JOINT

8:00 a.m.–10:30 a.m., CLEO/QELS Plenary Session, *Civic Auditorium*

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

10:30 a.m.–12:00 p.m., Coffee Break (ends at 11:00 a.m.) **and Exhibit-Only Time,** *Exhibit Hall*

11:00 a.m.–12:00 p.m., Lunch Break *(concessions available in the Exhibit Hall)*

12:00 p.m.–1:30 p.m.
JWA • CLEO/QELS Poster Session II

JWA1
Excimer Laser Micromachining of Glass Substrates, *Deepa M. Bhatt, Karen Williams, David A. Hutt, Paul P. Conway; Loughborough Univ., UK.* Excimer laser machining of microvias and tracks in CMZ glass (100 µm thick) at 248nm has been investigated and optimised in order to minimise hole taper, microcracking and debris.

JWA2
Inscription of Cylindrical and Planar Waveguides with Ultrafast Bessel Beams, *Veronique Zambon[1,2], Nathalie McCarthy[1,2], Michel Piché[1,2]; [1]Ctr. d'Optique, Photonique et Lasers, Univ. Laval, Canada, [2]Dept. de Physique, Ctr. d'Optique, Univ. Laval, Canada.* We fabricated planar and cylindrical waveguides in transparent dielectrics by using ultrafast Bessel beams instead of commonly used Gaussian beams. Excellent quality waveguides with low losses were produced by focusing millijoule femtosecond pulses with axicons.

JWA3
Optical Topography System for Laser Ablation Plume Measurements, *Anthony Valenzuela, George Rodriguez, Steven Clarke; Los Alamos Natl. Lab, USA.* We image the nanoscale plasma plume of laser-ablated titanium metal by using a Shack-Hartmann based optical topographic system. We show this diagnostic produces data with ultrafast temporal resolution that is concurrent with simulations.

JWA4
Fabrication of Sharp Conical Microstructures on Si Films by Nd:YAG-Laser Single-Pulse Irradiation, *Daniel Georgiev, Joe Moening; Univ. of Toledo, USA.* Sharp Si micro-cones were obtained by single-pulse laser irradiation (Q-switched Nd:YAG, 4th harmonic), of thin crystalline Si films on insulating substrates. The formation is due to localized melting and is controllable with important technological implications.

JWA5
Self-Organized Plasma Planes Create Nanogratings on NiTi Alloy Surfaces, *Yang Yang[1], Chunyong Liang[2], Hongshui Wang[2], Jianjun Yang[1]; [1]Inst. of Modern Optics, Nankai Univ., China, [2]School of Materials Science and Engineering, Hebei Univ. of Technology, China.* Nanogratings spaced at 630 nm on NiTi alloy surfaces are produced by self-organized nanoplasma planes following scan of linearly-polarized femtosecond laser pulses. Their formation characteristics are investigated. Theoretical analysis matches well with our observations.

JWA6
Fabrication of Noble Metal Nanoparticles in Intense Optical Field by Femtosecond Laser Irradiation of Aqueous Solution, *Takahiro Nakamura, Yuzuru Mochidzuki, Kouichi Takasaki, Shunichi Sato; Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan.* We demonstrated a novel fabrication technique of highly monodispersed noble metal nanoparticles by femtosecond pulsed laser irradiation of aqueous solution.

JWA7
Use of a High Spatial Resolution Wavefront Analyser to Predict Intensity Hot Spot in a Femtosecond Laser Chain, *David Jacob[1], Patrice Nagtegaele[1], Mathias Le Pennec[1], Laurent Bruel[2], Olivier Peillet[2], Federico Canova[3], Jean-Paul Chambaret[3]; [1]Cordouan Technologies, France, [2]CEA, France, [3]ENSTA, France.* We demonstrate the use of a new wavefront analyser called MIROMA in a laser chain to measure the residual spatial modulations of the beam induced by footprints of a deformable mirror and prevent optical damages.

JWA8
The Use of Circular Dammann Gratings (CDG) in Angle Measurement, *Fung Jacky Wen, Po Sheun Chung; City Univ. of Hong Kong, China.* We describe a robust method of inclined angle measurement based on the projection of the CDG image. An accuracy of 5% can easily be achieved and this method can be applicable in many different areas.

JWA9
Optical Super-Resolution through Aperture-Function Engineering and Vectorial Focusing Effects, *Keith A. Serrels, Euan Ramsay, Andrew J. Waddie, Mohammad R. Taghizadeh, Derryck T. Reid; Heriot Watt Univ., UK.* We demonstrate optical super-resolution by using custom obscuration apertures and polarization effects to manipulate the pupil-function and focal-plane point-spread-function in a two-photon microscope used for semiconductor flip-chip imaging. Experimental results suggest sub-100nm performance.

JWA10
Range Sensing Using Photometric Differentiation, *Victor Argueta, Augusto García-Valenzuela; CCADET, Univ. Nacional Autonoma de Mexico, Mexico.* We present a passive optical ranging method consisting of three photometric measurements from the light reflected by an object. The measurements are taken from a single position using a CCD camera and different apertures.

JWA11
Sellmeier and Thermo-Optic Dispersion Formulas for $RbTiOPO_4$, *Kiyoshi Kato[1], Takuya Mikami[1,2], Takayuki Okamoto[2]; [1]Chitose Inst. of Science and Technology, Japan, [2]Okamoto Optics Work Inc., Japan.* Thermo-optic constants for $RbTiOPO_4$ were measured from 20 to 120°C in the 0.532-1.571µm range. The Sellmeier and thermo-optic dispersion formulas that reproduce well the phase-matching conditions for normal and periodically poled crystals are presented.

JWA12
Generation of Ultrashort Pulses in the Visible Using Cascaded Intracavity Processes in Periodically Poled $MgO:LiNbO_3$, *Felix Ruebel, Peter Haag, Johannes Albert L'huillier; Technische Univ. Kaiserslautern, Germany.* We report on synchronously pumped OPOs with intracavity SHG or SFG in the same MgO:PPLN crystal. At e.g. 590nm an output power of 190mW was obtained with 140fs pulses at a repetition rate of 81MHz.

JWA13
52%-Efficient Single-Pass SHG in a PPLN Waveguide by Frequency Doubling of a cw-DFB RW Laser Diode, *Andreas Jechow, Axel Heuer, Ralf Menzel; Univ. of Potsdam, Germany.* 159 mW diffraction limited blue light at 488 nm could be generated in a periodically poled lithium niobate waveguide crystal by frequency doubling of a continuous wave distributed feedback ridge waveguide laser diode.

JWA14
Crystalline Cavities for Quantum and Nonlinear Optics, *Ivan S. Grudinin, Andrey B. Matsko, Lute Maleki; JPL, USA.* We present crystalline whispering gallery mode resonators (WGMR) operating as the efficient Raman lasers. Fundamental limitations on optical quality (Q) factor are discussed. A new resonant scattering phenomenon is observed.

JWA15
Aperture Symmetry and Lattice Arrangement Modulated Second-Harmonic Emission from Sub-Wavelength Metallic Apertures, *Tingjun Xu, Steve Blair; Univ. of Utah, USA.* We measure strong angular dependent second-harmonic generation from subwavelength apertures arrays with disordered, Penrose and square arrangements with different shapes. These measurements help to resolve the role symmetry plays in second-harmonic generation from aperture arrays.

JWA16
90° Phase-Matched $\chi^{(3)}$ Third-Harmonic Generation in BiB_3O_6, *Kentaro Miyata, Nobuhiro Umemura, Kiyoshi Kato; Chitose Inst. of Science and Technology, Japan.* BiB_3O_6 has been found to be 90° phase-matchable for type-1 and type-2 $\chi^{(3)}$ third-harmonic generation at 0.3263 and 0.3837 µm at 20°C. The improved Sellmeier equations that correctly reproduce the new data are presented.

JWA17
Polarization Insensitive Detection of Optical Phase Modulation via Two-Wave Mixing in Er-Doped Fiber with Saturable Absorption, *Daniel García-Casillas, Serguei Stepanov; Ctr. de Investigación Científica y de Educación Superior de Ensenada, Mexico.* Adaptive detection of phase modulated optical signal in polarization insensitive configuration based on two-wave mixing in Er-doped fiber is proposed. Experiments were performed in a birefringent 0.5m long Er-doped fiber at 1492nm.

JWA18
Optical Limiting in Bragg-Spaced Semiconductor Quantum Wells, *Dan T. Nguyen, Nai H. Kwong, Rolf Binder, Robert Norwood, Nasser Peyghambarian; Univ. of Arizona, USA.* We propose a new mechanism for optical limiting in which nonlinear absorption and nonlinear reflection act in concert. The mechanism is based on the light-induced shift of the band gap in Bragg-spaced semiconductor quantum wells.

JWA19
Characterization of Bending-Induced Density Change inside an Optical Fiber by Use of Four-Wave Mixing Microscopy, *Takehito Kawasumi, Yasuyuki Ozeki, Kazuyoshi Itoh; Osaka Univ., Japan.* Microscopic density characterization of transparent material with depth resolution is achieved with four-wave mixing microscopy. The density change inside a bent optical fiber with a curvature radius of 3.4 mm is successfully detected.

JWA20
Nonlinear Gain Amplification due to Two-Wave Mixing in a Broad-Area Semiconductor Amplifier with Moving Gratings, *Mingjun Chi[1], Jean-Pierre Huignard[2], Paul Michael Petersen[1]; [1]Optics and Plasma Res. Dept., Risø Natl. Lab, Technical Univ. of Denmark, Denmark, [2]Thales Res. and Technology, France.* Two-wave mixing in a broad-area semiconductor amplifier with moving gratings is investigated. It is shown that depending on direction of the moving gratings and the anti-guiding parameter the optical gain may increase or decrease.

JOINT

12:00 p.m.–1:30 p.m.
JWA • CLEO/QELS Poster Session II

JWA21
Nonlinear Raman Microspectroscopy for Structural and Chemical Analysis of Biological Solutions in Microfluidic Devices, *Rajan Arora, Georgi Petrov, Vladislav V. Yakovlev; Univ. of Wisconsin at Milwaukee, USA.* We demonstrate here for the first time potential applicability of coherent anti-Stokes Raman spectroscopy (CARS) for protein folding and crystallization in microchannels.

JWA22
Standoff Chemical Detection Using SUPER CARS, *Haowen Li[1], D. Ahmasi Harris[2], Bingwei Xu[2], Paul J. Wrzesinski[2], Vadim V. Lozovoy[2], Marcos Dantus[2]; [1]BioPhotonic Solutions Inc., USA, [2]Michigan State Univ., USA.* We report a new method for standoff chemical detection based on single ultrafast pulse excitation for remote coherent anti-Stokes Raman spectroscopy. Mode-selective and background-free excitations were achieved through optimal binary phase pulse shaping.

JWA23
OPO Resonator Length Stabilisation for Injection Seeding Using Fibre Coupled Heterodyne Detection, *Peter Mahnke, Martin Wirth, Andreas Fix; Deutsches Zentrum fuer Luft- und Raumfahrt, Germany.* By employing optical heterodyne measurements of injection seeded optical parametric oscillator pulses with the frequency shifted seed laser we present a fibre coupled solution for resonator length stabilisation.

JWA24
Few-Cycle Pulse Interactions in Dispersion-Managed Quadratic Photonic Crystals, *Valery E. Lobanov, Vladislav A. Chernykh, Anatoly P. Sukhorukov; Faculty of Physics, M.V. Lomonosov Moscow State Univ., Russian Federation.* We propose new type of photonic crystals with managed dispersion for few-cycle pulse nonlinear optics. Dispersive effects can be reduced in layered medium with alternating nonlinear and dispersion coefficients. Soliton propagation dynamics was also studied.

JWA25
Gouy Phase Compensated Quasi Phase Matching (GQPM), *Huw E. Major, Corin B. E. Gawith, Peter G. R. Smith; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* Using an appropriately designed quasi-phase matched structure it is theoretically possible to compensate for the deleterious effects of Gouy phase shift allowing a symmetric frequency response and tighter focussing for higher conversion efficiencies.

JWA26
Soliton Self-Frequency Shift and Spectral Broadening in Air-Core Photonic Crystal Fibres, *Andrey V. Gorbach, Dmitry V. Skryabin; Univ. of Bath, UK.* We report numerical investigation of the soliton self-frequency shift in air-core photonic crystal fibres, accompanied by the emission of Airy waves and strong cut-off of the input pulse spectrum due to Raman response of air.

JWA27
Amplitude-Equalized Clock Recovery Using Nonlinear Polarization Rotation in a Semiconductor Optical Amplifier, *Fei Wang, Xinliang Zhang, Jianji Dong, Yu Yu, Dexiu Huang; Wuhan Natl. Lab for Optoelectronics, Huazhong Univ. of Science and Technology, China.* We report an all-optical clock recovery technology using nonlinear polarization rotation of reflective semiconductor optical amplifier. Clock amplitude jitter of the recovered clock is lower than 1.5% over a 25 nm tuning range.

JWA28
Wavelength Conversion and 2R-Regeneration Using One Semiconductor Optical Amplifier with Cross-Gain Modulation Compression, *Napoleao S. Ribeiro, Cristiano M. Gallep, Evandro Conforti; Unicamp, Brazil.* A simple all-optical wavelength conversion scheme with 2R-regeneration based on SOA is presented, exploring the cross-gain modulation (XGM) compression phenomenon and performing both the conversion and regeneration in one single device.

JWA29
Analysis of One-Dimensional Photonic Band Gap Structure to Design Tunable Electro-Optic Filters for DWDM, *Ratnanjali Khandwal, Xiaoyuan Qi, Bethanie J. H. Stadler; Univ. of Minnesota, USA.* A DWDM tunable electro-optic filter using photonic bandgaps was designed. Tuning range and minimum channel-spacing was controlled by an electro-optic defect, Pb $(Mg_{1/3}Nb_{1/3})O_3$-$PbTiO_3$, or by including the EO material within the reflecting stacks.

JWA30
Trigonal Symmetry of Type I Collagen Probed by SHG Polarization Anisotropy, *Bor-Yuan Jiang, Shi-Wei Chu; Dept. of Physics, Natl. Taiwan Univ., Taiwan.* Conventional second-harmonic-generation anisotropy of collagen is modeled with cylindrical symmetry. We demonstrated that with thin fibrils, trigonal symmetry of constituent triple-helix molecules dominates the anisotropy, but it converged into cylindrical symmetry with thicker fibrils.

JWA31
Symmetry Breaking Bifurcation in a Vertical Grating-Waveguide Coupler, *Michaël Delqué, Adrien Dewandre, Kien Phan Huy, Simon-Pierre Gorza, Marc Haelterman; Optique, Photonique, Électro-Magnétisme, Radio-Communications, Acoustique-Photonique, Univ. Libre de Bruxelles, Belgium.* We propose a new scheme to observe the symmetry breaking dynamics of two counter-propagating beams in a Kerr-type nonlinear waveguide. Using a grating to couple light vertically allows for a single-beam geometry.

JWA32
Eyesafe Optical Parametric Oscillators Employing MgO-Doped PPSLT and Monolithic KTP, *Janez Zabkar[1,2], Marko Zgonik[2,3], Marko Marincek[1,2], Shunji Takekawa[4], Kenji Kitamura[4]; [1]Fotona d.d., Slovenia, [2]Jozef Stefan Inst., Slovenia, [3]Faculty of Mathematics and Physics, Univ. of Ljubljana, Slovenia, [4]Natl. Inst. for Material Science, Japan.* We compare the oscillation thresholds and slope efficiencies in 10 ns pulsed eyesafe OPOs based on MgO-doped PPSLT and monolithic KTP. The optimal combination of low threshold and high slope efficiency is achieved with PPSLT.

JWA33
Wavelength Transparent SBS Slow Light Using XGM-Wavelength Converter and Brillouin Fiber Laser, *Alan Cheng, Mable P. Fok, Chester Shu; Dept. of Electronic Engineering and Ctr. for Advanced Res. in Photonics, The Chinese Univ. of Hong Kong, Hong Kong.* We demonstrate a signal wavelength independent SBS slow light architecture using a XGM-wavelength converter and a Brillouin fiber laser. The signal is wavelength converted to become automatically aligned with the resonance induced by SBS.

JWA34
Wavelength Tunable Femtosecond Optical Pulse Generated from Filamentation-Assisted Fourth-Order Nonlinear Process in KTP Crystal, *Xipeng Zhang, Hongbing Jiang, Qihuang Gong; State Key Lab for Mesoscopic Physics and Dept. of Physics, Peking Univ., China.* Visible femtosecond laser pulse is generated during filamentation of an 808 nm femtosecond laser pulse by a fourth order nonlinear polarization. The wavelength could be tuned from 460 to 520 nm.

JWA35
Three-Photon Absorption in MgO-Doped $LiNbO_3$ Crystal, *He-Ping Li[1], J. K. Liao[1], X. G. Tang[1], W. Ji[2]; [1]School of Optoelectronic Information, Univ. of Electronic Science and Technology of China, China, [2]Dept. of Physics, Natl. Univ. of China, China.* Three-photon absorption in MgO-doped $LiNbO_3$ crystal has been investigated using the Z-scan and pump-probe techniques with femtosecond pulses at 780-nm wavelength. The microscopic origin for the observed optical nonlinearity is discussed.

JWA36
UV SHG Emission by the QPM Technique Using Ferroelectric Fluorides, *Kiyoshi Shimamura[1], Encarnacion A. G. Villora[1], Masaru Nakamura[1], Senguttuvan Nachimuthu[2], Masahiro Aoshima[2], Keiji Sumiya[2]; [1]Natl. Inst. for Materials Science, Japan, [2]Hitachi Chemical Co. Ltd., Japan.* Ferroelectric fluorides are the key materials for the SHG in the UV/VUV by the QPM technique. Ferroelectric characteristics and large single crystal growth are addressed. UV SHG emission is demonstrated with $BaMgF_4$ QPM devices.

JWA37
Enhancement of Broadband Terahertz Radiation by Carrier Dynamics Modulation with a Single Chirped Optical Pulse, *Chao-Kuei Lee[1], Sung-Hui Lin[2], Ci-Ling Pan[2]; [1]Inst. of Electro-Optical Engineering, Natl. Sun Yat-sen Univ., Taiwan, [2]Dept. of Photonics, Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan.* Over 60% enhancement of broadband THz radiation and two-fold bandwidth broadening are demonstrated by a single positive chirped optical pulse. A model of carrier dynamics modulation is proposed to explain this phenomenon.

JWA38
Terahertz Photonic Crystals, *Alexander Benz, Gernot Fasching, Christoph Deutsch, Aaron M. Andrews, Karl Unterrainer, Pavel Klang, Werner Schrenk, Gottfried Strasser; Vienna Univ. of Technology, Austria.* We present the design and the fabrication of a photonic crystal with a complete bandgap for TM-modes. The photonic crystal is used as a resonator for terahertz quantum-cascade lasers.

JWA39
Band Structure of Terahertz Metallic Photonic Crystals with High Metal Filling Factor, *Benjamin Reinhard[1], Garik Torosyan[2], Rene Beigang[1,2]; [1]Univ. of Kaiserslautern, Germany, [2]Fraunhofer Inst. for Physical Measurement Techniques IPM, Germany.* The band structure of two-dimensional photonic crystals consisting of metallic cylinders is investigated both experimentally and by numerical simulations. The crystals show large photonic band gaps in the terahertz spectral range.

JWA40
High Resolution Waveguide THz-TDS of Melamine, *S. Sree Harsha, Norman Laman, Daniel R. Grischkowsky; School of Electrical and Computer Engineering, Oklahoma State Univ., USA.* THz absorption spectra of planar ordered polycrystalline films of melamine were measured at 295 K and 77 K with linewidths considerably narrower than for conventional THz (far-infrared) spectroscopy.

JWA41
High-Temperature All-Optical Intersubband Terahertz Wave Switch, *Ines Waldmueller, Weng W. Chow, Michael C. Wanke; Sandia Natl. Labs, USA.* We propose an intersubband all-optical THz switch. Adjusting the optical control switch beam even strong THz probe signals with intensities of up to 1 MW/cm^2 can be modulated with extinction ratios of - 80 dB/mm.

JWA42
Terahertz Emission from Charge Transport in Inhomogeneous Fields, *Guillermo P. Acuna, Federico F. Buersgens, Christian H. L. Lang, Roland Kersting; LMU Univ. Munich, Germany.* We study terahertz emission due to charge transport in inhomogeneous fields of semiconductor devices. The dependence on the applied field unveils individual constituents such as intervalley transfer of electrons and the contribution of hole transport.

JWA43
Terahertz Surface Plasmon on Chirped Groove Grating, *Michael Martl, Juraj Darmo, Karl Unterrainer, Erich Gornik; Vienna Univ. of Technology, Austria.* The excitation of terahertz surface plasmon on metallized chirped groove gratings is studied in time- and frequency-domain. These gratings have a potential to launch and decouple broadband terahertz surface plasmon necessary for integrated optical circuits.

JWA44
Resonant Properties of Terahertz Metamaterials of Sub-Skin-Depth Thicknesses, *Ranjan Singh, Weili Zhang; Oklahoma State Univ., USA.* Optically thin terahertz metamaterials made from Pb split-ring resonators are investigated. The LC resonance emerges at a critical metal thickness near 0.15 skin depth and exhibits a characteristic evolution with increasing thicknesses at sub-skin-depth level.

JWA45
Temperature Dependences of the Dielectric Constants of Lower Alcohols Revealed by Terahertz Time-Domain Attenuated Total Reflection Spectroscopy, *Hiroyuki Yada, Masaya Nagai, Koichiro Tanaka; Dept. of Physics, Graduate School of Science, Kyoto Univ., Japan.* We have revealed the picosecond dynamics of lower alcohols by employing terahertz time-domain attenuated total reflection spectroscopy and have found that there exists no temperature-dependent relaxation in terahertz frequency region.

JWA • CLEO/QELS Poster Session II—Continued

JWA46
Passively Phase-Locked Multimode Semiconductor Laser: From Millimetre to Terahertz Wave Generation, *Sylwester Latkowski, Frederic Surre, Elif Degirmenci, Pascal Landais; Dublin City Univ., Ireland.* Generation of narrow microwave signals produced from the mode beating of a DBR laser is presented. The application of this process to the generation of cw-THz wave is also demonstrated using a slotted FP laser.

JWA47
Low Loss THz Fibers with Multiple Subwavelength Holes, *Alireza Hassani, Alexandre Dupuis, Maksim Skorobogatiy; Ecole Polytechnique de Montréal, Canada.* We propose the design of a THz Fiber that is composed of a polymer rod containing a hexagonal array of subwavelength air holes. A high air fraction gives an absorption loss of 0.018 1/cm.

JWA48
Wavelength Conversion by Terahertz Electro-Optic Modulation in Asymmetric Coupled Quantum Wells, *Jian-Zhong Zhang, Duncan Allsopp; Univ. of Bath, UK.* Wavelength conversion in coupled quantum wells driven by terahertz fields has been studied using a model that includes the effects of band structure, excitons and intersubband transitions. Good agreement is achieved with published experimental data.

JWA49
Terahertz Reflection Properties of Periodic Subwavelength Metallic Rectangles, *Xinchao Lu, Jiaguang Han, Weili Zhang; Oklahoma State Univ., USA.* Resonant terahertz reflection of periodic metallic rectangles is investigated. The reflection resonance, primarily attributed to dipolar localized surface plasmons, is influenced by a number of factors and is well fit by the Fano model.

JWA50
Waveguides Operating in the Restrahlen Band, *Jacob B. Khurgin[1], Greg Sun[2]; [1]Johns Hopkins Univ., USA, [2]Univ. of Massachusetts Boston, USA.* We investigate characteristics of waveguide using highly-reflective semiconductor in the restrahlen band and show advantages over both traditional dielectric waveguide and metal clad waveguides.

JWA51
Time-Domain THz Spectroscopy of Vibrational Modes in a Quasi-One-Dimensional Charge-Density-Wave Crystal, *A. Bandyopadhyay, S. L. Dexheimer; Washington State Univ., USA.* Time-domain terahertz spectroscopic studies of the quasi-one-dimensional material PtI(en) reveal a highly anisotropic complex refractive index, including a strongly polarized infrared-active phonon absorption at 2.24 THz corresponding to modulation of the charge-density-wave structure.

JWA52
Terahertz Inverse-Fourier Transform Image Synthesis, *D. H. Kang[1], M. A. Seo[1], A. J. L. Adam[2], J. W. Lee[1], P. C. M. Planken[2], D. S. Kim[1]; [1]Seoul Nat'l Univ, Republic of Korea, [2]Delft Univ. of Technology, Republic of Korea.* Starting from terahertz time-domain spectroscopy, we obtain electric field vector images at each frequency component. We then synthesize images for diffraction from a single slit for an arbitrary incident waveform by inverse Fourier-transformation.

JWA53
Tunable $SrTiO_3$/$DyScO_3$ Heterostructures for Applications in the Terahertz Range, *Petr Kužel[1], Filip Kadlec[1], Gregor Panaitov[2], Jürgen Schubert[2]; [1]Inst. of Physics, Acad. of Sciences of the Czech Republic, Czech Republic, [2]Inst. of Bio- and Nano-Systems and Ctr. of Nanoelectronics and Information Technology, Forschungszentrum Jülich GmbH, Germany.* High tunability of terahertz properties of epitaxial $SrTiO_3$/$DyScO_3$ thin film multilayers is demonstrated. An ac bias of 75 kV/cm induces a broadband 35% modulation of the transmission power around 500 GHz.

JWA54
Terahertz Field Mapping of Poynting Vectors through a One-Dimensional Grating, *M. A. Seo[1], A. J. L. Adam[2], J. H. Kang[3], D. H. Kang[1], J. W. Lee[1], Q. H. Park[3], P. C. M. Planken[2], D. S. Kim[1]; [1]Seoul Natl. Univ., Republic of Korea, [2]Univ. of Technology Delft, Netherlands, [3]Korea Univ., Republic of Korea.* We experimentally study Poynting vector flows when terahertz waves transmit through a multiple slit arrays. Our methods provide a new way of visualizing energy flows and determining different diffraction orders in the near-field.

JWA55
A High Power, Coherently Enhanced THz Source, *Yuelin Li, Yine Sun, Kwang-Je Kim; Argonne Natl. Lab, USA.* We propose a compact Smith-Purcell device can potentially generate hundreds of Watts of THz radiation, based on a train of short electron bunches from an rf photoemission gun at an energy of a few MeV.

JWA56
Dual-Band Planar Electric THz Metamaterial with Resonator Yield Analysis, *Thomas H. Hand[1], Yu Yuan[1], Sabarni Palit[1], Chris Bingham[2], Marco Rahm[1], David R. Smith[1], Willie J. Padilla[2], Nan Jokerst[1], Steven A. Cummer[1]; [1]Duke Univ., USA, [2]Boston College, USA.* THz radiation transmission through a dual-band electric metamaterial is presented, where we analyze manufacturing defects in the metamaterial. Removing different resonator percentages allows us to quantify the effects of manufacturing defects on the material response.

JWA57
Influence of Metal Permittivity on Transmission Properties of Terahertz Metamaterials, *Ranjan Singh[1], Abul K. Azad[2], Weili Zhang[1]; [1]Oklahoma State Univ., USA, [2]Los Alamos Natl. Lab, USA.* We present the effect of metal permittivity on transmission properties of double split-ring terahertz metamaterials. The measured LC resonance is enhanced with increasing imaginary permittivity of the constituent metals, showing consistence with numerical simulations.

JWA58
Complete Spectral Phase Retrieval by Modified Interferometric Field Autocorrelation Traces, *Shang-Da Yang, Shih-Lun Lin, Yong-Yuan Huang; Natl. Tsing Hua Univ., Taiwan.* We propose analytic retrieval of complete spectral phase profile by measuring two modified interferometric field autocorrelation traces using thick nonlinear crystals with slightly different central phase-matching wavelengths.

JWA59
Direct Measurement of Spectral Phase for Ultrafast Laser Pulses Based on Multi-Photon Intrapulse Interference, *Bingwei Xu, Vadim V. Lozovoy, Yves Coello, Marcos Dantus; Michigan State Univ., USA.* We present a direct measurement method of the spectral phase of ultrafast laser pulses. The second-derivative of the unknown spectral phase can be directly envisioned and extracted from the experimental 2-D-contour plot without mathematical manipulation.

JWA60
Hybrid Prism/Chirped Mirror Compressor for Multi-mJ, kHz, Sub-30 fs, CEP Stabilized Ti:Sa Laser, *Alexandre Trisorio, Lorenzo Canova, Rodrigo Lopez Martens; Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France.* We achieve pulse compression down to 24 fs with 1.1 mJ energy and full carrier-envelope phase (CEP) stabilisation at 1kHz using a compressor combining prisms and chirped mirrors.

JWA61
Coherent Pulse Injection into a Monolithic Passively Mode-Locked Laser, *Arun S. Mampazhy, Arthur Liu, Shuo-Yen Tseng, Christopher J. K. Richardson, Julius Goldhar; Univ. of Maryland, USA.* We investigate conditions for optically coherent injection locking of a monolithic mode-locked semiconductor laser. An interferometric technique is used to quantify the relationship between modal detuning, pulse shape, and optical spectrum.

JWA62
Ultrafast Laser Inscription of a Three-Dimensional Fan-Out Device for Multicore Fiber Coupling Applications, *Robert R. Thomson, Henry T. Bookey, Nicholas D. Psaila, Amanda Fender, Stuart Campbell, William N. Macpherson, James S. Barton, Derryck T. Reid, Ajoy K. Kar; School of Engineering and Physical Sciences, Heriot Watt Univ., UK.* A three-dimensional fan-out device has been fabricated using ultrafast laser inscription. The device allows each core of a multicore fibre to be addressed individually by a single mode fiber held in an FVA.

JWA63
A Windowed-Stripe Quantum-Dot Laser Structure for Self-Pulsation Generation and Lasing Dynamic Study under Femtosecond Optical Pulse Excitation, *D.-C. Wu[1,2], S.-Z. Wu[1,2], M.-H. Mao[1,2]; [1]Graduate Inst. of Electronics Engineering, Natl. Taiwan Univ., Taiwan, [2]Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan.* We demonstrated a new device structure with a central window on the quantum-dot laser stripe to generate the self-pulsation phenomenon. Furthermore, we apply the same device to study laser dynamics under femtosecond optical pulse excitation.

JWA64
Polarization Pulse Shaping of Femtosecond Laser Pulse with a Multi-Pass 2-D-SLM, *Yoshihiro Esumi, Takashi Suzuki, Hiroki Yazawa, Fumihiko Kannari; Dept. of Electronics and Electrical Engineering, Keio Univ., Japan.* We demonstrate time-dependent polarization shaping with no ambiguity of femtosecond laser pulses using a reflective-type two-dimensional spatial light modulator, which can independently control the orthogonal phase and amplitude.

JWA65
Sub-5 fs Pulse Generation in Vacuum Ultraviolet Using Four Wave Mixing in Hollow Fibers, *Ihar Babushkin, Frank Noack, Joachim Herrmann; Max-Born Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany.* We investigate the potential of four-wave mixing for VUV pulse generation in hollow waveguides with unprecedented short pulse durations and predict the generation of a 2.5fs pulse at 160nm using a 10fs, 800nm idler.

JWA66
Mode-Locked Laser Operation of a Diffusion-Bonded Yb:$KY(WO_4)_2$/$KY(WO_4)_2$ Crystal, *Simon Rivier[1], Andreas Schmidt[1], Valentin Petrov[1], Uwe Griebner[1], Andreas Gross[2], Sophie Vernay[2], Volker Wesemann[2], Daniel Rytz[2]; [1]Max-Born-Inst. for Nonlinear Optics and Short-Pulse Spectroscopy, Germany, [2]FEE GmbH, Germany.* We report the shortest pulses (62 fs) ever produced with an Yb-doped monoclinic double tungstate laser by passive mode-locking of diffusion-bonded Yb:$KY(WO_4)_2$/$KY(WO_4)_2$ achieving an average power of 182 mW at 1029 nm.

JWA67
Ultrafast Magneto-Optics Made Compact, *Mircea Vomir, Michèle Albrecht, Jean-Yves Bigot; Inst. de Physique et Chimie des Matériaux de Strasbourg, Ctr. Natl. de la Recherche Scientifique, Univ. Louis Pasteur, France.* We show that the ultrafast magnetization dynamics of magnetic materials can be investigated with a compact magneto-optical pump-probe set-up based on the use of a low power femtosecond fiber laser.

JWA68
Paper moved to CMS6

JWA69
Laser Power Locking for Improvement of Carrier-Envelope Phase Stability, *He Wang, Chengquan Li, Jason Tackett, Hiroki Mashiko, Christopher M. Nakamura, Eric Moon, Zenghu Chang; J. R. Macdonald Lab, Dept. of Physics, Kansas State Univ., USA.* The pulse energy fluctuation of a kilohertz femtosecond laser was reduced from 1.33% RMS to 0.28% RMS, which improves the carrier-envelope phase stability from 500 mrad to 200 mrad.

JWA70
50 kHz, 62μJ Femtosecond Pulse SHG at 389 nm from a Single Stage Ti:Sapphire Regenerative Amplifier, *Norihiro Inoue, Tomohiro Imahoko, Kazuya Takasago, Tetsumi Suimiyoshi; Cyber Laser Inc., Japan.* We have demonstrated the second harmonic generation with output pulses of a 50 kHz Ti:sapphire regenerative amplifier. 280 fs pulses with an average power of 3.1 W were generated at 389nm.

JWA71
Acousto-Optic Programmable Filters in Mercury Halides for Mid-Infrared Laser Pulse Shaping, *Pierre Tournois; Fastlite, Ecole Polytechnique, France.* Mercury Halides AOPDFs for direct laser pulse shaping in the Mid-Infrared are designed. Due to long wavelengths and low acoustic velocities in these materials, a new class of high resolution perpendicular diffraction devices is introduced.

JWA72
Femtosecond Pulse Shaping on Two-Color Laser Superposition Pulse Using a MEMS Micromirror SLM, *Tomoaki Abe, Ge Wang, Fumihiko Kannari; Dept. of Electronics and Electrical Engineering, Keio Univ., Japan.* We propose a nova pulse shaping scheme of two-color ω+2ω laser pulses using a MEMS Micromirror SLM. This scheme enables synchronous phase and amplitude modulation over two-color femtosecond pulses to generate asymmetric optical e-field pulses.

JWA73
Theoretical and Experimental Limits of Cavity-Dumping in Passively Mode-Locked Thin-Disk Oscillators, *Martin Siegel[1], Guido Palmer[1], Andy Steinmann[1], Matthias Pospiech[1], Uwe Morgner[1,2]; [1]Univ. of Hannover, Germany, [2]Laserzentrum Hannover, Germany.* Dynamical properties of mode-locked thin-disk lasers with cavity-dumping are studied with numerical simulations and experimental data. Limitations are identified, design criteria for future systems are deducted, and estimates of possible pulse energies given.

JWA74
The Effect (or Lack of It) of an Ultrashort Pulse's Spatial Profile on the Single-Shot Measurement of Its Temporal Profile, *Dongjoo Lee, Ziyang Wang, Xun Gu, Rick Trebino; Georgia Tech, USA.* A non-uniform spatial profile could distort single-shot pulse measurements. But, surprisingly, we show that these effects are significantly reduced by several fortuitous aspects of the GRENOUILLE technique and so usually have little effect in practice.

JWA75
Probing the $^4I_{13/2}$ Level Lifetime of Er-Ions Embedded in Ultrafast Laser Inscribed Waveguides, *Robert R. Thomson[1], Nicholas D. Psaila[1], Henry T. Bookey[1], Ajoy K. Kar[1], Nicola Chiodo[2], Roberto Osellame[2], Giulio Cerullo[2], Shaoxiong Shen[3], Animesh Jha[3]; [1]School of Engineering and Physical Sciences, Heriot Watt Univ., UK, [2]Inst. di Fotonica e Nanotechnologie del Consiglio Natl. delle Ricerche, Dept. di Fisica, Politecnico di Milano, Italy, [3]Inst. for Materials Res., Univ. of Leeds, UK.* Ultrafast laser inscription has been used to inscribe an optical waveguide in ErYb-doped glass. We demonstrate that the irradiation does not degrade the $^4I_{13/2}$ lifetime of Er-ions embedded in the modified material.

JWA76
Generation of Intense Ultra-Short Laser Pulse from Argon-Filled Hollow Waveguide Using MIIPS, *Haowen Li[1], D. Ahmasi Harris[2], Bingwei Xu[2], Paul J. Wrzesinski[2], Vadim V. Lozovoy[2], Marcos Dantus[2]; [1]BioPhotonic Solutions Inc., USA, [2]Michigan State Univ., USA.* We report a method for generation of ultra-broad bandwidth laser spectrum using self-phase modulation in the argon-filled hollow waveguide and pulse compression with multiphoton intrapulse interference phase scan technique.

JWA77
Nonlinear Optical Behavior of Ultrashort Pulses in Scattering Media, *Chris J. Lee, Willem P. Beeker, Leon Huisman, Peter J. M. van der Slot, Klaus -J. Boller; Univ. of Twente, Netherlands.* The nonlinear optical behavior of powdered systems remains difficult to model because of the spatial intensity distribution. We present a novel way to calculate time dependent second harmonic generation in powders and resulting autocorrelation signals.

JWA78
In-Line Holography for the 3-D Reconstruction of Laser Pulse Filamentation in Transparent Media, *Dimitris G. Papazoglou[1,2], Stelios Tzortzakis[1]; [1]Inst. of Electronic Structure and Laser, Foundation for Res. and Technology, Greece, [2]Materials Science and Technology Dept., Univ. of Crete, Greece.* In-line holographic microscopy is used to retrieve the 3-D distribution of the refractive index perturbation, resulting from the nonlinear propagation of 35fs IR pulses in transparent media, including the Kerr effect and plasma strings.

JWA79
Feedback-Controlled Interferometric Ultrashort Pulse Reconstruction Method, *Tae-Jung Ahn, Yongwoo Park, José Azaña; Enérgie, Matériaux et Télécommunications, Inst. Natl. de la Res. Scientifique, Canada.* We demonstrate a three-fold phase accuracy improvement in optical pulse reconstruction based on Hilbert transform temporal interferometry using a feedback-control for minimizing the phase errors associated with instabilities in the fiber-based interferometer.

JWA80
Analysis of Resolution and Feature Size in Extreme Ultraviolet Microscopy Images, *Mario C. Marconi[1], Przemyslaw W. Wachulak[1], Courtney A. Brewer[1], Fernando Brizuela[1], Randy Bartels[1], Carmen S. Menoni[1], Jorge J. Rocca[1], Erik H. Anderson[2], Weilun Chao[2]; [1]Colorado State Univ., USA, [2]Ctr. for X-Ray Optics, Lawrence Berkeley Natl. Lab, USA.* We describe a correlation algorithm that allows for the simultaneous determination of object size and resolution in images of nanoscale objects. The method was used to analyze images recorded with a 13.2 nm laser.

JWA81
Direct Pulse Compression of Yb-Doped Fiber Amplified Pulses by Use of a Dazzler, *Dimitrios N. Papadopoulos, Marc Hanna, Frederic Druon, Patrick Georges; Lab Charles Fabry de l'Inst. d'Optique, Ctr. Natl. de la Recherche Scientifique, Univ. Paris-Sud, France.* We demonstrate the generation of 56 fs, 0.23 μJ high quality pulses at 20 kHz from a stretcher-free fiber amplifier. Compression is achieved through active control of the spectral phase using an acousto-optic programmable filter.

JWA82
An Inline Automated Stokesmeter, *Alexander Heifetz, Shih C. Tseng, Selim M. Shahriar; Northwestern Univ., USA.* A Stokesmeter can be used for image segmentation, differentiation and remote sensing applications. We demonstrate an Inline Stokesmeter that is more efficient than a conventional one, and can be easily integrated with a CCD camera.

JWA83
Flexible Optical Probe for Planar Lightwave Circuits Testing, *Abdullah J. Zakariya, Tao Liu, Jose A. Martinez, Roberto R. Panepucci; Florida Intl. Univ., USA.* A flexible optical probe that accomplishes wafer-level directional coupling of light into optical waveguides is investigated optically and mechanically. Unoptimized directional coupling efficiency of 4% was achieved into an S-shaped polymer test waveguide.

JWA84
Silicon Microring Filters, *Shijun Xiao[1,2], Hao Shen[1,2], Maroof Khan[2], Minghao Qi[1,2]; [1]School of Electrical and Computer Engineering, Purdue Univ., USA, [2]Birck Nanotechnology Ctr., Purdue Univ., USA.* Detailed performance of silicon microring filters is analyzed, including amplitude, phase, bandwidth and free spectral range. With experiments and simulations, we show that unavoidable trade-off must be taken among these parameters.

JWA85
N×N All-Optical Packet Sorter, *C. C. Lee, L. F. K. Lui, P. K. A. Wai, H. Y. Tam; Hong Kong Polytechnic Univ., Hong Kong.* We experimentally demonstrated a 2×2 all-optical packet sorter which can be used as a building block for an N×N packet sorter for all-optical packet-switched network. Both the header and payload rates are 10 Gb/s.

JWA86
Slow Light Total-Internal-Reflection Optical Switch with 90-Degree Bend, *Ayumi Fuchida, Fumio Koyama; Tokyo Inst. of Technology, Japan.* We propose a novel optical switch with slowing light in Bragg reflector waveguide. Slowing light gives us large equivalent refractive index change due to its waveguide dispersion, which permits 90-degree bend of crossbar optical switches.

JWA87
Optimized Design of Flat-Band Finite-Size Coupled Resonator Optical Waveguides with Reduced In-Band Distortions, *Mohammad Soltani, Qing Li, Siva Yegnanarayanan, Ali Adibi; Georgia Tech, USA.* Silicon-on-insulator (SOI) finite-size CROWs with optimized flat-band spectrum, excellent group-delay response, and compact size are experimentally demonstrated using direct correspondence with ladder-type LC circuits. Sensitivity analysis attributes residual distortions to non-ideal fabrication rather than coupling-induced-frequency-shifts.

JWA88
Diffraction Property of Cholesteric Liquid Crystal Grating, *Wen-Chi Hung[1], Ming-Shan Tsai[2], I-Min Jiang[3], Pochi Yeh[4], Wood-Hi Cheng[1]; [1]Inst. of Electro-Optical Engineering, Natl. Sun Yat-Sen Univ., Taiwan, [2]Dept. of Applied Physics, Natl. Chiayi Univ., Taiwan, [3]Dept. of Physics, Natl. Sun Yat-Sen Univ., Taiwan, [4]Dept. of Electrical and Computer Engineering, Univ. of California at Santa Barbara, USA.* Diffraction property of cholesteric liquid crystal (CLC) grating has been theoretically and experimentally investigated. The experimental result is in good agreement with the Raman-Nath theoretical diffraction probed by a polarized beam in various polarization states.

JWA89
Improvement of Thermal Properties of Ultra-High Q Silicon Microdisk Resonators, *Mohammad Soltani, Qing Li, Siva Yegnanarayanan, Ali Adibi; Georgia Tech, USA.* Silicon-on-insulator ultra-high Q resonators with improved thermal properties are reported. A thin Si pedestal layer between microdisk and oxide increases the thermal conductivity dramatically, while Q is preserved, enabling higher field intensities in nonlinear-optical applications.

JWA90
Demonstration of a Photonic Analog-to-Digital Converter Scalable to 40 GS/s with 8-Bit Resolution, *Matthew E. Grein[1], Steven J. Spector[1], Hemonth G. Rao[1], Theodore M. Lyszczarz[1], Mike W. Geis[1], Donna M. Lennon[1], Jung Yoon[1], Robert T. Schulein[1], Anatol Khilo[2], Franz X. Kaertner[2]; [1]MIT Lincoln Lab, USA, [2]MIT, USA.* An initial system demonstration is shown for a CMOS-compatible optically sampled analog-to-digital converter with potential to achieve 40 GS/s with 8-10 effective number of bits (ENOB). Using commercial components, 7.6 ENOB has been achieved.

JWA91
Ring Resonator Induced Data Timing Skew in On-Chip WDM Optical Interconnects, *Yunchu Li[1], Lin Zhang[1], Raymond G. Beausoleil[2], Alan E. Willner[1]; [1]Univ. of Southern California, USA, [2]HP Labs, USA.* The optical data timing skew in clock synchronized optical interconnects is investigated. Up to 27 ps timing skew is induced by structure parameter variations of ring resonators, which can lead to 3.75-dB eye opening penalty.

JWA92
Ultrawideband Doublet Generation from NRZ-DPSK Signals, *Jianji Dong, Xinliang Zhang, Dexiu Huang; Wuhan Natl. Lab for Optoelectronics, Huazhong Univ. of Science and Technology, China.* We present optical ultrawideband doublet generation from NRZ-DPSK signals based on a length of SMF. The generated ultrawideband spectra using 25km SMF and 15km SMF are analyzed contrastively.

JWA93
Phase-Sensitive Amplification of Optical Signal by an SOA in a Nonlinear Sagnac Interferometer, *Yongzhang Leng, Christopher J. K. Richardson, Julius Goldhar; Lab for Physical Science and Dept. of Electronic and Computer Science, Univ. of Maryland at College Park, USA.* Phase-sensitive amplification of picosecond optical pulses was demonstrated using an SOA as the nonlinear medium inside a Sagnac interferometer with a weak control signal. Numerical simulations using a semiconductor amplifier model are consistent with experiments.

JWA94
160-Gb/s NRZ-to-PSK Conversion Using Linear Filtering in Silicon Ring Resonators, *Tong Ye[1], Yuanyuan Lu[1], Fangfei Liu[1], Qiang Li[1], Ziyang Zhang[2], Min Qiu[2], Yikai Su[1]; [1]Shanghai Jiao Tong Univ., China, [2]Royal Inst. of Technology, Sweden.* This paper proposes a scheme to achieve high-speed all-optical non-return-to-zero to phase-shift keying (NRZ-to-PSK) conversion by using the linear filtering in the silicon ring resonators. Simulation results are provided to verify the feasibility.

JWA • CLEO/QELS Poster Session II—Continued

JWA95
Influence of Group Velocity Dispersion on Phase-Preserving Amplitude Regeneration by a Nonlinear Amplifying Loop Mirror, *Klaus Sponsel[1], Kristian Cvecek[1], Christian Stephan[1], Georgy Onishchukov[1], Bernhard Schmauss[2], Gerd Leuchs[1]; [1]Inst. of Optics, Information and Photonics, Univ. of Erlangen-Nuremberg, Germany, [2]Inst. for Microwave Technology, Univ. of Erlangen-Nuremberg, Germany.* The influence of dispersion of the highly nonlinear fiber in the loop of a nonlinear amplifying loop mirror on its performance as a 2R regenerator for phase-encoded optical signals has been studied.

JWA96
Dynamic Photocurrent Analysis of *in situ* p-i-n PD Based Injection-Locking Monitor for Fabry-Perot Laser Diode Transmitter, *Yu-Sheng Liao[1], Gong-Ru Lin[2]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, [2]Graduate Inst. of Electro-Optical Engineering and Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan.* An on-line monitoring and auto-restorable scheme for injection-locking of FPLD by using an integrated monitoring photodiode to achieve auto locking restoration in 50 seconds with Q factor >7 and SMSR >35 dB at 2.5 Gbit/s.

JWA97
40 Gb/s Optical Clock Recovery Based on an Optical Parametric Oscillator with Photonic Crystal Fiber, *L. F. K. Lui[1], Ailing Zhang[1,2], P. K. A. Wai[1], H. Y. Tam[1], M. S. Demokan[1]; [1]Hong Kong Polytechnic Univ., Hong Kong, [2]School of Electronics Information and Communications Engineering, Tianjin Univ. of Technology, China.* We demonstrate a 40 Gb/s optical clock recovery based on optical parametric oscillator using a highly nonlinear photonic crystal fiber as the dynamic gain medium.

JWA98
Phase Shifted Multilevel Amplitude-Shift Keying for 100 Gb/s Ethernet Applications, *C. H. Kwok, Kenneth K. Y. Wong; Dept. of Electrical and Electronic Engineering, Univ. of Hong Kong, Hong Kong.* We propose a new modulation format for 100 Gb/s Ethernet applications. A ±49 ps/nm chromatic dispersion tolerance is achieved with a phase shifted multilevel amplitude-shift keying signal for 40 km single mode fiber transmission.

JWA99
60 GHz Millimeter-Wave Generation by Two-Mode Injection-Locked Fabry-Perot Laser Using Second-Order Sideband Injection in Radio-over-Fiber System, *Cheng Zhang, Cheng Hong, Mingjin Li, Weiwei Hu, Zhangyuan Chen; Natl. Lab on Advanced Optical Communication Systems and Networks, Peking Univ., China.* A scheme of two-mode injection-locked Fabry-Perot laser using second-order sideband injection is investigated, which can be used for 60 GHz millimeter-wave generation in radio-over-fiber system. Modulation response enhancement of Fabry-Perot lasers is also experimentally demonstrated.

JWA100
DPSK Wavelength Multicasting Using FWM with Three Unequally Spaced Pumps in a Bismuth-Oxide Highly Nonlinear Fiber, *Guo-Wei Lu, Kazi Sarwar Abedin, Tetsuya Miyazaki; Natl. Inst. of Information and Communications Technology, Japan.* We propose and experimentally demonstrate a compact 1-to-5 DPSK wavelength multicasting scheme using FWM with three unequally-spaced pumps in a 2-m-long Bi-HNLF. Power penalties are within 1.9-dB for all the converted signals.

JWA101
Chirp of Color-Free Injection-Locked Reflective Semiconductor Optical Amplifier Based Transmitter in 200GHz AWG Based WDM-PON after 25km Metropolitan Transmission, *Tzu-Kang Cheng[1], Gong-Cheng Lin[2], Hai-Lin Wang[2], Gong-Ru Lin[1]; [1]Inst. of Photonics and Optoelectronics, Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan, [2]Telecommunication Labs Advanced Technology Lab, Taiwan.* Chirp analysis of color-less RSOA transmitter with 2-3 ASE injection-locked modes for 1.25Gb/s metropolitan WDM-PON network reaching BER of 10^{-9} under receiving power below –29.5dBm and power penalty of <0.1dB after 25km transmission is demonstrated.

JWA102
All-Optical Signal Regeneration Using Optical Parametric Amplifier, *David M. F. Lai, C. H. Kwok, Kenneth K. Y. Wong; Univ. of Hong Kong, Hong Kong.* We demonstrate cross-gain modulation in an optical parametric amplifier for all-optical signal regeneration. A degraded 10-Gb/s return-to-zero signal has been successfully regenerated with a 1.3-dB receiver sensitivity improvement at 10^{-9} bit-error rate level.

JWA103
All-Optical Clock Recovery from both NRZ and NRZ-DPSK Signals at Different Bit-Rates, *Yu Yu, Xinliang Zhang, Jing Hu, Dexiu Huang; Wuhan Natl. Lab for Optoelectronics and School of Optoelectronic Science and Engineering, Huazhong Univ. of Science and Technology, China.* We propose and demonstrate all-optical clock recovery (CR) from both NRZ and NRZ-DPSK signals at different bit-rates, through simply preprocessing with single optical filter. Clock signal can be extracted successfully by cascading a CR unit.

JWA104
All-Optical Subcarrier Phase Modulation for WDM Radio-over-Fiber System, *Shangyuan Li, Yiqiao Song, Xiaoping Zheng, Hanyi Zhang, Bingkun Zhou; Tsinghua Univ., China.* Based on polarization rotation of DGD, an all-optical subcarrier phase modulation scheme for WDM radio-over-fiber system in one optical path is proposed and experimentally demonstrated. The working bandwidth is up to 2.7GHz at 20GHz carrier.

JWA105
Simultaneous Monitoring of Pulse Carving Misalignment and Phase Modulation Depth in RZ-DPSK Generation, *He Wen, Huan Jiang, Xin Chen, Xiaoping Zheng, Hanyi Zhang, Yili Guo; Tsinghua Univ., China.* A novel method to simultaneously monitoring pulse carving misalignment and phase modulation depth in RZ-DPSK generation is proposed. It is simple but effective and requires only one low-speed detector and processing circuit.

JWA106
Remote Inline All Optical Signaling and Monitoring in Passive Optical Network Scenarios by Means of Erbium Doped Fiber Amplifier Pump Modulation, *Fabio Di Vincenzo[1], Gabriella Cincotti[1], Giorgio Maria Tosi Beleffi[2], Davide Massimiliano Forin[2,3], Franco Curti[2], Antonio L. J. Teixeira[4]; [1]Univ. of Roma Tre, Italy, [2]ISCOM-Italian Communication Ministry, Italy, [3]Univ. of Tor Vergata, Italy, [4]Inst. de Telecomunicações, Univ. de Aveiro, Portugal.* In a passive optical network signalling and monitoring are very important architecture functions. The modulation of a booster amplifier laser diode pump can assist this function without corruption of downlink signals toward subscribers.

JWA107
Simultaneous Transmission of Two Channels Operating at the Same Wavelength in Standard Multimode Fibers, *Syed H. Murshid, Abhijit Chakravarty, Raka Biswas; Florida Inst. of Technology, USA.* Spatial domain multiplexing is a novel multiplexing technique providing a method to transmit multiple channels of same wavelength inside an optical fiber. Two such analog channels on optical fibers for LAN applications is reported.

JWA108
A Novel Optical Signal Monitoring Method of DPSK Signal Based on Delay Tap Sampling and Hausdorff Distance Measure, *Jian Zhao[1,2], Chao Lu[1,2], K. M. Lam[1], Z. H. Li[1,2], H. Y. Tam[2,3], P. K. A. Wai[1,2]; [1]Dept. of Electronic and Information Engineering, Hong Kong Polytechnic Univ., Hong Kong, [2]Photonics Res. Ctr., Hong Kong Polytechnic Univ., Hong Kong, [3]Dept. of Electrical Engineering, Hong Kong Polytechnic Univ., Hong Kong.* We demonstrate an optical signal monitoring method for NRZ-DPSK signals using asynchronous-delay-tap-sampling and Hausdorff-distance measure. The application of the technique for residual-dispersion-monitoring is demonstrated and high tolerance to other impairments and pulse shape is shown.

JWA109
Scale-Dependent Optical Near-Fields in InAs Quantum Dots and Their Application to Non-Pixelated Memory Architecture, *Makoto Naruse[1,2], Kazuhiro Nishibayashi[2], Tadashi Kawazoe[2], Kouichi Akahane[1], Naokatsu Yamamoto[1], Motoichi Ohtsu[2]; [1]Natl. Inst. of Information and Communications Technology, Japan, [2]Univ. of Tokyo, Japan.* We demonstrate scale-dependent near-field photoluminescence of InAs quantum dots. Our analysis, based on eigen-decomposition, leads to a novel non-pixelated memory architecture thanks to spectral diversity obtained at an optimal scale of optical near-fields.

JWA110
Ultrafast Transport in Dye Sensitized ZnO Nanotips Investigated by Terahertz Spectroscopy, *Hynek Němec[1], Jonathan Rochford[2], Olena Taratula[2], Hanhong Chen[2], Zheng Zhang[2], Yicheng Lu[2], Elena Galoppini[2], Villy Sundström[1]; [1]Lund Univ., Sweden, [2]Rutgers Univ., USA.* Transient far-infrared conductivity of as-grown and dye-sensitized ZnO nanotips is measured using time-resolved terahertz spectroscopy. We reveal that the sensitization procedure dramatically affects the transport properties of ZnO nanotips.

JWA111
Coherent Phonon Oscillations Excited by the E_{11} Transition in Micelle-Suspended Single-Walled Carbon Nanotubes, *Yong-Sik Lim[1], Jae-Geum Ahn[1], Intae Eom[2], Sohyun Park[2], Taiha Joo[2], Ki-Ju Yee[3], Erik H. Haroz[4], Layla Booshehri[4], Junichiro Kono[4]; [1]Dept. of Applied Physics, Konkuk Univ., Republic of Korea, [2]Dept. of Chemistry, POSTECH, Republic of Korea, [3]Dept. of Physics, Chungnam Univ., Republic of Korea, [4]Dept. of Electrical and Computer Engineering, Rice Univ., USA.* We report the observation of coherent phonon oscillations of RBMs excited by the E_{11} transition in isolated SWNTs. We observe stronger intensity for the $(n\text{-}m)\text{mod}3 = +1$ family than for the $(n\text{-}m)\text{mod}3 = -1$ family.

JWA112
Specular Reflection of THz Coherent Acoustic Phonons at Solid-Liquid Interfaces, *Yu-Chieh Wen[1], Yu-Ru Huang[1], Hung-Ping Chen[1], Vitalyi Gusev[2], Chi-Kuang Sun[1]; [1]Dept. of Engineering and Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, [2]Univ. du Maine, France.* We experimentally demonstrate significant reductions and spectral oscillations in THz coherent-phonon reflectivity at GaN-water interfaces. Our results indicated that the nanoscaled interfacial structures and water molecular resonances are responsible for the observed specular coupling characteristics.

JWA113
Ultrafast Rotational Wave Packet Dynamics Observed through Third Harmonic Conversion of a Femtosecond Probe Pulse, *Klaus K. Hartinger, Randy A. Bartels; Colorado State Univ., USA.* We observe rotational wave packet dynamics in CO_2 through third harmonic generation (THG). The conversion efficiency of THG is modulated by the wavepacket through ultrafast perturbations to linear and third-order optical susceptibilities.

JWA114
Optical Spin State Tomography Using Selection Rules for Photon-Spin Quantum State Transfer, *Yoshiaki Rikitake[1,2], Hiroshi Imamura[1,2], Hideo Kosaka[1,3]; [1]CREST-JST, Japan, [2]Nanotechnology Res. Inst., Natl. Inst. of Advanced Industrial Science and Technology, Japan, [3]Res. Inst. of Electrical Communication, Tohoku Univ., Japan.* We propose optical quantum state tomography for a single electron spin. The orientation of the spin in an arbitrary superposition state can be determined from the Faraday rotation measurements.

JWA • CLEO/QELS Poster Session II—Continued

JWA115
Optically Induced Spin Echoes in Rubidium Atoms: On- and Off-Resonant Manipulations of Spins, *Takeshi Moriyasu, Yuka Koyama, Toshiro Kohmoto, Yukio Fukuda; Kobe Univ., Japan.* Optically induced spin echoes are observed. Two types of spin echoes, on- and off-resonant manipulations by the control pulse, are discussed. Possibility of spin rotation around arbitrary axis by using the off-resonant manipulation is given.

JWA116
Evaluation of Density-Dependent Lifetime of 1s Paraexcitons in Cu_2O by cw Laser Based Excitonic Lyman Spectroscopy, *Kosuke Yoshioka, Takuro Ideguchi, Makoto Kuwata-Gonokami; Dept. of Applied Physics, The Univ. of Tokyo, SORST-CREST (JST), Japan.* The lifetime and the Auger coefficient for 1s paraexctons in Cu_2O from 5 K to 70 K was measured directly using excitonic Lyman spectroscopy. A possible experiment for realizing excitonic Bose-Einstein condensation is discussed.

JWA117
Enhanced Formation of Electron-Hole Droplets in Diamond by a Weak Pulse Injection, *Junko Omachi, Nobuko Naka, Kosuke Yoshioka, Makoto Kuwata-Gonokami; Univ. of Tokyo, Core Res. for Evolutional Science and Technology (CREST), Japan.* The electron-hole droplets (EHD) formation in diamond is remarkably enhanced due to the irradiation by a weak pulse hundreds of picoseconds after a stronger excitation pulse.

JWA118
Coherent Phonon Dynamics in Exciton Self-Trapping in the Strong Coupling Limit, *J. Mance, C. Hamner, S. L. Dexheimer; Washington State Univ., USA.* We probe the coupled electronic and lattice dynamics of exciton self-trapping in a strongly coupled quasi-one-dimensional system. The coherent phonon response reveals both optical and acoustic phonon contributions to the localization dynamics.

JWA119
Probing Laser-Induced Structural Changes Using Coherent Phonon Detection, *Vladimir A. Stoica, David A. Reis, Roy Clarke; Focus Ctr., Dept. of Physics, Univ. of Michigan, USA.* We find the onset of laser-induced InSb thermal dissociation using coherent optical phonon detection under asynchronous optical sampling. Additionally, laser-induced annealing of Sb thin films is monitored in photoacoustic measurements of sound velocity in real-time.

JWA120
Ultrafast Dynamics of Individual Air-Suspended Single-Walled Carbon Nanotubes, *Yee-Fang Xiao, Mark W. B. Wilson, Tam Q. Nhan, James M. Fraser; Queen's Univ., Canada.* The photoluminescnece lifetime of individual, air-suspended carbon nanotubes was measured to be 57±7 ps using femtosecond excitation correlation spectroscopy. With an excitation spot size larger than the nanotube, photoluminescence approaches a definite saturation limit.

JWA121
Ladder Operators for Optical Angular Momentum Transfer, *Hyunhee Choi, J. H. Woo, Jeong W. Wu; Ewha Womans Univ., Republic of Korea.* Ladder operators are introduced to analyze the Pancharatnam-Berry (PB) phase. Space-variant PB phase structures are identified in polarization grating and cholesteric liquid crystal. The wavefront shaping and the beam propagation direction alteration are demonstrated.

JWA122
Optical Tweezers with Resonant Particles, *M. J. Kendrick, D. H. McIntyre, O. Ostroverkhova; Dept. of Physics, Oregon State Univ., USA.* Optical tweezers are typically used on transparent dielectric particles. Particles with optical resonances would experience larger trapping forces and allow trapping of smaller particles. We present a study of increased trapping forces on such particles.

JWA123
A New Type of Surface Waves in Diffraction-Managed Optical Waveguide Arrays, *Ivan L. Garanovich, Andrey A. Sukhorukov, Yuri S. Kivshar; Nonlinear Physics Ctr., Ctr. for Ultra-High Bandwidth Devices for Optical Systems, Australian Natl. Univ., Australia.* We predict a novel type of defect-free surface waves which, in contrast to previously studied Tamm or Shockley type waves, appear in truncated but otherwise perfect arrays of coupled waveguides with periodically bent axes.

JWA124
Observation of an Intensity Dependent Minimum and Harmonic Dependent Linewidths in the High Harmonic Spectrum of Nitrogen, *Joseph P. Farrell[1,2], Brian K. McFarland[1,2], Markus Guehr[1,2], Philip H. Bucksbaum[1,2]; [1]Stanford PULSE Ctr., Stanford Univ., USA, [2]Stanford Linear Accelerator Ctr., USA.* We observe an intensity dependent minimum and harmonic dependent linewidths in the high harmonic spectrum of nitrogen. The quantum mechanical origin of these features and their relevance to molecular orbital reconstruction is discussed.

JWA125
Frequency Shifts at the Fiber-Optical Event Horizon, *Christopher E. Kuklewicz[1], Thomas G. Philbin[1,2], Scott Robertson[1], Stephen Hill[1], Friedrich König[1], Ulf Leonhardt[1]; [1]St Andrews Univ., UK, [2]Max Planck Res. Group of Optics, Information and Photonics, Germany.* Event horizons can be simulated by waves in a moving medium. Using ultrashort pulses in microstructured optical fibers, we have performed the first experimental demonstration of an artificial event horizon in optics.

JWA126
Numerical and Experimental Demonstration of a Single-Fiber Probe for Optical Trapping and Analysis, *Francesca Bragheri[1], Paolo Minzioni[1], Ilaria Cristiani[1], Carlo Liberale[2], Francesco De Angelis[2], Enzo Di Fabrizio[2]; [1]Electronics Dept., Univ. of Pavia, Italy, [2]Dept. di Medicina Sperimentale e Clinica, Univ. degli Studi Magna Graecia di Catanzaro, Italy.* We numerically analyze and experimentally show the use of an innovative fiber-tweezer based on total internal reflection. By using the realized structure, simultaneous 3-D trapping and fluorescence measurements are demonstrated.

JWA127
Synchronized Optical Spiking, *Michael Rosenbluh[1], Yaara Aviad[1], Elad Cohen[1], Lev Khaykovich[1], Wolfgang Kinzel[2], Evi Kopelowitz[1], Pinhas Yoskovits[1], Ido Kanter[1]; [1]Bar-Ilan Univ., Israel, [2]Univ. Wurzburg, Germany.* Diode laser with optical feedback can show chaotic intensity fluctuations in the form of short intensity spikes. Two such lasers can be synchronized to give identical isochronal spiking patterns.

JWA128
Parametric Amplification in Electromagnetically Induced Transparency, *Junji Okuma[1], Kenichi Harada[2], Kenji Mori[1], Nobuhito Hayashi[1], Masaharu Mitsunaga[1]; [1]Kumamoto Univ., Japan, [2]Japan Science and Technology Agency, Japan.* In an ordinary electromagnetically-induced-transparency setup in sodium vapor, we have observed a probe gain up to 15, attributable to the parametric amplification, accompanying the Stokes (or anti-Stokes) wave with similar output intensity.

JWA129
Theory and Experiment of Inhomogeneous Inter-Particle Spacing in a Dual-Beam Optical Trap, *Mitsunori Kawano, Reuven Gordon, J. Thomas Blakely; Dept. of Electrical and Computer Engineering, Univ. of Victoria, Canada.* A dynamic theory, using Maxwell's stress tensor analysis and the generalized multipole technique, is proposed to analyze inter-particle spacing in the dual-beam trap. The theory agrees well with our experiments.

JWA130
Implications of Electronic Structure for Optical Magnetism, *William M. Fisher, Samuel L. Oliveira, Stephen C. Rand; Div. of Applied Physics, Univ. of Michigan, USA.* Magnetic radiation from intense parametric scattering in different insulators exhibits the intensity dependence and saturation predicted by a simple classical theory, but growth rates vary with molecular structure.

JWA131
Enhanced Slow-Light Effect by Combining Broadband SBS System and Off-Resonance FBG, *Myungjun Lee, Ravi Pant, Mark A. Neifeld; Univ. of Arizona, USA.* We present a technique for improving the pulse-delay performance of stimulated Brillouin scattering (SBS) based slow-light system by combining it with a fiber Bragg grating (FBG) under distortion and system resource constraints.

JWA132
Coherent Control of Two-Photon Excited Fluorescence with Ultrabroadband Optical Pulses, *Masahiro Tanaka[1], Keisuke Isobe[2], Akira Suda[2], Fumihiko Kannari[1], Hiroyuki Kawano[2], Hideaki Mizuno[2], Atsushi Miyawaki[2], Katsumi Midorikawa[2]; [1]Keio Univ., Japan, [2]RIKEN, Japan.* We present that adaptive control can be applied to achieve the highest contrast ratio at the desired fluorescence intensity from a target fluorophore in the selective excitation with ultrabroadband optical pulses.

JWA133
Quantum Mechanical Description of the Dynamics of a Laser with Two Pulse/Cavity Round-Trip, *Andreas Schmitt-Sody, Ladan Arissian, Andreas Velten, Jean-Claude Diels; Dept. of Physics and Astronomy, Univ. of New Mexico, USA.* The density matrix of a two-level system interacting with a near resonant field, corresponds to the circulating intensities (diagonal elements) and the beat signal of the interfering outputs (off-diagonal element) of a ring laser.

JWA134
Raman Resonant Probe Gain and Pump Depletion in Rubidium Vapor for Simultaneous Slow and Fast Light Effects, *Gour S. Pati; Northwestern Univ., USA.* We demonstrate simultaneous slow and fast light effects using Raman resonant probe gain and pump depletion in rubidium. The use of a weak probe to produce anomalous dispersion in a pump highly simplifies metrological applications.

JWA135
Lateral Dynamics of Lattice Solitons, *Yonatan Sivan[1], Gadi Fibich[1], Boaz Ilan[2]; [1]Tel Aviv Univ., Israel, [2]Univ. of California at Merced, USA.* We derive an analytic formula for the lateral dynamics of solitons in a general inhomogeneous nonlinear media and demonstrate numerically that it can be valid for tens of diffraction lengths.

JWA136
Propelling Micro Beads with Femtosecond Light Bullets, *Nan Zhang, Zhijun Xu, Mingwei Wang, Weiwei Liu; Inst. of Modern Optics, Nankai Univ., China.* A femtosecond "light bullet" can propel a micro glass bead through laser ablation process. Theoretical analysis confirms the experimental observations and gives satisfactory explanations to the observed propulsion phenomenon.

QELS

CLEO

1:30 p.m.–3:15 p.m.
QWA • Plasmonic Devices and Waveguides
Mark Brongersma; Stanford Univ., USA, Presider

QWA1 • 1:30 p.m. Invited

Plasmonics: Chip-Based Component Devices and Metamaterials, *Harry A. Atwater; Caltech, USA.* Dispersion control and active materials integration have yielded plasmonic components including i) three-dimensional single layer plasmonic metamaterials ii) all-optical, electro-optic and MOS field effect modulation of plasmon propagation iii) plasmon-enhanced absorption in solar cells.

QWA2 • 2:00 p.m.

Deep-Subwavelength Coaxial Waveguides with a Hollow Core, *Peter B. Catrysse, Shanhui Fan; Stanford Univ., USA.* We analyze propagating plasmonic modes in deep-subwavelength coaxial metallic waveguides with a hollow core. Such modes couple to plane waves and exhibit much larger cut-off wavelengths than the TE_{11}-mode in a conventional coaxial waveguide.

1:30 p.m.–3:15 p.m.
QWB • Quantum Cryptography I
Eleni Diamanti; Inst. d'Optique, France, Presider

QWB1 • 1:30 p.m.

Entanglement-Based BBM92 QKD Experiment Using Superconducting Single Photon Detectors, *Toshimori Honjo[1,2], Sae Woo Nam[3], Hiroki Takesue[1,2], Qiang Zhang[4], Hidehiko Kamada[1], Yoshiki Nishida[5], Osamu Tadanaga[5], Masaki Asobe[5], Burm Baek[3], Robert H. Hadfield[3], Shigehito Miki[6], Mikio Fujiwara[6], Masahide Sasaki[6], Zhen Wang[6], Kyo Inoue[1,2,7], Yoshihisa Yamamoto[4,8]; [1]NTT Basic Res. Labs, Japan, [2]CREST, Japan Science and Technology Agency, Japan, [3]NIST, USA, [4]Stanford Univ., USA, [5]NTT Photonics Labs, Japan, [6]Natl. Inst. of Information and Communication Technology, Japan, [7]Osaka Univ., Japan, [8]Natl. Inst. of Informatics, Japan.* We report an entanglement-based BBM92 quantum key distribution experiment using superconducting single photon detectors. A 16-kbit sifted key with a quantum bit error rate of 6.9 % was successfully generated after 100 km fiber transmission.

QWB2 • 1:45 p.m.

A Portable QKD System Based on Entanglement, *Hannes Huebel[1], Andreas Poppe[2], Michael Hentschel[1], Anton Zeilinger[1,3]; [1]Univ. of Vienna, Austria, [2]Austrian Res. Ctr.s GmbH, Austria, [3]Austrian Acad. of Sciences, Austria.* We demonstrate a fully functioning and portable QKD system based on polarisation entanglement for long time usage. We further show the distribution of secure keys a rate of 1kbit/s over 25km for 24 hours.

QWB3 • 2:00 p.m.

Experimental Study of a Quantum Channel from a LEO Satellite to the Earth, *Paolo Villoresi[1], Thomas Jennewein[2], Fabrizio Tamburini[3], Markus Aspelmeyer[3,4], Cristian Bonato[1], Rupert Ursin[4], Claudio Pernechele[5], Vincenza Luceri[6], Giuseppe Bianco[7], Anton Zeilinger[2,4], Cesare Barbieri[3]; [1]Dept. of Information Engineering, Univ. of Padova, Italy, [2]Inst. for Quantum Optics and Quantum Information (IQOQI), Austrian Acad. of Sciences, Austria, [3]Dept. of Astronomy, Univ. of Padova, Italy, [4]Inst. für Experimentalphysik, Univ. Wien, Austria, [5]INAF, Italy, [6]e-GEOS-Ctr. di Geodesia Spaziale "G. Colombo", Italy, [7]Ctr. di Geodesia Spaziale, Italy.* The single-photon exchange between a satellite and an Earth-based station has been investigated using satellite-laser-ranging retroreflectors in orbit. A return rate of 5 photons-per-second was measured from satellite Ajisai at 1650 km from the observer.

1:30 p.m.–3:15 p.m.
CWA • Ultrafast Spectroscopy and Dynamics
Antoinette J. Taylor; Los Alamos Natl. Lab, USA, Presider

CWA1 • 1:30 p.m.

Ultrafast Probing of the Complex Refractive Index in an Active Mid Infrared Quantum Cascade Laser, *Wolfgang Parz[1], Thomas Müller[1], Max Austerer[1], Gottfried Strasser[1], Karl Unterrainer[1], Luke R. Wilson[2], John W. Cockburn[2], Andrey B. Krysa[3], John S. Roberts[3]; [1]Inst. of Photonics and Ctr. for MicroNanostructures, Vienna Univ. of Technology, Austria, [2]Dept. of Physics and Astronomy, Univ. of Sheffield, UK, [3]Natl. Ctr. for III-V Technologies, Dept. of Electronic and Electrical Engineering, Univ. of Sheffield, UK.* Time domain spectroscopy of broadband mid-infrared pulses transmitted through a quantum cascade laser cavity, reveals the complex refractive index and derivatives. We also monitor the response above threshold to study gain depletion and decoherence effects.

CWA2 • 1:45 p.m.

Nonlinear Phase Response of a Saturable Bragg Reflector for Modulation Depth Control, *Dominik Pudo, Hyunil Byun, Juliet Gopinath, Gale S. Petrich, Erich P. Ippen, Franz X. Kärtner, Leslie A. Kolodziejski; MIT, USA.* We demonstrate an interferometric configuration comprising a saturable Bragg reflector for phase-to-amplitude response conversion. Its static nonlinear phase response is determined and used to obtain tunable nonlinear amplitude depth modulation.

CWA3 • 2:00 p.m.

Time-Resolved Carrier Dynamics and the Quantum Confined Stark Effect in a Bilayer Quantum Dot Waveguide at 1340nm, *David B. Malins[1], Alvaro Gomez-Iglesias[1], Alan Miller[1], Peter Spencer[2], Edmund Clarke[2], Raymond Murray[2], Michael Flatte[3], Craig Pryor[3]; [1]School of Phyiscs and Astronomy, Univ. of St. Andrews, UK, [2]Dept. of Phyiscs, Imperial College, UK, [3]Dept. of Phyiscs and Astronomy, Univ. of Iowa, USA.* Quantum confined Stark effect and pump probe measurements are reported for the first time in a bilayer quantum dot waveguide at 1340nm, showing a shift of 40nm and ultrafast absorption recovery of 5ps.

1:30 p.m.–3:15 p.m.
CWB • Coherent Combining and Harmonic Generation of High-Power Fiber Lasers
Gregory Goodno; Northrop Grumman Space Technology, USA, Presider

CWB1 • 1:30 p.m.

Efficient Conversion of Light from Sparse Laser Arrays into Single-Lobed Far-Fields Using Phase Structures, *Mercedeh Khajavikhan, James R. Leger; Univ. of Minnesota, USA.* We demonstrate a new optical technique that converts light from a sparse array of mutually coherent sources into a single-lobed far-field with theoretical efficiency approaching 100%. Initial experimental results show 82% conversion efficiency.

CWB2 • 1:45 p.m.

All-Fiber Coherent Combining of Er-Doped Fiber Amplifiers by Active Resonantly Induced Refractive Index Control in Yb-Doped Fiber, *Andrei Fotiadi[1,2], Nikita G. Zakharov[1,3,4], Oleg L. Antipov[4], Patrice Mégret[1]; [1]Faculté Polytechnique de Mons, Belgium, [2]Ioffe Physico-Technical Inst., Russian Acad. of Sciences, Russian Federation, [3]State Univ. of Nizhny Novgorod, Russian Federation, [4]Inst. of Applied Physics, Russian Acad. of Sciences, Russian Federation.* We report on all-fiber coherent combining of 1.55μm Er-doped single mode amplifiers achieved by means of active phase control that specifically employs the refractive index changes in Yb-doped fiber induced by 980nm laser diode.

CWB3 • 2:00 p.m.

Fiber Laser Array Passively Phase Locked in a Ring Cavity, *Jerome Lhermite, Agnes Desfarges-Berthelemot, Vincent Kermene, Alain Barthelemy; XLIM, Unite Mixte de Recherche, Ctr. Natl. de la Recherche Scientifique, France.* We report on the passive phase-locking of an array of four fiber amplifiers in a ring cavity. The feedback loop is a single mode fiber that performs an intracavity filtering of the far field pattern.

QELS

JOINT

CLEO

1:30 p.m.–3:15 p.m.
QWC • Exciton and Spin Control in Quantum Dots
Presider to Be Announced

QWC1 • 1:30 p.m. Invited

Observation of Non Resonant Coupling of Single Quantum Dots to Photonic Crystal Nanocavity Modes, *Michael Kaniber, Arne Laucht, Andre Naumann, Felix Hofbauer, Jakob Angele, Max Bichler, Markus C. Amann, Jonathan Finley; Walter Schottky Inst., Germany.* We study single photon generation from quantum dots coupled to a photonic crystal nanocavity. Photon correlations are observed for detunings of 12meV indicating the presence of a remote optical coupling mechanism.

QWC2 • 2:00 p.m.

On-Resonant Trion Rabi Oscillations and Spin Quantum Beats in a Singly Charged InAs Quantum Dot, *Erik D. Kim[1], Katherine Smirl[1], Yanwen Wu[1], Alberto Amo[1], Xiaodong Xu[1], Duncan G. Steel[1], Allan S. Bracker[2], Daniel Gammon[2], Lu J. Sham[3]; [1]Univ. of Michigan, USA, [2]NRL, USA, [3]Univ. of California at San Diego, USA.* We demonstrate, to our knowledge, the first coherent transient measurements of a single self-assembled InAs quantum dot charged with a single electron. The measurements show both trion Rabi oscillations and spin quantum beats.

1:30 p.m.–3:15 p.m.
JWB • Intense Laser Interactions with Solids and Clusters
John Nees; Univ. of Michigan, USA, Presider

JWB1 • 1:30 p.m.

Characterization of Cluster/Monomer Ratio in Pulsed Supersonic Gas Jets, *Xiaohui Gao, Bonggu Shim, Michael C. Downer; Dept. of Physics, Univ. of Texas at Austin, USA.* Combining frequency-domain interferometry with transverse interferometry and Rayleigh scatter, we completely characterize all parameters—cluster mass fraction, total atomic density and average cluster size—that influence high-intensity laser interactions with clustering gas jets.

JWB2 • 1:45 p.m.

Observation of Hot Electron Beams in Intense Laser-Solid Interactions Characterized with Coherent Transition Radiation, *Byoung-ick Cho[1], Jens Osterholz[2], Aaron C. Bernstein[1], Gilliss M. Dyer[1], Todd Ditmire[1]; [1]Univ. of Texas at Austin, USA, [2]Heinrich-Heine-Univ., Germany.* Coherent transition radiation was observed from aluminum foils irradiated by an ultra-intense laser. Comparison of experiments and theoretical calculations indicated two streams of hot electron micro-pulses were generated by resonance absorption and j×B heating.

JWB3 • 2:00 p.m.

Relativistic Electron Jets from Laser-Solid Interactions at Kilohertz Repetition Rate, *Aghapi G. Mordovanakis[1], James Easter[1], Paul-Edouard Masson-Laborde[2], Bixue Hou[1], Gerard Mourou[3], Karl Krushelnick[1], Wojciech Rozmus[2], John Nees[1]; [1]Ctr. for Ultrafast Optical Science, Univ. of Michigan, USA, [2]Dept. of Physics, Univ. of Alberta, Canada, [3]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France.* Relativistic electron jets with energies up to 1.4MeV are observed from the interaction of kHz laser pulses with SiO_2 at $2x10^{18}W/cm^2$. The scaling of electron temperature with intensity is also presented for Al plasma.

1:30 p.m.–3:15 p.m.
JWC • Joint CLEO/QELS Symposium on Nonlinear Microscopy and Spectroscopy in Biology I
Seok-Hyun (Andy) Yun; Harvard Univ., USA, Presider

JWC1 • 1:30 p.m. Invited

New Nonlinear Signatures in Spectroscopy and Imaging, *Warren S. Warren, Martin Fischer, Dan Fu, Tong Ye, Ivan Piletic, Thomas Matthews; Duke Univ., USA.* Ultrafast laser pulse shaping makes it possible to observe nonlinear signatures, such as self phase modulation and sum frequency absorption, at safe laser powers for tissue. Neuronal activation and melanoma diagnosis are two early targets.

JWC2 • 2:00 p.m. Invited

Coherent Anti-Stokes Raman Scattering Microscopy, *Ji-Xin Cheng[1,2]; [1]Weldon School of Biomedical Engineering, Purdue Univ., USA, [2]Dept. of Chemistry, Purdue Univ., USA.* Laser-scanning coherent anti-Stokes Raman scattering (CARS) microscopy is ready for biomedical applications. Initial works have shown its great potential in the study of cancer, multiple sclerosis and cardiovascular diseases.

1:30 p.m.–3:15 p.m.
CWC • Other Topics in Nonlinear Optics
Majid Ebrahim-Zadeh; ICFO, Spain, Presider

CWC1 • 1:30 p.m.

Electro-Optic Reconfiguration of Quasi-Phase Matching in a Dammann Domain Grating for WDM Applications, *Adrián J. Torregrosa, Haroldo Maestre, Carlos R. Fernández-Pousa, Juan Capmany; Univ. Miguel Hernandez, Spain.* We have investigated electro-optic reconfiguration of quasi-phase matching in microstructured lithium niobate crystals patterned with a Damann domain disitribution. The number of possible WDM conversion channels in a same physical device can be considerably enhanced.

CWC2 • 1:45 p.m.

Nonperturbative Detection of Microwave Radiation Using Fiber Attached Electro-Optic Sensors, *Anthony Garzarella, Dong Ho Wu; NRL, USA.* Tests are described using fiber-attached, all-dielectric EO field sensors for the noninvasive detection of microwave fields generated by horn antennas and GTEM cell.

CWC3 • 2:00 p.m.

Beat-Wave-Seeded, Pulsed Optical Parametric Amplifier, *Yen-Chieh Huang, Tsong-Dong Wang, Wei-Chen Cheng; Natl. Tsinghua Univ., Taiwan.* We show in simulation and experiment the generation of comb-like sidebands and compressed pulses from a beat-wave-seeded optical parametric amplifier. Under suitable group-velocity mismatch, 50-fold pulse compression can be achieved for the output laser pulse.

CLEO

1:30 p.m.–3:15 p.m.
CWD • Semiconductor Disk Lasers
Martin Dawson; Univ. of Strathclyde, Inst. of Optics, UK, Presider

CWD1 • 1:30 p.m.
Short-Wavelength GaInNAs Semiconductor Disk Lasers, *Stephane Calvez[1], Jennifer E. Hastie[1], Sharon L. Vetter[1], Martin D. Dawson[1], Ville-Markus Korpijarvi[2], Janne Puustinen[2], Mircea Guina[2], Oleg Okhotnikov[2], Markus Pessa[2]; [1]Inst. of Photonics, Univ. of Strathclyde, UK, [2]Optoelectronics Res. Ctr., Tampere Univ. of Technology, Finland.* We report a GaInNAs/GaAs semiconductor disk laser with fundamental emission in the 1150-1200nm waveband, allowing frequency-doubled operation to the yellow/orange. Output power was 1W at 1197nm with a slope efficiency of 23%.

CWD2 • 1:45 p.m.
Monolithic Integration of Pump Lasers and a Vertical External Cavity Surface Emitting Laser (VECSEL), *Stefan Illek, Peter Brick, Wolfgang Diehl, Michael Furitsch, Hans Lindberg, Ines Pietzonka; OSRAM Opto Semiconductors, Germany.* Integration of optically-pumped VECSELs with pump lasers is demonstrated using an innovative contacting scheme. Devices for medium-power green conversion (λ~1060nm) are fabricated with threshold currents as low as 160mA and cw output powers exceeding 100mW.

CWD3 • 2:00 p.m.
Efficiency and Beam Quality Analysis of a Semiconductor Disk Laser, *Peter Roth, Alexander J. Maclean, Alan J. Kemp, Stephane Calvez, Martin D. Dawson, David Burns; Inst. of Photonics, Univ. of Strathclyde, UK.* The slope efficiency of semiconductor disk lasers is seen to be reduced at high output coupling. Careful adjustment of the cavity and pump mode sizes is also necessary for high efficiency and good beam quality.

1:30 p.m.–3:15 p.m.
CWE • CLEO Symposium on Light Filaments and Light Propagation in Atmosphere
Patrick K. Rambo; Sandia Natl. Labs, USA, Presider

CWE1 • 1:30 p.m. Invited
What Is a Filament and Why Is It So Interesting? *See Leang Chin; Laval Univ., Canada.* The full evolution of a filament is explored experimentally and numerically and a standardized definition is proposed. This is followed by discussing challenges in filamentation nonlinear optics and remote sensing of chem-bio agents.

CWE2 • 2:00 p.m.
A Strobed Liquid Spatial Light Modulator for Ultraintense Laser Pulses—Application to Filamentation Control, *Philipp Rohwetter, Manuel Queißer, Kamil Stelmaszczyk, Martin Fechner, Ludger Wöste; Freie Univ. Berlin, Germany.* We have implemented and tested a reflective spatial light modulator capable of patterning the far field intensity distribution of an intense pulsed laser beam, leading to spatially regularized multiple filamentation in air.

1:30 p.m.–3:00 p.m.
CWF • Detectors
Makoto Naruse; Natl. Inst. of Information and Communications Technology, Japan, Presider

CWF1 • 1:30 p.m. Invited
Geiger-Mode Avalanche Photodiode Arrays for Near-Infrared Single-Photon Detection, *Alex McIntosh; MIT Lincoln Lab, USA.* This paper will present a description of the state-of-the-art for Geiger-mode avalanche photodiode focal planes developed at Lincoln Lab for 1-1.5 μm wavelength laser radar and laser communications applications in photon-starved scenarios.

CWF2 • 2:00 p.m.
Geiger-Mode Quad-Cell Array for Adaptive Optics, *Brian F. Aull[1], Matthew J. Renzi[1], Andrew H. Loomis[1], Douglas J. Young[1], Bradley J. Felton[1], Thomas A. Lind[1], David M. Craig[1], Robert L. Johnson[2]; [1]MIT Lincoln Lab, USA, [2]Starfire Optical Range, AFRL, USA.* We report Shack-Hartmann wavefront sensors using arrays of high-fill-factor Geiger-mode quad cells hybridized to digital CMOS counting circuits. The absence of readout noise facilitates fast wavefront sensing at low light levels.

1:30 p.m.–3:00 p.m.
CWG • Ferroelectric-Based Nonlinear Optical Materials
Sunao Kurimura; Natl. Inst. for Materials Science, Japan, Presider

CWG1 • 1:30 p.m.
Mg-Doped Congruent $LiTaO_3$ Crystal for Large-Aperture Quasi-Phase Matching Device, *Hideki Ishizuki, Takunori Taira; Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan.* The first OPO experiment using a periodically poled Mg-doped congruent $LiTaO_3$ device was demonstrated. The dependence of OPO output wavelength on the period of quasi-phase matching structure could be characterized.

CWG2 • 1:45 p.m.
Ultra-Broadband Optical Parametric Generation in Periodically Poled Lithium Niobate and Stoichiometric Lithium Tantalate Crystals, *Hwan-Hong Lim[1], Om Prakash[1], Byoung Joo Kim[1], Krishnamoorthy Pandiyan[1], Myoungsik Cha[1], Bum Ku Rhee[2], Sunao Kurimura[3]; [1]Pusan Natl. Univ., Republic of Korea, [2]Sogang Univ., Republic of Korea, [3]Natl. Inst. for Material Science, Japan.* We report ultra-broad optical parametric gain spectra centered at near infrared in periodically poled congruent $LiNbO_3$ and stoichiometric $LiTaO_3$ crystals, using group-velocity matching near the degeneracy point. They can be useful for ultrafast pulse applications.

CWG3 • 2:00 p.m.
UV Laser Radiation Inhibits Domain Inversion in Lithium Niobate, *Sakellaris Mailis[1], Alistair C. Muir[1], Yongjun J. Ying[1], Collin L. Sones[1], Robert W. Eason[1,2], Tobias Jungk[2], Akos Hoffmann[2], Elisabeth Soergel[2]; [1]Optoelectronics Res. Ctr., Univ. of Southampton, UK, [2]Inst. of Physics Univ. of Bonn, Germany.* Continuous wave UV laser (λ=244 nm) irradiation of the +z face of lithium niobate single crystals inhibits ferroelectric domain inversion in the volume of the crystal which lies immediately below the UV exposed surface.

CLEO

PhAST

1:30 p.m.–3:15 p.m.
CWH • Photonic Crystal Filters and Buffers
Marin Soljacic; MIT, USA, Presider

CWH1 • 1:30 p.m. **Tutorial**
Toward Photonic Crystal Optical Buffer, *Toshihiko Baba[1,2]; [1]Yokohama Natl. Univ., Japan, [2]Core Res. for Evolutional Science and Technology, Japan Science and Technology Agency, Japan.* Potential and possibility of a photonic crystal optical buffer are discussed, and some recent advances are presented. A wideband dispersion-free tunable delay is experimentally demonstrated using SOI chirped photonic crystal coupled waveguides.

Toshihiko Baba received his Ph.D. Degree from Yokohama National University in 1990. He became a full professor at this university in 2005. He has studied ARROW waveguides, VCSELs, micro/nano-lasers, photonic crystals and Si photonics. He is a member of IEEE/LEOS and OSA and received the 2006-2007 LEOS Distinguished Lecturer Award.

1:15 p.m.–3:15 p.m.
PWA • Lasers in Manufacturing I
Friedhelm Dorsch; TRUMPF Photonics, Inc., USA, Presider

PWA1 • 1:15 p.m. **Invited**
Laser Applications in Manufacturing at Daimler AG, *Berthold Hopf; Daimler AG, Germany.* Daimler AG has established Laser Applications in manufacturing since many years. Lasers are used in the production of powertrain components as well as in the body shop. Today there are laserapplications worldwide in the different Daimler plants. Recently, there was the introduction of the remote laser welding technology (RobScan) for the new Mercedes-Benz C-Class.

PWA2 • 1:45 p.m. **Invited**
Lasers Change the Transportation Industry, *Holger Schlueter; TRUMPF Inc., USA.* The success of high-power laser technology in the conservative transportation industry is based on the maintenance concepts, decade long experience in multi-kW fiber delivery and understanding of the thermally induced optical effects in the beam delivery optics. All these technologies have been developed over the last decade and while they were not in the focus of the technological discussion of the multi-KW DPSSL beam source they are critical in the commercial success of the technology. Examples of successful industrial implementations of this system approach towards laser material processing are presented.

1:15 p.m.–3:15 p.m.
PWB • Lasers in Manufacturing II
Mikhail Bervas; SPI Lasers, UK, Presider

PWB1 • 1:15 p.m. **Invited**
Scaling Down of Stereolithography Processes—Bridging Several Orders of Magnitude, *Andreas Ostendorf, Rainer King; Laser Zentrum Hannover e.V., Germany.* Stereolithography is a well-established technology in rapid prototyping. There have been many efforts to decrease the structure sizes in order to make use of the powerful advantages in microsystems technology, e.g. for medical implants or MOEMS. By using modern ps and fs laser systems in the UV and IR regime it is possible to generate smallest structure sizes down to a few microns or by using 2-photon-polymerization it is even possible to write volume pixels with minimal dimension of 100 nm. Also the use of tailored polymer materials is an important factor to overcome existing barriers.

PWB2 • 1:45 p.m. **Invited**
A Review of New Laser Processes in Semiconductor Manufacturing, *Edward Swenson, Jeffrey A. Albelo; Electro Scientific Industries, Inc., USA.* The nostalgic and the novel will be reviewed, from laser activation of redundant DRAM and Flash, to the micromachining of interconnect, to the latest developments in Through Si Vias (TSV). A wide array of process improvements has been realized through judicious choices of laser source, pulse shape, pulse duration, and wavelength. In each application, robust processes have been enabled or improved, which have led to a significant economic impetus for further investigation and commercialization.

1:15 p.m.–3:15 p.m.
PWC • Organic LEDs for Low Power Displays
Ghassan Jabbour; Arizona State Univ., USA, Presider

PWC1 • 1:15 p.m. **Invited**
Market Context for OLED-Based Displays, *Phil Wright; OIDA, USA.*

PWC2 • 1:35 p.m. **Invited**
OLED Display Segments, *Steve Y. G. Mo; Samsung, Republic of Korea.*

PWC3 • 1:55 p.m. **Invited**
Solutions-Based Processing of OLEDs, *Daniel LeCloux; Dupont, USA.*

QELS

QWA • Plasmonic Devices and Waveguides—Continued

QWA3 • 2:15 p.m.
Deep Sub-Wavelength Confinement in Metal-Dielectric Multilayers, *Guy Bartal, Geoffroy Lerosey, Yongmin Liu, Dentcho A. Genov, Xiang Zhang; Univ. of California at Berkeley, USA.* We present linear and nonlinear deep sub-wavelength confinement in Metal-dielectric periodic nanostructures. The strong anisotropy supports the propagation of modes with very large transverse momentum, enabling confinement size limited only by the structure periodicity.

QWA4 • 2:30 p.m.
Crosstalk between Three-Dimensional Plasmonic Slot Waveguides, *Georgios Veronis, Shanhui Fan; Stanford Univ., USA.* We investigate in detail the crosstalk between three-dimensional plasmonic slot waveguides. We show that, with appropriate design, the crosstalk between such waveguides can be greatly reduced, without significantly affecting their modal size and attenuation length.

QWA5 • 2:45 p.m.
Leaky and Bound Modes of Finite Planar Metal-Insulator-Metal Plasmonic Waveguides, *Jing Chen, Gennady A. Smolyakov, Kevin J. Malloy; Ctr. for High Technology Materials, Univ. of New Mexico, USA.* Consideration of finite planar metal-insulator-metal plasmonic waveguides reveals bound and leaky modes with a spectral gap between them. Antenna mode formed in the leaky radiation region offers both free-space coupling mechanisms and beam steering devices.

QWA6 • 3:00 p.m.
Fabrication of Channel and Wedge Plasmon Polaritin Devices by Combined UV and Nanoimprint Lithography, *Rasmus B. Nielsen[1], Alexandra Boltasseva[1], Anders Kristensen[1], Sergey I. Bozhevolnyi[2], Valentyn Volkov[2], Irene Fernandez-Cuesta[3], Anna Klukowska[4]; [1]Technical Univ. of Denmark, Denmark, [2]Aalborg Univ., Denmark, [3]Inst. de Microelectrónica de Barcelona, Spain, [4]Micro Resist Technology Gmbh, Germany.* We present a large-scale compatible fabrication method for channel and wedge plasmon polariton waveguides. Optical characterization of fabricated devices using SNOM shows sub-wavelength confinement and propagation lengths in the hundreds of microns.

QWB • Quantum Cryptography I—Continued

QWB4 • 2:15 p.m.
Detection-Time-Bin-Shift Polarization Encoding Quantum Key Distribution System, *Lijun Ma, Tiejun Chang, Xiao Tang; NIST, USA.* Detection-time-bin-shift scheme for polarization encoding QKD is proposed. This scheme reduces cost and overcomes the security loss caused by dead-time and unbalanced characteristics of detectors. This scheme is experimentally demonstrated with the B92 protocol.

QWB5 • 2:30 p.m.
Polarization Independent DPS-QKD System Using Up-Conversion Detectors, *Yuki Iwai[1,2], Toshimori Honjo[2,3], Kyo Inoue[1,2,3], Hidehiko Kamada[3], Yoshiki Nishida[4], Osamu Tadanaga[4], Masaki Asobe[4]; [1]Osaka Univ., Japan, [2]CREST, Japan Science and Technology Agency, Japan, [3]NTT Basic Res. Labs, Japan, [4]NTT Photonics Labs, Japan.* We report a differential phase shift quantum key distribution experiment using up-conversion detectors. Though the detectors had polarization dependency, we were able to make the system polarization-independent by using polarization modulation.

QWB6 • 2:45 p.m.
Differential-Phase-Shift Quantum Key Distribution Utilizing Decoy Pulses, *Kyo Inoue[1,2,3], Keigo Hosokawa[1,3], Yuita Noguchi[1,3], Shusaku Hayashi[1,3]; [1]Osaka Univ., Japan, [2]NTT Basic Res. Labs, Japan, [3]CREST, Japan Science and Technology Agency (JST), Japan.* A differential-phase-shift quantum key distribution scheme utilizing decoy pulses is proposed. Alice sends a coherent pulse train that occasionally includes high-level decoy pulses. Eavesdropping is revealed from photon counting rates around the decoy pulses.

QWB7 • 3:00 p.m.
Robust Decoy-State Quantum Key Distribution with Heralded Single Photon Source, *Qin Wang[1,2], Wei Chen[2], Guilherme Xavier[1], Marcin Swillo[1], Sébastien Sauge[1], Maria Tengner[1], Tao Zhang[2], Zheng-Fu Han[2], Guang-Can Guo[2], Anders Karlsson[1]; [1]Dept. of Microelectronic and Applied Physics KTH, Royal Inst. of Technology, Sweden, [2]Dept. of Physics, Key Lab of Quantum Information, Chinese Acad. of Sciences, Univ. of Science and Technology of China, China.* We have experimentally demonstrated a decoy-state quantum key distribution scheme with a heralded single-photon source based on parametric down-conversion. What we used is a one-way BB84 protocol with a four-state and one-detector phase-coding scheme.

CLEO

CWA • Ultrafast Spectroscopy and Dynamics—Continued

CWA4 • 2:15 p.m.
Impulsive Alignment of Hot, Centrifugally Distorted Molecules, *Douglas W. Broege[1], Ryan N. Coffee[2], Phil H. Bucksbaum[1,2]; [1]Stanford Univ., USA, [2]Stanford Linear Accelerator Ctr., USA.* We achieve impulsive alignment in a 400K sample of diatomic iodine. Polarization measurements of rotational wave-packet revivals reveal dispersed oscillatory structures. These structures are due to centrifugal distortion resulting from the high temperature.

CWA5 • 2:30 p.m.
Sub-5-fs Real-Time Spectroscopy of Transition States in Bacteriorhodopsin during Retinal Isomerization, *Takayoshi Kobayashi[1,2,3,4], Atsushi Yabushita[3]; [1]Ultrashort Pulse Laser Project, Intl. Cooperative Res. Project, Japan Science and Technology Agency, Japan, [2]Univ. of Electro-Communications, Japan, [3]Natl. Chiao Tung Univ., Taiwan, [4]Osaka Univ., Japan.* The C=C stretching mode of bacteriorhodopsin was modulated by torsion of the C_{13}=C_{14} double bond with a period of 200 fs. The real-time data elucidates the relations among the real-time torsion angle, bond order.

CWA6 • 2:45 p.m. Invited
Nanoscale Heat Transport Probed with Soft-X-Rays, *Mark Siemens[1], Qing Li[2], Margaret Murnane[2], Henry Kapteyn[2], Ronggui Yang[2], Keith Nelson[3]; [1]JILA, USA, [2]Univ. of Colorado, USA, [3]MIT, USA.* We characterize heat transport in nanostructures, using coherent soft-x-rays to probe thermal surface deformation. By varying the substrate temperature, we observe the transition from diffusive to quasi-ballistic heat transport regimes.

CWB • Coherent Combining and Harmonic Generation of High-Power Fiber Lasers—Continued

CWB4 • 2:15 p.m.
Impact of Modal Interference on the Output Beam Properties of Large-Core Cladding-Pumped Fiber Amplifiers, *Jaclyn S. P. Chan, Pu Wang, Jayanta K. Sahu, William A. Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* Modal interference in few-moded large-core fiber amplifiers can yield output beams with good beam quality (M^2~1.2 - 1.4) giving the impression of single-mode operation despite significant higher-order mode content. Implications for high-power devices are discussed.

CWB5 • 2:30 p.m.
Yellow Frequency-Doubled Self-Heated Yb Fiber Laser, *Vladislav V. Dvoyrin, Valery M. Mashinsky, Oleg I. Medvedkov, Evgeny M. Dianov; Fiber Optics Res. Ctr., Russian Acad. of Sciences, Russian Federation.* 1160 nm Yb fiber laser with 55% efficiency was realized. ASE was suppressed due to self-heating of the active fiber during lasing. Laser power of 9.1 W was converted to 860 mW at 580 nm.

CWB6 • 2:45 p.m.
Harmonics Generation from Rod-Type Yb Doped Fiber Laser, *Ramatou Bello Doua[1,2], François Salin[1], Eric Freysz[3]; [1]Eolite, France, [2]Alphanov, France, [3]Univ. Bordeaux 1, France.* We presents a compact diode pumped, Q-switched Yb doped rod-type fiber laser producing near diffraction limited frequency doubled and tripled beams with a conversion efficiency of respectively 62% and 38%.

CWB7 • 3:00 p.m.
Dynamics of Harmonic Generation in Highly Nonlinear Silica Nanowires, *Goëry Genty[1], Bertrand Kibler[2], Paul Kinsler[3], John M. Dudley[2]; [1]Tampere Univ. of Technology, Finland, [2]Inst. Franche-Comté Electronique Mécanique Thermique et Optique-Sciences et Technologies, Univ. de Franche-Comté, France, [3]Blackett Lab, Imperial College London, UK.* We numerically investigate non phasematched third harmonic generation induced by few cycle pulses in highly nonlinear fused silica nanowires. We study in particular the spectral amplitude dependence on pump pulse parameters and carrier envelope phase.

3:15 p.m.–4:45 p.m., Coffee Break (ends at 3:45 p.m.) **and Exhibit-Only Time,** *Exhibit Hall*

QWC • Exciton and Spin Control in Quantum Dots—Continued

QWC3 • 2:15 p.m.
Sequential Preparation, Optical Control and Detection of Single Quantum Dot Hole Spin, *Andrew J. Ramsay, Stephen J. Boyle, Roman S. Kolodka, Hui-Yun Liu, A. Mark Fox, Maurice S. Skolnick; Univ. of Sheffield, UK.* We demonstrate a Rabi rotation of the positive trion, which is conditional on the initial spin state. We use photocurrent detection to make picosecond time-resolved measurements of the single quantum dot spin.

QWC4 • 2:30 p.m.
Transient Electromagnetically Induced Transparency in InGaAs Quantum Dots, *Saulius Marcinkevičius[1], Alexander Gusterov[2], Johann Peter Reithmaier[2]; [1]Royal Inst. of Technology, Sweden, [2]Kassel Univ., Germany.* Electromagnetically induced transparency (EIT) based on exciton spin transitions is observed in InGaAs quantum dots. Inhomogeneous broadening of the quantum dot ensemble, detrimental for EIT, is effectively reduced by using spectrally narrow pulses.

QWC5 • 2:45 p.m.
InGaAs Quantum Dot Population and Polarisation Dynamics for Ultrafast Pulse Train Amplification, *Jordi Gomis-Bresco[1], Sabine Dommers[1], Vasily V. Temnov[1], Ulrike K. Woggon[1], Matthias Laemmlin[2], Dieter Bimberg[2], Ermin Malic[2], Martin Richter[2], Eckehard Schöll[2], Andreas Knorr[2]; [1]Univ. of Dortmund, Germany, [2]Technische Univ. Berlin, Germany.* The ultrafast population and polarisation dynamics in electrically pumped InGaAs QDs is studied experimentally and theoretically. Limits for ultrafast pulse train amplification with THz repetition rates at high, electrically-injected, non-equilibrium carrier densities are discussed.

QWC6 • 3:00 p.m.
Tuning Exchange Interaction in Colloidal Nanocrystals, *Stefan Rohrmoser[1], Andrei Susha[2], Andrey Rogach[2], Dmitri Talapin[3], Horst Weller[4], Richard Harley[1], Pavlos Lagoudakis[1]; [1]Univ. of Southampton, UK, [2]Ludwig-Maximilians-Univ. München, Germany, [3]Univ. of Chicago, USA, [4]Univ. Hamburg, Germany.* We tune the exchange interaction in nanocrystals by manipulating the electron-hole wavefunction overlap under external electric fields and simultaneously probe the electronic structure and rich transient dynamics under strong magnetic fields (8T).

JWB • Intense Laser Interactions with Solids and Clusters—Continued

JWB4 • 2:15 p.m. Invited
High Order Harmonic Generation in High Intensity Laser-Solid Interactions, *Fabien Quéré[1], C. Thaury[1], H. George[1], J. P. Geindre[2], A. Lévy[1], T. Ceccotti[1], P. Monot[1], R. Marjoribanks[3], P. Audebert[2], Ph. Martin[1]; [1]Commissariat à l'Energie Atomique, DSM/DRECAM, CEN Saclay, France, [2]Lab pour l'Utilisation des Lasers Intenses, Ctr. Natl. de la Recherche Scientifique, Ecole Polytechnique, France, [3]Dept. of Physics and Inst. for Optical Sciences, Univ. of Toronto, Canada.* We will discuss the two mechanisms involved in high-order harmonic generation from plasma mirrors, and show that they can be clearly identified experimentally. The phase and coherence properties of these harmonics will be analyzed.

JWB5 • 2:45 p.m.
Photoionized Plasmas Created by Soft X-Ray Laser Irradiation of Solid Targets, *Mark Berrill, Fernando Brizuela, Benjamin Langdon, Herman Bravo, Carmen Menoni, Jorge J. Rocca; Colorado State Univ., USA.* We report the first experimental study of plasmas created by photoionization of solid targets with focused soft x-ray laser light. The plasma properties are dominantly determined by material absorption, in agreement with model simulations.

JWB6 • 3:00 p.m.
Theory and Experiment in Ultraintense Laser-Matter Interaction in Nanostructured Ni-Nanowire Target, *Robin Marjoribanks[1], Marina Servol[1,2], Ludovic Lecherbourg[1], Paul Forrester[1], Hart Levy[1], Luke McKinney[1], Brett Teeple[1], Yves Candela[1,3], Jean-Claude Kieffer[2], Simon Le Moal[1,4], Gábor Kulcsàr[1], John Sipe[1], Patrick Audebert[5], Jean-Paul Geindre[5], Anne Héron[6], Jean-Claude Adam[6]; [1]Univ. of Toronto, Canada, [2]Inst. Natl. de la Recherche Scientifique – Énergie, Matériaux et Télécommunications, Canada, [3]Inst. d'Optique, France, [4]École des Mines, France, [5]Lab pour l'Utilisation des Lasers Intenses (LULI), CEA/CEA/Ctr. Natl. de la Recherche Scientifique, Ecole Polytechnique, France, [6]Ctr. de Physique Théorique (CPhT), CEA/CEA/Ctr. Natl. de la Recherche Scientifique, Ecole Polytechnique, France.* Nickel nanowires present >90% absorption in an effective skin-depth ~1 μm, making efficient x-ray converters. We present new theoretical and experimental results for intensities from small-signal up to very clean relativistic pulses.

JWC • Joint CLEO/QELS Symposium on Nonlinear Microscopy and Spectroscopy in Biology I—Continued

JWC3 • 2:30 p.m.
Two-Photon Fluorescence Correlation Spectroscopy through a Dual-Clad Optical Fiber, *Yu-Chung Chang[1], Jing Yong Ye[1,2], James R. Baker Jr.[2], Theodore B. Norris[1,2]; [1]Ctr. for Ultrafast Optical Science, Univ. of Michigan, USA, [2]Michigan Nanotechnology Inst. for Medicine and Biological Sciences, Univ. of Michigan, USA.* We report the use of a dual-clad fiber for two-photon excited fluorescence correlation spectroscopy. The ability to detect nanoparticles has been demonstrated. This technique shows the potential of conducing FCS measurements *in vivo*.

JWC4 • 2:45 p.m.
Real-Time Blood Analysis Using Coherent Anti-Stokes Raman Scattering, *Arthur Dogariu[1], Alexander Goltsov[1], Marlan O. Scully[1,2]; [1]Princeton Univ., USA, [2]Texas A&M Univ., USA.* We demonstrate a real-time method of blood analysis. Using a novel coherent Raman technique we record the vibrational spectrum from picoliters of whole blood in milliseconds. This method will allow real-time, *in vivo*, blood monitoring.

JWC5 • 3:00 p.m.
Swept-Wavelength Optical Resonance-Raman Device (SWOrRD) for Detection of Chemicals and Microorganisms, *Jacob Grun[1], Charles K. Manka[2], Sergei Nikitin[2], Gelu Comansecu[2], Daniel Zabetakis[1], David Gillis[1], Jeffrey Bowles[1]; [1]NRL, USA, [2]Res. Support Instruments, USA.* Detection of microorganisms and chemicals using multi-wavelength resonance-Raman spectroscopy is described. Combined with a proper algorithm, this technique may lead to contactless sensor, capable of real-time detection of biological and chemical threats in complex environments.

CWC • Other Topics in Nonlinear Optics—Continued

CWC4 • 2:15 p.m. Invited
Ultrafast Carrier Dynamics in Semiconductor Nanowires, *Rohit P. Prasankumar[1], S. G. Choi[1], G. T. Wang[2], S. T. Picraux[1], A. J. Taylor[1]; [1]Los Alamos Natl. Lab, USA, [2]Sandia Natl. Labs, USA.* Ultrafast wavelength-tunable optical measurements on semiconductor nanowires allow us to independently probe the dynamics of electrons, holes and defect states. These investigations reveal the influence of two-dimensional confinement on carrier dynamics in these nanosystems.

CWC5 • 2:45 p.m.
Detection of Process-Dependent Changes in the $Hf_{(1-x)}Si_xO_2$/Si (100) Barrier Heights by Second Harmonic Generation, *Jimmy M. Price[1,2], Y. Q. An[1], M. C. Downer[1]; [1]Univ. of Texas at Austin, USA, [2]SEMATECH, USA.* We measure barrier heights of silicon/high-k dielectric structures, and their changes with processing, by identifying a photon-energy-dependent threshold for internal hole photoemission using spectroscopic time-dependent second-harmonic generation.

CWC6 • 3:00 p.m.
Noncollinear Mirrorless Optical Parametric Oscillator, *Valdas Pasiskevicius, Gustav Strömqvist, Carlota Canalias; Royal Inst. of Technology, Sweden.* The first demonstration of self-established noncollinear operation in the idler-counter-propagating mirrorless optical parametric oscillator is presented using periodically poled $KTiOPO_4$ having 800 nm period. The noncollinear geometry is employed for enhanced output wavelength tuning.

3:15 p.m.–4:45 p.m., Coffee Break (ends at 3:45 p.m.) **and Exhibit-Only Time,** *Exhibit Hall*

CWD • Semiconductor Disk Lasers—Continued

CWD4 • 2:15 p.m.
5W Mid-IR Optically Pumped Semiconductor Disk Laser, *John-Mark Hopkins[1], Nils Hempler[1], Benno Rösener[2], Nicola Schulz[2], Marcel Rattunde[2], Christian Manz[2], Klaus Koehler[2], Joachim Wagner[2], David Burns[1]; [1]Inst. of Photonics, Univ. of Strathclyde, UK, [2]Fraunhofer Inst. for Applied Solid State Physics, Germany.* We report multi-watt, TEM_{00} emission from a 2µm Sb-based optically-pumped semiconductor disk laser utilising an intra-cavity diamond heatspreader for thermal management. An output power of 5W and a wide tunability of over 160nm are achieved.

CWD5 • 2:30 p.m.
Characterisation of an InAs Quantum Dot Semiconductor Disk Laser, *Peter Schlosser[1], Stephane Calvez[1], Jennifer E. Hastie[1], Shirong Jin[1], Tim D. Germann[2], André Strittmatter[2], Udo W. Pohl[2], Dieter Bimberg[2], Martin D. Dawson[1]; [1]Inst. of Photonics, Univ. of Strathclyde, UK, [2]Technische Univ. Berlin, Germany.* We report the performance of a 1030nm semiconductor disk laser with gain region consisting of multiple sub-monolayers of InAs/GaAs quantum dots. Maximum output power of 512mW was achieved with 20% slope efficiency.

CWD6 • 2:45 p.m.
Spectrotemporal Gain Bandwidth Measurement in an InGaAs/GaAsP Quantum Well Vertical-External-Cavity Surface-Emitting Semiconductor Laser, *Anne Tropper[1], Sjoerd Hoogland[2], Arnaud Garnache[3], Keith G. Wilcox[1], Zakaria Mihoubi[1], Stephen Elsmere[1], Adrian Quarterman[1]; [1]Univ. of Southampton, UK, [2]Univ. of Toronto, Canada, [3]Univ. of Montpellier, France.* Analysis of spectral condensation in a VECSEL with a near-antiresonant gain structure incorporating InGaAs/GaAsP quantum wells emitting around 1030 nm shows the effective FWHM gain bandwidth of this laser to be 32 nm.

CWD7 • 3:00 p.m.
Experimental Realization of a Diffractive Unstable Resonator with Gaussian Outcoupled Beam Using a VECSEL Amplifier, *Hans-Christoph Eckstein, Uwe Detlef Zeitner; Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We experimentally realized a diffractive unstable laser resonator with a Gaussian shaped outcoupled beam. The structured mirror is assembled with a VECSEL which produces a high beam quality even for the highest amplifier gain.

CWE • CLEO Symposium on Light Filaments and Light Propagation in Atmosphere—Continued

CWE3 • 2:15 p.m. Invited
Filamentation with Ultraviolet Pulses, *Jean-Claude Diels, Alejandro Aceves, Xiaozhen Xu, Alexey Sukhinin, Oliver Chalus, Alain Bourdier; Univ. of New Mexico, USA.* Filamentation in air with ultraviolet pulses is reviewed. Channels of considerably more energy than in the visible/near infrared can be generated.

CWE4 • 2:45 p.m. Invited
Filament Induced Electric Events in Thunderstorms, *Jean-Pierre Wolf; GAP, Univ. of Genève, France.* Following positive laboratory-scale experiments, we investigated the ability to trigger real-scale lightning using ionized filaments generated by ultrashort laser pulses in the atmosphere. Under thunderstorm conditions, we observed electric events synchronized with the laser pulses.

CWF • Detectors—Continued

CWF3 • 2:15 p.m.
Highly Efficient, Ultra Low Dark Current Germanium Photodetectors Integrated on Submicron Silicon Waveguides, *Long Chen, Po Dong, Michal Lipson; School of Electrical and Computer Engineering, Cornell Univ., USA.* We demonstrate germanium photodetectors integrated on submicron silicon waveguides by low-temperature bonding and ion-cut. The devices show very low dark current of ~100 nA, fiber-accessed responsivity of 0.44 A/W, and quantum efficiency of > 90%.

CWF4 • 2:30 p.m.
Slab-Coupled Optical Waveguide Photodiode, *Shannon M. Madison, Jason J. Plant, Douglas C. Oakley, David C. Chapman, Antonio Napoleone, Paul W. Juodawlkis; MIT Lincoln Lab, USA.* We report the first high-current photodiode based on slab-coupled optical waveguide concept. The device has large mode (5.8x7.6µm) and ultra-low optical confinement (gamma~0.05%), allowing 2mm absorption length. The maximum photocurrent was 250mA (R=0.8A/W) at 1.55µm.

CWF5 • 2:45 p.m.
Investigation of Bandwidth Limitations in Separate Absorption, Charge and Multiplication (SACM) Avalanche Photodiodes (APD), *Hektor T. J. Meier, Bernd Witzigmann; Eidgenössische Technische Hochschule Zurich, Switzerland.* Bandwidth limitations of SACM-APDs are investigated using an energy balance transport model. A methodology to improve device performance based on the analysis of internal device currents is presented.

CWG • Ferroelectric-Based Nonlinear Optical Materials—Continued

CWG4 • 2:15 p.m.
Origin of Thermal Dephasing in CW SHG in Mg:SLT, *Sergey Tovstonog, Sunao Kurimura; Natl. Inst. for Materials Science, Japan.* We investigated the properties of single-pass second-harmonic generation of CW 542 nm radiation with high efficiency by QPM in Mg:SLT. Heat generation turned out to be directly related to green light absorption in the material.

CWG5 • 2:30 p.m.
Second-Harmonic Generation in Periodically Poled Lithium Tantalate Crystal Fiber, *Shan-Chuang Pei[1,2], De-Hao Sun[1], Chia-Hsiang Hsu[1], Tuan-Shu Ho[1], Fu-Jen Kao[3], Sheng-Lung Huang[1,4], A. H. Kung[2]; [1]Inst. of of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, [2]Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan, [3]Inst. of Biophotonics Engineering, Natl. Yang-Ming Univ., Taiwan, [4]Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan.* The fabrication of PPLT single crystal fibers by the LHPG method were achieved with *in-situ* monitoring of transient poling current. The whole cross section of fiber is poled through as seen from the confocal measurement.

CWG6 • 2:45 p.m.
Second Harmonic Generation in Single-Crystal Thin Membranes of $LiNbO_3$ Fabricated By Patterned He^+ Ion Implantation, *Ophir Gaathon[1], Avishai Ofan[1], Djordje Djukic[1], Jerry Dadap[1], Richard M. Osgood[1], Sasha Bakhru[2], Hassaram Bakhru[2]; [1]Columbia Univ., USA, [2]State Univ. of New York at Albany, USA.* We demonstrate room-temperature phase matching of second-harmonic generation by waveguide dispersion (WGD) in 3-µm-thick $LiNbO_3$ membranes. The membranes were made using patterned deep-ion-implantation-guided etching.

3:15 p.m.–4:45 p.m., Coffee Break (ends at 3:45 p.m.) **and Exhibit-Only Time,** *Exhibit Hall*

CWH • Photonic Crystal Filters and Buffers—Continued

CWH2 • 2:30 p.m.
Active Switching of Light in Silicon Based Self Collimating Photonic Crystals, *Timothy Hodson, C. Chen, A. Sharkawy, Dennis Prather; Univ. of Delaware, USA.* We design and characterize a photonic crystal (PhC) based silicon electro-optic modulator.

CWH3 • 2:45 p.m.
Slow Pulse Propagation in Long Photonic Crystal Coupled Cavity Waveguides, *Eiichi Kuramochi[1,2], Takasumi Tanabe[1,2], Hideaki Taniyama[1,2], Masaya Notomi[1,2]; [1]NTT Basic Res. Labs, NTT Corp., Japan, [2]CREST-JST, Japan.* A pulse delay corresponding to a slow group velocity of ~0.008c was observed in a low-loss coupled cavity waveguide formed by 60 photonic crystal nanocavities whose intrinsic *Q* was as high as 10^6.

CWH4 • 3:00 p.m.
Photonic Crystal Optical Limiting Filter, *Fuchyi Yang, Gary Yen, Brian T. Cunningham; Univ. of Illinois at Urbana Champaign, USA.* An optically tunable narrowband reflectance filter is fabricated on a plastic substrate over large surface areas using nanoreplica molding. The reflection peak wavelength was tuned ~25 nm using an optically active azobenzene liquid crystal film.

PWA • Lasers in Manufacturing I—Continued

PWA3 • 2:15 p.m. Invited
Lasers Illuminate the Future of Heavy Industry, *Ed Hansen; ESAB, USA.* Over the last several decades, lasers have found wide-spread acceptance in cutting applications throughout manufacturing. Recently, the emergence of high power solid-state lasers has enabled the development of practical laser welding systems for heavy industrial applications.

PWA4 • 2:45 p.m. Invited
High-Brightness Laser Beam Delivery Systems, *Roman Niedrig; HIGHYAG, Germany.* The performance of laser beam delivery systems is substantially ruled by the properties of the contained optical systems. For high brightness lasers, the laser power induced focus shift gains in importance. The correlations between the focus shift and basic optical parameters give rise to new guidelines for the design of beam delivery systems with improved performance.

PWB • Lasers in Manufacturing II—Continued

PWB3 • 2:15 p.m. Invited
Extreme UV High Resolution Microscopy, *Iain T. McKinnie; Kapteyn Murnane Labs, USA.* Kapteyn Murnane Laboratories (KMLabs) is a leading manufacturer of high average power and short pulse ultrafast lasers. We have recently introduced a new product, the WyvernTM: a fully-integrated ultrafast laser with unique operating specifications, including high repetition rates > 100kHz with high per-pulse energy, that will enable a new range of applications in micromachining, bio and nano-imaging, and chemical and materials spectroscopy. Amongst the most exciting of these will be the use of this class of laser to generate highly-coherent extreme-UV light for nanoscale imaging, patterning and metrology. The briefing will discuss the huge potential impact of this EUV light source, with near-term emphasis on high-resolution microscopy.

PWB4 • 2:45 p.m. Invited
Laser Processes Applied to High Volume Inkjet Manufacturing, *Richard Oram; Hewlett-Packard, USA.* This presentation will give insight to the many applications in where lasers are used at HP and especially where laser processes have been applied to microscale technologies where wafer level laser micromachining or surface processing of silicon, glass, and other materials are crucial steps to realize the potential of new products or their development. The unique advantages of laser micromachining are currently applied towards the thermal ink jet fabrication process within HP along with many other micromachining applications. For these applications, laser offers advantages over competing technologies by providing lower cost of ownership, reduced greenhouse gas emissions and simpler, more flexible photolithography-less process.

PWC • Organic LEDs for Low Power Displays—Continued

PWC4 • 2:15 p.m. Invited
Low Cost AMOLED Backplanes, *Arokia Nathan; Ignis, UK*

PWC5 • 2:35 p.m. Invited
Market and Financial Trends in Thin-Film Solar, *Kevin Cammack; U.S. Display Consortium, USA.*

PWC6 • 2:55 p.m.
PANEL: What Is the Roadmap for OLED Display Segments, Efficiencies, Winning Niches?

3:15 p.m.–4:45 p.m., Coffee Break (ends at 3:45 p.m.) **and Exhibit-Only Time,** *Exhibit Hall*

QELS

4:45 p.m.–6:30 p.m.
QWD • Fundamental and Novel Phenomena
Robert W. Boyd; Univ. of Rochester, USA, Presider

QWD1 • 4:45 p.m.
Fiber Optical Analogue of the Event Horizon, *Friedrich E. Koenig[1], Thomas G. Philbin[1,2], Christopher E. Kuklewicz[1], Scott Robertson[1], Stephen Hill[1], Ulf Leonhardt[1]; [1]School of Physics and Astronomy, Univ. of St. Andrews, UK, [2]Max Planck Res. Group of Optics, Information and Photonics, Germany.* We present a realistic scheme for an artificial event horizon in optics with ultrashort pulses in microstructured fibers that can probe the quantum effects of horizons, particularly Hawking radiation. We also show experimental progress.

QWD2 • 5:00 p.m.
Optical Solitons in *PT* Periodic Potentials, *Konstantinos Makris[1], Rami El-Ganainy[1], Demetrios Christodoulides[1], Ziad Musslimani[2]; [1]College of Optics, CREOL, USA, [2]Florida State Univ., USA.* We investigate the effect of nonlinearity in novel parity-time (*PT*) symmetric potentials. We show that new types of nonlinear self-trapped modes can exist in optical *PT* synthetic lattices.

QWD3 • 5:15 p.m. Invited
Parametric Origin of Optical Magnetism, *Samuel L. Oliveira[1], William M. Fisher[2], Stephen C. Rand[2]; [1]Univ. of Michigan, USA, [2]Div. of Applied Physics, Univ. of Michigan, USA.* Intense magnetic scattering in insulators is shown to be a second order process, depending on the product of optical electric and magnetic fields. Quantitative agreement (no free parameters) is achieved with saturated magnetic response.

4:45 p.m.–6:30 p.m.
QWE • Quantum Cryptography II
Benjamin J. Eggleton; Univ. of Sydney, Australia, Presider

QWE1 • 4:45 p.m.
Excess Noise Control in Gaussian-Modulated Coherent State Quantum Key Distribution System, *Bing Qi[1,2], Lei-Lei Huang[1,2], Yue-Meng Chi[1,2], Li Qian[1,2], Hoi-Kwong Lo[1,2,3]; [1]Ctr. for Quantum Information and Quantum Control (CQIQC), Univ. of Toronto, Canada, [2]Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada, [3]Dept. of Physics, Univ. of Toronto, Canada.* A novel polarization-frequency-multiplexing scheme is implemented to suppress noise in a fiber-based Gaussian-modulated coherent-state quantum key distribution system. The achievable secrete key rate is 0.30bit/pulse with a 5km-fiber and 0.05bit/pulse with a 20km-fiber.

QWE2 • 5:00 p.m.
Quantum Key Distribution over 25 km Using a Fiber Setup Based on Continuous Variables, *Simon Fossier[1,2], J. Lodewyck[1,2], E. Diamanti[2], M. Bloch[3], T. Debuisschert[1], R. Tualle-Brouri[2], P. Grangier[2]; [1]Thales Res. and Technology, France, [2]Lab Charles Fabry de l'Inst. d'Optique, France, [3]GeorgiaTech, France.* We describe a complete continuous variable quantum key distribution setup, reaching more than 2 kbit/s over 25 km. Time-multiplexing is used, and reconciliation is performed using fast and efficient LDPC error correcting codes.

QWE3 • 5:15 p.m.
Secure Optical Communications Using Anti-squeezed Light with Enhanced Fluctuations, *Tatsuya Tomaru, Shinya Sasaki; Hitachi Ltd., Japan.* Secure optical communications using antisqueezing are a realistic application of quantum information technologies. Antisqueezed light with enhanced fluctuations was transmitted over 100 km. Greater difficulty of eavesdropping than in a coherent-state case was shown.

QWE4 • 5:30 p.m. Invited
Experimental Demonstration of Continuous Variable Entanglement Distillation, *Ruifang Dong[1], Mikael Lassen[1,2], Christoph Marquardt[1], Radim Filip[1,3], Ulrik L. Andersen[1,2], Gerd Leuchs[1]; [1]Inst. for Optics, Information and Photonics, Univ. Erlangen-Nürnberg, Germany, [2]Technical Univ. of Denmark, Denmark, [3]Palacky Univ., Czech Republic.* We experimentally demonstrate distillation of continuous variable entanglement through an attenuating quantum channel and filter out a highly entangled state from a less non-entangled mixed state.

CLEO

4:45 p.m.–6:30 p.m.
CWI • Nonlinear Propagation and Generation
Anatoly Efimov; Los Alamos Natl. Lab, USA, Presider

CWI1 • 4:45 p.m.
Pulse Delay and Speed-Up of Ultra Fast Pulses in an Absorbing Quantum Well Medium, *Per L. Hansen, Mike van der Poel, Kresten Yvind, Jesper Mørk; Technical Univ. of Denmark, Denmark.* Slow down and speed-up of 180 fs pulses in an absorbing semiconductor beyond the existing models is observed. Cascading gain and absorbing sections give us significant temporal pulse shifting at almost constant output pulse energy.

CWI2 • 5:00 p.m.
Chirped-Pulse Slow and Fast Light in SOA with a Record Delay-Bandwidth Product of 10.7, *Forrest G. Sedgwick, Bala Pesala, Connie J. Chang-Hasnain; Univ. of California at Berkeley, USA.* A delay-bandwidth product of 10.7 is achieved using ultra-fast intraband nonlinearities in semiconductor optical amplifiers to generate fast light. A novel chirped-pulse scheme enhances the fast light effect and generates delays in addition to advance.

CWI3 • 5:15 p.m.
Optimized Supercontinuum Generation and Pulse Self-Compression in Filaments from the UV to the IR, *Christoph P. Hauri[1], Luat T. Vuong[2], Alex L. Gaeta[2]; [1]Paul Scherrer Inst., Switzerland, [2]School of Applied and Engineering Physics, Cornell Univ., USA.* We investigate supercontinuum generation produced by circularly polarized femtosecond filaments in argon for broadband self-compression. A comparison with linear polarization indicates greater beam pointing stability and extended supercontinuum generation due to varied spatial-temporal characteristics.

CWI4 • 5:30 p.m.
Absolute Phase Measurement for Broadband Collinear Raman Generation, *Andrea M. Burzo, Alexei V. Sokolov; Texas A&M Univ., USA.* We use collinear Raman generation in cooled hydrogen and obtain a wide comb of equidistant frequencies spanning over an octave of bandwidth. We adjust the frequencies to be commensurate and observe an f-to-2f interference.

4:45 p.m.–6:30 p.m.
CWJ • Parametric Amplifiers and Oscillators
Jean Toulouse; Lehigh Univ., USA, Presider

CWJ1 • 4:45 p.m. Tutorial
Fiber-Optic Parametric Amplifiers—Properties, Applications and Challenges, *Magnus Karlsson; Chalmers Univ. of Technology, Sweden.* This tutorial reviews the basic theory, properties and applications of fiber-based parametric amplifiers.

Magnus Karlsson received his Ph.D. in Electromagnetic Field Theory in 1994 from Chalmers University of Technology, Sweden. He has been with the Photonics Laboratory at Chalmers since 2003 as a professor in photonics. He has published around 80 scientific papers and 70 conference contributions in the areas of nonlinear optics and fiber optic communications, and serves on the technical committees for OFC and APOC.

QELS

4:45 p.m.–6:30 p.m.
QWF • Quantum Dots and Quantum Wells
Takashi Yatsui; Japan Science and Technology Agency, Japan, Presider

QWF1 • 4:45 p.m.
Plasmonic Nanocavity for Interaction with Colloidal Quantum Dots, *Yiyang Gong, Jelena Vučković; Stanford Univ., USA.* We propose to use low group velocity modes on a surface plasmon grating to mediate emission from colloidal quantum dots. We demonstrate the modification of emission wavelength and coupling as the grating periodicity is changed.

QWF2 • 5:00 p.m.
Role of Electron-Phonon Scattering on Single-Quantum-Dot Vacuum Rabi Splitting in a Photonic-Crystal Nanocavity, *Stephen Hughes[1], F. Milde[2], A. Knorr[2]; [1]Queen's Univ., Canada, [2]Technical Univ. Berlin, Germany.* We study the influence of electron-phonon scattering on the optical properties of a single-quantum-dot embedded within a planar photonic-crystal nanocavity. Regimes of strong coupling and side-coupled light transmission are explored as a function of temperature.

QWF3 • 5:15 p.m.
On the "Quantum Nature of a Strongly Coupled Single Quantum Dot-Cavity System", *Stephen Hughes; Queen's Univ., Canada.* Recent measurements on the unique quantum nature of a single-quantum-dot strongly coupled to a photonic-crystal nanocavity highlight two apparent mysteries. Here we introduce and exploit a quantized medium-dependent theory to help explain these mysteries.

QWF4 • 5:30 p.m.
Multiplying Photocurrent by Utilising Non-Radiative Energy Transfer in Hybrid Nanocrystal/Patterned Quantum Well Structures, *Soontorn Chanyawadee[1], Richard T. Harley[1], Mohamed Henini[2], Pavlos Lagoudakis[1]; [1]Univ. of Southampton, UK, [2]Univ. of Nottingham, UK.* We design, fabricate and demonstrate a hybrid nanocrystal/patterned p-i-n device that utilises fluorescence energy transfer and exhibits a three-fold increase of the measured photocurrent compared to its bare p-i-n counterpart.

JOINT

4:45 p.m.–6:30 p.m.
JWD • Intense Lasers and Laser Molecular Interactions
Katsumi Midorikawa; RIKEN, Japan, Presider

JWD1 • 4:45 p.m.
Single-Shot, Space- and Time-Resolved Measurement of Rotational Wavepacket Revivals in H_2 and D_2, *Yu-hsin Chen, Sanjay Varma, Howard M. Milchberg; Inst. for Res. in Electronics and Applied Physics, Univ. of Maryland, USA.* Femtosecond laser induced hydrogen and deuterium molecules alignment and periodic recurrences are measured in a single shot for the first time, using single-shot supercontinuum spectral interferometry. An analytical model of rotational wavepacket revivals is derived.

JWD2 • 5:00 p.m.
Strong-Field Induced Vibrational Coherence in the Ground Electronic State of Hot I_2, *Li Fang, George N. Gibson; Univ. of Connecticut, USA.* We observe large amplitude coherent vibrations in ground state neutral I_2 created by strong-field ionization, through "Lochfrass," or "R-selective ionization." Simulations show that the vibrational coherence is stronger for hot molecules than for cold molecules.

JWD3 • 5:15 p.m.
Broadband Terahertz Lasing in Aligned Molecules, *Andrew G. York, Howard M. Milchberg; Inst. for Res. in Electronics and Applied Physics, Univ. of Maryland, USA.* No broadband lasing medium like Ti:Saph has been demonstrated yet for terahertz radiation. We show that laser-aligned molecules can amplify broadband terahertz radiation, allowing high-energy chirped-pulse amplification at terahertz frequencies.

JWD4 • 5:30 p.m.
Intense Field Ionization of Methane, Ethane, Butane and Octane: Transition from Molecular to Atomic Response, *Sasikumar Palaniyappan, Robert Mitchell, Robert Sauer, Isaac Ghebregziabher, Samantha White, Anthony DiChiara, Matthew DeCamp, Barry C. Walker; Univ. of Delaware, USA.* Ion yields of C^{+n} (n<6) from methane, ethane, butane and octane are measured from 10^{13}W/cm^2 to 10^{19}W/cm^2, with photoelectron spectra up to 0.5 MeV. As one reaches 10^{17} W/cm^2 the molecular response becomes atomic-like.

4:45 p.m.–6:30 p.m.
JWE • Joint CLEO/QELS Symposium on Nonlinear Microscopy and Spectroscopy in Biology II
Alberto Bilenca; Harvard Medical School, USA, Presider

JWE1 • 4:45 p.m. Invited
Mid-IR Pulse Shaping for Enhanced 2-D IR Spectroscopy, *Sang-Hee Shim, David B. Strasfeld, Yun L. Ling, Martin T. Zanni; Univ. of Wisconsin at Madison, USA.* This presentation covers new advances in automating 2-D IR spectroscopy using a novel mid-IR pulse shaper. This shaper permits extremely rapid collection of highly accurate 2-D IR spectra. Applications to membrane peptides will be presented.

JWE2 • 5:15 p.m. Invited
Femtosecond Broadband Stimulated Raman Spectroscopy, *Richard A. Mathies; Univ. of California at Berkeley, USA.* Femtosecond Stimulated Raman Spectroscopy is a new time-resolved vibrational technique that enables the recording of high resolution (10-20 cm^{-1}) vibrational spectra of dynamic and reactive chemical and biological systems with < 50 fs time resolution.

CLEO

4:45 p.m.–6:30 p.m.
CWK • Pulse Shaping
Jean-Claude Diels; Univ. of New Mexico, USA, Presider

CWK1 • 4:45 p.m.
All-Optical Oscillator Based on a Single Bistable Vertical-Cavity Semiconductor Optical Amplifier (VCSOA), *Haijiang Zhang[1], Christopher F. Marki[1,2], Matthias Gross[1], Pengyue Wen[1,3], Sadik Esener[1]; [1]Univ. of California at San Diego, USA, [2]Marki Microwave Inc., USA, [3]Avago Technologies US Inc., USA.* A novel all-optical oscillator is demonstrated for the first time by employing a cascadable VCSOA inverter in a closed optical loop, which generates a self-sustained square-like waveform with ~80ps switching time and 5:1 extinction ratio.

CWK2 • 5:00 p.m.
Initial Development of Supercontinuum in Fibers with Anomalous Dispersion Pumped by Nanosecond-Long Pulses, *Nikolai Korneev[1], Evgeny A. Kuzin[1], Baldemar Ibarra-Escamilla[1], Migel Bello-Jiménez[1], Ariel Flores-Rosas[1], Olivier Pottiez[2]; [1]Inst. Natl. de Astrofisica, Optica y Electrónica, Mexico, [2]Ctr. de Investigaciones en Optica, Mexico.* We propose a simple two-stage model of supercontinuum formation for nanosecond-long pulse. First the sea of solitons is formed, then the spectrum is broadened by Raman interaction. We found a good correspondence with experiments.

CWK3 • 5:15 p.m.
Designer Femtosecond Pulse Shaping Using Grating-Engineered Quasi-Phasematching in Lithium Niobate, *Lukasz Kornaszewski[1], Markus Kohler[1], Derryck T. Reid[1], Usman K. Sapaev[2]; [1]Heriot-Watt Univ., UK, [2]Acad. of Sciences of Uzbekistan, Uzbekistan.* Tailored femtosecond pulses with fully engineered intensity and phase profiles are demonstrated using second-harmonic generation of an Er:fiber laser in an aperiodically-poled lithium niobate crystal. The profiles created include square, stepped, double and triple pulses.

CWK4 • 5:30 p.m.
Tunable Narrow-Bandwidth Picosecond Pulses by Spectral Compression of Femtosecond Pulses in Second-Order Nonlinear Crystals, *Marco Marangoni[1], Daniele Brida[1], Giovanni Cirmi[1], Cristian Manzoni[1], Giulio Cerullo[1], Daniele Fusaro[2], Filippo M. Pigozzo[2], Antonio D. Capobianco[2], Fabio Baronio[3], Matteo Conforti[3], Costantino De Angelis[3]; [1]Politecnico di Milano, Italy, [2]Univ. di Padova, Italy, [3]Univ. di Brescia, Italy.* We exploit second-harmonic generation with large group velocity mismatch to efficiently convert femtosecond pulses into tunable narrowband picosecond pulses. The temporal shape of the picosecond pulses can be tailored by engineering the aperiodically poled crystal.

CLEO

4:45 p.m.–6:30 p.m.
CWL • Semiconductor Ring Lasers
Siyuan Yu; Univ. of Bristol, UK, Presider

CWL1 • 4:45 p.m.
CW Operation of Fabricated Semiconductor Ring Lasers Based on Retro-Reflector Cavities with Parabolic Mirrors, *Zhuoran Wang[1], Guohui Yuan[1], Guy Verschaffelt[2], Jan Danckaert[2], Siyuan Yu[1]; [1]Dept. of Electrical and Electronic Engineering, Univ. of Bristol, UK, [2]Dept. of Applied Physics and Photonics, Vrije Univ. Brussel, Belgium.* CW operation is achieved in novel semiconductor ring lasers based on retro-reflector cavities with parabolic mirrors downsized to equivalent ring radius of 16μm at room temperature. L-I curves and optical spectra are observed.

CWL2 • 5:00 p.m.
Monolithic Integration of Semiconductor Ring Lasers with Distributed Bragg Gratings, *Sándor Fürst[1], Gábor Mezősi[1], Siyuan Yu[2], Marc Sorel[1]; [1]Univ. of Glasgow, UK, [2]Univ. of Bristol, UK.* Monolithic integration of 1.55-μm ring lasers with distributed Bragg reflectors and distributed feedback lasers are presented. Such configurations show potential for mm-wave generation, wavelength tunability and are attractive for nonlinear dynamics studies in semiconductor lasers.

CWL3 • 5:15 p.m.
Loss-Reduced Rectangular Ring Laser Based on Active Vertical Coupler through Asymmetric Double Shallow Ridge and ICP/ICP Cascade Etching, *Ruiying Zhang, Zhong Ren, Siyuan Yu; Univ. of Bristol, UK.* Rectangular ring lasers based on an active vertical coupler structure are fabricated through asymmetric double shallow ridge and ICP/ICP cascade etching. 25% reduction of I_{th} and the single mode operation with SMSR 23dB are achieved.

CWL4 • 5:30 p.m.
Regimes of Operations of Semiconductor Ring Lasers under Optical Injection and Applications to Optical Signal Processing, *Nicola Calabretta[1], Stefano Beri[1,2], R. Notzel[1], Erwin A. J. M. Bente[1], Jan Danckaert[2], Meint K. Smit[1], Harm J. S. Dorren[1]; [1]Technical Univ. of Eindhoven, Netherlands, [2]Vrije Univ. Brussel, Belgium.* We present a detailed characterization of the semiconductor ring-laser operating regimes with special emphasis on the response to optical injection. Applications to an optical set/reset bistable memory and four-wave-mixing tunable THz signals generation are demonstrated.

4:45 p.m.–6:30 p.m.
CWM • Nanoparticles and Molecular Approaches for Biosensing
James Tunnell; Univ. of Texas at Austin, USA, Presider

CWM1 • 4:45 p.m.
Molecular Interferometric Imaging Biosensor to Study Molecular Interactions, *Ming Zhao, Xuefeng Wang, David Nolte; Purdue Univ., USA.* Molecular Interferometric Imaging (MI2) approaches the single-molecule limit for label-free direct optical detection. It is simpler, cheaper and more sensitive than surface plasmon resonance for dynamic studies of molecular interactions.

CWM2 • 5:00 p.m.
Two-Photon-Induced Photoluminescence Imaging of Tumors Using Near-Infrared Excited Gold Nanoshells, *Jaesook Park[1], Arnold Estrada[1], Kelly Sharp[2], Krystina Sang[2], Jon A. Schwartz[2], Danielle K. Smith[1], Chris Coleman[2], J. Donald Payne[2], Brian A. Korgel[1], Andrew K. Dunn[1], James W. Tunnell[1]; [1]Univ. of Texas at Austin, USA, [2]Nanospectra Biosciences Inc., USA.* We report strong two-photon-induced photoluminescence (TPIP) from silica/gold nanoshells (NS). We demonstrate its potential application for imaging the 3-D distribution of NS in tumors using a NIR laser scanning multi-photon microscope.

CWM3 • 5:15 p.m.
Detection of Neural Cell Activity Using Plasmonic Gold Nanoparticles, *Jiayi Q. Zhang[1], Tolga Atay[1], Arto V. Nurmikko[2]; [1]Physics Dept., Brown Univ., USA, [2]Div. of Engineering, Brown Univ., USA.* Metal nanoparticles have been studied intensively for their applications using localized surface plasmon polariton (SPP) resonance. We have demonstrated for the first time that using gold nanoparticles, one can detect electrical activities from the neurons.

CWM4 • 5:30 p.m.
Three-Dimensional Motion of a Nanoparticle on the Cell Membrane Observed by Non-Interferometric Widefield Optical Profilometry, *Chau-Hwang Lee[1], Chun-Chieh Wang[2], Chia-Wei Lee[1], Chia-Yun Huang[1], Jiunn-Yuan Lin[2], Pei-Kuen Wei[1]; [1]Academia Sinica, Taiwan, [2]Natl. Chung Cheng Univ., Taiwan.* We directly observe three-dimensional motion of a gold nanoparticle on the membrane of a living cell by using non-interferometric widefield optical profilometry. We identify the occurrence of particle internalization and actin aggregation which indicates endocytosis.

4:45 p.m.–6:30 p.m.
CWN • Optical Modulation Techniques
Peter Winzer; Alcatel-Lucent Bell Labs, USA, USA, Presider

CWN1 • 4:45 p.m. Invited
Optical OFDM, *Arthur J. Lowery; Monash Univ., Australia. Optical* Orthogonal Frequency Division Multiplexing (OFDM) is a type of electronic dispersion and nonlinearity compensation that is scalable to extremely-high data rates, offering plug-and-play convenience in free-space, multi-mode and long-haul communication systems.

CWN2 • 5:15 p.m.
Laser RIN and Linewidth Requirements for Direct Detection Optical OFDM, *Zuraidah Zan, Malin Premaratne, Arthur J. Lowery; Monash Univ., Australia.* We identify experimentally the effects of laser linewidth and intensity noise on optical OFDM systems and show that commercial DFB lasers are suitable transmitters even when operated at low powers.

CWN3 • 5:30 p.m.
Bit Error Rate Calculation for a Single Sideband OFDM Signal with Direct Detection Optically Pre-Amplified Receivers, *Wei-Ren Peng[1,2], Kai-Ming Feng[3], Sien Chi[1], Alan E. Willner[2]; [1]Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, [2]Dept. of Electrical Engineering, Univ. of Southern California, USA, [3]Inst. of Communications Engineering, Natl. Tsing Hua Univ., Taiwan.* We provide a fast BER calculation for a SSB-OFDM signal by considering the subcarrier SNR separately. Numerical results show our method can accurately evaluate the BER for different QAMs under a strong optical filtering.

4:45 p.m.–6:30 p.m.
CWO • 3-D Structuring of Photonic Crystals
Anders Kristensen; Technical Univ. of Denmark, Denmark, Presider

CWO1 • 4:45 p.m. Invited
Fabrication of Tailored Photonic Crystals Using Multiphoton Lithography, *Joseph Perry[1], Vincent W. Chen[1], Wenting Dong[1], Yadong Zhang[2], Kelly J. Perry[2]; [1]Georgia Tech, USA, [2]Focal Point Microsystems, USA.* Multiphoton lithography methods have been used to fabricate tailored photonic crystal structures with controllable stop bands that are effective templates for the formation of high contrast photonic crystals by post-fabrication processing.

CWO2 • 5:15 p.m.
Diffractive Optic Near-Field Interference Based Fabrication of Telecom Band Diamond-Like 3-Dimensional Photonic Crystals, *Debashis Chanda, Ladan Abolghasemi, Moez Haque, Mi Li Ng, Peter R. Herman; Univ. of Toronto, Canada.* A single laser exposure method of fabricating three-dimensional polymer photonic crystal having large number of layers has been demonstrated using a novel multi-layer diffractive optical element. Strong photonic stopbands are reported in the telecom band.

CWO3 • 5:30 p.m.
3-D Nanoscale Pattern Formation in Porous Silicon, *Ik Su Chun, Edmond K. Chow, Xiuling Li; Univ. of Illinois at Urbana-Champaign, USA.* A simple and effective processing technique for 3-D nanoscale pattern formation in light emitting porous silicon is reported. The technique is based on metal assisted chemical etching and defined by the 2-D nanoscale metal pattern.

CLEO

PhAST

4:45 p.m.–6:30 p.m.
CWP • Advanced Functionality in High Confinement Waveguides
Armand Rosenberg; NRL, USA, Presider

3:45 p.m.–5:00 p.m.
PWD • PANEL: Trends in High-Power Diode Lasers
Friedhelm Dorsch; TRUMPF Photonics, Inc., USA, Presider

3:45 p.m.–5:00 p.m.
PWE • Organic Solar Cells
Ghassan Jabbour; Arizona State Univ., USA, Presider

PWE1 • 3:45 p.m. Invited
Vision for Polymetric and Heterojunction Solar Cells, *Craig Cruickshank; cintellia Ltd., UK.*

PWE2 • 4:05 p.m. Invited
Organic Solar Cells: Pathways to Market Adoption, *James Dietz; Plextronics, Inc., USA.*

PWE3 • 4:25 p.m. Invited
The Reality of Organic Solar Cells: Today and Tomorrow, *David Ginley; Natl. Renewable Energy Lab, USA.*

PWE4 • 4:45 p.m. Invited
Material Issues in Small Molecule Organic Solar Cells, *Jian Li; Arizona State Univ., USA.*

CWP1 • 4:45 p.m. Invited
Polarization Manipulation Devices Based on Silicon Photonic Wire Waveguides and Their Practical Application, *Koji Yamada, Hiroshi Fukuda, Tai Tsuchizawa, Toshifumi Watanabe, Hiroyuki Shinojima, Hidetaka Nishi, Sei-ichi Itabashi; NTT Microsystem Integration Labs, Japan.* A compact polarization splitter and rotator based on silicon photonic wire waveguides have been developed. Using these devices, a low-loss polarization diversity system for ring-resonator wavelength filter has also been developed.

NOTES

CWP2 • 5:15 p.m.
Light Localization in Silicon Nanophotonic Waveguides, *Jung S. Park, Shun H. Yang, Prabhakar R. Bandaru, Shayan Mookherjea; Univ. of California at San Diego, USA.* We report the first observation of Anderson light localization in compact silicon nanophotonic slow-light waveguides consisting of long sequences of coupled resonators fabricated on a silicon-on-insulator (SOI) chip.

CWP3 • 5:30 p.m.
Aberration Corrected Ultra-Compact Ultra-Large Angle Curved Grating Multiplexer and Demultiplexer on SOI Platform, *Yingyan Huang[1], Jing Ma[1], Seongsik Chang[2], Qian Zhao[3], Seng-Tiong Ho[3]; [1]OptoNet Inc., USA, [2]HP Labs, USA, [3]Northwestern Univ., USA.* We describe a novel aberration free etched diffraction grating on SOI platform for on chip wavelength multiplexing and demultiplexing. Initial fabrication with 1 micron slit gives 200GHz channel pass band with < 0.2mm^2 chip size.

QELS

QWD • Fundamental and Novel Phenomena—Continued

QWD4 • 5:45 p.m.
Electromagnetic Spin-Orbit Interactions via Scattering, *Luat T. Vuong[1], Janne M. Brok[2], Aurele J. L. Adam[2], Paul C. M. Planken[2], H. P. Urbach[2]; [1]School of Applied and Engineering Physics, Cornell Univ., USA, [2]Faculty of Applied Sciences, Delft Inst. of Technology, Netherlands.* The longitudinal components of orthogonal-circularly polarized fields gain or lose topological charge after sub-wavelength-aperture transmission depending on the polarization handedness. We verify our analysis experimentally and numerically, and produce shadow-side spiral-phase fields of arbitrary vorticity.

QWD5 • 6:00 p.m.
Quantum Enhancement of Optical Beam Position Accuracy by Self-Focusing, *Mankei Tsang; Caltech, USA.* The standard and Heisenberg quantum limits on the position accuracy of an optical beam are rigorously derived. A simple scheme of beating the standard quantum limit by self-focusing is proposed.

QWD6 • 6:15 p.m.
Observation of a Comb of Optical Squeezing over Many Gigahertz of Bandwidth, *Charles C. Harb; Univ. of New South Wales, Australia.* We experimentally measure optical squeezing at multiple longitudinal modes of an optical parametric amplifier. We present data up to 5.1 GHz that shows the magnitude of the squeezing is greater than observable at baseband.

QWE • Quantum Cryptography II—Continued

QWE5 • 6:00 p.m.
Experimental Implementation of Entanglement Concentration Using Schmidt Projection, *Taehyun Kim, Franco N. C. Wong; MIT, USA.* We implement entanglement concentration by the Schmidt projection protocol, known for its optimal efficiency for large number of qubits, using photon pairs entangled in polarization and momentum and employing single-photon two-qubit quantum logic.

QWE6 • 6:15 p.m.
Entanglement on Demand through Time Reordering, *Joseph E. Avron[1], Gili Bisker[1], David Gershoni[1], Netanel H. Lindner[1], Eli A. Meirom[1], Richard J. Warburton[2]; [1]Technion, Israel, [2]Heriot-Watt Univ., UK.* Entangled photons can be generated on demand in a novel scheme involving unitary time reordering of the photons emitted in a radiative decay. This scheme can be applied to the biexciton cascade in quantum dots.

CLEO

CWI • Nonlinear Propagation and Generation—Continued

CWI5 • 5:45 p.m.
Simple and Practical 157nm and 193nm Coherent Light Source, *Xiaoshi Zhang, Hsiao-Hua Liu, Dirk Müller, Sterling Backus; Kapteyn-Murnane Labs Inc., USA.* We demonstrate a fully-coherent UV light source at 193 and 157nm using gas-filled hollow waveguide. We obtained 200 nJ/pulse and 20 nJ/pulse energy at 193 and 157nm respectively from a 200 uJ/pulse ti:sapphire laser.

CWI6 • 6:00 p.m.
Nonlinear Compression toward Few-Cycle Pulses in Two-Photon Semiconductor Amplifiers, *Noam Kaminski, Alex Hayat, Pavel Ginzburg, Meir Orenstein; Dept. of Electrical Engineering, Technion, Israel.* Ultra broadband nonlinear two-photon gain is proposed for pulse compression down to few optical cycles. Recent experimental report on two photon gain in semiconductor is exploited for analysis of pulse compression under realistic semiconductor parameters.

CWI7 • 6:15 p.m.
Generation of Long Plasma Channels in Air by Using Axicon-Generated Bessel Beams, *Selcuk Akturk[1], Bing Zhou[1], Benjamin Pasquiou[2], Aurelien Houard[1], Michel Franco[1], Arnaud Couairon[3], Andre Mysyrowicz[1]; [1]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France, [2]Inst. d'Optique, Campus Polytechnique, France, [3]Ctr. de Physique Théorique, Ctr. Natl. de la Recherche Scientifique, France.* By focusing ultrashort laser pulses in air with axicon, long and continuous plasma channels can be formed. The channel length is significantly longer than that obtained by filamentation with lens of same effective focal distance.

CWJ • Parametric Amplifiers and Oscillators—Continued

CWJ2 • 5:45 p.m.
Strong Signal Suppression due to the Combined Effect of Raman and Parametric Gain in a Fiber Parametric Amplifier, *John C. C. Wang, Stuart G. Murdoch, Rainer Leonhardt, John D. Harvey; Dept. of Physics, Univ. of Auckland, New Zealand.* The combined action of parametric gain and Raman scattering can lead to the complete suppression of an input optical signal. Experimentally we are able to demonstrate over 95% (13dB) suppression.

CWJ3 • 6:00 p.m.
6.4-dB Small Signal Gain Enhancement in Raman-Assisted Fiber Optical Parametric Amplifiers, *S. H. Wang[1], Lixin Xu[2], P. K. A. Wai[1], H. Y. Tam[1]; [1]Hong Kong Polytechnic Univ., Hong Kong, [2]Univ. of Science and Technology of China, China.* We reported a 6.4-dB gain enhancement of a Raman-assisted fiber optical parametric amplifier over the sum of the gains of the individual Raman and parametric amplifiers by keeping the amplifiers out of the saturation region.

CWJ4 • 6:15 p.m.
All-Fiber, High Power, Cladding-Pumped 1565nm MOPA Pumped by High Brightness 1535nm Pump Sources, *Shaif-ul Alam, A. T. Harker, R. J. Horley, F. Ghiringhelli, M. P. Varnham, P. W. Turner, M. N. Zervas; SPI Lasers UK Ltd., UK.* We have demonstrated for the first time a cladding pumped C-band amplifier using high brightness in-band pump source at 1535nm. Output power >10W was obtained at 1565nm with better than 40dB OSNR.

NOTES

QELS

QWF • Quantum Dots and Quantum Wells—Continued

QWF5 • 5:45 p.m. Invited
Carrier Multiplication in Nanocrystal Quantum Dots and Solar Energy Conversion, *Victor I. Klimov; Los Alamos Natl. Lab, USA.* This paper discusses aspects of carrier multiplication (multiexciton generation by single photons) in semiconductor nanocrystals such as its mechanism, competing relaxation channels, ultimate efficiencies for photon-to-exciton conversion and implications of this process in photovoltaics.

QWF6 • 6:15 p.m.
Coherent Probing and Saturation of a Strongly Coupled Quantum Dot, *Dirk R. Englund, Andrei Faraon, Ilya Fushman, Jelena Vučković; Stanford Univ., USA.* We coherently probe a quantum dot, strongly coupled to a photonic crystal nano-cavity, using a resonant laser beam. The coupled system's response is highly nonlinear. The method has applications for classical and quantum information processing.

JOINT

JWD • Intense Lasers and Laser Molecular Interactions—Continued

JWD5 • 5:45 p.m.
Highly Efficient Cross-Polarized Wave Generation in the UV Region, *Lorenzo Canova[1], Nikolay Minkovski[2], Stoyan Kourtev[2], Olivier Albert[1], Nicolas Forget[3], Thomas Oksenhendler[3], Rodrigo Lopez-Martens[1], Solomon M. Saltiel[2]; [1]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France, [2]Faculty of Physics, Univ. of Sofia, Bulgaria, [3]Fastlite, Ecole Polytechnique, France.* We demonstrate experimentally the generation of cross-polarized wave in BaF_2 crystal in the UV. The efficiency in the UV below XPW saturation is about 30 times higher then in visible for the same input intensity.

JWD6 • 6:00 p.m.
Direct Measurement of the Carrier-Envelope Phase of Amplified Pulses with Multi-kHz Update Rates, *Sebastian Koke, Christian Grebing, Bastian Manschwetus, Günter Steinmeyer; Max-Born-Inst., Germany.* A novel all-electronic scheme for real-time measurement and stabilization of the carrier-envelope phase of kHz pulse trains is demonstrated, revealing new insight into the pulse-to-pulse phase fluctuations of such lasers.

JWD7 • 6:15 p.m.
Ultra-High Intensity-High Contrast 300-TW Laser at 0.1 Hz Repetition Rate, *Victor P. Yanovsky[1], Vladimir Chvykov[1], Galina Kalinchenko[1], Pascal Rousseau[1], Thomas Planchon[1], Takeshi Matsuoka[1], Anatoly Maksimchuk[1], John Nees[1], Gilles Cheriaux[2], Gerard Mourou[2], Karl Krushelnik[1]; [1]Univ. of Michigan, USA, [2]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France.* The highest intensity -high contrast -300 TW laser is demonstrated by developing additional amplifying stage to the HERCULES-50 TW laser. To our knowledge this is the first Petawatt-scale laser at 0.1 Hz repetition rate.

JWE • Joint CLEO/QELS Symposium on Nonlinear Microscopy and Spectroscopy in Biology II—Continued

JWE3 • 5:45 p.m.
5-D Spectroscopic Microscopy for Intelligent Femtosecond Laser Writing of Optical Waveguides, *Jianzhao Li, Haibin Zhang, Shane M. Eaton, Peter R. Herman; Univ. of Toronto, Canada.* A dual purpose femtosecond laser processing and 5-D spectroscopic (xyz, time, wavelength) microscopy system provides intelligent *in situ* analysis and on-the-fly control of optical waveguides during laser writing. Definitive evidence of heat accumulation effects is reported.

JWE4 • 6:00 p.m.
Imaging Multiple Focal Planes Simultaneously: Multifocal, Photon Counting, Multiphoton Microscopy, *Kraig E. Sheetz, Ramon Carriles, Erich E. Hoover, Jeff Squier; Colorado School of Mines, USA.* Multiple image planes in a multiphoton microscope are acquired simultaneously through novel photon counting electronics and previous scaling limitations are overcome by a new Yb:KGW femtosecond oscillator laser design.

JWE5 • 6:15 p.m.
***In vitro* SHG/THG Imaging of Porcine Cornea,** *Louis Jay[1], Arnaud Brocas[1], Kanwarpal Singh[1], Isabelle Brunette[2], Tsuneyuki Ozaki[1]; [1]Enérgie, Matériaux et Télécommunications, Inst. Natl. de la Res. Scientifique, Canada, [2]Hopital Maisonneuve Rosemont. Univ. de Montréal, Canada.* THG and SHG signals can be detected on the cornea's whole thickness in forward or backward directions, allowing the observation of epithelium, stroma and endothelium by topographic and high resolution imaging.

CLEO

CWK • Pulse Shaping—Continued

CWK5 • 5:45 p.m.
Design of a Tunable Time-Delay Element with High Data Fidelity Using Dispersion Management, *Zhimin Shi, Robert W. Boyd; Inst. of Optics, Univ. of Rochester, USA.* We propose a design method for a tunable time-delay element based on the eye-diagram metrics of a system. Two approaches using dispersion management are given, and both show improved fractional delay with high data fidelity.

CWK6 • 6:00 p.m. Invited
Spatial Phase Shaping in Nonlinear Microscopy, *Eric Olaf Potma; Univ. of California at Irvine, USA.* The contrast in nonlinear coherent microscopy is improved by using spatial phase shaping of the incident laser beams. This approach exhibits promising applications for biomedical imaging studies.

NOTES

CWL • Semiconductor Ring Lasers—Continued

CWL5 • 5:45 p.m.
Active Q-Switching in Semiconductor Ring Lasers, *Gábor Mezősi, Sándor Fürst, Marc Sorel; Univ. of Glasgow, UK.* We report on the integration of semiconductor ring lasers with tunable directional couplers to modulate the Q-factor of the ring cavity. Active Q-switching is demonstrated with 120 ps pulses, up to frequencies of 1.8 GHz.

CWL6 • 6:00 p.m.
Passively Modelocked Bi-Directional Vertical External Ring Cavity Surface Emitting Laser, *Tomasz J. Ochalski[1], Aoife de Burca[1], Guillaume Huyet[1], Jari Lyytikäinen[2], Mircea Guina[2], Markus Pessa[2], Agata Jasik[3], Jan Muszalski[3], Maciej Bugajski[3]; [1]Tyndall Natl. Inst., Ireland, [2]Tampere Univ. of Technology, Finland, [3]Inst. of Electron Technology, Poland.* We propose and demonstrate a modelocked bi-directional VECSEL with a double V cavity configuration. The laser generates 1.04 µm optical pulses with a 0.76GHz repetition rate and a total average output power of 4 mW.

CWL7 • 6:15 p.m.
Equilateral-Triangle-Resonator Mid-Infrared Laser Diodes, *Shui-Qing Yu[1], Yong Cao[1], Shane R. Johnson[1], Yong-Hang Zhang[1], Yong-Zhen Huang[2]; [1]Arizona State Univ., USA, [2]Inst. of Semiconductors, Chinese Acad. of Sciences, China.* Single-mode, continuous-wave, electrically-injected, GaSb based, 2.1 µm, equilateral-triangle-resonator lasers with a wavelength tuning range of 3.25 nm are demonstrated at 77 K.

CWM • Nanoparticles and Molecular Approaches for Biosensing—Continued

CWM5 • 5:45 p.m.
Recognition of Double-Stranded DNA by Gold Nanoprobes for Malignant Melanoma Detection, *Jihye Ahn[1], Wounjhang Park[1], Lynne T. Bemis[2], William A. Robinson[2]; [1]Dept. of Electrical and Computer Engineering, Univ. of Colorado at Boulder, USA, [2]Health Science Ctr. and School of Medicine, Univ. of Colorado at Denver, USA.* We report the detection of mutated BRAF gene expressed in malignant melanoma. We demonstrate the detection of short and long, single- and double-stranded DNAs using gold nanoprobes.

CWM6 • 6:00 p.m.
Fast-Decay-Time Scintillation of LaF_3:Ce Colloidal Nanocrystals, *Nathan J. Withers[1], Krishnaprasad Sankar[1], Tosifa A. Memon[1], Brian A. Akins[1], Jiangjiang Gu[1,2], Tingyi Gu[1,2], Gennady A. Smolyakov[1], Marek Osinski[1]; [1]Univ. of New Mexico, USA, [2]Shanghai Jiao Tong Univ., China.* Positron emission tomography requires high-brightness fast-decay scintillators for coincidence counting of positron annihilation events. We demonstrate that LaF_3:Ce nanocrystals show promising characteristics for that application. Scintillation response and photoluminescence lifetime below 27 ns are measured.

CWM7 • 6:15 p.m.
Intracellular Photodisruption with Targeted Silver/Dendrimer Nanocomposites and Femtosecond Lasers, *Christine Tse[1], Wojciech Lesniak[2], Marwa J. Zohdy[1], Lajos Balogh[2], Matthew O'Donnell[1,3], Theodore B. Norris[4,5], Jing Yong Ye[4,5]; [1]Dept. of Biomedical Engineering, Univ. of Michigan, USA, [2]Dept. of Radiation Medicine, Roswell Park Cancer Inst., USA, [3]Bioengineering Dept., Univ. of Washington, USA, [4]Ctr. for Ultrafast Optical Science, Univ. of Michigan, USA, [5]Michigan Nanotechnology Inst. for Medicine and Biological Sciences, USA.* Folate-targeted silver/dendrimer nanocomposites were developed and tested on a human oral epidermoid cancer cell line. We observed a reduced threshold in targeted cells for femtosecond-laser-induced optical breakdown, which leads to selective photodisruption of cancer cells.

CWN • Optical Modulation Techniques—Continued

CWN4 • 5:45 p.m.
Creating RZ Data Modulation Formats Using Parallel Silicon Microring Modulators for Pulse Carving in DPSK, *Lin Zhang[1], Yunchu Li[1], Jeng-Yuan Yang[1], Raymond G. Beausoleil[2], Alan E. Willner[1]; [1]Dept. of Electrical Engineering, Univ. of Southern California, USA, [2]HP Labs, USA.* We propose ultra-small silicon microring-based pulse carvers operated at 10 Gb/s. RZ-DPSK transmitter is obtained in chip-size of only tens of µm² and exhibits lower power-penalty than MZM-based one by 1.7 dB in data transmission.

CWN5 • 6:00 p.m.
Demonstration of a 1550-nm Photon-Counting Receiver with < 0.5 Detected Photon-Per-Bit Sensitivity at 187.5 Mb/s, *Matthew E. Grein[1], Laura E. Elgin[1], Bryan S. Robinson[1], Alan L. Kachelmyer[1], David O. Caplan[1], Mark L. Stevens[1], John J. Carney[1], Scott A. Hamilton[1], Don M. Boroson[1], Carsten Langrock[2], M. M. Fejer[2]; [1]Lincoln Lab, MIT, USA, [2]Edward L. Ginzton Lab, Stanford Univ., USA.* We implemented a photon-counting optical receiver using a periodically-poled lithium niobate waveguide and an emulated array of silicon Geiger-mode avalanche photodiodes. We achieved a sensitivity of < 0.5 detected photons/bit at 187.5 Mb/s.

CWN6 • 6:15 p.m.
Mid-Infrared Lasers and the Kruse-Mie Theorem in Fog for Free-Space Optical Communication Applications, *Paul Corrigan, Rainer Martini, Edward A. Whittaker, Clyde Bethea; Stevens Inst. of Technology, USA.* We demonstrate that in NYC metro fog mid-infrared systems transmit over 300% more power and have 3x greater range than conventional FSO systems. We report that the benchmark Kruse-Mie theorem underestimates mid-infrared systems by +200%.

CWO • 3-D Structuring of Photonic Crystals—Continued

CWO4 • 5:45 p.m.
Layer-by-Layer Three-Dimensional Chiral Photonic Crystals, *Michael Thiel[1], Martin Wegener[1], Georg von Freymann[2]; [1]Inst. für Angewandte Physik, Univ. Karlsruhe, Germany, [2]Forschungszentrum Karlsruhe, Germany.* We have fabricated and characterized polymeric three-dimensional layer-by-layer chiral photonic crystals. The obtained circular dichroism from polarization stop bands centered around 1.55 µm is comparable with that of recently demonstrated circular-spiral photonic crystals.

CWO5 • 6:00 p.m.
Three-Dimensional Photonic Band Gap Structures Made by Direct Laser Writing and Silicon Single-Inversion, *Martin Hermatschweiler[1,2], Michael Thiel[1], Martin Wegener[1,2], Georg von Freymann[3]; [1]Univ. Karlsruhe (TH), Germany, [2]DFG-Ctr. for Functional Nanostructures, Univ. Karlsruhe (TH), Germany, [3]Inst. für Nanotechnologie, Germany.* We realize a variety of silicon photonic crystal structures. Direct laser writing of polymeric templates (square/circular spirals and slanted pore structures) combined with a silicon single-inversion procedure leads to band gaps in the near infrared.

CWO6 • 6:15 p.m.
Er Doped As_2S_3 Photoresist for 3-D Direct Laser Fabrication of 3-D Nanostructures, *Sean H. Wong[1], Georg von Freymann[1], Dieter Fenske[2], Manfred Kappes[3], Oliver Kiowski[3], Frank Peiris[4], Joerg Lindner[5], Geoffrey A. Ozin[6], Michael Thiel[7], Markus Braun[7], Alexandra Ledermann[7], Martin Wegener[7]; [1]Inst. for Nanotechnology, Forschungszentrum Karlsruhe in der Helmholtz-Geminshaft, Germany, [2]Inst. für Anorganische Chemie, Univ. Karlsruhe (TH), Germany, [3]Inst. für Physikalische Chemie II, Univ. Karlsruhe (TH), Germany, [4]Dept. of Physics, Kenyon College, USA, [5]Inst. für Angewandte Physik, EP IV, Univ. Augsburg, Germany, [6]Chemistry Dept., Univ. of Toronto, Canada, [7]Inst. für Angewandte Physik, Univ. Karlsruhe (TH), Germany.* We present a novel high-index-of-refraction (2.45) photoresist material based on erbium doped arsenic trisulfide. It shows room temperature photoluminescence at 1.5 microns wavelength, and can directly be used for direct laser writing.

CWP • Advanced Functionality in High Confinement Waveguides—Continued

CWP4 • 5:45 p.m.
Multimode-Interference Waveguide Crossing Coupled Microring-Resonator-Based Switch Nodes for Photonic Networks-on-Chip, *Fang Xu, Andrew W. Poon; Hong Kong Univ. of Science and Technology, Hong Kong.* We propose two-dimensional nonblocking low-power photonic switch nodes for networks-on-chip using multimode-interference-based waveguide crossing-coupled microring electro-optic switch array in silicon-on-insulator.

CWP5 • 6:00 p.m.
Novel Filtering Function Using an Embedded Ring Resonator, *Lin Zhang[1], Yunchu Li[1], Muping Song[1,2], Teng Wu[1], Raymond G. Beausoleil[3], Alan E. Willner[1]; [1]Dept. of Electrical Engineering, Univ. of Southern California, USA, [2]Dept. of Information and Electronic Engineering, Zhejiang Univ., China, [3]HP Labs, USA.* A novel resonator based on embedded rings may find important applications as novel ultra-small filter, modulator and delay element. It exhibits 10× higher delay and potential for high-speed modulation.

CWP6 • 6:15 p.m.
Densely Folded Silicon Photonic Wire Biosensors in Ring Resonator and Mach-Zehnder Configurations, *Siegfried Janz, Adam Densmore, Dan-Xia Xu, Philip Waldron, Trevor Mischki, Greg Lopinski, J. Lapointe, A. Delage, E. Post, C. Storey, P. Cheben, B. Lamontagne, J. H. Schmid; Natl. Res. Council Canada, Canada.* We demonstrate silicon waveguide molecular sensors formed by folding long photonic wire waveguides into dense spiral paths that occupy spot sizes less than 150 microns in diameter, and are hence suitable for biochip array formats.

NOTES