Empire	Crystal	Gold	Valley	California

FiO

07:00–17:30 Registration, *Market Street Foyer, Fairmont Hotel*

08:00—09:30 VIP Industry Leaders Networking Event: Connecting OSA Corporate Members and Young Professionals, *Courtyard Atrium, Sainte Claire Hotel*

08:30—18:00 An OIDA Workshop/Roadmap Report Session
Optical Communications in Networks Workshop: Future Directions and Metrics in Aggregation Networks, *Regency 1 & 2, Fairmont Hotel*

Tuesday, 18 October

Empire

08:00–10:00
FTuA • Optical Manipulation I
Carlos Lopez-Mariscal; Naval Research Lab, USA, Presider

FTuA1 • 08:00 Invited
Optical Manipulation and Sizing of Aerosol Droplets using Bessel Beams, Toni Carruthers[1], Jim Walker[1], Abby Casey[1], Andrew J. Orr-Ewing[1], Jonathan P. Reid[1]; [1]*Chemistry, Univ. of Bristol, United Kingdom.* Investigation of sub-micron aerosol particles can provide insight into cloud forming properties. Bessel beam optical trapping techniques are used to confine and characterise droplets using elastic scattered light and cavity ring down techniques.

FTuA2 • 08:30 Invited
Towards Cooling of Optically Trapped Aerosols, David McGloin[1]; [1]*Electronic Engineering and Physics, Univ. of Dundee, United Kingdom.* We review recent results in the optical manipulation of aerosols, considering work moving towards the study of supercooled liquid droplets and the analysis of the freezing process. We consider new aerosol production methods using SAWs.

Crystal

08:00–10:00
FTuB • Ultrashort Pulses: 20th Anniversary of Frequency-Resolved Optical Gating Symposium I
Rick Trebino; Georgia Tech, USA, Presider

FTuB1 • 08:00 Invited
Advances in Attosecond Metrology and Spectroscopy, Reinhard Kienberger; [1]*Technische Univ. Muenchen, Germany.* The generation of ever shorter pulses is a key to exploring ultrafast dynamics in matter. Attosecond XUV pulses are available since about 10 years. Measurement techniques and spectroscopic methods have been developed for their applications.

FTuB2 • 08:30 Invited
Ultrafast Coherent X-Rays - from Femtoseconds to Zeptoseconds, Margaret Murnane; [1]*Univ. of Colorado at Boulder, USA.* Abstract not available.

Gold

08:00–10:00
FTuC • Biomedical Imaging
Presider to be Announced

FTuC1 • 08:00 Invited
High Speed Optical Imaging for Biomedical Applications, Maciej Wojtkowski[1]; [1]*Nicolaus Copernicus Univ., Poland.* Recently, Fourier domain Optical Coherence Tomography (FdOCT) using CMOS detectors and swept light sources has achieved imaging speeds of more than 100 000 optical A-scans per second. I will demonstrate a new advancements of ophthalmic FdOCT both in morphological and the functional imaging.

FTuC2 • 08:30 Invited
Optical Coherence Microrheology: Imaging Tissue Viscoelastic Properties, Amy Oldenburg[1,2]; [1]*Physics and Astronomy, Univ. of North Carolina at Chapel Hill, USA;* [2]*Biomedical Research Imaging Center, Univ. of North Carolina at Chapel Hill, USA.* Volumetric imaging of tissue mechanical properties using active probes (magnetic nanoparticles) and passive probes (plasmon-resonant gold nanorods) by processing signals from optical coherence tomography provides a new window into tissue mechanics.

Valley

08:00–10:00
FTuD • Nonlinear Optics in Micro/Nano Optical Structures I
Michal Bajcsy; Stanford Univ., USA, Presider

FTuD1 • 08:00 Invited
Ultra-high-quality Whispering-Gallery-Mode Resonators for Single Nanoparticle Detection and Measurement, Lan Yang, Jiangang Zhu, Lina He, Sahin Kaya Ozdemir, Woosung Kim; *Washington Univ. in St Louis, USA.* We discuss a self-referencing sensing technique using high-quality Whispering-Gallery-Mode (WGM) resonators for detection and measurement of single nanoparticles. We also demonstrate self-heterodyne detection of nanoparticles with radius of 10 nm using WGM microlasers.

FTuD2 • 08:30
Multi-photon State Generation from Strongly Coupled Quantum Dot-Cavity System, Michal Bajcsy[1], Arka Majumdar[1], Jelena Vuckovic[1]; [1]*Ginzton Laboratory, Stanford Univ., USA.* We describe how photon induced tunneling in strongly coupled cavity-quantum dot system can be used to generate photon states consisting mainly of a particular Fock state and present initial experimental observations of this effect.

California

08:00–10:00
FTuE • State of the Art Bio-Optical Technologies
Sean Hart; US Naval Res. Lab., USA, Presider

FTuE1 • 08:00 Invited
Optical Explorations of Single Biomolecules and Enzymes in Solution with an Anti-Brownian Electrokinetic Trap, W.E. Moerner[1], Samuel Bockenhauer[1], Randall Goldsmith[1], Yan Jiang[1], Quan Wang[1]; [1]*Stanford Univ., USA.* We discuss a self-referencing sensing technique using high-quality Whispering-Gallery-Mode (WGM) resonators for detection and measurement of single nanoparticles. We also demonstrate self-heterodyne detection of nanoparticles with radius of 10 nm using WGM microlasers.

FTuE2 • 08:30 Invited
Silk Fibroin Optofluidics, Peter Domachuk; [1] *Univ. of Sydney, Australia.* The ancient silk fibre finds new application as a bio-chemically functional optofluidic material. We demonstrate a silk protein diffraction grating doped with human haemoglobin. The haemoglobin remains chemically active within the grating.

Hillsborough	Atherton	Sacramento	Piedmont	Glen Ellen
FiO		LS		

07:00–17:30 Registration, *Market Street Foyer, Fairmont Hotel*

08:00—09:30 VIP Industry Leaders Networking Event: Connecting OSA Corporate Members and Young Professionals, *Courtyard Atrium, Sainte Claire Hotel*

08:30—18:00 An OIDA Workshop/Roadmap Report Session
Optical Communications in Networks Workshop: Future Directions and Metrics in Aggregation Networks, *Regency 1 & 2, Fairmont Hotel*

Hillsborough

08:00–10:00
FTuF • Digital Holographic Interferometery and Microscopy I
Toyohiko Yatagai; Utsunomiya Univ. Japan, Presider

FTuF1 • 08:00 Invited

Impact of Digital Holography on Microscopy and Nanoscopy, Christian Depeursinge, Shan Shan Kou, Isabelle Bergoend, Cristian Arfire, Yann Cotte, Nicolas Pavillon; *Ecole Polytechnique Fédérale de Lausanne, SCI-STI-CHD microvision group, Switzerland.* This communication focus on the most relevant developments in coherent imaging applied to microscopy. Digital Holographic Microscopy (DHM) appears as an innovative imaging modality, offering both nanometer accuracy, subwavelength resolution and tomography for real 3D imaging.

FTuF2 • 08:30

Region-of-Interest Sharpness Correction, Abbie E. Tippie[1], James Fienup[1]; [1]*Institute of Optics, Univ. of Rochester, USA.* Maximizing a sharpness metric over a region-of-interest (ROI) improves the wavefront correction for anisoplanatic images over that specific region. We discuss ROI size and scene content that contribute to the effectiveness of this technique.

Atherton

08:00–09:45
FTuG • Plasmonic Metamaterials
Presider to be Announced

FTuG1 • 08:00 Tutorial

Recent Progresses in Optical Metamaterials, Xiang Zhang; *Univ. of California at Berkeley, USA.* Metamaterials are artificially designed subwavelength composites that possess extraordinary properties not existing in naturally occurring materials. In particular, they can alter the propagation of electromagnetic waves resulting in negative refraction, subwavelength focusing and even in cloaking of macroscopic objects. Such unusual properties can be obtained by a careful design of dielectric or metal-dielectric composites on a deep sub-wavelength scale. The metamaterials may have profound impact in wide range of applications such as nano-scale imaging, nanolithography, and integrated nano photonics. I will discuss a few recent experiments demonstrating intriguing phenomena associated with Metamaterials. These include subdiffraction limit imaging and focusing, low-loss and broad-band negative-refraction of visible light, negative-index metamaterials and the first cloak operating at optical frequencies; an all-dielectric "carpet cloak" with broad-band and low-loss performance. I will also present our recent demonstration of a deep sub-wavelength plasmonic laser.

Sacramento

08:00–10:00
LTuA • Pushing the Limits of Nonlinear Imaging
Warren S. Warren; Duke Univ., USA, Presider

LTuA1 • 08:00 Invited

Applications of Multiphoton Microscopy - Lessons from the 90's and Where It's All Headed, Warren Zipfel[1]; [1]*Cornell Univ., USA.* Multiphoton microscopy grew rapidly in the decade after it was first demonstrated in 1990. This talk reviews the impact MPM has had on biology and the technological improvements needed for the growth in the future.

LTuA2 • 08:30

Cross-phase Modulation Microscopy, Prathyush Samineni[1], Martin C. Fischer[1], Warren S. Warren[1,2]; [1]*Chemistry, Duke Univ., USA;* [2]*Radiology & Biomedical Engineering, Duke Univ., USA.* We report our recently developed spectral re-shaping technique for cross-phase modulation imaging, which extends widely employed phase microscopy to the nonlinear regime.

Piedmont

08:15–10:00
LTuB • Coherence and Control in Energy Transfer III
Jennifer Ogilvie; Univ. of Michigan, USA, Presider

LTuB1 • 08:15 Invited

"Making the Molecular Movie": First Frames… Coming Features, Hubert Jean-Ruel[2], Meng Gao[2], Ryan R. Cooney[2], Cheng Lu[2], Gustavo Moriena[2], German Sciaini[2], and R. J. Dwayne Miller[1,2]; [1]*University of Hamburg,Germany;* [2]*University of Toronto,Canada.* Femtosecond Electron Diffraction has enabled atomic resolution to structural changes as they occur. New insights from an atomic perspective of the evolution of structure order parameters to barrier crossing dynamics will be presented.

Glen Ellen

08:00–10:00
LTuC • Information in a Photon I
Ian Walmsley; Univ. of Oxford, UK, Presider

LTuC1 • 08:00 Invited

Multi-bit-per-photon, Spectrally-efficient Optical Communications Architectures, Sam Dolinar; *NASA, USA.* Abstract not available.

LTuC2 • 08:30

Quantum Ghost Image Tracking, Mehul Malik[1], Heedeuk Shin[1], Robert W. Boyd[1,2]; [1]*Optics, Univ. of Rochester, USA;* [2]*Physics, Univ. of Ottawa, Canada.* A quantum ghost image identification scheme is modified to track a moving object. The speed and direction of the object are extrapolated from the rate of change of coincidence counts.

FiO

Empire

FTuA • Optical Manipulation I—Continued

FTuA3 • 09:00
Optical Trapping of Low Index Particles in Liquid Crystal, Francesco Aieta[1,2]; [1]*FIMET, Università Politecnica delle Marche, Italy;* [2]*SEAS, Harvard Univ., USA.* Optical Trapping in Liquid Crystal (LC) exhibits features not ascribable to the classical interpretation of the phenomenon. We show results driving to this direction supported by a model for the LC molecules realignment induced by a focused beam.

FTuA4 • 09:15
Precise Optical Measurements of Particle Size in Air-Filled Hollow-Core Photonic Crystal Fiber, Oliver A. Schmidt[1], Tijmen G. Euser[1], Martin K. Garbos[1], Philip Russell[1]; [1]*Max Planck Institute for the Science of Light, Germany.* A novel dual-beam launching method allows controlled optical trapping and high-speed (9 cm/s) propulsion of microparticles in air-filled hollow-core PCF. Optical, viscous, and gravitational forces can be measured and the particle size determined.

Crystal

FTuB • Ultrashort Pulses: 20th Anniversary of Frequency-Resolved Optical Gating Symposium I—Continued

FTuB3 • 09:00 Invited
Generation and Characterization of Isolated Attosecond Pulses for Atomic and Molecular Physics, Mauro Nisoli; [1]. *Department of Physics, Politecnico di Milano National Research Council of Italy, Institute of Photonics and Nanotechnologies (CNR-IFN).* We will review recent experimental progress in the generation, characterization and application of XUV pulses, produced by high-order harmonic generation in gases, with duration down to the attosecond time scale.

Gold

FTuC • Biomedical Imaging—Continued

FTuC3 • 09:00
Observation of Flow-Dependent Blood Optical Inhomogeneity Using Joint Spectral and Time Domain OCT, Danuta Bukowska[1], Maciej Szkulmowski[1], Szymon Tamborski[1], Daniel Szlag[1], Iwona Gorczynska[1], Andrzej Kowalczyk[1], Maciej Wojtkowski[1]; [1]*Institute of Physics, Nicolaus Copernicus Univ., Poland.* In this paper we would like to report that dynamic change of human blood refractive index have an influence on Doppler OCT measurement. The obtained data show an interesting attributes of this phenomenon.

FTuC4 • 09:15
A System for All-Optical Spectrum Recognition using a Spatial Light Modulator, Joseph E. Vornehm[1], Zhimin Shi[1], Robert W. Boyd[1,2]; [1]*Institute of Optics, Univ. of Rochester, USA;* [2]*Department of Physics, Univ. of Ottawa, Canada.* We propose a programmable system for optical spectrum recognition using a diffraction grating, a phase-only spatial light modulator (SLM), and two detector elements.

Valley

FTuD • Nonlinear Optics in Micro/Nano Optical Structures I—Continued

FTuD3 • 08:45
Time-Resolved Vibrational Nanospectroscopy Using Femtosecond Infrared Scattering Scanning Near-field Optical Microscopy, Xiaoji Xu[1], Honghua Yang[1], Andrew C. Jones[1], Markus B. Raschke[1,2]; [1]*Department of physics, Univ. of Colorado, USA;* [2]*JILA, Univ. of Colorado, USA.* We combine scattering scanning near-field optical microscopy with ultrafast infrared light, enabling spectroscopy at nanometer scale. Time resolved free induction decay behaviors of surface polymer molecules are observed.

FTuD4 • 09:00
Highly Coherent, Microcavity Brillouin Laser on Silicon, Jiang Li[1], Hansuek Lee[1], Tong Chen[1], Oskar Painter[1], Kerry J. Vahala[1]; [1]*Department of Applied Physics, California Institutute of Technology, USA.* In this work, we report on a compact silica-on-silicon stimulated Brillouin laser (SBL) that has efficiency in excess of 85% and a measured Schawlow-Townes frequency noise of 60 milliHertz.

FTuD5 • 09:15
Ultrafast Dynamics of Nucleation and Growth of Metallic Domains in VO^2, Nathaniel Brady[1], Prashanth Upadhya[2], Minah Seo[2], Joyeeta Nag[3], Rohit Prasankumar[2], Richard Haglund[3], David Hilton[1]; [1]*Univ. of Alabama at Birmingham, USA;* [2]*Los Alamos National Laboratory, USA;* [3]*Vanderbilt Univ., USA.* We performed nondegenerate pump (800 nm)-probe (0.4 eV or 0.7 eV) transmission spectroscopy in vanadium dioxide (VO2). These show a complex time dependence that appears to be correlated with nucleation and growth of metallic domains.

California

FTuE • State of the Art Bio-Optical Technologies—Continued

FTuE3 • 09:00 Invited
Integrated Micro-Fluorescence-Activated Cell Sorter (µFACS), Chun H. Chen; [1]. Abstract not available.

Hillsborough | Atherton | Sacramento | Piedmont | Glen Ellen

FiO | **LS**

FTuF • Digital Holographic Interferometery and Microscopy I—Continued

FTuF3 • 08:45
Sub-pixel Movement Detection with Compressive Holography, Yi Liu[1], Lei Tian[1], George Barbastathis[1,2]; [1]*MIT, USA;* [2]*Singapore-MIT Alliance for Research and Technology (SMART) Centre, Singapore.* We present experimental results of using compressive holography method to detect sub-pixel displacement.

FTuF4 • 09:00
Phase Conjugating Interferometer for Optical Vortices in Rotating Frame, Alexey Okulov[1]; [1]*Russian Academy of Sciencies, Russian Federation.* We analyze rotational Doppler effect in noninertial frame for laser beams with angular momentum. The phase-conjugating optical interferometer with photorefractive mirror or static volume hologram produces rotating helical interference pattern.

FTuF5 • 09:15
Withdrawn

FTuG • Plasmonic Metamaterials—Continued

FTuG2 • 08:45
Theory of Near-IR Metatronic Nanocircuits Using Transparent Conducting Oxides (TCO), Humeyra Caglayan[1], Nader Engheta[1]; [1]*Department of Electrical and Systems Engineering, Univ. of Pennsylvania, USA.* We theoretically investigate TCO nanorods functioning as optical nanocircuits in NIR regimes. Using the circuit theory and FDTD simulations, we explore the nanoscale circuit element functionalities controlled by the polarization of incident E-field

FTuG3 • 09:00
Mapping Surface Plasmon Propagation by Collection-Mode Near-Field Microscopy, Francesco Tantussi[1], Michele Cortellezzi[1], Francesco Fuso[1], Maria Allegrini[1], Johann Berthelot[2], Alexandre Bouhelier[2]; [1]*CNISM, Dipartimento di Fisica "Enrico Fermi", Universsà di Pisa, Italy;* [2]*Laboratoire Interdisciplinaire Carnot de Bourgogne, CNRS UMR 5209, Université de Bourgogne, France.* Surface plasmon propagation along striped Gold structures has been investigated by collection-mode near-field microscopy, leading to map the field intensity at the structure surface and to assess the system behavior at the nanoscale.

FTuG4 • 09:15
Internal Homogenization: Effective Permittivity of Multilayered Spheres, Uday Chettiar[1], Nader Engheta[1]; [1]*Department of Electrical and Systems Engineering, Univ. of Pennsylvania, USA.* Internal homogenization for effective permittivity of coated spheres is discussed for plasmonic and dielectric materials. Such an effective model of homogenization is a useful tool in designing coated particles with desired resonant properties.

LTuA • Pushing the Limits of Nonlinear Imaging—Continued

LTuA3 • 08:45
Spectral Shifting Measurement of Cross Phase Modulation With a Balanced Photodiode, Jesse W. Wilson[1], Warren Warren[1,2]; [1]*Chemistry, Duke Univ., USA;* [2]*Radiology, Duke Univ., USA.* Biomedical imaging of the nonlinear refractive index n2 requires a measurement technique that, unlike z-scan, is robust in inhomogeneous scattering media. We present an adaptation of a pump-probe experiment to measure n2 via cross-phase modulation.

LTuA4 • 09:00 Invited
Advances in STED Nanoscopy, Volker Westphal[1], Stefan W. Hell[1]; [1]*NanoBiophotonics, MPI f. Biophysical Chemistry, Germany.* Diffraction-unlimited imaging is one of the emerging fields in microscopy. In all of these techniques, fluorophore switching is key. The first technique developed is STED, recent advances will be shown.

LTuB • Coherence and Control in Energy Transfer III—Continued

LTuB2 • 08:45
Accurate Simulations of Two-Dimensional Photon-Echo Signals: What Have We Learnt? Dassia Egorova; [1]*Physical Chemistry, Univ. of Kiel, Germany.* We analyse our findings gained from accurate simulations of two-dimensional photon-echo signals for various models in order to determine what particular system properties are responsible for the observed quantum coherence in the photosynthetic compounds.

LTuB3 • 09:00 Invited
Exploiting Coherence to Optimize Energy Redistribution in Stimulated Raman Microscopy, H.L. Offerhaus, A.C.W. van Rhijn, E.T. Garbacik and J.L. Herek; [1]*Twente Univ., Netherlands*. ACoherent anti-Stokes Raman scattering with phase-shaped pulses exploits interference effects for optical discrimination of molecules in complex mixtures. We present our approaches combining adaptive pulse shaping and closed-loop optimization strategies for chemically selective microscopy.

LTuC • Information in a Photon I—Continued

LTuC3 • 08:45 Invited
Compressive Imaging and the 1-Pixel Camera: Extracting Information fro Multiplexed Photons, Kevin Kelly[1]; [1]*Rice Univ., USA*. Abstract not available.

LTuC4 • 09:15
Quantum Frequency Translation and Interference of Two Photons of Different Color, M. G. Raymer[1]; Hayden McGuinness[1]; Steven van Enk[1]; Colin McKinstrie[2]; [1]*Univ. of Oregon, USA;* [2]*Bell Laboratories, Alcatel-Lucent, USA.*Two photons having different colors can exhibit the Hong-Ou-Mandel interference effect if the usual beam splitter is replaced by Bragg scattering via four-wave mixing in an optical fiber, which acts as a frequency shifter.

Empire	Crystal	Gold	Valley	California

FiO

FTuA • Optical Manipulation I—Continued

FTuA5 • 09:30

Advanced Optical Micromanipulations in Structured Counter-Propagating Laser Beams, Oto Brzobohaty[1], Martin Siler[1], Vitezslav Karasek[1], Pavel Zemanek[1], Tomas Cizmar[2], Kishan Dholakia[3]; *[1]Institute of Scientific Instruments of the ASCR, v.v.i., Czech Republic; [2]SUPA, School of Medicine,, Univ. of St. Andrews, United Kingdom; [3]SUPA, School of Physics and Astronomy, Univ. of St. Andrews, United Kingdom.* Flexible optical trapping system based on a single or multiple dual-beam traps will be presented and its utilization for advanced optical micromanipulation demonstrated.

FTuA6 • 09:45

Raman Microspectroscopy Monitoring of Lipids in Algal Cells, Ota Samek[1], Zdenek Pilat[1], Jan Jezek[1], Mojmir Sery[1], Silvie Bernatova[1], Pavel Zemanek[1], Ladislav Nedbal[2], Martin Trtilek[3]; *[1]Institute of Scientific Instruments of the ASCR, v.v.i., Czech Republic; [2]Institute of Systems Biology and Ecology of the AS CR, v.v.i., Czech Republic; [3]Photon Systems Instruments, Czech Republic.* Raman microspectroscopy is utilised for fast, noninvasive detection and characterization of algal cells and in combination with optical sorting provides an efficient tool for optimal algal selection.

FTuB • Ultrashort Pulses: 20th Anniversary of Frequency-Resolved Optical Gating Symposium I—Continued

FTuB4 • 09:30 Invited

Interferometric FROG for Few-Cycle Pulse Characterization and as an Ultrafast Spectroscopy Tool, Gunter Steinmeyer[1,2], Gero Stibenz[1,3], Susanta K. Das[1], Rüdiger Grunwald[1], Markus B. Raschke[4]; *[1]Max-Born-Insitut für Nichtlineare Optik und Kurzzeitspektroskopie, Germany; [2]Optoelectronics Research Centre, Tampere Univ. of Technology, Finland; [3]APE Angewandte Physik & Elektronik GmbH, Germany; [4]Department of Physics, and JILA., Univ. of Colorado, USA.* We discuss interferometric FROG as a tool for precise pulse characterization as well as for the measurement of the ultrafast surface plasmon dynamics of metallic nanostructures. A new THG interferometric FROG method will also be introduced.

FTuC • Biomedical Imaging—Continued

FTuC5 • 09:30 Invited

SERS Nanodomes for In-Line Detection within Biomedical Tubing, Brian T. Cunningham[1], Charles J. Choi[1], Hsin-Yu Wu[1]; *[1]Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA.* Replica-molded silver nanodomes on flexible substrates are embedded into tubing for SERS-based detection of chemicals flowing through the tubing. Applications include detection of intravenously delivered drugs and urinary metabolites in catheters.

FTuD • Nonlinear Optics in Micro/Nano Optical Structures I—Continued

FTuD6 • 09:30

Generation of Continuous-Wave UV, Visible, and Near-IR Waves in a Whispering-Gallery Resonator, Jeremy Moore[1], Matthew Tomes[1], Tal Carmon[1], Mona Jarrahi[1]; *[1]Univ. of Michigan, USA.* We experimentally demonstrate generation of continuous-wave UV, visible, and near-IR waves in a periodically-poled lithium niobate whispering-gallery resonator pumped with a telecommunication-compatible IR source, at a record-low pump power of 200mW.

FTuD7 • 09:45

Optical Arbitary Waveform Generation from an On-Chip Microresonator Frequency Comb, Fahmida Ferdous[1], Houxun Miao[2,3], Daniel E. Leaird[1], Kartik Srinivasan[2], Jian Wang[1,4], Lei Chen[2], Andrew M. Weiner[1,4]; *[1]ECE, Purdue Univ., USA; [2]Center for Nanoscale Science and Technology, National Institute of Standards and Technology, USA; [3]Nanocenter, Univ. of Maryland, USA; [4]Birck Nanotechnology Center, Purdue Univ., USA.* We report spectral phase characterization, compression, and shaping of on-chip microresonator combs.

FTuE • State of the Art Bio-Optical Technologies—Continued

FTuE4 • 09:30

High Spatial Resolution Sensing of Cytokine Secretion by Nano-Plasmonic-Resonator Array, Sheng Wang[1], Sadao Ota[1], Bin Guo[1], Jongeun Ryu[2], Christopher Rhodes[1], Yi Xiong[1], Sheraz Kalim[3], Li Zeng[1], Yong Chen[2], Michael A. Teitell[3], Xiang Zhang[1,4]; *[1]NSF Nanoscale Science and Engineering Center (NSEC), Univ. of California Berkeley, USA; [2]Mechanical and Aerospace Engineering, Univ. of California Los Angeles, USA; [3]Pathology and Laboratory Medicine, Univ. of California Los Angeles, USA; [4]Materials Sciences Division, Lawrence Berkeley National Laboratory, USA.* Sub-micron resolution quantitative mapping of endogenous cytokine secretion is realized by an in-situ immunoassay based on giant optical enhancement of a tunable-nano-plasmonic-resonator (TNPR) array fabricated by nano-imprint lithography (NIL).

FTuE5 • 09:45

Pump-probe Microscopy Captures Cellular Detail of Melanoma in-vivo, Jesse W. Wilson[1], Thomas E. Matthews[1], Simone Degan[1], Jennifer Y. Zhang[2], Mary Jane Simpson[1], Warren Warren[1,3]; *[1]Chemistry, Duke Univ., USA; [2]Dermatology, Duke Univ., USA; [3]Radiology, Duke Univ., USA.* Pump-probe imaging of melanin with near-infrared pulses coupled with multphoton autofluorescence captures both chemical contrast and cellular detail in a live, developing melanoma.

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

10:00–16:00 Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*

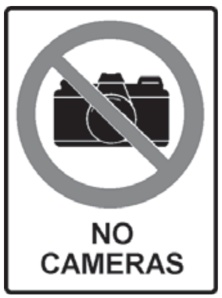
10:00–12:00 OSA Network of Entrepreneurs (ONE) Workshop, *Courtyard Atrium, Sainte Claire Hotel*

Hillsborough	Atherton	Sacramento	Piedmont	Glen Ellen
FiO		LS		

FTuF • Digital Holographic Interferometery and Microscopy I—Continued

FTuF6 • 09:30 Invited

Digital Holographic Interferometry And Microscopy For 3-D Object Visualization, Georges Nehmetallah[1], Partha P. Banerjee[1]; [1]*Univ. of Dayton, USA.* We use digital holographic interferometry to determine the 3-D dynamic deformation of dents evolution in time of reflective objects and also we use digital holographic microscopy for 3-D profile of spherical lenses on Silicon wafers.



FTuG • Plasmonic Metamaterials—Continued

FTuG5 • 09:30

Wall-Avoiding Field Distributions in Plasmonic Waveguides, Francisco J. Rodríguez-Fortuño[1,2], Nader Engheta[1]; [1]*Department of Electrical and Systems Engineering, Univ. of Pennsylvania, USA;* [2]*Nanophotonics Technology Center, Universidad Politécnica de Valencia, Spain.* We explore the combination of modes in a multimode plasmonic waveguide so that the total field distribution of combined fields avoids the metallic walls and therefore shows a reduced propagation loss for given propagation lengths.

LTuA • Pushing the Limits of Nonlinear Imaging—Continued

LTuA5 • 09:30 Invited

Zonal Adaptive Optical Microscopy, Na Ji[1], Eric Betzig[1]; [1]*Janelia Farm Research Campus, Howard Hughes Medical Institute, USA.* Inhomogeneous optical properties of biological samples degrade imaging quality. Using an image-based zonal adaptive optical approach, we recovered diffraction-limited resolution from mouse brains in vivo to a depth of 450 micron.

LTuB • Coherence and Control in Energy Transfer III—Continued

LTuB4 • 09:30 Invited

Evidences of Vibrational and Electronic Coherences in Two-dimensional Spectra of Molecular Complexes, Vytautas Butkus[1], Darius Abramavicius[1,2], Leonas Valkunas[1,3]; [1]*Faculty of Physics, Vilnius Univ., Lithuania;* [2]*State Key Laboratory of Supramolecular Complexes, Jilin Univ., China;* [3]*Center for Physical Sciences and Technology, Lithuania.* Simulations of vibrational and electronic coherences in two-dimensional spectra of model systems are presented. Premises of distinguishing the nature of coherence oscillations are given and applied to experimental results of porphyrin hexamer.

LTuC • Information in a Photon I—Continued

LTuC5 • 09:30 Invited

Mastering Pulsed Quantum Light, C. Silberhorn, B.Brecht, A. Christ, A.Eckstein; *Max Planck Institute for the Science of Light, University of Paderborn, Germany.* The intrinsic structure of pulsed quantum light can be exploited to introduce highly efficient multi-mode quantum information encoding for high bit rate applications. We present tools for the control and manipulation of broadband frequency modes.

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

10:00–16:00 Exhibit Hall Open, *Imperial Ballroom, Fairmont Hotel*

10:00–12:00 OSA Network of Entrepreneurs (ONE) Workshop, *Courtyard Atrium, Sainte Claire Hotel*

Empire	Crystal	Gold	Valley	California

FiO

10:30–12:30
FTuH • Single Molecule Detection, Diagnostics and Therapy I
Antonia Carruthers, Univ. of Bristol, UK, Presider

FTuH1 • 10:30 Invited
Single Molecule Studies of Unstructured Protein Function and Dynamics, Abhinav Nath[1], Corey O'Hern[2,3], Andrew D. Miranker[1], Elizabeth Rhoades[1]; [1]*Molecular Biophysics & Biochemistry, Yale Univ., USA;* [2]*Physics, Yale Univ., USA;* [3]*Mechanical Engineering & Materials Science, Yale Univ., USA.* Unstructured proteins are biologically important, but challenging to characterize by traditional biophysical methods. Single-molecule fluorescence can probe the conformations of disease-related unstructured proteins, in solution or bound to partners.

FTuH2 • 11:00
Super-Resolution 3D Co-Localization of Protein Superstructures and the Cellular Surface in Live *Caulobacter crescentus*, Matthew D. Lew[1,2], Steven F. Lee[2,4], Jerod L. Ptacin[3], Marissa K. Lee[2], Lucy Shapiro[3], W.E. Moerner[2]; [1]*Electrical Engineering, Stanford Univ., USA;* [2]*Chemistry, Stanford Univ., USA;* [3]*Developmental Biology, Stanford Univ. School of Medicine, USA;* [4]*Chemistry, Univ. of Cambridge, United Kingdom.* We demonstrate live cell 3D super-resolution fluorescence imaging of internal protein superstructures co-localized with the cell surface. Our sequential two-color imaging technique demonstrates the advantage of using only one reading laser.

FTuH3 • 11:15 Invited
Enabling Resolution with Gabor-Domain Optical Coherence Microscopy, and Applications, Jannick P. Rolland,[1] Panomsak Meemon,[1] Jianing Yao,[1] Kevin P. Thompson,[2,1], Kye-Sung Lee,[1]; *Univ. of Rochester, USA.* We report images of *in vivo* skin epidermal cells and new GRIN material obtained using volumetric optical coherence microscopy from a liquid-lens-based, dynamic focusing objective, and a high-speed astigmatism-corrected Czerny-Turner spectrometer.

10:30–12:00
FTuI • Fiber Sources in Non-Telecom Windows I ▶
Siddharth Ramachandran; Boston Univ., USA, Presider

FTuI1 • 10:30 Invited
Parametric Generation of Mid-IR Light, Stojan Radic; *Univ. of California at San Diego, USA.* Abstract not available.

FTuI2 • 11:00 ▶
High Power Photonic Crystal Fiber Lasers and their Intracavity Coherent Combining, Boris Shulga[1], Amiel A. Ishaaya[1]; [1]*Electrical and Computer Engineering, Ben-Gurion Univ. of the Negev, Israel.* We experimentally demonstrate high power CW operation of a rod-type photonic crystal fiber laser with single and double pump pass configurations. Moreover, we investigate Q-switched pulsed operation of the laser and intracavity coherent combining.

FTuI3 • 11:15 ▶
An All Fiber Mode-Locked Tm/Ho Fiber Laser Employing C-band Components, Rajesh Kadel[1], Andrew M. Jones[1], Brian R. Washburn[1]; [1]*Physics, Kansas State Univ., USA.* An all fiber mode-locked Tm/Ho co-doped fiber laser at 2 µm is presented that uses a C-band isolator and coupler. We investigate using Er-doped, dispersion compensating, and highly nonlinear fiber for intracavity dispersion compensation.

10:30–12:00
FTuJ • Optofluidics for Enhanced Sensing ▶
Peter Domachuk, University of Sydney, Australia, Presider

FTuJ1 • 10:30 Invited ▶
Optofluidic Nanostructures for Concentration and Sensing, David Sinton[1], Carlos Escobedo[1]; [1]*Mechanical Engineering, Univ. of Victoria, Canada.* We demonstrate the first active utilization of flow-through nanohole array sensors for achieving both the active electrohydrodynamic concentration and the subsequent sensing of electrically charged analyte using the same optofluidic nanostructure.

FTuJ2 • 11:00 Invited ▶
Title to be Announced, Michal Lipson; [1]*Cornell Univ., USA.* Abstract not available.

10:30–12:00
FTuK • Coherence and Optical Sciences
Ian Coddington; NIST, USA, Presider

FTuK1 • 10:30
Causality and the Complete Positivity of Classical Polarization Maps, Omar Gamel[1], Daniel F. James[1]; [1]*Physics, Univ. of Toroto, Canada.* We derive the most general transformation on a classical polarization matrix from simple physical principles and the matrix theory of positive maps.

FTuK2 • 10:45
$\chi(2)$-Lens Mode Locking of Nd:YVO4 Laser Operating at 1.34µm Transition, Hristo L. Iliev[1], Ivan Buchvarov[1]; [1]*Physics Department, Sofia Univ., Bulgaria.* Self-starting $\chi(2)$-lens mode-locking of a 1.34-µm Nd:YVO4 laser using second harmonic generation in PPMgSLT is demonstrated. A train of 3.6 ps pulses with ~0.8 W average output power at 120 MHz is achieved

FTuK3 • 11:00
Development of an "Interferometric Quasi-Autocollimator", Matthew D. Turner[1], Charles A. Hagedorn[1], Stephan Schlamminger[1,2], Jens H. Gundlach[1]; [1]*Center for Experimental Nuclear Physics and Astrophysics, Univ. of Washington, USA;* [2]*National Institute of Standards and Technology, USA.* We have developed a device that uses weak-value amplification to measure angular deflections of a target mirror while remaining insensitive to all translations of the target. We present demonstrated sensitivities and discuss practical implementation.

FTuK4 • 11:15
Morphological Profile of Femtosecond Laser-Induced Periodic Grooves on Metals, Taek Yong Hwang[1], Chunlei Guo[1]; [1]*The Institute of Optics, Univ. of Rochester, USA.* Using femtosecond laser irradiation, we create laser-induced periodic surface structures (LIPSSs) on metals. For the first time, the morphological profiles of LIPSSs created at various incident beam angles are studied.

10:30–11:45
FTuL • Nonimaging Techniques for Sensing I
Presider to Be Announced

FTuL1 • 10:30 Invited
Chip-scale Microscopy for Addressing Petri-dish Imaging Needs, Guoan Zheng, Seung Ah Lee, Chang-huei Yang; *California Institute of Technology, USA.* We will discuss our recent work on chip-scale microscopy for imaging petri-dish cultures. We will report the demonstration of a chip-scale imaging solution that is capable of autonomous and high-resolution imaging over the entire culture growth area. We further demonstrate that this solution enables direct imaging of cell cultures from within an incubator.

FTuL2 • 11:00
Nonlinear Tomographic Imaging of Scattering and Attenuation, Keith J. Dillon[1], Yeshaiahu Fainman[1]; [1]*Electrical and Computer Engineering, Univ. of California, San Diego, USA.* We consider the problem of simultaneously computing the unknown scattering and attenuation in a sample, in the short wavelength limit. We demonstrate the method applied to reconstruction of an opaque object without correspondence.

FTuL3 • 11:15
Movies of Nanoscale Dynamics Using Soft X-Ray Laser Illumination, Sergio Carbajo[1,2], Isela Howlett[1,2], Anne Sakdinawat[1,3], Yanwei Liu[1,3], Weilun Chao[1,4], Erik H. Anderson[1,4], Alexander Vinogradov[5], Igor Artioukov[5], David T. Attwood[1,3], Mario C. Marconi[1,2], Jorge J. Rocca[1,2], Carmen S. Menoni[1,2]; [1]*NSF ERC for EUV Science and Technology, USA;* [2]*Electrical and Computer Engineering, Colorado State Univ., USA;* [3]*Electrical and Computer Engineering, Univ. of California Berkeley, USA;* [4]*Center for X-ray Optics, Lawrence Berkeley National Laboratory, USA;* [5]*P. N. Lebedev Physical Institue, Russian Federation.* Movies of magnetic force microscope tips oscillating at 65.5 kHz were acquired using flash soft x-ray laser illumination. Changes in the oscillation amplitude of 11 ± 4 nanometers were detected.

Hillsborough | Atherton | Sacramento | Piedmont | Glen Ellen

FiO | **LS**

Hillsborough — FiO

10:30–12:00
FTuM • Three-Dimensional Structure Design, Fabrication, and Nanopatterning II
Debashis Chanda; Univ. of Illinois at Urbana-Champian, USA, Presider

FTuM1 • 10:30 Invited
Beyond the Rayleigh Limit in Optical Lithography, M. Suhail Zubairy[1]; [1]*Texas A&M Univ., USA.* It is well known that the precision with which a pattern could be etched in interference lithography is limited by the wavelength of the light. In this talk we shall discuss several schemes for sub-wavelength lithography using classical light.

FTuM2 • 11:00
High Precision Matrix Laser Lithography for Fabrication of Novel Types of Optical Security Elements, Marek Skeren[1], Jakub Svoboda[1], Martin Nývlt[1], Pavel Fiala[1]; [1]*Dept. of Physical Electronics, FNSPE, Czech Technical Univ., Czech Republic.* Laser matrix lithography device is presented which can be used for fabrication of various diffractive structures including novel types of optical security elements. New ideas in encryption of information using diffractive elements are presented.

FTuM3 • 11:15
Adaptive Optical Methods for Parallelized Laser Fabrication, Patrick S. Salter[1], Hassan Al-Wakeel[1], Alexander Jesacher[2], Martin Booth[1]; [1]*Engineering Science, Univ. of Oxford, United Kingdom;* [2]*Division of Biomedical Physics, Innsbruck Medical Univ., Austria.* We develop adaptive optics for 3D laser microfabrication. Correction of focal depth induced aberrations and beam shaping are applied to fabrication of photonic structures. Adaptive multispot schemes are used for rapid parallel fabrication.

Atherton — FiO

10:30–12:00
FTuN • Optomechanics II
Tal Carmon; Univ. of Michigan, USA, Presider

FTuN1 • 10:30 Invited
GaAs Disks Optomechanics, C. Baker[1], L. Ding[1], P. Senellart[2], Aristide Lemaitre[2], S. Ducci[1], G. Leo[1], Ivan Favero[1]; [1]*Université Paris, France;* [2]*CNRS, France.* We report on GaAs disks optomechanical resonators having GHz mechanical modes, vacuum optomechanical coupling reaching 1MHz, permitting a motional sensitivity of 10-17m/ÖHz. Dynamical back-action self-oscillation is observed. Integration with waveguides suspended on the chip is presented.

FTuN2 • 11:00
A Cavity Effect on Optical Forces, Joel T. Rubin[1], Lev I. Deych[1]; [1]*Physics, Queens College of CUNY, USA.* Using an analytically solvable model of a nanoparticle interacting with a spherical optical resonator we show that particle-induced modification of the cavity mode renders standard gradient approximation for the optomechanical interaction invalid.

FTuN3 • 11:15
Single-input Spherical Microbubble Resonator, Síle Nic Chormaic[1,2], Amy Watkins[1,2], Jonathan Ward[1,3], Yuqiang Wu[1,2]; [1]*Physics, Univ. College Cork, Ireland;* [2]*Tyndall National Institute, Ireland;* [3]*Humboldt Universitaet zu Berlin, Germany.* We present a method for fabricating single-input optical microbubble resonators with diameters less than 100 micron. We observe a mode shift up to 22 GHz in the spectra when water is inserted into the cavity.

Sacramento — LS

10:30–12:00
LTuD • Novel Technologies for Multiphoton Imaging
Chris Xu; Cornell Univ., USA, Presider

LTuD1 • 10:30 Invited
Microprisms for Chronic In Vivo Multiphoton Microscopy of Cortex, Michael Levene[1]; [1]*Yale Univ., USA.* We demonstrate the use of microprisms for chronic in vivo multiphoton microscopy of mouse cortex. These prisms enable a point-of-view more typical of ex-vivo, cortical slice preparations, but in an in vivo context.

LTuD2 • 11:00 Invited
Volumetric Multiphoton Microscopy: Simultaneous Imaging in 3D, Jeff Squier[1], Erich Hoover[1], Erich Chandler[1], Michael Young[1]; [1]*Colorado School of Mines, USA.* Parallel multiphoton imaging of multiple focal planes while employing single element detection is demonstrated. This novel imaging modality enables three-dimensional specimen volumes to be recorded simultaneously in dynamic fashion.

Piedmont — LS

10:30–12:00
LTuE • Coherence and Control in Energy Transfer IV
Eitan Geva; Univ. of Michigan, USA, Presider

LTuE1 • 10:30 Invited
Comparison of Electronic and Vibrational Coherence Measured by Two-Dimensional Electronic Spectroscopy, Daniel B. Turner[1], Gregory D. Scholes[1]; [1]*Chemistry, Univ. of Toronto, Canada.* We measured broadband two-dimensional electronic spectra of a laser dye, a quantum dot, and an algal photosynthetic protein. We determined the origin of the cross peak oscillations by investigating the nonrephasing contribution in each system.

LTuE2 • 11:00 Invited
Beyond Third-Order Response: Strong-Pulse and N-Wave-Mixing Optical Spectroscopies, Maxim Gelin[1], Dassia Egorova[2], Wolfgang Domcke[1]; [1]*Technical Univ. of Munich, Germany;* [2]*Chemical Department, Univ. of Kiel, Germany.* We describe two complementary nonperturbative methods for the calculation of N-wave-mixing signals and apply them to study strong-field effects in the coherent dynamics and optical responses of a series of model systems

Glen Ellen — LS

10:30–12:15
LTuF • Information in a Photon II
Michael Raymer; Univ. of Oregon, USA, Presider

LTuF1 • 10:30 Invited
Building Multimode Quantum Networks, Ian A. Walmsley[1], J. Nunn[1], N. Langford[1], A. Datta[1], L. Zhang[1], Brian Smith[1], N. Thomas-Peter[1], J. Spring[1], B. Metcalf[1], D. England[1], K. Reim[1], P. Michelberger[1], T. Champion[1]; [1]*Univ. of Oxford, United Kingdom.* Light offers a route to the generation of macroscopic quantum states based on both multiple photons (e.g. Schrödinger kittens) and multiple modes (e.g. Dicke-Werner). The combination of these approaches affords new possibilities in both fundamental physics and in technological applications. The routes to building scalabl networks embodying such systems from feasible laboratory resources will be discussed.

LTuF2 • 11:00
Information Capacity of Quantum Reading, Saikat Guha[1], Zachary Dutton[1], Ranjith Nair[1], Jeffery Shapiro[1], Brent Yen[1]; [1]*Disruptive Information Processing Technologies group, Raytheon BBN Technologies, USA.* We investigate quantum limits on the capacity of optically reading classical data from a coded target, and show that non-classical sources can outperform classical sources.

LTuF3 • 11:15 Invited
Quantum Optics on Photonic Chips, Dirk Englund;[1] *Columbia Univ., USA.* Abstract not available.

Empire	Crystal	Gold	Valley	California

FiO

FTuH • Single Molecule Detection, Diagnostics and Therapy I—Continued

FTuH4 • 11:45 Invited

Ocular Imaging and Crystalline Lens Optical Properties, Susana Marcos[1], Alberto de Castro[1], Enrique Gambra[1], Judith Birkenfeld[1], Sergio Ortiz[1], Pablo Perez Marino[1], Carlos Dorronsoro[1]; *[1]Instituto de Optica, Spain.* The crystalline lens shows extraordinary abilities in the young eye (focusing, aberration compensation). We present measurements of optical and structural lens properties with imaged-based methods (wavefront sensing, Purkinje, Scheimplfug and OCT).

FTuH5 • 12:00

Single Molecule Tracking with Kalman Filtering, M. Yavuz Yüce[1], Alper T. Erdogan[2], Alexandr Jonáš[1], Alper Kiraz[1]; *[1]Physics, Koc Univ., Turkey; [2]Electrical Engineering, Koc Univ., Turkey.* Kalman filtering has been applied to single molecule tracking. Position and velocity of the molecules constitute the state of the process. They are measured from single frame data by maximum likelihood estimation.

FTuH6 • 12:15

Dark-field Interferometric Detection of Single Human Viruses and Bacteriophage, Anirban Mitra[1], Filipp Ignatovich[2], Lukas Novotny[2,1]; *[1]Department of Physics and Astronomy, Univ. of Rochester, USA; [2]The Institute of Optics, Univ. of Rochester, USA.* We introduce a new nanoparticle detection scheme which combines phase-sensitive heterodyne interferometry and background-free dark-field detection to enable us characterize in real-time single human viruses and bacteriophage down to ~24 nm in radius.

FTuI • Fiber Sources in Non-Telecom Windows I—Continued

FTuI4 • 11:30 Invited

Tellurite Microstructured Fibers and Their Applications, Yasutake Ohishi[1]; *[1]Research Center for Advanced Photon Technology, Toyota Technological Institute, Japan.* We demonstrate widely tunable soliton and dispersive wave source generation in a highly non-linear tellurite MOF pumped by a 1550 nm femtosecond laser and a suspended core nanowire with optimized nonlinearity together with single-mode propagation.

FTuJ • Optofluidics for Enhanced Sensing—Continued

FTuJ3 • 11:30

Determination of Microdroplet Contact Angles Using Electrically Eriven Droplet Oscillations, Yasin Karadag[1], Alexandr Jonáš[1], Nevin Tasaltin[1], Alper Kiraz[1]; *[1]Physics, Koç Universty, Turkey.* Contact angles of micrometer-sized NaCl-water droplets are determined by whispering gallery mode spectroscopy, using the dependence of the lowest-order mechanical resonant frequency of the electrically driven droplet oscillations on the droplet size

FTuJ4 • 11:45

Enhancing the Sensitivity of Whispering Gallery Mode Biosensors Using Plasmons, Jon Swaim[1], Joachim Knittel[1], Warwick P. Bowen[1,2]; *[1]Department of Physics, Univ. of Queensland, Australia; [2]Centre for Engineered Quantum Systems, Univ. of Queensland, Australia.* We show that a localized surface plasmon resonance in a metallic nanorod can reduce the optical mode volume of a whispering gallery mode resonator by as much as 30000, significantly improving its detection sensitivity as a biological sensor.

FTuK • Coherence and Optical Sciences—Continued

FTuK5 • 11:30

Single-Channel Transport in Multichannel Disordered Systems, Abe Pena[1], Andrey A. Chabanov[1], Azriel Genack[2]; *[1]Physics, Univ. of Texas at San Antonio, USA; [2]Physics, Queens College, The City Univ. of New York, USA.* Static and dynamic aspects of the crossover to single-channel transport in multichannel disordered systems are studied in statistics measurements of microwave radiation transmitted in ensembles of quasi-1D waveguides with various degrees of disorder.

FTuK6 • 11:45

Mid-IR Photoluminescence Measurement of InAs/GaSb Type II Superlattices, Hong Cai[1,2], Sheng Liu[2,1], Liwei Cheng[2,3], Elaine Lalanne[2], Fow-Sen Choa[2,3], Anthony Johnson[1,2,3]; *[1]Physics, Univ. of Maryland, Baltimore County, USA; [2]CASPR, Univ. of Maryland, Baltimore County, USA; [3]CSEE, Univ. of Maryland, Baltimore County, USA.* The photoluminescence(PL) of InAs/GaSb type-II superlattices is measured with different excitation wavelengths at various temperatures. With 160fs excitation, the PL at 78K is centered at 4.9μm with 980nm spectral width and 2.5ns estimated lifetime.

FTuL • Nonimaging Techniques for Sensing I—Continued

FTuL4 • 11:30

Exploiting Optical Forces to Characterize Electromagnetic Fields, Dana C. Kohlgraf-Owens[1], Sergey Sukhov[1], Aristide Dogariu[1]; *[1]CREOL, Univ. of Central Florida, USA.* We demonstrate the simultaneous measurement of different components of an optical field using a single near field scanning optical microscope (NSOM) probe. This opens the door to tomographic reconstruction of near field data.

12:00–13:30 Exhibit Only Time, *Imperial Ballroom, Fairmont Hotel*

12:00–13:30 Fellow Member Lunch, *Ballroom, Sainte Claire Hotel*

12:00–14:00 "Mission:Optical" Student Chapter Competition, *Imperial Ballroom, Fairmont Hotel*

Hillsborough | Atherton | Sacramento | Piedmont | Glen Ellen

FiO | **LS**

FTuM • Three-Dimensional Structure Design, Fabrication, and Nanopatterning II—Continued

FTuM4 • 11:30
Performance of Double-Groove Grating with +1st-Order Diffraction Angle Larger than Substrate-Air Critical Angle, Hideo Iizuka[1,3], Nader Engheta[2], Hisayoshi Fujikawa[3], Kazuo Sato[3], Yasuhiko Takeda[3]; [1]*Toyota Research Institute, Toyota Motor Engineering & Manufacturing North America, USA;* [2]*Department of Electrical and Systems Engineering, Univ. of Pennsylvania, USA;* [3]*Toyota Central R&D Labs, Japan.* We present a technique to couple the normally incident light into the +1st-order transmission with around 97% efficiency and with a 50° diffraction angle in a TiO2 double-groove grating attached on the SiO2 substrate.

FTuM5 • 11:45
Novel Optical Document Security Elements Based on Waveguide Effect, Jakub Svoboda[1], Marek Skeren[1], Martin Possolt[1], Pavel Fiala[1]; [1]*Department Of Physical Electronics, Czech Technical Univ. In Prague, Faculty of Nuclear Sciences and Physical Engineering, Czech Republic.* A novel type of optical document security elements have been designed and fabricated. The paper presents theory and application of waveguide effect in thin foils together with incoupling and outcoupling light through diffraction gratings.

FTuN • Optomechanics II—Continued

FTuN4 • 11:30
Cavity Optomechanics with Silicon Nitride Membrane Gratings, Utku Kemiktarak[1], Michael Metcalfe[1], Mathieu Durand[2], John Lawall[2]; [1]*NIST / JQI, USA;* [2]*National Institute of Standarts and Technology, USA.* We demonstrate high reflectivity micromechanical membranes patterned with subwavelength gratings. We investigate their optical and mechanical properties by coupling them to a Fabry-Perot cavity.

FTuN5 • 11:45
Mechanical Motion of a Microspherical Pendulum, Síle Nic Chormaic[1,2], Yuqiang Wu[1,2], Jonathan Ward[1,3]; [1]*Physics, Univ. College Cork, Ireland;* [2]*Photonics Centre, Tyndall National Institute, Ireland;* [3]*Institut fuer Physik, Humboldt Universitaet zu Berlin, Germany.* Silica microspherical pendulums are fabricated and their mechanical resonances are detected as variations in the transmitted laser power from a tapered fiber. The thermal damping and amplification of the taper/pendulum coupling noise is observed.

LTuD • Novel Technologies for Multiphoton Imaging—Continued

LTuD3 • 11:30
Tunable Multi-Photon Absorption Cross-sections using Seeded CdSe/CdS Nanorod Heterostructures, Tze Chien Sum[1], Guichuan Xing[1], Kok Loong Chou[1], Cheng Hon Alfred Huan[1], Sabyasachi Chakrabortty[2], Yin Thai Chan[2]; [1]*Division of Physics and Applied Physics, Nanyang Technological Univ., Singapore;* [2]*Department of Chemistry, National Univ. of Singapore, Singapore.* A strategy to enhance the MPA cross-sections whilst independently tuning the emissive wavelengths of QDs using seeded CdSe/CdS nanorod heterostructures and a unifying picture for comparing 3PA cross-sections between II-VI QDs is presented.

LTuD4 • 11:45
Withdrawn

LTuE • Coherence and Control in Energy Transfer IV—Continued

LTuE3 • 11:30
Coherent Acoustic Phonon Dynamics in Exciton Self-Trapping, J. G. Mance[1], Susan L. Dexheimer[1]; [1]*Washington State Univ., USA.* The dynamics of exciton self-trapping are studied using femtosecond impulsive excitation techniques. The low-frequency response reflects generation of coherent acoustic waves, with an acoustic wavelength that scales with exciton localization length.

LTuE4 • 11:45
Dynamics of Two-Photon Interband Picosecond Absorption in Crystals, Alexander Y. Karasik[1]; [1]*Nonlinear optics of solid state, Prokhorov General Physics Institute RAS, Russian Federation.* Dynamics of interband two-photon absorption in crystals is studied on picosecond-second time scale. Kinetics of the generation of electronic excitations and nonlinear absorption coefficients are measured for PbWO4, ZnWO4, PbMoO4, CaMoO4 crystals.

LTuF • Information in a Photon II—Continued

LTuF4 • 11:45 Invited
Time-energy Entangled Waveguide Source for High Dimensional QKD, Franco Wang; [1] *MIT, USA.* A PPKTP waveguide source of 1560-nm entangled photons has been developed for high-rate QKD capable of carrying over 10 bits per photon at 1 Gbps by utilizing its full spectral and temporal contents.

12:00–13:30 Exhibit Only Time, *Imperial Ballroom, Fairmont Hotel*

12:00–13:30 Fellow Member Lunch, *Ballroom, Sainte Claire Hotel*

12:00–14:00 "Mission:Optical" Student Chapter Competition, *Imperial Ballroom, Fairmont Hotel*

12:00–13:30
JTuA • FiO/LS Joint Poster Session I

JTuA1
Photoluminescence properties of Eu doped zinc oxide films prepared by sol-gel method, Tomomi Arima[1], Yutaka Natume[2], Hironobu Sakata[1], Moriaki Wakaki[1]; [1]*Optical and Imaging Science & Technology, Tokai Univ., Japan;* [2]*R & D, NHK SPRING Co. Ltd., Japan.* Undoped and 5at% Eu doped ZnO films were prepared by the sol-gel process using the spin-coating method. The films were analyzed by XRD. Photoluminescence spectra of the films were characterized at room temperature and 12K.

JTuA2
Alternative Coherent-Mode Representation of a Planar Electromagnetic Source, Miguel A. Olvera[1], Andrey Ostrovky[1]; [1]*Faculty of Physics and Mathematics, Autonomous Univ. of Puebla, Mexico.* We propose an alternative coherent-mode representation of a planar electromagnetic source which avoids solving the Fredholm integral equation, but based on results of usual radiometric measurements. Mathematical simulation illustrates the technique.

JTuA3
Refractive nonlinear response in thin nonlocal nonlinear media, Emma V. García[1], Maximino Arrroyo[1], Marcela Méndez[1], David Iturbe[2], Sabino Chávez[2]; [1]*Benemérita Universidad Autónoma de Puebla, Mexico;* [2]*Instituto Nacional de Astrofísica Óptica y Electrónica, Mexico.* We present a model to describe purely refractive local or nonlocal nonlinear response in thin media with any magnitude of photoinduced phase shift. The results are in agreement with self phase modulation and Z-scan experiments.

JTuA4
Analysis of nanostructural morphology of MgF2 thin films prepared by sol-gel method, Daiki Ono[1], Eisuke Yokoyama[1], Moriaki Wakaki[1], Yosuke Kanzaki[2]; [1]*Optical and Imaging Science & Technology, Tokai Univ., Japan;* [2]*R & D, SUWA Optronics Co. Ltd., Japan.* MgF2 antireflective films were prepared using sol-gel methods. Optical and structural properties were analyzed and discussed. The reflectance loss decreased less than 1% in the visible region due to the nanostructure of the film.

JTuA5
Measurement of Optical Phase Amplification in Three-Wave Mixing, Douglas C. French[1], Igor Jovanovic[1]; [1]*Mechanical and Nuclear Engineering, Penn State Univ., USA.* Amplification of optical phase in a phase-sensitive three-wave mixing is experimentally demonstrated and correlated to amplitude deamplification.

JTuA6
Z-scan for Thick Media as a Function of the Photo-induced Focal Length, Israel Severiano[1], Marcela Méndez[1], Maximino Arrroyo[1], David Iturbe[2]; [1]*Facultad de Ciencias Físico Matemáticas, Benemerita Universidad Autonoma de Puebla, Mexico;* [2]*Óptica, Instituto Nacional de Astrofísica Óptica y Electrónica, Mexico.* The z-scan technique for thick media is numerically calculated considering the media as a set of lenses, where the focal length of each lens is proportional to the incident beam radius to some power m.

JTuA7
Modeling of a two coupled-cavities fiber laser, Emanuel Paulucci[1]; [1]*Universidad Nacional de La Plata, Centro de Investigaciones Opticas, Argentina.* In this work we develop a numerical model to calculte the output of an optical fiber laser. The model solutions are compared with previously obtained experimental results, and a good agreement between them is observed.

JTuA8
Signal to Noise Ratio Modeling of a Multiplexed Quantum Dot System, Kelly Goss[1], Mike E. Potter[1], Geoff G. Messier[1]; [1]*Dept. of ECE, Univ. of Calgary, Canada.* Multiplexed quantum dots (QDs) have unique spectral emissions with varying wavelength and intensity. An experimentally verified model of the signal and noise power is presented to analyze the limiting factors to reading the spectral emissions.

JTuA9
Iterative phase retrieval based on the use of additional intensities measurements, Nikolay V. Petrov[1], Mikhail V. Volkov[2], Victor G. Bespalov[1]; [1]*St Petersburg State Univ. ITMO, Russian Federation;* [2]*Fock Institute of Physics, Russian Federation.* Additional datasets allow the wavefront phase retrieval by the iteration procedure. They can be obtained in practice using the set of parameters in the phase analyzer, radiation and registration systems of the phase retrieval setups.

JTuA10
Modified Parallel Relaxation Method and Computing System for Algebraic Image Reconstruction, Iryna V. Musiichuk[1], Natalia I. Zabolotna[1]; [1]*Department of Laser and Optoelectronic Technology, Vinnytsia National Technical Univ., Ukraine.* The mathematical model of modified parallel relaxation method for its implementation in tomography systems is described and its advantages are shown. The modified method reflection on parallel optical-electronic computing system structure is proposed

JTuA11
Impact of Surface Roughness on the Effective Dielectric Constant and Subwavelength Image Resolution of Metal-Insulator Stack Lenses, Shivanand Shivanand[1], Alon Ludwig[2], Kevin J. Webb[1]; [1]*Electrical and Comp. Engineering, Purdue Univ., USA;* [2]*Univ. of Toronto, Canada.* The effective dielectric constant for a multilayer metal-insulator stack is obtained from a numerical simulation and compared with the analytical result. The impact of the surface roughness for subwavelength imaging is established.

JTuA12
Laser Scanning Confocal Microscopy and Luminescent Polymer: Improving Structural Characterization of Cellulose Fibers, Regina E. Alves[1]; [1]*Physics Institute of São Carlos, Univ. of São Paulo, Brazil.* A new method for characterizing the lignocellulosic fibers after biodegradation was developed using a combination of laser scanning confocal microscopy and a polymer. Mapping the enzymatic action and PTHT incorporation on the fiber was possible.

JTuA13
Super resolution imaging by nanoscale localization sampling on nanohole arrays, Kyujung Kim[1], Youngjin Oh[2], Wonju Lee[2], Donghyun Kim[1,2]; [1]*Program for Nanomedical Science and Technology, Yonsei Univ., Republic of Korea;* [2]*School of Electrical and Electronic Engineering, Yonsei Univ., Republic of Korea.* We investigated an imaging method by nanoscale localization sampling (NLS) to break an optical diffraction limit. NLS is a technique based on locally amplified hot spots occurred by surface plasmon localization on nanohole arrays.

JTuA14
Perspectives for laboratory implementation of the DLCZ protocol for quantum repeaters, Milrian D. Mendes[1], Daniel Felinto[1]; [1]*Departamento de Física, Universidade Federal de Pernambuco, Brazil.* We analyze the efficiency and scalability of the DLCZ protocol for quantum repeaters through experimentally accessible measures of entanglement (concurrence; CHSH inequality) providing a better time estimate to succeed in each step of the protocol.

JTuA15
Phase Unwrapping in Digital Holography by Dual-wavelength Method, Wang Yujia[1], Zhuqing Jiang[1], Cheng Guofeng[1], Wu Jiangtao[1], Shiquan Tao[1]; [1]*Beijing Univ. of Technology, China.* Phase unwrapping is done by using a pair of phase images of two different wavelengths. We experimentally demonstrate this method in use for phase imaging by digital holography.

JTuA16
Withdrawn

JTuA17
Localized Field Enhancement and Far Field Directivities of the Specific Nanostructures for Surface-enhanced Raman Scattering, Hsin-Hung Cheng[1], Ying-Yu Chang[1], Jen-You Chu[2], Ding-Zheng Lin[2], Yi-Ping Chen[2], Jia-Han Li[1]; [1]*Engineering Science and Ocean Engineering, National Taiwan Univ., Taiwan;* [2]*Material and Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan.* The plasmonic interference nanostructures with two localized hot spots are presented to improving the field enhancements and directivities by using finite-difference time-domain method.

JTuA18
Withdrawn

JTuA19
Gait Recognition by Jacobi-Fourier Moments, Alfonso Padilla-Vivanco[1]; [1]*Ingenierías, UPT, Mexico.* A method to calculate the temporal correlation in terms of a moment function representation of lower body images for gait recognition is presented. A Jacobi-Fourier moment history is obtained from N-frames to describe shape of individuals.

JTuA20
Quantum Random Walks with Multiple Photons, Robert Cross, Bryan Gard, Petr Anisimov, Jonathan Dowling; *Physics and Astronomy, Lousiana State Univ., USA.* We show that there are interesting and unpublished aspects to high level photonic random walks with multiple walkers. We also investigate g(1), g(2), and g(3) coincidence detection to find multi-photon correlations in these random walks.

JTuA21
Power-tunable plasmon resonance sensor using Kerr nonlinearity, Abraham Vázquez-Guardado[1], Gisela López-Galmiche[1], Miguel A. Fuentes-Fuentes[1], Daniel E. Ceballos-Herrera[1], Daniel A. May-Arrioja[2], José J. Sánchez-Mondragón[1]; [1]*Optics, INAOE, Mexico;* [2]*Universidad de Tamaulipas, Mexico.* We present the design of a tunable plasmon resonance sensor using a nonlinear Kerr media. Using the power dependence of the nonlinearity, we tune phase matching condition for the plasmon resonance.

JTuA22
Strong coupling criterion for two interacting excitons in a nanocavity, Nicolas Quesada[1], Paulo C. Cardenas[2], Boris A. Rodriguez[2], Herbert Vinck-Posada[3]; [1]*Physics, Univ. of Toronto, Canada;* [2]*Fisica, Universidad de Antioquia, Colombia;* [3]*Fisica, Universidad Nacional de Colombia, Colombia.* We study the strong coupling between light and two interacting excitons in Quantum dots (QDs). We derive a reasonable definition of the dynamical regimes in the system by incorporating coherent and spontaneous emission and incoherent pumping.

JTuA23
Measuring Anisotropic Cell Motility on Curved Substrates, Kyle M. Douglass[1], Nicklaus A. Sparrow[2], Marga Bott[2], Cristina Fernandez-Valle[2], Aristide Dogariu[1]; [1]*CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA;* [2]*Department of Molecular Biology and Microbiology, Burnett School of Biomedical Science, College of Medicine, Univ. of Central Florida, USA.* Anisotropic Schwann cell motility was observed on quartz cylinders with varying radii of curvature. Novel image processing and microscopies allowed for determination of the statistics of cell motion and facilitate further motility studies.

JTuA • FiO/LS Joint Poster Session I—Continued

JTuA24
Enhanced Optical Generation and Detection of Acoustic Phonons in Optical Microcavities, Norberto D. Lanzillotti-Kimura[1], Alejandro Fainstein[1], Bernard Jusserand[2], Bernard Perrin[2], Aristide Lemaitre[3]; *[1]Optical Properties Laboratory, Instituto Balsiero and Centro Atomico Bariloche, Argentina; [2]Institut des NanoSciences de Paris, France; [3]Laboratoire de Photonique et des NanoStructures, France.* The enhancement of the ultrafast coherent generation and detection of acoustic phonons in optical microcavities is experimentally studied. We report pump-probe terahertz ultrasonics experiments as a function of laser energy and probe incidence angle.

JTuA25
Thermal-Lens Spectroscopy in Binary Liquids Mixtures: Effect of Isotope Substitution, Pardeep Kumar[1], Indrajit Bhattacharyya[1], Debabrata Goswami[1]; *[1]Chemistry, Indian Institute of Technology Kanpur, India.* Using femtosecond pump-probe thermal lens (TL) spectroscopy, we show that the effect of isotope substitution can be monitored through a modulation of TL signals in binary liquids showing the important of molecular properties on TL.

JTuA26
Withdrawn

JTuA27
Multipoint Sensor using fiber Bragg Gratings, Marco A. Betanzos-Torres[1], Juan Castillo-Mixcoatl[1], Severino Muñoz-Aguirre[1], Georgina G. Beltrán Pérez[1]; *[1]FCFM, Benemérita Universidad Autónoma de Puebla, Mexico.* FBG-based sensors usually employ the spectral shift of Bragg wavelength to determine a physical variable magnitude. In this work, a multipoint sensor system that does not require spectral analysis to evaluate such variable is presented.

JTuA28
Optical Beam Bistability and Hysteresis in Nonlinear Nanosuspensions, Alexander Shamray[1], George Pobegalov[1], Peter Agruzov[1], Pavel Gaenko[1], Igor Ilichev[1]; *[1]Ioffe Physical-Technical Institute, Russian Federation.* An optical bistability and hysteresis were observed in the LaF3:Er:Yb nanosuspension. It was driven by the light-induced change in a local particle concentration and explained as a threshold behavior of the nonlinear four waves mixing.

JTuA29
A Simple Method for Measuring the Cleave Angle of Optical Fiber Facets Using a Cylindrical Lens, Victor Manuel Duran-Ramirez[1], Alejandro Martinez-Rios[2], Guillermo Salceda-Delgado[2], Ismael Torres-Gomez[2]; *[1]Ciencias Exactas y Tecnología, Centro Universitario de los Lagos, Mexico; [2]Division de Fotonica, Centro de Investigaciones en Optica, Mexico.* A simple experimental setup for measuring the cleave angle of optical fiber facets using a laser, a plano-convex cylindrical lens and a slit is described.

JTuA30
From Quantum Wires to Quantum Loops: Enhancement of Nonlinear Optical Properties, Shoresh shafei[1], Mark G. Kuzyk[1]; *[1]Physics and Astronomy, Washington State Univ., USA.* We investigate a system of 1-D quantum wires confined to a plane, as building blocks of quantum loops, to study the role of geometry on their nonlinear optical (NLO) properties.

JTuA31
Cascaded coupling in asymmetric long period gratings in channel waveguides, Ruchi Garg[1], Krishna Thyagarajan[1]; *[1]Physics Department, Indian Institute of Technology Delhi, India.* We present a novel concept of cascaded coupling achieved by a pair of non-identical long period gratings placed in the cladding of the channel waveguide structure. As an application, a broad-band transmission spectrum is demonstrated.

JTuA32
Surface Optomechanics: Calculating Optically Excited Acoustical Whispering-Gallery Modes in Microspheres, John Zehnpfennig[1], Gaurav Bahl[1], Matthew Tomes[1], Tal Carmon[1]; *[1]EECS, Univ. of Michigan, USA.* We numerically calculate mechanical whispering-gallery modes in a micron-scale silica sphere revealing Rayleigh, transverse, and longitudinal deformations.

JTuA33
Finite Difference Time Domain Based Beam Propagation Model for Helically Propagating Spatial Domain Multiplexed Optical Channel in Multimode Fibers, Syed Murshid[1], Raka Biswas[1]; *[1]Electrical and Computer Engineering, Florida Institute of Technology, USA.* Finite Difference Time Domain (FDTD) method is used to develop a CAD based beam propagation model for helical channels of spatially multiplexing systems. The output from a single channel model is presented and compared to experimental results.

JTuA34
Ultra-Efficient Cooling of Resonators: Beating Sideband Cooling with Quantum Control, Sai Vinjanampathy[1], Kurt Jacobs[1,4], Xiaoting Wang[2], Frederick W. Strauch[3]; *[1]Physics, Univ. of Massachusetts,Boston, USA; [2]Dept. of Applied Mathematics and Theoretical Physics, Univ. of Cambridge, United Kingdom; [3]Dept. of Physics, Wiliams College, USA; [4]Hearne Institute of Theoretical Physics, Louisiana State Univ., USA.* We present a scheme to cool resonators that employ the same configuration as sideband cooling, though we achieve significantly colder temperatures. We also present a method for fast, high-fidelity quantum information transfer between resonators.

JTuA35
Withdrawn

JTuA36
Propagation of linearly polarized Laguerre-Gauss vortex beams, Jessica P. Conry[1], Reeta Vyas[1], Surendra Singh[1]; *[1]Physics Department, Univ. of Arkansas, USA.* Evolution of transverse intensity profiles for the dominant and cross-polarization components of linearly polarized Laguerre-Gauss laser beams is studied experimentally as they propagate away from their waist.

JTuA37
Quantum interference and entanglement of photons which do not overlap in time, Ralph O. Wiegner[1], Christoph Thiel[1], Joachim von Zanthier[1], Girish S. Agarwal[2]; *[1]Institute for Optics, Information and Photonics, Univ. of Erlangen-Nuremberg, Germany; [2]Department of Physics, Oklahoma State Univ., USA.* We discuss the possibility of quantum interferences and entanglement of photons which exist at different intervals of time. The corresponding two-photon correlation function is shown to violate Bell's inequalities.

JTuA37a
Plasmonic Toroidal Response of four U-shaped resonant rings at Optical Frequencies, Yao-Wei Huang[1], Wei Ting Chen[1], Pin Chieh Wu[1], Yuan-Fong Chau[2], Din Ping Tsai[1,3], Vassili A. Fedotov[4], Vassili Savinov[4], Nikolay I. Zheludev[4]; *[1]Department of Physic, National Taiwan Univ., Taiwan; [2]Department of Electronic Engineering, Ching Yun Univ., Taiwan; [3]Instrument Technology Research Center, National Applied Research Laboratories, Taiwan; [4]Optoelectronics Research Centre and Centre for Photonic Metamaterials, Univ. of Southampton, United Kingdom.* The toroidal spectral responses of toroidal metamolecule integrated by four gold U-shaped SRRs at optical frequencies are numerically studied. Downsizing the structure achieve observation of a plasmonic toroidal mode at optical frequencies.

JTuA38
Can diffraction provide quantitative information about energy flux in an optical vortex? Karen Volke-Sepulveda[1], Roland A. Terborg[1]; *[1]Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico.* We propose a simple method for determining the local inclination of the helical wave fronts of an optical vortex by studying the asymmetric diffraction pattern produced by a single-slit aperture at different transverse planes.

JTuA39
Enhancement of Entanglement in Coupled Quantum Dots via interaction with Squeezed Light, William Rawlinson[1], Arnab Mitra[1,2], Reeta Vyas[1]; *[1]Department of Physics, Univ. of Arkansas, USA; [2]Department of Physics, California State Polytechnic Univ., USA.* Evolution of entanglement of formation is studied when coupled quantum dots in a zero entangled state are placed in a high-Q cavity and are interacting with field initially in a squeezed-coherent state.

JTuA40
Terahertz Birefringence Measurements of Doped Yttrium Vanadate Crystals, Tsong-Ru Tsai[1], Chao-Kuei Lee[2]; *[1]Institute of Optoelectronic Sciences, National Taiwan Ocean Univ., Taiwan; [2]Department of Photonics, National Sun Yat-Sen Univ., Taiwan.* Terahertz birefringence of Cr:YVO4 and Cr,Ca:YVO4 crystals were determined by THz time-domain spectroscopy. The birefringence of Cr:YVO4 and Cr,Ca:YVO4 at 1.0 THz were found to be as large as 1.01 and 0.95, respectively.

JTuA41
Withdrawn

JTuA42
Information in a Photon When Loss Encodes the Bit, Saikat Guha[1], Zachary Dutton[1], Jonathan L. Habif[1]; *[1]Disruptive Information Processing Technologies group, Raytheon BBN Technologies, USA.* We investigate quantum limits on the information that can be reliably extracted by a photon. Applications range across transverse optical imaging to optical reading and continuous-variable tomography.

JTuA43
Diffraction Heuristics for Diffraction at Infinity by an Index Discontinuity in a 1-D Slab, Marius Peloux[1,2], Jean-Paul Hugonin[1], Pierre Chavel[1]; *[1]Laboratoire Charles Fabry de l'Institut d'Optique, France; [2]Essilor International, France.* We study the far field reflected diffraction pattern of an index discontinuity in a thin 1-D slab illuminated by a plane wave using a modelling technique based on geometrical and Fourier optics.

Empire | Crystal | Gold | Valley | California

FiO

Empire

13:30–15:15
FTuO • Single Molecule Detection, Diagnostics and Therapy II
Andrew Forbes; National Laser Centre, South Africa, Presider

FTuO1 • 13:30 Invited
Single Molecule Analysis of Yeast Rrp44 Exonuclease Reveals a Spring-loaded Mechanism of RNA Unwinding, Gwangrog Lee[1,3], Matthew A. Bratkowski[2], Fang Ding[2], Ailong Ke[2], Taekjip Ha[1,3]; [1]*Department of Physics, Univ. of Illinois at Urbana-Champaign, USA;* [2]*Department of Molecular Biology and Genetics, Cornell Univ., USA;* [3]*Howard Hughes Medical Inst., USA.* The eukaryotic exosome catalyzes a series of reactions such as RNA processing and decay. Rrp44 is a key catalytic subunit of the yeast exosome complex and enables multi-enzymatic activities, including endoribonuclease, exoribonuclease and duplex unwinding. Its exoribonuclease and unwinding activities are indispensable for the complete degradation of mRNA that forms a variety of secondary structures.

FTuO2 • 14:00
Fluorescence of Influenza Hemagglutinin Surface Protein, A. Katz[1], Alexandra Alimova[2], Paul Gottlieb[2], John Robbins[3], Swapan K. Gayen[1]; [1]*Physics Dept., City College of New York, USA;* [2]*Sohie Davis School of Biomedical Education, City College of New York, USA;* [3]*National Institute of Child & Human Development, NIH, USA.* Spectroscopy of avian influenza hemagglutinin reveals changes in peak position and emission intensity of tryptophan fluorescence upon exposure to an acidic environment. These are attributed to conformational changes induced by lower pH.

Crystal

13:30–15:30
FTuP • Ultrashort Pulses: 20th Anniversary of Frequency-Resolved Optical Gating Symposium II
David Fittinghoff, LLNL, USA, Presider

FTuP1 • 13:30 Invited
Complex Pulses and New Physics: How FROG Has Led to New Paradigms for Ultrafast Nonlinear Optics, John Dudley[1]; [1]*CNRS, France.* The use of FROG to provide complete amplitude and phase characterization of complex ultrafast pulses has opened fundamentally new directions of research in numerous areas of optical physics. This talk reviews a selection of results in source development, nonlinear optics, and applications.

FTuP2 • 14:00 Invited
Frequency Resolved Optical Gating of Atomic and Molecular Coherence: From Weak to Strong Field Regimes, Stanislav O. Konorov, Xiaoji G. Xu, John W. Hepburn, Valery Milner; [1]*Univ. of British Columbia; Canada.* Frequency resolved gating of laser-induced atomic coherence enables complete reconstruction of the quantum evolution of atomic and molecular systems driven by laser fields. The method is applied to characterization and control of laser-matter interactions.

Gold

13:30–15:30
FTuQ • Instrumentation for Optical Microscopy and OCT I
Paul S. Carney, Univ. of Illinois at Urbana-Champaign, USA, Presider

FTuQ1 • 13:30 Invited
***In Vivo* and Three-Dimensional Imaging of Vasculature in the Eye by Optical Coherence Tomography,** Yoshiaki Yasuno[1]; [1]*Computational Optics Group, Univ. of Tsukuba, Japan.* High-speed and high-sensitive Doppler optical coherence tomography is demonstrated for the detailed non-invasive investigation of posterior eye. A comprehensive angiography based on optical coherence tomography is presented.

FTuQ2 • 14:00
Investigation of Collagen Fiber Organization in Cornea and Sclera using Quantitative SHG Microscopy, Raghu Ambekar[1], Kimani C. Toussaint[1]; [1]*ECE, Univ. of Illinois Urbana Champaign, USA.* We propose the application of Fourier transform-second harmonic generation and polarization-resolved second-harmonic generation microscopy to quantify collagen fiber organization and content, respectively.

Valley

13:30–15:30
FTuR • Lasers and Photoemission for Accelerator Science
Csaba Toth; LBNL, USA, Presider

FTuR1 • 13:30 Tutorial
Lasers for High Brightness X-FEL Photo Injectors, William White; [1]*.SLAC, USA.* Performance of the LCLS x-ray FEL is critically dependent on characteristics of a conventional laser that drives the RF-photogun, generating a high-brightness electron beam. The evolution and future of this laser system will be discussed.

California

13:30–15:30
FTuS • Optical Manipulation II
Mena Issler, ETH Zurich, Switzerland, Presider

FTuS1 • 13:30
Optically Induced Crystals of Submicron Particles, Georg A. Raithel[1], Betty N. Slama-Eliau[1], Rachel E. Sapiro[1]; [1]*Physics, Univ. of Michigan, USA.* We prepare three-dimensional, light-induced crystals of submicron polystyrene spheres in aqueous solution. The crystals contain several thousand particles. We study Bragg scattering and trapping forces. Good agreement with a model is found.

FTuS2 • 13:45
Efficient Plasmonic Trapping using Bowtie Nanoantennas, Brian J. Roxworthy[1], Kimani C. Toussaint[2,1]; [1]*Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA;* [2]*Mechanical Science and Engineering, Univ. of Illinois at Urbana-Champaign, USA.* Highly efficient, low-numerical aperture optical trapping of 1-μm polystyrene beads is demonstrated using plasmonic Au bowtie nanoantenna arrays. The effect of polarization, array periodicity, and wavelength on trapping efficiencies is studied.

FTuS3 • 14:00
An Adaptive Anti-Brownian Electrokinetic Trap for Prolonged Observation of Single Molecules in Solution, Quan Wang[1,2], W.E. Moerner[1]; [1]*Chemistry, Stanford Univ., USA;* [2]*Electrical Engineering, Stanford Univ., USA.* We report an improved Anti-Brownian ELectrokinetic (ABEL) trap for studying single molecules in solution, using a Kalman filter-based tracking algorithm. We have also developed a method to extract transport properties of trapped objects in real-time.

Hillsborough	Atherton	Sacramento	Piedmont	Glen Ellen
FiO		LS		

13:30–15:30 FTuT • Optical Communications I

Nikola Alic; Univ. of California at San Diego, USA, Presider

FTuT1 • 13:30

Demonstration of 2-Tbit/s Data Link using Orthogonal Orbital-Angular-Momentum Modes and WDM, Irfan M. Fazal[1], Jian Wang[1], Jeng-Yuan Yang[1], Nisar Ahmed[1], Bishara Shamee[1], Yan Yan[1], Alan Willner[1], Sam Dolinar[2], Kevin Birnbaum[2], Baris Erkmen[2], John Choi[2]; [1]*Electrical Engineering Systems, Univ. of Southern California, Los Angeles, USA;* [2]*Jet Propulsion Lab, USA.* We present a 2-Tbit/s data link using two orthogonal orbital angular momentum (OAM) spatial modes with 25 wavelength division multiplexed (WDM) channels on each mode.

FTuT2 • 13:45

Enhanced Dynamic Equalization Performance of a 112 Gb/s PM-QPSK Coherent Receiver by Gain Adaptation in CMA, Vitor B. Ribeiro[1,2], Reginaldo Silva[1], Claudio Floridia[1], Glauco Simões[1], Edson Silva[1], Aldario Bordonalli[2], Júlio Oliveira[1]; [1]*DRC, CPqD, Brazil;* [2]*DMO - FEE, Universidade de Campinas - UNICAMP, Brazil.* The CMA in 112 Gb/s PM-QPSK coherent receivers has a relatively slow convergence speed. This paper proposes and experimentally demonstrates a simple gain adaptation method that improves the convergence of a receiver dynamic equalizer.

FTuT3 • 14:00 Invited

Toward New Class of Fiber Communications Infrastructure: EXAT initiatives, Yoshinari Awaji; *NICT, Japan.* Abstract not available.

13:30–15:30 FTuU • Tunable and Active Plasmonics

Stefan A. Maier; Imperial College London, UK, Presider

FTuU1 • 13:30 Invited

Active and Tunable Plasmonics and Metamaterials, Harry Atwater[1], Imogen Pryce, Koray Aydin; [1]*Applied Physics, California Institute of Technology, USA.* Highly compliant substrates allow generation of actively tunable metamaterials based on split ring resonators with frequency tunability over several resonant linewidths. Applications in sensing and spectroscopy will be discussed.

FTuU2 • 14:00

Electrically Induced Harmonic Generation with Plasmonics, Wenshan Cai[1], Alok Vasudev[1], Mark L. Brongersma[1]; [1]*Department of Materials Science And Engineering, Stanford Univ., USA.* We experimentally demonstrate electrically controlled harmonic generation of light from a plasmonic nanocavity. By applying an external voltage, we tune the frequency-doubled signal by ~7% per volt and ~140% at a bias of 20 V.

13:30–15:30 LTuG • Optical Metamaterials: Experimental Methods

David Smith; Duke Univ., USA, Presider

LTuG1 • 13:30 Invited

Recent Progress in Optical Metamaterials, Xiang Zhang; [1]*Univ. of California at Berkeley, USA.* I will discuss a few recent experiments demonstrating intriguing phenomena associated with Metamaterials. These include subdiffraction limit imaging and focusing, low-loss and broad-band negative-refraction of visible light, negative-index metamaterials and the first cloak operating at optical frequencies; an all-dielectric "carpet cloak" with broad-band and low-loss performance. I will also present our recent demonstration of a deep sub-wavelength plasmonic laser.

LTuG2 • 14:00 Invited

Title to Be Announced, Harald Geissen; [1]*Universität Stuttgart, Germany.* Abstract not available.

13:30–15:15 LTuH • Absolute Metrology I

Charles Bamber; NRC Ottawa, Canada, Presider

LTuH1 • 13:30 Invited

Title to Be Announced, John Howell; [1]*Univ of Rochester, USA.* Abstract not available.

LTuH2 • 14:00 Invited

Absolute Calibration of Optical Detectors Using Two-Mode Squeezed Light, Jeff Lundeen[1], Offir Cohen[2], Pierre Mahou[2], Brian Smith[2], Ian A. Walmsley[2]; [1]*Institute for National Measurement Standards, National Research Council, Canada;* [2]*Clarendon Laboratory, Univ. of Oxford, United Kingdom.* A squeezed two-mode light source is used to demonstrate the absolute efficiency calibration of a photon-number-resolving detector. This is a higher dynamic range generalization of the method by Klyshko for single-photon detectors.

13:30–15:30 LTuI • Information in a Photon III

Daniel Gauthier; Duke Univ., USA, Presider

LTuI1 • 13:30 Invited

Hyper-Entanglement: How To Enlarge Your Hilbert Space Without Really Trying, Paul Kwiat[1], Trent Graham[1]; [1]*Univ of Illinois at Urbana-Champaign, USA.* Photon pairs simultaneously entangled in multiple degrees of freedom enable new capabilities in quantum information and metrology. We present several examples, including minimal-measurement quantum process tomography and "superdense teleportation".

LTuI2 • 14:00

Multidimensional Quantum Communication by Temporal Phase Manipulation, Alex Hayat[1], Xingxing Xing[1], Amir Feizpour[1], Aephraim M. Steinberg[1]; [1]*Physics, Univ. of Toronto, Canada.* We present a multidimensional quantum communication scheme based on temporal phase modulation where the Hilbert space is comprised of an infinite set of orthonormal temporal phase profiles.

FTuO • Single Molecule Detection, Diagnostics and Therapy II—Continued

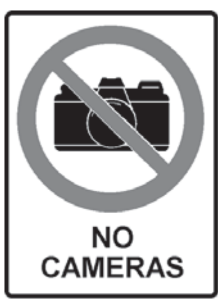
FTuO3 • 14:15
Molecular Imaging at the Sub-Cellular Level by Extreme Ultraviolet Single-Shot Laser Nano-Ablation, Carmen Menoni[1,4], Jorge Filevich[1,4], Ilya Kuznetsov[1,4], Feng Dong[2,4], Elliot Bernstein[2,4], Michael McNeil[3], Dean C. Crick[3], Jorge J. Rocca[1,4]; [1]*ECE, Colorado State Univ., USA;* [2]*Chemistry, Colorado State Univ., USA;* [3]*Microbiology, Immunology & Pathology, Colorado State Univ., USA;* [4]*Engineering Research Center for Extreme Ultraviolet Science and Technology, Colorado State Univ., USA.* Laser ablation mass spectrometry imaging is demonstrated with sub-cellular spatial resolution using Extreme Ultraviolet laser pulses. The technique has the potential to yield 3D maps of cell composition with 100nm lateral and 20nm depth resolution.

FTuO4 • 14:30
Multivariate Optical Computing for Biological Samples using a Digital Micromirror Device, Zachary J. Smith[1], Sven Strombom[1], Sebastian Wachsmann-Hogiu[1,2]; [1]*Center for Biophotonics, UC Davis, USA;* [2]*Department of Pathology, Univ. of California, Davis, USA.* We have developed a spectrometer incorporating a digital micromirror device as a multivariate optical computer. The computer can report quantitative concentrations of component spectra with an SNR advantage compared to traditional CCD-based systems.

FTuO5 • 14:45
High-Speed Frequency Domain Camera for Biomedical Imaging, Victor Shia[1], David Watt[2], Gregory W. Faris[1]; [1]*Molecular Physics Laboratory, SRI International, USA;* [2]*Engineering & Systems Group, SRI International, USA.* We report on development of a high-speed frequency domain camera for biomedical imaging with real-time processing. Tests show this system is capable of shot-noise-limited phase and amplitude imaging in as little as 3 ms.

FTuP • Ultrashort Pulses: 20th Anniversary of Frequency-Resolved Optical Gating Symposium II—Continued

FTuP3 • 14:30 Invited
Volumetric Multiphoton Microscopy: Simultaneous Imaging in 3D, Jeff Squier[1], Erich Hoover[1], Erich Chandler[1], Michael Young[1]; [1]*Physics, Colorado School of Mines, USA.* Parallel multiphoton imaging of multiple focal planes while employing single element detection is demonstrated. This novel imaging modality enables three-dimensional specimen volumes to be recorded simultaneously in dynamic fashion.



FTuQ • Instrumentation for Optical Microscopy and OCT I—Continued

FTuQ3 • 14:15
Tracking of Micrometer-Size Particles with High-Numerical Aperture Lensless Digital Holographic Microscopy, Jorge Garcia-Sucerquia[1], Jhon Restrepo[1]; [1]*School of Physics, Universidad Nacional de Colombia Sede Medellin, Colombia.* We present a method to track micrometer-size particles with high numerical aperture lensless holographic microscopy. The method is tested with modeled in-line holograms and real experiments to track bubbles in cubic millimeters of soda.

FTuQ4 • 14:30
Digital Holographic Microscopy for 3D Tracking of Nanoparticles, Frederic Verpillat[1], Fadwa Joud[1], Pierre Desbiolles[1], Michel Gross[1]; [1]*Laboratoire Kastler Brossel, Ecole Normale Supérieure, France.* We propose a digital holographic microscope to track gold particle in Brownian motion. We are able to localize 100nm particles in 3D from single shots and to reconstruct trajectories consistent with the theoretical law of diffusion.

FTuQ5 • 14:45
Optimizing Shape of Femtosecond Laser Pulses for Homodyne Detection of Nonlinear Optical Signals, Baolei Li[1], Kevin E. Claytor[1], Warren S. Warren[2,3], Martin C. Fischer[2]; [1]*Physics, Duke Univ., USA;* [2]*Chemistry, Duke Univ., USA;* [3]*Biomedical Engineering, Duke Univ., USA.* Based on homodyne detection of weak nonlinear signals with our spectral reshaping technique, pulse shapes are optimized for fast nonlinear imaging using femtosecond mode-locked lasers.

FTuR • Lasers and Photoemission for Accelerator Science—Continued

FTuR2 • 14:15 Invited
High-energy Femtosecond Laser Sources at MHz Repetition Rates for Experiments with Picosecond-/Femtosecond-/Attosecond Electron Bunches, Alexander Apolonski[1,2]; [1]*MPQ, Germany;* [2]*Ludwig-Maximilians-Universitaet Muenchen, Germany.* Several high-energy femtosecond laser systems at MHz repetition rates developed in our group together with their scientific applications are described

FTuR3 • 14:45 Invited
Ultrafast, Plasmonically Enhanced Photoemission from Metals Péter Dombi[1]; [1]*Research Institute for Solid-State Physics and Optics, Hungary.* Ultrafast plasmonic phenomena are increasingly important related to the field enhancement and sub-wavelength confinement of plasmons. We review few-cycle plasmon generation, strong-field plasmonic photoemission and all-optical electron acceleration.

FTuS • Optical Manipulation II—Continued

FTuS4 • 14:15
Optical Trapping and Manipulation with Plasmonic Nanopillar Antennas for Enhanced Biosensing, Arif E. Cetin[1], Cihan Yilmaz[2], Ahmet A. Yanik[1], Sivasubramanian Somu[2], Ahmed Busnaina[2], Hatice Altug[1]; [1]*Electrical Engineering, Boston Univ, USA;* [2]*Mechanical Engineering, Northeastern Univ., USA.* We propose metallic nanopillar antenna arrays on a metallic film combining the strengths of localized and propagating surface plasmons for high performance sensing, spectroscopy as well as optical trapping all in the same platform.

FTuS5 • 14:30
Aberration Correction in an Optical Trapping System Using a Deformable Membrane Mirror, Caroline Muellenbroich[1], Niall McAlinden[1], Amanda J. Wright[1]; [1]*Physics, Institute of Photonics, Univ. of Strathclyde, United Kingdom.* We investigate the capabilities of a deformable mirror at improving lateral trapping force by correcting for aberrations. The optimum mirror shape was determined with a genetic algorithm using bead displacement from equilibrium as a merit factor.

FTuS6 • 14:45
Experimental Demonstration of an Intensity Minimum at the Focus of a Laser Beam Created by Spatial Coherence, Taco D. Visser[1,2], Shreyas B. Raghunathan[1], Thomas van Dijk[2], Erwin J. Peterman[2]; [1]*Delft Univ. of Technology, Netherlands;* [2]*VU Univ., Netherlands.* We demonstrate that the focusing of a Bessel-correlated beam produces an intensity minimum at focus rather than a maximum. Varying the size of an iris changes this minimum into a maximum in a continuous manner.

FTuT • Optical Communications I—Continued

FTuT4 • 14:30
Fiber Transmission of Picosecond Pulsed Laser Beam, Chunning Huang[1], Yun Liu[1]; [1]*Oak Ridge National Lab, USA*. The transmission of kilowatt level, picosecond laser pulses through a 100-ft large mode area polarization maintaining optical fiber is experimentally studied for laser based ion-beam diagnostics at the Spallation Neutron Source (SNS).

FTuT5 • 14:45
Optical A/D using Oversampling by Second-Order DSM, Erin Reeves[1], Pablo Costanzo[1], Sergio Granieri[1], Azad Siahmakoun[1]; [1]*Physics & Optical Eng., Rose-Hulman I. T., USA*. A novel photonic analog-to-digital convertor (A/D) based on delta-sigma modulation technique has been investigated and a prototype fiber-optic A/D that operates at 30 MS/s and a binary output of 6 bits of resolution.

FTuU • Tunable and Active Plasmonics—Continued

FTuU3 • 14:15
Tunable Metal Optics through Circuit Analysis, Etai Rosenkrantz[1]; [1]*Ilse Katz Institute for Nanoscale Science and Technology, Ben-Gurion Univ., Israel.* Excitation of surface plasmons (SPs) at a metal-dielectric interface can be tuned by applying an electric field. Through circuit analysis we examine the variation in the material refractive index under an external field.

FTuU4 • 14:30 Invited
Tunable and Nonlinear Microwave and Terahertz Metamaterials, Ranjan Singh[1], Matthew T. Reiten[1], Jiangfeng Zhou[1], Jie Xiong[1], Lawrence M. Earley[1], Abul K. Azad[1], John F. O'Hara[1], Quanxi Jia[1], Antoinette J. Taylor[1], Hou-Tong Chen[1]; [1]*MPA-CINT, Los Alamos National Laboratory, USA*. By incorporating semiconducting or complex metal oxide materials and devices, we experimentally demonstrate tunable and nonlinear metamaterials operating at microwave and terahertz frequencies, through the application of an external stimulus.

LTuG • Optical Metamaterials: Experimental Methods—Continued

LTuG3 • 14:30 Invited
A Negative Index Metamaterial Operating at UV/Visible, J. Parsons[1], R. Maas[1], E. Verhagen[1], R. J. Walters[1], A. Polman[1]; [1]*Photonic Materials Group, FOM Institute AMOLF, The Netherlands.* We demonstrate the first optical metamaterial with a three-dimensional negative index in the blue/UV spectral range. Using focused ion beam milling and evaporation we fabricate Ag/Si3N4 multilayer structures composed of coupled metal/insulator/metal (MIM) plasmonic waveguides.

LTuH • Absolute Metrology I—Continued

LTuH3 • 14:30 Invited
Nonorthogonal State Discrimination Below The Homodyne Limit, F. E. Becerra[1], J. Fan[1], G. Baumgartner[2], S. Polyakov[1], Goldhar[3], J. T. Kosloski[4], and A. Migdall[1]; [1]*Joint Quantum Institute, Department of Physics, University of Maryland, and National Institute of Standards and Technology, USA;* [2]*Laboratory for Telecommunications Sciences, USA;* [3]*Department of Electrical and Computer Engineering, USA;* [4]*Department of Electrical and Computer Engineering, Johns Hopkins University, USA*. It is possible to construct a receiver to allow discrimination of nonorthogonal phase states with error rates below the homodyne limit. We present an experimental test of such a receiver.

LTuI • Information in a Photon III—Continued

LTuI3 • 14:15 Invited
Photonic Quantum Measurements for Metrology and Entanglement Verification, Geoff Pryde[1]; [1]*Griffith Univ., Australia*. We experimentally demonstrate how adaptive measurement and readily-available entangled states can beat the standard limit in ab initio phase measurement.

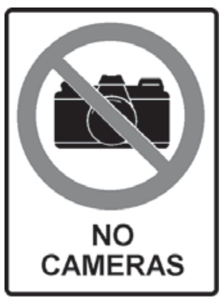
LTuI4 • 14:45 Invited
Spatial Entanglement and Orbital Angular Momentum, Martin P. van Exter[1], Henrique Di Lorenzo Pires[1]; [1]*Huygens Laboratory, Leiden Univ., Netherlands.* We review a series of experiments on spatial entanglement, both in two dimensions and in orbital angular moment. Two-photon scattering is introduced as tool to quantify the dimensionality of the entanglement and proof its purity.

Empire | **Crystal** | **Gold** | **Valley** | **California**

FiO

FTuO • Single Molecule Detection, Diagnostics and Therapy II—Continued

FTuO6 • 15:00
Studying Subunit Cooperativity by Counting Hydrolyzed ATP on Single Chaperonin Nanomachines in Solution, Yan Jiang[1,2], Nick Douglas[3], Nick Conley[4], Erik Miller[3], Judith Frydman[3], W.E. Moerner[1]; *[1]Chemistry, Stanford Univ., USA; [2]Applied Physics, Stanford Univ., USA; [3]Biology, Stanford Univ., USA; [4]Radiology, Stanford Univ., USA.* Single chaperonin proteins are trapped by an Anti-Brownian Electrokinetic trap and hydrolyzed Cy3-ATP counted using stepwise photobleaching. Unlike ensemble averaging the observed ATP number distributions depart from the standard cooperativity models



FTuP • Ultrashort Pulses: 20th Anniversary of Frequency-Resolved Optical Gating Symposium II—Continued

FTuP4 • 15:00 Invited
Spectrograms for Probing Nonlinear Pulse Propagation, Selçuk Aktürk[1,3], Cord Arnold[2,3], Bing Zhou[3], Ciro D'Amico[3], Shichua Chen[3], Michel Franco[3], Arnaud Couairon[4] and Andre Mysyrowicz[3]; *[1]Department of Physics, Istanbul Technical Univ., Turkey; [2]Department of Physics, Lund Univ., Sweden; [3]Laboratoire d'Optique Appliquée, École Nationale Supérieure des Techniques Avancées—École Polytechnique, France; [4]Centre de Physique Théorique, École Polytechnique, France.* We investigate nonlinear propagation dynamics of ultrashort pulses using their spectrograms; and developed a FROG setup, capable of measuring pulse durations down to single optical cycles. We also demonstrate relativistic intensities with table-top laser source.

FTuQ • Instrumentation for Optical Microscopy and OCT I—Continued

FTuQ6 • 15:00 Invited
Imaging of the Human Retina by Polarization Sensitive and Cellular Resolution OCT, Christoph Hitzenberger[1]; *[1]Center for Medical Physics and Biomedical Engineering, Medical Univ. of Vienna, Austria.* New developments of OCT for advanced retinal imaging are presented: tissue specific contrast by polarization sensitive OCT is used to segment retinal lesions; high resolution OCT is used to study the temporal behavior of photoreceptors.

FTuR • Lasers and Photoemission for Accelerator Science—Continued

FTuR4 • 15:15
Spectral Control of Supercontinuum Generated by Intense Femtosecond Pulses with Diffractive Optics, Rocio Borrego Varillas[1], Carolina Romero[1], Acner Camino[1], Gladys Minguez-Vega[2], Omel Mendoza-Yero[2], Warein Holgado[1], Iñigo Sola[1], Luis Roso[3], Javier R. Vazquez de Aldana[1]; *[1]Fisica Aplicada, Universidad de Salamanca, Spain; [2]Departament de Física, Universitat Jaume I, Spain; [3]Centro de Laseres Pulsados (CLPU), Spain.* We demonstrate that supercontinuum generation with a diffractive lens in a sapphire plate gives rise to new spectral phenomenology. Applicability of these pulses is supported by a spatial and temporal study.

FTuS • Optical Manipulation II—Continued

FTuS7 • 15:00 Invited
Optically Induced and Directed Manipulation on Surfaces, Michael Summers[1], Richard Dear[1], Lee Moore[1], M. Rickards[1], J. Taylor[2], Grant Ritchie[1]; *[1]Univ. of Oxford, United Kingdom; [2]Durham Univ., United Kingdom.* This paper describes our work trapping colloidal particles near surfaces using evanescent fields and optically induced thermal gradients.

15:30–16:00 Coffee Break, *Imperial Balllroom, Fairmont Hotel*

15:30–17:00 Meet the Editors of the APS Journals, *Imperial Ballroom, Fairmont Hotel*

Hillsborough	Atherton	Sacramento	Piedmont	Glen Ellen
FiO		LS		

FTuT • Optical Communications I—Continued

FTuT6 • 15:00
Spatial Multiplexer and Experimental Attenuation of a Four Channel Spatial Domain Multiplexed System in Multimode Fibers Using Fiber Taper Technology, Syed Murshid[1], Abhijit Chakravarty[1]; [1]*Electrical and Computer Engineering, Florida Institute of Technology, USA.* Spatial domain multiplexing enables co-propagation of multiple spatially separated channels of same wavelength over multimode fibers. Spatial multiplexer and attenuation of four such channels over a tapered 62.5/125μm step index fiber is reported.

FTuT7 • 15:15
Analysis of Spatially Multiplexed Helically Propagating Channels in Step Index Optical Waveguides, Syed Murshid[1], Raka Biswas[1]; [1]*Electrical and Computer Engineering, Florida Institute of Technology, USA.* Spatial Domain Multiplexing (SDM) is a novel optical multiplexing technique that allows co-propagation of multiple helical channels of same wavelength through a single optical fiber. Helical propagation of SDM channels is discussed and analyzed.

FTuU • Tunable and Active Plasmonics—Continued

FTuU5 • 15:00
Tunable Coupling Between Magnetic Plasmon Polaritons and Bloch Surface Waves, Hai Liu[1], Xiudong Sun[1], Yanbo Pei[1], Fengfeng Yao[1], Yongyuan Jiang[1]; [1]*Harbin Institute of Technology, China.* We numerically study the coupling of magnetic plasmon polaritons with Bloch surface waves. This coupling can be tuned by the periodicity of the multilayer substrate, and strong coupling results in a 1.5-fold enhancement of magnetic field intensity.

FTuU6 • 15:15
Triangular Metal Wedge/Groove Based Hybrid Plasmonic Structures for Low-Threshold Deep-Subwavelength Lasing, Yusheng Bian[1], Zheng Zheng[1], Ya Liu[1], Jiansheng Liu[1], Jinsong Zhu[2], Tao Zhou[3]; [1]*School of Electronic and Information Engineering, Beihang Univ., China;* [2]*National Center for Nanoscience and Technology of China, China;* [3]*Department of Physics, New Jersey Institute of Technology, USA.* We propose triangular metal wedge/groove based hybrid plasmonic structures for lasing applications. Theoretical studies show the laser's properties could be tuned by controlling the tip angle of the metallic substrate.

LTuG • Optical Metamaterials: Experimental Methods—Continued

LTuG4 • 15:00
Control of Spontaneous Emission and Reflectance in Anisotropic Metamaterials based on Irregular and Discontinuous Metallic Inclusions, Heng Li[1], Thejaswi Tumkur[1], Yuri A. Barnakov[1], Mikhail A. Noginov[1]; [1]*Norfolk State Univ., USA.* We show that a metamaterial based on irregular and discontinuous metallic inclusions can show a property expected of hyperbolic metamaterials, such as control of spontaneous emission and reduced reflection.

LTuG5 • 15:15
Resonantly-Coupled Atoms — Opto-Bistable Nano-Elements, Alexander E. Kaplan[1]; [1]*Electrical & Computer Engineering, Johns Hopkins-Earth & Planetar, USA.* Small ensembles of coupled resonant atoms (down to a pair of identical atoms spaced by a few nanometers) can exhibit strong optical bistability with a low switching threshold.

LTuH • Absolute Metrology I—Continued

LTuH4 • 15:00
Polarization Dependent Single-Photon Tunneling through a Chiral Photonic Bandgap Liquid Crystal Structure, Andreas C. Liapis[1], George M. Gehring[1], Svetlana G. Lukishova[1,2], Robert W. Boyd[1,3]; [1]*The Institute of Optics, Univ. of Rochester, USA;* [2]*Laboratory for Laser Energetics, Univ. of Rochester, USA;* [3]*Department of Physics, Univ. of Ottawa, Canada.* Using fourth-order interference, we have measured the relative tunneling delay between photons of opposite handedness through a cholesteric liquid crystal structure. The resulting time delay or advancement can be tuned by tilting the sample.

LTuH5 • 15:15
A Novel Phased Array Planar Laser Based on the Membrane 2D Photonic Crystals, Kamila Lesniewska-Matys[1], Bartlomiej Salski[2], Pawel Szczepanski[1,3]; [1]*Institute of Microelectronics and Optoelectronics, Warsaw Univ. of Technology, Poland;* [2]*QWED Sp. z o.o.,, Poland;* [3]*National Institute of Telecommunications, Poland.* A novel phased array multi-channel laser, based on membrane two dimensional photonic crystals with square and triangular symmetry operating on fundamental supermode is proposed and study above threshold generation.

LTuI • Information in a Photon III—Continued

LTuI5 • 15:15
Superadditive Optical Communications with Joint Detection Receivers and Concatenated Coding, Zachary Dutton[1], Saikat Guha[1], Jian Chen[1], Jonathan L. Habif[1]; [1]*Raytheon BBN Technologies, USA.* We present an optical communication receiver system concept able to achieve superadditive capacities. We present the first concatenated coding strategies compatible with our recently proposed joint-detection receivers.

15:30–16:00 Coffee Break, *Imperial Balllroom, Fairmont Hotel*

15:30–17:00 Meet the Editors of the APS Journals, *Imperial Ballroom, Fairmont Hotel*

Empire | Crystal | Gold | Valley | California

FiO

16:00–17:30
FTuV • Photonics for Switching and Interconnects
Mihaela Dinu, Bell Labs, Alcatel-Lucent, USA, Presider

FTuV1 • 16:00 Tutorial

Device Challenges and Opportunities for Optical Interconnects, David A. B. Miller[1]; *[1]Ginzton Lab, Stanford Univ., USA.* Optical interconnects offer substantially reduced energy and increased density compared to wires, but very high-performance integrated devices are essential. The talk summarizes requirements and progress towards goals.

David A. B. Miller received his Ph.D. from Heriot-Watt University in Physics in 1979. He was with Bell Laboratories from 1981 to 1996, as a department head from 1987. He is currently the W. M. Keck Professor of Electrical Engineering, and a Co-Director of the Stanford Photonics Research Center at Stanford University. He has been active in professional societies and was President of the IEEE Lasers and Electro-Optics Society in 1995. 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, including especially the use of optics for interconnection. He has published more than 240 scientific papers and the text "Quantum Mechanics for Scientists and Engineers", holds 69 patents, has received numerous awards, is a Fellow of OSA, IEEE, APS, and the Royal Societies of Edinburgh and London, holds two honorary degrees, and is a Member of the National Academy of Sciences and the National Academy of Engineering.

16:00–17:30
FTuW • Fiber Sources in Non-Telecom Windows II
Yasutake Ohishi; Toyota Technological Institute Japan, Presider

FTuW1 • 16:00 Invited

Supercontinuum Generation at Mid-IR Wavelengths in Chalcogenide Photonic Crystal Fibers, Curtis R. Menyuk[1], Jonathan Hu[1], Robert J. Weiblen[1], Andrew Docherty[1]; *[1]Computer Science and Electrical Engineering, Univ. of Maryland Baltimore County, USA.* Obtaining a broadband radiation spectrum in the wavelength range from 3 µm to 10 µm is a challenge. Supercontinuum generation in photonic crystal fibers appears to be a promising approach.

FTuW2 • 16:30

Raman Amplifier with > 200 W Average Power Based on a Step-index Fused Silica Fiber, Miroslaw Rekas[1], Oliver Schmidt[1], Stephan Rhein[1], Hagen Zimer[2], Thomas Schreiber[1], Ramona Eberhardt[1], Andreas Tuennermann[1]; *[1]Fraunhofer Institute for Applied Optics and Precision Engineering, Germany; [2]JT Optical Engine GmbH + Co. KG, Germany.* More than 200 W output power from a Raman amplifier is presented. 1 W seed signal (wavelength 1125 nm) was generated in a Raman oscillator and fed into the Raman Amplifier subsequently. Conversion efficiency of 86% was achieved.

16:00–17:30
FTuX • Instrumentation for Optical Microscopy and OCT II
Christoph Hitzenberger; Medical Univ. of Vienna, Austria, Presider

FTuX1 • 16:00 Invited

Micro-Optical Sectioning Tomography to Obtain Brainwide Image at Neurite Level, Qingming Luo[1,2], Shaoqun Zeng[1,2]; *[1]Britton Chance Center for Biomedical Photonics, Wuhan National Laboratory for Optoelectronics, China; Key Laboratory of Biomedical Photonics of Ministry of Education, [2]Huazhong University of Science and Technology, China.* To fill the gap between micrometer-scale resolution and centimeter-sized specimen in brain connectome studies, we developed a micro-optical sectioning tomography system that can perform a three-dimensional structural neurite image of a Golgi-stained whole mouse brain.

FTuX2 • 16:30

Interferometric Synthetic Aperture Microscopy: Asymptotics and Corrections, Eric W. Hofreiter[1], Stephen A. Boppart[1], Paul S. Carney[1]; *[1]Electrical and Computer Engineering, Univ. of Illinois, USA.* ISAM is computed tomography based in broadband, interferometric detection with depth of imaging limited only by signal-to-noise. The theory relies on an asymptotic analysis for which corrections are presented.

16:00–17:30
FTuY • Coherence and Holography
Georges Nehmetallah; Univ. of Dayton, USA, Presider

FTuY1 • 16:00

What Kind of a Phase Does One Measure in Usual Interference Experiments? Emil Wolf[1,2]; *[1]Department of Physics and Astronomy, Univ. of Rochester, USA; [2]Institute of Optics, Univ. of Rochester, USA.* It is taken for granted that usual interference experiments provide information about phase of monochromatic light. However, monochromatic light is not realizable. We will elucidate the meaning of the phase that is measured.

FTuY2 • 16:15

Statistical Similarity and Complete Coherence in the Space-frequency Domain, Mayukh Lahiri[1], Emil Wolf[1,2]; *[1]Department of Physics and Astronomy,, Univ. of Rochester, USA; [2]Institute of Optics, Univ. of Rochester, USA.* We show that complete spatial coherence in the space-frequency domain leads to a condition which reflects the notion of the recently developed concept of statistical similarity. We also illustrate the usefulness of this condition.

FTuY3 • 16:30

Scattering of Partially Coherent Radiation from Optically Inhomogeneous Media, Sergey Sukhov[1], David Haefner[1], Janghwan Bae[1], Deqiang Ma[2], Douglas Carter[2], Aristide Dogariu[1]; *[1]CREOL, Univ. of Central Florida, USA; [2]KaMin LLC, USA.* Using a customized coupled dipoles technique, we quantify the influence of the state of spatial coherence of an incident field on the statistical properties of optical radiation scattered from randomly inhomogeneous media.

16:00–17:30
FTuZ • Nonimaging Techniques for Sensing II
Mark Anastasio; Washington Univ. in St. Louis, USA, Presider

FTuZ1 • 16:00 Invited

Extracting Information from Optical Fields Through Spatial and Temporal Modulation, Randy Bartels[1,2], David Winters[1], David Kupka[1], Wenbing Dang[1], Ali Pezeshki1[1]; *[1]Department of Electrical and Computer Engineerig, Colorado State Univ., USA; [2]School of Biomedical Engineering, Colorado State Univ., USA.* We present techniques for obtaining information through spatial and temporal decomposition of optical fields. Limiting cases of sub-wavelength and extended objects is discussed.

FTuZ2 • 16:30

Coherence Retrieval by Measuring the Diffracted Field from a Binary Planar Phase Mask, Seongkeun Cho[1], Miguel A. Alonso[2]; *[1]Physics and Astronomy, Univ. of Rochester, USA; [2]The Institute of Optics, Univ. of Rochester, USA.* A simple scheme is proposed for the retrieval of the coherence properties of a field, based on far-field measurements of the intensity following diffraction by a movable planar phase mask.

Hillsborough — FiO

16:00–17:30
FTuAA • Three-Dimensional Structure Design, Fabrication, and Nanopatterning III
Martin Booth; Univ. of Oxford, UK, Presider

FTuAA1 • 16:00 Invited

Three-Dimensional Fabrication below the Diffraction Limit via Two-Color Photo-Inhibition/Initiation Lithography, Robert McLeod, *Univ. of Colorado, USA.* Abstract not available.

FTuAA2 • 16:30

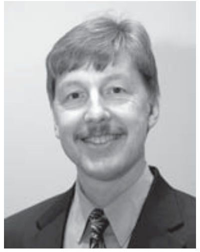
2D and 3D Writing of Silver Nanostructures Through Multiphoton Photoreduction, Kevin Vora[1], SeungYeon Kang[1], Shobha Shukla[1], Eric Mazur[1]; [1]*SEAS, Harvard Univ., USA.* We present a technique for direct writing silver nanostructures in 2D and 3D. Nonlinear optical interactions between a silver-ion doped resin and femtosecond pulses create silver nanostructures inside a dielectric matrix.

Atherton — FiO

16:00–17:30
FTuBB • Information Theory in Optics I: Classical Information Theory
Nikola Alic; Univ. of California at San Diego, USA, Presider

FTuBB1 • 16:00 Tutorial

Elementary Information Theory Applied to Phase-(in)Sensitive Transmission Links, Colin McKinstrie; *Bell Labs, USA.* In this tutorial, I will review the basic concepts of information theory and quantum optics. Subsequently, I will use these concepts to dis-cuss the noise properties and information capacities of optical links, which are sequences of transmission fibers (attenuators) and phase-insensitive or phase-sensitive amplifiers.



Colin J. McKinstrie received BSc and PhD degrees from the Universities of Glasgow and Rochester, in 1981 and 1986, respectively. From 1985 to 1988 he was a Postdoctoral Fellow of Los Alamos National Laboratory. In 1988 Dr McKinstrie returned to the University of Rochester as a Professor of Mechanical Engineering and a Scientist in the Laboratory for Laser Energetics. While there, his main research interests were laser fusion and nonlinear optics. Since 2001 Dr McKinstrie has been a Member of the Technical Staff at Bell Laboratories, where his research concerns the amplification and transmission of optical pulses in communication systems, and applications of parametric devices in quantum information science.

Sacramento — LS

16:00–17:30
LTuJ • Controlling Light with NanoPlasmonics
Harald Geissen; Universität Stuttgart, Germany, Presider

LTuJ1 • 16:00 Invited

Amplification and Lasing with Surface Plasmons: Review of Recent Progress, Pierre Berini[1]; [1]*SITE, Univ. of Ottawa, Canada.* Surface plasmon amplifiers and lasers have been investigated for many years. Several important demonstrations have been reported. This topic is reviewed and its status assessed. Directions for future research are suggested.

LTuJ2 • 16:30 Invited

Withdrawn

Piedmont — LS

16:00–17:30
LTuK • Absolute Metrology II
Jeff Lundeen; National Research Council, Canada, Presider

LTuK1 • 16:00 Invited

New Directions in Force Detection: Entanglement, Noise Cancellation, and Quantum Nondemolition, Carlton Caves; [1]*Univ of New Mexico, USA.* Abstract not available.

LTuK2 • 16:30 Invited

Dispersion Cancellation and Precise Measurement with Quantum Interferometry, Alexander V. Sergienko[1,2], David S. Simon[1], Olga V. Minaeva[3]; [1]*Dept. of ECE/ENG, Boston Univ., USA;* [2]*Dept. of Physics, Boston Univ., USA;* [3]*Dept. of BME, Boston Univ., USA.* We demonstrate a technique allowing for simultaneous even and odd-order spectral dispersion cancellation in a single experiment. We discuss advantages quantum interference offers for ultra-precise measurement in telecommunication.

Glen Ellen — LS

16:00–17:30
LTuL • Attosecond and Strong Field Science I
Ken Schafer; Louisiana State University, USA, Presider

LTuL1 • 16:00 Invited

Time-Dependent Electronic Dynamics in Atoms, Molecules, and Solids Probed by Ultrashort Pulses*, Joachim E. Burgdorfer[1]; [1]*Theoretical Physics, Vienna Univ. of Technology, Austria.* Sub-femtosecond XUV and phase-stabilized IR pulses with sub-cycle time resolution open up novel pathways for studying electronic dynamics on the attosecond scale. These issues will be addressed presenting examples of atoms, molecules, and solids.

LTuL2 • 16:30 Invited

Transient Absorption Spectroscopy with Attosecond Pulse Trains, Lukas Gallmann[1], Mirko Holler[1], Florian Schapper[1], Ursula Keller[1]; [1]*Physics Department, ETH Zurich, Switzerland.* Transient absorption spectroscopy using attosecond pulse trains is introduced as a new spectroscopic tool in attosecond science. We discuss its application to the observation of interferences between transiently bound electron wavepackets in helium.

FiO

Tuesday, 18 October

FTuV • Photonics for Switching and Interconnects—Continued

FTuV2 • 16:45
Non-volatile Bistable All-Optical Switch from Mechanical Buckling, Varat Intaraprasonk[2], Shanhui Fan[1]; *[1]Department of Electrical Engineering, Stanford Univ., USA; [2]Department of Applied Physics, Stanford Univ., USA.* A non-volatile all-optical bistable optomechanical switch comprising two parallel buckling waveguides is proposed. The bistability from mechanical buckling requires no maintenance power while optical coupling allows all-optical switching and reading.

FTuV3 • 17:00 Invited
Silicon Photonics for Modulation, Switching, and Tuning, Michael Watts[1]; *[1]Massachusetts Institute of Technology, USA.* Thermal and electro-refractive silicon photonic modulators, switches, and tunable filters have been demonstrated with ultralow switching energies and high-speed operation. These elements form building blocks that will enable future generations of large-scale microphotonic systems.

FTuW • Fiber Sources in Non-Telecom Windows II—Continued

FTuW3 • 16:45
Relative Intensity Noise Characterization of a Linear Polarized 1.1 kW Fiber-Amplified Narrow-Band ASE Source, Oliver Schmidt[1], Andrea Kliner[2], Miroslaw Rekas[1], Christian Wirth[1], Stephan Rhein[2], Thomas Schreiber[1], Ramona Eberhardt[1], Andreas Tuennermann[1,2]; *[1]Fraunhofer IOF Jena, Germany; [2]Friedrich-Schiller Univ., Institute of Applied Physics, Germany.* We present the characterization of narrow-linewidth ASE source, which has been amplified to 1.1 kW using a RMO-fiber design. SBS is known as the main limiting effect for fiber amplified single-frequency and narrow-band signals, respectively.

FTuW4 • 17:00 Invited
Coherence-Preserving kW-Level Tm Fiber Amplifiers at 2 mm, Gregory D. Goodno; *Northrop Grumman, USA.* We review the design and performance of an actively phase-locked, multi-stage Tm-doped fiber amplifier chain, and we discuss the impact of Tm's longer emission wavelength on linear and nonlinear limits for coherent fiber combining.

FTuX • Instrumentation for Optical Microscopy and OCT II—Continued

FTuX3 • 16:45
A Side-View Confocal Microendoscope for in vivo Sagittal Imaging of the Mouse Brain, Jun Ki Kim[1], Jinwoo Choi[1], Seok H Yun[1]; *[1]Harvard medical school and wellman center for photomedicine, Massachusetts General hospital, USA.* We have developed a miniature confocal side-view endoscope with a diameter of 350micron for sagittal imaging of mouse brain in vivo. This new tool can visualize the vertical layers of neurons from cerebral cortex to hippocampus.

FTuX4 • 17:00 Invited
Adaptive Optics Applied to 2-Photon Microscopy, Jerome Mertz; *Univ. of Boston, USA.* I will describe some effects of scattering tissue on pulsed illumination, and show how temporal pulse broadening can be measured with a camera. Results will be compared to theory. Implications for AO will be discussed.

FTuY • Coherence and Holography—Continued

FTuY4 • 16:45
Observation of Axial Phase Evolution of Highly Confined Light Fields, Myun-Sik Kim[1], Toralf Scharf[1], Stefan Mühlig[2], Carsten Rockstuhl[2], Hans Peter Herzig[1]; *[1]STI IMT OPT, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland; [2]Institute of Condensed Matter Theory and Solid State Optics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Germany.* Highly confined light fields demonstrate peculiar phase features, e.g., Gouy phase anomaly. Longitudinal-differential phase measurements are applied to investigate phase evolutions of confined light fields for physical optical phenomena.

FTuY5 • 17:00
Amplitude and Phase Holographic Optical Elements in Diarylethene-based Photochromic Polymers, Giorgio Pariani[1,2], Rossella Castagna[1,3], Chiara Bertarelli[1,3], Andrea Bianco[2]; *[1]Dipartimento di Chimica, Materiali e Ingegneria Chimica "G. Natta", Politecnico di Milano, Italy; [2]Osservatorio Astronomico di Brera, Istituto Nazionale di Astrofisica, Italy; [3]Center for Nano Science and Technology, Istituto Italiano di Tecnologia at PoliMi, Italy.* Photochromic polymers are developed to produce amplitude HOEs, namely Computer Generated Holograms for the interferometrical optical testing of aspheres, and phase HOEs (Volume Phase Holographic Gratings), which are tested with promising results.

FTuY6 • 17:15
The Creation of Angular Momentum in Optical Waves Propagating Through Atmospheric Turbulence, Darryl J. Sanchez[1], Denis W. Oesch[2]; *[1]AFRL, USA; [2]SAIC, USA.* In this First publication in a series, we demonstrate a mechanism by which distributed atmospheric turbulence can impart angular momentum to beams propating through it and identify the mechanism by which it can become non-trivial.

FTuZ • Nonimaging Techniques for Sensing II—Continued

FTuZ3 • 16:45
Design and Fabrication of a UV-Visible Coded Aperture Spectral Imager (CASI), David S. Kittle[1], Daniel L. Marks[1], David J. Brady[1], Holly Rushmeier[2], Min H. Kim[2]; *[1]Electrical and Computer Engineering, Duke Univ., USA; [2]Computer Science, Yale Univ., USA.* CASI is a snapshot capable UV-visible spectral imager for measuring bird plumage. Near apochromatic UV-visible optics were designed and built with an MTF for a 4Mpx detector. Wide-spectral bandwidth data from CASI is then presented.

FTuZ4 • 17:00
Demonstration of Real-Time All-Optical Image Processing Using Optical Parametric Amplification of Complex Objects, Peter M. Vaughan[1], Rick Trebino[1]; *[1]Physics, Georgia Institute of Technolog, USA.* We have demonstrated image processing beyond simple edge enhancement using Optical Parametric Amplification imaging. Specifically, we demonstrate selection of particular spatial frequencies and spatial regions in a wavelength converted image.

FTuZ5 • 17:15
Simultaneous Single-Shot Measurement of Two Ultrashort Pulses Using Polarization-Gating Double-Blind FROG, Tsz Chun Wong[1], Justin Ratner[1], Peter M. Vaughan[1], Vikrant Chauhan[1], Rick Trebino[1]; *[1]Physics, Georgia Institute of Technology, USA.* The polarization-gating "double-blind" FROG technique is used to demonstrate true simultaneous single-shot measurement for two different, nontrivial ultrashort pulses.

16:00–17:30 Minorities and Women in OSA (MWOSA) Tea, *Sainte Claire Room, Sainte Claire Hotel*

18:00–19:00 Division of Laser Science Annual Business Meeting, *Hillsborough Room, Fairmont Hotel*

18:00–19:00 OSA Annual Business Meeting, *Empire Room, Fairmont Hotel*

19:00–20:30 OSA Member Masquerade Reception, *Ballroom, Sainte Claire Hotel*

19:00–22:00 Laser Science Banquet, *Gordon Biersch, 33 East San Fernando Street, San Jose, CA, Phone: 408.294.6585*

21:00–23:00 OSA Student Member Party, *Firehouse #1, 69 North San Pedro St, San Jose, CA, Phone: 408.287.6969*

Hillsborough | Atherton | Sacramento | Piedmont | Glen Ellen

FiO | **LS**

FTuAA • Three-Dimensional Structure Design, Fabrication, and Nanopatterning III—Continued

FTuAA3 • 16:45
Photolithography and Direct Three-Dimensional Writing (and Erasing) Based on Silver Nanoparticles Formation (and Oxidation) Within a Polymer, Antonio M. Silva[1], Cid B. de Araújo[3], André Galembeck[2]; *[1]Centro de Tecnologias Estratégicas do Nordeste, Brazil; [2]Departamento de Química, Universidade Federal de Pernambuco, Brazil; [3]Departamento de Física, Universidade Federal de Pernambuco, Brazil.* A new three-dimensional plasmonic lithography is presented. The process of direct writing with a laser beam in a polymeric matrix is demonstrated and explained. The plasmonic structure can be erased chemically.

FTuAA4 • 17:00
High Resolution Large Area Nanopatterning for Plasmonics and Metamaterials with Nanostencil Lithography, Serap Aksu[1,2], Min A. Huang[2,3], Alp A. Artar[2,3], Ronen Adato[2,3], Ahmet A. Yanik[2,3], Hatice Altug[2,3]; *[1]MSE, Boston Univ., USA; [2]Photonics Center, Boston Univ., USA; [3]ECE, Boston Univ., USA.* We demonstrate a versatile fabrication approach for high-resolution large area patterning of optical antennas and metamaterials with reusable nanostencils. Technique offers simple and high-throughput fabrication scheme on variety of substrates.

FTuAA5 • 17:15
Three-Dimensional Light Modulation Using a Piecewise Implementation of the Gerchberg-Saxton Algorithm, Mark Jayson Villangca[1], Paul Leonard Atchong Hilario[1], Giovanni A. Tapang[1]; *[1]National Institute of Physics, Univ. of the Philippines Diliman, Philippines.* We simultaneously generate arbitrary patterns at different positions along the optical axis by extending the Gerchberg-Saxton (GS) algorithm with the angular spectrum method and imposing a piecewise defined aperture.

FTuBB • Information Theory in Optics I: Classical Information Theory—Continued

FTuBB2 • 16:45 Tutorial
Information Theory and Digital Signal Processing in Optical Communications: Scaling Beyond the Imminent Single-Mode Fiber Capacity Limit, Peter Winzer; *Bell Labs, USA.* With digital coherent detection routinely used in modern optical communication systems, wavelength-division multiplexing is rapidly approaching its fundamental Shannon capacity limits. Radically new techniques are required to satisfy the exponentially increasing demand for network capacity.

LTuJ • Controlling Light with NanoPlasmonics—Continued

LTuJ3 • 17:00 Invited
Nonlinear Optical Response of Nanoantennas, Hayk Harutyunyan[1], Giorgio Volpe[2], Romain Quidant[2], Lukas Novotny[1]; *[1]Institute of Optics, Univ. of Rochester, USA; [2]ICFO-Institut de Ciencies Fotoniques, Mediterranean Technology Park, Spain.* We employ non-linear processes to study the properties of optical antennas.

LTuK • Absolute Metrology II—Continued

LTuK3 • 17:00 Invited
Quantum Metrology from Sub-Poissonian to Super-Heisenberg, John G. Rarity[1]; *[1]E&EE Department, Univ. of Bristol, United Kingdom.* We investigate ways of exploiting pair photons from photonic crystal fibre for metrology. Due to their non-degenerate form this can allow higher resolution heralded two photon fringes while new two-color photon interferometry paradigms emerge.

LTuL • Attosecond and Strong Field Science I—Continued

LTuL3 • 17:00 Invited
Toward *ab initio* Modeling of Strong Field Molecular Ionization, Michael Spanner[1]; *[1]Steacie Institute for Molecular Sciences, National Research Council of Canada, Canada.* Coupled time-dependent single-particle Schroedinger equations describing the neutral amplitude and continuum electron are constructed. Results of strong field ionization on small (e.g. N2) to medium size (e.g. n-butane) molecules will be considered.

16:00–17:30 Minorities and Women in OSA (MWOSA) Tea, *Sainte Claire Room, Sainte Claire Hotel*

18:00–19:00 Division of Laser Science Annual Business Meeting, *Hillsborough Room, Fairmont Hotel*

18:00–19:00 OSA Annual Business Meeting, *Empire Room, Fairmont Hotel*

19:00–20:30 OSA Member Masquerade Reception, *Ballroom, Sainte Claire Hotel*

19:00–22:00 Laser Science Banquet, *Gordon Biersch, 33 East San Fernando Street, San Jose, CA, Phone: 408.294.6585*

21:00–23:00 OSA Student Member Party, *Firehouse #1, 69 North San Pedro St, San Jose, CA, Phone: 408.287.6969*