider

LTuB1 • 8:00 a.m. Invited
Mode Selection in High-Power Single-Frequency Lasers, *Dietmar Kracht, M. Hildebrandt, L. Winkelmann, O. Puncken, B. Schulz, R. Wilhelm, M. Frede; Laser Zentrum Hannover e.V., Germany.* We report on mode selection methods in high-power single-frequency laser systems for gravitational wave detection. That covers transversal selection in oscillators via resonator design as well as longitudinal by injection locking and different amplification schemes.

LTuB2 • 8:30 a.m. Invited
Precision Optics for High Laser Power, *David H. Reitze; Univ. of Florida, USA.* The use of high power lasers in precision measurement applications places demands on optical components, particularly with respect to thermal management. We discuss methods to improve component performance, with an emphasis on gravitational wave interferometers.

8:45 a.m.–10:00 a.m.
LTuC • Properties and Dynamics of Interfaces and Surfaces I
Rob Walker; Univ. of Maryland, USA, Presider

Turn the page for the first presentation in this session.

OMD

8:00 a.m.–10:00 a.m.
OTuA • OTFT Materials and Devices
Chung-Chih Wu; Natl. Taiwan Univ., Taiwan, Presider

OTuA1 • 8:00 a.m. Invited
New Organic Materials and Processes for Thin Film Electronics, *Zhenan Bao; Stanford Univ., USA.* Heteroacene organic semiconductors and polymers will be presented. They have shown mobility as high as 0.75 cm^2/Vs and on/off ratio greater than 106. A crosslinked dielectric material, allowing low voltage operation will also be presented.

OTuA2 • 8:30 a.m. Invited
Solution-Processed Organic Thin Film Transistors, *Thomas N. Jackson; Pennsylvania State Univ., USA.* Using TIPS-pentacene and F-TES-ADT we have demonstrated solution-processed organic semiconductor thin films with strong molecular ordering, transistors with mobility >1.5 $cm^2/V{\cdot}s$, and ring oscillators with propagation delay <5 μsec/stage.

FTuA • Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources I—Continued

FTuA3 • 9:00 a.m.
Gated Large-Bandwidth Soft-X-Ray Continuum Generation on the Leading Edge of the Driver Pulse, *Thomas Pfeifer, Aurélie Jullien, Mark J. Abel, Phillip M. Nagel, Daniel M. Neumark, Stephen R. Leone; Univ. of California at Berkeley, USA.* Soft-x-ray continuum radiation is experimentally produced by high-harmonic generation on the leading edge of the laser pulse. Ionization gating implies isolated attosecond pulses can be generated with larger bandwidth, tunable wavelength, and longer driver pulses.

FTuA4 • 9:15 a.m.
Optical Frequency-Modulated Continuous-Wave Interferometers and Their Applications, *Jesse Zheng; PhotonTech, Canada.* This paper discusses optical frequency-modulated continuous-wave (FMCW) interferometers, including their principles, characters, optical configurations and applications.

FTuB • Silicon Photonics—Continued

FTuB2 • 8:45 a.m.
Wavelength Selective Coupler with Vertical Gratings on Silicon Chip, *Kazuhiro Ikeda[1], Hyo Chang Kim[1], Maziar Nezhad[1], Ashok Krishnamoorthy[2], John Cunningham[2], Yeshaiahu Fainman[1]; [1]Univ. of California at San Diego, USA, [2]Sun Microsystems, USA.* We demonstrate a wavelength selective coupler on a silicon chip using vertical grating structures, which possess simplicity in design and fabrication. The coupler can be used for add-drop filters and other functional devices.

FTuB3 • 9:00 a.m. Invited
Silicon Photonic Integrated Circuits for Optical Interconnect, *Ansheng Liu[1], Ling Liao[1], Doron Rubin[2], Juthika Basak[1], Hat Nguyen[1], Yoel Chetrit[2], Rami Cohen[2], Nahum Izhaky[2], Mario Paniccia[1]; [1]Intel Corp., USA, [2]Intel Corp., Israel.* We discuss integrated silicon photonic technologies that enable Tbit/s optical link for future VLSI interconnect applications. We also review recent advances in various fundamental building blocks, including 30 Gbit/s data transmission using silicon optical modulators.

FTuC • Propagation in Disordered Media—Continued

FTuC3 • 8:45 a.m.
Statistics of Random Signal Intensity in the Presence of Gaussian Noise, *A. A. Chabanov; Univ. of Texas at San Antonio, USA.* The intensity probability distribution of a random field in the presence of a Gaussian noise has been derived to retrieve the statistics of microwave pulsed transmitted intensity from a noisy background at long delay times.

FTuC4 • 9:00 a.m. Invited
Anderson Localization in Disordered Photonic Lattices, *Mordechai Segev, Tal Schwartz, Guy Bartal, Shmuel Fishman; Technion — Israel Inst. of Technology, Israel.* We present the first observation of Anderson Localization in disordered photonic lattices, and study the combined effects of nonlinearity and disorder, under normal and anomalous dispersion.

JTuA • Quantum Information—Continued

JTuA4 • 9:00 a.m.
Observing the Spin Hall Effect of Light via Quantum Weak Measurements, *Onur Hosten, Paul G. Kwiat; Univ. of Illinois, USA.* Using the techniques of "quantum weak-measurements" as a coherent amplification mechanism for small signals, for the first time we have measured the recently proposed "spin Hall effect" of light.

JTuA5 • 9:15 a.m.
Scalable Quantum Information Processing with Microwave Photons, *Pavel Lougovski[1], Carlos López[2], Juan Carlos Retamal[2], Enrique Solano[3]; [1]Oregon Ctr. for Optics, USA, [2]Dept. de Física, Univ. de Santiago de Chile USACH, Chile, [3]Physics Dept., Ludwig-Maximilians-Univ., Germany.* We demonstrate how a scalable superconducting-qubit-based quantum computer can be realized by performing deterministic quantum gates on microwave photons. We discuss experimental feasibility of our approach.

FTuD • Biosensors I—Continued

FTuD3 • 8:45 a.m.
A Label-free DNA Optical Fiber Sensor for Detection of Bacteria - *F. tularensis*, *Xingwei Wang[1,2], Kristie Cooper[2], Anbo Wang[2]; [1]Univ. of Massachusetts Lowell, USA, [2]Virginia Tech, USA.* This paper presents a label-free DNA optical fiber sensor for detection of *F. tularensis* bacteria by detection of complementary deoxyribonucleic acid (DNA) sequences. The sensor features cost efficiency, speed, and ease of use.

FTuD4 • 9:00 a.m.
Surface Plasmon Resonance Nanohole Array Sensor and its Application on Protein Specific Binding, *Lin Pang[1], Grace Hwang[2], Yeshaiahu Fainman[1]; [1]Univ. of California at San Diego, USA, [2]MITRE Corp., USA.* A surface plasmon resonance biosensor based on two-dimensional metallic nanohole array is presented. The resonance is narrowed by a crossed polarizer-analyzer pair. Protein specific bindings are used to demonstrate real-time label-free microfluidic packaged sensor.

FTuD5 • 9:15 a.m.
DCDHF Fluorophores Designed for Single-Molecule Cellular Imaging, *Samuel J. Lord[1], Hui Wang[2], Na Liu[2], Zhikuan Lu[2], Robert J. Twieg[2], W. E. Moerner[1]; [1]Stanford Univ., USA, [2]Kent State Univ., USA.* We are developing a new class of single-molecule fluorophore that brighten upon rigidization, which can be used to reduce the background fluorescence for applications in cellular imaging.

FTuE • Precision Engineering in Optics—Continued

FTuE4 • 9:00 a.m.
Design Criteria for Combined Diffractive Optical Elements for Quasi-Absolute Testing of Aspherics, *Gufran Sayeed Khan, Klaus Mantel, Irina Harder, Norbert Lindlein, Johannes Schwider; Inst. of Optics, Information and Photonics, Univ. of Erlangen-Nuremberg, Germany.* Recently, we reported first experimental results of a three position quasi-absolute test for rotationally symmetric aspherics by using combined diffractive optical elements (Combo-DOEs). Here we investigate several systematic error sources and present an optimised Combo-DOE.

FTuE5 • 9:15 a.m.
A Finite-Element Analysis of Errors in Three-Flat Tests Caused by Rotation Dependent Flat Deformations, *Nicholas Laurenchet[1,2], Ulf Griesmann[1], Johannes Soons[1]; [1]NIST, USA, [2]Inst. Français de Mechanique Avancée, France.* Rotation of wedged flats as part of three-flat test procedures leads to rotation angle dependent deformations. We estimate the magnitude of the deformations and the effect on the test uncertainty using finite element modeling.

LTuA • Time-Resolved X-Ray and Electron Diffraction—Continued

LTuA2 • 9:00 a.m. Invited
Chemical Dynamics Probed by Ultrafast X-Ray Absorption Spectroscopy, *Xiaodi Li, Brian Ahr, Christopher M. Laperle, Taewoo Lee, Christian Reich, Christoph Rose-Petruck; Brown Univ., USA.* Ultrafast laser pump-XAFS probe spectra of various organometallic complexes in solution have been measured using a laser-driven plasma x-ray source. A new x-ray source driven by a 15-W, 5-kHz laser system has been developed.

LTuB • Precision Techniques at High Laser Power I—Continued

LTuB3 • 9:00 a.m.
Adaptive Optical Elements for Future Gravitational Wave Interferometers, *Muzammil A. Arain, Volkar Quetschke, Luke F. Williams, Guido Mueller, David B. Tanner, David H. Reitze; Dept. of Physics, Univ. of Florida, USA.* Thermal lensing and beam deformation in next generation gravitational wave interferometer optical subsystems must be compensated to ensure efficient operation. Here we present two possible adaptive focusing elements which use heat-induced photothermal effects.

LTuB4 • 9:15 a.m.
ASE Suppression in a Diode-Pumped Nd:YLF Regenerative Amplifier Using a Volume Bragg Grating, *Andrey V. Okishev[1], Christophe Dorrer[1], Vadim I. Smirnov[2], Leonid B. Glebov[3], Jonathan D. Zuegel[1]; [1]Lab for Laser Energetics, Univ. of Rochester, USA, [2]OptiGrate, USA, [3]College of Optics and Photonics, CREOL, Univ. of Central Florida, USA.* Instrument-limited suppression of out-of-band amplified spontaneous emission (ASE) is demonstrated for the first time in a Nd:YLF diode-pumped regenerative amplifier using a volume Bragg grating (VBG) as a cavity mirror.

LTuC • Properties and Dynamics of Interfaces and Surfaces I—Continued

LTuC1 • 8:45 a.m. Invited
Evidence for an Enhanced Proton Concentration at the Liquid Water Surface from SHG Spectroscopy, *Richard J. Saykally; Dept. of Chemistry, Univ. of California, USA.* Using resonant UV SHG spectroscopy, we have observed surface-enhanced concentrations of several ions in aqueous solutions, confirming theoretical predictions from several groups. Our experiments also support recent predictions of enhanced proton concentrations at aqueous surfaces.

LTuC2 • 9:15 a.m. Invited
Going Nonlinear to Study Liquid Surfaces of Environmental Importance, *Geri Richmond; Univ. of Oregon, USA.* A summary of our most recent studies of environmentally important processes at liquid surfaces will be presented. The studies are a combination of vibrational sum frequency spectroscopy and molecular dynamics simulations.

OTuA • OTFT Materials and Devices—Continued

OTuA3 • 9:00 a.m. Invited
Phenylenevinylene Oligomers and Poly-p-Phenylenevinylene for Organic Field-Effect Transistors, *Tetsuo Tsutsui[1,2], Takeshi Yasuda[1,2], Hiroshi Kayashima[2], Katsuhiko Fujita[1,2]; [1]Inst. for Materials Chemistry and Engineering, Kyushu Univ., Japan, [2]Graduate School of Engineering Sciences, Kyushu Univ., Japan.* For understanding of the roles of inter-chain and intra-chain charge transport in linear conjugated chains, field-effect mobilities of both oligopnenylenevinylenes and poly-p-phenylenevinylene were evaluated. Both p-channel and n-channel carrier transport was observed.

Frontiers in Optics | **Joint** | **Frontiers in Optics**

FTuA • Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources I—Continued

FTuA5 • 9:30 a.m.
Extreme Ultraviolet Polarimetry with High-Order Harmonics, *Nicole Brimhall, Matthew Turner, Nick Herrick, David D. Allred, R. Steven Turley, Michael Ware, Justin Peatross; Brigham Young Univ., USA.* High-order harmonic generation is utilized as a source of extreme ultraviolet light for polarization sensitive reflectometry.

FTuB • Silicon Photonics—Continued

FTuB4 • 9:30 a.m.
Intrinsic Losses in Silicon-On-Insulator Microring Bends, *Shijun Xiao, Maroof Khan, Hao Shen, Minghao Qi; Birck Nanotechnology Ctr., Purdue Univ., USA.* We demonstrate a new method to estimate intrinsic losses in silicon-on-insulator microring bends, which is based on the traveling wave theory and the accurate measurement of microring's resonance response.

FTuB5 • 9:45 a.m.
Wavelength-Independent Bent-Fiber Coupler to an Ultra-High Q Cavity Demonstrated over 850 nm Span, *Steven Wang, Tal Carmon, Eric P. Ostby, Kerry J. Vahala; Caltech, USA.* A bent tapered-fiber coupler is experimentally demonstrated to allow wavelength independent fiber-to-cavity coupling over an 850nm span; opening current technology of ultra-high Q cavities for applications spanning the UV to the IR band.

FTuC • Propagation in Disordered Media—Continued

FTuC5 • 9:30 a.m.
Vortex Interaction with Nonlinear Photonic Lattices of Varying Coherence, *Anita Fors, Eugenia Eugenieva, Zhigang Chen; San Francisco State Univ., USA.* We study numerically interaction of a singly-charged vortex with nonlinear photonic lattices optically induced with varying spatial coherence. We observe that the dynamics of vortex phase evolution and lattice deformation is dependent on the coherence.

FTuC6 • 9:45 a.m.
Beam Criterion for Atmospheric Propagation, *Olga Korotkova[1], Emil Wolf[2,3]; [1]Dept. of Physics and Astronomy, Univ. of Rochester, USA, [2]Inst. of Optics, Univ. of Rochester, USA, [3]College of Optics and Photonics, CREOL and FPCE, Univ. of Central Florida, USA.* A criterion is introduced for testing whether a beam (monochromatic or partially coherent) retains its beam-like form after it propagates any particular distance through the turbulent atmosphere. Several examples are given.

JTuA • Quantum Information—Continued

JTuA6 • 9:30 a.m.
Creation of a Two-Photon 4-Qubit Square Cluster in Optical Fibres, *Yasaman Soudagar, Félix Bussières, José M. Fernandez, Nicolas Godbout; École Polytechnique de Montréal, Canada.* We propose a scheme for building a 4-qubit square cluster using only two photons and two degrees of freedom: polarization and time-bin. This reduces the amount of resources required for optical cluster state computing.

JTuA7 • 9:45 a.m.
Violation of Cauchy-Schwarz Inequality in Continuous-Variable Regime, *Alberto M. Marino, Vincent Boyer, Paul D. Lett; NIST, USA.* We have observed a violation of the Cauchy-Schwarz inequality in the continuous-variable regime with the use of bright relative-intensity squeezed beams. The relation between the squeezing spectrum and the $g^{(2)}$ functions is studied.

FTuD • Biosensors I—Continued

FTuD6 • 9:30 a.m.
Covalent Attachment for Surface Enhancement of Lanthanide Emission, *Abneesh Srivastava, Gregory W. Faris; SRI Intl., USA.* We have used functionalized disulfide organic precursors for covalent linkage of labeled fluorophore to silver nanoparticles in solution. This approach is meant to optimize surface-fluorophore separation for plasmon enhancement applications in biological assay.

FTuD7 • 9:45 a.m.
Photonic Readout of Microcantilevers for Sensor Applications, *Jong Wok Noh, Ryan R. Anderson, Seunghyun Kim, Gregory P. Nordin; Brigham Young Univ., USA.* We have developed an in-plane photonic transduction method for microcantilever sensors that permits high sensitivity readout of microcantilever deflection and is scalable to large numbers of microcantilevers on a single chip.

8:00 a.m.–9:30 a.m., Minorities and Women in OSA (MWOSA) Networking Breakfast, *Fairmont Hotel, Club Regent*

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

10:00 a.m.–5:00 p.m., Exhibit Hall Open

Hillsborough	Sacramento	Piedmont	Glen Ellen	Atherton
Frontiers in Optics	**Laser Science**			**OMD**

FTuE • Precision Engineering in Optics—Continued

FTuE6 • 9:30 a.m. Invited

Advanced in Diamond-Turning Machines, Including Fast Tool Servos, *Christian Brecher, Christian Wenzel; RWTH Aachen, Germany.* Mass production of complex optics is enabled by replication methods. Fast Tool Servo turning can be used for machining the required moulds. The paper presents different process steps in off-axis machining of freeform surfaces using Fast Tool Servo assisted turning.

LTuA • Time-Resolved X-Ray and Electron Diffraction—Continued

LTuA3 • 9:30 a.m. Invited

Non-Thermal Collapse of the Silicon Lattice Observed with Femtosecond Electron Diffraction, *Maher Harb, Ralph Ernstorfer, Christoph T. Hebeisen, German Sciaini, Thibault Dartigalongue, R J Dwayne Miller; Univ. of Toronto, Canada.* Femtosecond electron diffraction was used to reveal the dynamics of laser induced melting in silicon. It is shown that at a fluence of 70 mJ/cm^2 diffraction peaks decay in 500 femtoseconds, indicating an electronically-driven disorder.

LTuB • Precision Techniques at High Laser Power I—Continued

LTuB5 • 9:30 a.m.

Progress of Laser Amplifiers for TIL, *Dong Yang, Shaobo He, Yuanbin Chen, Yong Liu, Jianguo Liu, Wenyi Wang; Laser Fusion Res. Ctr., China Acad. of Engineering Physics, China.* The amplifier performance was studied at Technical-integration-line facility (TIL). Simulation and experimental results indicated that TIL amplifier satisfied design specification.

LTuB6 • 9:45 a.m.

Effect of Transmitted Wavefront Error of Large Aperture Nd-glass Slab by Two Polishing Process on Beam Quality, *Wenyi Wang, Jingqin Su, Fang Wang, Lanqin Liu, Runchang Zhao, Fuquan Li, Dongxia Hu, Zhitao Peng, Dong Yang, Haiwu Yu, Hai Zhou, Feng Jing, Xiaofeng Wei, Xiaomin Zhang; Laser Fusion Res. Ctr., China Acad. of Engineering Physics, China.* Numerical modeling and experiment research for quantitative analysis of beam quality influenced by transmitted wavefront errors of large aperture Nd-glass slabs by conventional polishing and computer-controlled polishing processes were performed.

LTuC • Properties and Dynamics of Interfaces and Surfaces I—Continued

LTuC3 • 9:45 a.m.

Confinement or Properties of the Interface? Dynamics of Nanoscopic Water in Reverse Micelles, *David E. Moilanen[1], Nancy E. Levinger[2], Michael D. Fayer[1]; [1]Stanford Univ., USA, [2]Colorado State Univ., USA.* The dynamics of water in two different types of reverse micelles of the same water pool size are probed to study the effect of the surfactant headgroup (ionic vs. polar) on the water dynamics.

OTuA • OTFT Materials and Devices—Continued

OTuA4 • 9:30 a.m.

Dibenzotetrathiafulvalene Bisimides: New Building Blocks for Organic Electronic Materials, *Yunqi Liu, Xike Gao, Ying Wang, Gui Yu, Daoben Zhu; Inst. of Chemistry, Chinese Acad. of Sciences, China.* Novel dibenzotetrathiafulvalene bisimides were designed and synthesized. Their field-effect transistors fabricated at room temperature showed excellent p-type performance in air, with high mobility up to 0.40 and even high on/off ratio of 10^7-10^8.

OTuA5 • 9:45 a.m.

High Mobility Thin-Films of a Family of Disk-Like Organic Semiconductors by Weak Epitaxy Growth, *Donghang Yan; Changchun Inst. of Applied Chemistry, Chinese Acad. of Sciences, China.* We developed a weak epitaxy growth technology to fabricate high-quality organic semiconductor thin film. The carrier field-effect motility of phthalocyanine compound film reaches 0.32 cm^2/Vs.

8:00 a.m.–9:30 a.m., Minorities and Women in OSA (MWOSA) Networking Breakfast, *Fairmont Hotel, Club Regent*

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

10:00 a.m.–5:00 p.m., Exhibit Hall Open

Frontiers in Optics

10:30 a.m.–12:30 p.m.
FTuF • Ultrafast Dynamics: THz to X-Rays
David A. Reis; Univ. of Michigan, USA, Presider

FTuF1 • 10:30 a.m. Tutorial

Advances in Time Resolved Ultrafast X-Ray Science, *Philip H. Bucksbaum; Stanford Univ., USA.* X-rays have probed atomic-scale structure for a century, but new ultrafast x-rays can record atomic motion as well. The sources, techniques, and science applications are discussed in this tutorial.

Philip H. Bucksbaum is Professor of Physics, Applied Physics, and Photon Science at Stanford Univ. and the Stanford Linear Accelerator Ctr. He directs the Stanford PULSE Ctr., which emphasizes ultrafast x-ray research. Professor Bucksbaum received his A.B. in Physics from Harvard Univ. in 1975 and his Ph.D. in Physics from Univ. of California at Berkeley in 1980. He was on the research staff of Bell Labs from 1981-1990, and was on the Physics faculty of the Univ. of Michigan from 1990-2006, where he held the Otto Laporte Collegiate Chair starting in 1998 and the Peter Franken University Chair in 2005, and directed the NSF FOCUS Frontier Ctr. from 2001 to 2005. He joined SLAC and the Stanford faculty in 2006. Professor Bucksbaum is a Fellow of both the OSA and the APS, and a member of the Natl. Acad. of Sciences.

10:30 a.m.–12:30 p.m.
FTuG • Silicon Nanophotonics
Presider to Be Announced

FTuG1 • 10:30 a.m. Invited

Plasmomic Laser Antennas, *Federico Capasso; Harvard Univ., USA.* Surface plasmon devices consisting of a resonant optical antenna on a semiconductor laser facet and of antenna arrays on an optical fiber facet are presented. Near-field applications in the near- and mid-ir are discussed.

FTuG2 • 11:00 a.m.

Spectral and Spatial Modal Control of Two Dimensional Photonic Crystal Bragg Lasers, *Lin Zhu, Guy DeRose, Axel Scherer, Amnon Yariv; Caltech, USA.* We demonstrate electrically-pumped, edge-emitting, single-mode, large-area photonic crystal lasers with angled facets. We obtain the spectral and spatial modal control of the laser by designing the photonic crystal lattice and index contrast.

10:30 a.m.–12:30 p.m.
FTuH • Coherence and Polarization I
Tom Brown; Univ. of Rochester, USA, Presider

FTuH1 • 10:30 a.m. Invited

Unified Theory of Coherence and Polarization and Some of Its Applications, *Emil Wolf[1,2]; [1]Univ. of Rochester, USA, [2]College of Optics, CREOL and FPCE, Univ. of Central Florida, USA.* An account will be given of the unified theory of coherence and polarization formulated not long ago. It will be illustrated by examples which reveal the close relationship between the two phenomena.

FTuH2 • 11:00 a.m.

A Cascade of Singularities in Young's Interference Experiment, *Taco D. Visser[1], Robert W. Schoonover[2]; [1]Free Univ., Netherlands, [2]Univ. of Illinois at Urbana-Champaign, USA.* Even if the incident fields in Young's experiment are partially coherent, there are always correlation singularities on the observation screen. These can evolve into phase singularities, which can unfold into triplets of polarization singularities.

10:30 a.m.–12:15 p.m.
FTuI • Quantum Sensing and Imaging I
Michael Vasilyev; Univ. of Texas at Arlington, USA, Presider

FTuI1 • 10:30 a.m. Invited

Quantum Optical Sensing: Single-Mode, Multi-Mode and Continuous-Time, *Jeffrey H. Shapiro; MIT, USA.* Quantum limits on optics-based precision measurements are described, contrasting single-mode, multi-mode, and continuous-time paradigms. The latter suggests that $1/N$, where N is the measurement's average photon number, is not the ultimate quantum limit on precision.

FTuI2 • 11:00 a.m.

Even-Order Dispersion-Cancellation in Low Coherence Interferometry, *Kostadinka K. Bizheva[1], Prabakar Puvanathasan[1], Jeff S. Lundeen[2], Morgan W. Mitchell[3], Kevin Resch[1]; [1]Dept. of Physics and Astronomy, Univ. of Waterloo, Canada, [2]Clarendon Lab, Univ. of Oxford, UK, [3]ICFO, Inst. de Ciencies Fotoniques, Spain.* Even-order dispersion cancellation an effect previously identified with frequency-entanglement, is demonstrated using a broadband low-coherence interferometer. This interferometer signal broadens by 14% when enough dispersion is introduced to broaden a standard interferogram by 4250%.

10:30 a.m.–12:15 p.m.
FTuJ • Biosensors II
Adam Wax; Dept. of Biomedical Eng., Duke Univ., USA, Presider

FTuJ1 • 10:30 a.m. Invited

Femtosecond Stimulated Raman Spectroscopy, *Richard A. Mathies; Univ. of California at Berkeley, USA.* Femtosecond Stimulated Raman Spectroscopy is a new time-resolved vibrational technique that enables the recording of high resolution (10-20 cm^{-1}) vibrational spectra of dynamic and reactive chemical and biological systems with < 50fs time resolution.

FTuJ2 • 11:00 a.m.

Optically Driven Surfactant Coated Aqueous Droplets: A New Method to Develop Micro-reactors, *Sanhita Dixit, Arseny Vasilyev, Gregory Faris; SRI Intl., USA.* We demonstrate laser driven optical motion of surfactant coated water drops immersed in decanol using the thermal Marangoni effect. The method is a promising new approach to study emulsions at the micrometer length scale.

Frontiers in Optics

10:30 a.m.–12:30 p.m.
FTuK • Photonic Crystals
Presider to Be Announced

FTuK1 • 10:30 a.m. Invited

Theory of Luminescence of One-Dimensional Resonant Photonic Crystals, *Lev I. Deych[1], Mikhail Erementchouk[2], Alexander A. Lisyansky[1], Eougenious L. Ivchenko[3], Mikhail Voronov[1]; [1]Queens College, USA, [2]NanoScience Technology Ctr., Univ. of Central Florida, USA, [3]Ioffe Physical-Technical Inst., Russian Federation.* Phenomenological approach to description of luminescence from one-dimensional resonant photonic crystals is introduced and its connection with microscopic quantum description is discussed. Transfer-matrix method of calculating emitted intensity is developed and applied to multiple-quantum-well structures.

FTuK2 • 11:00 a.m. Invited

Gap and Defects in Periodic Structures, *Martijn de Sterke[1], Ross C. McPhedran[1], S. Mahmoodian[1], Lindsay C. Botten[2], Kokou Dossou[2], Andrey Sukhorukov[3]; [1]Univ. of Sydney, Australia, [2]Univ. of Technology, Australia, [3]Australian Natl. Univ., Australia.* We consider photonic crystals near band gap edges: we develop an analytic theory for weak defects, and also show how to manipulate the band edge curvature in 1-D structures, such as found in optical fibers.

Laser Science

10:30 a.m.–12:30 p.m.
LTuD • Optical Probes of Nanomaterials
Robert Dickson; Georgia Tech, USA, Presider

LTuD1 • 10:30 a.m. Invited

Electronic Energy Relaxation in Colloidal Quantum Dots, *Philippe Guyot-Sionnest, Anshu Pandey; Univ. of Chicago, USA.* In colloidal quantum dots, energy dissipation by intraband, interband, and 'Auger' relaxation have very different mechanisms and rates which are being probed by transient optical measurements. Surface vibrations, phonons and spectator carrier play important roles.

LTuD2 • 11:00 a.m. Invited

Optical Spectroscopy of Individual Carbon Nanotubes, *Tony F. Heinz; Columbia Univ., USA.* Single-walled carbon nanotubes constitute a family of model 1-dimensional nanoscale materials. We describe recent progress in probing individual nanotubes using elastic and inelastic light scattering techniques to elucidate their electronic excitations, phonons, and their interaction.

10:30 a.m.–12:30 p.m.
LTuE • Precision Techniques at High Laser Power II
David H. Reitze; Univ. of Florida, USA, Presider

LTuE1 • 10:30 a.m. Invited

Adaptive Optics for Terrestrial Astronomy, *Claire Max; Ctr. for Adaptive Optics, Univ. of California at Santa Cruz, USA.* Laser guide star adaptive optics is revolutionizing astronomy by enabling large ground- based telescopes to image at the diffraction limit. This talk describes the status and future plans for this new technology.

LTuE2 • 11:00 a.m. Invited

Femtosecond Lidar and Coherent Control, *Jean-Pierre Wolf[1], L. Bonacina[1], F. Courvoisier[1], M. Moret[1], P. Bejot[1], J. Extermann[1], A. Rondi[1], J. Kasparian[2], N. Lascoux[2], R. Salamé[2], E. Salmon[2], P. Maioli[2], V. Boutou[2], L. Guyon[2], B. Thuillier[2], S. Champeaux[3], L. Berge[3], C. Guet[3], N. Blanchot[4], O. Bonville[4], A. Boscheron[4], P. Canal[4], M. Castaldi[4], O. Hartmann[4], C. Lepage[4], L. Marmande[4], E. Mazataud[4], G. Mennerat, L. Patissou[4], D. Raffestin[5], M. Roth[5], H. Rabitz[5]; [1]GAP-Biophotonics, Univ. of Geneva, Switzerland, [2]LASIM, Univ. Claude Bernard Lyon [1], France, [3]CEA/DIF, DPTA, France, [4]DLP/SEM/LALI, CEA/CESTA, France, [5]Frick Lab, Princeton Univ., USA.* We present the most powerful white light femtosecond Lidar experiment to date using a 30J-30TW laser. We also discuss the applicability of coherent control to femtosecond Lidar experiments, in order to identify bioagents in air.

10:30 a.m.–11:45 a.m.
LTuF • Properties and Dynamics of Interfaces and Surfaces II
Presider to Be Announced

LTuF1 • 10:30 a.m. Invited

Nonlinear Optical Studies of Structure and Solvation across Liquid Surfaces, *Robert A. Walker; Univ. of Maryland, USA.* Resonance enhanced second harmonic generation and vibrational sum frequency spectroscopy have been used to examine how solvent polarity and hydrogen bonding changes across weakly and strongly associating liquid interfaces.

LTuF2 • 11:00 a.m. Invited

Studying Reorientation with Surface-Selective Spectroscopy, *John T. Fourkas, Robert Walker; Univ. of Maryland, USA.* Vibrational sum frequency spectroscopy (VSFS) has become a widely used technique for probing the structure of liquid interfaces with molecular-level detail. We will discuss using VSFS to extract information about orientational dynamics at interfaces.

OMD

10:30 a.m.–12:00 p.m.
OTuB • Organic Laser and Other New Devices
Chung-Chih Wu; Natl. Taiwan Univ., Taiwan, Presider

OTuB1 • 10:30 a.m. Invited

Very Low-Threshold Amplified Spontaneous Emission Characteristics of Bis-Styrylbenzene Derivatives and Their Electrical Pumping, *Hajime Nakanotani[1,2], Daisuke Yokoyama[1,2], Chihaya Adachi[1,2]; [1]Ctr. for Future Chemistry, Kyushu Univ., Japan, [2]JST-CREST, Japan.* By doping spiro-SBCz into a wide energy gap CBP host, we demonstrate an extremely low ASE threshold of E_{th}=0.11±0.05 μJ/cm^2.In addition, we discuss prospect for organic laser diode based on electircal pumping of spiro-SBCz.

OTuB2 • 11:00 a.m. Invited

Resonators, Sub-Wavelength Patterning and Optical Environments for Polymer Thin-Film Laser Structures, *Paul N. Stavrinou; Imperial College London, UK.* Laser geometries for polymer thin-films are discussed and include 1-D, 2-D and metallic elements to provide the feedback. Lateral optical confinement within the structures using variations in refractive index is also considered.

Frontiers in Optics

FTuF • Ultrafast Dynamics: THz to X-Rays—Continued

FTuF2 • 11:15 a.m.
Ultrafast Insulator-Metal Transition Induced in a Manganite by Stretching of a Metal-Oxygen Bond with THz Pulses, *Matteo Rini[1], Jiro Itatani[1], Yasuhide Tomioka[2], Yoshimori Tokura[2], Robert W. Schoenlein[1], Andrea Cavalleri[3]; [1]Lawrence Berkeley Natl. Lab, USA, [2]Correlated Electron Res. Ctr., Japan, [3]Univ. of Oxford, UK.* The magnetoresistive manganite $Pr_{0.7}Ca_{0.3}MnO_3$ becomes metallic when THz pulses are used to resonantly drive a stretching Mn-O vibration. A five-order-of-magnitude drop of the sample resistivity and ultrafast, nanosecond-lived reflectivity changes are observed.

FTuF3 • 11:30 a.m. Invited
Accelerator-Based Ultrafast X-Ray Light Sources: New Tools for Probing Correlated Electronic Structure, *Robert W. Schoenlein; Lawrence Berkeley Natl. Lab, USA.* Accelerator-based ultrafast x-ray light sources providing coherent picosecond to attoseconds pulses will be instrumental for direct measurements of electronic and atomic structural dynamics, providing new insight into correlated phenomena in atoms, molecules and complex solids.

FTuG • Silicon Nanophotonics—Continued

FTuG3 • 11:15 a.m. Invited
Narrow Linewidth Microlasers on Silicon, *Kerry Vahala, Lan Yang, Tao Lu; Caltech, USA.* After reviewing several laser sources based on high-Q microtoroid lasers, the recent observation of fundamental linewidths as narrow as 4 Hz in microtoroid lasers will be described. Inverse-power (Schawlow-Townes) broadening is observed.

FTuG4 • 11:45 a.m.
Coupling between Fundamental Whispering Gallery Modes in Chains of Microspheres, *Lev I. Deych[1], Carsten Schmidt[2], Akradi Chipouline[2], T. Pertsch[2], A. Tünnermann[3]; [1]Dept. of Physics, Queens College of CUNY, USA, [2]Inst. of Applied Physics, Friedrich Schiller Univ., Germany, [3]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* Propagation of a fundamental WGM in a chain of microspheres is studied. We found that modes with various orbital and azimuthal numbers are excited in this process resulting in significant distortion of the field distribution.

FTuH • Coherence and Polarization I—Continued

FTuH3 • 11:15 a.m.
Pancharatnam—Berry Phase in Young's Interference Experiment, *Ari T. Friberg[1], Jani Tervo[2], Tero Setälä[3]; [1]Royal Inst. of Technology, Sweden, [2]Univ. of Joensuu, Finland, [3]Helsinki Univ. of Technology, Finland.* We make use of the spectral interference law to derive the Pancharatnam—Berry phase in the electromagnetic Young's two-pinhole setup. The phase has a straightforward connection to the Stokes parameters at the openings.

FTuH4 • 11:30 a.m.
Optical Interferometry with Pulsed Fields, *Robert W. Schoonover[1], Brynmor J. Davis[1], Randy A. Bartels[2], P. Scott Carney[1]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Colorado State Univ., USA.* An analysis of coherence properties of pulsed fields in interferometric experiments is presented. The results bear on means to recover certain statistical properties of the source in a two-pinhole experiment.

FTuH5 • 11:45 a.m.
Polarimetric Filtering of Time-Reversal in Multiple Scattering, *John Broky, Jeremy Ellis, Aristide Dogariu; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Time-reversed trajectories in multiple scattering produce constructive interference. Ensemble averaging leads to enhancement of backscattered intensity. We demonstrate that polarization analysis identifies time-reversed contributions even within a single realization of wave-matter interaction.

FTuI • Quantum Sensing and Imaging I—Continued

FTuI3 • 11:15 a.m. Invited
Quantum Imaging and Lithography, *Yanhua Shih; Univ. of Maryland, Baltimore County, USA.* Quantum imaging has demonstrated two peculiar features: (1) reproducing ghost images in a nonlocal manner, and (2) enhancing spatial resolution beyond diffraction limit. This talk will review the history and emphasize its non-classical nature.

FTuI4 • 11:45 a.m.
Subwavelength Resolution via Dark State, *Yuri Rostovtsev, Marlan O. Scully; Inst. for Quantum Studies, Texas A&M Univ., USA.* We study improving of spatial resolution of fluorescence microscopy by using dark states formed via interaction with bi-chromatic optical fields. This approach has applications to coherent Raman spectroscopy.

FTuJ • Biosensors II—Continued

FTuJ3 • 11:15 a.m. Invited
Micro- and Nanotechnology for Bioengineering, *Luke Lee; Univ. of California at Berkeley, USA.* No abstract available.

FTuJ4 • 11:45 a.m.
Rotating Polarization Polarimeter, *Neeraj Kothari, Aliakbar Jafarpour, Rick Trebino; Georgia Tech, USA.* Chirality is an excellent indicator of life, but natural samples exhibit massive depolarizing light scattering, rendering conventional polarimeters useless. We show that rotating-polarization polarimeter outperforms conventional polarimeters, by operating on samples 1000 times more scattering.

FTuK • Photonic Crystals—Continued

FTuK3 • 11:30 a.m.
Gap-Edge Asymptotics of Defect Modes in 2-D Photonic Crystals, *Kokou B. Dossou[1], Lindsay C. Botten[1], Ross C. McPhedran[2], Ara A. Asatryan[1], C. Martijn de Sterke[2]; [1]Univ. of Technology, Sydney, Australia, [2]Univ. of Sydney, Australia.* We consider 2-D photonic crystal defect modes and deduce and demonstrate a simple exponential law linking the frequency difference of the mode and band gap edge to the relative change in modal electric energy.

FTuK4 • 11:45 a.m.
Optimal Design and Analysis of the Multi-Mode Interference Based Photonic Crystal Demultiplexer, *Dae-Seo Park, Jae-Hyun Kim, Beom-Hoan O, Se-Geun Park, El-hang Lee, Seung Gol Lee; Inha Univ., Republic of Korea.* We proposed the ultra compact 1.31/1.55μm demultiplexer which composed of photonic crystal with a triangular lattice of air holes. Its operation was based on multi-mode interference effect and band gap property of photonic crystal.

LTuD • Optical Probes of Nanomaterials—Continued

LTuD3 • 11:30 a.m. Invited
Optical Measurements of the Electronic and Elastic Properties of Metal Nanoparticles, *Gregory Hartland; Notre Dame Univ., USA.* Time-resolved and single particle spectroscopy has been used to examine the properties of metal nanoparticles. The results provide information about the elastic constants and the plasmon dephasing times for particles with different sizes and shapes.

LTuE • Precision Techniques at High Laser Power II—Continued

LTuE3 • 11:30 a.m.
CW Rb Vapor Lasers Directly Pumped by Laser Diode Arrays with Volume Transmission Gratings, *Randall J. Lane, Alan B. Petersen, John Gloyd, Raj Patel; Spectra-Physics Lasers, USA.* We describe CW atomic Rb vapor lasers, operating at 795 nm pumped by line-narrowed laser diode arrays using volume transmission gratings. Various laser architectures have been explored with output power up to 800 mW.

LTuE4 • 11:45 a.m.
Narrow Linewidth High Power Semiconductor MOPA Achieved Using Optical Phase Lock Loops (OPLLs), *Wei Liang[1], Naresh Satyan[1], Amnon Yariv[1], Anthony Kewitsch[2], George Rakuljic[2]; [1]Caltech, USA, [2]Telaris Inc., USA.* Using an Optical Phase Lock Loop, a 1W semiconductor MOPA is locked to a -3dBm reference laser and its 20dB linewidth is reduced from 2.2MHz to 0.22MHz.

LTuF • Properties and Dynamics of Interfaces and Surfaces II—Continued

LTuF3 • 11:30 a.m.
Time Resolved Measurements of Melting and Solidification in Si Using Third Harmonic Generation of Light, *Bryan C. Gundrum, Robert S. Averback, David G. Cahill; Univ. of Illinois, USA.* Time resolved measurements of melting and solidification on (001) Si using third harmonic generation (THG) were performed with subpicosecond time resolution. In addition, we show that the THG signal is sensitive to specimen temperature.

OTuB • Organic Laser and Other New Devices—Continued

OTuB3 • 11:30 a.m.
Dendrimer Based NanoPhotonic Integrated Circuit for Terahertz Computing and Sensing, *Anis Rahman; Applied Res. and Photonics, Inc., USA.* At ARP dendrimer is utilized for a number of photonic devices including photonic integrated circuits. Dendrimer waveguides are created for multiple photonic functionalities that enable a wide range of applications in communication and sensing.

OTuB4 • 11:45 a.m.
All Organic Photomemory Devices with High Efficiency, *Kallarakkal. R. Rajesh, Sung Hak Bae, In Ho Yoon, Choon Sup Yoon; KAIST, Republic of Korea.* We report all organic thin film photomemory devices based on lead phthalocyanine and polyvinylidene fluoride, which show a very high efficiency of 1500%. Information in the form of light is effectively stored as electric polarization.

Frontiers in Optics

FTuF • Ultrafast Dynamics: THz to X-Rays—Continued

FTuF4 • 12:00 p.m.
Chirped Multilayer Soft X-Ray Mirrors for Attosecond Soft X-Ray Pulses, *Ulf Kleineberg[1,2], Michael Hofstetter[1], Alexander Apolonskiy[3], Vladimir Pervak[3], Eleftherios Goulielmakis[2], Martin Schultze[2], Matthias Uiberacker[3], Vladislav Yakovlev[2], Ferenc Krausz[2,3]; [1]Ludwig Maximilians Univ. Munich, Germany, [2]Max-Planck-Inst. of Quantum Optics, Germany, [3]LMU Munich, Germany.* Aperiodic XUV multilayer coatings with broad spectral bandwidth and flat dispersion have been developed, fabricated and characterized as reflecting and spectrally filtering optical elements for attosecond XUV pulses from a High Harmonic Generation source.

FTuF5 • 12:15 p.m.
Electron Wave-Packet Dynamics in a Relativistic Laser Field, *Justin B. Peatross[1], Carsten Müller[2], Christoph Keitel[2]; [1]Brigham Young Univ., USA, [2]Max Planck Inst. für Kernphysik, Germany.* We present a closed analytical approximate solution to the Klein Gordon equation for a free electron in a strong plane-wave electromagnetic field. The 3-D expression is convenient for producing movies and exploring non-dipole behavior.

FTuG • Silicon Nanophotonics—Continued

FTuG5 • 12:00 p.m. Invited
High-Performance Optical Receivers in CMOS Using Ge-on-SOI Detectors, *Clint L. Schow, Steven J. Koester, Laurent Schares, Richard John; IBM T.J. Watson Res. Ctr., USA.* We have produced a family of high-speed, high-sensitivity hybrid optical receivers consisting of Ge-on-SOI photodiodes paired with CMOS ICs that illustrate the potential offered by future monolithically-integrated, silicon-based receivers.

FTuH • Coherence and Polarization I—Continued

FTuH6 • 12:00 p.m.
Determining Anisotropic Polarizability of Optically Inhomogeneous Media in Near-Field Measurements, *David P. Haefner, Jeremy Ellis, Sergey Sukhov, Aristide Dogariu; College of Optics and Photonics, CREOL, Univ. of Central Florida, USA.* Analyzing the fluctuations in near field polarimetric measurements, we show that it is possible to determine anisotropies in the effective polarizability of inhomogeneous materials.

FTuH7 • 12:15 p.m.
Fourier Phase Contrast Microscope, *Chandra S. Yelleswarapu, Alexey Veraksa, Samir Laoui, Devulapalli V. Rao; Univ. of Massachusetts Boston, USA.* Novel Fourier phase contrast microscope is developed exploiting monochromaticity, intensity and phase coherence of laser and photo-induced birefringence of liquid crystals. As condenser annulus-phase plate is not required the images are free from artifacts.

FTuI • Quantum Sensing and Imaging I—Continued

FTuI5 • 12:00 p.m.
Towards Photonic Hybrid Entanglement, *Félix Bussières[1,2], Allison Rubenok[1], Nicolas Godbout[2], Wolfgang Tittel[1]; [1]IQIS, Univ. of Calgary, Canada, [2]COPL, Polytechnique Montréal, Canada.* We propose a scheme to generate hybrid photonic entanglement which we define as entanglement between photonic qubits with different encodings, namely time-bin and polarization, using a PPLN crystal.

FTuJ • Biosensors II—Continued

FTuJ5 • 12:00 p.m.
Optical Biosensor Based on Morphology Dependent Resonances, *Anisur Rahman, Sunil Kumar; Polytechnic Univ., USA.* A new optical biosensor based on MDR resonances is presented. An asymptotic expression is developed based on Maxwell equations to characterize WGM resonance shifts. The proposed biosensor is designed based on the theory developed.

12:30 p.m.–2:00 p.m., Exhibit-Only Time/Lunch Break

FTuK • Photonic Crystals—Continued

FTuK5 • 12:00 p.m.
Electrically Pumped Photonic Crystal Lasers, *Zhaoyu Zhang, Victor Liu, Ting Hong, Axel Scherer; Caltech, USA.* Visible electrically pumped 2-D photonic crystal lasers were fabricated within membranes of InGaP /InGaAlP quantum well material which has the PIN diode structure incorporated. They're the first current driven lasers with ultrasmall mode volumes.

FTuK6 • 12:15 p.m.
Maximize the Input Angle for the Self-Collimation of Photonic Crystals Composed of Anisotropic Materials by Optimizing the Dispersion Surfaces, *Mohammad M. Siraj[1], J. W. Haus[1], Paras Prasad[2], Paul Markowicz[2]; [1]Univ. of Dayton, USA, [2]SUNY Buffalo, USA.* We found that the input angles of a photonic crystal composed of anisotropic constituents for self-collimation regime is maintained as materials become more birefringent. We model the optical properties of a photobleached DAST crystal.

LTuD • Optical Probes of Nanomaterials—Continued

LTuD4 • 12:00 p.m.
Dynamics of Quantum Dot Photonic Crystal Lasers, *Bryan C. Ellis, Ilya Fushman, Dirk Englund, Bingyang Zhang, Yoshihisa Yamamoto, Jelena Vuckovic; Stanford Univ., USA.* The large signal modulation rate of quantum dot photonic crystal lasers was investigated. The authors find that the modulation rate is limited by the rate of carrier capture into the dots to around 30GHz.

LTuD5 • 12:15 p.m.
Coherent Acoustic Phonon Generation in Exciton Self-Trapping, *F. X. Morrissey, S. L. Dexheimer; Washington State Univ., USA.* The dynamics of exciton self-trapping in quasi-one-dimensional systems are studied using femtosecond impulsive excitation techniques. Low temperature measurements reveal the generation of a coherent acoustic wave associated with the formation of the localized lattice deformation.

LTuE • Precision Techniques at High Laser Power II—Continued

LTuE5 • 12:00 p.m.
Measurements of Power Distribution between Lateral Modes of Broad Area Laser Diode, *Nikolai Stelmakh, Sheldon Fernandes; Univ. of Texas at Arlington, USA.* Analysis of optical power of broad-area laser diode lateral modes is performed using spatially resolved spectrometer with 1GHz-spectral resolution. The lateral mode thresholds and slope efficiencies were compared with laterally resolved gain depletion model.

LTuE6 • 12:15 p.m.
Scaling Laws of Disk Lasers, *Dlitrii Kouznetsov, Jean-François Bisson, Ken-ichi Ueda; Inst. for Laser Science, Univ. of Electro-Communications, Japan.* The general limit of power scaling of disk lasers comes from overheating, round-trip loss and the amplified spontaneous emission. The round-trip loss should scale inversely proportional to the cubic root of the desired output power.

12:30 p.m.–2:00 p.m., Exhibit-Only Time/Lunch Break

Frontiers in Optics

2:00 p.m.–4:00 p.m.
FTuL • Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources II
Regina Soufli; Lawrence Livermore Natl. Lab, USA, Presider

FTuL1 • 2:00 p.m. Invited

Large-Scale, Long-Term Stable Femtosecond Timing Distribution and Synchronization, *Jung-Won Kim; MIT, USA.* Long-term stable and femtosecond-precision timing distribution and synchronization over 300 m distance is demonstrated based on the use of optical pulse trains generated from ultralow-noise mode-locked lasers.

FTuL2 • 2:30 p.m. Invited

The Performance of the Advanced Light Source Slicing Beamline, ALS BL6.0, *Philip Heimann, Ernie Glover, Marc Hertlein, Bruce Rude, David Plate, Howard Padmore, Robert Schoenlein; Lawrence Berkeley Natl. Lab, USA.* A beamline optimized for the bunch slicing technique has been constructed and commissioned at the Advanced Light Source (ALS). This beamline includes an in-vacuum undulator, soft and hard x-ray beamlines and a femtosecond laser system.

2:00 p.m.–4:00 p.m.
FTuM • Active Photonic Devices in Silica
Presider to Be Announced

FTuM1 • 2:00 p.m.

Optical Modulator on Si Employing Ge Quantum Wells, *Jonathan E. Roth[1], Onur Fidaner[1], Rebecca K. Schaevitz[1], Elizabeth H. Edwards[1], Yu-Hsuan Kuo[1,2], Theodore I. Kamins[1,3], James S. Harris, Jr.[1], David A. B. Miller[1]; [1]Stanford Univ., USA, [2]Dept. of Electrical Engineering and the Graduate Inst. of Electronics Engineering, Natl. Taiwan Univ., Taiwan, [3]Quantum Science Res., Hewlett-Packard Labs, USA.* We demonstrate the first electroabsorption modulator using the quantum-confined Stark effect in Ge. For 10 V swing, the contrast ratio is 7.3 dB at 1457 nm, and exceeds 3 dB over 20 nm bandwidth.

FTuM2 • 2:15 p.m.

Efficient and Compact Taper Coupler for Silicon-on-Insulator Rib Waveguide, *Seunghyun Kim, Seungmoo Yang, Hasul Kim, Gregory P. Nordin; Brigham Young Univ., USA.* A compact taper coupler for SOI rib waveguide with vertical and horizontal silicon taper and SU8 waveguide structure has been designed and fabricated. For a taper length of only 71μm, simulation shows 79% coupling efficiency.

FTuM3 • 2:30 p.m. Invited

Silicon Evanescent Racetrack Laser, *Alexander W. Fang[1], Hyundai Park[1], John Bowers[1], Richard Jones[2], Mario J. Paniccia[2], Oded Cohen[3], Omri Raday[3]; [1]Univ. of California at Santa Barbara, USA, [2]Intel Corp., USA, [3]Intel Corp., Israel.* We describe the utilization of hybrid silicon evanescent waveguides, consisting of III-V quantum wells bonded to silicon rib-waveguides for evanescently coupled gain, to achieve an on-chip racetrack laser integrated with photodetectors on a silicon platform.

2:00 p.m.–3:45 p.m.
FTuN • Coherence and Polarization II
Miguel A. Alonso; Inst. of Optics, Univ. of Rochester, USA, Presider

FTuN1 • 2:00 p.m. Invited

Optical Vortex Coronagraph, *Grover A. Swartzlander[1], Erin Ford[1], Rukiah Abdul-Malik[1], Joshua Kim[1], Laird Close[2], Mary Anne Peters[2], David Palacios[3], Daniel Wilson[3]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]Steward Observatory, Univ. of Arizona, USA, [3]JPL, USA.* The optical vortex coronagraph is a promising scheme for achieving high contrast low loss imaging of exoplanets. Observatory and laboratory measurements will be presented and analyzed. Procedures for achieving improved performance will be described.

FTuN2 • 2:30 p.m.

Stress-Induced Focal Splitting: Effects of Higher Order Symmetry, *Alexis K. Spilman, Thomas G. Brown; Inst. of Optics, Univ. of Rochester, USA.* Double-focus systems may be constructed using a parallel-face window under symmetric stress of order m greater-than or equal-to three and illuminated with circularly polarized light. We describe comparisons of focal splitting under higher order stress.

Joint

2:00 p.m.–3:45 p.m.
JTuB • Quantum Sensing and Imaging II
Yanhua Shih; Univ. of Maryland, Baltimore County, USA, Presider

JTuB1 • 2:00 p.m. Invited

The Spatial Dimension of Quantum Optics, *Hans Albert Bachor[1], M. Lassen[2], V. Delaubert[3], J. Janousek[2], K. Wagner[1], H. Zou[1], P. K. Lam[1], N. Treps[3], P. Buchhave[2], C. Fabre[3], C. C. Harb[4]; [1]Australian Natl. Univ., Australia, [2]Dept. of Physics, Technical Univ. of Denmark, Denmark, [3]Lab Kastler Brossel, France, [4]Univ. of New South Wales, Australia.* The spatial properties of laser beams can be used to encode, transfer and detect quantum information into high order modes with high efficiency. We demonstrate the use of multimode states, including spatial squeezing and entanglement.

JTuB2 • 2:30 p.m.

Angular Dimensionality of Two-Photon Entanglement, *J. P. (Han) Woerdman, J. B. Pors, S. S. R. Oemrawsingh, M. P. Van Exter, A. Aiello, G. W. 't Hooft, E. R. Eliel; Univ. Leiden, Netherlands.* We pass twin photons through rotatable angular phase-plates and detect entanglement which has a continuously variable azimuthal dimension. Experimentally, this dimension has been varied from 2.2 to 3; values up to 100 are practically feasible.

Frontiers in Optics

2:00 p.m.–4:00 p.m.
FTuO • Nonlinear Microscopy in Biology I
Chris Schaffer; Cornell Univ, USA, Presider

FTuO1 • 2:00 p.m. Tutorial

CARS Microscopy: Biomedical Imaging by Nonlinear Vibrational Spectroscopy, *Sunney Xie; Harvard Univ., USA.* Coherent anti-Stokes Raman scattering (CARS) microscopy is a noninvasive imaging technique using vibration spectroscopy as a contrast mechanism. Recent advances have allowed significant improvements in sensitivity, robustness, and cost, opening a range of biomedical applications.

Xiaoliang Sunney Xie received a B.S. in chemistry from Peking Univ. in 1985, followed by his Ph.D. in 1990 from the Univ. of California at San Diego. After postdoctoral research at the Univ. of Chicago, Xie joined Pacific Northwest Natl. Lab in 1992, where he later became a Chief Scientist. In 1999, he was appointed Professor of Chemistry at Harvard Univ. Xie has contributed to the emergence of room temperature single-molecule spectroscopy and its biological applications, both in vitro and in living cells. Xie's team also has developed coherent anti-Stokes Raman scattering microscopy, a highly sensitive bioimaging technique that provides vibrational contrast with molecular selectivity. A Fellow of the American Association for the Advancement of Science and Biophysical Society, Xie was recipient of the 2007 Willis E. Lamb Award for Laser Science and Quantum Optics, a 2004 NIH Director's Pioneer Award, the 2003 Sackler Prize, and the 1996 Coblentz Award.

Frontiers in Optics

2:00 p.m.–4:00 p.m.
FTuP • Aberration Theory in Optical Testing
Eric Novak; Veeco, USA, Presider

FTuP1 • 2:00 p.m. Invited

Orthonormal Polynomials for Wavefront Analysis in Optical Testing, *Virendra Mahajan[1], Guang-ming Dai[2]; [1]Aerospace Corp., USA, [2]AMO Laser Vision Correction Group, USA.* We have derived closed-form orthonormal polynomials over noncircular apertures using a new matrix approach. Isometric plots, interferograms and point-spread functions are illustrated. Their use in optical testing is discussed.

FTuP2 • 2:30 p.m. Invited

Pitfalls in Using Zernike Circle Polynomials over Noncircular Pupils, *Guang-ming Dai[1], Virendra Mahajan[2]; [1]AMO Laser Correction Group, USA, [2]Aerospace Corp., USA.* We discuss the disadvantages of using Zernike circle polynomials for analyzing non-circular wavefronts, such as ocular wavefronts over elliptical pupils and the main mirror of telescopes with obscuration.

Laser Science

2:00 p.m.–4:00 p.m.
LTuG • Precision Techniques on Short Time Scales I
Jean-Pierre Wolf; GAP-Biophotonics, Univ. of Geneva, Switzerland, Presider

LTuG1 • 2:00 p.m. Invited

Science and Applications Based on Laser Control, *Marcos Dantus; Michigan State Univ., USA.* Results from a systematic research on shaped-pulse fragmentation of isolated molecules will be presented. Interestingly, a single control parameter can cause order of magnitude changes, and guide us in predicting molecular fragmentation patterns.

LTuG2 • 2:30 p.m. Invited

Using Wavepackets to Explore and Control Non-Perturbative Interactions, *Robert R. Jones; Univ. of Virginia, USA.* The creation of well-characterized wavepackets enables the controlled investigation of non-perturbative dynamics in atoms and molecules, from time-dependent electron-electron interactions in atoms to molecular orientation-dependent processes in intense laser fields.

2:00 p.m.–4:00 p.m.
LTuH • Clocks, Navigation and Magnetometers
Presider to Be Announced

LTuH1 • 2:00 p.m. Invited

Atom Optic Inertial and Gravitational Sensors, *Brenton Young, D. Scott Bonomi, Thomas Patterson, Frank Roller, Thang Tran, Artyom Vitouchkine, Todd Gustavson, Mark Kasevich; AOSense, Inc., USA.* The exquisite accuracies of atom optic sensors hold great promise for demanding applications in navigation, guidance, pointing and geophysical exploration. We describe our efforts to transition these sensors from the laboratory into the field.

LTuH2 • 2:30 p.m. Invited

Atom Interferometry and Inertial Sensors, *Phillippe Bouyer; CNRS - Lab Charles Fabry, Inst. d'Optique, France.* We discuss the development of new atom interferometers using atom lasers as coherent atomic sources to improve their performances. We will discuss possible applications in navigation and fundamental physics, on ground or in space.

2:30 p.m.–4:00 p.m.
LTuI • Imaging and Microscopy — Non-Biological I
Chris Bardeen; Univ. of California at Riverside, USA, Presider

LTuI1 • 2:30 p.m. Invited

Resonantly Tweezing Single Plasmonic Objects to Controlling Plasmonic Excitations of Metal Nanoparticles, *Norbert Scherer; Univ. of Chicago, USA.* No abstract available.

OMD

2:00 p.m.–3:45 p.m.
OTuC • Materials and Devices for Organic Photovoltaics
Jason Brooks; Universal Display Corp., USA, Presider

OTuC1 • 2:00 p.m. Plenary

The Use of Heavy Metal Complexes in Organic LEDs and Solar Cells, *Mark Thompson[1], Stephen R. Forrest[2], Julie Brown[3], Tissa Sajoto[1], Peter Djurovich[1], Carsten Borek[1], Dolores Perez[1], Yiru Sun[2], Jason Brooks[3]; [1]Univ. of Southern California, USA, [2]Dept. of Chemistry, Univ. of Michigan, USA, [3]Universal Display Corp., USA.* We have investigated the use of heavy metal complexes in organic solar cells. The goal is to efficiently utilize triplet excitons to enhance efficiencies. I will discuss our most recent results in this direction.

FTuL • Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources II—Continued

FTuL3 • 3:00 p.m. Invited

Short-Pulse X-Ray Optics: Effects and Considerations, *Sarvjit D. Shastri; Advanced Photon Source, Argonne Natl. Lab, USA.* Newer synchrotron radiation sources should provide sub-picosecond x-ray pulse durations. Various optics considerations for such short pulses will be addressed, including temporal broadening effects, pulse length preservation, and possibilities of further compression.

FTuM • Active Photonic Devices in Silica—Continued

FTuM4 • 3:00 p.m.

Lithographic Control of Resonance Wavelengths in Micro-Resonators, *Shijun Xiao, Maroof H. Khan, Hao Shen, Minghao Qi; Purdue Univ., USA.* We present and verify an analytical theory for the resonance wavelength shift due to resonator's perimeter change.

FTuM5 • 3:15 p.m.

Local Dispersion Relation and Local Group Velocity of Arbitrary-Shape Photonic Crystal Waveguides, *Babak Dastmalchi[1], Abbas Mohtashami[2], Reza Kheradmand[3], Mohammadreza Ahmadpour Monazam[3], Kurt Hingerl[2], Javad Zarbakhsh[2]; [1]Dept. of Physics, Azarbaijan Univ. of Tarbiat Moallem, Iran, [2]Johannes Kepler Univ. Linz, Austria, [3]Res. Inst. for Applied Physics and Astronomy, Univ. of Tabriz, Iran.* We study the local dispersion relation and local group velocity in arbitrary non-stacking photonic crystal waveguides, in which plain wave expansion technique cannot be applied and supercell cannot be defined.

FTuN • Coherence and Polarization II—Continued

FTuN3 • 2:45 p.m.

Coherent and Partially Coherent Vortex Beams in Turbulence, *Greg Gbur; Univ. of North Carolina at Charlotte, USA.* The evolution of the scintillation and topological charge of coherent and partially coherent vortex beams in turbulence is analyzed. The possibility of using such beams in optical communications is discussed.

FTuN4 • 3:00 p.m.

Interference of Optical Beams with Topological Charge, *Matt James Burch, Surendra Singh; Univ. of Arkansas, USA.* Interference of optical beams carrying equal but opposite integer topological charge is studied using a modified Mach-Zehnder interferometer.

FTuN5 • 3:15 p.m.

Radial Polarizers with an Azimuthally Transmitted Component of the E-Field, *E. Frins[1], D. Tierney[2], H. Schmitzer[2], W. Dultz[3]; [1]Facultad de Ingenieria, J Herrera y Reissig 565, Uruguay, [2]Xavier Univ., USA, [3]Univ. Frankfurt (Main), Germany.* Radial polarizers in the input of a lens can form the focus to a spot or ring like shape. We present two different radial polarizers which transmit the azimuthal component of the light field.

JTuB • Quantum Sensing and Imaging II—Continued

JTuB3 • 2:45 p.m.

Engineering Quantum States of Light on Demand via Projective Measurements, *Pavel Lougovski[1], Nick VanMeter[2], Dmitry Uskov[3], Konrad Kieling[4], Jens Eisert[4], Jonathan P. Dowling[2]; [1]Oregon Ctr. for Optics, USA, [2]Hearne Inst. for Theoretical Physics, USA, [3]Tulane Univ., USA, [4]Imperial College London, UK.* We apply a theory of an optical quantum state generator to quantum information and metrology problems. We demonstrate how different entangled states of light can be constructed in an optimal way for given resources.

JTuB4 • 3:00 p.m.

Compact High Quantum Efficiency Single Photon Detector in the Ultraviolet Wavelengths, *Kyle S. McKay[1], Felix Lu[1], Jungsang Kim[1], Henry H. Hogue[2]; [1]Duke Univ., USA, [2]DRS Sensors and Targeting Systems, USA.* We demonstrate a high quantum efficiency single photon detector with operating wavelength extended into the ultraviolet range (250nm-1000nm). Quantum efficiency of 6% is demonstrated at 300 nm, with estimated internal efficiency of 24%.

JTuB5 • 3:15 p.m.

Sagnac Effect in Vortex Superposition States of Bose-Einstein Condensates, *Sulakshana N. Thanvanthri[1], Kishor T. Kapale[1,2], Jonathan P. Dowling[1]; [1]Louisiana State Univ., USA, [2]JPL, Caltech, USA.* Creating vortex state superposition in Bose-Einstein Condensates (BEC) has been studied by coupling BEC with superpositions of orbital angular momentum states of light. We study the Sagnac effect occurring in superpositions of BEC vortex states.

FTuO • Nonlinear Microscopy in Biology I—Continued

FTuO2 • 2:45 p.m.

Optical Second Order Nonlinearity in Collagen: Molecular Origins Determined by Sum-Frequency, Infrared and Raman Spectroscopy, *Andre Knoesen[1], Israel Rocha-Mendoza[1], Diego R. Yankelevich[1], Mingshi Wang[1], Karen M. Reiser[1], Curt W. Frank[2]; [1]Univ. of California at Davis, USA, [2]Stanford Univ., USA.* The molecular origins of second order nonlinear effects in collagen fibril assemblies have been identified with sum-frequency generation, infrared and Raman vibrational spectroscopies.

FTuO3 • 3:00 p.m. Invited

Hybrid Technique for Coherent Raman Spectroscopy, *Dmitry Pestov, Ariunbold Gombojav, Xi Wang, Robert K. Murawski, Vladimir A. Sautenkov, Alexei V. Sokolov, Marlan O. Scully; Inst. for Quantum Studies and Dept. of Physics, Texas A&M Univ., USA.* We develop a hybrid technique for coherent Raman spectroscopy, and apply it to pyridine. The comparison with spontaneous Raman measurements shows 10^5-fold increase in Raman-scattering efficiency and provides an estimate for the excited coherence ($\sim 0.5 \times 10^{-3}$).

FTuP • Aberration Theory in Optical Testing—Continued

FTuP3 • 3:00 p.m. Invited

A Fast Three-Step Phase Shifting Algorithm for Real-Time Three-Dimensional Shape Measurement, *Peisen Huang; Stony Brook Univ., USA.* A novel three-step phase shifting algorithm, which is more than three times faster than the traditional algorithm, is described and its application in a high-resolution, real-time 3-D shape measurement system discussed.

LTuG • Precision Techniques on Short Time Scales I—Continued

LTuG3 • 3:00 p.m. Invited

Molecular Control Experiments Using Ultrashort XUV Pulses, *Per Johnsson, Wing Kiu Siu, Arjan Gijsbertsen, Marc Vrakking; AMOLF, Netherlands.* We present results obtained using charged particle imaging of atomic and molecular processes, induced by extreme ultraviolet laser light, both in the form of attosecond pulses and as intense free electron laser pulses.

LTuH • Clocks, Navigation and Magnetometers—Continued

LTuH3 • 3:00 p.m. Invited

Optical Atomic Clocks Based on Neutral Atoms, *Christopher W. Oates, Zeb Barber, Jason Stalnaker, Chad Hoyt, Yann LeCoq, Leo Hollberg; NIST, USA.* We report on two optical clocks: one uses freely expanding calcium atoms, while the other is based on lattice-confined ytterbium. We measure a fractional instability between the clocks of 4×10^{-16} @ 100 s.

LTuI • Imaging and Microscopy — Non-Biological I—Continued

LTuI2 • 3:00 p.m. Invited

Near Field Optical and Infrared Imaging of Material and Metamaterial Surfaces, *Gilbert Walker[1], Slava Romanov[2], Shell Ip[1], Toan Nguyen[1]; [1]Univ. of Toronto, Canada, [2]Univ. of Pittsburgh, USA.* We present IR near field imaging of organic and inorganic materials. Spatial resolution below 20 nm was achieved. Theoretical models for the optics are presented. We discuss apertureless imaging of light emerging from nanoholes.

OTuC • Materials and Devices for Organic Photovoltaics—Continued

OTuC2 • 2:45 p.m. Invited

Design of Conjugated Polymers for the Optimization of Solar Cell Performance, *Barry C. Thompson, Jean M. J. Fréchet; Dept. of Chemistry, Univ. of California at Berkeley, USA.* The influence of polythiophene structure on polymer-fullerene bulk-heterojunction solar cells is described. Regioregularity is found to influence device stability and variation in the identity and distribution of alkyl substituents is found to affect device efficiency.

OTuC3 • 3:15 p.m. Invited

Plastic Bulk-Heterojunction Solar Cells and Near-Infrared Photodetectors, *Yang Yang; Univ. of California at Los Angeles, USA.* Polymer based solar cells and photodetectors have tremendous application in harnessing solar energy and photodetection in a cost-effective way. Here we studied self-organization effect in polymer solar cells and demonstrated plastic near-infrared photodetectors.

Frontiers in Optics

FTuL • Optical Systems and Instrumentation for Short and Ultra Short Pulse X-Ray/VUV Sources II—Continued

FTuL4 • 3:30 p.m.
Comparison of Titanium Dioxide and Silicon Nitride Chirped Mirrors for Femtosecond Pulse Compression, *Olexiy V. Shulika[1], Igor A. Sukhoivanov[2], Alla V. Kublyk[1], Sergey O. Yakushev[1]; [1]Natl. Univ. of Radio Electronics, Ukraine, [2]Univ. Guanajuato, Mexico.* We numerically compare properties of SiO_2-TiO_2 and SiO_2-Si_3N_4 chirped mirrors oriented to λ = 800 nm. Silicon nitride mirrors provide better pulse compression. Numerical optimization of silicon nitride mirrors has also been made.

FTuL5 • 3:45 p.m.
Computed Tomographic Reconstructon For Solid Rocket Motors Using Digital X-Ray Imaging, *Selvanayaham Vibinkumar[1], V. R. Ravindran[2], M. K. Suresh[1], C. Sreelekshmi[2], M. C. Santhoshkumar[1]; [1]Natl. Inst. of Technology, India, [2]Vikram Sarabhai Space Ctr., India.* 3-DCT image reconstruction directly from Digital X-ray imaging system is the most advanced technique in the NDT field. The studies carried out to develop the technology using Digital X-ray imaging system are presented.

FTuM • Active Photonic Devices in Silica—Continued

FTuM6 • 3:30 p.m. Invited
Active Plasmonic Structures and Metamaterials, *Harry Atwater, Henri J. Lezec, Jennifer A. Dionne, Carrie E. Ross, Luke A. Sweatlock, Domenico Pacifici, Ken Diest, Matthew Dicken, Vivian Ferry; Caltech, USA.* Plasmonics has provided nanoscience researchers new control of optical dispersion and light localization at nanoscale dimensions. I will discuss plasmonic concepts that are yielding metamaterials designs and building blocks for chip-based optical device technology.

FTuN • Coherence and Polarization II—Continued

FTuN6 • 3:30 p.m.
Polarization Properties of Ince-Gaussian Beams, *Adam M. Goldstein, Reeta Vyas, Surendra Singh; Univ. of Arkansas, USA.* Longitudinal and cross polarization properties of vector Ince-Gaussian light beams are studied when the light beams are linearly and circularly polarized by using the solutions of scalar paraxial wave equation in elliptical cylindrical coordinates.

Joint

JTuB • Quantum Sensing and Imaging II—Continued

JTuB6 • 3:30 p.m.
Development of Single-Photon Source Based on Single Trapped Barium Ions, *Gang Shu, Nathan Kurz, Ryan Bowler, Sanghoon Chong, Matt Dietrich, Gary Howell, Adam Kleczewski, Viki Mirgon, Joseph Pirtle, Joanna Salacka, Li Wang, Boris B. Blinov; Dept. of Physics, Univ. of Washington, USA.* A pulse laser driving Ba based single photon source has been proposed with its simple structure, high repetition rate and potential application in Quantum computation and communication.

Frontiers in Optics

FTuO • Nonlinear Microscopy in Biology I—Continued

FTuO4 • 3:30 p.m.
Malignant Melanoma: Identification Using Second Harmonic Imaging, *Karen M. Reiser[1], Lyudmila Gulyaeva[2], S. V. Sidirov[3], André Knoesen[4]; [1]School of Medicine, Univ. of California at Davis, USA, [2]Inst. of Molecular Biology and Biophysics, Russian Federation, [3]Russian Acad. of Medical Sciences, Russian Federation, [4]College of Engineering, Univ. of California at Davis, USA.* Structural abnormalities in the collagen architecture of biological tissues are detectable with second harmonic generation imaging. Recent pilot data suggest that malignant melanoma can be identified with SHG by specific changes in its optical signature.

FTuO5 • 3:45 p.m.
Two-Photon Luminescence Imaging of Cancer Cells Using Molecularly Targeted Gold Nanorods, *Nicholas J. Durr[1], Timothy Larson[1], Danielle K. Smith[1], Brian A. Korgel[1], Konstantin Sokolov[2], Adela Ben-Yakar[1]; [1]Univ. of Texas at Austin, USA, [2]Univ. of Texas M.D. Anderson Cancer Ctr., USA.* We demonstrate the ability to image cancerous cells in a three-dimensional tissue phantoms utilizing bright two-photon luminescence from molecularly targeted gold nanorods. Nanorod labeled cells provide three orders-of-magnitude more signal than autofluorescence from unlabeled cells.

4:00 p.m.–4:30 p.m., Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*

FTuP • Aberration Theory in Optical Testing—Continued

FTuP4 • 3:30 p.m.
Quantitative Phase Estimation with a Bright Field Microscope, *Sri Rama Prasanna Pavani, Ariel R. Libertun, Carol J. Cogswell; Univ. of Colorado at Boulder, USA.* We demonstrate quantitative phase imaging on a bright field transmission microscope with an amplitude mask in the field diaphragm and a post processing algorithm.

FTuP5 • 3:45 p.m.
Aberration Analysis of the Putative Projector for Lorenzo Lotto's "Husband and Wife," *David G. Stork[1,2]; [1]Ricoh Innovations, USA, [2]Stanford Univ., USA.* Geometrical constraints upon Lorenzo Lotto's putative projector for "Husband and wife" lead to off-axis aberrations as severe as defocus arising from limited depth of field. This and other facts undercut claims Lotto used a projector.

LTuG • Precision Techniques on Short Time Scales I—Continued

LTuG4 • 3:30 p.m.
Controlling Fragmentation in Molecular Ions via Dynamic Resonances, *Sarah Nichols[1], Brett J. Pearson[2], Thomas C. Weinacht[1]; [1]SUNY Stony Brook, USA, [2]Dickinson College, USA.* We examine the role that ultrafast dynamic resonances in molecular ions play in controlling fragmentation. By creating wave packets on ionic potential energy surfaces, one can time-resolve ionic resonances leading to molecular fragmentation.

LTuG5 • 3:45 p.m.
Coherent Population Transfer in Heteronuclear Molecules, *Michaela Tscherneck, Nicholas P. Bigelow; Univ. of Rochester, USA.* We solve the time-dependent Schrödinger equation for molecular systems in the presence of short laser pulses and show that a high transfer efficiency between various molecular levels can be achieved.

LTuH • Clocks, Navigation and Magnetometers—Continued

LTuH4 • 3:30 p.m. Invited
High Sensitivity Atomic Magnetometers and their Applications, *Michael Romalis; Princeton Univ., USA.* I will review recent progress in optical magnetometry techniques using spin-polarized alkali-metal atoms and discuss their applications for detection of nuclear magnetic resonance, biological magnetic fields, rotation sending, and fundamental physics tests.

LTuI • Imaging and Microscopy — Non-Biological I—Continued

LTuI3 • 3:30 p.m. Invited
Strongly Emissive ss-DNA-encapsulated Ag Nanoclusters as New Single Molecule Fluorophores, *Robert Dickson; Georgia Tech, USA.* Highly emissive ssDNA-encapsulated Ag dimers and trimers have been created and studied in polymeric and biological systems. Fluorescence intensities and photostabilities greatly exceed those of existing organic dyes. Full photophysical characterization will be reported.

OTuC • Materials and Devices for Organic Photovoltaics—Continued

4:00 p.m.–4:30 p.m., Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*

Frontiers in Optics

4:30 p.m.–6:30 p.m.
FTuQ • Ultrafast Science: X-Rays and Accelerators
Ting Guo; Univ. of California at Davis, USA, Presider

FTuQ1 • 4:30 p.m. Invited
Ultrafast Coherent Diffractive X-Ray Imaging, *Henry Chapman; Lawrence Livermore Natl. Lab, USA.* Single ultrafast pulse high-resolution coherent x-ray images and holograms have been recorded at the FLASH free-electron laser. These experiments point the way to near-atomic resolution imaging at future x-ray laser sources.

FTuQ2 • 5:00 p.m.
Energy Gain of, and Re-radiated Power from, Initially Stationary Electrons Struck by a Sub-Joule Ultrashort Laser Pulse: An Exact Simulation, *Hyun Min Cho, Robert W. Hellwarth; Univ. of Southern California, USA.* An initially stationary electron can gain up to 0.23GeV energy, and re-radiate up to a total of 7 attojoules, when struck by a 0.6 Joule optical pulse that is an exact solution of Maxwell's equations.

4:30 p.m.–6:00 p.m.
FTuR • Short Pulse Fiber Lasers and Amplifiers
Presider to Be Announced

FTuR1 • 4:30 p.m. Invited
Ultra-High-Power Fiber Amplifiers: Scope and Limitations, *Martin Fermann; IMRA America Inc., USA.* Applications of ultrafast fiber lasers based on present and possible future peak and average power limits governed by the availability of large core fibers, pulse stretching and compression technology and optical phase control are discussed.

FTuR2 • 5:00 p.m.
Experimental Investigation of Self-Starting in a Passively Mode-Locked Fiber Laser Based on a Symmetrical NOLM, *Ruben Grajales-Coutiño[1], Baldemar Ibarra-Escamilla[1], Evgeny A. Kuzin[1], Olivier Pottiez[2], Joseph W. Haus[3]; [1]INAOE, Mexico, [2]CIO, Mexico, [3]Univ. of Dayton, USA.* We experimentally demonstrate self-starting operation of a figure-eight mode-locked fiber laser using a power-balanced NOLM and a Quarter-Wave retarder in the loop. The laser generates 30 ps pulses with a repetition frequency of 0.8 MHz.

4:30 p.m.–6:30 p.m.
FTuS • Coherence and Polarization III
Tom Brown; Univ. of Rochester, USA, Presider

FTuS1 • 4:30 p.m. Invited
Depolarization Analyzed by Matrix Logarithms, *Russell Chipman; Univ. of Arizona, USA.* An order-independent decomposition of Mueller matrices based on matrix roots and matrix logarithms provides nine depolarization parameters, three closely associated with retardance, three related to diattenuation, and three more related to the matrix diagonal.

FTuS2 • 5:00 p.m.
Light-Polarization Visualizer with Polymeric Composite Mixtures, *Riccardo Castagna, Daniele E. Lucchetta, Luigino Criante, Francesco Vita, Francesco Simoni; Univ. Politecnica delle Marche, Dip. FIMET and CNISM, Italy.* Long-lasting polarized laser light exposition of halo-alkanes in acrylate mixtures results in visualization of interesting polarization dependent light-propagation effects. This phenomenon represents a device able to indicate the polarization states of the incident light.

4:30 p.m.–6:30 p.m.
FTuT • Photonic Crystals and Emission
Mikhail Noginov; Norfolk State Univ., USA, Presider

FTuT1 • 4:30 p.m. Invited
Optics with Three-Dimensional Photonic Crystals, *Willem Vos; FOM Inst. and Univ. Twente, Netherlands.* We will discuss recent experimental developments with three-dimensional photonic crystals, including ultrafast all-optical switching, spontaneous emission control of quantum dots, and new fabrication methods.

FTuT2 • 5:00 p.m.
Modified Spontaneous Emission Using Higher-Order Pseudogaps in 3-D Polymer Photonic Crystal at Telecommunication Wavelengths, *Michael J. Ventura, Min Gu; Ctr. for Micro-Photonics, Swinburne Univ. of Technology, Australia.* The fabrication of a three-dimensional woodpile photonic-crystal is realised in a homogeneously doped PbSe polymer-nanocomposite-material. Infrared emission from the PbSe nanocrystals is overlapped with higher-order photonic-crystal pseudogaps and modification of spontaneous emission is observed.

4:30 p.m.–6:30 p.m.
FTuU • Nonlinear Microscopy in Biology II
Presider to Be Announced

FTuU1 • 4:30 p.m. Invited
Simultaneous Spatial and Temporal Focusing in Nonlinear Microscopy, *Chris Xu; Cornell Univ., USA.* We present in this paper our recent theoretical and experimental work on simultaneous spatial and temporal focusing in nonlinear microscopy.

FTuU2 • 5:00 p.m.
Effects of Refractive-Index Mismatch and Scattering on Simultaneous Spatial and Temporal Focusing, *Michael E. Durst, Guanghao Zhu, Chris Xu; Cornell Univ., USA.* We theoretically and experimentally demonstrate the pulse broadening effects of scattering and refractive-index mismatch on simultaneous spatial and temporal focusing.

Frontiers in Optics

4:30 p.m.–6:30 p.m.
FTuV • General Optical Design and Instrumentation I

R. John Koshel; Lambda Res. Corp., College of Optical Sciences, Univ. of Arizona, USA, Presider

FTuV1 • 4:30 p.m.
Beam Retardation Design of Diffractive Element for Linearizing Sinusoidal Scanning: Experimental Verification, *Jed Khoury[1], Charles L. Woods[1], Bahareh Haji-saeed[2], John Kierstead[2]; [1]AFRL, Sensors Directorate, Hanscom Air Force Base, USA, [2]Solid State Scientific Corp., USA.* In this paper, we have fabricated and characterized our previously designed diffractive element for converting nonlinear sinusoidal scanning into linear scanning, based on beam retardation (phase lag) through propagation in an inhomogeneous media.

FTuV2 • 4:45 p.m. Invited
Analytic Design of Laser Beam Shaping Optics, *David L. Shealy[1], John L. Hoffnagle[2]; [1]Univ. of Alabama at Birmingham, USA, [2]IBM Almaden Res. Ctr., USA.* For a 2-plano-aspheric lens laser beam shaper, one obtains analytic functions for the sag of aspherics, the wavefront, the irradiance along rays, and the caustic surfaces when transforming a Gaussian beam into a flattened-Lorentzian beam.

Laser Science

4:30 p.m.–5:45 p.m.
LTuJ • Precision Techniques on Short Time Scales II

Thomas C. Weinacht; SUNY Stony Brook, USA, Presider

LTuJ1 • 4:30 p.m.
Quantum Control of Energy Flow, *Daniel G. Kuroda, Valeria D. Kleiman; Univ. of Florida, USA.* We investigate the coherent control of energy transfer in different nanomaterials in solution.

LTuJ2 • 4:45 p.m.
Double Femtosecond Pulses Mode-Locked Ti:Sapphire Oscillator, *Jiahui Peng, Alexei V. Sokolov; Inst. for Quantum Studies and Dept. of Physics, Texas A&M Univ., USA.* We demonstrate a simple method to control spectrum and to generate synchronized double femtosecond pulses in a mode-locked Ti:Sapphire laser. And the difference of two wavelengths is easily tuned in large range.

LTuJ3 • 5:00 p.m.
A μController Tuned Seventeen Wavelengths Dye Laser, *Nasrullah Khan, Zahid Saleem, A. Wahid; Comsats Inst. of Information Technology, Pakistan.* Operation of a multiple pulse lengths distributed feedback dye laser is reported. Solution of Rh6G in ethanol (1mM) was pumped by the five pairs of second harmonic of a passively modelocked Nd:YAG laser.

4:30 p.m.–6:30 p.m.
LTuK • Laser-Based Space Missions

Guido Mueller; Univ. of Florida, USA, Presider

LTuK1 • 4:30 p.m. Invited
Overview of Laser Applications on European Space Missions, *Eamonn M. Murphy; European Space Agency (ESA), Directorate of Technical and Quality Management (ESTEC), Netherlands.* The European Space Agency, has ongoing space mission developments where laser applications are playing a central role. The implementation of lasers for these missions is a key mission driver in terms of performance and reliability.

LTuK2 • 5:00 p.m. Invited
History of Spaceflight Lasers at Goddard Space Flight Center, *Tracee L. Jamison[1], Chad Sheng[2], Robert Bousquet[2], Debra Cope[2], John Canham[3], Melanie Ott[1]; [1]NASA Goddard Spaceflight Ctr., USA, [2]Genesis Engineering, USA, [3]Swales Aerospace, Inc., USA.* NASA GSFC possesses premier knowledge in space qualifying lasers for space. However, getting LIDAR instruments in space has not been a smooth road. Lack of replacement parts and space qualifcation costs are the main challenges.

4:30 p.m.–6:30 p.m.
LTuL • Imaging and Microscopy — Non-Biological II

Gilbert Walker; Univ. of Toronto, Canada, Presider

LTuL1 • 4:30 p.m. Invited
Understanding Nanostructured Solar Cell Performance with Time-Resolved Electrostatic Force Microscopy, *David C. Coffey, Obadiah Reid, Liam C. S. Pingree, David Ginger; Univ. of Washington, USA.* We describe the use of time-resolved electrostatic force microscopy and photoconductive atomic force microscopy in order to study charge generation, transport, and trapping in donor/acceptor blend organic solar cells.

LTuL2 • 5:00 p.m. Invited
Photophysics of Organic Semiconductors Probed by Single Molecule Spectroscopy and Near-Field Optics, *Steve Buratto; Univ. of California at Santa Barbara, USA.* We use single molecule fluorescence and near-field optics to directly compare structures of oligo(phenylenevinylene) (OPV) molecules and their luminescence properties, the emission from macromolecules derived from OPVs and the morphology of films made from OPVs.

OMD

4:30 p.m.–6:15 p.m.
OTuD • Materials and Devices for OLEDs II

Jason Brooks; Universal Display Corp., USA, Presider

OTuD1 • 4:30 p.m. Invited
Novel Approaches to Highly Efficient Organic Devices, *Karsten Walzer, Gregor Schwartz, Qiang Huang, R. Meerheim, Karl Leo; Inst. fuer Angewandte Photophysik, Technische Univ. Dresden, Germany.* We discuss high-efficiency RGB and white organic light emitting diodes, utilizing doped transport layers for low-voltage operation and flexible configuration, and novel approaches for white emitting systems which allow high quantum efficiency and long lifetime.

OTuD2 • 5:00 p.m. Invited
OLEDs with Enhanced Display Performances, *Chih-Jen Yang, Ting-Yi Cho, Kun-Chung Tien, Chun-Liang Lin, Chung-Chih Wu; Natl. Taiwan Univ., Taiwan.* In this presentation, a few OLED structures with enhanced display performances, such as the contrast, will be discussed.

FTuQ • Ultrafast Science: X-Rays and Accelerators—Continued

FTuQ3 • 5:15 p.m. Invited

Laser Plasma Accelerators: High Quality and Tuneable Electron Beam, *Victor Malka; Lab d'Optique Appliquée, Ecole Polytechnique ENSTA, France.* A review of laser plasma accelerator and its related applications for medicine (radiotherapy), chemistry (femtolysis) and material science (radiography) will be presented.

FTuQ4 • 5:45 p.m.

Ultra-Broadband Optical Parametric Chirped-Pulse Amplification Pumped by an Yb:YLF Chirped-Pulse Amplification Laser, *Yutaka Akahane[1], Makoto Aoyama[1], Kanade Ogawa[1,2], Koichi Tsuji[1], Akira Sugiyama[1], Koichi Yamakawa[1], Tetsuo Harimoto[3], Junji Kawanaka[2], Hajime Nishioka[4], Masayuki Fujita[5]; [1]Japan Atomic Energy Agency, Japan, [2]Inst. of Laser Engineering, Osaka Univ., Japan, [3]Faculty of Engineering, Yamanashi Univ., Japan, [4]Inst. for Laser Science, Univ. of Electro-Communications, Japan, [5]Inst. for Laser Technology, Japan.* We have demonstrated ultra-broadband parametric amplification with a bandwidth of over 200nm pumped by an Yb:YLF chirped-pulse amplification laser at degeneracy.

FTuR • Short Pulse Fiber Lasers and Amplifiers—Continued

FTuR3 • 5:15 p.m.

Dynamics of Gain-Guided Solitons in a Fiber Laser, *Luming Zhao[1], Dingyuan Tang[1], Tee Hiang Cheng[1], Hwa-Yaw Tam[2], Chao Lu[3]; [1]School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore, [2]Dept. of Electrical Engineering, Hong Kong Polytechnic Univ., Hong Kong, [3]Dept. of Electronic and Information Engineering, Hong Kong Polytechnic Univ., Hong Kong.* We report experimental and numerical studies on the dynamics of gain-guided solitons in a passively mode-locked Erbium-doped fiber laser made of purely normal dispersion fibers.

FTuR4 • 5:30 p.m.

Period-Doubling of Dispersion-Managed Soliton in Erbium-Doped Fiber Lasers at around Zero Dispersion, *Luming Zhao[1], Dingyuan Tang[1], Tee Hiang Cheng[1], Hwa-Yaw Tam[2], Chao Lu[3]; [1]School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore, [2]Dept. of Electrical Engineering, Hong Kong Polytechnic Univ., Hong Kong, [3]Dept. of Electronic and Information Engineering, Hong Kong Polytechnic Univ., Hong Kong.* Period-doubling of dispersion-managed soliton in Erbium-doped fiber ring lasers operating at near zero net cavity group velocity dispersion was experimentally observed, which suggests that the period-doubling is an intrinsic feature of the mode-locking fiber lasers.

FTuR5 • 5:45 p.m.

Generation of 85ps Modelocked Pulses via TPA in Silicon, *En-Kuang Tien, Feng Qian, Nuh S. Yuksek, Ozdal Boyraz; Univ. of California at Irvine, USA.* A novel pulse compression and modelocking scheme by using TPA and TPA induced free carrier absorption in silicon waveguides is demonstrated. Experimentally we obtain 12 fold pulse compression and 85ps modelocked pulses at 1550nm.

FTuS • Coherence and Polarization III—Continued

FTuS3 • 5:15 p.m.

Surface Plasmons in Young's Experiment Modulate the Spatial Coherence of Light, *Choon How Gan[1], Greg Gbur[1], Taco Visser[2]; [1]Univ. of North Carolina at Charlotte, USA, [2]Free Univ., Netherlands.* We demonstrate theoretically that the coherence properties of light may be modulated by surface plasmons in Young's interference experiment. This is promising for the development of "coherence converting" devices for applications such as coherence tomography.

FTuS4 • 5:30 p.m.

Theory of Reflection by Volume Gratings and Boundaries: Polarization and Interference Properties, *Sergiy Mokhov, L. B. Glebov, V. I. Smirnov, B. Ya Zeldovich; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Fresnel and volume-holographic reflections are studied. Hyperbolic arctan of reflection amplitude is shown to be the sum of two contributions: due to impedance and refractive index modulations. Mutual influence of Fresnel and volume reflections revealed.

FTuS5 • 5:45 p.m.

A Ray-Based Framework for Propagating Partially Coherent Field Information through Optical Systems, *Jonathan C. Petruccelli, Miguel A. Alonso; Inst. of Optics, Univ. of Rochester, USA.* A technique based on angle-impact Wigner functions is proposed to ray-optically propagate scalar and electromagnetic nonparaxial partially coherent fields through optical systems composed of piecewise transparent homogeneous media.

FTuT • Photonic Crystals and Emission—Continued

FTuT3 • 5:15 p.m.

Terahertz-Modulation Room-Temperature Photonic Crystal Nanocavity Laser, *Dirk R. Englund[1], Ilya D. Fushman[1], Jelena D. Vuckovic[1], Hatice F. Altug[2]; [1]Stanford Univ., USA, [2]Boston Univ., USA.* We demonstrate a photonic crystal cavity laser with near-microwatt threshold and employing a surface-passivated InGaAs quantum well. The laser operates at room temperature and produces pulses with FWHM shorter than 3 ps (detector response limited).

FTuT4 • 5:30 p.m. Invited

Linear and Nonlinear Localization of Light in Light-Induced Lattices, *Zhigang Chen[1,2], Xiaosheng Wang[1], Jianke Yang[3]; [1]San Francisco State Univ., USA, [2]Nankai Univ., China, [3]Univ. of Vermont, USA.* We provide a brief overview of our recent work on linear and nonlinear localization of light in optically-induced photonic structures, including nonlinear self-trapping of discrete solitons and photonic bandgap guidance in lattices with structured defects.

FTuU • Nonlinear Microscopy in Biology II—Continued

FTuU3 • 5:15 p.m. Invited

Two-Photon Fluorescence and Second-Harmonic Generation Microendoscopy for Minimally Invasive *in vivo* Imaging at the Cellular Scale, *Mark Schnitzer; Stanford Univ., USA.* The combination of micro- and fiber-optics enables minimally invasive nonlinear optical imaging in live subjects by microendoscopy. I will describe the development and application of two-photon excited fluorescence and second-harmonic generation microendoscopy in the mammalian nervous system.

FTuU4 • 5:45 p.m.

A Miniature Microscope for Two-Photon Imaging and Femtosecond Laser Surgery, *Christopher Hoy[1], Nicholas Durr[1], Pengyuan Chen[1], Hyejun Ra[2], Wibool Piyawattanametha[2], Olav Solgaard[2], Adela Ben-Yakar[1]; [1]Univ. of Texas at Austin, USA, [2]Stanford Univ., USA.* We present a miniaturized two-photon microscope system employing air-core photonic crystal fiber and a resonantly-driven two-axis MEMS scanning mirror for simultaneous cellular imaging and femtosecond laser microsurgery. We will present design analysis and performance characterization.

FTuV • General Optical Design and Instrumentation I—Continued

FTuV3 • 5:15 p.m.
Laser Projection Systems Design: Speckle Simulation Approaches, *Nikolai I. Petrov; Unaffiliated, Russian Federation.* The speckle patterns caused by different optical elements in laser projection systems are analyzed, methods for speckle reduction are proposed. Effects of partial coherence of light source and surface roughness of optical elements are considered.

FTuV4 • 5:30 p.m.
Interference Design of Diffractive Element for Resonant Scanner Angular Correction, *Bahareh Haji-saeed[1], John Kierstead[1], Jed Khoury[2], Charles L. Woods[2]; [1]Solid State Scientific Corp., USA, [2]AFRL, Sensors Directorate, Hanscom Air Force Base, USA.* This paper proposes an optical corrective element with zooming capability for converting nonlinear sinusoidal scanning to linear scanning. The design methodology is based on the classical equation for diffraction gratings.

FTuV5 • 5:45 p.m.
Principal Curvature Measurements: Towards Wave Front Optical Testing with Next Level Accuracy, *Weiyao Zou, Jannick Rolland; College of Optics and Photonics, CREOL and FPCE, Univ. of Central Florida, USA.* We demonstrate in this paper how the local wavefront principal curvatures and directions may be obtained with a Differential Shack Hartman (DSH) sensor.

LTuJ • Precision Techniques on Short Time Scales II—Continued

LTuJ4 • 5:15 p.m.
Time-Domain Analysis of the Dipole-Dipole Interaction between Rubidium Atoms, *Yan Xiao, Brian J. Ricconi, J. Gary Eden; Lab for Optical Physics and Engineering, Dept. of Electrical and Computer Engineering, Univ. of Illinois, USA.* Rubidium atomic wavepackets are analyzed in the frequency domain to show a shift of the quantum beating from two rubidium atoms. Temporal analysis confirms this shift, which is attributed to dipole-dipole interactions between atoms.

LTuJ5 • 5:30 p.m.
Intracavity Phase Measurement Using Compact Mode-Locked All Solid-State Laser, *Yule Zhang, Jean-Claude Diels; Ctr. for High Technology Materials, Univ. of New Mexico, USA.* We generate two pulses in the Nd:Vanadate laser by using MQWs as the saturable absorber. The phase shifts of the two pulses caused by the electro optical modulation are measured through the beat frequency.

LTuK • Laser-Based Space Missions—Continued

LTuK3 • 5:30 p.m. Invited
Inter-Satellite Laser Mapping of the Gravitational Field of the Earth, *Michelle Stephens[1], James Leitch[1], Robert Pierce[1], R. Steve Nerem[2], Peter Bender[2], Mike Watkins[3], Bill Folkner[3]; [1]Ball Aerospace and Technologies Co., USA, [2]Univ. of Colorado, USA, [3]JPL, USA.* Mapping of changes in the Earth's gravity field from space can be improved by using laser ranging between two spacecraft. An interferometric laser ranging system that has been partially developed and tested will be described.

LTuL • Imaging and Microscopy — Non-Biological II—Continued

LTuL3 • 5:30 p.m. Invited
Probing Photophysics of Individual Quantum Dot/Organic Hybrid Nanostructures, *Mike Barnes, Kevin T. Early, Kevin McCarthy, Michael Y. Odoi, Nathan Hammer, Todd Emrick; Univ. of Massachusetts at Amherst, USA.* We describe single-molecule spectroscopy and simulation of intensity trajectories from CdSe quantum dots coordinated with conjugated organic ligands. We show that blinking-suppression in these systems can be explained through a modified diffusive coordinate model.

OTuD • Materials and Devices for OLEDs II—Continued

OTuD3 • 5:30 p.m.
High Performance Organic Light-Emitting Diodes (OLEDs) with Molybdenum Oxide (MoOx) as the Buffer Layer, *Zheng Chen, Zhenbo Deng, Denghui Xu, Chunjun Liang, Xiufang Li, Kai Zhao; Key Lab of Luminescence and Optical Information, Beijing Jiaotong Univ., China.* An ultrathin molybdenum oxide (MoOx) layer was introduced into OLEDs as hole-injection buffer layer. The turn-on voltage of the device decreased from 3.8V to 2.8V and the maximum luminescence value increased from 6300cd/m^2 to 11000cd/m^2.

OTuD4 • 5:45 p.m.
Carrier Trapping: A Nature of High Device Efficiency of Phosphorescent Metal Complexes for Light-Emitting Diodes, *Yuguang Ma; Jilin Univ., China.* Our investigations for the electrophorphorescent devices demonstrate that charge trapping-induced direct recombination on the phosphorescent metal complexes is the nature of very high device efficiency as these type of materials used for light-emitting diodes.

Frontiers in Optics

FTuQ • Ultrafast Science: X-Rays and Accelerators—Continued

FTuQ5 • 6:00 p.m. Invited
Ultrafast X-Ray Measurements of Coherent Atomic-Motion and Bond Softening in Bismuth, *David A. Reis; Univ. of Michigan, USA.* We measure ultrafast dynamics of coherent atomic-motion and impulsive softening of the interatomic forces of photo-excited bismuth. Femtosecond and picometer resolution was achieved with random sampling of x rays from the Subpicosecond Pulse Source.

FTuS • Coherence and Polarization III—Continued

FTuS6 • 6:00 p.m.
High-Resolution Integrated Image Sensor with Polymer Micropolarization Array, *Viktor Gruev, Alessandro Ortu, Zheng Yang, Jan Van der Spiegel, Nader Engheta; Univ. of Pennsylvania, USA.* A novel image sensor for high-resolution polarization imaging is presented. The image sensor combines polymer polarization filters with CMOS imaging technology in order to extract the first three Stokes parameters at the focal plane.

FTuS7 • 6:15 p.m.
Polarization Effects in Single-Shot Time Resolved Four Wave Mixing, *Yuri Paskover, Ilya Sh. Averbukh, Yehiam Prior; Weizmann Inst. of Science, Israel.* We demonstrate single-pulse polarization sensitive measurement of coherent vibrational evolution of molecules by geometrical space-time mapping combined with non-linear signal imaging.

FTuT • Photonic Crystals and Emission—Continued

FTuT5 • 6:00 p.m.
Intense and Directional Emission from Three-Dimensional Photonic Crystal, *Heeso Noh, Michael Scharrer, Hui Cao, Robert P. H. Chang; Northwestern Univ., USA.* We observe intense and directional photoluminescence from the ZnO inverse opal. It originates from the stationary inflection point of high-order band structure, which enhances the density of states and coupling efficiency.

FTuT6 • 6:15 p.m.
High Resolution Wavelength Demultiplexers Using the Second Photonic Band of Planar Photonic Crystals, *Babak Momeni, Ehsan Shah Hosseini, Mohammad Soltani, Ali Adibi; Georgia Tech, USA.* A superprism-based photonic crystal wavelength demultiplexer in the second-band is proposed, which considerably improves the spectral resolution of these devices. Major challenges in the implementation of these devices are discussed, and appropriate solutions are presented.

FTuU • Nonlinear Microscopy in Biology II—Continued

FTuU5 • 6:00 p.m.
Ultrashort Pulse Excitation for Nonlinear Optical Microscopy, *Alvin T. Yeh, Adam M. Larson, Chao Wang, Kenith E. Meissner; Dept. of Biomedical Engineering, Texas A&M Univ., USA.* Two-photon absorption is characterized as a function of pulse duration for molecular systems. Enhancement in fluorescence intensity is observed for shorter pulses and depends on the relative spectral widths of two-photon absorption and pulse bandwidth.

FTuU6 • 6:15 p.m.
Multi-Photon Microscopy in Biological Tissue with Ultrashort Shaped Pulses, *Peng Xi, Yair Andegeko, Lindsay R. Weisel, Bingwei Xu, John Pote, Rebekah M. Martin, Marcos Dantus; Michigan State Univ., USA.* Multi-photon imaging with ultrashort (~10 fs) pulses has been limited by phase distortions introduced by microscope objectives. Here we present a number of advantages in biomedical imaging gained by phase-corrected and phase shaped femtosecond pulses.

6:30 p.m.–7:00 p.m., Division of Laser Science Annual Business Meeting, *Fairmont Hotel, Fairfield Room*

6:30 p.m.–8:00 p.m., OSA Member Reception, *Sainte Claire Hotel, Ballroom*

7:30 p.m.–10:00 p.m., Laser Science Banquet, *Gordon Biersch Brewery, 33 E. San Fernando St.**

*Tickets must be purchased in advance. See Special Events section for more information.

FTuV • General Optical Design and Instrumentation I—Continued

FTuV6 • 6:00 p.m.
Intracavity Mode Selection with Conical-Shaped Mirror, *Boris Spektor, Yurij Parkhomenko, Joseph Shamir; Israel Inst. of Technology, Israel.* This work extends to two dimensions an earlier work, where laser beam structuring was obtained in one dimension. The new model considers cylindrical symmetry where one resonator reflector is replaced by a conical-shaped mirror.

FTuV7 • 6:15 p.m.
Porro-Prism Retroreflector Based on Corner Geometry of Volume Bragg Gratings, *Sergiy Mokhov, L. B. Glebov, B. Ya. Zeldovich; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We consider relatively thin optical element: Porro Prism configuration for pair of 45-degree Volume Bragg Gratings. We calculate efficiency, spectral and angular selectivity versus hologram strength and thickness, with applications for laser resonators.

LTuK • Laser-Based Space Missions—Continued

LTuK4 • 6:00 p.m. Invited
CALIPSO: Polarization Performance of a Space-Based, Backscatter LIDAR, *Paula Wamsley[1], C. S. Weimer[1], J. T. Applegate[1], Bill Hunt[2]; [1]Ball Aerospace and Technologies Corp., USA, [2]NASA Langley Res. Ctr., USA.* The CALIPSO satellite has completed nearly a year of on-orbit operation. This paper discusses development and on-orbit performance of the dual-wavelength, polarization sensitive LIDAR developed for NASA by prime contractor Ball Aerospace and Technologies Corp.

LTuL • Imaging and Microscopy — Non-Biological II—Continued

LTuL4 • 6:00 p.m. Invited
Effects of Aggregation on the Emission of PPV Oligomers, *G. A. Sherwood[1], R. Cheng[1], T. M. Smith[2], J. Wildeman[3], D. J. Yaron[1], Linda Peteanu[1]; [1]Carnegie Mellon Univ., USA, [2]Univ. of Richmond, USA, [3]Univ. of Groningen, Netherlands.* We present studies of MEH-PPV oligomer aggregates exhibiting highly structured emission at the single aggregate level. Trends in emission intensity and Franck-Condon structure with chain length and size are modeled to understand the inter-molecular interactions.

OTuD • Materials and Devices for OLEDs II—Continued

OTuD5 • 6:00 p.m.
Ambipolar Transporting Naphtho[2,3-c][1,2,5]thiadiazole Derivatives for Non-Doped Red-Emitting OLEDs, *Yong Qiu[1], Ruiping Gao[2,1]; [1]Tsinghua Univ., China, [2]Natl. Natural Science Foundation of China, China.* We reported a new type of red-emitting materials based on naphtho[2,3-c][1,2,5]thiadiazole(NTD). These materials not only showed high photoluminescent efficiency but also showed ambipolar charge transporting properties. Non-doped, pure-red OLEDs were prepared by using NTD derivatives.

6:30 p.m.–7:00 p.m., Division of Laser Science Annual Business Meeting, *Fairmont Hotel, Fairfield Room*

6:30 p.m.–8:00 p.m., OSA Member Reception, *Sainte Claire Hotel, Ballroom*

7:30 p.m.–10:00 p.m., Laser Science Banquet, *Gordon Biersch Brewery, 33 E. San Fernando St.**

Frontiers in Optics

8:00 a.m.–10:00 a.m.
FWA • Ultrafast Dynamics of Biological and Chemical Systems I
Koichi Yamakawa; Advanced Photon Res. Ctr., Japan, Presider

FWA1 • 8:00 a.m. Invited

Development of a Light-Driven Paradigm for Time-Resolved Investigations of Enzyme Mechanism: B_{12} Dependent Glutamase Mutase, *Roseanne J. Sension; Univ. of Michigan, USA.* Optical spectroscopies with time-resolution extending over 6 decades in time (10 fs to 10 ns) are used to investigate B_{12} cofactors in solution and bound to the AdoCbl dependent enzyme glutamate mutase.

FWA2 • 8:30 a.m.

Ultrafast Gigantic Photo-Response in Organic Salt (EDO-TTF)$_2$PF$_6$ Initiated by 20-fs Laser Pulses, *Jiro Itatani[1,2], Matteo Rini[1], Andrea Cavalleri[3], Ken Onda[2,4], Tadahiko Ishikawa[4], Shinya Koshihara[2,4], Xiangfeng Shao[2,5], Hideki Yamochi[2,5], Gunzi Saito[5], Robert W. Schoenlein[1]; [1]Lawrence Berkeley Natl. Lab, USA, [2]Japan Science and Technology Agency, Japan, [3]Univ. of Oxford, UK, [4]Tokyo Inst. of Technology, Japan, [5]Kyoto Univ., Japan.* The early dynamics of a photo-induced phase transition in the charge-ordered organic salt (EDO-TTF)$_2$PF$_6$ was investigated with 10-fs resolution. The gigantic photo-response (|DR/R|>100%) characteristic of the insulator-to-metallic phase transition was observed <50-fs after excitation.

8:00 a.m.–10:00 a.m.
FWB • High Power Fiber Lasers and Amplifiers
Martin Fermann; IMRA America, Inc., USA, Presider

FWB1 • 8:00 a.m. Invited

Short-Length, High-Power Multi-Core Coherently Coupled Fiber Lasers, *Nasser Peyghambarian[1], L. Li[1], V. L. Temyanko[1], H. Li[1], J. V. Moloney[1], P. Polynkin[1], J. Albert[2], A. Schülzgen[1]; [1]Univ. of Arizona, USA, [2]Carlton Univ., Canada.* An all-fiber approach is utilized to phase lock and select the in-phase supermode of compact 19- and 37-core fiber lasers that are a few cm long, aligning-free in operation, and environmentally robust.

FWB2 • 8:30 a.m.

A Counter-Propagating Cascaded Raman Fiber Amplifier Pulsed Pumped with a 1.06 μm Source, *Carl Farrell, Christophe Codemard, Johan Nilsson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report gain and noise measurements for a pulsed pumped cascaded Raman fiber amplifier with a counter-propagating signal. Gain is measured as high as the 7th order Stokes for different pulse duty cycles.

8:00 a.m.–10:00 a.m.
FWC • Complex Light Fields
Presider to Be Announced

FWC1 • 8:00 a.m.

Arbitrary 2-D Pattern Formation Beyond the Rayleigh Limit, *Sean J. Bentley; Adelphi Univ., USA.* A relatively simple new technique to generate arbitrary two-dimensional patterns in a multi-photon absorber with resolution exceeding the Rayleigh limit has been developed. This four-beam interference technique could greatly extend photolithography capabilities.

FWC2 • 8:15 a.m.

Analysis and Generation of Spatiotemporal Bessel Beams, *Michaël Dallaire, Michel Piché, Nathalie McCarthy; Ctr. d'Optique, Photonique et Laser (COPL), Univ. Laval, Canada.* We describe theoretically and experimentally quasi-invariant wave packets characterized by a spatiotemporal Bessel function profile. These beams can propagate in an anomalous dispersion media, such that diffraction and dispersion compensate each other.

FWC3 • 8:30 a.m.

Huge Deformations of Laguerre-Gaussian Beams Reflected and Refracted at a Dielectric Interface, *Hiroshi Okuda, Hiroyuki Sasada; Keio Univ., Japan.* We observe intensity distributions of the reflected and refracted Laguerre-Gaussian beams near the critical incidence. Their transverse deformations are evident with the naked eye and agree well with those calculated using angular spectrum analysis.

8:00 a.m.–10:00 a.m.
FWD • Metamaterials I
Nader Engheta; Univ. of Pennsylvania, USA, Presider

FWD1 • 8:00 a.m. Invited

Stacked 3-D Metamaterials in the Optical Wavelength Range, *Harald Giessen; Univ. Stuttgart, Germany.* We manufactured vertically aligned stacked 4-layer split-ring metamaterials using a planarization technique. We measured the optical properties of these 3-D metamaterials in the near infrared. Plasmon hybridisation is used to explain the optical spectra.

FWD2 • 8:30 a.m.

Optical Double Negative Metamaterial at 813 nm, *Uday K. Chettiar, Alexander V. Kildishev, Hsiao-Kuan Yuan, Wenshan Cai, Shumin Xiao, Vladimir P. Drachev, Vladimir M. Shalaev; Purdue Univ., USA.* A negative index metamaterial demonstrating n=-1.0+0.8i with both negative effective permittivity and permeability at 813nm of linearly polarized light is fabricated. It also exhibits a negative refractive index (n= -0.7+1.3i) at 772nm for orthogonal polarization.

8:00 a.m.–10:00 a.m.
FWE • Clinical and Preclinical Imaging and Therapeutics
Adam M. Zysk; Univ. of Illinois at Urbana-Champaign, USA, Presider

FWE1 • 8:00 a.m. Invited

Molecular Response and Imaging-Based Combination Strategies for Optimal PDT, *Tayyaba Hasan; Massachusetts General Hospital, USA.* Optical imaging is an increasingly useful tool in biomedical studies, in the investigations of cell biology mechanisms and in the detection and diagnosis of disease. An overview of studies from different laboratories will be presented.

FWE2 • 8:30 a.m.

***In vivo* Estimation of Total Hemoglobin Content and Hemoglobin Saturation in the Detection of Cervical Epithelial Pre-Cancers,** *Vivide Tuan-Chyan Chang, Peter S. Cartwright, Nirmala Ramanujam; Duke Univ., USA.* Total hemoglobin concentration, hemoglobin saturation and scattering coefficient were extracted from cervical diffuse reflectance spectra (400-600 nm) using a Monte Carlo-based model. Total hemoglobin was shown to distinguish pre-cancerous from normal tissues ($p < 0.05$).

8:30 a.m.–12:00 p.m. SWA • Joint FiO/LS Symposium: Optics and the Second "Magic Decade" of Quantum Mechanics, *Fairmont Hotel, Belevedere Room*
Joseph Eberly; Univ. of Rochester, USA, Symposium Organizer
See Page 14.

Hillsborough

Frontiers in Optics

8:00 a.m.–10:00 a.m.
FWF • Light-Confining Micro- and Nano-Structures
Presider to Be Announced

FWF1 • 8:00 a.m. Invited
Light Confining Silicon Photonic Structures for Enhanced Nonlinearities, *Michal Lipson; Cornell Univ., USA.* No abstract available.

FWF2 • 8:30 a.m. Invited
Recent Advances in Highly Nonlinear Microstructured Optical Fibers, *David Richardson, F. Poletti, M. L. V. Tse, P. Horak, N. G. R. Broderick, J. Y. Y. Leong, X. Feng, K. Frampton, W. H. Loh, S. Asimakis, P. Petropoulos; Univ. of Southampton, UK.* Microstructured fiber technology offers the prospects of fibers with unique nonlinear and dispersive properties. We review the latest developments in the field and progress towards various application optimized fiber types.

Sacramento

Laser Science

8:15 a.m.–10:00 a.m.
LWA • Cavity Ringdown Spectroscopy I
Pat Vaccaro; Yale Univ., USA, Presider

LWA1 • 8:15 a.m. Invited
Development of a cw Cavity Enhanced Instrument for Simultaneous Detection of Multiple Trace Species, *Frank Keutsch[1], E. J. Moyer[2], D. S. Sayres[2], T. F. Hanisco[2], L. Lapson[2], N. Allen[2], J. H. Kroll[2], J. G. Anderson[2]; [1]Univ. of Wisconsin at Madison, USA, [2]Harvard Univ., USA.* An instrument for simultaneous measurement of atmospheric water isotopes using cavity enhanced absorption spectroscopy has been developed. High precision and accuracy measurements (HDO <0.1 ppbv) were achieved by improved cavity design and data fitting algorithms.

Piedmont

Joint

8:00 a.m.–10:00 a.m.
JWA • Radiation Pressure, Cooling and Quantum Cantilevers I
Roman Schnabel; Leibnitz Univ. Hannover, Germany, Presider

JWA1 • 8:00 a.m. Invited
Quantum Theory of Cavity-Assisted Cantilever Cooling, *Florian Marquardt[1], J. P. Chen[2], A. A. Clerk[3], S. M. Girvin[4]; [1]Ludwig-Maximilians-Univ. Munich, Germany, [2]Dept. of Physics, Cornell Univ., USA, [3]Dept. of Physics, McGill Univ., Canada, [4]Dept. of Physics, Yale Univ., USA.* We present the quantum theory of optomechanical cooling, for a cantilever coupled to an optical cavity. The cantilever's ground state may be reached if the mechanical frequency is larger than the cavity decay rate.

JWA2 • 8:30 a.m. Invited
Laser Cooling Micromechanical Structures with High-Finesse Optical Cavities, *Jack Harris, J. D. Thompson, B. M. Zwickl, A. M. Jayich; Yale Univ., USA.* We have realized a high-finesse optical cavity which incorporates a micromechanical cantilever. This cantilever's response to radiation pressure can lead to optical nonlinearity, laser cooling, squeezing, and other quantum optical effects.

Glen Ellen

Laser Science

8:30 a.m.–10:00 a.m.
LWB • Time-Resolved Photoemission, Photoionization and Photodetachment I
R J Dwayne Miller; Univ. of Toronto, Canada, Presider

LWB1 • 8:30 a.m. Invited
Time-Resolved Photoelectron Spectroscopy of Clusters, *Daniel M. Neumark; Univ. of California at Berkeley, USA.* Time-resolved photoelectron-based techniques with femtosecond and attosecond resolution will be used to probe dynamics in clusters.

Atherton

OMD

8:00 a.m.–10:00 a.m.
OWA • Device Physics
Chihaya Adachi[1,2]; [1]Ctr. for Future Chemistry, Kyushu Univ., Japan, [2]JST-CREST, Japan, Presider

OWA1 • 8:00 a.m. Invited
Interfaces in Organic Electronic Devices: New Insights to Traditional Concepts, *S. T. Lee, C. S. Lee; City Univ. of Hong Kong, Hong Kong.* Interfaces in organic electronic devices are often analyzed with assumptions (1) vacuum level alignment and (2) negligible band bending at interfaces of organic materials. These assumptions are reassessed in the light of recent experimental results.

OWA2 • 8:30 a.m. Invited
Carrier Transport Properties in Organic Phosphorescent Emissive Layer and Their Application to Efficient Organic Phosphorescent Devices, *Changhee Lee[1], Heume-il Baek[1], Byung Doo Chin[2]; [1]Seoul Natl. Univ., Republic of Korea, [2]Korea Inst. of Science and Technology, Republic of Korea.* We studied electrical properties of OLEDs consisting of the emission layer doped with phosphorescent molecules. Different doping profile is necessary for better efficiency and lifetime due to different conduction properties of $Ir(ppy)_3$- and $btp_2Ir(acac)$-doped CBP.

8:30 a.m.–12:00 p.m. SWA • Joint FiO/LS Symposium: Optics and the Second "Magic Decade" of Quantum Mechanics, *Fairmont Hotel, Belevedere Room*
Joseph Eberly; Univ. of Rochester, USA, Symposium Organizer
See Page 14.

Frontiers in Optics

FWA • Ultrafast Dynamics of Biological and Chemical Systems I—Continued

FWA3 • 8:45 a.m. Invited

Excited State Dynamics in Single and Double-Stranded DNA Constructs: Ultrafast Formation of the Major Radiation Product in DNA, *Carlos E. Crespo-Hernández[1], Bern Kohler[2]; [1]Case Western Reserve Univ., USA, [2]Ohio State Univ., USA.* Using femtosecond transient and infrared spectroscopic techniques we show that vertical base stacking determines the fate of singlet-excited states in DNA and its major photodimer product is fully formed ~1 picosecond after ultraviolet excitation.

FWA4 • 9:15 a.m.

Naphthalene Bisimides on the Way to Opto-Electronic Devices, *Patrizia Krok[1], Stefan Lochbrunner[1], Alfred Blaszczyk[2], Marcel Mayor[2], Eberhard Riedle[1]; [1]Lehrstuhl für BioMolekulare Optik, Univ. of Munich, Germany, [2]Forschungszentrum Karlsruhe GmbH, Inst. for Nanotechnology, Germany.* Femtosecond spectroscopy reveals a picoscond electron transfer from the substituent onto the naphthalene bisimide chromophore. This process quenches the fluorescence and switches the conduction properties. The behavior strongly depends on details of the core-substitution.

FWB • High Power Fiber Lasers and Amplifiers—Continued

FWB3 • 8:45 a.m. Invited

High-Power Laser Development for mW to kW Applications, *Berthold Schmidt, Susanne Pawlik, Yvonne Manz, Karl-Heinz Gulden, Norbert Lichtenstein; Bookham Switzerland AG, Switzerland.* Developments in high power laser diodes have generated a tremendous bandwidth of new applications for a device domain that was preliminary designed for telecom. In this communication this trend is documented and results are presented.

FWB4 • 9:15 a.m.

Recent Developments on Coupled Fiber Lasers, *Moti Fridman, Vardit Eckhouse, Nir Davidson, Asher A. Friesem; Weizmann Inst. of Science, Israel.* Recent developments on the effect of coupling strength when coherently adding fiber lasers are presented. Analytical, numerical and experimental results reveal that coupling strength can be substantially reduced by choosing the proper configuration.

FWC • Complex Light Fields—Continued

FWC4 • 8:45 a.m.

Electromagnetic Momentum in a Dielectric, *Michael E. Crenshaw, Thomas B. Bahder; US Army RDECOM, USA.* A new momentum of the electromagnetic field in a dielectric is derived directly from the Fresnel relations. The new momentum is linear in the electric field and we compare it with other momentum-like electromagnetic quantities.

FWC5 • 9:00 a.m.

Electromagnetic Modified Bessel-Gauss Beams and Waves, *S. R. Seshadri; Unaffiliated, USA.* Cylindrically symmetric transverse magnetic modified Bessel-Gauss beams and waves are treated. The rate of spreading of these waves on propagation reduces and approaches that of the Bessel waves as the beam shape parameter is increased.

FWC6 • 9:15 a.m.

Fields with Maximum Focal Irradiance, *Nicole J. Moore[1], Miguel A. Alonso[1], Colin J. R. Sheppard[2]; [1]Univ. of Rochester, USA, [2]Natl. Univ. of Singapore, Singapore.* Upper bounds on the focal irradiance of monochromatic fields (both scalar and electromagnetic), given their input power and directional spread, are found analytically. The fields that achieve these bounds are also calculated.

FWD • Metamaterials I—Continued

FWD3 • 8:45 a.m.

Determination of Sign of Refractive Index of Active Media via Time-Domain Calculation, *Joseph B. Geddes III[1], Tom G. Mackay[2], Akhlesh Lakhtakia[3]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Univ. of Edinburgh, UK, [3]Pennsylvania State Univ., USA.* We show that the signs of the real and imaginary parts of the refractive index of a physically-realizable linear active medium can be unambiguously determined using a finite-difference calculation in the time domain.

FWD4 • 9:00 a.m.

Fabrication of Metamagnetics for Visible Wavelengths, *Hsiao-Kuan Yuan[1], Wenshan Cai[1], Uday K. Chettiar[1], Vashista De Silva[1], Alexander V. Kildishev[1], Alexandra Boltasseva[2], Vladimir P. Drachev[1], Vladimir M. Shalaev[1]; [1]Electrical and Computer Engineering Dept., Purdue Univ., USA, [2]COM.DTU Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark.* An improvement in the surface roughness of coupled silver nanostrips produces stronger magnetic response. We designed and experimentally demonstrated that improved coupled strips can provide controllable metamagnetism from 491 nm to 754 nm.

FWD5 • 9:15 a.m.

Diffusion Approximation for Disordered Photonic Crystals, *Lev I. Deych[1], Mikhail Erementchouk[2], Alexander A. Lisyansky[1], Hui Cao[3]; [1]Dept. of Physics, Queens College, USA, [2]NanoScience Technology Ctr., Univ. of Central Florida, USA, [3]Dept. of Physics and Astronomy, Northwestern Univ., USA.* We develop a theoretical framework for description of diffusive radiative transport in disordered photonic crystals. We define an inhomogeneous equilibrium distribution of light intensity inside photonic crystals and derive the static limit of diffusion equation.

FWE • Clinical and Preclinical Imaging and Therapeutics—Continued

FWE3 • 8:45 a.m. Invited

Nanobiophotonics and Nanoclinics for Multimodal Imaging and Targeted Therapy, *Paras N. Prasad; State Univ. of New York at Buffalo, USA.* This talk will highlight major activities and challenges in emerging nanobiophotonics created by fusion of photonics, nanotechnology and biotechnology. Nanoclinic, a multifunctional nanoparticle platform, provides opportunities for multimodal optical imaging and light controlled targeted therapy.

FWE4 • 9:15 a.m.

GDx-MM: An Imaging Mueller Matrix Retinal Polarimeter, *Karen Twietmeyer[1], Russell Chipman[1], Ann Elsner[2]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]School of Optometry, Indiana Univ., USA.* An imaging polarimeter capable of measuring a complete Mueller matrix of the retina has been designed, built, calibrated, validated, and used on human subjects. Retardance, diattenuation, and depolarization images of normal retinas are presented.

FWF • Light-Confining Micro- and Nano-Structures—Continued

FWF3 • 9:00 a.m. Invited

Nonlinear Interactions in Nanowaveguides, *Alexander Gaeta; Cornell Univ., USA.* We demonstrate that nonlinear optical processes can be greatly enhanced by exploiting the ability to dramatically tailor the dispersion of waveguides whose cross-section is sub-wavelength in scale.

LWA • Cavity Ringdown Spectroscopy I—Continued

LWA2 • 8:45 a.m. Invited

Cavity Enhanced Spectroscopy with Novel Near- and Mid-Infrared Laser Sources, *J. B. Paul, Jim Scherer; NovaWave Technologies, USA.* Recent advances in cavity enhanced spectroscopy are presented, including results obtained with a rapidly scanned fiber laser at 1 micron, results at 2.23 microns using diode lasers, and results at 3.3 microns using difference-frequency generation.

LWA3 • 9:15 a.m. Invited

Recent Advances in Cavity Enhanced Spectroscopy, *Kevin K. Lehmann, Paul Johnston; Univ. of Virginia, USA.* Broad bandwidth cavity enhanced spectroscopy provides a way to measure a wide absorption spectrum in parallel with very high sensitivity. Recent work, by use and other, in the field will be reviewed.

JWA • Radiation Pressure, Cooling and Quantum Cantilevers I—Continued

JWA3 • 9:00 a.m. Invited

Sub-Kelvin Optical Cooling of a Micro-mechanical Resonator, *Dirk Bouwmeester; Univ. of California at Santa Barbara, USA.* Using radiation forces, we demonstrate cooling of the vibrational mode of a micro-mechanical resonator made to support a tiny mirror of a resonator. Optical cooling to 135 ± 15 mK from room temperature is demonstrated.

LWB • Time-Resolved Photoemission, Photoionization and Photodetachment I—Continued

LWB2 • 9:00 a.m. Invited

Tracking Photoionization and Photodetachment Processes in Liquid Water, *Stephen Bradforth; Univ. of Southern California, USA.* Deposition of several eVs of energy into aqueous solutions leads to electron ionization processes from the solute or water. Experiments tracking these processes from their precursor molecular states will be described.

OWA • Device Physics—Continued

OWA3 • 9:00 a.m.

Transient Electroluminescence and Transient Current Properties in Organic Light-Emitting Diodes, *Noriyuki Takada, Toshihide Kamata; Natl. Inst. of Advanced Industrial Science and Technology, Japan.* Transient electroluminescence and transient current from organic light-emitting diodes were investigated by driving the device with short voltage-pulses. We discuss the possible operating mechanisms from these transient behaviors after the voltage pulse was turn off.

OWA4 • 9:15 a.m.

Impedance Spectroscopy of Conductively Doped Organic Carrier-Transport Materials, *Chung-Chia Chen, Chung-Chih Wu; Graduate Inst. of Electro-Optical Engineering, Nationl Taiwan Univ., Taiwan.* We performed the impedance spectroscopy of the F_4-TCNQ-doped hole-transport layer. The difference in impedance spectra between undoped and doped materials were examined and the equivalent circuits were established with extracted parameters.

Frontiers in Optics

FWA • Ultrafast Dynamics of Biological and Chemical Systems I—Continued

FWA5 • 9:30 a.m. Invited

More Power to X-Rays: From Ultrafast Dynamics of Metal Complexes to Enhanced Damage to DNA, *Ting Guo, Joshua D. Carter, Neal N. Cheng, Yongquan Qu, Rhiannon Porter; Univ. of California at Davis, USA.* X-ray spectroscopy was used to investigate charge transfer and subsequent events such as structural rearrangement and radical generation in metal complexes including metal nanoparticles. Several new phenomena were observed and the accompanying mechanisms were investigated.

FWB • High Power Fiber Lasers and Amplifiers—Continued

FWB5 • 9:30 a.m.

Noise Figure of Gain Controlled EDFAs with Extended Dynamic Gain Range, *Júlio C. R. Oliveira[1], João B. Rosolem[1], Aldário C. Bordonalli[2]; [1]CPqD - Telecom & IT Solutions, Brazil, [2]Univ. of Campinas, Brazil.* Noise figure measurements for a newly proposed hybrid gain-controlled EDFA with extended dynamic gain range were conducted. They showed a performance comparable to that of equivalent (booster, in-line or pre-amplifier) commercial EDFAs without gain control.

FWB6 • 9:45 a.m.

Laser Transmitter at 518nm for Optical Undersea Communications Using Efficient Nonlinear Conversion of a Picosecond Fiber-Laser System at 1.56μm, *Pavel Polynkin[1], N. Peyghambarian[1], Jerome Moloney[1], Rostislav Roussev[2], M. M. Fejer[2]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]Edward L. Ginzton Lab, Stanford Univ., USA.* Viable laser transmitter for emerging optical undersea communications is reported. The high data-rate, picosecond fiber-laser system at 1.56μm is frequency-tripled into transparency window of seawater in cascade of two PPLN crystals operated at room temperature.

FWC • Complex Light Fields—Continued

FWC7 • 9:30 a.m.

Point Spread Function of Optical Systems with Asymmetric Apodization, *Keshavulu Goud Matta[1], Karuna Sagar Dasari[1], Komala Rajanala[2], Lacha Goud Sivagouni[2]; [1]Dept. of Physics, Nizam College, Osmania Univ., India, [2]Dept. of Physics, Univ. College of Science, Osmania Univ., India.* An asymmetric PSF has been obtained with 'good' and 'bad' sides. The asymmetry has been found to increase with the width of the edge-strips and is seen to decrease with an increased central region apodization.

FWC8 • 9:45 a.m.

Adaptation to the Edge of Chaos in a Self-Starting Soft-Aperture Kerr-Lens Mode-Locked Laser, *Wen-Feng Hsieh, Chih-Chang Hsu, Ja-Hong Lin; Dept. of Photonics, Natl. Chiao Tung Univ., Taiwan.* We experimentally and numerically demonstrate that the Kerr coefficient acts as a slow-varying control parameter for self-starting Kerr-lens mode-locking lasers that suppresses the chaotic state after transient relaxation to a stable mode-locking state.

FWD • Metamaterials I—Continued

FWD6 • 9:30 a.m.

Modeling the Propagation of Optical Beams in Three-Dimensional Photonic Crystals, *Majid Badieirostami, Babak Momeni, Ali Adibi; Georgia Tech, USA.* We show that the propagation of optical beams inside three-dimensional photonic crystals can be efficiently described by an approximate scalar diffraction model. Using this model, we discuss some unique diffractive phenomena inside the PC structures.

FWD7 • 9:45 a.m.

Spontaneous Decay and Superradiance in a Two-Dimensional Resonance Photonic Crystal, *Igor V. Mel'nikov[1,2], Joseph W. Haus[3], A. N. Knigavko[2,4]; [1]Optolink Ltd., Russian Federation, [2]High Q Labs, Inc., Canada, [3]Univ. of Dayton, USA, [4]Brock Univ., Canada.* The phase synchronization across a 2-D resonance photonic crystal with lateral confinement of the radiation is predicted. This builds up an emission anisotropy and excitation transfer along the Bragg planes along with pronounced excitation localization.

FWE • Clinical and Preclinical Imaging and Therapeutics—Continued

FWE5 • 9:30 a.m. Invited

Rapid Therapy Evaluation Using Chronic, Wide-Field Optical Imaging of Microvascular Blood Flow Dynamics, *Bernard Choi, Wangcun Jia, Jennifer Channual, Kristen M. Kelly, Justin Lotfi; Univ. of California at Irvine, USA.* We employ speckle imaging and window chamber models to study vascular remodeling processes after light-based therapies. Our data demonstrate that the response involves substantial remodeling over a monitoring period of up to 30 days post-intervention.

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

10:00 a.m.–4:00 p.m., Exhibit Hall Open

Hillsborough	Sacramento	Piedmont	Glen Ellen	Atherton
Frontiers in Optics	**Laser Science**	**Joint**	**Laser Science**	**OMD**

FWF • Light-Confining Micro- and Nano-Structures—Continued

FWF4 • 9:30 a.m.
Tunable Beam Diffraction in Infiltrated Microstructured Fibers, *Christian R. Rosberg[1], Francis H. Bennet[1], Dragomir N. Neshev[1], Andrey A. Sukhorukov[1], Wieslaw Krolikowski[1], Yuri S. Kivshar[1], Per D. Rasmussen[2], Ole Bang[2], Anders Bjarklev[2]; [1]Australian Natl. Univ., Australia, [2]Technical Univ. of Denmark, Denmark.* We introduce a new platform for studying spatial nonlinear effects in periodic photonic structures based on microstructured optical fibers infiltrated with high-index nonlinear liquids. Tunable beam diffraction is demonstrated experimentally in a two-dimensional photonic lattice.

FWF5 • 9:45 a.m.
Observation of Surface Soliton Arrays at the Edge of a Two-Dimensional Photonic Lattice, *Alex Samodurov, Xiaosheng Wang, Cibo Lou, Zhigang Chen[1,2]; [1]San Francisco State Univ., USA, [2]Nankai Univ., China.* We report the first observation of surface soliton arrays at the edge of a semi-infinite optically-induced photonic lattice with both self-focusing and self-defocusing nonlinearity. Experimental results are corroborated by numerical simulations.

LWA • Cavity Ringdown Spectroscopy I—Continued

LWA4 • 9:45 a.m.
Multi-Species Gas Detection and Precise Line Area Measurements Using CRDS and a High-Precision Wavemeter, *Bruce A. Richman, Chris W. Rella, Sze Tan; Picarro, Inc., USA.* We demonstrate precise measurement of absorption line width made possible with a high-precision wavelength monitor, enabling the determination of species concentration from the line area. We also demonstrate simultaneous measurement of multiple species concentrations.

JWA • Radiation Pressure, Cooling and Quantum Cantilevers I—Continued

JWA4 • 9:30 a.m. Invited
Toward the Quantum Ground State of a Gram-Scale Object, *Nergis Mavalvala[1], Thomas Corbitt[1], Christopher Wipf[1], Timothy Bodiya[1], David Ottaway[1], Nicolas Smith[1], Yanbei Chen[2], Helge Müller-Ebhardt[2], Henning Rehbein[2], Daniel Sigg[3], Stanley Whitcomb[4]; [1]LIGO Lab, MIT, USA, [2]Max-Planck-Inst. für Gravitationsphysik, Germany, [3]LIGO Hanford Observatory, USA, [4]LIGO Lab, Caltech, USA.* We describe an experiment in which coupling between intense optical fields and mirror oscillators is used for generating squeezed states of light, and also for optically cooling a gram-scale mirror oscillator.

LWB • Time-Resolved Photoemission, Photoionization and Photodetachment I—Continued

LWB3 • 9:30 a.m. Invited
Photodetachment of OH^- and NO_2^- in Water, *Christian Petersen, Jan Thøgersen, Svend Knak Jensen, Søren Keiding; Aarhus Univ., Denmark.* Using wideband femtosecond absorption spectroscopy, from 1000-50000 cm^{-1} we study the response of solute and solvent following photodetachment of small molecules in water. We discuss recent measurements and calculations on nitrite and hydroxide ions.

OWA • Device Physics—Continued

OWA5 • 9:30 a.m.
Novel Polymeric Light Emitting Diode Having Conjugation Length Control Moiety, *Minyoung Choi[1], Sangyup Song[2], Bing Chen[1], Michael R. Wang[1]; [1]Univ. of Miami, USA, [2]New Span Opto-Technology Inc., USA.* To control the emitting color, we designed new PPVs containing silicon and nitrogen atoms to act as the π-conjugation interrupt units. According to the monomer feeding ratios, the emitting light revealed from blue to red.

OWA6 • 9:45 a.m.
Analysis of Coherence Length of Organic Light Emitting Diodes, *Chih-Hung Tsai[1], Kun-Cheng Tien[1], Hao-Wu Lin[1], Chun-Liang Lin[1], Ming-Che Chen[2], Kuei-Ming Chang[2], Chung-Chih Wu[1]; [1]Dept. of Electrical Engineering, Graduate Inst. of Electro-Optical Engineering, and Graduate Inst. of Electronics Engineering, Natl. Taiwan Univ., Taiwan, [2]Taipei Municipal Jianguo High School, Taiwan.* The coherence lengths of organic light emitting diodes were measured using a Newton's Ring apparatus. The results show that the coherence lengths are about 3~10μm depending on the spectral width of the devices.

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

10:00 a.m.–4:00 p.m., Exhibit Hall Open

Frontiers in Optics

10:30 a.m.–12:00 p.m.
FWG • Ultrafast Pulse Measurements I
Franz X. Kaertner; MIT, USA, Presider

FWG1 • 10:30 a.m. Invited
Measuring Everything You've Always Wanted to Know about an Ultrashort Pulse but Thought Couldn't Be Done, *Rick Trebino, Pamela Bowlan, Pablo Gabolde; Georgia Tech, USA.* We present two techniques for measuring the complete spatio-temporal intensity and phase, E(x,y,z,t), of an ultrashort pulse, one in and near a focus and the other for a single pulse.

FWG2 • 11:00 a.m.
Spectral Phase Diagnostic for PETAL Laser: SPIRITED, *Jacques Luce, Claude Rouyer; CEA, France.* SPIRITED stands for a high-performance user-friendly concept related to Spectral Phase Interferometry Resolved In Time Extra Dimensional. It helps measure the output temporal shape of femto to picosecond lasers.

10:30 a.m.–12:00 p.m.
FWH • Diffractive Micro- and Nanostructures for Sensing and Information Processing I
Jurgen Jahns; Fern Univ., Germany, Presider

FWH1 • 10:30 a.m. Invited
Recent Advances in Scanning Holographic Microscopy, *Guy Indebetouw; Virginia Tech, USA.* The principles of scanning holography are reviewed. Results illustrating the capability of accessing different imaging modes (fluorescence, absorption, quantitative phase) are discussed, as well as the possibility of synthesizing unconventional point-spread functions.

FWH2 • 11:00 a.m.
An Ultra-High Resolution Volume Holographic Spectrometer, *Majid Badieirostami[1], Omid Momtahan[1], Chao Ray Hsieh[1], Ali Adibi[1], David J. Brady[2]; [1]Georgia Tech, USA, [2]Duke Univ., USA.* We have designed a compact spectrometer by cascading a simple Fabry-Perot etalon and a cylindrical beam volume hologram. Using this spectrometer, ultra-high resolution over a large bandwidth has been experimentally demonstrated for diffuse light sources.

10:30 a.m.–12:00 p.m.
FWI • Light Interaction with Engineered Materials
Presider to Be Announced

FWI1 • 10:30 a.m.
Three-Photon Absorption in Semiconductors, *Peter D. Olszak[1], Claudiu Cirloganu[1], Scott Webster[1], Lazaro A. Padilha[1], Milton Woodall[2], David J. Hagan[1], Eric W. Van Stryland[1]; [1]College of Optics and Photonics, CREOL and FPCE, Univ. of Central Florida, USA, [2]DRS Infrared Technologies, USA.* The bandgap and wavelength scaling of three-photon absorption is studied in several semiconductors by the Z-scan technique. The 3PA coefficient is found to vary as Eg^{-7} as predicted by theory.

FWI2 • 10:45 a.m.
Microscopic Observation of Photodoping Process in Ag/GeS_2 film, *Yasuyuki Sata[1], Moriaki Wakaki[1], Yoshihisa Murakami[2], Norihide Takeyama[3], Yoshikazu Kanai[3]; [1]Tokai Univ., Japan, [2]Tsukuba Univ. of Tech., Japan, [3]Genesia Corp., Japan.* The photodoping process of Ag atoms in a Ag/a-GeS_2 double layer film was studied through the microscopic processing and observation using a SEM, an AFM and a multi functional confocal laser scanning microscope.

FWI3 • 11:00 a.m.
Pulse Shaping of ns-Scale Pulses Using Modulation Instability, *Evgueni A. Kuzin[1], Jaime Gutiérrez-Gutiérrez[1], Migel Bello-Jiménez[1], Baldemar Ibarra-Escamilla[1], Ariel Flores-Rosas[1], Roberto Rojas-Laguna[2]; [1]INAOE, Mexico, [2]Univ. de Guanajuato, Mexico.* The pulses form DFB laser amplified to 1-50 W were launched to the fiber. MI side lobs were then filtered. Resulting wave form shows to be more squared with substantially reduced relaxation oscillation peak.

10:30 a.m.–12:00 p.m.
FWJ • Metamaterials II
Hui Cao; Northwestern Univ., USA, Presider

FWJ1 • 10:30 a.m. Invited
Progress in Negative Phase Metamaterials, *Allan D. Boardman[1], Neil King[1], Ortwin Hess[2], Yuriy Rapoport[3]; [1]Univ. of Salford, UK, [2]Univ. of Surrey, UK, [3]Taras Shevchenko Kyiv Natl. Univ., Ukraine.* A review of the state-of-the-art of negative phase metamaterials is presented for which the phase velocity and group velocity form a backward wave mode. The scenarios embraced include loss, gain, solitons and slow light.

FWJ2 • 11:00 a.m.
Examination of Energy and Group Velocities in Positive and Negative Index Chiral Materials with and without Dispersion, *Monish R. Chatterjee, Partha P. Banerjee; Univ. of Dayton, USA.* Concepts of energy and group velocities, Poynting and propagation vectors are examined for both positive and negative index materials. Known definitions for these entities are explored in terms of the interplay of chirality and dispersion.

10:30 a.m.–12:00 p.m.
FWK • Optical Coherence Tomography
Paras N. Prasad, Sr.; SUNY at Buffalo, USA, Presider

FWK1 • 10:30 a.m. Invited
Intraoperative Optical Biopsy of Breast Cancer, *Adam M. Zysk, Stephen A. Boppart; Beckman Inst., Univ. of Illinois at Urbana-Champaign, USA.* Optical coherence tomography (OCT) of breast tissue yields high-resolution optical biopsies that can be used to identify cancerous regions. We present intraoperative OCT studies of surgical margin scanning and biopsy needle guidance.

FWK2 • 11:00 a.m.
Time-Gated Fourier Domain Optical Coherence Tomography, *Matthew S. Muller, Paul J. L. Webster, James M. Fraser; Queen's Univ., Canada.* A novel OCT system is presented that combines FDOCT with ultra-fast time-gating. By processing backscattered light in the optical domain, the user can select a limited field of view for improved contrast and acquisition speed.

Hillsborough

Frontiers in Optics

10:30 a.m.–12:00 p.m.
FWL • Spectral Imaging and Holographic Storage
Presider to Be Announced

FWL1 • 10:30 a.m.
Estimation of Object Spectral Content Using Phase Diversity, *Matthew R. Bolcar, James R. Fienup; Inst. of Optics, Univ. of Rochester, USA.* We present a method of estimating object spectral content using phase diversity with a grey-world assumption. Operation of a multi-aperture system is simulated, using sub-aperture piston phase diversity.

FWL2 • 10:45 a.m.
Adaptive Spectroscopy, *Michael E. Gehm, Joseph M. Kinast; Univ. of Arizona, USA.* We report on our theoretical and experimental investigations of adaptive spectroscopy—the introduction of active filters into spectrometer design. Simulations indicate these systems can achieve sensor performance beyond that of traditional approaches.

FWL3 • 11:00 a.m.
Spectral Imaging System with Spectral Zooming Capability, *Bing Chen[1], Jame J. Yang[2], Zhiqiang Liu[1], Michael R. Wang[1]; [1]Univ. of Miami, USA, [2]New Span Opto-Technology Inc., USA.* We report a new spectral imaging system with spectral zooming capability based on the Fourier spatial filter principle. It is suitable for real-time application. The imaging results and spectral resolution is presented.

Sacramento

Laser Science

10:30 a.m.–12:00 p.m.
LWC • Cavity Ringdown Spectroscopy II
Frank Keutsch; Univ. of Wisconsin at Madison, USA, Presider

LWC1 • 10:30 a.m. Invited
Polarization Resolved Cavity Ring-Down Spectroscopy as a Probe of Intrinsic Optical Anistropies, *Patrick H. Vaccaro; Yale Univ., USA.* The ultrasensitive technique of Cavity Ring-Down Polarimetry (CRDP) will be discussed, with emphasis placed upon the extraction of molecular chiroptical properties in rarefied environments and the optical measurement of linear retardation with high intrinsic precision.

LWC2 • 11:00 a.m. Invited
Ultrasensitive Spectroscopy of Liquid Samples in Sub-Nanoliter Volumes, *Alexander A. Kachanov[1,2], Richard N. Zare[2]; [1]Skymoon Res. and Development, USA, [2]Stanford Univ., USA.* Cavity ringdown spectroscopy, cavity-enhanced spectroscopy, and thermal lensing are compared as UV-Vis detectors for high performance liquid chromatography and capillary electrophoresis separations. Thermal lensing shows the best performance, yielding sub-nanomolar detection limits.

Piedmont

Joint

10:30 a.m.–12:00 p.m.
JWB • Radiation Pressure, Cooling and Quantum Cantilevers II
Presider to Be Announced

JWB1 • 10:30 a.m. Invited
Cooling of a Micro-Mechanical Oscillator Using Radiation Pressure Induced Dynamical Back-Action, *A. Schliesser[1], N. Nooshi[1], P. Del'Haye[1], K. Vahala[2], Tobias J. Kippenberg[1]; [1]Max Planck Inst. of Quantum Optics, Germany, [2]Dept. of Applied Physics, Caltech, USA.* We demonstrate how dynamical backaction of radiation pressure can be exploited for passive laser-cooling of high-frequency (>50 MHz) mechanical oscillation modes of ultra-high-finesse optical microcavities from room temperature to below 10 K.

JWB2 • 11:00 a.m.
Opto-Mechanical Modal Spectroscopy of a Micron-Scale On-Chip Resonator at >1GHz Frequency, *Tal Carmon, Kerry J. Vahala; Caltech, USA.* >1GHz optically-induced vibrations are demonstrated in an on-chip micron-scaled device in which radiation pressure of a (CW) optical input pushes the structure to mechanically oscillate. Many mechanical eigen-modes are investigated.

Glen Ellen

Laser Science

10:30 a.m.–12:00 p.m.
LWD • Time-Resolved Photoemission, Photoionization and Photodetachment II
Christoph Rose-Petruck; Brown Univ., USA, Presider

LWD1 • 10:30 a.m. Invited
Spin- and Time-Resolved Two Photon Photoemission, *Martin Aeschlimann; Univ. of Kaiserslautern, Germany.* The temporal evolution of the energy, momentum and spin behavior of excited electrons in metals and inorganic and organic semiconductors has been investigated by means of femtosecond time- and spin-resolved photoemission spectroscopy (TR-2PPE).

LWD2 • 11:00 a.m. Invited
Adaptive Sub-Wavelength Control of Nano-Optical Fields, *Walter Pfeiffer[1], Martin Aeschlimann[2], Michael Bauer[3], Tobias Brixner[4], Javier Garcia de Abajo[5]; [1]Univ. of Bielefeld, Germany, [2]Univ. of Kaiserslautern, Germany, [3]Univ. of Kiel, Germany, [4]Univ. of Wuerzburg, Germany, [5]Inst. de Optica, Spain.* We show experimentally that optimally polarization-shaped femtosecond laser pulses provide spatial control over electron photoemission from nanostructures. Emission patterns are manipulated with subdiffraction resolution, illustrating the potential of electric near-field control in nanophotonics.

Atherton

OMD

10:30 a.m.–12:15 p.m.
OWB • Solution-Processed Organic Electronic Devices
Chihaya Adachi[1,2]; [1]Ctr. for Future Chemistry, Kyushu Univ., Japan, [2]JST-CREST, Japan, Presider

OWB1 • 10:30 a.m. Invited
Printed Cathode from Conducting Ag-Paste for Realization of All-Printable Polymer Light-Emitting Diodes, *Yong Cao, Wenjin Zeng, Chi Zhang, Fei Huang, Hongbin Wu; Inst. of Polymer Optoelectronic Materials and Devices, South China Univ. of Technology, China.* Bilayer cathode consisted from cationic conjugated polyelectrolyte and Ag-conducting paste printed on top of RGB active polymers without thermal deposition has been developed for realization of all printable roll-to-roll polymer light-emitting devices and displays.

OWB2 • 11:00 a.m. Invited
Solution Processed Organic Solar Cells with High Open Circuit Voltages Approaching 1.3 V, *Thomas Kietzke[1,2], Lawrence Dunn[1,3], Richard Yee Cheong Shin[1], Teck Lip Tam[1], Zhi Kuan Chen[1], Ananth Dodabalapur[1,3], Alan Sellinger[1]; [1]Inst. of Materials Res. and Engineering, Singapore, [2]Univ. of Potsdam, Germany, [3]Univ. of Texas at Austin, USA.* Novel electron accepting materials based on 2-vinyl-4,5-dicyanoimidazoles (DCI) are blended with donor polymers to prepare efficient organic solar cells reaching external quantum efficiencies of 25% and open circuit voltages up to 1.3 V.

FWG • Ultrafast Pulse Measurements I—Continued

FWG3 • 11:15 a.m.
Two-Dimensional Spectral Interferometry, a Versatile, Linear Method for Real-Time Beam Characterization, *Thomas A. Planchon, Wafa Amir, Colby J. Childress, Charles G. Durfee, Jeffrey A. Squier; Colorado School of Mines, USA.* Two-dimensional spectral interferometry is a linear, real-time method for spatio-temporal beam characterization. It is used here to measure the spatio-temporal structures induced by a 2-D pulse shaper and to enhance a time-resolved spatial phase measurement.

FWG4 • 11:30 a.m.
Comparative Appraisement of PM Sagnac Loops for High-Performance All-Optical Gating at 1053-1064nm, *Alain Jolly, Céline Granier, Jean François Gleyze; CEA, France.* We present a variety of non-linear Sagnac loops to perform high-performance optical gating at 1053-1064nm. Temporal resolutions and optical contrasts are demonstrated, from standard and microstructured fibers, in the ranges 500fs - 3ps and 30dB.

FWG5 • 11:45 a.m.
***In situ* Single Shot Peak Intensity Calibration of Multi-Joule Ultra-Intense Laser Focus,** *Enam Chowdhury[1], Anthony Link[1], Dustin Offermann[1], Linn Van Woerkom[1], Richard Freeman[1], Patrick Rambo[2], Jens Schwarz[2], Matthias Geissel[2], Eric Brambrink[2], Aaron Edens[2], Briggs Atherton[2], John Porter[2]; [1]Ohio State Univ., USA, [2]Sandia Natl. Labs, USA. In situ* single shot peak intensity has been calibrated to be 1.25×10^{17} Wcm^{-2}/J energy at the ultra-intense focus of a multi-joule laser pulse using optical field ionization of high charge states of inert gases.

FWH • Diffractive Micro- and Nanostructures for Sensing and Information Processing I—Continued

FWH3 • 11:15 a.m.
Active Slow-Light Rotation Sensor, *Jacob Scheuer, Ben Z. Steinberg; Tel Aviv Univ., Israel.* We study the eigen-modes and frequency splitting of circular coupled laser array in a rotating framework for ultra-sensitive integrated optical rotation sensing applications. Frequency and coupling variations are found to be the main sensitivity limiters.

FWH4 • 11:30 a.m.
Integrated Micro-Opto-Fluidic Systems for Optical Manipulation of Cell Cultures, *Stefan Sinzinger, Martin Amberg, Andreas Oeder, Daniel Hein; Technische Univ. Ilmenau, Germany.* Microfluidic systems have a large variety of applications in biomedicine and life sciences. The goal of the reseach is to develop integrated optofluidic microsystems which combine the microfluidic channels and parts of the optical functionality.

FWH5 • 11:45 a.m.
Using a Fabry-Perot to Reduce Distortion in a Gain-Based Delay System, *Myungjun Lee, Ravi Pant, Michael D. Stenner, Mark A. Neifeld; Univ. of Arizona, USA.* We present a technique for simultaneously increasing the gain-based slow light pulse delay and reducing the distortion by combining a Lorentzian gain line system and a component Fabry-Perot (FP).

FWI • Light Interaction with Engineered Materials—Continued

FWI4 • 11:15 a.m.
Observation of Superluminal of Light Propagation in Doped Phthalocyanine with PMMA Glass, *Yundong Zhang, Qiuyun Ouyang, Hao Wang, Nan Wang, He Tian, Wei Qiu, Ping Yuan; Harbin Inst. of Technology, China.* We observed the superluminal of light propagation by population oscillation technique in doped Phthalocyanine with polypropyl methacrylate (PMMA) glass. The maximum time advancement was 10.43ms, corresponding group velocity was -0.19m/s.

FWI5 • 11:30 a.m.
Enhanced Bandwidth Optical Parametric Amplifier Using Bragg Reflection Waveguide, *Ritwick Das, Krishna Thyagarajan; Indian Inst. of Technology, Delhi, India.* A novel design for optical parametric amplification using quasi-phase matching in Bragg reflection waveguide is proposed. The unique dispersion characteristics exhibited by Bragg reflection waveguides are exploited for enhancing the bandwidth with appreciable efficiency.

FWI6 • 11:45 a.m.
Sol-Gel Synthesis and Characterization of Ag, Au Nanoparticles in ZrO_2 Thin Films, *Eisuke Yokoyama, Yusuke Moriyama, Hironobu Sakata, Moriaki Wakaki; Tokai Univ., Japan.* ZrO_2 thin films containing silver and gold nanoparticles were prepared using the sol-gel and dip coating methods. The physical properties of the films were studied as the basic materials for the plasmonic devices.

FWJ • Metamaterials II—Continued

FWJ3 • 11:15 a.m.
Metal-Dielectric Composites with Dissipative and Active Components, *Sergey Sukhov[1,2], Sergey Moiseev[2], Aristide Dogariu[1]; [1]College of Optics and Photonics, CREOL, Univ. of Central Florida, USA, [2]Inst. of Radio Engineering and Electronics of RAS, Russian Federation.* We consider optical properties of metal-dielectric composites with active laser medium as one of components. Using exact electrodynamical calculations, we investigate the behavior of amplification coefficient necessary to compensate the absorption at metallic inclusions.

FWJ4 • 11:30 a.m.
Compensating Losses in Doped Negative-Index Metamaterials via Four-Wave Mixing and Quantum Control, *Alexander K. Popov[1], Sergey A. Myslivets[2], Thomas F. George[3], Vladimir M. Shalaev[4]; [1]Univ. of Wisconsin at Stevens Point, USA, [2]Inst. of Physics of Russian Acad. of Sciences, Russian Federation, [3]Univ. of Missouri at St. Louis, USA, [4]Purdue Univ., USA.* Switching from absorption to amplification and narrowband filtering are shown possible in doped solids based on parametric amplification and quantum interference. The results are discussed in the context of compensation of losses in negative-index metamaterials.

FWJ5 • 11:45 a.m.
Elongation of the Surface Plasmon Polariton Propagation Length without Gain, *G. Zhu[1], M. F. Mayy[1], V. A. Podolskiy[2], V. I. Gavrilenko[1], M. A. Noginov[1]; [1]Norfolk State Univ., USA, [2]Oregon State Univ., USA.* We have demonstrated that the presence of dye in an adjacent dielectric can elongate the propagation length of a surface plasmon polariton even without optical gain.

FWK • Optical Coherence Tomography—Continued

FWK3 • 11:15 a.m.
Evaluation of Blood Vessel Mimic Development with Optical Coherence Tomography, *Garret T. Bonnema, Kristen O. Cardinal, Stuart K. Williams, Jennifer K. Barton; Univ. of Arizona, USA.* An endoscope for optical coherence tomography was developed to acquire cross-sectional images of tissue engineered blood vessels. This device was used to examine how the scaffold material affects the development of the cellular lining.

FWK4 • 11:30 a.m.
Full Range Complex Ultrahigh Resolution Fourier Domain Optical Coherence Tomography, *Prabakar Puvanathasan, Kostadinka K. Bizheva; Dept. of Physics and Astronomy, Univ. of Waterloo, Canada.* A full-range ultrahigh resolution Fourier domain optical coherence tomography system based on fiberoptic frequency shifters, with axial resolution of 1.6 µm and dynamic range of 117dB is presented and used to image in-vivo biological tissue.

FWK5 • 11:45 a.m.
Mid-Infrared Spectroscopy Optical Coherence Tomography, *Kazuhiro Gesho, Ichirou Ishimaru, Kazuya Yamamoto, Masahiro Kondo, Takaki Harada; Kagawa Univ., Japan.* We describe spectroscopic optical coherence tomography in the mid-infrared region as a method for separating and analyzing biological molecules. Such auto-correlation interferometry is capable of obtaining broadband spectra using low spatial coherence light.

FWL • Spectral Imaging and Holographic Storage—Continued

FWL4 • 11:15 a.m.
Low-Density Permutation Codes for Optical and Digital Holographic Data Storage, *Sergei S. Orlov[1], Kirill V. Shcheglov[2], Hongtao Liu[3], Snejana I. Abarji[2]; [1]Stanford Univ., USA, [2]NASA JPL, USA, [3]Illinois Inst. of Technology, USA.* We present new class of modulation codes based on permutation coding which satisfy channel coding constraint suitable for holographic and optical data storage, and simultaneously have strong error correction capability and high code rate efficiency.

FWL5 • 11:30 a.m.
In-Line Digital Holographic Microscopy with Improved Phase Reconstruction, *Anith Nelleri, Joby Joseph, Kehar Singh; Indian Inst. of Technology, Delhi, India.* A plane wave instead of spherical reference wave, and spectral method to avoid quadratic phase sampling are used in the reconstruction process of an in-line digital holographic microscopy. This results in non-erroneous phase reconstruction.

FWL6 • 11:45 a.m.
Angular Directivity of Diffracted Wave in Bragg-Mismatched Readout of Volume Holographic Gratings, *Alexander Heifetz, John T. Shen, Shih C. Tseng, Gour S. Pati, Jong-Kwon Lee, Selim M. Shahriar; Northwestern Univ., USA.* We investigated angular directivity of a diffracted beam in a shift-invariant holographic correlator. We showed that the experimental results agree well with our theoretical model, while the prediction of coupled wave model is incorrect.

LWC • Cavity Ringdown Spectroscopy II—Continued

LWC3 • 11:30 a.m. Invited
Nano-Scale Spectroscopy with an Ultra-High-Q Monolithic Optical Resonator, *Andrew Pipino, I. M. P. Aarts, W. M. M. Kessels, M. C. M. van de Sanden; Eindhoven Univ. of Technology, Netherlands.* A unique and challenging new direction in spectroscopy is realized by using an ultra-low-loss monolithic optical resonator to probe monolayers, thin films, and nano-scale materials. Achievements, optical designs, and future challenges will be discussed.

JWB • Radiation Pressure, Cooling and Quantum Cantilevers II—Continued

JWB3 • 11:15 a.m.
Chaotic Opto-Mechanical Quivering of Micron-Scaled On-Chip Resonators Excited by Radiation Pressure, *Tal Carmon, Michael C. Cross, Kerry J. Vahala; Caltech, USA.* Opto-mechanical vibration of an on-chip oscillator is experimentally excited by radiation-pressure nonlinearity to a regime where oscillation is chaotic. Period-doubling and broad power spectra are measured in spherical- and toroidal-resonators.

JWB4 • 11:30 a.m.
Signature of Noise Mechanisms in the Linewidth of Self-Sustained Optomechanical Oscillations, *Mani Hossein-Zadeh, Hossein Rokhsari, Kerry J. Vahala; Caltech, USA.* We study the linewidth-noise relation in a self-sustained radiation-pressure-driven optomechanical oscillator. The experimental outcomes demonstrate that at room temperature Brownian noise is the dominant noise mechanism in this oscillator.

LWD • Time-Resolved Photoemission, Photoionization and Photodetachment II—Continued

LWD3 • 11:30 a.m. Invited
Time Resolved Photoemission of Correlated Electron Materials, *Martin Wolf, Luca Perfetti, Panos Loukakos, Martin Lisowski, Ewe Boversiepen; Freie Univ. Berlin, Germany.* Using femtosecond time-resolved photoemission from solids we study the mechanism of the laser-driven ultrafast insulator to metal transition in the Mott insulator TaS_2 and the dynamics of electron-phonon coupling in high-Tc superconductors.

OWB • Solution-Processed Organic Electronic Devices—Continued

OWB3 • 11:30 a.m.
Fabrication of Organic Opto-Electronic Device Structures by Resonant Infrared Pulsed-Laser Deposition, *Hee K. Park[1], Stephen L. Johnson[2], Richard F. Haglund[2]; [1]AppliFlex LLC, USA, [2]Vanderbilt Univ., USA.* We demonstrate a novel route to room-temperature, vacuum-compatible deposition of simple opto-electronic devices, such as small-molecule and polymer light-emitting diodes and multilayer structures containing inorganic quantum dots, using resonant infrared laser ablation.

OWB4 • 11:45 a.m.
Self-Assembled Fibers of a Discotic Liquid Crystal, *Kenneth D. Singer, Volodimyr Duzhko; Case Western Reserve Univ., USA.* We report on the controlled self-assembly of phthalocyanine-based discotic molecules into molecular fibers in organic solvents and on the fabrication of one-dimensional donor-acceptor blends.

OWB5 • 12:00 p.m.
Water-Soluble and Ambient-Stable Au@MWNTs Nanohybrids by *in situ* Fabrication in Solution, *Hongzheng Chen, Renjia Zhou, Minmin Shi, Mang Wang; Zhejiang Univ., China.* Water-soluble and ambient-stable Au@MWNTs hybrids with high-density and well-distributed Au nanoparticles were obtained assisted by organic optoelectronic active molecules as an interlinker via a facile *in situ* fabrication method in solution.

12:00 p.m.–1:30 p.m.
JWC • Joint FiO/LS Poster Session II

Optical Sciences Posters

JWC1
Optical Fiber Sensor with a Sol-gel Deposited TiO_2 Sensing Film for Volatile Organic Compounds Detection, *Severino Muñoz-Aguirre, Carlos Martínez-Hipatl, José Ramos-Méndez, Juan Castillo-Mixcóatl, Georgina Beltrán-Pérez, Rodolfo Palomino-Merino; Benemerita Univ. Autonoma de Puebla, Mexico.* An optical-fiber gas sensor was developed depositing a TiO_2-film doped with organic dyes by sol-gel. The light intensity change by interaction with volatile organic compounds (VOC) was measured. There are shown results for ethanol detection.

JWC2
Series of Corrections to Far-Field Estimates, *Miguel A. Alonso[1], Riccardo Borghi[2]; [1]Univ. of Rochester, USA, [2]Univ. Roma Tre, Italy.* The complete series of corrections to far-field estimates (e.g. the Fraunhofer formula) is derived for scalar and electromagnetic monochromatic fields in free space. The series' convergence depends on the smoothness of the angular spectrum.

JWC3
Influence of Process Conditions on the Optical Properties HfO_2/SiO_2 Thin Films for High Power Laser Coatings, *Kuo-Jui Hsiao[1], Jose M. Blanco Rodriguez[1], Jesse T. Jensen[1], Dinesh Patel[1], Dave Alessi[2], Eduardo Granados Mateo[1], Yong Wang[1], Jorge J. Rocca[1], Carmen S. Menoni[1], Peter Langston[2], Albert Ogloza[2]; [1]Dept. of Electrical and Computer Engineering, Colorado State Univ., USA, [2]Naval Air Warfare Ctr., USA.* The influence of process conditions on loss, refractive index, and laser induced damage threshold of HfO_2/SiO_2 thin films grown by ion beam assisted sputtering is investigated to realize films with losses less than 20 ppm.

JWC4
Spectroscopic Features of Visible Radiation from Femtosecond Laser Induced Plasma in a Planar Water Microjet, *M. Anija, Reji Philip; Raman Res. Inst., India.* Bremsstrahlung radiation, superposed characteristic emissions and spectral blue shifting are observed from femtosecond laser induced plasma in a planar water microjet. Characteristic emissions are not reported previously for aqueous plasmas excited by femtosecond laser.

JWC5
Photodetachment of Tribromocuprate(I) Anion: Observation of Vibrational Wave Packets, *Diana M. Suffern, Victor Lenchenkov, Stephen E. Bradforth; Univ. of Southern California, USA.* Electron photodetachment of the tribromocuprate(I) anion $CuBr_{32}$- in water is achieved by ultrafast pump-dispersed probe spectroscopy resulting in a transient absorption signal containing oscillatory features that correspond to the vibrational frequencies in the detached product.

JWC6
Modification of Directional Emission from a Deformed Microsphere by Surrounding Medium, *Scott Lacey; Franklin & Marshall College, USA.* Far field emission of a deformed glass microsphere is measured in two surrounding media. Dynamical eclipsing causes the emission pattern to exhibit qualitative differeneces when the spheroid is immersed in water rather than air.

JWC7
Resonance Thin-Film Filter for Polychromatic Light, *Nikolai I. Petrov; Istra, Russian Federation.* The frustrated-total-internal-reflection spatial-frequency filtering devices operating in a visible spectral range are designed. Spectral shapes of transmitted light are calculated for different refractive indices and thicknesses of layers.

JWC8
Measurement of Birefringence in Nonlinear Crystals by Interferometry, *Hee Joo Choi, Byeong Joo Kim, Hwan Hong Lim, Myoungsik Cha; Pusan Natl. Univ., Republic of Korea.* We present a method to estimate birefringence of wafer-type materials by using Michelson interferometry. The difference between the ordinary and extraordinary refractive indices of a $LiNbO_3$ wafer was determined to an accuracy of 10^{-3}.

JWC9
Chirped Pulse Adiabatic Passage in CARS, *Svetlana A. Malinovskaya; Dept. of Physics and Engineering Physics, Stevens Inst. of Technology, USA.* We use adiabatic passage control scheme implementing chirped femtosecond laser pulses to maximize coherence of Raman transitions in CARS. We investigate energy and phase relaxation as factors of quantum decoherence.

Optics in Biology and Medicine Posters

JWC10
Optically Corrected Diode Laser for Confocal Scanning Microscope, *Dmitry Rozhetskin, Suganda Jutamulia, Y. King Liu; Univ. of Northern California, USA.* We propose the use of optically corrected laser diode in the confocal scanning microscope. The resulted beam has no astigmatism and produces a round diffraction limited spot on a sample.

JWC11
Hybrid Ray Optics and Continuum Mechanics Modeling of Cell Deformation in the Optical Stretcher, *Andrew E. Ekpenyong, Michael G. Nichols; Creighton Univ., USA.* There is no direct method for measuring the optical pressures that stretch biological cells in the optical stretcher. A hybrid computational method has been developed to quantify the deformation of living cells.

JWC12
Optical Micromanipulation and Force Spectroscopy of Ultrasound Contrast Agent Microbubbles for Targeted Molecular Imaging, *Valeria Garbin[1], Marlies L. J. Overvelde[1], Benjamin Dollet[1], Dan Cojoc[2], Enrico Ferrari[2], Enzo Di Fabrizio[3], Nico de Jong[1], Detlef Lohse[1], Michel Versluis[1]; [1]Univ. of Twente, Netherlands, [2]Lab Nazionale TASC, Italy, [3]Univ. "Magna Graecia", Italy.* The conventional applications of optical tweezers (micromanipulation, force sensor) can be extended to low-index particles, to understand the dynamics of ultrasound contrast microbubbles for targeted molecular imaging.

JWC13
Speckle-Based Investigation of Light Propagation in Blood/Saline and Blood/Water Mixtures, *Dan P. Popescu[1], Mark D. Hewko[1], Jeri Friesen[1], Tarek Kashour[2], Michael G. Sowa[1]; [1]Natl. Res. Council of Canada, Canada, [2]St. Boniface General Hospital, Canada.* A weak correlation exists between hematocrit concentration and scattering coefficients obtained by applying various models to optical coherence tomography results. Meanwhile, speckle intensity scales with the hematocrit concentration and can provide complementary information.

JWC14
A Multi-Objective Genetic Approach for Optimal Control of Photo-Induced Processes, *Luigi Bonacina[1], Jérôme Extermann[1], Ariana Rondi[1], Véronique Boutou[2], Jean-Pierre Wolf[1]; [1]Univ. of Geneva, Switzerland, [2]LASIM, Univ. of Lyon 1, France.* We have applied a multi-objective genetic algorithm to the optimization of multiphoton excited fluorescence. Our study indicates the consistent advantages this method can offer to experiments based on adaptive shaping of femtosecond pulses.

JWC15
Infused Photonic Crystal Fibers for Protein Analysis, *Eric J. Page, Jenna Knowles; Univ. of San Diego, USA.* Light propagation through photonic crystal fibers infused with protein solutions was investigated. We concentrated on one protein and describe the light propagation properties at different protein concentrations and denatured states.

JWC16
Paper withdrawn.

JWC17
Dual-Wavelength NIR/SWIR Vein Imaging, *Herbert D. Zeman, Gunnar Lovhoiden, Soujanya Ganesh; Luminetx Corp., USA.* The Luminetx VeinViewer uses polarized NIR light to view veins and reduce the visibility of the skin. Skin visibility can be reduced further by combining two images, one with NIR and one with SWIR light.

JWC18
Numerical Simulations of the Chromatic Aberration and the Chromatic Optical Performance of Pseudophakic Eyes, *Huawei Zhao; Advanced Medical Optics, Inc., USA.* Numerical simulations of the chromatic aberration and its effects on the optical performance of pseudophakic eyes in white light are presented using chromatic optical path difference equations with spherical-aberration-correcting aspherical IOLs.

JWC19
Analysis of Human and Chimpanzee Sperm Swimming Speed in Laser Trapping Experiments, *James S. Tam, Jaclyn M. Nascimento, Linda Z. Shi, Michael W. Berns; Univ. of California at San Diego, USA.* This study compares the velocity distribution of the sperm subpopulation analyzed in laser trapping experiments with that of the entire sperm population. The distributions are found equal for human sperm, yet unequal for chimpanzee sperm.

JWC20
Visualization of Birefringence in Tissue by Conventional Optical Coherence Tomography, *Yinqi Feng[1], Zheng Chang[2]; [1]Beijing Inst. of Petrochemical Technology, Opto-Mechatronic, China, [2]Beijing Inst. of Petrochemical Technology, Dept. of Mechanical Engineering, China.* Changes of cartilage properties with dehydration, mechanical and chemical actions are presented and analyzed. The layer structures of cartilage tissues on COCT images provide birefringence information resulting primarily from tissues' linear or fibrous structures.

JWC21
Influence of the Pi-Electrons Distribution on the Magnetooptical Activity Stimulation in Some Aromatic Liquids, *Shukhrat Egamov; Samarkand State Univ., Uzbekistan.* Experimental results of Faraday rotation spectra in a range between 1.8 - 3.65 eV were obtained for H_2O, CCl_4, dimethilaniline, benzene, nitrobenzene, o-toluidine, o-anisidine, m-chloraniline and o-chloraniline. SCF MNDO/D calculations were chosen for evaluations.

JWC22
Fluorescent Tissue Transglutaminase Substrates for Tumor Boundary Imaging, *Chia-Pin Pan, Jeanne P. Haushalter, Khalid Amin, Zishan Haroon, Gregory W. Faris; SRI Intl., USA.* A novel strategy is developed to image tumor boundaries optically by crosslinking fluorescent tissue transglutaminase substrates with tumor tissues.

JWC • Joint FiO/LS Poster Session II—Continued

JWC23
Cell Tracking by Border-Optical Hybrid Model, *Miguel Torres-Cisneros[1], Gabriel Aviña-Cervantes[1], Olivier Debeir[2], Javier Sanchez-Mondragon[3]; [1]Univ. de Guanajuato, Mexico, [2]Univ. Libre Bruselas, Belgium, [3]INAOE, Mexico.* We propose an hybrid method (image processing and correlation) to obtain cells detection and cells migration tracking in order to analyze cells behaviors under different conditions.

Quantum Electronics Posters

JWC24
All-Optical Defect and Slow Light in a Superradiant Photonic Crystal, *Igor V. Mel'nikov[1,2]; [1]Optolink Ltd., Russian Federation, [2]High Q Labs, Inc., Canada.* An all-optical buildup control over a defect that mediates the light slowing, pinning, retrieval, and fusion is found in a resonance photonic crystal. The departures from the self-induced transparency are found and analyzed.

JWC25
Approaches to Modeling Photonic Crystal Based Structures, *Ivan Richter, Pavel Kwiecien, Milan Šiňor; Czech Technical Univ. in Prague, Czech Republic.* Photonic crystal based structures are numerically modeled using different approches. Both mode matching and finite difference time domain techniques are applied and compared on several interesting examples of PhC-structures, including PhC waveguides and cavities.

JWC26
Innovative Micro-Cavity Resonator Design Using Particle Swarm Optimization, *Jeremiah D. Brown[1], Eric G. Johnson[2]; [1]Univ. of Central Florida, College of Optics, USA, [2]Univ. of North Carolina at Charlotte, Ctr. for Optoelectronics, USA.* Particle swarm optimization is used to design innovative geometries of micro-cavity optical resonators with very high q-factors at desired resonances. The quality factor and resonant frequency of the cavity are evaluated using eigenmode analysis.

JWC27
Single-Layer Guided-Mode Resonance Polarizer, *Kyu J. Lee, Ronald LaComb, Robert Magnusson; Univ. of Connecticut, USA.* Optical characteristics of an e-beam patterned guided-mode resonance polarizer are presented. Parameters of the fabricated device are confirmed by AFM. Experimental spectral response of the polarizer agrees qualitatively with theory.

JWC28
Nonlinear Optical Properties of CdTe Using Pump-Probe X-Scan Technique, *Daniel Probst, Abdullatif Y. Hamad; Southern Illinois Univ. Edwardsville, USA.* Nonlinear refraction and two photon absorption coefficients of CdTe were determined using the newly developed x-scan technique. The experiments were performed using a 1.064 μm Nd:YAG laser with pulse duration of 11 ns.

JWC29
Synthesis and Characterization of Ag° Nanoparticles, *Miguel Torres-Cisneros[1], Celso Velásquez-Ordóñez[2], Javier Sánchez-Mondragon[3], Jesus Escobedo Alatorre[4], Daniel May-Arrioja[3], Francisco Arteaga[1]; [1]Univ. de Guanajuato, Mexico, [2]Univ. Autónoma Metropolitana, Mexico, [3]INAOE, Mexico, [4]Univ. Autonoma del Estado de Morelos, Mexico.* We report results of chemical synthesis for silver particles of 2-10 nm size obtained by reduction of Ag^{+}. The material morphology was examined by electron microscopy (TEM) and physical properties were studied by photoluminescence.

JWC30
Beam Energy Exchange Dependence on Grating Period in Bismut Silicate ($Bi1_2SiO_{20}$) with Optical Activity and Linear Birefringence under Strong Nonlinear Regime, *Fernando Magana[1], Isabel Casar[1], Jose Murillo[2], Rurik Farias[2], Arturo Zuñiga[3]; [1]Inst. de Física, Univ. Nacional Autónoma de Mexico, Mexico, [2]Ctr. de Investigación en Materiales Avanzados S.C., Mexico, [3]Escuela Superiorde Fisica y Matematicas, Inst. Politecnico Nacional, Mexico.* We calculated the energy exchange in BSO, considering different grating periods, optical activity, birefringence, absorption, polarization angle, nonlinear conditions and high dc fields. Large beam energy exchange may occur in spite of absorption.

JWC31
Stable Propagation of Bell Shaped and Vortex Solitons in a Quadratic-Cubic Tandem, *Erwin Martí-Panameño[1], Ángel Vergara Betancourt[1], Luz Gómez Pavón[2], David Iturbe Castillo[3]; [1]Benemerita Univ. Autonoma de Puebla, Mexico, [2]BUAP, Mexico, [3]Inst. Nacional de Astrofísica, Óptica y Electrónica, Mexico.* In this work, applying the numerical experiment techniques, we demonstrate the stable propagation of (2+1)D spatial solitons, as well as vortex solitons with spin 1 and 2 in a cubic-quadratic nonlinear optical tandem.

JWC32
Two-Photon Absorption Spectra of Salen Dye Complexes, *Ubaldo M. Neves[1], L. De Boni[1], Zhihong Ye[2], Xiu R. Bu[2], Cleber R. Mendonça[1]; [1]Univ. of São Paulo, Brazil, [2]Dept. of Chemistry and NASA Ctr. for High Performance Polymers and Composites, Clark Atlanta Univ., USA.* This work reports the degenerate (2PA) spectrum for a series of Salen complexes possessing two azo dye units. The 2PA properties of these molecules were found to be additive effect of chromophores.

JWC33
Pattern-Dependence Suppression in Multi-Section SOAs, *Claudio Crognale[1], Sante Saracino[2]; [1]Technolabs S.p.A., Italy, [2]Siemens S.p.A., Italy.* We numerically demonstrate how the optical gain pattern-dependence in long saturated SOAs working far from transparency can be suppressed with a proper management of the optical gain nonlinearities in a cascade of properly biased amplifiers.

JWC34
Fiber-Optic Hysteretic Quantizer for Analog-to-Digital Conversion, *Nazanin Hoghooghi, Sergio C. Granieri, Azad Siahmakoun; Rose-Hulman Inst. of Technology, USA.* An optical bistable device that exhibits hysteresis behavior is modeled and experimentally demonstrated. This device is based on cross-gain modulation in two coupled semiconductor optical amplifier ring resonators operating in the C-band region.

JWC35
Characterization of Erbium-Doped Fiber Ring Laser that Uses Polarization Controllers, *Alberto Varguez-Flores, Georgina Beltrán-Pérez, Severino Muñoz-Aguirre, Juan Castillo-Mixcóatl; Facultad de Ciencias Fisico Matemáticas, BUAP, Mexico.* The characterization of an all-fiber laser with different gain medium was performed. The polarization controllers were used to obtain the best emissions. The results showed that the laser emission bandwidth was reduced in 41%.

JWC36
Magnetoplasmonic Effects in 2-D Magnetophotonic Crystals, *Alexander G. Zhdanov[1], A. A. Fedyanin[1], A. V. Baryshev[2], A. B. Khanikaev[2], H. Uchida[2], M. Inoue[2]; [1]M. V. Lomonosov Moscow State Univ., Russian Federation, [2]Toyohashi Univ. of Technology, Japan.* Magneto-optical Kerr effect in 2-D magnetophotonic crystals (slabs) formed from the array of nickel nanorods is considered. The peculiarities of optical properties have magnetoplasmonic nature. The experimental results are proved by numerical calculations.

JWC37
Periodic Intensity Fluctuations in Functionalized Semiconductor Quantum Dots: Correlation with Ligand Coverage, *Kevin T. Early, Kevin D. McCarthy, Nathan I. Hammer, Michael Y. Odoi, Ravi Tangirala, Todd S. Emrick, Michael D. Barnes; Univ. of Massachusetts at Amherst, USA.* Fluorescence microscopy has been used in conjunction with atomic force microscopy to study size-correlated emission properties of single oligo-phenylene vinylene-functionalized CdSe nanocrystals, which reveals size-dependent intensity fluctuations on time scales of 10-60 seconds.

JWC38
Guided-Mode Resonance Filters Fabricated in UV Curable Polymers, *Kyu J. Lee, Robert Magnusson; Univ. of Connecticut, USA.* Guided-mode resonance devices fabricated by soft lithography are presented. The fabrication process using an elastomeric mold and UV curable polymers is simple and cost-effective. Resonant photopolymer filters at 1550 nm are made and characterized.

JWC39
Diffusive Coordinate Model for Blinking Suppression and Intensity Fluctuations in CdSe-OPV Nanocrystals, *Kevin D. McCarthy[1], Kevin T. Early[1], Nathan I. Hammer[1], Michael Y. Odoi[1], Michael D. Barnes[1], Todd Emrick[2], Ravi Tangirala[2]; [1]George H. Richason Jr. Chemistry Lab, Univ. of Massachusetts at Amherst, USA, [2]Dept. of Polymer Science and Engineering, Univ. of Massachusetts at Amherst, USA.* We describe here numerical simulation of a modified Frantsuzov-Marcus diffusive coordinate (DC) model[1] which yields blinking suppression and low frequency fluctuations as observed[2] in Oligo-(phenylene vinylene) (OPV) coated CdSe quantum dots.

JWC40
Classical and Quantum Fresnel Relations for Left Handed Materials, *Jagdish Rai Luthra; Univ. de Los Andes, Colombia.* Fresnel relations are examined for the new class of materials with negative refractive index, also known as Left Handed Materials. Interesting new results are presented for Brewster's angle, total internal reflection and the Goos-Hanchen effect.

JWC41
Analytical Study of a 1-D Metalo-Dielectric Photonic Crystal, *A. Alejo-Molina[1], J. J. Sánchez-Mondragon[1], Celso Velásquez-Ordoñez[2], A. Zamudio-Lara[3], P. Ojeda-May[4]; [1]Inst. Nacional de Astrofísica Optica y Electrónica, Mexico, [2]Univ. Auntónoma Metropolitana-Iztapalapa, Mexico, [3]Ctr. for Res. in Engineering and Applied Sciences, UAEM, Mexico, [4]Univ. Kassel, Germany.* We analytically study a 1-D metalodielectric Photonic Crystal (PC) made out periodic extremely thin metal inlays in a Dielectric PC substrate.

JWC42
Similarities between the Dynamic Behavior of a Random Laser and that of a Traditional Q-Switched Laser, *Xingyu Zhang, Qingpu Wang, Jun Chang, Ping Li, Shuzhen Fan, Chen Zhang; School of Information Science and Engineering, Shandong Univ., China.* We studied the dynamic characteristics of a random laser made of solution of Rh6G dye in ethanol with Ti_2O_3 microparticles pumped by 532-nm 40-ps pulses and compared them with those of a traditional Q-switched laser.

JWC • Joint FiO/LS Poster Session II—Continued

JWC43
Bistability and Hysteresis in the Dynamics of Directly Modulated Multiple Quantum Well Lasers, *Jijo P. Ulahannan, Manu P. John, V. M. Nandakumaran; Intl. School of Photonics, India.* We present the work on the dynamics of directly modulated multiple quantum well lasers showing hysteresis and bistability under certain operating conditions. The results promise a better way to ensure security in optical communication channels.

JWC44
Near-Field Phase Patterns of Metallic Nanostructures by Oblique Incident Light, *Shih-Hui Chang; Inst. of Electro-Optical Science and Engineering, Natl. Cheng-Kung Univ., Taiwan.* Near-field phase patterns formed by metallic nanostructures with oblique incident light are studied by 3-D periodic finite-difference time-domain method with split-field field-transformation technique. The surface plasmon resonant effects by s- and p-polarized light are discussed.

Vision and Color Posters

JWC45
Adaptation of the Zernike's Phase-Contrast Method for Retinal Imaging, *Eric Logean, Chris Dainty; Applied Optics Group, Experimental Physics, Natl. Univ. of Ireland, Galway, Ireland.* An illumination suitable for phase imaging of the retina is proposed. Using this geometry we obtained images from glass objects and retinal samples. *In situ* phase imaging of the retina appears to be feasible.

JWC46
Intraocular Camera for Retinal Prostheses: Design Constraints Based on Visual Psychophysics, *Noelle R. B. Stiles, Michelle C. Hauer, Pamela Lee, Patrick J. Nasiatka, Jaw-Chyng Lue, James D. Weiland, Mark S. Humayun, Armand R. Tanguay, Jr.; Univ. of Southern California, USA.* Optical system design constraints for an intraocular camera are determined by visual psychophysics techniques, including pixellation limits adequate for navigation and object identification, optimal pre- and post-pixellation blurring, and the elimination of gridding artifacts.

JWC47
Modulations in the Images of Periodic Square-Wave Targets by Human Eye in the Presence of Stiles-Crawford Effect of the First Kind, *Sumit Ghosh, Pronab Mondal; Indian Students Chapter of Optical Society of America, India.* The modulations in the images of the square-wave targets for all transmitted spatial frequencies have been determined from the intensity distributions, formed by human eye in the presence of Stiles-Crawford Effect of the First Kind.

Laser Science Posters

JWC48
Laser Assisted Surface Layer Formation On AISI 304 SS With Preplaced Si_3N_4-Zr-Ni, *P. Rajarajan[1], M. Jamal Mohamed Jaffar[2], D. Sastikumar[1]; [1]Natl. Inst. of Technology, India, [2]Jamal Mohamed College, India.* AISI 304 SS with preplaced Si_3N_4-Zr-Ni coating was laser treated for topological character modification. Smooth and cracks free surface conditions were observed. Highly hardened phases (1020HV) were found to be uniformly distributed.

JWC49
Microring Resonators Using Multiphoton Absorption Polymerization, *Linjie Li[1], Wei-Yen Chen[1], Tie-Nan Ding[1], Warren Herman[2], P-T Ho[1], John Fourkas[1]; [1]Univ. of Maryland, USA, [2]Lab for Physical Sciences, USA.* We demonstrate the fabrication of polymer microring add-drop filters using multiphoton absorption polymerization and present the characterization of these devices.

JWC50
Mixed Vanadate Crystals Nd:$Y_xGd_{1-x}VO_4$ with Direct and Indirect Pumping Capabilities, *Yuanji Tang[1], Nils Fernelius[2], Xiaoyi Wang[1], Suning Tang[1]; [1]Crystal Res., Inc., USA, [2]AFRL, USA.* A series of mixed vanadate crystals Nd:$Y_xGd_{1-x}VO_4$ with the same Nd^{3+} dopant level was investigated. The results revealed general characteristics and trends in laser performance at different Y/Gd ratios and at direct and indirect pumping.

JWC51
Intracavity Frequency-Doubled Nd:YAG-$BaWO_4$ Raman Laser Generating Average Output Power of 3.1 W at 590 nm, *Xingyu Zhang, Qingpu Wang, Jun Chang, Ping Li, Shutao Li, Zhenhua Cong, Xiaolei Zhang; School of Information Science and Engineering, Shandong Univ., China.* We report an all solid state laser generating average output power of 3.1 W at 590 nm. The laser consists of a diode-side-pumped Nd:YAG module, an intracavity $BaWO_4$ Raman crystal a KTP frequency doubling crystal.

Organic Thin Films Posters

JWC52
Accuracy of the ATR Method for Electro-Optic Measurement of Poled Polymer Thin Films in Multilayer Structures, *Dong Hun Park, Chi H. Lee, Warren N. Herman; Lab for Physical Sciences, Univ. of Maryland, USA.* We discuss advantages and accuracy of the attenuated total reflection (ATR) method for the measurement of the electro-optic coefficients of poled polymer thin films in multilayer structures containing transparent conducting oxide layers.

JWC53
Optical Switching in Benzocyclobutene Microring Lattice, *W. Y. Chen, T. N. Ding, W. Cao, S. Y. Tseng, W. N. Herman, P. T. Ho; Lab for Physical Sciences, Univ. of Maryland, USA.* We demonstrate optical switching in a polymer lattice with more than 100 benzocyclobutene (BCB) microrings. The nonlinear refractive index n_2 of BCB is estimated about -6x10^{-15} cm^2/W.

JWC54
Processing of Organic-Inorganic Hybrids for Integrated Optics Filters, *Paulo S. André[1,2], Rogério Nogueira[1], Rute A. Ferreira[2,3], Carlos Vicente[1,2,3], Luis D. Carlos[2,3], Lara P. Pellegrino[2,4], Paulo Monteiro[1,4]; [1]Inst. de Telecomunicações, Univ. de Aveiro, Portugal, [2]Dept. de Física, Univ. de Aveiro, Portugal, [3]CICECO, Univ. de Aveiro, Portugal, [4]Siemens SA, Portugal.* We report a optical filter based on integrated optics waveguide gratings written in organic/inorganic sol-gel derived poly(oxyethylene)/siloxane hybrid.

JWC55
Photo-Formation of Gold Nanoparticles in the Solid Monoliths of Au(III)-Chitosan-Silica Aerogels: Photoacoustic and Electron Microscopic Studies, *Narayanan Kuthirummal[1], Adam Dean[1], Chunhua Yao[2], William Risen, Jr.[2]; [1]College of Charleston, USA, [2]Brown Univ., USA.* Effect of 320-nm light on the solid monoliths of Au(III)-chitosan-silica aerogels (Au/NH_2=1:5) has been investigated. A slight blue shift of about 7 nm is noticed in the plasmon resonance peak upon increasing the exposure duration.

JWC56
Dispensed Fluorinated Polymer Waveguides and Laser-Ablated Undercut Couplers for Optical Interconnects on PC Boards, *Yongzhang Leng, Victor Yun, Warren N. Herman, Julius Goldhar; Univ. of Maryland at College Park, USA.* Techniques for directly dispensing fluorinated polymer waveguides on printed circuit (PC) boards and for fabricating undercut couplers are presented. The dispensed fluorinated polymer waveguides and undercut couplers provide low loss transmission at 1550 nm.

NOTES

Frontiers in Optics

1:30 p.m.–3:30 p.m.
FWM • RF Photonics I
Presider to Be Announced

FWM1 • 1:30 p.m. Invited

Radio Frequency over Fibre Systems, *Alwyn Seeds, C.- P. Liu, T. Ismail; Univ. College London, UK.* This paper reviews the technologies and applications of radio frequency (RF) analog optical links including direct and external intensity modulated approaches, frequency modulated links and millimetre-wave transmission systems. Wireless and other applications are discussed.

FWM2 • 2:00 p.m. Invited

Photonic Generation of RF and Microwave Frequencies, *Lute Maleki[1,2]; [1]JPL, USA, [2]OEwaves, Inc., USA.* Photonics technology has enabled the generation of highly spectrally pure and stable reference signals at frequencies ranging from 1-100 GHz, and beyond. This talk presents recent developments and future prospects in the field.

1:30 p.m.–3:30 p.m.
SWB • Photonic Materials I
Astrid Aksnes; Norwegian Univ. of Science and Technology, Norway, Presider

SWB1 • 1:30 p.m. Invited

Recent Advances in Photonic Crystal Fibers, *Philip Russell; Univ. Erlangen-Nuremberg, Germany.* Through its unique and varied characteristics, PCF is creating many new possibilities in diverse areas of research and technology. Some recent advances will be discussed, including developments in nanoacoustics, gas-laser devices and compact supercontinuum sources.

SWB2 • 2:00 p.m. Invited

Advances in Photonic Crystal Structures, *Richard De La Rue; Univ. of Glasgow, UK.* Photonic crystals continue to command the interest of the optoelectronics research community. Translating the research results already demonstrated into practical devices depends critically on technological advances that are still incomplete. This situation will be analysed.

1:30 p.m.–3:30 p.m.
FWN • Quantum Light-Matter Interface
Andrew White; Univ. of Queensland, Australia, Presider

FWN1 • 1:30 p.m. Invited

Photonic Bus Connecting Atomic-Ensemble Spin-Wave Quantum Memories, *Vladan Vuletic[1], Jonathan Simon[1,2], Haruka Tanji[1,2], Saikat Ghosh[1]; [1]MIT, USA, [2]Harvard Univ., USA.* A single spin-wave quantum (magnon) is transferred phase-coherently between two atomic ensembles via a dark state of an optical resonator. Partial transfer results in an entangled state, with the magnon shared between the two ensembles.

FWN2 • 2:00 p.m.

Deterministic Generation of Polarization-Entangled Photon Pairs from a Cavity-QED System, *Ying Gu[1], Pengbo Li[1], Qihuang Gong[1], Guangcan Guo[1,2]; [1]State Key Lab for Mesoscopic Physics and Dept. of Physics, Peking Univ., China, [2]Key Lab of Quantum Information, Univ. of Science and Technology, China.* We propose a cavity-QED scheme that can deterministically generate polarization entangled photon pairs. A four-level tripod atom successively couples to two cavities possessing polarization degeneracy, and by the STIRAP process entangled photons are produced.

1:30 p.m.–3:30 p.m.
FWO • Plasmonic Metamaterials and Waveguides
Presider to Be Announced

FWO1 • 1:30 p.m. Invited

Plasmon Resonances in Photonic Chiral Metamaterials, *Nikolay Zheludev, V. Fedotov, A. Schwanecke, E. Plum, N. Papasimakis, K. Marinov; Univ. of Southampton, UK.* We report on the development of photonic 2-D- and 3-D-chiral metamaterials with intriguing properties including giant rotary power and asymmetric transmission which are due to the excitation of chiral and enantiomeric sensitive plasmons.

FWO2 • 2:00 p.m.

Theoretical Studies of Loss Compensation in Active Planar Plasmonic Structures, *V. A. Podolskiy[1], G. Zhu[2], M. F. Mayy[2], M. Bahoura[2], K. Reynolds[2], M. A. Noginov[2]; [1]Oregon State Univ., USA, [2]Norfolk State Univ., USA.* We develop an analytical description of mode excitation in active planar plasmonic systems, analyze the effect of material gain on mode structure and lifetime and solve the controversy regarding the refractive index of active media.

1:30 p.m.–3:30 p.m.
FWP • Advances in Optical Trapping
Presider to Be Announced

FWP1 • 1:30 p.m. Tutorial

Advances in Single Molecule Biophysics: Breaking the Nanometer Barrier with Optical Tweezers, *Steven M. Block; Stanford Univ., USA.* Recent advances in optical trapping instrumentation for use in biophysical applications have reached atomic-level resolution for the motions of individual biomolecules. This tutorial will describe how it's done and some of what we've learned.

Steven M. Block holds the Stanford W. Ascherman chair in Sciences in the Depts. of Applied Physics and Biology at Stanford Univ. He earned his B.A. and M.A. degrees in physics at Oxford Univ. (1974; 1978), a master's in biology at Univ. of Colorado (1982); and a Ph.D. in biophysics at Caltech (1983). He was staff scientist at the Rowland Inst. in Cambridge and a lecturer at Harvard Univ. (1987-1993), then professor of molecular biology at Princeton Univ. (1994-1999), before joining Stanford Univ. in 1999. Block has been elected to the American Acad. of Arts and Sciences (2000), the American Association for the Advancement of Science (2006), and the Natl. Acad. of Sciences (2007). He received the Young Investigator Award of the Biophysical Society (1994) and later served as its President (2005-2006). He received the Award for Research Excellence in Nanotechnology from the Nano/Bio Interface Ctr. at the Univ. of Pennsylvania in 2006.

Frontiers in Optics

1:30 p.m.–3:30 p.m.
FWQ • Optical Vortices and Imaging Complex Media
Grover A. Swartzlander, Jr.; Optical Sciences Ctr., Univ. of Arizona, USA, Presider

FWQ1 • 1:30 p.m.
A Novel Technique for Determination of Optical Properties of Turbid Media, *Mangalpady R. Shenoy, Prerana Prerana, Bishnu P. Pal; Indian Inst. of Technology Delhi, India.* Optical properties like anisotropy factor and scattering coefficient of complex turbid media were determined through laser light scattering experiment. Experimental results were matched to the corresponding Monte-Carlo simulation results to obtain the scattering parameters.

FWQ2 • 1:45 p.m.
Measuring of Spray Using Digital Holography, *Yan Yang[1], Kang Bo-seon[2]; [1]Dept. of Mechanic, Chongqing Inst. of Technology, China, [2]Dept. of Mechanical Engineering, Chonman Natl. Univ., China.* Influencing parameters of digital holography are discussed. The correlation coefficient method is introduced to locate the best focal plane. The spatial positions and velocities of droplets can be obtained by spray holograms.

FWQ3 • 2:00 p.m.
Investigations of the Attenuation Coefficient of a Narrow-Bandwidth Pulsed Laser Beam in Water, *Dahe Liu, Jianhui Bai, Yi Huang, Yinan Liu; Beijing Normal Univ., China.* The attenuation coefficient of pulsed laser beam in water is investigated. It is found that the attenuation coefficient is dependent on the pulse energy and the line width of the laser, rather than a constant.

Laser Science

1:45 p.m.–3:30 p.m.
LWE • Slow and Stored Light
Ronald Walsworth; Harvard-Smithsonian Ctr. for Astrophysics, USA, Presider

LWE1 • 1:45 p.m. Invited
Optimizing Slow and Stored Light via EIT in Alkali Vapor, *Irina Novikova[1], Nate Phillips[1], Alexey V. Gorshkov[2], Mikhail D. Lukin[2], Yanhong Xiao[3], M. Klein[3], David F. Phillips[3], Ronald L. Walsworth[2,3]; [1]College of William and Mary, USA, [2]Harvard Univ., USA, [3]Harvard-Smithsonian Ctr. for Astrophysics, USA.* We investigate the possibility to achieve high-efficiency quantum memory in atomic vapor. We demonstrate a procedure to obtain the maximum efficiency for the storage and retrieval of light pulses based on a pulse-shape optimization.

2:30 p.m.–3:30 p.m.
LWF • Beyond the Simple Quantum Limit in Gravitational Wave Detectors
Nergis Mavalvala; MIT, USA, Presider

Turn the page for the first presentation in this session.

1:30 p.m.–3:30 p.m.
LWG • 2-Dimensional Spectroscopy I
Harald Kauffmann; Univ. of Vienna, Austria, Presider

LWG1 • 1:30 p.m. Invited
Ultrafast 2-D-IR Vibrational Echo Spectroscopy of Concentrated Salt Solutions Analyzed Using a New Experimental Observable, *Michael D. Fayer, Sungnam Park, Kyungwon Kwak; Stanford Univ., USA.* Ultrafast 2-D-IR vibrational echo spectroscopy is applied to the dynamics of water in concentrated aqueous salt solutions. A new experimental observable is introduced as a robust approach to extracting dynamics from 2-D-IR data.

LWG2 • 2:00 p.m. Invited
Automated 2-D IR Spectroscopy Using Mid-IR Pulse Shaping and Applications to Membrane Peptides, *Sang-Hee Shim, David B. Strasfeld, Yun L. Ling, Martin Zanni; Univ. of Wisconsin-Madison, USA.* This presentation covers new advances in automating 2-D IR spectroscopy using a novel mid-IR pulse shaper. This shaper permits extremely rapid collection of highly accurate 2-D IR spectra. Applications to membrane peptides will be presented.

OTF

1:30 p.m.–3:15 p.m.
TWA • Organic Thin Films for Photonic Applications I
Zakya Kafafi; NRL, USA, Presider

TWA1 • 1:30 p.m. Invited
Surface-Emitting Distributed Feedback Lasing Based on Multilayer Polymer Films, *Kenneth D. Singer, Thomas Boatwright, Joseph R. Lott, Hyunming Song, Yeheng Wu, Eric Baer, Anne Hiltner, Christoph Weder; Case Western Reserve Univ., USA.* We report on the fabrication of a multilayer all-polymer surface emitting distributed feedback dye laser. Output power, emission spectrum, and threshold for various designs are described.

TWA2 • 2:00 p.m.
Beam Coupling and Coherent Amplification in Photorefractive Liquid Crystals under AC Electric Field, *Xiudong Sun, Yanbo Pei, Fengfeng Yao; Harbin Inst. of Technology, China.* Two-beam coupling phenomenon in C_{60}-doped nematic liquid crystals under a nonbiased alternating sinusoidal electric field was studied. The stable asymmetric energy transferring and large beam coupling ratio was obtained. Then the coherent amplification was realized.

Frontiers in Optics

1:30 p.m.–3:30 p.m.
FWR • Diffractive Micro- and Nanostructures for Sensing and Information Processing II
Markus Testorf; Dartmouth College, USA, Presider

FWR1 • 1:30 p.m. Invited
Temporal Processing with Micro-Optical Structures, *Jurgen Jahns[1], Hans Knuppertz[1], Adolf W. Lohmann[2]; [1]Fern Univ., Germany, [2]Univ. of Erlangen-Nuremberg, Germany.* Microoptical elements and instruments are suitable for the analog processing of optical ps/fs-pulses. We discuss various approaches based on Talbot self-imaging, Talbot band experiments and micro-optics to implement optical tapped delay-lines with "arbitrary" impulse responses.

FWR2 • 2:00 p.m.
Biochemical Sensor Based on a Resonant Microcavity, *Andrea M. Armani[1], Sabine Flicker[2], Rudolf Valenta[2], Richard C. Flagan[1], Kerry J. Vahala[1]; [1]Caltech, USA, [2]Medical Univ. of Vienna, Austria.* Monoclonal antibodies, which recognize a single binding site on their target antigen, were used to sensitize the surface of ultra-high Q resonators. Experiments verifying the sensitivity and specificity of the microcavities were performed.

Frontiers in Optics

FWM • RF Photonics I—Continued

FWM3 • 2:30 p.m. Invited

Optical Arbitrary Waveform Generation, *Andreas Leven[1], Y. Yang[1], R. Kopf[1], A. Tate[1], T. C. Hu[1], J. Frackoviak[1], R. Reyes[1], N. G. Weimann[1], Y. K. Chen[1], R. DeSalvo[2], G. Burdge[2], G. Deibner[2], F. Quinlan[3], S. Gee[3], P. Delfyett[3]; [1]Bell Labs, Alcatel-Lucent, USA, [2]Harris Corp., USA, [3]CREOL/College of Optics and Photonics, Univ. of Central Florida, USA.* Optical means for generating arbitrary waveforms have attracted renewed interest because of the wide bandwidth. We will review different optical techniques for generating arbitrary waveforms and will present our latest results using a time-domain approach.

SWB • Photonic Materials I—Continued

SWB3 • 2:30 p.m.

Programmable Lenses Using Photonic Non-Crystals, *Paul Stellman, George Barbastathis; MIT, USA.* We design lenses with minimal aberrations and arbitrary focal length by iteratively solving Hamilton's equations for a slowly-varying photonic non-crystal material.

SWB4 • 2:45 p.m.

Field Intensity and Localized Mode Pattern Symmetry in Photonic Crystals, *Dong Xiao, H. T. Johnson; Univ. of Illinois at Urbana-Champaign, USA.* A mode pattern photonic band structure representation is created by the finite element method to demonstrate the connection between the mode pattern, the band symmetry and the localized light intensity inside a photonic crystal.

FWN • Quantum Light-Matter Interface—Continued

FWN3 • 2:15 p.m.

Controlled Optical Transitions between Optical Bistable States in Three-Level Atomic Bistability System, *Haibin Wu, Amitabh Joshi, Min Xiao; Dept. of Physics, Univ. of Arkansas, USA.* We investigate noise-induced transitions between bistable states in a three-level atomic bistability system. Correlations between noises added on the coupling beam and the transition rate are systematically studied in detail.

FWN4 • 2:30 p.m. Invited

Deterministic Quantum Interface between Light and Room Temperature Atomic Ensembles, *Thomas Fernholz, Kasper Jensen, Brian Julsgaard, Hanna Krauter, Jakob F. Sherson, Eugene S. Polzik; Univ. of Copenhagen, Denmark.* We discuss protocols for mapping quantum states of light onto atomic spins, including the recently demonstrated quantum teleportation between light and matter. We show how these protocols can be improved using spin and light squeezing.

FWO • Plasmonic Metamaterials and Waveguides—Continued

FWO3 • 2:15 p.m.

Near-Field Study of Double-Layered Gold Nanorods, *Ji-young Kim, Hsiao-Kuan Yuan, Reuben M. Bakker, Vladimir P. Drachev, Vladimir M. Shalaev; School of Electrical and Computer Engineering, Purdue Univ., USA.* An optical negative-index material, double-layered gold nanorods, is studied in the near-field for reflection and transmission modes at different near-field probes, wavelengths and polarizations of light. The enhanced transmission is observed under certain parameters.

FWO4 • 2:30 p.m.

Characterization of Terahertz Surface Plasmons on Structured Metal Surfaces, *Wenqi Zhu, Ajay Nahata; Univ. of Utah, USA.* We demonstrate the ability to characterize the vector field components of terahertz surface plasmons. We use an electro-optic crystal as the detection medium and place it in close proximity to a bullseye structure.

FWO5 • 2:45 p.m.

Plasmonic Waveguides as Transmission Lines, *Sukru Ekin Kocabas, Dany-Sebastien Ly-Gagnon, David A. B. Miller; Stanford Univ., USA.* We show that simple transmission line models can describe mode propagation in plasmonic waveguides. Despite different metal behavior at near-infrared compared to microwaves, our simulation results agree very well with our impedance model predictions.

FWP • Advances in Optical Trapping—Continued

FWP2 • 2:15 p.m.

***In situ* Raman Measurement of an Individual Silicon Nanowire Trapped Using Optoelectronic Tweezers (OET),** *Arash Jamshidi[1], P. James Schuck[2], Peter J. Pauzauskie[3,4], Aaron T. Ohta[1], Hsan-Yin Hsu[1], Justin Valley[1], Peidong Yang[3,4], Ming C. Wu[1]; [1]Dept. of Electrical Engineering, Univ. of California at Berkeley, USA, [2]Molecular Foundry, Lawrence Berkeley Natl. Lab, USA, [3]Dept. of Chemistry, Univ. of California at Berkeley, USA, [4]Materials Sciences Div., Lawrence Berkeley Natl. Lab, USA.* We demonstrate in situ Raman measurement of individual silicon nanowires (100 nm diameter, 10-20 μm in length) which are trapped using optoelectronic tweezers (OET).

FWP3 • 2:30 p.m.

Integrated-Fiber-Probe for All Optical 3-D Trapping and Manipulation, *Carlo Liberale[1], Paolo Minzioni[2], Francesco De Angelis[1], Enzo Di Fabrizio[1], Ilaria Cristiani[2]; [1]Univ. della Magna Graecia, Italy, [2]CNISM and Univ. of Pavia, Italy.* A new approach to purely-optical fiber 3-D-trapping is proposed. The configuration, exploiting total-internal-reflection, is highly promising because it allows particles trapping, manipulation and analysis. Its efficiency is demonstrated by numerical simulations.

FWP4 • 2:45 p.m.

Annular Laser Trap: A Tool for High-Throughput Sperm Sorting and Analysis, *Bing Shao[1], Linda Z. Shi[2], Sadik C. Esener[2], Michael W. Berns[1,2]; [1]Beckman Laser Inst., Univ. of California at Irvine, USA, [2]Univ. of California at San Diego, USA.* A continuous, size-tunable 3-D annular laser trap based on axicons provides a way to sort sperm base on motility and chemotaxis, and study the effects of laser radiation, optical force and obstacles on sperm motility.

Frontiers in Optics

FWQ • Optical Vortices and Imaging Complex Media—Continued

FWQ4 • 2:15 p.m.
Delocalization Due to Transverse Disorder in Random Layered System, *Sheng Zhang[1], Jongchu Park[1], Valery Milner[2], Jing Wang[1], Azriel Z. Genack[1]; [1]Queens College of City Univ. of New York, USA, [2]Univ. of British Columbia, Canada.* The transmission of laser beam through a random layered system follows and then departs from an exponential decay. Such delocalization effect depends on the transverse disorder of the layers and angular spread of incident beam.

FWQ5 • 2:30 p.m.
The Generation of Structural Stable Optical Vortices in the Singular Beams Array, *Yana V. Izdebskaya, Vladlen Shvedov, Alexander V. Volyar; Taurida Natl. Univ., Ukraine.* We consider theoretically and experimentally a singular beams array whose axes lie on the surface of a hyperboloid of revolution. We show that such array can be structural stable and carry high orbital angular momentum.

FWQ6 • 2:45 p.m.
Study of Optical Vortex Beam Generated by Fabricated Optical Wedge in Continuous and Polychromatic Regimes, *Balpreet Singh Ahluwalia, Jing Bu, Xiaocong Yuan; Nanyang Technological Univ., Singapore.* An optical wedge is reported to possess wavelength scalability in generation of optical vortex. The geometrical stability of the optical vortices generated by wedge at the focal vicinity in continuous and femtosecond regime is investigated.

Laser Science

LWE • Slow and Stored Light—Continued

LWE2 • 2:15 p.m. Invited
Slow and Stored Light by EIT in Solids, *A. L. Alexander, M. J. Sellars, J. J. Longdell, Neil Manson; Australian Natl. Univ., Australia.* Rare earth doped solids are used for slowing and storing light with and without EIT. Magnetic and electric fields and optical pumping are involved in improving inhomogeneous broadening, coherence times and enhancing the storage properties.

LWE3 • 2:45 p.m. Invited
Slow Light in Optical Fibers, *Alexander Gaeta; Cornell Univ., USA.* We describe our recent work on producing all-optical, tunable delays in optical waveguides, including schemes that can operate at high bandwidths suitable for telecommunications.

LWF • Beyond the Simple Quantum Limit in Gravitational Wave Detectors—Continued

LWF1 • 2:30 p.m. Invited
Preparing Squeezed States for Gravitational Wave Detectors, *Roman Schnabel[1,2], H. Vahlbruch[1,2], S. Chelkowski[1,2], B. Hage[1,2], A. Franzen[1,2], K. Danzmann[1,2]; [1]Leibnitz Univ. Hannover, Germany, [2]Max-Planck-Inst. für Gravitationsphysik (Albert-Einstein-Inst.), Germany.* This contribution reports the generation of a broadband squeezed field for Fourier frequencies down to 1Hz. Such fields will be used to improve the sensitivities of future gravitational-wave detectors beyond their quantum noise limits.

LWG • 2-Dimensional Spectroscopy I—Continued

LWG3 • 2:30 p.m. Invited
Probing Peptide Structures by Two-Dimensional Infrared Spectroscopy, *Nien-Hui Ge[1], Hiroaki Maekawa[1], Soohwan Sul[1], Claudio Toniolo[2]; [1]Univ. of California at Irvine, USA, [2]Univ. of Padova, Italy.* Femtosecond two-dimensional infrared spectroscopy reveals the multiple conformations of monomeric N-acetyl-L-prolinamide and the chain length dependence of the spectral features for 3_{10}-helical homopeptides Z-$(Aib)_n$-OtBu with n = 3, 5, 8, and 10 in $CDCl_3$.

OTF

TWA • Organic Thin Films for Photonic Applications I—Continued

TWA3 • 2:15 p.m. Invited
Polymers with Unprecedented NLO Response, *Nasser Peyghambarian[1], Y. Enami[1], C. T. DeRose[1], D. Mathine[1], C. Loychik[1], C. Greenlee[1], R. A. Norwood[1], T. D. Kim[2], J. Luo[2], Y. Tian[2], A. K.-Y. Jen[2]; [1]Univ. of Arizona, USA, [2]Univ. of Washington, USA.* Using efficient electro-optical polymer poling in hybrid sol-gel EO modulators we have achieved 0.65V V_π Mach-Zehnder modulators in a new EO polymer, AJ309, which undergoes thermal crosslinking during the poling process.

TWA4 • 2:45 p.m.
Faraday Rotation Measurements on Thin Films of Regioregular Alkyl Substituted Polythiophene, *Palash Gangopadhyay[1], Alejandra Lopez-Santiago[1], Ramakrishna Voorakaranam[1], Charles L. Greenlee[1], Robert A. Norwood[1], Martin Heeney[2], Andre Persoons[1], Nasser Peyghambarian[1]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]Organic Semiconductors, Merck Chemicals Ltd., UK.* Faraday rotation has been measured in thin films of regioregular alkyl substituted polythiophene derivatives in their pristine state. These results could lead to a new frontier of conjugated polymer research.

Frontiers in Optics

FWR • Diffractive Micro- and Nanostructures for Sensing and Information Processing II—Continued

FWR3 • 2:15 p.m.
Double Cladding Optical Fiber Laser Externally Locked with Guided Mode Resonance Filter, *Alok A. Mehta[1], Eric G. Johnson[2]; [1]College of Optics and Photonics, Univ. of Central Florida, USA, [2]Univ. of North Carolina at Charlotte, Ctr. for Optoelectronics, USA.* A cladding pumped fiber laser operated in an external cavity configuration is evaluated experimentally using a guided mode resonance filter as the external feedback element.

FWR4 • 2:30 p.m. Invited
Silicon Based Optoelectronics for Wavelength Routing, *Sanjay Patel; Bell Labs, Alcatel-Lucent, USA.* No abstract available.

Frontiers in Optics

FWM • RF Photonics I—Continued

FWM4 • 3:00 p.m. Invited

Electroabsorption Modulator for Analog Fiber Link Applications, *Paul K. Yu, I. Shubin, X. B. Xie, W. S. C. Chang; Univ. of California at San Diego, USA.* Design and performance of electroabsorption waveguide modulators for high gain and low noise figure analog fiber links are presented. Peripheral coupled waveguide design has led to electroabsorption modulator with high linearity and optical saturation power.

SWB • Photonic Materials I—Continued

SWB5 • 3:00 p.m. Invited

Strong Photon-Photon Correlations in Photonic Crystals, *Shanhui Fan, Jung-Tsung Shen; Stanford Univ., USA.* We solve exactly two-photon transport in photonic-crystal waveguide coupled to a two-level system. Notable features include two-photon bound state that behaves as a composite particle, and effective attractive or repulsive interactions in space for photons.

FWN • Quantum Light-Matter Interface—Continued

FWN5 • 3:00 p.m.

Observation of Raman Ramsey Fringes Using Delayed Optical Pulses in Atomic Vapor Medium, *Gour S. Pati, K. Salit, M. S. Shahriar; Northwestern Univ., USA.* We report observation of high contrast Raman Ramsey fringes in atomic vapor medium using time delayed optical pulse pairs.

FWN6 • 3:15 p.m.

Trapped Barium Ions for Quantum Computing, *Gary T. Howell, R. Bowler, M. R. Dietrich, A. Kleczewski, N. Kurz, V. Mirgon, J. S. Salacka, G. Shu, L. Wang, B. B. Blinov; Univ. of Washington, USA.* We report progress on investigating $^{137}Ba^{+}$ as a trapped ion qubit candidate. Internal-state manipulations have been performed on single trapped ions of $^{138}Ba^{+}$ and progress has been made towards performing the same operations on $^{137}Ba^{+}$.

FWO • Plasmonic Metamaterials and Waveguides—Continued

FWO6 • 3:00 p.m.

Surface States in One and Two-Dimensional Photonic Crystals, *Michael Bergmair, Kurt Hingerl; CD-Lab, Univ. Linz, Austria.* One and two-dimensional metallic photonic crystals show for a certain polarization and frequency surface resonances. Their properties are investigated by analytic expressions for the energy velocity and the local density of states.

FWO7 • 3:15 p.m.

Fundamental Limit to Optical Components, *David A. B. Miller; Stanford Univ., USA.* We prove an upper bound to performance for linear optical components, completely independent of detailed design. For one-dimensional dispersive and slow light structures, the bound depends only on length and maximum dielectric constant.

FWP • Advances in Optical Trapping—Continued

FWP5 • 3:00 p.m.

Real-Time Sperm Tracking and Ring Trapping System, *Linda Z. Shi[1], Bing Shao[1], Michael W. Berns[2]; [1]Univ. of California at San Diego, USA, [2]Univ. of California at Irvine, USA.* An automatic microscope system is designed to study sperm response to annular laser trap. The sperm velocity, microscope stage movement and laser power at each image frame is saved at video rate.

FWP6 • 3:15 p.m.

Laserless Optical Trapping, *Carlos López-Mariscal[1], Julio C. Gutiérrez-Vega[1], David McGloin[2], Kishan Dholakia[2]; [1]Photonics and Mathematical Optics Group, Tecnológico de Monterrey, Mexico, [2]Univ. of St. Andrews, UK.* We report the use of light from a thermal source for optical trapping and guiding of dielectric microscopic particles.

3:30 p.m.–4:00 p.m., Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*

Hillsborough	Sacramento	Piedmont	Glen Ellen	Atherton	Belvedere
Frontiers in Optics	**Laser Science**			**OTF**	**Frontiers in Optics**

FWQ • Optical Vortices and Imaging Complex Media—Continued

FWQ7 • 3:00 p.m.
Signature of Photon Localization in Vortex Core Statistics, *Sheng Zhang, Azriel Z. Genack; Queens College of City Univ. of New York, USA.* Theoretical expressions for the relations between the statistics of vorticity near phase singularities and total transmission are found and verified in microwave measurements. Variance of the vorticity characterizes the degree of photon localization.

FWQ8 • 3:15 p.m.
Two-Beam Coupling Nonlinear Deconvolution, *Jed Khoury[1], Charles L. Woods[1], Bahareh Haji-saeed[2], William D. Goodhue[3], John Kierstead[4]; [1]AFRL, Sensors Directorate, Hanscom Air Force Base, USA, [2]Electrical and Computer Engineering Dept., Univ. of Massachusetts at Lowell, USA, [3]Physics Dept., Univ. of Massachusetts at Lowell, USA, [4]Solid State Scientific Corp., USA.* We introduce a new technique for nonlinear image correction; the impulse response of the distorted function and the distorted image are jointly-Fourier transformed to pump a clean reference beam in a two beam coupling arrangement.

LWE • Slow and Stored Light—Continued

LWE4 • 3:15 p.m.
Distortion, Noise and Delay Study for Wavelength-Conversion and Dispersion Based Slow-Light System, *Ravi Pant[1], Michael D. Stenner[1,2], Mark A. Neifeld[1,2]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA.* For wavelength-conversion dispersion based slow-light system, large gain required for amplifying the incoming pulses increases delay at the expense of amplifier noise. We present the distortion, signal-to-noise ratio (SNR) and delay tradeoff in these systems.

LWF • Beyond the Simple Quantum Limit in Gravitational Wave Detectors—Continued

LWF2 • 3:00 p.m. Invited
Quantum Measurement in Gravitational-Wave Detectors, *Yanbei Chen; Max-Planck-Inst. fuer Gravitationsphysik, Germany.* Laser interferometric gravitational-wave detectors measure tiny motions of macroscopic mirrors. Complex interferometer configurations and quantum optical techniques will be used to enhance sensitivity in future interferometers, which will reach and surpass the Standard Quantum Limit.

LWG • 2-Dimensional Spectroscopy I—Continued

LWG4 • 3:00 p.m. Invited
Triply Resonant Hyper-Raman Spectroscopy, *Anne M. Kelley, Weinan Leng; Univ. of California at Merced, USA.* The normally weak process of hyper-Raman scattering should be greatly enhanced when the excitation is both one- and two-photon resonant. This triply resonant process is explored both theoretically and experimentally for organic nonlinear chromophores.

TWA • Organic Thin Films for Photonic Applications I—Continued

TWA5 • 3:00 p.m.
Temperature Dependent Carrier Dynamics of Polythiophenes by TR-THz Spectroscopy, *Okan Esenturk[1], Joseph S. Melinger[2], Edwin J. Heilweil[3]; [1]Univ. of Maryland, USA, [2]NRL, USA, [3]NIST, USA.* Time-resolved temperature-dependent THz differential transmission measurements on P3HT films show enhanced absorption followed by fast decay at low temperatures. Temperature dependent dynamics permit extraction of carrier hopping mechanism activation energies.

FWR • Diffractive Micro- and Nanostructures for Sensing and Information Processing II—Continued

FWR5 • 3:00 p.m.
Silicon Membrane-Based Narrow Bandpass Leaky-Mode Resonance Filter, *Mehrdad Shokooh-Saremi, Robert Magnusson; Univ. of Connecticut, USA.* A periodic silicon membrane, designed by using the particle swarm optimization (PSO) technique, acts as a narrow bandpass leaky-mode resonance filter. The linewidth is ~0.5 nm at central wavelength of 1.55 μm.

FWR6 • 3:15 p.m.
Integrated High Speed Tunable Filter Based on Super Compact Grating, *Yingyan Huang[1], Jing Ma[1], Seng-Tiong Ho[2]; [1]OptoNet Inc., USA, [2]Northwestern Univ., USA.* We present an integrated high-speed tunable filter based on super compact grating on InP platform. The fabricated 4-channels filter demonstrates less than 500 nanosecond tuning speed with 200GHz pass band and ~3mm^2 chip size.

3:30 p.m.–4:00 p.m., Coffee Break, *Exhibit Hall (Fairmont Hotel, Imperial Ballroom)*

Frontiers in Optics

4:00 p.m.–6:00 p.m.
FWS • RF Photonics II
Andreas Leven; Bell Labs, Alcatel-Lucent USA, Presider

FWS1 • 4:00 p.m. Invited
An Overview of Analog Microwave Photonics, *Keith Williams; NRL, USA.* An overview of analog microwave photonics will be presented. The performance requirements for externally-modulated analog microwave photonic links will be reviewed with specific emphasis placed on modulator efficiency, laser noise, detected photocurrent and link linearity.

FWS2 • 4:30 p.m. Invited
High-Power Quantum Dot Laser Diodes for RF Photonics, *Dennis Deppe; Univ. of Central Florida, USA.* It is shown that the relative intensity noise in laser diodes may be reduced to <-180 dB/Hz through use of a long cavity with ultra-low internal loss.

4:00 p.m.–6:00 p.m.
SWC • Photonic Materials II and Structured Nonlinear Crystals
Peter Moulton; Q-Peak Inc., USA, Presider

SWC1 • 4:00 p.m. Invited
Air-Clad Photonic Crystal Fibers for High-Power Single-Mode Lasers, *Kent E. Mattsson; Crystal Fibre, Denmark.* The talk presents basics and record-breaking experimental data of double-clad fiber structures, fiber lasers and multimode combiners based on photonic crystal fiber technology.

SWC2 • 4:30 p.m. Invited
Advances in Structured Nonlinear Semiconductor Crystals, *Paulina S. Kuo[1], Konstantin L. Vodopyanov[1], J. E. Schaar[1], X. Yu[1], A. C. Lin[1], M. M. Fejer[1], J. S. Harris[1], David F. Bliss[2], Candace L. Lynch[2], Timothy Zens[2]; [1]Stanford Univ., USA, [2]AFRL, USA.* Microstructured semiconductors, like orientation-patterned GaAs, achieve quasi-phase-matching through controlled, periodic inversions of the crystallographic orientation. These nonlinear optical materials are becoming more mature and are being used to generate mid-infrared and THz radiation.

4:00 p.m.–6:00 p.m.
FWT • EIT and Quantum Information
Vladan Vuletic; MIT, USA, Presider

FWT1 • 4:00 p.m. Invited
Electromagnetically-Induced Transparency with Classical and Nonclassical Light, *J. Appel, F. Vewinger, E. Figueroa, K.-p. Marzlin, Alexander Lvovsky; Univ. of Calgary, Canada.* We present our progress towards storage of squeezed light by means of electromagnetically-induced transparency as well as protocols for routing, frequency conversion, and geometric steering of optical modes in atomic systems with multiple excited levels.

FWT2 • 4:30 p.m.
Phase Dependent EIT, *Hebin Li, Vladimir Sautenkov, Yuri Rostovtsev, Marlan O. Scully; Inst. for Quantum Studies, Texas A&M Univ., USA.* We study the EIT of Rb vapor under the condition when a microwave field resonant to the hyperfine transition has been applied. Developed theory and applications will be discussed.

4:00 p.m.–5:45 p.m.
FWU • Near Field Optics
Presider to Be Announced

FWU1 • 4:00 p.m. Invited
Nonlinear Plasmonics with Coupled Gold Nanoparticles, *Lukas Novotny; Univ. of Rochester, USA.* We present a study of nonlinear frequency generation at coupled gold nanoparticles. Second harmonic generation, sum-frequency generation, and four-wave mixing (4WM) are investigated as a function of the distance between a pair of particles.

FWU2 • 4:30 p.m.
Heterodyne Near-field Scanning Optical Microscopy with Spectrally Broad Sources, *Maxim Abashin, Robert E. Saperstein, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* We propose and demonstrate the use of an inexpensive, low temporal coherence source in Heterodyne Near-field Scanning Optical Microscopy. This system is a simplified means for high-resolution group velocity measurements in nanophotonic devices.

4:00 p.m.–6:00 p.m.
FWV • Diffuse Imaging and Spectroscopy
Presider to Be Announced

FWV1 • 4:00 p.m. Invited
Modulated Imaging in a Pre-Clinical Model of Wound Healing, *David J. Cuccia[1], Jae G. Kim[2], Joon S. You[1], Anthony J. Durkin[2]; [1]Modulated Imaging Inc., USA, [2]Beckman Laser Inst. and Medical Clinic, Univ. of California at Irvine, USA.* We present a wide-field spectral imaging modality called modulated imaging for quantitatively imaging superficial tissues. We apply this method to an animal skin-flap model to determine in vivo local concentrations of oxy- and deoxy-hemoglobin and water.

FWV2 • 4:30 p.m.
Differential Infrared Optical Mammography, *Sanhita Dixit[1], Christopher Comstock[2], Gregory Faris[1]; [1]SRI Intl., USA, [2]Univ. of California at San Diego, USA.* A differential optical mammography technique is discussed. The imaging modality uses infrared trans-illumination to image breast tissue. Preliminary imaging data demonstrate potential use in screening for breast cancer.

Frontiers in Optics

4:00 p.m.–5:45 p.m.
FWW • Virtual/Mixed Environments and Interactivity
Mark Lucente; Zebra Imaging, Inc., USA, Presider

FWW1 • 4:00 p.m. Tutorial
Mountain Tops and Wilderness: A New Vision, *Jannick P. Rolland; CREOL, USA.* In this tutorial, we will focus on emerging deployable displays and displays worn on the body to support mobile users. Designs suitable for integration into the eyeglasses form factor will also be discussed.

Jannick Rolland received a Diploma from the Inst. D'Optique, Graduate School in France in 1984, and the Ph.D. degree in optical science from the Univ. of Arizona in 1990. She is a Professor of Optics at the Univ. of Central Florida. After completing a Postdoctoral Fellowship, she joined the Research Faculty at Univ. of North Carolina at Chapel Hill in 1992 and headed the Vision Res. Group 1992-1996. She holds 13 patents, wrote 6 book chapters, and has over 60 peered review publications related to optical design, augmented reality, vision, and image quality assessment. Dr. Rolland served on the editorial board of the Journal Presence (MIT Press) 1996-2006, and as Associate Editor of Optical Engineering 1999-2004. She is a Guest Editor for a special issue of the IEEE Journal of Display Technology on medical displays. She is a Fellow of the Optical Society of America, and a member of SPIE, IEEE, and SID.

Laser Science

4:00 p.m.–5:45 p.m.
LWH • Cold Atom and Molecule Systems
Presider to Be Announced

LWH1 • 4:00 p.m. Invited
Ultracold Collisions in Atomic Strontium, *T. C. Killian[1], Y. N. Martinez[1], P. G. Mickelson[1], S. Nagel[1], P. Pellegrini[2], R. Côté[2]; [1]Rice Univ., USA, [2]Univ. of Connecticut, USA.* Photoassociative spectroscopy in an intercombination-line magneto-optical trap has determined the ground-state s-wave scattering lengths of ^{88}Sr and ^{86}Sr. Recent work with a crossed optical dipole trap allows us to study atoms in metastable states.

LWH2 • 4:30 p.m. Invited
Cooling of an Atom in a Cavity to the Quantum Ground State of Axial Motion, *H. Jeff Kimble, A. D. Boozer, A. Boca, R. Miller, T. E. Northup; Caltech, USA.* Localization to the ground state of axial motion is demonstrated for a single, trapped atom strongly coupled to the field of a high-finesse optical resonator. Applications in Quantum Optics and Information Science will be discussed.

4:00 p.m.–6:00 p.m.
LWI • Chip-Scale Atomic Devices
John Kitching; NIST, USA, Presider

LWI1 • 4:00 p.m. Invited
Overview of Chip-Scale Atomic Devices, *Amit Lal; Microsystems Technology Office (MTO), Defense Advanced Res. Projects Agency (DARPA), USA.* No abstract available.

LWI2 • 4:30 p.m. Invited
The Chip-Scale Atomic Clock: Development Status, *Robert Lutwak[1], Ahmed Rashed[1], Matthew Varghese[2], Gary Tepolt[2], Mark Mescher[2], John LeBlanc[2], Darwin K. Serkland[3], Gregory M. Peake[3]; [1]Symmetricom - Technology Realization Ctr., USA, [2]Charles Stark Draper Lab, USA, [3]Sandia Natl. Labs, USA.* This paper reports on the authors' recent progress in the development of a Chip-Scale Atomic Clock.

4:00 p.m.–6:15 p.m.
LWJ • 2-Dimensional Spectroscopy II
Nien-Hui Ge; Univ. of California at Irvine, USA, Presider

LWJ1 • 4:00 p.m. Invited
Electronic 2-D-FT Experiments: Looking into Inter-Domain Electronic Coupling of a Multi-Band J-Type Aggregate, *F. Milota, J. Sperling, A. Nemeth, Harald Kauffmann; Univ. of Vienna, Austria.* We investigate molecular excitonics and its quantum-kinetic dynamics in a J-aggregate using 2-D electronic spectroscopy. The measurements enable to look into electronic couplings and their intermediate quantum-stochastic trace on the road to population transfer.

LWJ2 • 4:30 p.m. Invited
Two-Dimensional Electronic Spectroscopy of Photosynthetic Light-Harvesting Complexes, *Elizabeth Read[1,2], Gregory S. Engel[1,2], Donatas Zigmantas[1,2], Tessa R. Calhoun[1,2], Gabriela Schlau-Cohen[1,2], Graham R. Fleming[1,2]; [1]Lawrence Berkeley Natl. Lab, USA, [2]Univ. of California at Berkeley, USA.* A variety of two-dimensional electronic spectroscopy experiments on natural light-harvesting complexes reveal inter-chromophore coupling and monitor ultrafast dynamics, furthering understanding of the way these proteins function and the underlying design principles of photosynthesis.

OTF

4:00 p.m.–6:00 p.m.
TWB • Organic Thin Films for Photonic Applications II
Ghassan Jabbour; Arizona State Univ., USA, Presider

TWB1 • 4:00 p.m. Invited
Recent Advances in Organic Photovoltaic Cells and Integrated Modules, *Bernard Kippelen, S. Yoo, W. J. Potscavage, B. Domercq, J. Kim, J. Holt; Georgia Tech, USA.* Efficient organic photovoltaic (OPV) modules with open-circuit voltages of 2.48 V have been fabricated from blends of poly(3-hexylthiophene) (P3HT) and a soluble C_{70} derivative, [6,6]-phenyl C_{71} butyric acid methyl ester (PCBM-70).

TWB2 • 4:30 p.m.
F8T2 Copolymer/C_{60} Heterojunction Photovoltaic Devices, *Mihaela Breban[1], Sundar Manoharan[1,2], Warren Herman[1], Danilo Romero[1]; [1]Univ. of Maryland, USA, [2]Indian Inst. of Technology, India.* We explore poly(9,9-dioctylfluorene-co-bithiophene) copolymer (F8T2) for photovoltaic applications. Devices fabricated with F8T2/C_{60} blend show open-circuit voltage of 1V and power conversion efficiency of 1.15% for operation in the short-wavelength region of the solar spectrum.

Frontiers in Optics

FWS • RF Photonics II—Continued

FWS3 • 5:00 p.m.
Bandwidth Enhancement by Optical Modulation of Injection-Locked Semiconductor Lasers, *Erwin K. Lau, Hyuk-Kee Sung, Xiaoxue Zhao, Devang Parekh, Connie J. Chang-Hasnain, Ming C. Wu; Univ. of California at Berkeley, USA.* We experimentally demonstrate optical modulation of injection-locked lasers, resulting in a resonant amplification of the transmitted signal. We enhance the 3-dB bandwidth of a 25-GHz electro-optic modulator to >59 GHz and demonstrate the system's tunability.

FWS4 • 5:15 p.m.
Passive Modelocking in an Electrically Pumped High Power Semiconductor Laser at 1550 nm, *Faisal R. Ahmad, Farhan Rana; Cornell Univ., USA.* We report on the generation of stable modelocked pulses from monolithic semiconductor diode lasers with repetition rates > 5 GHz, pulse widths approaching 6 ps, and output powers exceeding 150 mW.

SWC • Photonic Materials II and Structured Nonlinear Crystals—Continued

SWC3 • 5:00 p.m. Invited
Domain Structured KTP: Advances in Technology, Characterization and Applications, *Valdas Pasiskevicius, Carlota Canalias, Fredrik Laurell; Royal Inst. of Technology, Sweden.* Current state of poling technology in $KTiOPO_4$ allows submicrometer QPM periodicities and novel applications. A promising application in broadband infrared parametric amplifiers is reviewed. Photochromic damage in KTP and other nonlinear crystals will be discussed.

FWT • EIT and Quantum Information—Continued

FWT3 • 4:45 p.m.
Low Light Level V-Type Electromagnetically Induced Transparency Using Tapered Fiber Embedded in Rubidium Vapor, *Gour S. Pati[1], S. Spillane[2], R. Beausoleil[2], K. Salit[1], M. Hall[1], P. Kumar[1], M. S. Shahriar[1]; [1]Northwestern Univ., USA, [2]HP Labs, USA.* We report observation of V-type electromagntically induced transparency (EIT) at a few nW of optical power, using tapered fiber (TF) embedded in a rubidium vapor.

FWT4 • 5:00 p.m.
Interplay Between Four-Wave Mixing and Six-Wave Mixing in Rubidium Atoms, *Blake L. Anderson, Yanpeng Zhang, Min Xiao; Univ. of Arkansas, USA.* Interference between four-wave and six-wave mixing signals is observed in a four-level atomic system due to atomic coherence. The experimental and theoretical conditions for generating such interesting effects are investigated.

FWT5 • 5:15 p.m.
All-Optical Switching at Ultra-Low Light Levels, *Jiepeng Zhang, Gessler Hernandez, Yifu Zhu; Florida Intl. Univ., USA.* We report an experimental demonstration of all-optical switching with the signal and control light pulses containing about 20 photons each, corresponding to a control energy density of ~10^{-5} photons per atomic cross section.

FWU • Near Field Optics—Continued

FWU3 • 4:45 p.m.
Near-Field from 2-Dimensional Defects at Metallic Surfaces, *Raúl García-Llamas, Jorge Gaspar-Armenta, Judith Tánori-Cordova; Univ. de Sonora, Mexico.* The diffraction of plane P-polarized electromagnetic waves from 2-D Gaussian defects is studied theoretically. The Near-Field shows that the defects act like surface nano- antenna as its dimensions are in the nanometric range.

FWU4 • 5:00 p.m.
Near-Field Imager Based on Nanophotodetector Array, *Boyang Liu, Yingyan Huang, Ki Young Kim, Seng-Tiong Ho; Dept. of Electrical Engineering and Computer Science, Northwestern Univ., USA.* A novel high-speed near-field imager is presented based on channelized nanoscale-pixel photodetector (NPD) array with metal-semiconductor-metal detector structure and graded $In_{0.53}Ga_{0.47}As/In_{0.52}Al_{0.48}As$ superlattice as active medium. The NPD array can reach sub-wavelength spatial resolution of $<\lambda/8$.

FWU5 • 5:15 p.m.
Polarization Mode Conversion and Near-Field Optical Coupling in Apertureless SNOM Probes, *Wataru Nakagawa[1], Hans Peter Herzig[1], Christian Hafner[2]; [1]Inst. of Microtechnology, Univ. of Neuchâtel, Switzerland, [2]Swiss Federal Inst. of Technology, Zürich, Switzerland.* Using rigorous electromagnetic modeling tools, we investigate near-field optical coupling effects in apertureless SNOM probes, including polarization mode conversion and the interaction of the emitted optical fields with objects placed in the probe near-field zone.

FWV • Diffuse Imaging and Spectroscopy—Continued

FWV3 • 4:45 p.m. Invited
Photoacoustic Imaging: High-Resolution Optical Imagine beyond the Quasi-Ballistic Regime, *Lihong Wang; Washington Univ., USA.* Photoacoustic imaging can penetrate beyond ~1 mm into scattering biological tissues. It is a hybrid functional imaging technology that combines high ultrasonic resolution and strong optical contrast in a single modality.

FWV4 • 5:15 p.m.
Intraoperative Needle-Based Refractive Index Measurement of *ex vivo* Human Breast Tissue, *Adam M. Zysk[1], Daniel L. Marks[1], Freddy T. Nguyen[1], Jan G. Kotynek[2], Frank J. Bellafiore[2], Patricia A. Johnson[2], Kendrith M. Rowland[2], Stephen A. Boppart[1,2]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Carle Foundation Hospital, USA.* Refractive index measurements offer high contrast between normal fatty tissue and diagnostically significant structures. We have developed a needle-based device capable of measuring internal tissue properties. We present preliminary clinical data from human specimens.

Frontiers in Optics

FWW • Virtual/Mixed Environments and Interactivity—Continued

FWW2 • 4:45 p.m.
Object Based Disparity Morphing Tool for Stereo Images and Video, *Chiao Wang, Alexander A. Sawchuk; Signal and Image Processing Inst., Univ. of Southern California, USA.* We develop a horizontal disparity morphing tool in which users can enhance/reduce the perceived stereo effect of selected objects for general stereo images and video, and view the results on autostereoscopic displays.

FWW3 • 5:00 p.m. Invited
Novel Approaches in Optical Imaging and Visualization of Early Cancer Screening, Diagnosis and Treatment, *Eric J. Seibel; Univ. of Washington, USA.* Ultrathin, flexible endoscopes are being developed for imaging cancer in previously inaccessible regions of the body, allowing image-guided biopsy and laser diagnostics/therapeutics. Cancer diagnosis at high sensitivity/specificity is achieved with optical tomography microscopes.

Laser Science

LWH • Cold Atom and Molecule Systems—Continued

LWH3 • 5:00 p.m.
Vacuum Rabi Splitting and Intracavity Dark State in a Cavity-Atoms System, *Gessler Hernandez, Jiepeng Zhang, Yifu Zhu; Florida Intl. Univ., USA.* We report an experimental study of a cavity-atom composite system and observation of the intracavity dark state and the multi-atom vacuum Rabi splitting.

LWH4 • 5:15 p.m.
Rotating Three-Electron Wigner Molecules in Strong Magnetic and Circularly Polarized Field, *Matt K. Kalinski; Utah State Univ., USA.* We investigate the formation of rotating Wigner molecules in external magnetic and circularly polarized fields consisting of three-electrons in the analogy to recently discovered stabilized Langmuir states in strong magnetic and the circularly polarized fields.

LWI • Chip-Scale Atomic Devices—Continued

LWI3 • 5:00 p.m. Invited
Technology and Applications of Miniature Atomic Magnetometers, *Mark Prouty; Geometrics, Inc., USA.* Recent work by Geometrics, NIST, and Sandia has shown the feasibility of producing total field magnetometers, widely used in geophysics, that are two orders of magnitude smaller and lower power than existing commercial sensors.

LWJ • 2-Dimensional Spectroscopy II—Continued

LWJ3 • 5:00 p.m. Invited
Optical 2-D Fourier Transform Spectroscopy of Semiconductors, *Steven Cundiff[1], Tianhao Zhang[1], Xiaoqin Li[1], Alan D. Bristow[1], Irina Kuznetsova[2], Torsten Meier[2], Peter Thomas[2], Lijun Yang[3], Igor V. Schweigert[3], Shaul Mukamel[3], Richard P. Mirin[4]; [1]JILA, NIST and Univ. of Colorado, USA, [2]Dept. of Physics and Material Sciences Ctr., Philipps Univ., Germany, [3]Chemistry Dept., Univ. of Calfornia at Irvine, USA, [4]NIST, USA.* Optical two-dimensional Fourier transform spectra of excitonic resonances in semiconductors are measured and calculated. They provide insight into many-body interactions in direct gap semiconductors by separating the contributions to the coherent optical nonlinear response.

OTF

TWB • Organic Thin Films for Photonic Applications II—Continued

TWB3 • 4:45 p.m.
Deep Blue Phosphorescent OLEDs with Improved Device Stability, *Oliver Molt, Evelyn Fuchs, Christian Lennartz, Klaus Kahle, Nicolle Moonen, Jens Rudolph, Christian Schildknecht, Gerhard Wagenblast; BASF AG, Germany.* Cyclometallated iridium N-heterocyclic carbene (NHC)-complexes have become known as efficient deep blue triplet emitters in OLEDs. Herein we discuss new materials and device setups for carbene-based deep blue OLEDs with improved stability and lifetime.

TWB4 • 5:00 p.m.
Hybrid Silicon Organic RCE LED for Optical Interconnects and Optical Communications Using Specialized Conductive Adhesives, *Demetris L. Geddis, Justin E. Glover, Sean D. Cherry; Norfolk State Univ., USA.* An RCE-infrared organic light emitting diode was fabricated using silicon as the anode and cathode. The erbium tris(8-hydroxyquinole) emission layer was vacuum-deposited and the device was formed using unidirectional customized conductive adhesives in different configurations.

TWB5 • 5:15 p.m. Invited
Pushing the Resolution Limit in Multiphoton Absorption Polymerization, *John T. Fourkas; Univ. of Maryland, USA.* Multiphoton absorption polymerization makes possible the fabrication of 3-D structures with features considerably smaller than the diffraction limit. We will discuss progress in improving resolution to the realm of a fortieth of a wavelength.

Frontiers in Optics

FWS • RF Photonics II—Continued

FWS5 • 5:30 p.m.
Tunable Optical Clock Pulse Generation from a Phase Modulated CW Light Using an SBS-Assisted Optical Filter, *Masatoshi Saruwatari, K. Tsuji, M. Oiwa, K. Jumgmin, N. Onodera; Natl. Defense Acad., Japan.* We propose tunable optical clock pulse generation from PM light using SBS-assisted optical filtering. With this method, tunable 20-GHz pulses are successfully generated from 10-GHz PM signal by filtering the first-sidebands in PM light.

FWS6 • 5:45 p.m.
Channel Interference and Information Rate in an Orbital Angular Momentum Multiplexed Free-Space Optical Link, *Jaime A. Anguita, Mark A. Neifeld; Univ. of Arizona, USA.* The effect of atmospheric turbulence on the crosstalk among orbital angular momentum (OAM) states in an OAM-multiplexed free-space optical communication link is studied via numerical simulations. Information rates of the multi-channel system are computed.

SWC • Photonic Materials II and Structured Nonlinear Crystals—Continued

SWC4 • 5:30 p.m. Invited
Advances in Structured Ferroelectric Nonlinear Crystals, *Martin M. Fejer; Stanford Univ., USA.* No abstract available.

FWT • EIT and Quantum Information—Continued

FWT6 • 5:30 p.m.
Implementations of Double-Resonance Slow Light, *Ryan M. Camacho, Michael V. Pack, Curtis J. Broadbent, Irfan Ali-Khan, John C. Howell, Aaron Schweinsberg, Robert W. Boyd; Univ. of Rochester, USA.* Recent experiments demonstrating slow light between two absorbing resonances are reviewed as well as some recently demonstrated implementations, including low-light level buffering, image delays and interferometry.

FWT7 • 5:45 p.m.
Effects of Atomic Motion on the Controllable Nonclassical Photon Statistics, *C. H. Raymond Ooi, SangKyung Lee, Byung-Gyu Kim, Su-Yong Lee, Jae-wook Ahn, Hai-Woong Lee; Dept. of Physics, Korea Advanced Inst. of Science and Technology, Republic of Korea.* We study the effects of atomic motion on quantum correlation between Stokes and antiStokes photons from driven double Raman scheme. The atomic motion gives interesting correlation profiles that depend on the detection scheme.

FWU • Near Field Optics—Continued

FWU6 • 5:30 p.m.
Optical 2-D Nanoantennae Arrays, *Reuben M. Bakker[1], Alexandra Boltasseva[2], Zhengtong Liu[1], Samuel Gresillon[3], Rasmus H. Pedersen[2], Alexander V. Kildishev[1], Vladimir P. Drachev[1], Vladimir M. Shalaev[1]; [1]Purdue Univ., USA, [2]Technical Univ. of Denmark (DTU), Denmark, [3]CNRS and Univ. Paris, France.* Gold nanoantennas arrays are developed for sensing technology, nanolithography, nanolasers and imaging of field enhancement. Far- and near-field spectroscopy supported by finite element simulations shows a strong resonance tunable in the visible.

FWV • Diffuse Imaging and Spectroscopy—Continued

FWV5 • 5:30 p.m.
Multiple Scattering Effects on Particle Sizing in Optical Characterization of Biological Tissues, *Wendy Yip, Xu Li; Northwestern Univ., USA.* We examine the validity of the independent-scattering assumption of particle sizing in biophotonics applications via full-wave solutions. We find a complex dependence of biological tissue's optical properties on its multi-scale organization of intracellular particles.

FWV6 • 5:45 p.m.
Understanding Cell Nano-Architecture and Its Alteration in Carcinogenesis via Partial-Wave Spectroscopy, *Hariharan Subramanian, Prabhakar Pradhan, Vadim Backman; Northwestern Univ., USA.* Single-cell partial-wave spectroscopy (PWS) provides unprecedented insights into the nanoscale architecture of living biological cells. We demonstrate that PWS enables diagnosis of pre-cancerous changes in histologically normal cells far earlier than any existing detection technique.

FWV7 • 6:00 p.m.
Volume Holographic Gratings Using PQ/PMMA for Angle-Depth-Wavelength Filters, *Yuan Luo, Paul J. Gelsinger, George Barbastathis, Jennifer K. Barton, Raymond K. Kostuk; Dept. of Electrical and Computer Engineering, and College of Optical Sciences, Univ. of Arizona, USA.* In this paper, we use angle multiplexing with in-plane reference beams to make gratings using PQ/PMMA. The hologram is applied to spectral-spatial imaging systems as a filter to obtain the depth sections of an object.

6:00 p.m.–7:30 p.m., FiO Postdeadline Papers, *Locations are listed in Postdeadline Papers program in conference bag*

FWW • Virtual/Mixed Environments and Interactivity—Continued

FWW4 • 5:30 p.m.
Optical 3-D Input Device for 3-D Navigation in a Panoramic Virtual Environment, *Shih-Ching Yeh, Alexander A. Sawchuk; Univ. of Southern California, USA.* We describe an interactive panoramic 360 degree virtual environment for several users, composed of five large-scale plasma screens driven by networked computers. User navigation in the system is via a 3-D optical tracking device.

LWH • Cold Atom and Molecule Systems—Continued

LWH5 • 5:30 p.m.
Long Range Cs Rydberg Molecules, *Arne Schwettmann, K. Richard Overstreet, Jonathan Tallant, James Shaffer; Univ. of Oklahoma, USA.* We present calculations of long range Cs Rydberg molecules. The molecules are formed by multipole interactions and can be controlled using an external electric field. Experimental progress on detecting these molecules will be reviewed.

LWI • Chip-Scale Atomic Devices—Continued

LWI4 • 5:30 p.m.
A Miniature Differential Atomic Magnetometer Based on a Diverging Laser Beam, *Eleanor R. Hodby, Elizabeth A. Donley, John Kitching; NIST, USA.* We demonstrate a novel miniature atomic magnetometer that uses differential detection of the spatially diverging components of a light field to monitor the Larmor precession frequency of alkali atoms confined in a micromachined vapor cell.

LWI5 • 5:45 p.m.
Coupling to Trapped Atoms with a Magnetic Cantilever, *Matthew D. Eardley[1,2], Y.-J Wang[1], J. Moreland[1], L. Hollberg[1], J. Kitching[1]; [1]NIST, Boulder, USA, [2]Dept. of Physics and Astronomy, SUNY at Stony Brook, USA.* We are interested in using a magnetic microfabricated cantilever to both magnetically trap and drive transitions in laser-cooled Rb atoms. We ascertain the feasibility and show a possible scenario for such an experiment.

LWJ • 2-Dimensional Spectroscopy II—Continued

LWJ4 • 5:30 p.m.
Rise-Time Measurements of Low Capacitance CMOS Detectors Using a Pump-Probe Technique, *Salman Latif, Sukru E. Kocabas, Liang Tang, David A. B. Miller; Stanford Univ., USA.* Optical interconnect and clocking applications require low capacitance, high speed, CMOS-compatible photodetectors. We characterize the small-signal pump-probe response of Silicon on Sapphire CMOS compatible detectors showing response ~ 35 ps.

LWJ5 • 5:45 p.m.
Compression of Femtosecond Laser Pulses by Using Doubled-Line Density Gratings, *Changhe Zhou, Jiangjun Zheng, Enwen Dai, Wei Jia; Shanghai Inst. of Optics and Fine Mechanics, China.* We proposed and demonstrated a novel doubled-line density gratings structure for compression of femtosecond laser pulses, where a doubled-line density gratings structure means the second grating has a doubled density of the first one.

LWJ6 • 6:00 p.m.
Analysis and Fabrication of Fabry-Perot Interferometer Filters Using MEMS Technology, *Srihari P. Sankisa, Banmali S. Rawat, Moncef B. Tayahi; Univ. of Nevada, USA.* The Fabry-Perot Interferometer (FPI) filters with phase reduction have been thoroughly analyzed and fabricated using micro electromechanical systems (MESM) technology. The main advantages of these filters are: small power requirements, higher sensitivity and stability.

TWB • Organic Thin Films for Photonic Applications II—Continued

TWB6 • 5:45 p.m.
Realization and Characterization of Organic Two-Dimensional Periodic Structures, *Francesco Vita[1], Daniele E. Lucchetta[1], Riccardo Castagna[1], Luigino Criante[1], Oriano Francescangeli[1], Lua Pierantoni[2], Francesco Simoni[1]; [1]Univ. Politecnica delle Marche, Italy, [2]Univ. Politecnica delle Marche, Dip. DEB and CNISM, Italy.* Large-area two-dimensional periodic structures have been holographically recorded in polymer dispersed liquid crystals. Removal of the liquid crystal results in a polymeric film with spatially ordered voids. Obtained structures have been studied in guiding configuration.

6:00 p.m.–7:30 p.m., FiO Postdeadline Papers, *Locations are listed in Postdeadline Papers program in conference bag*

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

8:00 a.m.–10:10 a.m.
SThA • Best of Topicals I
Michael Duncan, Naval Res. Lab, USA, Presider

Introducton by Presider at 8:00 a.m.

SThA1 • 8:05 a.m. Invited

The Hyperlens: From Meta-Materials to Meta-Devices, *Evgenii Narimanov; Princeton Univ., USA.* We propose an approach to far-field optical imaging beyond the diffraction limit, based on metamaterials with strong dielectric anisotropy. Such imaging systems allow image magnification, are robust with respect to material losses and can be fabricated by adapting existing metamaterial technologies. (Photonic Metamaterials: From Random to Periodic, 2007)

SThA2 • 8:30 a.m. Invited

The Nature of Terahertz Conductivity in Nanomaterials, *Frank Hegmann[1], David G. Cooke[2], Markus Walther[3]; [1]Univ. of Alberta, Canada, [2]Technical Univ. of Denmark, Denmark, [3]Univ. of Freiburg, Germany.* Time-resolved terahertz spectroscopy is ideal for probing carrier dynamics, transport, and localization in nanomaterials. Models to describe the terahertz conductivity observed in nanomaterials are discussed, with an emphasis on the applicability of the Drude-Smith model. (Optical Terahertz Science and Technology, 2007)

8:00 a.m.–10:00 a.m.
SThB • Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments I
Farzin Amzajerdian; NASA Langley Res. Ctr., USA, Presider

SThB1 • 8:00 a.m. Tutorial

Qualification and Lessons Learned with Space Flight Fiber Optic Components, *Melanie Ott; NASA Goddard Space Flight Ctr., USA.* This tutorial will focus on qualification methods and guidelines, examples of hardware development challenges and lessons learned from the past ten years of development and testing of optical fiber components for space flight programs.

Melanie N. Ott is the Group Leader of the Photonics Group and Labs in the Parts, Packaging and Assembly Technologies Office, at NASA Goddard Space Flight Ctr. For the past thirteen years Ott has supported a variety of NASA programs in design, development, manufacturing, testing, failure analysis and reliability of space flight optical fiber components and systems. She has published over 50 papers and presentations on the subject of photonics for space flight, many of which are available on the photonics website at URL; misspiggy.gsfc.nasa.gov/photonics. Current projects that Ott is providing optical fiber system hardware include; the Lunar Orbiter Laser Altimeter and Laser Ranging System on the Lunar Reconnaissance Orbiter, the Express Logistics Carrier on International Space Station, and the Mars Science Lab ChemCam. Ott holds a masters and bachelors in Electrical Engineering with Optics emphasis from Virginia Tech.

8:00 a.m.–10:00 a.m.
SThC • (Guarded) Rational Exuberance: Renaissance after the Telecom Boom? Part I
Jay Wiesenfeld; Bell Labs, Alcatel-Lucent, USA, Presider

SThC1 • 8:00 a.m. Invited

Verizon's Optical Network Transformation, *William C. Uliasz; Verizon, USA.* Verizon's optical network, encompassing access/metro/ultra-long haul-core is evolving to a dynamic end-to-end all-optical network. This talk describes the vision and challenges of integrating the pertinent new technologies. William C. Uliasz is the Director for the Access and Transport Network Architecture team in the Verizon Technology Organization (VTO). His team is responsible for defining the target architecture for Verizon's optical network.

SThC2 • 8:30 a.m. Invited

Back to the Future: High-Speed Transmission Systems Are Back, *Benny Mikkelsen; Mintera Corp., USA.* No abstract available.

8:00 a.m.–9:30 a.m.
FThA • Ultrafast Dynamics of Biological and Chemical Systems II
David H. Reitze; Univ. of Florida, USA, Presider

FThA1 • 8:00 a.m. Invited

Coherent Nonlinear Optical Spectroscopy of Proteins: Femtosecond Analogues of Multidimensional NMR, *Shaul Mukamel, Wei Zhuang, Darius Abramavicius, Tomoyuki Hayashi, Dmitri Voronine; Univ. of California at Irvine, USA.* Multidimensional snapshots of the response of complex biomolecules to sequences of ultrafast optical pulses which probe their electronic and vibrational dynamics are simulated. Correlation plots show cross-peaks which carry information about structural, fluctuations and chirality.

FThA2 • 8:30 a.m.

Search for Pure Vibrational Dephasing of Electronically Excited Dye Molecules in Solution, *Patrizia Krok, Ida Z. Kozma, Markus Breuer, Stefan Lochbrunner, Eberhard Riedle; Lehrstuhl für BioMolekulare Optik, Univ. of Munich, Germany.* 10fs pulses compressed with Brewster-angled chirped mirrors are used to measure the vibronic wavepacket motion in a perylene dye. The coherence lifetime of 1.0 - 1.5ps indicates that vibrational relaxation and pure dephasing contribute equally.

8:00 a.m.–10:00 a.m.
FThB • Advanced Biological Microscopy and Tissue Ablation
Gregory Faris; SRI Intl., USA, Presider

FThB1 • 8:00 a.m. Tutorial

Confocal Microscopy without a Pinhole, *Jerome Mertz; Boston Univ., USA.* New fluorescence imaging techniques have been developed that provide confocal-like out-of-focus background rejection by simple widefield imaging with a CCD camera. I will review various techniques including structured illumination microscopy and dynamic speckle illumination microscopy.

Jerome Mertz received an A.B. in physics from Princeton Univ. in 1984, and a Ph.D. in quantum optics from Univ. of California at Santa Barbara and the Univ. of Paris VI in 1991. Following postdoctoral studies at the Univ. of Konstanz, Germany (Jürgen Mlynek group) and at Cornell Univ. (Watt Webb group), he obtained a lecturer position at the Ecole Supérieure de Physique et de Chimie Industrielle in Paris, where he became a CNRS research director. He is currently an associate professor of Biomedical Engineering at Boston Univ. His interests are in the development and applications of novel optical microscopy techniques for biological imaging.

Hillsborough	Sacramento	Piedmont	Glen Ellen
Frontiers in Optics	**Laser Science**		

8:00 a.m.–10:00 a.m.
FThC • Metamaterials-Based Devices
Partha P. Banerjee; Univ. of Dayton, USA, Presider

FThC1 • 8:00 a.m. Invited
Surface Plasmon-Polariton Transport, Localization and Detection, *Mark Brongersma; Stanford Univ., USA.* In this presentation I will discuss recent progress in the development of nanoscale plasmonic device structures capable of transporting, localizing, and detecting light. Exciting future directions in the field of nanoscale polaritonics will be highlighted.

FThC2 • 8:30 a.m.
Ultra-Long Range Surface Plasmon-Polaritons at Optical Frequencies, *Junpeng Guo, Ronen Adato; Univ. of Alabama at Huntsville, USA.* We will show that the propagation distance of symmetric mode surface plasmon-polaritons can be extended significantly by placing lower index of refraction dielectric layers than that of cladding on each side of the metal film.

8:00 a.m.–9:45 a.m.
LThA • Cold Atoms and Degenerate Gases I
Presider to Be Announced

LThA1 • 8:00 a.m. Invited
Theory of Atom Number Statistics of Bose Condensates, *Marlan O. Scully, Anatoly Svidzinsky; Inst. for Quantum Studies, Texas A&M Univ., USA.* We present a new method of calculating fluctuations of a Bose-Einstein condensate (BEC) of N interacting atoms. It is applicable both for ideal and interacting Bogoliubov BEC and yields remarkable accuracy at all temperatures.

LThA2 • 8:30 a.m. Invited
Interference of Fluctuating Condensates, *Eugene Demler; Harvard Univ., USA.* No abstract available.

8:00 a.m.–10:00 a.m.
LThB • General Techniques
Frederick J. Raab; LIGO Hanford Observatory, USA, Presider

LThB1 • 8:00 a.m.
Fiber Optics Sensor for Measuring Fluid Flow, *Anisur Rahman, Sunil Kumar; Polytechnic Univ., USA.* A new fiber optics sensor for measuring fluid flow is presented. Numerical model with detail fabrication processes are outlined. The flow sensor is designed at the end of multimode optical fiber based on Fabry-Perot interferometry.

LThB2 • 8:15 a.m.
Three-Dimension Frequency-Modulated Continuous-Wave Interferometric Fiber-Optic Displacement Sensor, *Jesse Zheng; PhotonTech, Canada.* A triple-sensor-multiplexed fiber-optic displacement sensor is discussed. The sensor is based on optical frequency-modulated continuous-wave (FMCW) interference and frequency-division multiplexing, and can measure the displacements of three objects or 3-dimension-displacement of a single object precisely.

LThB3 • 8:30 a.m.
Spectroscopy on Slow Molecules in Hollow-Core Photonic Bandgap Fibers, *Jan Hald[1], Jes Henningsen[2], Jan C. Petersen[1]; [1]Danish Fundamental Metrology Ltd., Denmark, [2]Niels Bohr Inst., Denmark.* We demonstrate saturation spectroscopy on the slow fraction of molecules in a gas-filled hollow-core photonic bandgap fiber. The gas-filling process is studied both theoretically and experimentally.

8:00 a.m.–10:00 a.m.
LThC • Terahertz Spectroscopy I
Masayoshi Tonouchi; Osaka Univ., Japan, Presider

LThC1 • 8:00 a.m. Invited
Ingredients Analysis of Aqueous Solutions and Food Products with Reflection THz Spectroscopy, *Peter Uhd Jepsen[1], Uffe Møller[1], David Cooke[1], Jacob Riis Folkenberg[2]; [1]Technical Univ. of Denmark, Denmark, [2]Foss A/S, Denmark.* Reflection THz spectroscopy is useful for analysis of liquids and food products. We will illustrate this with examples from food science, liquid analysis, and identification of hazardous liquids.

LThC2 • 8:30 a.m. Invited
Tertiary Structural Effects on Protein Picosecond Dynamics: Terahertz Dielectric Response, *Joseph R. Knab[1], Yunfen He[1], Ferdinand Lipps[1], Jing Yin Chen[1], Benjamin Moeller[1], Susan Gregurick[2], Andrea Markelz[1]; [1]Univ. at Buffalo, USA, [2]Biochemistry Dept., Univ. of Maryland, USA.* Terahertz time domain spectroscopy reveals hydration and temperature dependent "dynamical transitions" in both native and denatured proteins. These transitions may arise from hydration dependent side chain motion with these picosecond transitions subsequently influencing tertiary dynamics.

NOTES

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

SThA • Best of Topicals I—Continued

SThA3 • 8:55 a.m. Invited

The Atmospheric Chemistry Experiment (ACE): Interferometry in Orbit, *Peter Bernath[1,2]; [1]Univ. of Waterloo, Canada, [2]Univ. of York, UK.* ACE is a Canadian-led satellite mission that is measuring the concentration of more than thirty atmospheric constituents using a Michelson interferometer. A mission overview and selected results will be presented. (Fourier Transform Spectroscopy, 2007)

SThB • Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments I—Continued

SThB2 • 8:45 a.m. Invited

Radiation Testing of Er and Yb Doped Optical Fibers, *Todd Rose, G. A. Sefler, J. R. Linares, H. G. Muller; Aerospace Corp., USA.* Gamma induced transmission losses for ErYb and Yb fibers are evaluated with and without the presence of pump light. Significant photo-induced annealing is observed, which renders them viable for space applications.

SThB3 • 9:15 a.m. Invited

Space-Qualification Testing of Laser Optics, *Wolfgang Riede[1], Helmut Schröder[1], Paul Allenspacher[1], Denny Wernham[2], Yngve Lien[2], Sébastien Becker[2]; [1]Inst. of Technical Physics, Deutches Zentrum für Luft- und Raumfahrt (DLR), Germany, [2]European Space Agency, Netherlands.* Laser optics operated under a high-vacuum environment are exposed to an increased risk of failure. This paper addresses test procedures, results and lessons-learned from long-term test campaigns carried out at ESA/ESTEC and DLR.

SThC • (Guarded) Rational Exuberance: Renaissance after the Telecom Boom? Part I—Continued

SThC3 • 9:00 a.m. Invited

Preparing for the Future with a View of the Past, *Kathy Tse; AT&T Labs, USA.* As head of AT&T's Photonic Technology Planning group, Kathy is involved in looking forward and keeping the AT&T network competitive and ready for future services and demand. This requires a healthy respect for the advantages and challenges of new technologies as well as a pragmatic view of operationalizing that technology for network deployments. She will talk about AT&T's vision for the future and technology enablers.

FThA • Ultrafast Dynamics of Biological and Chemical Systems II—Continued

FThA3 • 8:45 a.m. Invited

Ultrafast Vibrational Spectroscopy of Water in Reverse Micelles, *Nancy Levinger[1,2], Michael D. Fayer[2], David E. Moilanen[2]; [1]Colorado State Univ., USA, [2]Stanford Univ., USA.* While steady-state vibrational spectroscopy provides information about molecular structure, time-resolved methods makes it possible to follow structural evolution. Using time-resolved infrared spectroscopy, we follow dynamics of water in confined environments present in reverse micelles.

FThA4 • 9:15 a.m.

Two-Dimensional Vibrational Spectroscopy: Hydrogen Bond Dynamics in Ionic Solutions, *Sungnam Park[1,2], Kyungwon Kwak[1], Kelly J. Gaffney[2], Michael D. Fayer[1]; [1]Stanford Univ., USA, [2]SSRL, Stanford Linear Acceleration Ctr., USA.* Hydrogen bond dynamics in a series of NaBr solutions were investigated. Slopes of peak position in 2-D correlation spectra were used as a new experimental observable to extract FFCF. FFCF decays slower in ionic solutions.

FThB • Advanced Biological Microscopy and Tissue Ablation—Continued

FThB2 • 8:45 a.m.

Application of Supercontinuum Lasers to Confocal Microscopy, *Jonathan H. Frank[1], Alan D. Elder[2], Johannes Swartling[2], Ashok R. Venkitaraman[3], Anand D. Jeyasekharan[3], Clemens F. Kaminski[2]; [1]Combustion Res. Facility, Sandia Natl. Labs, USA, [2]Dept. of Chemical Engineeering, Univ. of Cambridge, UK, [3]MRC Cancer Cell Unit, Hutchinson/MRC Res. Ctr., UK.* Spectrofluorometric imaging microscopy is demonstrated in a confocal microscope using a supercontinuum laser as an excitation source and a custom-built prism spectrometer for detection, providing spectrally resolved fluorescence excitation and detection from 450-700 nm.

FThB3 • 9:00 a.m.

Superresolving Nonlinear Microscopy, *Michael R. Beversluis, Stephan J. Stranick; NIST, USA.* We are developing a coherent anti-Stokes Raman scattering (CARS) microscope that uses complementary pump and Stokes beam pupil phase masks to achieve superresolution. This allows chemically-specific imaging beyond the diffraction limit.

FThB4 • 9:15 a.m.

Recent Developments in STED-Microscopy, *Benjamin Harke, Katrin I. Willig, Gerald Donnert, Stefan W. Hell; Max-Planck-Inst. for Biophysical Chemistry, Germany.* We present recent developments in high resolution stimulated emission depletion (STED) Microscopy concerning novel light sources, and discuss applications both for technical and biological samples.

Hillsborough	Sacramento	Piedmont	Glen Ellen
Frontiers in Optics	**Laser Science**		

FThC • Metamaterials-Based Devices—Continued

FThC3 • 8:45 a.m.
Tailoring Filtering Functions at Nanoscale: Optical Nanofilters, *Nader Engheta, Andrea Alù; Univ. of Pennsylvania, USA.* We have developed optical filter concepts in a subwavelength region, by forming collections of nanoparticles as optical lumped nanocircuits. Our numerical simulations reveal how such nanofilters can be designed in analogy with their RF filters.

FThC4 • 9:00 a.m.
Tunable Nanoelectromechanical RGB Pixels, *Robert Magnusson, Mehrdad Shokooh-Saremi; Univ. of Connecticut, USA.* Tunable leaky-mode resonant silicon-nitride pixels providing red/green/blue spectral lines are analyzed. Critical dimensions, rate of tuning, linewidths, and polarization properties are quantified.

FThC5 • 9:15 a.m.
Ultra-Compact On-Chip Photonic Crystal Interferometers with High Sensitivity, *Maysamreza Chamanzar, Babak Momeni, Ali Adibi; Georgia Tech, USA.* High group index property of photonic crystals (PCs) is used to enhance the spectral sensitivity of on-chip optical interferometry. A planar PC is used in a Young interferometer demonstrating one order of magnitude sensitivity improvement.

LThA • Cold Atoms and Degenerate Gases I—Continued

LThA3 • 9:00 a.m. Invited
Quantum Statistics of a Degenerate Bose Gas, *Mark G. Raizen; Univ. of Texas at Austin, USA.* We have observed atomic number squeezing by direct atom counting, and our results are consistent with many-body number state generation. Progress towards controlled entanglement and few-body tunneling will be discussed.

LThB • General Techniques—Continued

LThB4 • 8:45 a.m.
Two Wave Mixing Analysis In Rb:$BaTiO_3$ Using $Bi_{12}TiO_{20}$, *Arun Anand[1], Chittur S. Narayanamurthy[2]; [1]Inst. for Plasma Res., India, [2]M S Univ. of Baroda, India.* A noval two wave mixing analysis in Rb:$BaTiO_3$ (Rhobium doped Barium Titanate) using photorefractive BTO (Bismuth Titanium Oxide) along one of the writing beams and a small power red He-Ne laser is reported.

LThB5 • 9:00 a.m.
Measurement of Particle Size of Lycopodium Powder Using He-Ne Laser, *Balusamy Renganathan[1], Alagan Viswanathan[1], D. Sastikumar[1], S. Sahul Hameed[2]; [1]Natl. Inst. of Technology, India, [2]Kings Engineering College, India.* The present study describes the method of determining the particle size of the lycopodium powder using laser source. The observed values are found to be in good agreement with the standard values.

LThB6 • 9:15 a.m.
Defining the Degree of General Astigmatism of a General Astigmatic Beam, *George Nemes[1], Julio Serna[2]; [1]Astigmat, USA, [2]Complutense Univ., Spain.* We define the degree of general astigmatism (DGA) of a general astigmatic beam, a measurable positive number expressing the departure of such a beam from more symmetrical beams, the latter having the DGA = 0.

LThC • Terahertz Spectroscopy I—Continued

LThC3 • 9:00 a.m. Invited
Solar Energy Conversion Processes in Nanostructured Materials Studied via Time-Resolved THz Spectroscopy, *Matt Beard[1], Jeffery Blackburn[1], Michael Heben[1], Xin Ai[1], Garry Rumbles[1], Randy J. Ellingson[1], Arthur J. Nozik[1,2]; [1]Natl. Renewable Energy Lab, USA, [2]Dept. of Chemistry, Univ. of Colorado, USA.* We discuss time-resolved THz spectroscopy measurements for three important solar energy conversion approaches; (1) electronically coupled semiconductor nanocrystals, (2) a bulk heterojunction formed between P3HT and PCBM, and (3) films of single walled carbon nanotubes.

NOTES

Frontiers in Optics

SThA • Best of Topicals I—Continued

SThA4 • 9:20 a.m.
Readout-Signal Amplification by Homodyne Detection Scheme, *Hideharu Mikami[1], Takeshi Shimano[1], Hiromi Kudo[1], Jiro Hashizume[2], Harukazu Miyamoto[1]; [1]Central Res. Lab, Hitachi, Ltd., Japan, [2]Mechanical Engineering Res. Lab, Hitachi, Ltd., Japan.* Optical signal amplification by using homodyne detection scheme was newly proposed and demonstrated experimentally. We estimated that the scheme improved S/N for an 8-layer and 3x-read-speed Blu-ray Disc by more than 20 dB. (Optical Data Storage, 2007)

SThA5 • 9:45 a.m.
MAD On-Sky Results in Star Oriented Mode, *Enrico Marchetti[1], Roland Brast[1], Bernard Delabre[1], Rob Donaldson[1], Enrico Fedrigo[1], Christoph Frank[1], Norbert Hubin[1], Johann Kolb[1], Miska Le Louarn[1], Jean-Louis Lizon[1], Sylvain Oberti[1], Roland Reiss[1], Christian Soenke[1], Sebastien Tordo[1], Andrea Baruffolo[2], Paolo Bagnara[2], Antonio Amorim[3], Jorge Lima[3]; [1]European Southern Observatory, Germany, [2]INAF - Osservatorio Astronomico di Padova, Italy, [3]Faculdade de Ciencias, Univ. de Lisboa, Portugal.* The MAD demonstrator performed on-sky observations at VLT telescope for validating Ground-Layer, Laser Tomography and Multi-Conjugate Adaptive Optics correction. Here we present the results obtained on the sky and in laboratory for Star Oriented mode. (Adaptive Optics, 2007)

SThB • Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments I—Continued

SThB4 • 9:45 a.m.
Radiation Defects in Nonlinear Optical Materials Used for Space-Based Applications, *Galina Malovichko, Martin Meyer, Valentin Grachev; Physics Dept., Montana State Univ., USA.* The Electron Paramagnetic Resonance (EPR) and simultaneous EPR/optical study of defects in crystals irradiated by gamma photons, electrons, protons and neutrons is presented. Among investigated materials are congruent and stoichiometric $LiNbO_3$, $Li_2B_4O_7$, and $KTiOPO_4$.

SThC • (Guarded) Rational Exuberance: Renaissance after the Telecom Boom? Part I—Continued

SThC4 • 9:30 a.m. Invited
Technologies for the Optical Renaissance, *Robert W. Tkach; Bell Labs, Alcatel-Lucent, USA.* Relentless growth in data traffic looks as if it is finally beginning to work off the excess capacity installed in the boom. As demand for optical networking equipment recovers, a variety of new technologies are becoming available and some old ones are resurfacing. Bob Tkach is the Director of Optical Transmission Research at Bell Laboratories, Alcatel-Lucent.

FThB • Advanced Biological Microscopy and Tissue Ablation—Continued

FThB5 • 9:30 a.m.
Intrastromal Refractive Index Change Induced in Cat Corneas by Femtosecond Laser Micromachining, *Li Ding, Krystel R. Huxlin, Wayne H. Knox; Univ. of Rochester, USA.* A Ti:Sapphire femtosecond laser with a pulse energy of 0.3 nJ at 93 MHz repetition rate was used for micromachining the stromal layer of cat corneas. Refractive index changes as large as 0.005-0.01 were observed.

FThB6 • 9:45 a.m.
Pulsed Laser-Induced Damage in Rat Corneas: Time-Resolved Imaging of Physical Effects and Acute Biological Response, *Anoop V. Cherian, Kaustubh R. Rau; Natl. Ctr. for Biological Sciences, Tata Inst. of Fundamental Res., India.* Cavitation induced damage was studied in rat corneas using a combination of time-resolved imaging and fluorescence microscopy at high spatial resolution. Cavitation bubble expansion leads to cell compression in epithelial layers, but minimal biological damage.

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

Hillsborough	Sacramento	Piedmont	Glen Ellen
Frontiers in Optics	**Laser Science**		

FThC • Metamaterials-Based Devices—Continued

FThC6 • 9:30 a.m.
Initial Designs and Simulated Performance of Coated Nano-Particle Lasers, *Joshua A. Gordon, Richard W. Ziolkowski; Univ. of Arizona, USA.* The optical properties of coated nanometer-sized spherical particles comprised of a gain medium core covered with a concentric plasmonic shell are investigated. Numerically predicted super-resonant radiative scattering suggests the possibility of realizing highly sub-wavelength lasers.

FThC7 • 9:45 a.m.
Nanophotonic Quantum Dot Waveguides with Low Loss, *Chia-Jean Wang, Ludan Huang, Babak A. Parviz, Lih Y. Lin; Univ. of Washington, USA.* We present loss characterization results for nanophotonic quantum dot waveguides. Loss data measured over 10, 15, and 20 μm lengths using 500 nm wide structures show reduced loss compared to other sub-diffraction nanophotonic waveguides.

LThA • Cold Atoms and Degenerate Gases I—Continued

LThA4 • 9:30 a.m.
Model for the Supersolid Formation in Bose Einstein Condensate with Attractive Oscillatory Potential, *Matt K. Kalinski; Utah State Univ., USA.* We show that a one-dimensional oscillatory Coulomb-like soft core interaction potential predicts the existence of supersolid density modulation in Bose Einstein condensate when the critical potential strength is reached.

LThB • General Techniques—Continued

LThB7 • 9:30 a.m.
Chopper Mediated Volume and Spherical Bragg Lasers, *Nasrullah Khan, Zahid Saleem, Abdul Wahid, N. Abas; Comsats Inst. of Information Technology, Pakistan.* We report the formation techniques of helically perforated chopper mediated varying period dynamic and thin film coated reflective ball permanent spherical Bragg gratings for tunable multiple wavelengths collinear and round cavity distributed feedback lasers.

LThB8 • 9:45 a.m.
Coupling Model for 2x1 Photonic Crystal Vertical Cavity Laser Arrays, *Ann C. Lehman, Kent D. Choquette, P. Scott Carney; Univ. of Illinois at Urbana-Champaign, USA.* We derive a theory expressing the coherence properties of 2x1 photonic crystal vertical-cavity surface-emitting laser arrays. Using only the far-field interferogram, this theory predicts the frequency splitting between the lasers in agreement with spectral measurements.

LThC • Terahertz Spectroscopy I—Continued

LThC4 • 9:30 a.m.
Terahertz Study of Trichloroanisole by Time-Domain Spectroscopy, *Yew Li Hor, Hee C. Lim, John F. Federici, Eric Moore, Joseph W. Bozzelli; New Jersey Inst. of Technology, USA.* This work presents THz time-domain spectroscopy applied in transmission to three TCA compounds (2,3,4-TCA, 2,4,6-TCA and 2,5,6-TCA) in pellet form pressed with polyethylene. Experiment results would be compared to theoretical modeling of the vibrational modes.

LThC5 • 9:45 a.m.
Enantiomeric Dependence of the Far-Infrared Spectra of Polycrystalline Tyrosine and Valine, *Timothy A. French[1], Alan B. True[1], Konstanze Schroeck[2], Charles A. Schmuttenmaer[1]; [1]Yale Univ., USA, [2]Ruhr Univ. of Bochum, Germany.* The far-infrared spectra of polycrystalline samples of tyrosine and valine have been measured using THz time-domain spectroscopy. The crystal structures, vibrational frequencies, and intensities were calculated using CHARMM32b1.

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

NOTES

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

10:30 a.m.–12:10 p.m.
SThD • Best of Topicals II
Michael Duncan, Naval Res. Lab, USA, Presider

SThD1 • 10:30 a.m. Invited

Scanning Holographic Microscopy for Multi-functional Imaging, *Guy Indebetouw; Virginia Polytechnic Inst. and State Univ., USA.* The background of scanning holographic microscopy is reviewed. Advantages of the method illustrate the possibility of capturing simultaneously a number of holograms accessing different imaging modes such as absorbance, reflectance, fluorescence, and phase contrast. (Digital Holography, 2007)

SThD2 • 10:55 a.m. Invited

Optical Frequency Comb Generation from a Monolithic Micro-Resonator via the Kerr Nonlinearity, *Pascal Del'Haye, Albert Schliesser, Tobias Wilken, Ronald Holzwarth, Tobias Kippenberg; Max-Planck-Inst. for Quantum Optics, Germany.* It is shown that the cascaded optical sidebands generated via optical parametric oscillations in a monolithic microcavity are equidistant down to a resolution bandwidth limited level of 2 kHz. (Nonlinear Optics: Materials, Fundamentals and Applications, 2007)

10:30 a.m.–12:30 p.m.
SThE • Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments II and Ceramic Materials I
Gregory Quarles; VLOC, USA, Presider

SThE1 • 10:30 a.m. Invited

Rethinking the Flight Qualification Processes of Solid-State and Fiber-Based Laser Systems, *Donald Barry Coyle; NASA Goddard Space Flight Ctr., USA.* Flight quality laser systems for next generation remote sensing missions can expect an increase in lifetime requirements of >10X and efficiency goals of 2X. New methods in design, engineering, packaging and testing are being presented.

SThE2 • 11:00 a.m. Invited

Design, Qualification and On-Orbit Performance of the CALIPSO Aerosol Lidar Transmitter, *Floyd E. Hovis[1], Carl Weimer[2], Jeff Applegate[2], William Luck[3], Michael Cisewski[3]; [1]Fibertek Inc., USA, [2]Ball Aerospace and Technologies Corp., USA, [3]NASA Langley Res. Ctr., USA.* The laser transmitter for the CALIPSO aerosol lidar mission has been operating as orbit as planned since June 2006. We will discuss the design and qualification process that led to this successful result.

10:30 a.m.–12:30 p.m.
SThF • (Guarded) Rational Exuberance: Renaissance after the Telecom Boom? Part II
Ming Wu; Univ. of California at Berkeley, USA, Presider

SThF1 • 10:30 a.m. Invited

Digital Optical Networks - PIC Based Systems for Advanced Network Architectures, *David F. Welch; Infinera Corp., USA.* Photonic Integrated Circuit (PIC) based fiberoptic telecommunication systems have changed the implementation of bandwidth management functions in optical transport networks, resulting in the Digital Optical Network. In this advanced network architecture, information is managed in a fashion that is un-constrained by the wavelength on which the information is carried, enabling transparency at the service layer and future-proofing the network.

SThF2 • 11:00 a.m. Invited

Post Bubble Entrepreneurial Paradigm? *Milton Chang; Incubic, LLC, USA.* Milton Chang has an exceptional investment track record, and founded Incubic to institutionalize this approach in a venture capital firm. Milton has personally built two businesses from zero to successful IPO, as CEO. The proven ability to build true business from zero is distinct from operating experience, and is critical to the start-up process and success.

10:30 a.m.–12:15 p.m.
FThD • Ultrafast Pulse Measurements II
Barry C. Walker; Univ. of Delaware, USA, Presider

FThD1 • 10:30 a.m. Invited

The Long and the Short of Interferometric Pulse Measurement, *Ian Walmsley, Piotre Wasylczyk, Simon-Pierre Gorza, Antoine Monmayrant, Alex Radunsky; Univ. of Oxford, UK.* We discuss recent developments in spectral shearing interferometry for ultrashort pulse characterisation. Long nonlinear crystals enable compact, highly sensitive devices for space-time measurements, and spatial encoding extends this capability to the single cycle regime.

FThD2 • 11:00 a.m.

The Ability of SHG Frequency-Resolved Optical Gating to Measure Complex Ultrashort Laser Pulses, *Lina Xu, Rick Trebino; Georgia Tech, USA.* We demonstrate that second harmonic generation (SHG) frequency-resolved optical gating (FROG), which is a simple technique to measure the intensity and phase of simple ultrashort laser pulses, is capable of measuring extraordinarily complex pulses.

FThD3 • 11:15 a.m.

Spectro-Temporal Imaging by Sum Frequency Generation: Ultrafast Optical Oscilloscope, *Aram Zeytunyan[1], Tigran Mansuryan[1], Meri Kalashyan[1], Garegin Yesayan[1], Levon Kh Mouradian[1], Frédéric Louradour[2], Alain Barthélémy[2]; [1]Yerevan State Univ., Armenia, [2]XLIM Inst. de Recherche, Faculté des Sciences, France.* We experimentally demonstrate an aberration-free self-reference spectro-temporal imaging of femtosecond pulses through a new spectral compression/temporal lensing method based on second harmonic generation.

10:30 a.m.–12:30 p.m.
FThE • Seeing the Invisible: Strategies for Imaging Transparent Cell Types I
Melanie C. Campbell; Univ. of Waterloo, Canada, Presider

FThE1 • 10:30 a.m. Invited

Visualizing Retinal Layers Using Polarization Sensitive OCT and Scattering Contrast at 840 and 1050 nm, *Johannes F. de Boer; Wellman Ctr. for Photomedicine, Massachusetts General Hospital, USA.* Contrast in Optical Coherence Tomography is provided by differences in tissue scattering properties. Additional contrast mechanisms are polarization properties and wavelength dependent scattering. The latter two contrast mechanisms will be investigated for retinal imaging.

FThE2 • 11:00 a.m.

A Polychromatic High Sensitivity Double-Pass System to Measure Intraocular Scattering, *Guillermo M. Pérez, Pablo Artal; Lab de Óptica, Spain.* We developed an instrument based on the double-pass technique to quantify intraocular scattering in the living eye by recording and analyzing retinal images with a large fied of view.

FThE3 • 11:15 a.m. Invited

Mueller Matrix CSLO Polarimetry and Improved Imaging of Retinal Structures, *Juan Bueno; Univ. de Murcia, Spain.* The ocular optics and the retina present polarization properties that can be used to improve fundus imaging. In particular, Stokes-Mueller polarimetry will be shown as an alternative technique to image living retinal structures.

Hillsborough

Frontiers in Optics

10:30 a.m.–12:30 p.m.
FThF • Optical Antennae
Lukas Novotny; Univ. of Rochester, USA, Presider

FThF1 • 10:30 a.m. Invited
Surface Plasmon-Based Optical Manipulation: Towards Ultra Gentle Nano-Tweezers, *Romain Quidant; Inst. de Ciencies Fotoniques, Spain.* We investigate how enhanced surface plasmon fields bound to noble metal structures can be exploited to revisit optical manipulation and extend its applicability down to the nano-scale.

FThF2 • 11:00 a.m.
Far-Field Characterization of Gold Nanoantenna Arrays, *Zhengtong Liu[1], Alexandra Boltasseva[2], Reuben M. Bakker[1], Samuel Gresillon[3], Hsiao-Kuan Yuan[1], Alexander V. Kildishev[1], Vladimir P. Drachev[1], Vladimir M. Shalaev[1]; [1]Purdue Univ., USA, [2]Technical Univ. of Denmark, Denmark, [3]CNRS and Univ. Paris 6, France.* Elliptical gold nanoantenna arrays were studied. Their measured transmittance and reflectance spectra agree well with finite element simulation results. We varied the geometries in simulations and show their effects on the spectra.

FThF3 • 11:15 a.m.
Bowtie Nanoantennas as Substrates for Electrochemical Surface-Enhanced Raman Scattering (SERS), *Frank Jäckel, Anika A. Kinkhabwala, W.E. Moerner; Stanford Univ., USA.* Single gold bowtie nanoantennas are used for electrochemical SERS. Certain vibrational modes of para-mercaptoaniline show a switching-on behavior related to roughening of the nanostructure's surface upon electrochemical cycling, underlining the importance of well-characterized SERS substrates.

Sacramento

Laser Science

10:30 a.m.–12:00 p.m.
LThD • Cold Atoms and Degenerate Gases II
Mark G. Raizen; Univ. of Texas at Austin, USA, Presider

LThD1 • 10:30 a.m. Invited
Optical Lattice Experiments, *David Weiss, Karl D. Nelson, Xiao Li; Penn State, USA.* We have spatially resolved ~250 single, neutral atoms in a 3-D array. The atoms are trapped in a blue-detuned optical lattice, and can function as qubits in a quantum computer.

LThD2 • 11:00 a.m. Invited
Coherent Control of Pairs of Cold Atoms in a Double-Well Optical Lattice, *Patricia J. Lee, M. Anderlini, B. L. Brown, J. Sebby-Strabley, W. D. Phillips, J. V. Porto; NIST, USA.* We present techniques for coherent manipulation of an array of isolated atom pairs in a lattice of double-well potentials, and their potential applications in quantum information processing.

Piedmont

Frontiers in Optics

10:30 a.m.–12:30 p.m.
FThG • General Optical Design and Instrumentation II
Marty Valente; Univ. of Arizona, USA, Presider

FThG1 • 10:30 a.m.
Miniature Computer-Tomography Imaging Spectrometer, *Wei Zhou, James Leger; Univ. of Minnesota, USA.* A miniature computer-tomography imaging spectrometer ($2mm^3$) has been designed using a hybrid combination of diffractive, refractive, and graded-index optical elements. The diffractive elements are fabricated directly onto the ends of the micro-GRIN-lenses by focused-ion-beam etching.

FThG2 • 10:45 a.m.
A Slow-Light Fourier-Transform Interferometer, *Zhimin Shi, Robert W. Boyd; Inst. of Optics, Univ. of Rochester, USA.* We propose a new type of Fourier-transform interferometer based on a tunable slow-light medium. Such a FT-interferometer requires no moving arm, can have very fine spectral resolution, and is more compact than a conventional FT-interferometer.

FThG3 • 11:00 a.m.
A Snap-Shot Dual-Disperser Imager for Compressive Hyperspectral Imaging, *Renu John[1], David J. Brady[1], Rebecca M. Willett[1], Michael Gehm[2], Timothy J. Schulz[3]; [1]Duke Univ., USA, [2]Univ. of Arizona, USA, [3]Michigan Technological Univ., USA.* We demonstrate a single-shot, dual-disperser spectral imaging system using coded apertures to perform compressive imaging. We also describe associated multiscale reconstruction algorithms to retrieve hyperspectral data from single-shot image. We show simulated and experimental results.

FThG4 • 11:15 a.m.
Near Infrared Lidar System for Hazard Detection and Mitigation Onboard Aircraft, *Mary E. Ludwig, Joseph D. Matchett, Elizabeth J. Billmers, Richard I. Billmers; RL Associates, Inc., USA.* A near infrared range-gated Lidar system using polarization discrimination to mitigate aviation hazards is modeled and tested. Functionality is demonstrated in rain and fog conditions, and modeled for detection of water phase in cirrus clouds.

Glen Ellen

Laser Science

10:30 a.m.–12:30 p.m.
LThE • Terahertz Spectroscopy II
Matt Beard; Natl. Renewable Energy Lab, USA, Presider

LThE1 • 10:30 a.m. Invited
Terahertz Spectroscopy in the Near Field, *Hui Zhan[1], Michael Hvasta[1], Victoria Astley[1], Jason Deibel[1], Daniel Mittleman[1], Feng Hao[1], Peter Nordlander[1], Y. Lim[2]; [1]Rice Univ., USA, [2]Konkuk Univ., Republic of Korea.* We observe a terahertz field enhancement in the junction between a sub-wavelength metal probe tip and a metallic substrate. We exploit this in the first observation of a metal-insulator transition using terahertz near-field techniques.

LThE2 • 11:00 a.m. Invited
THz High Field Generation, THz Coherent Spectroscopy and THz Coherent Control, *Ka-Lo Yeh, Matthias C. Hoffmann, János Hebling, Keith A. Nelson; MIT, USA.* THz pulses with over ten microjoules of energy are generated and used to drive nonlinear material responses. Nonlinear THz coherent spectroscopy and coherent control are illustrated.

NOTES

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

SThD • Best of Topicals II—Continued

SThD3 • 11:20 a.m. Invited

Fiber-Top Cantilevers: A New Generation of Micromachined Sensors for Multipurpose Applications, *Davide Iannuzzi[1], Szabolcs Deladi[2], Herman Schreuders[1], Martin Slaman[1], Jan H. Rector[1], Michael Elwenspoek[2]; [1]Vrije Univ. Amsterdam, Netherlands, [2]Univ. of Twente, Netherlands.* Fiber-top cantilevers are new monolithic devices obtained by carving a cantilever out of the edge of a single-mode optical fiber. Here we report evidences of their potential impact as sensing devices for multipurpose applications. (18th International Conference on Optical Fiber Sensors, 2006)

SThD4 • 11:45 a.m. Invited

THz Tunable Slow Light and Fast Light of Ultrashort Pulses in Semiconductor Optical Amplifiers, *Bala Pesala[1], Forrest G. Sedgwick[1], Alexander V. Uskov[1], Connie Chang-Hasnain[1], Tony H. Lin[2]; [1]Univ. of California at Berkeley, USA, [2]Calmar Optcom Inc., USA.* Electrically tunable delays and advances for 600fs pulses are achieved using ultrafast nonlinearities in SOAs. Feasibility of cascading multiple SOAs to achieve higher delays is confirmed using a novel scheme that uses a single SOA. (Slow and Fast Light, 2007)

SThE • Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments II and Ceramic Materials I—Continued

SThE3 • 11:30 a.m. Invited

Advances in Ceramic Laser Media, *Ken-ichi Ueda; Univ. of Electro-Communications, Japan.* No abstract available.

SThE4 • 12:00 p.m. Invited

Ceramic Materials for Advanced Domes, Windows and Lasers, *Richard Gentilman; Raytheon, USA.* Ceramics are replacing single crystals in high power SSLs. Optical attenuation must be very low because of long optical path lengths though the gain material. Current ceramic laser material development in the US is reviewed.

SThF • (Guarded) Rational Exuberance: Renaissance after the Telecom Boom? Part II—Continued

SThF3 • 11:30 a.m. Invited

Analyzing New Technology, *Kathleen Perkins; Breault Res. Organization Inc., USA.* Since joining BRO in 1995, Perkins has leveraged her experience on 5th-Avenue to grow the company. As CEO, Perkins' marketing savvy and business sense has helped the company grow its 2003 revenue by more than 75% in 2004. She remains focused on the customer, working to implement customer-centric business processes in every department.

SThF4 • 12:00 p.m. Invited

Title to Be Announced, *Richard Swanson; SunPower Corp., USA.* No abstract available.

FThD • Ultrafast Pulse Measurements II—Continued

FThD4 • 11:30 a.m. Invited

Two-Dimensional Spectral Shearing Interferometry (2-DSI) of Few-Cycle Laser Pulses, *Franz X. Kaertner, J. Birge; MIT, USA.* We apply the new pulse measurement technique, two-dimensional spectral shearing interferometry, to the characterization of few-cycle laser pulses and discuss its limitations in approaching the single-cycle regime.

FThD5 • 12:00 p.m.

***In situ* Optical Heterodyne Four Wave Mixing,** *Andrey Kharchenko, Yuri Paskover, Yehiam Prior; Weizmann Inst. of Science, Israel.* We demonstrate a novel experimental approach to heterodyne detection where the local oscillator field is derived from the alignment of polarizable anisotropic molecules added in small amounts to the measured sample.

FThE • Seeing the Invisible: Strategies for Imaging Transparent Cell Types I—Continued

FThE4 • 11:45 a.m.

Methods for Measuring Light Scatter in Intraocular Lenses, *Marrie H. van der Mooren[1], Joris Coppens[2], Tom van den Berg[2], Patricia Piers[1]; [1]AMO Groningen BV, Netherlands, [2]Netherlands Inst. for Neuroscience, Netherlands.* Light scatter in intraocular lenses may be a significant factor in quality of vision for patients implanted with these lenses. This paper describes two quantitative methods for measuring light scatter in intra ocular lenses *in situ.*

FThE5 • 12:00 p.m. Invited

The Application of Molecular Contrast Optical Coherence Tomography to Imaging Cells in the Living Retina, *Joseph Izatt; Duke Univ., USA.* We describe molecular contrast optical coherence tomography and its potential applications for retinal imaging. Other functional contrast mechanisms including blood flow and cellular optical property fluctuations will also be discussed.

Hillsborough

Frontiers in Optics

FThF • Optical Antennae—Continued

FThF4 • 11:30 a.m.
Plasmon Guiding in Coupled Nanovoids, *Isabel Romero[1], Tatiana Teperik[1], Francisco Javier García de Abajo[1,2]; [1]Donostia Intl. Physics Ctr., Spain, [2]Inst. de Óptica - CSIC, Spain.* Plasmon propagation is investigated in arrays of silica particles buried in gold. Long propagation distances are obtained, thus providing a realistic scenario for plasmonic circuits based upon buried structures.

FThF5 • 11:45 a.m.
Ideas for Optical Nanoantenna Design: From Microwave to Visible Frequencies, *Jingjing Li, Alessandro Salandrino, Nader Engheta; Univ. of Pennsylvania, USA.* We discuss how nanoantenna designs can be inspired and benefit from the conventional microwave antenna design techniques. Several optical nanoantenna ideas, analyzed numerically by transplanting the classic antenna concepts from microwaves to optics, are presented.

FThF6 • 12:00 p.m.
Metal Nanoparticle Metamaterials for Engineering Dielectric Constants and Their Applications to Near Resonant Surface Plasmon Waveguides, *Devang Parekh, Lars Thylen, Connie J. Chang-Hasnain; Univ. of California at Berkeley, USA.* We analyze metal nanoparticle metamaterials, allowing engineered negative or positive epsilon. Dissipative losses of bulk materials and near-resonant waveguides are treated and figures of merit formulated, quantifying necessary improvements in optical losses for various applications.

Sacramento

Laser Science

LThD • Cold Atoms and Degenerate Gases II—Continued

LThD3 • 11:30 a.m.
A TWIST for Ultracold, Polar Molecules, *Jan Kleinert, Chris Haimberger, Patrick Zabawa, Nicholas P. Bigelow; Univ. of Rochester, USA.* We present a ThinWIre electroStatic Trap (TWIST) for ultracold, polar NaCs molecules formed via photoassociation from a mixed species MOT. The TWIST is superimposed onto the atom clouds, enabling a continous accumulation of molecules.

LThD4 • 11:45 a.m.
Angular Momentum Transfer to BEC by a Two-Photon Stimulated Raman Technique, *Kevin C. Wright[1], L. Suzanne Leslie[2], Nicholas P. Bigelow[1,2]; [1]Dept. of Physics and Astronomy, Univ. of Rochester, USA, [2]Inst. of Optics, Univ. of Rochester, USA.* We have used a pair of near-resonant Raman detuned beams of differing optical angular momentum (OAM) to couple two different internal atomic spin states and coherently transfer OAM to the center-of-mass motion of a BEC.

Piedmont

Frontiers in Optics

FThG • General Optical Design and Instrumentation II—Continued

FThG5 • 11:30 a.m.
A Highly Compact Chaotic Cavity for Optical Trace Gas Sensing Applications, *Dongxia Qu[1], Allen Hsu[2], Abhishek Agrawal[1], Tiffany Ko[1], Evgenii Narimanov[1], Claire Gmachl[1]; [1]Princeton Univ., USA, [2]MIT, USA.* We present a novel chaotic cavity for *in situ* trace gas sensing. The multi-pass cavity achieves ~15-m optical path length in a cavity of only 68 mL volume with little beam overlap on the mirror.

FThG6 • 11:45 a.m.
Fiber Optic Sensor for Measuring Refractive Index of Liquids, *Govindan Gobi, Dillibabu Sastikumar; Natl. Inst. of Technology, India.* A Simple technique for determining the refractive index of liquids using reflective type of fiber optic displacement sensor is described. The refractive indices observed for the liquids range from 1.33 to 1.52.

FThG7 • 12:00 p.m.
Numerical Analysis of the Role of Core-Clad Index Contrast in a Multicore Fiber Bundle, *Xianpei Chen, Chris Xu; Cornell Univ., USA.* We demonstrate numerically that a large core-clad index contrast lowers couplings between neighboring cores, achieving a fiber bundle with a higher core density, less coupling, and effectively single moded propagation in each core.

Glen Ellen

Laser Science

LThE • Terahertz Spectroscopy II—Continued

LThE3 • 11:30 a.m. Invited
THz-TDS System Using fs Fiber Laser at a Wavelength of 1.5 μm, *Masayoshi Tonouchi; Osaka Univ., Japan.* We review the development of THz-TDS with a 1.5-μm-fiber laser. A variety of emitters such as surfaces of InAs, InGaAs, and InSb, photoconductive switches, and DAST are examined.

LThE4 • 12:00 p.m.
Studies of Shift and Rectification Currents in GaAs(111) Using Terahertz Emission Spectroscopy, *James M. Schleicher, Shayne M. Harrel, Charles A. Schmuttenmaer; Yale Univ., USA.* The dependence of THz pulse emission on surface orientation has been used to study carrier dynamics in GaAs(111). We find that the angular dependence of linearly polarized excitation is well described by known theory.

NOTES

Empire	Crystal	Gold	Valley	California
Frontiers in Optics				
SThD • Best of Topicals II—Continued	**SThE • Space-Qualification of Materials and Devices for Laser Remote Sensing Instruments II and Ceramic Materials I—Continued**	**SThF • (Guarded) Rational Exuberance: Renaissance after the Telecom Boom? Part II—Continued**		**FThE • Seeing the Invisible: Strategies for Imaging Transparent Cell Types I—Continued**
12:30 p.m.–2:00 p.m., Lunch Break				

Hillsborough	Sacramento	Piedmont	Glen Ellen
Frontiers in Optics	**Laser Science**	**Frontiers in Optics**	**Laser Science**

FThF • Optical Antennae—Continued

FThF7 • 12:15 p.m.
Finesse Enhancement with Two-Ring Resonator Structure, *Landobasa Y. Tobing, Desmond C. S. Lim, Mee Koy Chin; Nanyang Technological Univ., Singapore.* We theoretically demonstrate that a simple two-ring resonator structure can have significantly larger finesse than the single-ring case.

FThG • General Optical Design and Instrumentation II—Continued

FThG8 • 12:15 p.m.
Holographic Spectrometers Using Cylindrical Beam Volume Holograms for Large Spectral Range and High Throughput Spectroscopy, *Chaoray Hsieh, Omid Momtahan, Ali Adibi; Georgia Tech, USA.* Compact slit-less spectrometers using cylindrical beam volume holograms (CBVHs) are presented with several advantages over conventional spectrometers. Spectrometers with large spectral range, large acceptance angle, or high throughput can be demonstrated using special-designed multiplexed CBVHs.

LThE • Terahertz Spectroscopy II—Continued

LThE5 • 12:15 p.m.
Time-Resolved Spectroscopy of the Charge-Transfer Gap in $Sr_2CuO_2Cl_2$, *Steve Dodge[1], Andreas B. Schumacher[2], Lance L. Miller[3], Daniel S. Chemla[2,4]; [1]Simon Fraser Univ., Canada, [2]Materials Science Div., E. O. Lawrence Berkeley Natl. Lab, USA, [3]Condensed Matter Physics, Ames Lab, Iowa State Univ., USA, [4]Dept. of Physics, Univ. of California at Berkeley, USA.* We present energy- and time-resolved pump-probe spectroscopy near the charge-transfer gap in the undoped cuprate compound $Sr_2CuO_2Cl_2$. The photoinduced response relates simply to the thermal response, indicating a common phonon-mediated origin.

12:30 p.m.–2:00 p.m., Lunch Break

NOTES

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

2:00 p.m.–4:00 p.m.
FThH • Silicon and III-V Based Optoelectronics for Optical Interconnects
Alyssa B. Apsel; Cornell Univ., USA, Presider

FThH1 • 2:00 p.m. Tutorial

Devices for Optical Interconnects to Chips, *David A. B. Miller; Stanford Univ., USA.* This tutorial will discuss the requirements for devices for optical interconnects to chips, and recent progress in devices that are integrable with silicon technology, including germanium quantum wells.

David A. B. Miller received the B.Sc. degree from St Andrews Univ., and, in 1979, the Ph.D. degree from Heriot-Watt Univ., both in Physics. He was with Bell Labs from 1981 to 1996, as a department head from 1987, latterly of the Advanced Photonics Res. Dept. He is currently the W. M. Keck Professor of Electrical Engineering, the Director of the Solid State and Photonics Lab, and a Co-Director of the Stanford Photonics Res. Ctr. at Stanford Univ., Stanford, California, USA. His research interests include physics and devices in nanophotonics, nanometallics, and quantum-well optoelectronics, and fundamentals and applications of optics in information sensing, switching, and processing. He has published more than 200 scientific papers, holds 62 patents, is a Fellow of OSA, IEEE, APS, and the Royal Societies of Edinburgh and London, holds honorary degrees from the Vrije Univ. Brussel and Heriot-Watt Univ., and has received numerous awards.

2:00 p.m.–4:00 p.m.
SThG • Ceramic Materials II
Ken-ichi Ueda; Univ. of Electro-Communications, Japan, Presider

SThG1 • 2:00 p.m. Invited

Advances in Fluoride-Based Ceramic Laser Media, *Michel Mortier[1], P. Aubry[1], P. Gredin[1], D. Vivien[1], G. Patriarche[2]; [1]Ecole Natl. Supérieure de Chimie de Paris, France, [2]Lab de Photonique et de Nanostructures, France.* The synthesis and characterization of transparent fluoride ceramics is reported. The entire process is specially designed for fluorine compounds and their specific reactivity and sensitivity to oxygen and moisture.

SThG2 • 2:30 p.m.

Characterization of Composite Er:YAG Ceramic Laser Gain Materials, *Elizabeth R. Kupp[1], Sang-Ho Lee[1], Mariola H. Ramirez[1], Venkat Gopalan[1], John Q. Dumm[2], Vida K. Castillo[3], Greg J. Quarles[3], Gary L. Messing[1]; [1]Penn State Univ., USA, [2]II-VI Corp./AMDC, USA, [3]II-VI Corp./VLOC, USA.* We produced composite Er:YAG ceramic laser gain materials. We will present an overview of the processing of these materials, and materials characterization results, including Er distribution analysis, bulk optical property measurements and laser testing.

2:00 p.m.–4:00 p.m.
FThI • Nanoscale Concentration of Light I
Gennady Shvets; Univ. of Texas at Austin, USA, Presider

FThI1 • 2:00 p.m. Invited

Plasmonic Metamaterial and Superlens, *Xiang Zhang; Univ. of California at Berkeley, USA.* I will discuss physics of the plasmonic metamaterials, and their applications. We demonstrated the superlens that works at near field and far field that is capable to beat the diffraction limit. This breakthrough may impact technological applications.

FThI2 • 2:30 p.m. Invited

Full Coherent Control on Nanoscale, *Mark I. Stockman; Georgia State Univ., USA.* We consider theory and experimental data on coherent control of nanoscale energy localization in nanosystems. Two new ideas will be presented: (i) Spatio-temporal control in combination with adiabatic energy concentration and (ii) Time-reversal coherent control.

2:00 p.m.–4:00 p.m.
FThJ • Microstructured and Novel Optical Fibers
Presider to Be Announced

FThJ1 • 2:00 p.m. Invited

Electronic and Plasmonic Materials inside Microstructured Optical Fibers, *Pier Sazio[1], Adrian Amezcua-Correa[1], Chris E. Finlayson[1], John R. Hayes[1], Thomas J. Scheidemantel[2,3], Neil F. Baril[2,4], Bryan R. Jackson[2,4], Dont-Jin Won[2,5], Feng Zhang[2,3], Elena R. Margine[2,3], Venkatraman Gopalan[2], Vincent H. Crespi[2,3,5], John V. Badding[2,4]; [1]Optoelectronics Res. Ctr., Univ. of Southampton, UK, [2]Materials Res. Inst., Pennsylvania State Univ., USA, [3]Dept. of Physics, Pennsylvania State Univ., USA, [4]Dept. of Chemistry, Pennsylvania State Univ., USA, [5]Dept. of Materials Science and Engineering, Pennslyvania State Univ., USA.* We report the growth of metal and crystalline semiconductor structures within holey fibers via a high-pressure microfluidic chemical vapour deposition process, to create novel photonic, electronic and plasmonic functionality inside the fiber waveguide.

FThJ2 • 2:30 p.m. Invited

Novel and Microstructured Fibres for Sensing Applications, *William N. MacPherson, James S. Barton, Duncan P. Hand, Julian D. C. Jones; Heriot-Watt Univ., UK.* Recent advances in novel optical fibers, including multicore and microstructured fibres, are enabling new sensing techniques. Here we consider the benefits and applications of these new fiber designs for practical sensor applications.

2:00 p.m.–2:45 p.m.
FThK • Seeing the Invisible: Strategies for Imaging Transparent Cell Types II
Melanie C. Campbell; Univ. of Waterloo, Canada, Presider

FThK1 • 2:00 p.m.

Confocal Polarimetry Measurements of Tissue Infected with Malaria, *Melanie C. W. Campbell[1], Christopher J. Cookson[1], Juan M. Bueno[2], Aden Seaman[1], Marsha L. Kisilak[1]; [1]Univ. of Waterloo, Canada, [2]Univ. de Murcia, Spain.* Malaria infected and control tissues were measured using a confocal laser scanning Macroscope in reflection mode, with differing polarizations. The contrast of the malaria parasites within the tissue was increased.

FThK2 • 2:15 p.m. Invited

Making Ganglion Cells Visible in the Living Retina, *Bill Merigan; Univ. of Rochester, USA.* The soma, axons and dendrites of primate ganglion cells are sufficiently large to be resolved *in vivo* with adaptive optics. We are studying autofluorescence, exogenously added fluorescence and phase as signals for ganglion cell imaging.

Hillsborough	Sacramento	Piedmont	Glen Ellen

Frontiers in Optics

2:00 p.m.–3:30 p.m.
FThL • Plasmonics and Nanocrystals
Qiwen Zhan; Univ. of Dayton, USA, Presider

FThL1 • 2:00 p.m. Invited
Hybrid Plasmons for Manipulating Molecular and Excitonic Energy Redistribution Pathways, *Gary Wiederrecht[1], Jeffrey E. Hall[1], Alexandre Bouhelier[2]; [1]Argonne Natl. Lab, USA, [2]Dépt. Nanosciences, Inst. Carnot de Bourgogne, USA.* Strong coupling of molecular excitons and plasmons are used to manipulate molecular energy redistribution pathways on an ultrafast timescale. Ramifications for controlling energy decay pathways in molecules and excitons are discussed.

FThL2 • 2:30 p.m.
Size Dependent Surface Plasmon Scattering of Single Cu Nanowires, *Sang-Youp Yim[1], Hong-Gyu Ahn[1], Dae-Geun Kim[1], Koo-Chul Je[1], Holglyeol Ju[1], Moohyun Choi[2], Chang Woo Park[2], Seung-Han Park[1]; [1]Natl. Res. Lab of Nonlinear Optics, Yonsei Univ., Republic of Korea, [2]Dept. of Applied Chemistry, Hanbat Natl. Univ., Republic of Korea.* Surface plasmon scattering spectra of single Cu nanowires were studied using total internal reflection microscopy. In particular, we have observed a strong surface plasmon peak in deep red and the red-shift with increasing the diameter.

2:00 p.m.–4:00 p.m.
FThM • Diffractive Micro- and Nanostructures for Sensing and Information Processing III
Stefan Sinzinger; Technische Univ. Ilmenau, Germany, Presider

FThM1 • 2:00 p.m. Invited
Polarization Optimized 4-π Geometries for Microscopy, *Gerd Leuchs, Hildegard Konermann, Robert Maiwald, Markus Sondermann, Susanne Quabis, Norbert Lindlein, Ulf Peschel; Inst. für Optik, Information und Photonik, Univ. Erlangen, Germany.* Tailored polarization can lead to a smaller focal spot in high numerical aperture focusing. The same radial polarization mode maximizes the coupling to an atom when using the correct 4π geometry.

FThM2 • 2:30 p.m.
Angle-Wavelength Matching Conditions for Multiplexed Three-Dimensional Spatial and Spectral Holographic Imaging, *Raymond K. Kostuk[1], George Barbastathis[2], Paul Geisler[1], Yuan Luo[1], Jonathan M. Watson[2], [1]Univ. of Arizona, USA, [2]MIT, USA.* Angle-wavelength matching process in volume holograms using both rigorous coupled wave and scalar grating theories is evaluated. Rigorous coupled wave analysis indicates that high diffraction efficiency can be obtained over a very broad spectral-angle range.

2:00 p.m.–4:00 p.m.
FThN • Coherence and Polarization IV
Presider to Be Announced

FThN1 • 2:00 p.m. Invited
Title to Be Announced, *Aristide Dogariu; Univ. of Central Florida, USA.* No abstract available.

FThN2 • 2:30 p.m.
Definitions of the Degree of Polarization of a Light Beam, *Asma Al-Qasimi[1], Daniel F. V. James[1], Olga Korotkova[2], Emil Wolf[3]; [1]Univ. of Toronto, Canada, [2]Univ. of Rochester, USA.* We discuss conditions under which certain ad hoc expressions for the degree of polarization of a light beam, frequently used in the literature, are valid.

2:00 p.m.–3:45 p.m.
FThO • Random Lasers and Disordered Media
Presider to Be Announced

FThO1 • 2:00 p.m.
Statistics of Lasing Peaks and ASE Spikes from Amplifying Random Media, *Xiaohua Wu, Hui Cao; Northwestern Univ., USA.* We studied experimentally the ensemble-averaged spectral correlation functions and statistical distributions of spectral spacing and intensity of ASE spikes and lasing peaks from weakly scattering systems under local pumping. Their differences revealed distinct physical mechanisms.

FThO2 • 2:15 p.m. Invited
Theory of the Spatial Structure of Nonlinear Modes in Random Lasers, *Hakan E. Tureci[1], Li Ge[2], Stefan Rotter[2], A. Douglas Stone[2]; [1]ETH Zurich, Switzerland, [2]Yale Univ., USA.* A new formalism for calculating exact non-linear multi-mode lasing states for complex resonators is applied to a 2-D- random laser. We show the existence of novel "composite" random lasing states.

NOTES

Empire | Crystal | Gold | Valley | California

Frontiers in Optics

FThH • Silicon and III-V Based Optoelectronics for Optical Interconnects—Continued

FThH2 • 2:45 p.m. Invited

Optical Interconnects Using Injection-Locked VCSELs, *Lukas Chrostowski; Univ. of British Columbia, Canada.* Injection-Locked Vertical Cavity Lasers exhibit drastically enhanced performance. The 3-dB bandwidth can be increased up to 40 GHz, due to a resonance frequency enhancement. Such VCSELs may play a role in future optical interconnects.

FThH3 • 3:15 p.m. Invited

III-V/Silicon Photonics for Optical Interconnects: Bonding Technology and Integrated Devices, *Gunther Roelkens, J. Brouckaert, J. Van Campenhout, D. Van Thourhout, R. Baets; Ghent Univ., Belgium.* The heterogeneous integration of III-V components and silicon-on-insulator waveguide circuits using DVS-BCB adhesive die-to-wafer bonding is presented. Advances in the fabrication of laser diodes and photodetectors in the bonded epitaxial layer structure are reported.

SThG • Ceramic Materials II—Continued

SThG3 • 2:45 p.m.

Effect of Stoichiometry on Grain Growth and Transparency of Nd:YAG Ceramics, *Sang-Ho Lee[1], Elizabeth Kupp[1], John Dumm[2], Vida Castillo[3], Greg Quarles[3], Gary Messing[1]; [1]Pennsylvania State Univ., USA, [2]II-VI Inc., USA, [3]VLOC, USA.* Polycrystalline 1 at% Nd:YAG ceramics were prepared by reactive sintering. We have measured in-line optical transmittance and scattering loss for several compositions near stoichiometric ceramics. The best optical transmittance (~84%) was obtained at stoichiometric composition.

SThG4 • 3:00 p.m. Invited

Optical Ceramics: The Promise for a New Technology for High-Power Lasers and Nuclear Radiation Detection, *Romain Gaume; Stanford Univ., USA.* We will present the benefits offered by transparent polycrystalline materials for high-power laser and efficient nuclear detector applications over single-crystal and glass-based technologies. The current challenges in transparent ceramic fabrication will also be discussed.

FThI • Nanoscale Concentration of Light I—Continued

FThI3 • 3:00 p.m.

Localization and Correlation of Waves in the Time Domain, *Azriel Z. Genack[1], Andrey A. Chabanov[2], Chik-Him Wong[3], Chik-Him Wong[3], Sai-Kit Cheung[3], Ping Sheng[3], Zhao-Qing Zhang[3]; [1]Queens College of CUNY, USA, [2]Univ. of Texas at San Antonio, USA, [3]Hong Kong Univ. of Science and Technology, Hong Kong.* Measurements of the microwave spectrum for localized waves allow us to establish the connection between spatial localization, giant fluctuations and strong correlation in the time domain using a model of localized modes.

FThI4 • 3:15 p.m.

Strongly Resonant Transmission in Periodic Anisotropic Layered Media, *Andrey A. Chabanov; Univ. of Texas at San Antonio, USA.* Novel photonic metamaterials have been engineered from spatially periodic, strongly birefringent dielectric materials and have been studied with microwaves to demonstrate extraordinary field amplitude growth within their structure at the photonic band edge transmission resonances.

FThJ • Microstructured and Novel Optical Fibers—Continued

FThJ3 • 3:00 p.m.

Microstructure-Fiber-Based Ultrafast Optical Parametric Oscillators, *Jay E. Sharping[1], Jeremy R. Sanborn[1], Mark A. Foster[2], Daniel Broaddhus[2], Alexander L. Gaeta[2], Jacob Lasri[3], Ove Lyngnes[3], Kurt Vogel[3]; [1]Univ. of California at Merced, USA, [2]Cornell Univ., USA, [3]Precision Photonics, USA.* We report on the generation ultrafast, high-power pulses using a microstructure-fiber-based optical parametric oscillators. This approach provides new opportunities for extending the functionality of mode-locked fiber lasers.

FThJ4 • 3:15 p.m.

ASE Characterization of an Er^{3+}-Doped Microstructured Tellurite Fiber for Broadband Amplification at 1550 nm, *Enves F. Chillcce, Carlos L. César, Luiz C. Barbosa, Reginaldo Da Silva, Aldário C. Bordonalli; Univ. of Campinas, Brazil.* A preliminary ASE spectral characterization of an Er^{3+}-doped microstructured tellurite fiber sample is presented by using a 980-nm pump laser. The amplifier presented a 3-dB bandwidth of around 70 nm, centered at 1545 nm.

3:00 p.m.–4:00 p.m.
FThP • Engineering the Eye: Advances in Retinal Prostheses I

Joseph Carroll; Univ. of Rochester, USA, Presider

FThP1 • 3:00 p.m. Invited

Quantitative Assessment of Spatial Vision in Second Sight Retinal Prosthesis Subjects, *Matthew J. McMahon[1], Avi Caspi[1], Jessy D. Dorn[1], Kelly H. McClure[1], Mark S. Humayun[2], Robert J. Greenberg[1]; [1]Second Sight Medical Products, USA, [2]Doheny Eye Inst., USA.* Electrical stimulation of a grid of retinal electrodes produces localized spots of light that can be used to construct an image of the world with a resolution determined by the spacing between neighboring electrodes.

Frontiers in Optics

FThL • Plasmonics and Nanocrystals—Continued

FThL3 • 2:45 p.m.
Nanoparticles in Microcavities as All-Optical Tunable Systems, *Rebecca Sainidou, Franscisco Javier García de Abajo; Inst. de Optica - CSIC, Spain.* An all-optical tunable system is proposed consisting of metallic nanoparticles within open metallic cavities. Resonant nanoparticle-cavity interaction is observed through both electromagnetic forces, intended to move the nanoparticle, and light absorption of the combined system.

FThL4 • 3:00 p.m.
Wavelength-Dependent Blinking Statistics of CdSe Nanocrystals Studied by Fluorescence Microscopy, *Kenneth L. Knappenberger, Daryl B. Wong, Stephen R. Leone; Univ. of California, USA.* Blinking statistics of CdSe nanocrystals are studied as a function of excitation wavelength, surface-passivation and particle aspect ratio. The on/off events exhibit an excitation-dependent behavior that limits the duration of on events.

FThL5 • 3:15 p.m.
Effects of Field-Induced Exciton Anticrossing and Line-Broadening on the Analog Characteristics of InGaAsP Optical ADQW-EAM's, *Dong Kwon Kim, David S. Citrin; Georgia Tech, USA.* Theoretical estimation of the InGaAsP optical ADQW-EAM's yielded ~3.5 times enhancement of slope efficiency at much reduced operating bias-field against comparable SQW EAM's, which is attributed to field-induced exciton anticrossing and line-broadening in ADQW's.

FThM • Diffractive Micro- and Nanostructures for Sensing and Information Processing III—Continued

FThM3 • 2:45 p.m.
Holographic Optical Tweezer Driven with Real-Time Multi-Focus Iterative Fourier Transform Algorithm, *Marek Skeren, Ondrej Komenda; Czech Technical Univ., Czech Republic.* Holographic optical tweezer is presented based on the liquid crystal spatial light modulator operated in phase-only regime. Synthetic diffractive structures projected on this modulator are generated using new real-time multi-focus iterative Fourier transform algorithm.

FThM4 • 3:00 p.m.
Characterization of Femtosecond Laser Induced Nanogratings in Fused Silica, *Nathan Lemke, Timothy D. Gerke, Ariel R. Libertun, Rafael Piestun; Univ. of Colorado, USA.* We analyze different variables for controlling birefringence induced in glass by a femtosecond laser. Parameters such as writing power, speed, polarization and the number of written layers can control the resulting retardance and orientation.

FThM5 • 3:15 p.m.
Polychromatic Vortex: An Interferometric Investigation, *Ravindra Pratap Singh, Virendra Kumar Jaiswal; Physical Res. Lab, India.* A polychromatic vortex was produced and its properties were studied using interferometry. We confirmed the charge of the vortex and obtained its positions for red, green and blue colors, which were found to be different.

FThN • Coherence and Polarization IV—Continued

FThN3 • 2:45 p.m.
Measurement of the Coherency Matrix of a Stochastic Electromagnetic Broadband Beam, *Panomsak Meemon, Maryam Chopra, Mohamed Salem, Kye Sung Lee, Jannick Rolland; Univ. of Central Florida, USA.* The statistical ensemble of a fluctuating, statistically-stationary and partially polarized beam is presented in terms of 2x2 matrix, so-called coherency matrix. Here we present a method to measure the matrix elements of a broadband beam.

FThN4 • 3:00 p.m.
Coherent-Mode Representation of Partially Coherent and Partially Polarized Optical Fields, *Andrey S. Ostrovsky, Paulo C. Romero Soría; Univ. Autonoma de Puebla, Mexico.* The coherent-mode representation of partially coherent, partially polarized optical field is defined on the basis of the unified theory of coherence and polarization. An example of the coherent-mode representation of the imaging process is given.

FThN5 • 3:15 p.m.
Focusing of Partially Coherent Light, *Thomas van Dijk, Taco D. Visser; Free Univ., Netherlands.* We investigate the focusing of partially coherent light and show that for certain types of correlation functions the intensity distribution can exhibit a local minimum at the geometrical focus.

FThO • Random Lasers and Disordered Media—Continued

FThO3 • 2:45 p.m. Invited
Variable Coherence Sensing, *Aristide Dogariu; Univ. of Central Florida, USA.* Manipulating the statistical properties of the radiation provides means for developing robust sensing approaches. Controlling the coherence properties of light offers new possibilities for solving inverse problems and allows stochastic sensing with subwavelength resolution.

FThO4 • 3:15 p.m.
Mode Statistics in Random Lasers, *Oleg Zaitsev; Univ. of Duisburg-Essen, Germany.* Random lasers are modeled with non-Hermitian random matrices. The mean and variance of the number of lasing modes and the frequency spacing distribution in the two-mode regime were computed.

NOTES

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

FThH • Silicon and III-V Based Optoelectronics for Optical Interconnects—Continued

FThH4 • 3:45 p.m.
Integration of Polymer Pins, Volume Gratings and Waveguides for Chip-to-Board and Board-to-Chip Optical Interconnects, *Justin L. Stay, Muhannad S. Bakir, Ricardo Villalaz, Rohit Ogra, Thomas K. Gaylord, James D. Meindl; Georgia Tech, USA.* Polymer pins, waveguides, and volume grating couplers are integrated together to provide optical input/output (I/O) between printed-wiring/waveguide board and chip. The fabrication processes needed to enable these configurations are described and experimentally evaluated.

SThG • Ceramic Materials II—Continued

SThG5 • 3:30 p.m. Invited
High-Power Solid State Ceramic Laser Program, *Alexander E. Mandl, D. E. Klimek; Textron Systems, USA.* No abstract available.

FThI • Nanoscale Concentration of Light I—Continued

FThI5 • 3:30 p.m.
Fabrication and Characterization of Plasmonic Nanolenses for Applications in Biophotonics, *Francesco De Angelis, G. Das, C. Liberale, F. Mecarini, E. Di Fabrizio; Univ. della Magna Graecia, Italy.* In this work we present the fabrication of a novel plasmonic nanostructure for Surface Enhanced Raman Scattering for single molecule detection. High sensitivity measurements of a few hundred molecules will be presented.

FThI6 • 3:45 p.m.
Experimental Confirmation of Backscattering Enhancement Induced by a Photonic Jet, *Alexander Heifetz, Kevin Huang, Alan V. Sahakian, Xu Li, Allen Taflove, Vadim Backman; Northwestern Univ., USA.* Our microwave-scaled experiments confirmed the properties of a sub-wavelength-waist photonic jet emitted by a dielectric sphere, and associated enhanced position-dependent backscattering perturbations by a $\lambda/10$ diameter metal particle. The results were supported by FDTD simulations.

FThJ • Microstructured and Novel Optical Fibers—Continued

FThJ5 • 3:30 p.m. Invited
Chalcogenide Optical Fibre Nanowires, *Benjamin J. Eggleton, Eric C. Mägi, Libin Fu, Dong-Il Yeom, Hong C. Nguyen; Univ. of Sydney, Australia.* We experimentally demonstrate enhanced Kerr non-linear effects in tapered highly non-linear As_2Se_3 chalcogenide fibre with sub-wavelength waist diameter. We observe enhanced non-linearity of 68.4 $W^{-1}m^{-1}$, which is 45,000 times larger than standard silica single-mode fibre.

FThP • Engineering the Eye: Advances in Retinal Prostheses I—Continued

FThP2 • 3:30 p.m. Invited
A Model of Temporal Integration during Electrical Stimulation of the Human Retina, *Alan Horsager[1], Scott H. Greenwald[2], James D. Weiland[1], Mark S. Humayun[1], Robert J. Greenberg[3], Matthew J. McMahon[3], Geoff M. Boynton[2], Ione Fine[2]; [1]Univ. of Southern California, USA, [2]Univ. of Washington, USA, [3]Second Sight Medical Products, Inc., USA.* We will describe how the high temporal sensitivity of the visual system allows for the ability to control the quality of the percept through manipulation of the timing properties of the electrical signal.

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

NOTES

Frontiers in Optics

FThM • Diffractive Micro- and Nanostructures for Sensing and Information Processing III—Continued

FThM6 • 3:30 p.m.
Wavelength-Multiplexed Microholographic Data Storage with Diffraction-Limited Pit Size, *Pengfei Wu[1], Zhiqiang Liu[2], Jame J. Yang[1], Angel Flores[2], Michael R. Wang[2]; [1]New Span Opto-Technology Inc., USA, [2]Univ. of Miami, USA.* Micro-grating multiplexing is obtained by using a single beam containing multiple wavelengths from white light coded with a wavelength combiner. In addition, we have successfully recorded micro-grating array with diffraction-limited pit size.

FThM7 • 3:45 p.m.
Nano-Structured Metal-Dielectric Resonant Waveguide Filters, *Ashifi Gogo[1], Kristen Pudenz[2], Markus Testorf[1]; [1]Dartmouth College, USA, [2]Iowa State Univ., USA.* A parametric study of resonant waveguide filters is presented. The spectral and angular response of pure dielectric filter designs is compared with devices consisting of nano-structured combinations of metal and dielectric structures.

FThN • Coherence and Polarization IV—Continued

FThN6 • 3:30 p.m.
Evolution of 3-D Polarization in Inhomogeneous Medium, *Nikolai I. Petrov; Unaffiliated, Russian Federation.* Generalized Stokes parameters consisting of nine real parameters in terms of irreducible tensor operators are considered. The degree of polarization by these parameters is defined and operator method for calculation of polarization evolution is developed.

FThN7 • 3:45 p.m.
Simultaneous Measurement Method of Birefringence and Optical Rotation Using Spectroscopic-Polarized Modulator, *Bari Kato, Toshitaka Wakayama, Yukitoshi Otani, Norihiro Umeda; Tokyo Univ. of Agriculture and Technology, Japan.* A purpose of this study is to evaluate orientation of functional polymers. A channeled spectrum is generated by two pairs of spectroscopic-polarized modulators. We demonstrate to measure birefringence and optical rotation dispersion by single-shot measurement.

FThO • Random Lasers and Disordered Media—Continued

FThO5 • 3:30 p.m.
Effect of Local Pumping on 1-D Random Laser Modes, *Xiaohua Wu[1], Jonathan Andreasen[1], Hui Cao[1], Alexey Yamilov[2]; [1]Northwestern Univ., USA, [2]Univ. of Missouri, USA.* We calculated the quasimodes in one-dimensional random systems and the lasing modes under a global (or local) gain. Local pumping could make the lasing modes differ drastically from the quasidmodes of a weakly scattering system.

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

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

4:30 p.m.–6:30 p.m.
FThQ • Computational Imaging II
George Barbastathis; MIT, USA, Presider

FThQ1 • 4:30 p.m. Invited
Depth of Field with Multi-Aperture LWIR Imagers, *Andrew D. Portnoy[1], Mohan Shankar[1], Nikos Pitsianis[1], David Brady[1], Robert Gibbons[2], Alan Silver[2], David Keller[3], Caihua Chen[4], Dennis Prather[4]; [1]Duke Univ., USA, [2]Raytheon Co., USA, [3]Tessera Technologies, USA, [4]Univ. of Delaware, USA.* We use a multiaperture approach to design a thin LWIR camera. Having a shorter focal length, the microlens array provides an extended depth of field over the conventional system.

FThQ2 • 5:00 p.m.
Compressive Imaging Using Random Active Illumination, *Pawan K. Baheti[1], Mark A. Neifeld[1,2]; [1]Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA, [2]College of Optical Sciences, Univ. of Arizona, USA.* We present experimental results to demonstrate a compressive imaging system based on the use of structured light. Illumination patterns are defined using binary-valued random vectors and reconstruction is done using projection onto convex sets.

4:30 p.m.–6:45 p.m.
SThH • Nanocrystals and Quantum Dots
Martin M. Fejer; Stanford Univ., USA, Presider

SThH1 • 4:30 p.m. Invited
Nanocrystals for Optical Bio-Sensing, *A. Paul Alivisatos; Univ. of California at Berkeley, USA.* No abstract available.

SThH2 • 5:00 p.m. Invited
Ordered Quantum Wire and Quantum Dots Systems for Nanophotonics Applications, *Eli Kapon, Fredrik Karlsson; Ecole Polytechnique Fédérale de Lausanne, Switzerland.* Fabrication technology and optical properties of site- and spectrally-controlled quantum wires and quantum dots grown on patterned substrates are described. Applications in generation of non-classical light, quantum cavity electrodynamics and ultra-low threshold lasers are discussed.

4:30 p.m.–6:30 p.m.
FThR • Nanoscale Concentration of Light II
Presider to Be Announced

FThR1 • 4:30 p.m. Invited
Extraordinary Optical Properties of SiC Membranes: Superlensing, Sub-Surface Imaging, and Enhanced Transmission through Hole Arrays in Mid-IR, *Gennady Shvets[1], Dmitriy Korobkin[1], Yaroslav Urzhumov[1], Burton Neuner III[1], Christopher Fietz[1], Christian Zorman[2], Thomas Taubner[3], Rainer Hillenbrand[4]; [1]Univ. of Texas at Austin, USA, [2]Case Western Reserve, USA, [3]Stanford Univ., USA, [4]Max-Planck-Inst. für Biochemie, Germany.* We have demonstrated a mid-IR superlens fabricated from a SiC membranes and incorporated into an NSOM for subsurface imaging. Enhanced transmission/absorption through hole arrays in a perforated SiC membranes will also be reported.

FThR2 • 5:00 p.m.
Nanoconnectors at Optical Frequencies, *Andrea Alù, Nader Engheta; Univ. of Pennsylvania, USA.* Following our paradigm for nanocircuit elements at optical frequencies, here we introduce the concept of 'short-circuit' optical nanoconnectors, consisting of plasmonic waveguides with a high-permittivity core surrounded by a low-permittivity concentric shell.

4:30 p.m.–6:15 p.m.
FThS • Microstructured, Nonlinear and Novel Optical Fibers
Michael J. Messerly; Lawrence Livermore Natl. Lab, USA, Presider

FThS1 • 4:30 p.m. Tutorial
Review of Progress in Photonic Band-Gap Fibers, *Karl Koch; Corning, Inc., USA.* The unique properties of air-core photonic band-gap fibers and their underlying principles of operation are reviewed. In addition, applications and other opportunities for these fibers are reviewed.

After graduating from the Univ. of Rochester's Inst. of Optics in 1990, Karl worked at the Air Force Weapons Lab in Albuquerque, New Mexico on nonlinear frequency conversion and high-power lasers until 1998 when he joined Corning Inc. in Corning, New York where, as part of the Optical Physics group, he has led the photonic crystal fiber research effort and worked in the general area of optical physics and waveguides. He has over 50 publications in refereed journals and has served on numerous technical program committees including ASSL, CLEO, QELS, OFC and is currently associate editor for the Journal of Lightwave Technology and will Co-Chair the Frontiers in Optics meeting in 2008.

4:30 p.m.–5:45 p.m.
FThT • Engineering the Eye: Advances in Retinal Prostheses II
Joseph Carroll; Univ. of Rochester, USA, Presider

FThT1 • 4:30 p.m.
Intraocular Camera for Retinal Prostheses: Optical Design, *Michelle C. Hauer, Patrick J. Nasiatka, Noelle R. B. Stiles, Jaw-Chyng (Lormen) Lue, Rajat Agrawal, James D. Weiland, Mark S. Humayun, Armand R. Tanguay, Jr.; Univ. of Southern California, USA.* Optical system design considerations are presented for an intraocular camera that is intended for use in conjunction with an epiretinal microstimulator array to form an intraocular retinal prosthesis for restoring functional vision to the blind.

FThT2 • 4:45 p.m. Invited
Mechanisms for Functional Vision Recovery in People with RP and the Subretinal ASR Retinal Prosthesis, *Ronald A. Schuchard[1,2]; [1]Emory Univ., USA, [2]VA Rehabilitation R&D COE, USA.* Understanding the mechanisms of functional vision recovery by retinal prosthetic technology (e.g., neurotrophic for ASR) will optimize efforts to maximize everyday function and training of visual skills evaluated with appropriate and accurate outcome measures.

Hillsborough	Sacramento	Piedmont

Frontiers in Optics

4:30 p.m.–6:30 p.m.
FThU • Cloaking
Presider to Be Announced

FThU1 • 4:30 p.m. Tutorial

Optical Metamaterials: From Magnetics with Rainbow Colors to Negative-Index and Cloaking, *Vladimir M. Shalaev; Purdue Univ., USA.* Metamaterials are expected to open a gateway to unprecedented electromagnetic properties and functionality unattainable from naturally occurring materials. We review this new emerging field and recent progress in demonstrating metamaterials in the optical range.

Vladimir M. Shalaev, the Robert and Anne Burnett Professor of Electrical and Computer Engineering and Professor of Biomedical Engineering at Purdue Univ., specializes in nano-photonics, nano-plasmonics, and optical metamaterials. Dr. Shalaev has several awards for his research in the field of nano-photonics and metamaterials. He is a Fellow of the American Physical Society (APS), Fellow of The International Society for Optical Engineering (SPIE), and a Fellow of the Optical Society of America (OSA). Dr. Shalaev is editor/co-editor for a number of journals and book series in the area of nanoscale optics. He has authored and edited 7 books, published 20 invited book chapters, and over 250 research papers.

4:30 p.m.–6:30 p.m.
FThV • Diffractive Micro- and Nanostructures for Sensing and Information Processing IV
Gerd Leuchs; Inst. für Optik, Information und Photonik, Germany, Presider

FThV1 • 4:30 p.m. Invited

New Holographic 3-D Light Shaping, *Laura C. Thomson[1], Graeme Whyte[2], Michael Mazilu[3], Johannes K. Courtial[1]; [1]Univ. of Glasgow, UK, [2]Univ. of Cambridge, UK, [3]Univ. of St. Andrews, UK.* Holograms can shape the 3-D intensity distribution of light beams. Here we describe work on 3-D intensity shaping of various kinds of beams, including monochromatic travelling waves, evanescent waves and self-reconstructing beams.

FThV2 • 5:00 p.m.

Synthesis and Implementation of 3-D Wavefields for Ranging Applications, *Markus Testorf[1], Canh Ly[2], Joseph N. Mait[2]; [1]Dartmouth College, USA, [2]Army Reserach Lab, USA.* Superpositions of Laguerre-Gaussian modes are used to measure range. Beam patterns are experimentally realized using a spatial light modulator. Fundamental and practical limits of the 3-D beam synthesis problem are investigated.

4:30 p.m.–6:30 p.m.
FThW • Coherence and Polarization V
Greg Gbur; Univ. of North Carolina at Charlotte, USA, Presider

FThW1 • 4:30 p.m. Invited

Retinal Birefringence Changes Associated with Exudative Eye Disease, *Ann E. Elsner[1], Dean A. VanNasdale[1], Yanming Zhao[1], Masahiro Miura[2], Anke Weber[3], Karen Twietmeyer[4], Russell Chipman[4], Stephen A. Burns[1]; [1]Indiana School of Optometry, USA, [2]Tokyo Medical Univ., Japan, [3]Univ. Eye Hospital, Germany, [4]Univ. of Arizona, USA.* The polarization properties of light returning from normal and diseased retinas provides information beyond that available from intensity variations, including both the increased depolarized light in lesions and their higher contrast in depolarized light images.

FThW2 • 5:00 p.m.

Measuring Human Macular Birefringence by Applying Mueller Calculus to Scanning Laser Polarimetry, *Yanming Zhao, Dean A. VanNasdale, Bryan P. Haggerty, Benno L. Petrig, Ann E. Elsner; School of Optometry, Indiana Univ., USA.* A scanning laser polarimeter was employed to acquire birefringence images of human retinas. The corneal retardance was mathematically compensated by using Mueller calculus, and the influence of age on macular retardance was studied.

NOTES

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

FThQ • Computational Imaging II—Continued

FThQ3 • 5:15 p.m.
Reconstruction Using Adaptive Feature-Specific Imaging, *Jun Ke, Mark A. Neifeld; Univ. of Arizona, USA.* Adaptive feature-specific imaging is applied in image reconstruction. We demonstrate significant reduction in number of measurements required to achieve a given performance as compared to static feature-specific imaging.

FThQ4 • 5:30 p.m.
Projective Imager Design with Task Specific Information, *Amit Ashok, Pawan K. Baheti, Mark A. Neifeld; Univ. of Arizona, USA.* We use task-specific information as a metric to optimize the performance of a projective imager for a target detection task. The optimized imager doubles the performance at low signal-to-noise ratios.

FThQ5 • 5:45 p.m.
Non Uniform Sampling Generalizations of Nyquist and Shannon's Theorems Based on an Investigation of Phase Space, *Bryan Hennelly[1], Markus Testorf[2]; [1]Natl. Univ. of Ireland, Maynooth, Ireland, [2]Dartmouth College, USA.* A novel sampling theorem is presented based on a heuristic view of signals in phase space. The optimum non-uniform sampling distribution for a given compact shape of the signal in phase space is derived.

SThH • Nanocrystals and Quantum Dots—Continued

SThH3 • 5:30 p.m.
Photoluminescence of GaN Nanowires of Different Crystallographic Orientations, *Alan Chin[1], Tai S. Ahn[2], Hongwei Li[3], Sreeram Vaddiraju[3], Christopher J. Bardeen[2], Cun Zheng Ning[1,4], Mahendra K. Sunkara[3]; [1]NASA Ames Res. Ctr., USA, [2]Univ. of California at Riverside, USA, [3]Univ. of Louisville, USA, [4]Arizona State Univ., USA.* Our studies of time-integrated and time-resolved photoluminescence of a-axis and c-axis GaN nanowires demonstrate that the blue-shifted ultraviolet photoluminescence in a-axis GaN nanowires relative to c-axis GaN nanowires can be attributed to surface state emission.

SThH4 • 5:45 p.m.
Quantum Dot Fluorescence Antibunching in Chiral Photonic Bandgap Hosts as a Single Photon Source, *Luke J. Bissell[1], Zhimin Shi[1], Heedeuk Shin[1], Svetlana G. Lukishova[1], Sean M. White[1], Megan A. Hahn[2], Robert W. Boyd[1], Carlos R. Stroud, Jr.[1], Todd D. Krauss[2]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Chemistry, Univ. of Rochester, USA.* A single-photon source based on single CdSe quantum-dot fluorescence in a chiral-photonic-bandgap liquid-crystal host manifests itself in observed fluorescence antibunching. Chiral-photonic-bandgap structures will provide deterministically handed, circular-polarized fluorescence, even for emitters without a dipole moment.

FThR • Nanoscale Concentration of Light II—Continued

FThR3 • 5:15 p.m. Invited
Light Confinement at Surfaces and the Plasmonic Talbot Effect, *Javier Garcia de Abajo[1], Rebecca Sainidou[1], Tatiana V. Teperik[2], Mark Dennis[3], Nikolay I. Zheludev[3]; [1]CSIC, Spain, [2]DIPC, Spain, [3]Univ. of Southampton, UK.* Metal-surface plasmons, dielectric-film guided modes, and lattice singularities in patterned interfaces will be reviewed as genuine methods to achieve 2-D light confinement. Light concentration using the Talbot effect will be examined in these systems.

FThR4 • 5:45 p.m.
Propagating Modes with Large Bandwidth in Nanoscale Cylindrical Holes, *Peter B. Catrysse, Shanhui Fan; Stanford Univ., USA.* Subwavelength cylindrical holes in optically thick metallic films always support propagating modes near the surface plasmon frequency, regardless of how small the holes are. Here, we design nanoscale holes supporting modes with very large bandwidth.

FThS • Microstructured, Nonlinear and Novel Optical Fibers—Continued

FThS2 • 5:15 p.m. Invited
Nonlinearity and Dispersion Characteristics of Bismuth-Based Highly Nonlinear Fiber, *Naoki Sugimoto, Tomoharu Hasegawa, Tatsuo Nagashima, Seiki Ohara; Asahi Glass Co., Japan.* Nonlinear coefficient and GVD of bismuth-based nonlinear fiber were determined. High nonlinearity γ~1100 $W^{-1}km^{-1}$ was obtained in step-index type bismuth-based fiber. Bismuth-based photonic crystal fiber was also developed to reduce GVD.

FThS3 • 5:45 p.m.
Single-Channel 2R Regeneration in Quasi-Continuous Dispersion-Managed Nonlinear Medium, *Pallavi G. Patki[1], Veronika Stelmakh[1], Muthiah Annamalai[1], Michael Vasilyev[1], Taras I. Lakoba[2]; [1]Univ. of Texas at Arlington, USA, [2]Univ. of Vermont, USA.* We demonstrate single-channel 1.5-dB eye-opening improvement in a dispersion-managed modification of Mamyshev's regenerator. This is a first step toward realization of multi-channel 2R regeneration via dispersion management.

FThT • Engineering the Eye: Advances in Retinal Prostheses II—Continued

FThT3 • 5:15 p.m. Invited
High Resolution Optoelectronic Retinal Prosthesis, *Daniel Palanker; Stanford Univ., USA.* Retinal prosthetic system based on conversion of near-infrared light into pulsed electric current using subretinal photodiode array will be presented. System performance, limits of resolution and issues of the interface with retina will be discussed.

Frontiers in Optics

FThU • Cloaking—Continued

FThU2 • 5:15 p.m.
On Perfect Invisibility and Cloaking, *David A. B. Miller; Stanford Univ., USA.* Perfect invisibility even to pulses is possible in principle using sensors and sources around a volume and a new calculation formula, though would always be challenging for broadband electromagnetic waves and usually discoverable quantum-mechanically.

FThU3 • 5:30 p.m.
Cloaking at Optical Wavelengths, *Uday K. Chettiar, Wenshan Cai, Alexander V. Kildishev, Vladimir M. Shalaev; Purdue Univ., USA.* A design for a cloak based on coordinate transformation at optical wavelengths is presented. A possible realization is proposed and the design performance is studied using finite element method simulations.

FThU4 • 5:45 p.m.
IR and Optical Cloaking with Metamaterials with Plasmonic Implants: Theory and Simulations, *Mário Silveirinha, Andrea Alù, Nader Engheta; Univ. of Pennsylvania, USA.* In our recent works, we suggested that plasmonic layers may provide cloaking for an object. Here we discuss how such plasmonic covers may be designed at terahertz, infrared and optical frequencies using metallic implants.

FThV • Diffractive Micro- and Nanostructures for Sensing and Information Processing IV—Continued

FThV3 • 5:15 p.m.
Finite-Number-of-Periods Gratings: Analysis Using the Total-Field/Scattered-Field Finite-Difference-Time-Domain Method, *Aristeides D. Papadopoulos, Elias N. Glytsis; Natl. Technical Univ. of Athens, Greece.* Finite-number-of-periods holographic/surface-relief gratings are analyzed using the total-field/scattered-field finite-difference-time-domain (TF/SF-FDTD) method. Second-order and fourth-order TF/SF-FDTD formulations are used with various averaging schemes to treat permittivity/permeability discontinuities. TF/SF-FDTD results are compared with alternative methods.

FThV4 • 5:30 p.m.
Linear Spectral Estimation and the Design of Superresolution Filters, *Markus Testorf[1], Michael Fiddy[2]; [1]Dartmouth College, USA, [2]Univ. of North Carolina at Charlotte, USA.* A linear spectral estimation technique, the PDFT algorithm, is presented as a promising design strategy for superresolution filters. This non-iterative algorithm is applied to synthesize filters with rotational symmetry and compared with other approaches.

FThV5 • 5:45 p.m.
White Light Computer-Generated Phase Hologram, *Cristhiane Gonçalves[1], José Carlos Pizolato[2], Giuseppe A. Cirino[2], Luiz G. Neto[1]; [1]Univ. of Sao Paulo, Brazil, [2]Holovision Inc, Brazil.* A computer-generated phase hologram designed to operate under white light illumination is proposed. The element is calculated based on the halftoning technique and in the partial spatial coherence of a white light extended source.

FThW • Coherence and Polarization V—Continued

FThW3 • 5:15 p.m.
Retinal Artery and Vein Diameters in Diabetic Retinopathy and Normal Eyes by Polarimetric Imaging, *Benno L. Petrig[1], Ann E. Elsner[1], Dean A. VanNasdale[1], Bryan P. Haggerty[1], Yanming Zhao[1], Brian Hansel[1], Masahiro Miura[2], Anke Weber[3]; [1]Indiana Univ., USA, [2]Tokyo Medical Univ., Japan, [3]Univ. Hospital Aachen, Germany.* Superior temporal retinal artery and vein diameters of patients with diabetic retinopathy were measured using near infrared light with crossed and parallel detectors and compared to normal age- and sex-matched controls.

FThW4 • 5:30 p.m. Invited
Spectral Depolarization and Roughness Measurements of Painted Metal Surfaces, *Dennis Goldstein; Consultant, USA.* Mueller matrices for commercially painted metal surfaces have been measured with a spectropolarimeter. A profilometer has been used to collect roughness measurements of the samples as well. Measures of depolarization of the samples are presented.

NOTES

Empire	Crystal	Gold	Valley	California

Frontiers in Optics

FThQ • Computational Imaging II—Continued

FThQ6 • 6:00 p.m.
Redistribution of Information for Imaging Systems with Increasing Numerical Aperture, *Arthur S. van de Nes, Peter Török; Imperial College London, UK.* We describe a redistribution from entrance pupil to focal region of information contained in conserved quantities such as energy, linear- and angular-momentum, for imaging systems with increasing numerical aperture; allowing for system optimization.

FThQ7 • 6:15 p.m.
The Phase-Space Interpretation of Self-Imaging and Discrete Representations of Paraxial Optical Systems, *Markus Testorf[1], Bryan Hennelly[2]; [1]Dartmouth College, USA, [2]Natl. Univ. of Ireland, Maynooth, Ireland.* Phase-space diagrams of the Talbot effect and the spectral Talbot effect are used to construct discrete representations of linear canonical transformations. Their importance is illustrated in the context of diffractive optics and compressive imaging.

SThH • Nanocrystals and Quantum Dots—Continued

SThH5 • 6:00 p.m. Invited
Quantum Dots for Advanced Semiconductor Lasers, *Dennis Deppe; Univ. of Central Florida, USA.* Efficiency and power limitations in laser diodes caused by internal optical loss, threshold, and resistivity are analyzed to show how epitaxial nanostructures can increase efficiency and power.

SThH6 • 6:30 p.m.
Luminescence Properties of Doped Nanostructures, *Amitava Patra; Indian Association for the Cultivation of Science, India.* Here, we report the role of crystal phase and surface coating on the modification of the radiative and nonradiative relaxation mechanisms of rare-earth doped nanocrystals and study their local structure by EXAFS.

FThR • Nanoscale Concentration of Light II—Continued

FThR5 • 6:00 p.m. Invited
Experimental Demonstration of Sub-Wavelength Imaging by Left-Handed Metamaterials, *Ekmel Ozbay; Bilkent Univ., Turkey.* We review the studies conducted in our group concerning electromagnetic properties of metamaterials and photonic crystals with negative refraction, subwavelength focusing, and flat lens phenomena.

FThS • Microstructured, Nonlinear and Novel Optical Fibers—Continued

FThS4 • 6:00 p.m.
Slow, Fast, and Backwards Light Propagation in Erbium-Doped Optical Fibers, *Robert W. Boyd[1], George M. Gehring[1], Giovanni Piredda[1], Aaron Schweinsberg[1], Katie Schwertz[1], Zhimin Shi[1], Heedeuk Shin[1], Joseph Vornehm, Jr.[1], Petros Zerom[1], Paul Narum[2]; [1]Univ. of Rochester, USA, [2]Norwegian Defence Res. Establishment, Norway.* Erbium-doped optical fiber can serve as either a saturable absorber or (when pumped) as a saturable amplifier, leading to slow or fast light propagation respectively. Exotic propagation effects are observed in this system.

5:30 p.m.–9:00 p.m., Science Educators' Day, *Fairmont Hotel, Regency Ballroom*

Frontiers in Optics

FThU • Cloaking—Continued

FThU5 • 6:00 p.m.
Cloaking an Object Near an Obstacle with Plasmonic Materials, *Andrea Alù, Nader Engheta; Univ. of Pennsylvania, USA.* We have recently explored theoretically the possibility of using anomalous properties of plasmonic materials to cloak dielectric and metallic objects. Here we numerically analyze this setup in presence of an obstacle or a ground plane.

FThU6 • 6:15 p.m.
Invisible Lenses with Isotropic Materials, *Juan C. Miñano, Pablo Benitez, Žarko Gačević; Univ. Politecnica de Madrid, Spain.* A perfect invisible lens (within the Geometrical Optics approximation) made of isotropic spherical-graded-index material is introduced. This unique lens is compared with other known invisible lenses (Pendry-Schurig-Smith's and Leonhart's).

FThV • Diffractive Micro- and Nanostructures for Sensing and Information Processing IV—Continued

FThV6 • 6:00 p.m.
Rigorous Diffraction and Imaging by Multilayer Phase Structures in Extreme UV Lithography, *Aura M. Nugrowati, Joseph J. M. Braat; Delft Univ. of Technology, Netherlands.* A rigorous model of projection system for extreme UV lithography will be presented to image multilayer phase structures. These structures have the potential of achieving better image resolution than the commonly used absorbing structures.

FThV7 • 6:15 p.m.
Deep-Etched Grating for Polarization Separation, *Changhe Zhou, Bo Wang, Jijun Feng, Huayi Ru; Shanghai Inst. of Optics and Fine Mechanics, China.* We designed and fabricated a deep-etched subwavelength fused silica grating for polarization separation, which has etched depth of 2.0μm and period of 890nm, for polarization efficiency >80% and polarization isolation >50 for wavelength at 1550nm.

FThW • Coherence and Polarization V—Continued

FThW5 • 6:00 p.m.
Polarization Components Analysis for Material Monitoring, *J. Scott Tyo[1], Brian G. Hoover[2]; [1]Univ. of Arizona, USA, [2]Advanced Optical Technologies, USA.* Linear and nonlinear components analysis of data from a monostatic laser polarimeter is applied to the task of remote, nonimaging discrimination among different material conditions on paint and polymer coupons independent of their spatial orientations.

FThW6 • 6:15 p.m.
Scattered Intensity Fluctuations for Characterizing Inhomogeneous Media, *Sergey Sukhov, David P. Haefner, Aristide Dogariu; College of Optics and Photonics, CREOL, Univ. of Central Florida, USA.* When near field sensing is performed in reflection-emission configuration, statistical analysis of data provides information about the dielectric contrast and composition of inhomogeneous media. We report on modeling the statistical properties of this scattered intensity.

5:30 p.m.–9:00 p.m., Science Educators' Day, *Fairmont Hotel, Regency Ballroom*

NOTES

FiO/LS/OMD Key to Authors and Presiders

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

FiO/LS/OMD Conference Program Addendum

Presentation Time Change

The following paper's presentation time has been moved up by 30 minutes, to Thursday, September 20, at 4:45 p.m.
FThT3, High Resolution Optoelectronic Retinal Prosthesis, *Daniel Palanker, Stanford Univ., USA*

Session Time Change

All four FiO Postdeadline Paper sessions will begin at 6:15 p.m. on Wednesday, September 19, and end by 8:00 p.m. The full program for these sessions is available in your registration packet.

Presentation Times for SMB

Joint FiO/SPRC Symposium, Monday, September 17, 1:00 p.m.–4:30 p.m.

1:00 p.m.
Commercialization of Printed Thin Film Solar Cells, *Jim Sheats, Nanosolar, USA*

1:45 p.m.
Electronic Retinal Prostheses for Restoration of Sight, *Dan Palanker, Stanford Univ., USA*

2:15 p.m.
IC Inspection Technology: Present Status and Future Challenges, *Mehdi Vaez-Irvani, KLA-Tencor, USA*

3:00 p.m.
Fundamentals and Applications of Photonic Crystals and Metamaterials, *Shanhui Fan, Stanford Univ., USA*

3:45 p.m.
Optical Mapping of Neuronal Circuitry in a Living Brain, *Mark Schnitzer, Stanford Univ., USA*

Symposium on Undergraduate Research

The full program for this symposium is available in your registration packet. Please note that the time of session SMD has changed since the *FiO/LS/OMD Conference Program* was printed. The correct times are listed in the separate six-page program in your packet.

Abstract for Invited Paper SThF4

High Efficiency Silicon Solar Cells, *Richard M. Swanson, SunPower Corp., USA*. Conversion efficiency has emerged as an important contributor to further reducing photovoltaic system cost. This presentation will discuss the various improvements that have increased the efficiency of commercial products by over 50% in the last 5 years, as well as the impact of these developments on system cost.

The organizers of FiO 2007 gratefully acknowledge the support of the Air Force Office of Scientific Research (AFOSR).

The organizers of OMD 2007 gratefully acknowledge the support of the Universal Display Corporation.

UNIVERSAL DISPLAY CORPORATION™

Presider Updates

Joseph P. Culver, *Washington Univ. in St. Louis, USA*, will preside over FWV: Diffuse Imaging and Spectroscopy.

Rosalind M. Wynne, *Villanova Univ., USA,* will preside over FThJ: Microstructured and Novel Optical Fibers.

John L. Hall, *JILA, Univ. of Colorado, USA,* will preside over LTuH: Clocks, Navigation and Magnetometers.

Jack Harris, *Yale Univ., USA,* will preside over JWB: Radiation Pressure, Cooling and Quantum Cantilevers II.

Urs Utzinger, *Univ. of Arizona, USA,* will preside over session FTuD Biosensors I.

Withdrawn Oral Presentations

FME6
FMF1
FTuH3
FTuM2
FWH3
FWN2
FWU2
FThT2
FThW4
LTuK1
LWI2
LThA5
OTuA5
TWA5

Withdrawn Posters

JSuA40
JWC16

Short Course Cancellations

SC253
SC304
SC305

FiO Exhibit Guide Addendum

OSA Corporate Member

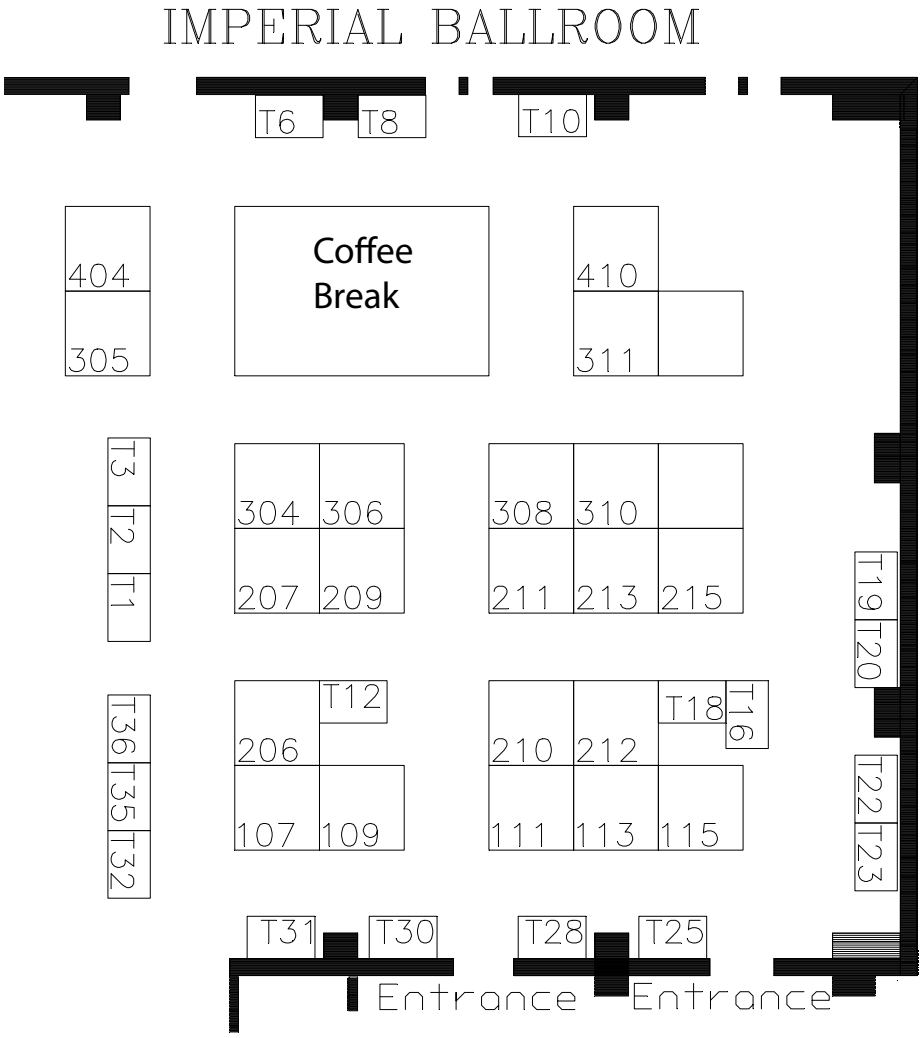
Ophir-Spiricon
Table 12
60 West 1000 North
Logan, UT 84341
Phone: 435.753.3729
Fax: 435.753.5231
E-mail: sales@ophir-spiricon.com
URL: www.ophir-spiricon.com

Manufacturer of laser power and energy meters that are NIST-traceable. Also manufacturer of laser beam profilers from Deep UV to Far IR.

Precision Asphere, LLC.
Table 31
48860 Milmont Drive, Unit 105-C
Fremont, California 94538
Phone: 510.668.1508
Fax: 510.668.1595
E-mail: sales@precisionasphere.com
URL: www.precisionasphere.com

PRECISION ASPHERE, LLC. is a US company specialized in manufacturing of high precision custom aspheres. With our proprietary computer controlled technology and over 13 years of asphere manufacturing experience, PRECISION ASPHERE offers you the highest PERFORMANCE-to-COST ratio in the industry.

Floorplan as of 9/10/07



FiO Management thanks the following corporate sponsors for their generous support:

JK Consulting
Thin Film Design & Applications

Bringing Innovative Solutions Into focus
OPTIKOS™
Since 1982 ISO 9001 Certified

nature photonics

Newport
Experience | Solutions
Spectra-Physics
A Division of Newport Corporation

THORLABS

Swamp Optics
FROG
Size doesn't matter. It's how you measure it.

Empire Room
6:15 p.m.–7:51 p.m.
PDP-A • FiO Postdeadline Papers I
Presider to Be Announced

PDP-A1 • 6:15 p.m.
Optics with Superhydrophobic Surfaces—a New Class of Switches and Sensors, *Helmut Rathgen[1], Kazuyasu Sugiyama[2], Frieder Mugele[1]; [1]Physics of Complex Fluids, Univ. of Twente, Netherlands, [2]Physics of Fluids, Univ. of Twente, Netherlands.* We introduce the use of structured hydrophobic surfaces for optical switches and sensors and demonstrate an ultra sensitive ultrasound sensor based on a superhydrophobic diffraction grating. Superhydrophobic photonic crystals promise devices with tunable stop band.

PDP-A2 • 6:27 p.m.
Lens Designs of High NA Objectives for Page-Based Holographic Data Storage Systems, *Yuzuru Takashima, Lambertus Hesselink; Stanford Univ., USA.* High NA (0.7 ~ 0.8) objective lens in which both object and pupil aberrations are compensated for are designed in two-element configurations, and are usable for a combination of holographic and surface recordings.

PDP-A3 • 6:39 p.m.
Nonlinear Self-Filtering via Modulation Instability, *Dmitry V. Dylov, Jason W. Fleischer; Princeton Univ., USA.* We consider the nonlinear propagation of a mixture of coherent and spatially-incoherent light. We derive a diffraction/dispersion relation for the coupling and show experimentally how joint modulation instability can recover signals from a noisy background.

PDP-A4 • 6:51 p.m.
Production and Detection of Atomic Hexadecapole at Earth's Magnetic Field, *Victor Acosta; Univ. of California at Berkeley, USA.* We report a novel method that allows selective creation and detection of a macroscopic long lived hexadecapole polarization in the $F = 2$ ground state of ^{87}Rb atoms at Earth's magnetic field (510 mG).

PDP-A5 • 7:03 p.m.
Nanoimprinted Circular Grating Distributed Feedback Dye Laser, *Yan Chen; Caltech, USA.* A surface emitting polymer dye laser is fabricated by nanoimprint lithography. The laser cavity consists of a 2nd-order circular grating distributed-feedback structure. This nanoimprinted dye laser offers a low-cost coherent light source for lab-on-chip microsystems.

PDP-A6 • 7:15 p.m.
Ultrafast Optical Image Processing through Non-Collinear Third-Harmonic Generation in Thin Organic Films, *Canek Fuentes-Hernandez, Shuo-Yen Tseng, Daniel Owens, Bernard Kippelen; Georgia Tech, USA.* We report on ultrafast image processing based on non-collinear third-harmonic generation in a polymer composite and demonstrate image frequency conversion and image recognition using 100 fs pulses at 1,550 nm in a compact correlator geometry.

PDP-A7 • 7:27 p.m.
Creating Vortex Retarders Using Photo-Aligned Liquid Crystal Polymers, *Scott McEldowney[1], David Shemo[1], Russell Chipman[2], Paula Smith[2]; [1]JDSU, USA, [2]College of Optical Sciences, Univ. of Arizona, USA.* We present developments using photo-aligned liquid crystal polymers for creating vortex retarders. Polarization properties of devices with different modes and theoretical and experimental point spread functions in Mueller matrix format for these components are presented.

PDP-A8 • 7:39 p.m.
Achievement an Arbitrary Bandwidth of 4-skip-0 Bandpass Filters, *Cheng-Chung Lee, Sheng-Hui Chen; Natl. Central Univ., Taiwan.* By varying the refractive index of the thin film material the bandwidth can be fine tuned to an arbitrary value. A 4-skip-0 bandpass filter for 100GHz DWDM system of optical communication was designed and fabricated.

Crystal Room
6:15 p.m.–7:51 p.m.
PDP-B • FiO Postdeadline Papers II
Presider to Be Announced

PDP-B1 • 6:15 p.m.
Ultrafast Dynamics of the Vibrations of Aqueous Azide Ion and the O-H Modes of Bound Water Molecules, *Frank C.H. Kuo, Dmitriy Yu. Vorobyev, Jianxin Chen, Robin M. Hochstrasser; Univ. of Pennsylvania, USA.* Dual frequency two dimensional infrared spectroscopy has been used to investigate the dynamics of the azide-water solvation shell. A positive correlation of the two frequency distributions is found and decays on the ultrafast timescale.

PDP-B2 • 6:27 p.m.
Noise and Electromagnetically Induced Transparency, *Yanhong Xiao[1], Tun Wang[2], Maria Baryakhtar[1], David F. Phillips[1], Susanne F. Yelin[1,2], Ronald L. Walsworth[1,3]; [1]Harvard-Smithsonian Ctr. for Astrophysics, USA, [2]Univ. of Connecticut, USA, [3]Harvard Univ., USA.* We report coherence-induced conversion of laser phase noise to intensity noise via inetraction with an atomic medium. The spectrum of intensity fluctuations exhibits a narrow linewidth, that is immune to power broadening.

PDP-B3 • 6:39 p.m.
Observation of Accelerating Airy Beams, *John Broky, Georgios Siviloglou, Aristide Dogariu, Demetrios Christodoulides; College of Optics and Photonics, CREOL, USA.* We report the first observation of Airy optical beams. These wavepackets have been realized in both one- and two-dimensional configurations. It is demonstrated experimentally that these non-diffracting Airy beams tend to freely accelerate during propagation.

PDP-B4 • 6:51 p.m.
Two-Photon Absorption by H2 Molecules: Origin of the 2175A Astronomical Band? *Peter P. Sorokin[1], James H. Glownia[2]; [1]IBM Res. (Emeritus), USA, [2]Los Alamos Natl. Lab, USA.* The UV spectra of OB stars are oftentimes dominated by a broad extinction band peaking at 2175 angstroms. We show that two-photon absorption by H2 molecules in clouds enveloping such stars fully explains this band.

PDP-B5 • 7:03 p.m.
Studies of Halo Nuclei by Laser Spectroscopy, *Gordon W. F. Drake; Dept. of Physics, Univ. of Windsor, Canada.* This paper describes recent progress in techniques for the determination of the nuclear charge radius for exotic "halo" nuclei such as ^{6}He by the use of high precision laser spectroscopy to measure the isotope shift.

PDP-B6 • 7:15 p.m.
Nonlinear Terahertz Pump-Terahertz Probe Measurements of Semiconductor Carrier Dynamics, *Haidan Wen[1], Michael Wiczer[2], Aaron Lindenberg[1,3]; [1]PULSE Ctr., Stanford Linear Accelerator Ctr., USA, [2]Dept. of Physics, Univ. of Illinois at Urbana-Champaign, USA, [3]Dept. of Materials Science and Engineering, Stanford Univ., USA.* The field dependence of THz absorption in semiconductors is studied. Nonlinear absorption of ultrafast THz pulses is observed and can be attributed to free carrier excitation by the intense THz field.

PDP-B7 • 7:27 p.m.
Two-Beam Optical Trap in a Waveguide, *Sergei Kuehn[1], Philip Measor[1], Holger Schmidt[1], Evan J. Lunt[2], Aaron R. Hawkins[2]; [1]Univ. of California at Santa Cruz, USA, [2]Brigham Young Univ., USA.* We demonstrate a novel dual-beam particle trap relying on waveguide loss instead of beam divergence. The implementation of this trap on an optofluidic chip opens numerous possibilities for on-chip particle control and manipulation.

PDP-B8 • 7:39 p.m.
Room-Temperature Polaritons in InGaN Microcavities, *Yuh-Jen Cheng[1], Jung-Tang Chu[2], Hao-Chung Kuo[2], Tien-Chang Lu[2], Shing-Chung Wang[2]; [1]Academia Sinica, Taiwan, [2]Dept. of Photonics and Inst. of Electro-Optics, Natl. Chiao Tung Univ., Taiwan.* We report the observation of room-temperature strong exiton-photon coupling in InGaN multiple quantum well microcavities. A 9 meV Rabi splitting with >60% peak to valley contrast was demonstrated. The anticrossing spectra were also observed.

Gold Room
6:15 p.m.–7:51 p.m.
PDP-C • FiO Postdeadline Papers III
Presider to Be Announced

PDP-C1 • 6:15 p.m.
Cavity Nonlinear Optics at Low Photon Numbers from Collective Atomic Motion, *Subhadeep Gupta[1], Kevin L. Moore[2], Kater W. Murch[2], Dan M. Stamper-Kurn[2]; [1]Univ. of Washington, USA, [2]Univ. of California at Berkeley, USA.* We report on nonlinear optical phenomena from collective motion of ultracold atoms within a strong-coupling cavity. The nonlinearity arises from probe-induced atom displacement. Longevity of motional coherence allows nonlinearity at extremely low cavity photon numbers.

PDP-C2 • 6:27 p.m.
Generation of Subnatural Linewidth Biphotons, *Shengwang Du, Pavel Kolchin, Chinmay Belthangady, Guang-Yu Yin, Stephen E. Harris; Stanford Univ., USA.* We describe the generation of time-energy entangled bipotons with a sub-natural linewidth and a correlation time of about 100 ns. We use electromagnetically-induced transparency in a ^{85}Rb two-dimensional magneto-optical trap.

PDP-C3 • 6:39 p.m.
Quantum Tomography of a Bright Phase-Stable Polarization-Entangled Single-Mode-Fiber Two-Photon Source, *Jingyun Fan, Matthew D. Eisaman, Alan Migdall; Natl. Inst. of Standards and Technology, USA.* We have demonstrated a bright single-mode-fiber source of polarization-entangled photon pairs with visibility > 97% and fidelity > 95% at a detected coincidence rate of 7 kHz/nm over a 3 dB, 10THz bandwidth.

PDP-C4 • 6:51 p.m.
Controlling Cavity Reflectivity with a Single Quantum Dot, *Dirk R. Englund, Andrei Faraon, Ilya Fushman, Jelena Vuckovic; Stanford Univ., USA.* We demonstrate that a single quantum dot coherently alters the reflectivity spectrum of an optical cavity. At higher power, we measure giant optical nonlinearity. The QD-controlled reflectivity opens the door to quantum information processing applications.

PDP-C5 • 7:03 p.m.
High-Flux Hyperentangled Photon-Pairs from a Microstructure-Fiber Sagnac Interferometer, *Jun Chen, Jingyun Fan, Matthew D. Eisaman, Alan Migdall; Natl. Inst. of Standards and Technology, USA.* We generate hyperentangled (time-bin and polarization) photon-pairs using a microstructure-fiber Sagnac interferometer. Two-photon-interference visibilities in both degrees of freedom are >83%, and the Bell's inequality is violated by 25 σ at a 1-kHz coincidence rate.

PDP-C6 • 7:15 p.m.
A Slow Light Beam Splitter, *Yanhong Xiao[1], Mason Klein[1], Michael Hohensee[1], Liang Jiang[2], David F. Phillips[1], Ronald L. Walsworth[1]; [1]Harvard-Smithsonian Ctr. for Astrophysics, USA, [2]Harvard Univ., USA.* A slow-light beamsplitter using the rapid transport of coherence in a wall-coated atomic vapor cell under electromagnetically-induced-transparency is presented. Such a beamsplitter may improve quantum repeater perforamce and be useful in quantum and classical optics.

PDP-C7 • 7:27 p.m.
Measurement of Intracavity Quantum Fluctuations of Light Using an Atomic Fluctuation Bolometer, *Kater W. Murch, Kevin L. Moore, Subhadeep Gupta, Dan M. Stamper-Kurn; Univ. of California at Berkeley, USA.* We present measurements of the spectral noise power of photon number fluctuations inside a high-finesse Fabry-Perot optical resonator, measured through the resonator-enhanced momentum diffusion of ultracold atoms trapped within.

PDP-C8 • 7:39 p.m.
Four-Wave Mixing and Two-Photon Interference in a Three-Level Atomic Ensemble, *Shengwang Du[1], Eun Oh[2,3], Jianming Wen[4], Morton H. Rubin[4]; [1]Stanford Univ., USA, [2]NRL, USA, [3]Univ. of Virginia, USA, [4]Univ. of Maryland, Baltimore County, USA.* Interference of degenerate four-wave mixing in a three-level atomic ensemble is studied in both classical and quantum regimes. Biphoton interference shows photon anti-bunching or bunching effect under different situations.

Valley Room
6:15 p.m.–7:51 p.m.
PDP-D • FiO Postdeadline Papers IV
Presider to Be Announced

PDP-D1 • 6:15 p.m.
High-Power Broadband THz Emission from GaP Waveguides Pumped by High Power Ultrafast Fiber Lasers, *Charles J. Divin, Guoqing Chang, Malakeh A. Musheinish, Almantas Galvanauskas, Theodore B. Norris; Univ. of Michigan, USA.* Broadband THz generation is demonstrated using optical rectification in 6 mm GaP waveguides pumped by a high power ultrafast Yb-doped fiber amplifier. 120 μW THz radiation is obtained from 14 W pump power.

PDP-D2 • 6:27 p.m.
Ultrafast Nonlinear Switching Dynamics in Metallic Photonic Crystals, *Tilman Höner zu Siederdissen[1], Tolga Ergin[1], Jürgen Kuhl[1], Markus Lippitz[1], Harald Giessen[2]; [1]Max Planck Inst., Germany, [2]Univ. of Stuttgart, Germany.* Time-resolved studies of the nonlinear transmission in one-dimensional metal-dielectric photonic crystals using femtosecond pump-probe spectroscopy at room temperature reveal its sub-picosecond switching dynamics and exhibit a surprising intensity dependence.

PDP-D3 • 6:39 p.m.
Metal Nanowire Arrays in Photonic Crystal Fibres, *Luis N. Prill Sempere, Markus A. Schmidt, Hemant K. Tyagi, Chris G. Poulton, Philip St. J. Russell; Max-Planck Res. Group (IOIP), Germany.* Nanowire arrays are produced by pumping molten metal into the holes of silica PCF. Distinct dips in the transmitted spectra coincide with the coupling of the core-guided light to leaky plasmonic resonances in the nanowires.

PDP-D4 • 6:51 p.m.
Measurements of the Gouy Phase Shift for Surface Plasmons, *Wenqi Zhu, Amit Agrawal, Ajay Nahata; Univ. of Utah, USA.* We directly measure the Gouy phase shift of converging surface plasmon-polaritons using terahertz (THz) time-domain spectroscopy. We perform numerical simulations to determine the surface electric field distribution and associate it with Gouy phase shift.

PDP-D5 • 7:03 p.m.
Photomodification of Semicontinuous Silver Films with ps Pulses—New Spectrum-Structure Optimization Technique, *Piotr Nyga, Mark D. Thoreson, Vashista de Silva, Vladimir P. Drachev, Vladimir M. Shalaev; Purdue Univ., USA.* Semicontinuous silver films were photomodified with picosecond laser operating at 10.6μm. Slow spectral and structural changes were obtained. This technique allows the creation of filters for mid-IR wavelengths and optimization of films for sensing applications.

PDP-D6 • 7:15 p.m.
Low-Loss Ultra-Compact SOI Microring Add-Drop Filters, *Shijun Xiao, Maroof Khan, Hao Shen, Minghao Qi; Purdue Univ., USA.* We demonstrate low propagation loss ~ 0.07dB/round-trip in SOI microring resonators with a radius of 2.5 μm (FSR~ 32 nm) and ultra-compact 3rd microring add-drop filters with box-like channel dropping responses.

PDP-D7 • 7:27 p.m.
Loss Determination of Hollow-Core Waveguides by Optically-Induced Particle Transport, *Philip Measor[1], Sergei Kühn[1], Holger Schmidt[1], Evan J. Lunt[2], Aaron R. Hawkins[2]; [1]Univ. of California at Santa Cruz, USA, [2]Brigham Young Univ., USA.* A new method for loss measurements in hollow-core waveguides utilizing radiation pressure induced transport of dielectric microspheres is introduced and experimentally demonstrated.

PDP-D8 • 7:39 p.m.
Modeling and Testing of Electro-Refractive Coupled Quantum Well Modulators, *Chia-Jean Wang, Elizabeth T. Kunkee, Chun-Ching Shih, QiSheng Chen, Larry J. Lembo; Northrop Grumman Space Technology, USA.* We present a comprehensive theoretical model for coupled quantum well modulators and use the results to guide device fabrication. Test measurements for InP Mach-Zehnder intensity modulators show agreement with the simulation.

Key to Authors
(**Bold** Denotes Presenting Author)