Room A1 | Room A2 | Room A3 | Room A4

CLEO

8:00 a.m.–12:00 p.m. Registration Open, *San Jose McEnery Convention Center, Concourse Level*

8:00 a.m.–9:45 a.m.
CFA • Surface-Enhanced and Fiber Raman Technologies
Zuyuan He; Univ. of Tokyo, Japan, Presider

CFA1 • 8:00 a.m.
Mixed Dimer Double Resonance Substrates for Surface-Enhanced Raman Spectroscopy, *Mohamad G. Banaee, Paul Peng, Eric D. Diebold, Eric Mazur, Kenneth B. Crozier; School of Engineering and Applied Sciences, Harvard Univ., USA.* Surface enhanced Raman spectroscopy is performed on mixed dimers, consisting of pairs of gold nanoparticles with different shapes and plasmon frequencies. These are termed double resonance substrates. The results are compared to double dimer geometry.

CFA2 • 8:15 a.m.
Surface-Plasmon Enhanced Raman Scattering of DNA Molecules on Regular Arrays of Modified Gold Nanoparticles, ***Ho-Jong Kim***[1]*, Jea-Ho Song*[1]*, Byung-Jun Ahn*[1]*, Tae-Soo Kim*[1]*, Yanqun Dong*[1]*, Jung-Hoon Song*[1]*, Sanghun Kim*[2]*, Hee Jin Sohn*[2]*, Dong Han Ha*[2]*;* [1]*Kongju Natl. Univ., Republic of Korea,* [2]*Div. of Advanced Technology, Korea Res. Inst. of Standards and Science, Republic of Korea.* We performed SERS studies of DNA monolayer on modified Au nanoparticle regular arrays. Drastic enhancement of SERS from DNA molecules was observed when closely spaced arrays were optimally prepared by e-beam lighography and chemical modification.

CFA3 • 8:30 a.m.
Active Plasmon Tuning of Metal-Elastomer Nanostructures, ***Fumin Huang****, Robin M. Cole, Sumeet Mahajan, Jeremy J. Baumberg; Univ. of Cambridge, UK.* Surface plasmon metal-elastomer nanostructures are *actively* tuned by stretching mechanically-tuneable elastomeric films. Tuneable plasmonic resonances and unusual inter-particle coupling are experimentally demonstrated. Such structures are highly suitable for developing optimal Raman and fluorescence sensors.

CFA4 • 8:45 a.m.
Raman Amplification at 800 nm in Single-Mode Fiber for Biological Sensing and Imaging, *Ata Mahjoubfar,* ***Keisuke Goda****, Bahram Jalali; Univ. of California at Los Angeles, USA.* We report the first experimental demonstration of Raman amplification in a fiber at wavelengths near 800 nm and propose its application to fast real-time optical sensing and imaging in this technologically important band.

8:00 a.m.–9:45 a.m.
CFB • Metamaterial Devices
Peter Catrysse; Stanford Univ., USA, Presider

CFB1 • 8:00 a.m.
Magnetic Interaction at Optical Frequencies in InP-Based Waveguide Device Combined with Metamaterial, ***Tomohiro Amemiya***[1]*, Takahiko Shindo*[2]*, Daisuke Takahashi*[2]*, Nobuhiko Nishiyama*[2]*, Shigehisa Arai*[1,2]*;* [1]*Quantum Nanoelectronics Res. Ctr., Tokyo Inst. of Technology, Japan,* [2]*Dept. of Electrical and Electronic Engineering, Tokyo Inst. of Technology, Japan.* We developed a waveguide optical device combined with left-handed materials consisting of minute split-ring resonators. The device can operate as a 1.5-µm-band all-optical switch, making use of magnetic resonance between the resonators and light.

CFB2 • 8:15 a.m.
Plasmon Stimulated Emission in Arrays of Bimetallic Stripes, ***Ananth Krishnan****, Stephen P. Frisbie, Luis Grave de Peralta, Ayrton Bernussi; Texas Tech Univ., USA.* Plasmon stimulated emission gives rise to coherent emission of leakage radiation from adjacent stripes in arrays of bi-metallic structures coated with dye-doped dielectric. This resulted in unambiguous interference patterns imaged by Fourier-plane leakage radiation microscopy.

CFB3 • 8:30 a.m.
FDTD Simulation of Semiconductor Plasmonic Nano-Ring Laser at 1550nm Based on Realistic Semiconductor Gain Model, ***Xi Chen***[1]*, Bipin Bhola*[2]*, Yingyan Huang*[1]*, Seng-Tiong Ho*[1]*;* [1]*Northwestern Univ., USA,* [2]*Data Storage Inst., Singapore.* We discuss the regime where nano-ring laser is feasible in which the absorption loss in metal is compensated by semiconductor gain. A nanometre-scale electrically pumped ring laser design is simulated using multi-level multi-electron FDTD model.

CFB4 • 8:45 a.m.
A Nano-Optical Vector Network Analyzer, ***Robert L. Olmon***[1]*, Peter M. Krenz*[2]*, Brian A. Lail*[3]*, Laxmikant V. Saraf*[4]*, Glenn D. Boreman*[2]*, Markus B. Raschke*[1]*;* [1]*Univ. of Washington, USA,* [2]*CREOL, Univ. of Central Florida, USA,* [3]*Florida Inst. of Technology, USA,* [4]*Pacific Northwest Natl. Lab, USA.* We reconstruct the magnetic near-field and source current distribution of a linear IR optical antenna from the 3-D electric vector near-field as probed using s-SNOM. Fine details associated with antenna coupling are observed.

8:00 a.m.–9:45 a.m.
CFC • Security and Optical Monitoring
David Caplan; MIT Lincoln Lab, USA, Presider

CFC1 • 8:00 a.m.
CD Insensitive PMD Monitoring by Using FBG Notch Filter in 57-Gbit/s D8PSK and 38-Gbit/s DQPSK Systems, ***Jing Yang***[1]*, Changyuan Yu*[1,2]*, Linghao Cheng*[3]*, Zhaohui Li*[3]*, Chao Lu*[3]*, Alan Pak Tao Lau*[3]*, Hwa-Yaw Tam*[3]*, Ping-kong Alexander Wai*[3]*;* [1]*Natl. Univ. of Singapore, Singapore,* [2]*RF and Optical Dept., A*STAR Inst. for Infocomm Res., Singapore,* [3]*Photonic Res. Ctr., Hong Kong Polytechnic Univ., China.* A CD insensitive PMD monitoring scheme based on measuring RF power is demonstrated experimentally. By using a FBG notch filter, one sideband is filtered out and corresponding RF power is CD insensitive PMD monitoring signal.

CFC2 • 8:15 a.m.
OSNR Monitoring Using Two Fibre Interferometers, *Edward A. Flood, W. H. Guo, A. L. Bradley, M. Lynch, D. Reid, L. P. Barry,* ***J. F. Donegan****; Trinity College Dublin, Ireland.* Two Michelson fiber interferometers were used to measure the in-band OSNR of a noisy signal between 5 and 30dB within ±0.5dB without prior knowledge of the noise-free extinction ratio of the signal.

CFC3 • 8:30 a.m. Invited
Secure Optical Communications, ***Gregory Kanter****; NuCrypt, LLC., USA.* We describe the state of physics-based secure optical communication systems. Practical issues associated with both key generation and high-speed physical-layer secure data transmissions are discussed.

8:00 a.m.–9:45 a.m.
CFD • Ultrafast Fiber Amplifiers
Martin Fermann; IMRA America, Inc., USA, Presider

CFD1 • 8:00 a.m.
Double-Pass Single Stage Short Length Yb-Doped Rod Type Fibre Chirped Pulse Amplifier System, ***Yoann Zaouter****, Antoine Courjaud, Clemens Hönninger, Eric Mottay; Amplitude Systemes, France.* We report the generation of 200 µJ, 240 fs and 750 MW peak power pulses from a single stage 50 dB of gain Yb-doped rod type photonic crystal fibre chirped pulse amplifier in double-pass configuration.

CFD2 • 8:15 a.m.
Pulse Compression of a High Power Modelocked Thin Disk Oscillator Using a Rod-Type Fiber Amplifier, ***Clara J. Saraceno****, Oliver H. Heckl, Cyrill R. E. Baer, Christian Kraenkel, Thomas Suedmeyer, Ursula Keller; ETH Zürich, Switzerland.* We present a simple nonlinear compression setup based on a 70-µm diameter rod-type fiber amplifier seeded by a 12-W, 1.1-ps Yb:YAG modelocked thin-disk laser. We generate 55 W of compressed sub-100-fs pulses at 11.6 MHz.

CFD3 • 8:30 a.m.
All Fiber High Energy, High Power Picosecond Laser, *Simonette Pierrot*[1]*, Julien Saby*[1]*, Anthony Bertrand*[2]*, Flavien Liegeois*[2]*, Charles Duterte*[2]*, Benjamin Coquelin*[1]*,* ***Yves Hernandez***[2]*, François Salin*[1]*, Domenico Giannone*[2]*;* [1]*EOLITE Systems, France,* [2]*MULTITEL ASBL, Belgium.* We report on a 83W, 14µJ, 5.9MHz, 30ps MOPA fiber laser based on an Yb mode-locked fiber oscillator and a rod-type LMA amplifier. By frequency tripling, this configuration can generate up to 20W of UV.

CFD4 • 8:45 a.m.
1-Watt Average-Power 100-MHz Repetition-Rate 258-nm Ultaviolet Pulse Generation from a Femtosecond Ytterbium Fiber Amplifier, ***Xiangyu Zhou***[1,2]*, Dai Yoshitomi*[1,2]*, Yohei Kobayashi*[1,3]*, Kenji Torizuka*[1,2]*;* [1]*AIST, Japan,* [2]*CREST, JST, Japan,* [3]*Inst. for Solid State Physics, Univ. of Tokyo, Japan.* 1-Watt-average-power pulse at 258 nm was generated by frequency quadrupling fom a femtosecond ytterbium-doped fiber amplifier at 100 MHz. A resonant cavity was employed as the frequency doubling stage to increase conversion efficiency.

Room A5 | Room A6 | Room A7

QELS

8:00 a.m.–12:00 p.m. Registration Open, *San Jose McEnery Convention Center, Concourse Level*

8:00 a.m.–9:45 a.m.
QFA • Nonclassical Light
Christoph Marquardt; Max Planck Inst. for the Science of Light, Germany, Presider

QFA1 • 8:00 a.m. Invited
Squeezed Light for Gravitational Wave Detection, ***Roman Schnabel****; Leibniz Univ. Hannover, Germany.* The sensitivity of laser-interferometric gravitational wave detectors can be improved with squeezed light. The first squeezed-light laser, aiming for a permanent operation in such a detector, has now been accomplished and characterized.

QFA2 • 8:30 a.m.
Generation of a Comb of Vacuum Squeezing over 2.4 GHz for Multiplexed Communication, ***Michele Heurs***[1]*, James G. Webb*[1]*, Tim C. Ralph*[2]*, Elanor H. Huntington*[1]*;* [1]*Ctr. for Quantum Computer Technology, School of Engineering and Information Technology, Univ. of New South Wales, Australia,* [2]*Ctr. for Quantum Computer Technology, Dept. of Physics, Univ. of Queensland, Australia.* We demonstrate the measurement of a "squeezing comb", the time-resolved homodyne detection of the first twelve vacuum squeezing sidebands of an optical parametric oscillator, and propose its use as a multiplexed quantum communications channel.

QFA3 • 8:45 a.m.
Homodyne Locking of a Squeezer, *Michele Heurs*[1,2]*, Ian R. Petersen*[1]*, Matthew R. James*[3]*,* ***Elanor H. Huntington***[2]*;* [1]*School of Engineering and Information Technology, Univ. of New South Wales, Australia,* [2]*Ctr. for Quantum Computer Technology, School of Engineering and Information Technology, Univ. of New South Wales, Australia,* [3]*Dept. of Engineering, Faculty of Engineering and Information Technology, Australian Natl. Univ., Australia.* Homodyne locking is a new approach to frequency-locking an OPO-based squeezed-vacuum source and its driving laser. It is cheap, easy to implement, subsequent measurements are automatically phase-locked, and it is uniquely a sub-QNL frequency discriminator.

8:00 a.m.–9:45 a.m.
QFB • Quantum Optical Sources and Processes
Meir Orenstein; Technion – Israel Inst. of Technology, Israel, Presider

QFB1 • 8:00 a.m. Invited
Modulation of Photons and Biphotons, ***Steve Harris****, C. Belthangady, Chih-Sung Chuu, S. Du, P. Kolchin, S. Sensarn, I. A. Yu, J. M. Kahn, G. Y. Yin; Ginzton Lab, Stanford Univ., USA.* We use slow light to make biphotons that are sufficiently long to allow temporal modulation. The talk will describe experiments demonstrating modulation of single photons, non-local modulation and measurement of biphotons, and spread spectrum techniques.

QFB2 • 8:30 a.m.
Heralded, Pure-State Single-Photon Source Based on a KTP Waveguide, *Zachary H. Levine, Jun Chen, Alexander Ling,* ***Jingyun Fan****, Alan Migdall; NIST, USA.* We show that with simple spectral filtering, the Schmidt number for the transmitted photon-pairs (with 90% transmittance) which are produced via type-II parametric down-conversion in a KTP waveguide equals to unity to within 0.2%.

QFB3 • 8:45 a.m.
Frequency Down-Conversion of Single Photons into the Telecom Band, *Georgina A. Olivares-Renteria*[1]*, Carlo Ottaviani*[2]*, Giovanna Morigi*[2,3]*, Helge Ruetz*[3]*, Sebastian Zaske*[3]*, Johannes A. L'huillier*[4]*,* ***Christoph Becher***[3]*;* [1]*Univ. de Concepcion, Chile,* [2]*Univ. Autonoma de Barcelona, Spain,* [3]*Univ. des Saarlandes, Germany,* [4]*Technische Univ. Kaiserslautern, Germany.* We propose a practical implementation for single-photon down conversion based on difference frequency generation by a nonlinear crystal. A theoretical model is presented, where the quantum noise sources, relevant to the process, are identified.

8:00 a.m.–9:45 a.m.
QFC • Nanoresonators
Gennady Shvets; Univ. of Texas at Austin, USA, Presider

QFC1 • 8:00 a.m. Invited
Plasmonic Interference and Coherence in Metallic Nanostructures, ***Peter Nordlander****; Rice Univ., USA.* A general discussion of radiative interference processes in plasmonic nanostructures is presented. It will be shown that the interference between subradiant and superradiant plasmon modes can induce pronounced Fano resonances it the optical spectra.

QFC2 • 8:30 a.m.
Plasmon Hybridization Enhances the Transient Absorption Signal of a Single Nanoparticle, *David Molnar*[1,2]*, Thorsten Schumacher*[1,2]*, Kai Kratzer*[1,2]*,* ***Markus Lippitz***[1,2]*;* [1]*Max-Planck-Inst. for Solid State Res., Germany,* [2]*4th Physics Inst., Univ. of Stuttgart, Germany.* A tiny variation of a single metal nanoparticle's dielectric properties has only a weak influence on the light field. We demonstrate, using optical nano-antenna concepts, how plasmon hybridization helps to increase the particle's influence.

QFC3 • 8:45 a.m.
Self-Assembled Plasmonic Nanoparticle Clusters, ***Jonathan Fan***[1]*, Chihhui Wu*[2]*, Kui Bao*[3]*, Jiming Bao*[4]*, Rizia Bardhan*[3]*, Naomi Halas*[3]*, Vinothan Manoharan*[1]*, Peter Nordlander*[3]*, Gennady Shvets*[2]*, Federico Capasso*[1]*;* [1]*Harvard Univ., USA,* [2]*Univ. of Texas at Austin, USA,* [3]*Rice Univ., USA,* [4]*Univ. of Houston, USA.* Polymer-coated gold nanoshells are assembled, using capillary forces, into packed clusters with tailored surface plasmon resonances. Separation between nanoshells is engineered to be ~2nm. Strongly coupled resonances in nanoshell dimers and trimers are observed.

Room A8 | Room C1&2 | Room C3&4 | San Jose Ballroom IV (San Jose Marriott)

QELS | CLEO

8:00 a.m.–12:00 p.m. Registration Open, *San Jose McEnery Convention Center, Concourse Level*

8:00 a.m.–9:45 a.m.
QFD • Quantum Dots
Glenn Solomon; NIST, USA, Presider

QFD1 • 8:00 a.m.
Carrier Capture Studies in InGaAs Quantum Posts, *Dominik Stehr*[1], *Christopher M. Morris[1], Diyar Talbayev[2], Martin Wagner[3], Hyochul Kim[1], Antoinette J. Taylor[2], Harald Schneider[3], Pierre M. Petroff[1], Mark S. Sherwin[1]; [1]Univ. of California at Santa Barbara, USA, [2]Los Alamos Natl. Lab, USA, [3]Forschungszentrum Dresden-Rossendorf, Germany.* The capture dynamics of photogenerated carriers in InGaAs quantum posts (QPs) are investigated. We demonstrate that QPs efficiently capture carriers from the surrounding host material within a few picoseconds, making them attractive for device applications.

QFD2 • 8:15 a.m.
A Spin Phase Gate Based on Optically Generated Geometric Phases in a Self-Assembled Quantum Dot, *Erik D. Kim*[1], *Katherine Truex[1], Xiaodong Xu[1], Bo Sun[1], Duncan Steel[1], Allan Bracker[2], Dan Gammon[2], Lu Sham[3]; [1]Univ. of Michigan, USA, [2]NRL, USA, [3]Univ. of California at San Diego, USA.* We demonstrate the use of optically generated geometric phases to modify the phase of one of the spin states of an electron confined in an InAs quantum dot, effectively executing a spin phase gate.

QFD3 • 8:30 a.m.
Coherent Spectroscopy of Single GaAs Quantum Dots, *Christian Wolpert*[1,2], *Lijuan Wang[3], Paola Atkinson[3], Armando Rastelli[3], Oliver G. Schmidt[3], Markus Lippitz[1,2]; [1]Max-Planck-Inst. for Solid State Res., Germany, [2]4th Physics Inst., Univ. of Stuttgart, Germany, [3]Inst. for Integrative Nanosciences, IWF Dresden, Germany.* We report on Rabi oscillations in the ground state exciton transition of a single GaAs/AlGaAs quantum dot measured by a reflective, ultrafast pump-probe technique using only far field microscopic techniques.

QFD4 • 8:45 a.m.
Spin Blockaded Radiative Cascades in a Neutral Quantum Dot, *Yaron Kodriano[1]*, ***Eilon Poem**[1], Chene Tradonsky[1], Dmitry Galushko[1], Pierre M. Petroff[2], David Gershoni[1]; [1]Technion - Israel Inst. of Technology, Israel, [2]Material Dept., Univ. of California at Santa Barbara, USA.* We measure the polarization tomography of a novel radiative cascade, initiating from a matastable confined two electron-hole pairs state in which the holes form a spin-triplet configuration, blockaded from thermalizing to their ground singlet state.

8:00 a.m.–9:45 a.m.
QFE • Optical Interactions with Cold Atoms
Daniel Steck; Univ. of Oregon, USA, Presider

QFE1 • 8:00 a.m.
Observation of Collisional Narrowing in an Ensemble of Cold Atoms, *Yoav Sagi*, *Ido Almog, Nir Davidson; Weizmann Inst. of Science, Israel.* We study the coherence dynamics of optically trapped ^{87}Rb atoms. We observe a decrease of the dephasing rate for an increasing elastic collision rate, and show that it depends only on the phase space density.

QFE2 • 8:15 a.m.
Cooling Atoms with a Moving One-Way Barrier, *J. Thorn*, *E. Schoene, D. Steck; Univ. of Oregon, USA.* We demonstrate the use of a moving optical one-way barrier for cooling a collection of atoms, and how sensitive this method is to varying experimental parameters.

QFE3 • 8:30 a.m.
A Compact, Moveable, Microchip-Based System for High Repetition Rate Production of Bose-Einstein Condensates, *Kai M. Hudek*, *Daniel M. Farkas, Evan A. Salim, Stephen R. Segal, Matthew B. Squires, Dana Z. Anderson; Univ. of Colorado, USA.* We present a compact, moveable system for producing Bose-Einstein condensates (BECs) on an integrated microchip. The system occupies $0.4m^3$ and operates as fast as 0.3 Hz. Condensates of $1.9x10^4$ atoms in ^{87}Rb have been demonstrated.

QFE4 • 8:45 a.m.
Chip-Based Optical Interactions with Rubidium Vapor, *Pablo S. Londero*, *Jacob Levy, Aaron Slepkov, Amar Bhagwat, Kasturi Saha, Vivek Venkataraman, Michal Lipson, Alexander L. Gaeta; Cornell Univ., USA.* We demonstrate tightly confined interactions with Rb atoms on a chip of silicon nitride nanowires. Optical depths of 2 are observed, and absorption spectroscopy reveals strong effects of transit-time broadening and Van der Waals shifts.

8:00 a.m.–9:45 a.m.
CFE • Integration for Optical Communications
Todd H. Stievater; NRL, USA, Presider

CFE1 • 8:00 a.m.
High Performance Add-Drop Filter Tunable over a Large Spectral Range, *Hugo L. R. Lira*, *Jaime Cardenas, Michal Lipson; Cornell Univ., USA.* We demonstrate an error-free add-drop filter for a 10 Gbps signal, tunable over 16 nm. The structure consists of a series of ring resonators embedded between micro-heaters designed to ensure homogeneous temperature distribution.

CFE2 • 8:15 a.m.
Continuously-Tunable Optical Delay Line Using PLC-Based Optical FIR Filter, *NGUYEN H. Manh*, *Koji Igarashi, Kazuhiro Katoh, Kazuro Kikuchi; Dept. of Electronic Engineering, Univ. of Tokyo, Japan.* We demonstrate continuously-tunable optical delay using an optical FIR filter consisting of discrete time-delay elements. A 16-tap PLC-based FIR filter having a 10-ps unit time delay enables tunable delay in the range of 25 ps.

CFE3 • 8:30 a.m. Invited
Photonic Integrated Circuits for High-Speed Communications, *Chris R. Doerr*; *Bell Labs, Alcatel-Lucent, USA.* We review demonstrated complex monolithic photonic integrated circuits (PICs) designed for high-speed fiber-optic communication systems. We focus on PICs that deliver or receive advanced modulation formats.

8:00 a.m.–9:45 a.m.
CFF • 3-D Nanostructured Photonic Materials
Mads B. Christiansen; Technical Univ. of Denmark, Denmark, Presider

CFF1 • 8:00 a.m. Tutorial
Three-Dimensional Optical Metamaterials and Nanoantennas: Chirality, Coupling, and Sensing, *Harald Giessen*, *Na Liu; Univ. of Stuttgart, Germany.* We review the properties of optical 3-dimensional metamaterials and analyze their coupling properties as well as chirality and sensing applications.

Harald Giessen obtained his diploma in Physics from Kaiserslautern and his M.S. and Ph.D. in Optical Sciences from the University of Arizona in 1994 and 1995, respectively. After one year as post-doc at the Max-Planck-Institute for solid state research in Stuttgart, he moved to Marburg University. He became Associate Professor at the University of Bonn in 2001 and Full Professor at the University of Stuttgart in 2004. His research topics are ultrafast nano-optics, metamaterials, and white-light lasers. He was elected OSA fellow in 2008.

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

Room B2-B3	San Jose Salon I & II (San Jose Marriott)	San Jose Salon III (San Jose Marriott)
CLEO: Applications	CLEO	JOINT

8:00 a.m.–12:00 p.m. Registration Open, *San Jose McEnery Convention Center, Concourse Level*

8:00 a.m.–9:45 a.m.
AFA • Imaging and Lithography
Iain T. McKinnie; Kapteyn Murnane Labs, USA, Presider

AFA1 • 8:00 a.m. Invited
Laser Imaging inside Engines for Advanced Direct Injection Gasoline Engine Development, ***Michael Drake****; General Motors Global Res. and Development, USA.* Imaging techniques (laser Mie scattering, particle image velocimetry, spectrally-resolved spark and combustion luminosity, and laser induced fluorescence) allow fuel injection, fuel/air mixing, ignition, and combustion to be followed at kHz rates within one engine cycle.

AFA2 • 8:30 a.m.
Optical Technique for Porosity Detection inside Valve Body Spool Bores down to 5 mm Diameter, ***Ojas P. Kulkarni****, Mohammed N. Islam, Fred L. Terry, Jr.; Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA.* We inspect inner surfaces of valve body spool bores down to 5 mm diameter for porosity defects, using an optical probe with ~50 μm lateral resolution. The probe can also distinguish porosity from bump-type defects.

AFA3 • 8:45 a.m.
Non-Contact Surface Roughness Measurement of Crankshaft Journals Using a Super-Continuum Laser, ***Vinay V. Alexander***[1]*, Haqiu Deng*[2,1]*, Mohammed N. Islam*[1]*, Fred L. Terry Jr*[1]*;* [1]*Univ. of Michigan Ann Arbor, USA,* [2]*South China Univ. of Technology, China.* We measure the RMS roughness of crankshaft journals from 0.05-0.13 microns at a 45degree angle of incidence and 70cm standoff distance. The system is used to detect and sort journals not polished to specifications.

8:00 a.m.–9:45 a.m.
CFG • Nonlinear Optical Materials
Shekhar Guha; AFRL, USA, Presider

CFG1 • 8:00 a.m. Invited
Intrinsic Laser-Induced Damage in Bulk Transparent Dielectrics, ***Oleg M. Efimov****; HRL Labs, LLC, USA.* Our results from experiments on laser-induced damage in transparent dielectrics are incompatible with the well-known avalanche ionization model. The mechanism of damage may involve a collective response of the dielectric, such as "dielectric-metal" phase transition.

CFG2 • 8:30 a.m.
Slow-Light Enhanced Self-Phase Modulation, Three-Photon Absorption and Free-Carriers in Photonic Crystals: Experiment and Theory, ***Chad Husko***[1]*, Sylvain Combrié*[2]*, Quynh Tran*[2]*, Fabrice Raineri*[3,4]*, Alfredo De Rossi*[2]*, Chee Wei Wong*[1]*;* [1]*Columbia Univ., USA,* [2]*Thales Res. and Technology, France,* [3]*Lab de Photonique et de Nanostructures (CNRS UPR 20), France,* [4]*Univ. D. Diderot, France.* We demonstrate experimental results and analytical formulation of slow-light-enhanced self-phase modulation limited only by three-photon absorption. We present nonlinear figure-of-merits on three-photon-limited ultrafast switching, and critical intensities for free-carrier effects in photonic crystals.

CFG3 • 8:45 a.m.
Analysis on the Control of Nonlinear Light Collapse in Magneto-Optical Kerr Media, ***Katarzyna A. Rutkowska***[1,2]*, Yoav Linzon*[2]*, Boris A. Malomed*[3]*, Roberto Morandotti*[2]*;* [1]*Warsaw Univ. of Technology, Poland,* [2]*INRS-EMT, Univ. of Québec, Canada,* [3]*Tel Aviv Univ., Israel.* We demonstrate a novel approach to the nonlinear optical collapse control in magneto-optical Kerr media. A suitable and essential interplay between magnetically-induced birefringences is fully described via a superposition of the Cotton-Mouton and Faraday effects.

8:00 a.m.–9:45 a.m.
JFA • Intense X-Ray Sources and Applications
David Villeneuve; Natl. Res. Council Canada, Canada, Presider

JFA1 • 8:00 a.m. Invited
Scientific Highlights from Operation of FLASH and New Opportunities with LCLS, ***Jochen Schneider****; Deutsches Elektronen-Synchrotron DESY, Germany.* The performance of the world's first X-ray free-electron lasers FLASH at DESY in Hamburg and LCLS at SLAC in Stanford will be presented together with early scientific results.

JFA2 • 8:30 a.m.
Explosions of Clusters in Intense X-Ray Pulses, ***Kay Hoffmann***[1]*, N. Kandadai*[1]*, H. Thomas*[1]*, A. Helal*[1]*, J. Keto*[1]*, T. Ditmire*[1]*, B. Iwan*[2,3]*, N. Timneanu*[2,3]*, J. Andreasson*[2,3]*, M. Seibert*[2,3]*, D. van der Spoel*[2,3]*, J. Hajdu*[2,3]*, S. Schorb*[4]*, T. Gorkhover*[4]*, D. Rupp*[4]*, M. Adolph*[4]*, T. Möller*[4]*, G. Doumy*[5]*, L. F. DiMauro*[5]*, C. Bostedt*[6]*, J. Bozek*[6]*, M. Hoener*[7]*, B. Murphy*[7]*, N. Berrah*[7]*;* [1]*Univ. of Texas at Austin, USA,* [2]*Uppsala Univ., Sweden,* [3]*Stanford Univ., USA,* [4]*Inst. für Optik und Atomare Physik, Technische Univ. Berlin, Germany,* [5]*Ohio State Univ., USA,* [6]*LCLS, Stanford Linear Accelerator Ctr., USA,* [7]*Western Michigan Univ., USA.* Cluster explosion in ultrashort intense X-ray laser fields have been studied in first experiments at the LCLS with time-of flight techniques. Ion charge states and kinetic energy spectra indicate hydrodynamic and Coulombic plasma expansion contributions.

JFA3 • 8:45 a.m.
X-Ray-Induced Multiple Core Vacancies in Impulsively Aligned Molecules, ***James P. Cryan***[1,2]*, James M. Glownia*[1,2]*, Nora Berrah*[3]*, Cosmin Blaga*[4]*, John D. Bozek*[5]*, Christian Buth*[6]*, Louis F. DiMauro*[4]*, Li Fang*[3]*, Markus Guehr*[1]*, Matthias Hoener*[3]*, Jon P. Marangos*[7]*, Anne Marie March*[8]*, Brian K. McFarland*[1,2]*, Mariano Trigo*[1]*, Linda Young*[8]*, Philip H. Bucksbaum*[1,2]*, Ryan N. Coffee*[1,5]*;* [1]*Pulse Inst., SLAC Natl. Accelerator Lab, USA,* [2]*Stanford Univ., USA,* [3]*Western Michigan Univ., USA,* [4]*Ohio State Univ., USA,* [5]*Linac Coherent Light Source, SLAC Natl. Accelerator Lab, USA,* [6]*Louisiana State Univ., USA,* [7]*Imperial College London, UK,* [8]*Argonne Natl. Lab, USA.* We observe a rich angular spectrum resulting from the Auger decay of a single *K*-shell vacancy but an apparent angle independence for the decay of a double core vacancy 'localized' to a single atom.

Room A1 | Room A2 | Room A3 | Room A4

CLEO

CFA • Surface-Enhanced and Fiber Raman Technologies—Continued

CFA5 • 9:00 a.m.
Metal-Lined Capillaries for Efficient Raman Gas Sensing, *Michael P. Buric[1,2], Kevin P. Chen[1,2],* ***Joel Falk***[1,2]*, Steven D. Woodruff[1]; [1]Natl. Energy Technology Lab, USA, [2]Univ. of Pittsburgh, USA.* We mathematically and experimentally examine the use of reflective silver-lined capillary waveguides that support a large number of EH_{1n} modes to efficiently collect Raman Stokes scattering from gaseous samples.

CFA6 • 9:15 a.m.
High Spatial Resolution Distributed Fiber Sensor Using Raman Scattering in Single-Mode Fiber, ***Shellee D. Dyer***[1]*, Burm Baek[1], Sae Woo Nam[1], Michael Tanner[2], Robert H. Hadfield[2]; [1]NIST, USA, [2]Heriot-Watt Univ., UK.* We demonstrate a distributed fiber temperature sensor based on Raman scattering in single-mode fiber. Using low-timing jitter superconducting nanowire single-photon detectors, we are able to achieve spatial resolution as fine as 1 cm.

CFA7 • 9:30 a.m.
Design of Low-Loss Arrayed Waveguide Gratings for Applications in Integrated Raman Spectroscopy, ***Nur Ismail***[1]*, Alvin C. Baclig[2], Peter J. Caspers[2], Fei Sun[1], Kerstin Wörhoff[1], René M. de Ridder[1], Markus Pollnau[1], Alfred Driessen[1]; [1]Univ. of Twente, Netherlands, [2]Erasmus MC, Netherlands.* An integrated low-loss arrayed waveguide grating is designed for Raman spectroscopy of the human skin. The device layout targets spectral analysis of Raman-scattered light for *in vivo* determination of water concentration in the stratum corneum.

CFB • Metamaterial Devices—Continued

CFB5 • 9:00 a.m.
100 nm Metallic Checkerboard by Wafer-Scale Nanoimprint and Its Application in Surface Enhanced Raman Spectroscopy, ***Wen-Di Li****, Chao Wang, Stephen Y. Chou; Princeton Univ., USA.* A wafer-scale (~4 inch) 100 nm nano-checkerboard structure was fabricated. The fabrication combines multiple nanoimprint lithography, 3-D patterning and self-aligned etching. Transmission/reflection resonance at ~750 nm and Raman enhancement of ~ 4.5E6 were achieved.

CFB6 • 9:15 a.m.
Metal Optics as a Circuit Problem: Revealing the Possibility of an Optical Voltage Transformer, ***Matteo Staffaroni***[1]*, Eli Yablonovitch[1], Josh Conway[2]; [1]Univ. of California at Berkeley, USA, [2]Kinsey Technical Services, USA.* A simple circuit model is used to derive the fundamental electromagnetic properties of metals in the optical regime. The model reveals the possibility of optical voltage transformers capable of matching large impedances at the nanoscale.

CFB7 • 9:30 a.m.
Beam Steering of Mid-Infrared Light with Active Plasmonic Structures, *David C. Adams[1], Sukosin Thongrattanasiri[2], Viktor Podolskiy[2,1],* ***Daniel Wasserman***[1]*; [1]Univ. of Massachusetts at Lowell, USA, [2]Oregon State Univ., USA.* We demonstrate beaming of coherent mid-infrared radiation through subwavelength slits flanked by periodic grooves at a metal/semiconductor interface. Steering angle is controlled by tuning either the incident-light wavelength or the optical properties of the semiconductor.

CFC • Security and Optical Monitoring—Continued

CFC4 • 9:00 a.m.
Secure Optical Transmission in Single-User Channel Using Encrypted Wireless CDMA Codes, ***Zhenxing Wang***[1]*, Lei Xu[2], John Chang[1], Ting Wang[2], Paul R. Prucnal[1]; [1]Princeton Univ., USA, [2]NEC Labs, America, USA.* We propose to use encrypted wireless CDMA codes to transmit data securely through an optical single-user channel. Our experiment successfully transmits data at 1.56Gb/s with a BER of 10^{-3}, below FEC limit.

CFC5 • 9:15 a.m.
Multiple-Access Optical Chaos-Based Communications Using Optoelectronic Systems, ***Damien Rontani***[1,2,3]*, Alexandre Locquet[2,3], Marc Sciamanna[1,2,3], David S. Citrin[2,3], Atsushi Uchida[4]; [1]Ecole Supérieure d'Electricite, France, [2]Unite Mixte Intl. UMI, GeorgiaTech andCNRS, France, [3]Georgia Tech, USA, [4]Saitama Univ., Japan.* OFDM multiple-access technique is applied to optical chaos-based communications using an optoelectronic oscillator with multiple delayed feedback loops. The encrypted transmission of multiple data streams with better spectral efficiency than a single stream is possible.

CFC6 • 9:30 a.m.
Nonlinear Delayed Differential Optical Phase Feedback For High Performance Chaos Communications, ***Maxime Jacquot****, Roman Lavrov, Laurent Larger; FEMTO-ST / Optics, France.* We report on the latest developments in electro-optic chaos communications intended for physical layer optical data protection. Unprecedented performances have been obtained in bit rate and transmission quality, from laboratory and field experiments.

CFD • Ultrafast Fiber Amplifiers—Continued

CFD5 • 9:00 a.m.
All-Fiber-Integrated Nonlinear Chirped-Pulse Amplifier with Microjoule Energy at 1 MHz, ***Hamit Kalaycioglu****, Bulent Oktem, Çağrı Şenel, Punya Prasanna Paltani, F. Ömer Ilday; Bilkent Univ., Turkey.* We report 57kW of peak power, 4µJ of energy and nonlinear shift of ~22π at 1MHz repetition rate, the highest from an all-fiber-integrated amplifier, limited by Raman amplification. Numerical simulations provide good agreement with experiments.

CFD6 • 9:15 a.m.
Passive Synchronization between a 131-W Mode-Locked Nanosecond Yb-Doped Fiber Laser and a Femtosecond Ti:sapphire Laser, *Ming Yan,* ***Wenxue Li****, Qiang Hao, Yao Li, Kangwen Yang, Hui Zhou, Heping Zeng; East China Normal Univ., China.* We demonstrate a passive synchronization between a high power nanosecond fiber laser and a femtosecond Ti:sapphire laser with a cavity-length mismatch tolerance up to 8 cm and a timing jitter of 13 ps.

CFD7 • 9:30 a.m.
Long-Term Reliable Phase-Locked Seed Source for Yb-Fiber-Based Chirped Pulse Amplification, ***Yunseok Kim****, Young-Jin Kim, Seungman Kim, Seung-Woo Kim; KAIST, Republic of Korea.* We constructed a composite fiber-based femtosecond laser by combining Er- and Yb-doped fibers to achieve superb long-term stability along with high pump-to-signal conversion.

9:45 a.m.–10:15 a.m. Coffee Break, *San Jose McEnery Convention Center, Concourse Level*

NOTES

Room A5	Room A6	Room A7

QELS

QFA • Nonclassical Light—Continued

QFA4 • 9:00 a.m.
Experimental Quantum Averaging of Squeezed Quadratures, ***Mikael Lassen***[1], *Lars Skovgaard Madsen*[1], *Metin Sabuncu*[2], *Radim Filip*[3], *Ulrik Andersen*[1]; [1]*Technical Univ. of Denmark, Denmark,* [2]*Max-Planck-Inst. for the Science of Light, Germany,* [3]*Dept. of Optics, Palacky Univ., Czech Republic.* We demonstrate an averaging process, corresponding to the harmonic-mean, that average quantum noise sources better than the basic arithmetic-mean strategy. Using simple linear optics, homodyne detection and feedforward, and it is tested on squeezed states.

QFA5 • 9:15 a.m.
Frequency Translation of Single-Photon States by Four-Wave Mixing in a Photonic Crystal Fiber, ***Hayden J. McGuinness***[1], *Michael G. Raymer*[1], *Colin J. McKinstrie*[2], *Stojan Radic*[3]; [1]*Univ. of Oregon, USA,* [2]*Bell Labs, USA,* [3]*Univ. of California at San Diego, USA.* We study the effect of frequency translation of single-photon states in optical fiber through use of the Bragg scattering four-wave mixing process. Preliminary evidence shows that this goal has been achieved.

QFA6 • 9:30 a.m.
Two-Photon Interference and Commutation Relations, ***Brian J. Smith***[1,2], *N. Thomas-Peter*[2], *I. A. Walmsley*[2]; [1]*Ctr. for Quantum Technologies, Natl. Univ. of Singapore, Singapore,* [2]*Univ. of Oxford, UK.* We experimentally demonstrate spectral-temporal two-photon interference at a beam splitter with pure state separable photons. This shows the bosonic nature of light, characterizing creation and annihilation operators.

QFB • Quantum Optical Sources and Processes—Continued

QFB4 • 9:00 a.m.
Optimization of Synchronized Single-Photon Frequency Upconversion by Temporal and Spectral Control, *Xiaorong Gu,* ***E. WU****, Kun Huang, Yao Li, Haifeng Pan, Heping Zeng; East China Normal Univ., China.* Single photons at 1.04 µm were converted to the visible region by sum-frequency generation with a synchronized pumping beam at 1.55 µm and the maximum detection efficiency was reached 27.6%.

QFB5 • 9:15 a.m.
Electric-Field-Induced Coherent Control in a Semiconductor, ***Jared K. Wahlstrand***[1], *Haipeng Zhang*[1,2], *John E. Sipe*[1,3], *Steven T. Cundiff*[1,2]; [1]*JILA, NIST, Univ. of Colorado, USA,* [2]*Dept. of Electrical, Computer, and Energy Engineering, Univ. of Colorado, USA,* [3]*Dept. of Physics, Univ. of Toronto, Canada.* A static electric field enables 1+2-photon coherent control of the photoexcited carrier population in semiconductors. A theory based on the Franz-Keldysh effect is compared to results of an experiment in (100) GaAs.

QFB6 • 9:30 a.m.
Coherent Control of Wavefundtions in 2-D Fourier Transform Optical Spectroscopy, ***Jongseok Lim****, Han-gyeol Lee, Sangkyung Lee, Kanghee Lee, Jaewook Ahn; KAIST, Republic of Korea.* We demonstrate the advantage of coherent control technique in 2-D Fourier transform optical spectroscopy on atomic model system. By spectrally shaping individual pulses, we selectively turn on and off target couplings.

QFC • Nanoresonators—Continued

QFC4 • 9:00 a.m.
Microcavity Plasmonics, ***Ralf Ameling****, Harald Giessen; Univ. of Stuttgart, Germany.* We introduce the new concept of microcavity plasmonics: A cut-wire pair is strongly coupled to photonic modes in a microcavity. Large anticrossings of the symmetric and antisymmetric plasmon modes and the cavity modes are observed.

QFC5 • 9:15 a.m.
Enhanced Second Harmonic Generation in Plasmonic Nanocavities, ***Ye Pu***[1], *Rachel Grange*[1], *Chia-Lung Hsieh*[1,2], *Demetri Psaltis*[1]; [1]*École Polytechnique Fédérale de Lausanne, Switzerland,* [2]*Caltech, USA.* We experimentally demonstrate significantly enhanced second harmonic generation using nanoengineered plasmonic nanocavities of core-shell structures ($BaTiO_3$/Au). An enhancement factor of over 500 is measured in the second harmonic scattering efficiency compared to the bare core.

QFC6 • 9:30 a.m.
Self-Organized Nanophotonic Signal Transmission Device, ***Takashi Yatsui***[1], *Yo Ryu*[1], *Tetsu Morishima*[1], *Wataru Nomura*[1], *Tetsu Yonezawa*[2], *Masao Washizu*[1], *Hiroyuki Fujita*[1], *Motoichi Ohtsu*[1]; [1]*Univ. of Tokyo, Japan,* [2]*Hokkaido Univ., Japan.* We developed a self-assembly method for alignment of ZnO quantum dots (QDs) into a straight line. The polarization dependence of photoluminescence intensity revealed the signal transmission via an optical near-field along the QD chain.

9:45 a.m.–10:15 a.m. Coffee Break, *San Jose McEnery Convention Center, Concourse Level*

NOTES

Room A8	Room C1&2	Room C3&4	San Jose Ballroom IV (San Jose Marriott)
QELS		CLEO	

QELS

QFD • Quantum Dots—Continued

QFD5 • 9:00 a.m.
Transient Emission of the 'Off' State of Blinking Quantum Dots is Not Governed by Auger Recombination Dynamics, ***Shamir Rosen****, Osip Schwartz, Dan Oron; Weizmann Inst. of Science, Israel.* Blinking in colloidal nanocrystals is studied through photon counting from single nanocrystals. Size independent 'off' state dynamics are observed in contrast to predictions by prevailing models which attribute 'dark' states to Auger recombination assisted quenching.

QFD6 • 9:15 a.m.
Homogeneous Linewidth Temperature Dependence of Interfacial GaAs Quantum Dots Studied with Optical 2-D Fourier-Transform Spectroscopy, ***Denis Karaiskaj***[1,2]*, Galan Moody*[1,3]*, Alan D. Bristow*[1]*, Mark E. Siemens*[1]*, Xingcan Dai*[1]*, Allan S. Bracker*[4]*, Daniel Gammon*[4]*, Steven T. Cundiff*[1,3]*;* [1]*JILA, NIST, Univ. of Colorado, USA,* [2]*Univ. of South Florida, USA,* [3]*Dept. of Physics, Univ. of Colorado, USA,* [4]*NRL, USA.* Optical 2-D Fourier-transform spectroscopy extracts the temperature-dependent homogeneous lineshape of an ensemble of interfacial quantum dots. The asymmetric lineshape reveals that confinement and excitation-induced dephasing compete with strong exciton-phonon interactions, which dominate at higher temperature.

QFD7 • 9:30 a.m.
Coherent Writing and Reading of Quantum Dot Exciton State by Resonant Two Colors Polarized Laser Pulses, *Stanislav Khatsevich*[1]*,* ***Yaron Kodriano***[1]*, Chene Tradonsky*[1]*, Yael Benny*[1]*, Dmitry Galushko*[1]*, Pierre M. Petroff*[2]*, David Gershoni*[1]*;* [1]*Technion - Israel Inst. of Technology, Israel,* [2]*Univ. of California at Santa Barbara, USA.* We use a resonant circularly polarized picosecond laser pulse to write a coherent superposition of exciton's states. We use a second, delayed circularly polarized pulse, tuned into the biexciton resonance to read the exciton's state.

QFE • Optical Interactions with Cold Atoms—Continued

QFE5 • 9:00 a.m. Invited
A Quantum Gas Microscope for Detecting Single Atoms in a Hubbard-Regime Optical Lattice, ***Markus Greiner****; Harvard Univ., USA.* Abstract not available.

QFE6 • 9:30 a.m.
Cooling and Trapping of Neutral Mercury Atoms in a Magneto-Optical Trap, *Patrick Villwock, Sebastian Siol,* ***Thomas Walther****; Technische Univ. Darmstadt, Germany.* We report on the trapping of mercury in a magneto-optical trap from the background vapor using the $^1S_0$-$^3P_1$ intercombination line. Up to (3.2 ± 0.3) x 10^{6} ^{202}Hg-atoms have been captured at a density of (4.8 ± 1.4) x 10^{10} atoms/cm^3.

CLEO

CFE • Integration for Optical Communications—Continued

CFE4 • 9:00 a.m.
High-Speed Coupling-Modulated Lasers, ***Wesley D. Sacher****, Joyce K. S. Poon; Univ. of Toronto, Canada.* We propose and demonstrate laser modulation at rates greatly exceeding the relaxation resonance frequency by modulating the output coupler. An erbium fiber laser is modulated at over 10000 times its relaxation resonance frequency.

CFE5 • 9:15 a.m.
Integrated 500 MHz Femtosecond Waveguide Laser with Repetition Rate Multiplication to 2 GHz, ***Hyunil Byun***[1]*, Dominik Pudo*[1]*, Sergey Frolov*[2]*, Amir Hanjani*[2]*, Joseph Shmulovich*[2]*, Erich P. Ippen*[1]*, Franz X. Kärtner*[1]*;* [1]*MIT, USA,* [2]*CyOptics, USA.* An integrated passively mode-locked 2-GHz waveguide laser generating 285-fs pulses is demonstrated. It is based on a 500-MHz repetition rate laser integrated together with a pulse interleaver on a 45x50 mm silica waveguide chip.

CFE6 • 9:30 a.m.
Zero-Dark Current Operation of a Metal-Graphene-Metal Photodetector at 10 Gbit/s Data Rate, ***Thomas Mueller***[1,2]*, Fengnian Xia*[2]*, Phaedon Avouris*[2]*;* [1] *Inst. of Photonics, Vienna Univ. of Technology, Austria,* [2]*IBM T. J. Watson Res. Ctr., USA.* We demonstrate detection of an optical bit stream at 10 GBit/s data rate using a novel metal-graphene-metal photodetector. Utilizing an asymmetric metallization scheme allows zero-dark current operation, despite the fact that graphene is a semi-metal.

CFF • 3-D Nanostructured Photonic Materials—Continued

CFF2 • 9:00 a.m.
Stacked 2-D Photonic Crystal Reflectance Filters Fabricated by Nanoreplica Molding for Improving Optical Density and Angular Tolerance, ***Fuchyi Yang****, Brian T. Cunningham; Univ. of Illinois at Urbana-Champaign, USA.* Nanoreplica molding enables stacking of multiple 2-D photonic crystals on a large area plastic substrate to improve optical density and angular tolerance of the resulting narrowband optical limiting filter, used for laser eye/sensor protection.

CFF3 • 9:15 a.m.
Development of Two-Layer Integrated Phase Masks for Three-Dimensional Photonic Crystal Template Fabrication, ***Di Xu***[1]*, Kevin P. Chen*[1]*, Ahmad Harb*[2]*, Yuankun Lin*[2]*;* [1]*Dept. of Electrical and Computer Engineering, Univ. of Pittsburgh, USA,* [2]*Dept. of Physics and Geology, Univ. of Texas-Pan American, USA.* In this paper, we report the development of an integrated two-layer phase mask for five-beam holographic fabrication of three-dimensional photonic crystal templates.

CFF4 • 9:30 a.m.
Paper Withdrawn.

9:45 a.m.–10:15 a.m. Coffee Break, *San Jose McEnery Convention Center, Concourse Level*

NOTES

Room B2-B3

CLEO: Applications

AFA • Imaging and Lithography—Continued

AFA4 • 9:00 a.m. Invited

Laser Produced Plasma Light Sources for EUV Lithography, *Bruno La Fontaine*; *Cymer Inc., USA.* We present the latest results on high-power extreme-ultraviolet (EUV) light sources for lithography. This includes operation of high-power pulsed CO_2 lasers, high repetition-rate Sn droplet targets, and collection of EUV light using multilayer-coated optics.

AFA5 • 9:30 a.m.

Table-top Extreme Ultraviolet Laser Aerial Imaging of Lithographic Masks, *Fernando Brizuela*[1], *Sergio Carbajo[1], Anne Sakdinawat[2], Yong Wang[1], David Alessi[1], Dale Martz[1], Bradley Luther[1], Kenneth A. Goldberg[2], David T. Attwood[2], Bruno La Fontaine[3], Jorge Rocca[1], Carmen Menoni[1]; [1]Colorado State Univ., USA, [2]Ctr. for X-Ray Optics, USA, [3]Global Foundries, USA.* We report the first at-wavelength line edge roughness measurements of patterned EUV lithography masks realized using a table-top aerial imaging system based on a table-top λ=13.2 laser.

San Jose Salon I & II (San Jose Marriott)

CLEO

CFG • Nonlinear Optical Materials—Continued

CFG4 • 9:00 a.m.

Nonlinear Index Measurement by Intracavity Interferometry, *Andreas U. Velten*, *Andreas Schmitt-Sody, Jean-Claude Diels; Univ. of New Mexico, USA.* Intracavity Phase Interferometry is applied to the measurement of nonlinear indices with a sensitivity and accuracy outperforming the z-scan. The sample is placed in a mode-locked laser cavity in which two pulses circulate independently.

CFG5 • 9:15 a.m.

Cyanine Dyes with Exceptional Third-Order Nonlinear Optical Figures-of-Merit for All-Optical Switching, *Joel M. Hales*, *Jonathan D. Matichak, Stephen Barlow, Shino Ohira, Kada Yesudas, Jean-Luc Brédas, Seth R. Marder, Joseph W. Perry; Georgia Tech, USA.* A molecular design strategy that involves favorable control of one- and two-photon absorption resonances to produce exceptional nonlinear optical figures-of-merit for all-optical switching has been realized in a series of cyanines dyes.

CFG6 • 9:30 a.m.

Large Enhancement of Two-Photon Absorption in Semiconductors Using Highly Non-Degenerate Photons, *Claudiu M. Cirloganu*, *Lazaro A. Padilha, Scott Webster, Gero Nootz, David J. Hagan, Eric W. Van Stryland; Univ. of Central Florida, USA.* We performed frequency non-degenerate pump-probe experiments in several direct-gap semiconductors using femtosecond and picosecond pulses. Tuning the long wavelength photons in the IR region, we observed a 125-fold enhancement of the two-photon absorption coefficient.

San Jose Salon III (San Jose Marriott)

JOINT

JFA • Intense X-Ray Sources and Applications—Continued

JFA4 • 9:00 a.m.

Ultrafast X-Ray-Pump, Laser-Probe Spectroscopy at LCLS, *James M. Glownia*[1], *James Cryan[1], Oleg Kornilov[2], Marcus Hertlein[2], Oliver Gessner[2], A. Belkacem[2], Russell Wilcox[2], Gang Huang[2], James White[1], Vladimir Petrovic[1], Chandra Raman[3], Hamed Merdji[4], Dipanwita Ray[5], Jakob Andreasson[6], Janos Hajdu[6], Josef Frisch[1], William White[1], Christoph Bostedt[1], Philip H. Bucksbaum[1], Ryan Coffee[1]; [1]Stanford PULSE Inst. and LCLS, SLAC Natl. Accelerator Lab, USA, [2]Lawrence Berkeley Natl. Lab, USA, [3]Georgia Tech, USA, [4]Ctr. d'études de Saclay, France, [5]Kansas State Univ., USA, [6]Uppsala Univ., Sweden.* We report the first pump-probe spectra using 1 keV pulses from LCLS to excite N_2 in delayed coincidence with 800 nm laser pulses. The delay between pump and probe was controlled to within 50 fsec.

JFA5 • 9:15 a.m.

Nonlinear Processes in N_2 Using LCLS Short X-Ray Pulses, *Li Fang*[1], *Matthias Hoener[1], Markus Guehr[2], Cosmin Blaga[3], Christoph Bostedt[4], John D. Bozek[4], Phil Bucksbaum[2], Christian Buth[2,5], Ryan Coffee[4], James Cryan[2], Lou DiMauro[3], Oliver Gessner[6], James Glownia[2], Erik Hosler[6], Elliot P. Kanter[7], Oleg Kornilov[6], Edwin Kukk[8], Brian K. McFarland[2], Brendan Murphy[1], Steve T. Pratt[7], Daniel Rolles[9], Nora Berrah[1]; [1]Western Michigan Univ., USA, [2]PULSE Inst., SLAC, USA, [3]Ohio State Univ., USA, [4]LCLS, USA, [5]Louisiana State Univ., USA, [6]Lawrence Berkeley Natl. Lab, USA, [7]Argonne Natl. Lab, USA, [8]Dept. of Physics and Astronomy, Univ. of Turku, Finland, [9]Max-Planck ASG, Germany.* We use the unprecedented LCLS peak power to study nonlinear X-ray multiphoton physics in molecules. We report on fundamental questions concerning the creation and decay of double-core-hole vacancies in N_2 by short X-ray pulses.

JFA6 • 9:30 a.m.

1 Hz Operation of a Gain-Saturated 10.9 nm Table-Top Laser, *Yong Wang*, *David Alessi, Dale Martz, Mark Berrill, Brad Luther, Jorge Rocca; Colorado State Univ., USA.* We report a gain-saturated 10.9nm table-top soft X-ray laser operating at 1Hz. With an average power of 1μW and pulse energy ~2μJ this laser extends a shorter wavelength the ability to conduct table-top laser experiments.

9:45 a.m.–10:15 a.m. Coffee Break, *San Jose McEnery Convention Center, Concourse Level*

NOTES

CLEO

Room A1

10:15 a.m.–12:00 p.m.
CFH • Fiber Optic Sensing
Joseph Buck; Lockheed Martin Coherent Technologies, USA, Presider

CFH1 • 10:15 a.m.
Integrated Temperature Compensated Bragg Grating Refractometer - Benefiting from Birefringence, ***Richard M. Parker****, James C. Gates, Christopher Holmes, Martin C. Grossel, Peter G. R. Smith; Univ. of Southampton, UK.* UV written planar Bragg grating sensors have been shown to form effective refractometers. Here we show that by using the birefringence of an integrated waveguide a temperature insensitive Bragg grating refractometer can be realised.

CFH2 • 10:30 a.m.
Spatial Resolution Enhancement by External Phase Modulation in Long-Length FBG Sensing System Based on Synthesis of Optical Coherence Function, ***Koji Kajiwara****, Zuyuan He, Kazuo Hotate; Univ. of Tokyo, Japan.* External phase modulation is newly combined with the synthesis-of-optical-coherence-function for improvement of spatial resolution in distributed sensing system using a long-length fiber Bragg grating. The spatial resolution is improved from previously-reported 9.8mm to 4.0mm.

CFH3 • 10:45 a.m.
Novel Fiber Optical Inclinometer Based on a Concatenated Fused Taper and Tilted Fiber Bragg Grating, ***Liyang Shao****, Jacques Albert; Dept. of Electronics, Carleton Univ., Canada.* A fiber optical inclinometer based on cladding mode re-coupling mechanism is demonstrated by using a nonadiabatic taper cascaded with a weakly tilted fiber Bragg grating. The sensitivity is optimized for different ranges of angle.

CFH4 • 11:00 a.m.
Optical Coherence-Domain Reflectometry by Use of Optical Frequency Comb, *Zuyuan He,* ***Hiroshi Takahashi****, Kazuo Hotate; Univ. of Tokyo, Japan.* A novel optical coherence-domain reflectometry (OCDR) by use of an optical frequency comb source is proposed and demonstrated with high spatial resolution (<10 cm), large dynamic range (>45 dB), and short measurement time (≤10 s).

Room A2

10:15 a.m.–12:00 p.m.
CFI • Plasmonic Devices
Xiang Zhang; Univ. of California at Berkeley, USA, Presider

CFI1 • 10:15 a.m. Invited
Optical Metamaterials, ***Xiang Zhang****; Univ. of California at Berkeley, USA.* I will discuss recent experimental demonstrations of intriguing phenomena associated with Metamaterials and plasmonics. These include sub-diffraction imaging and focusing, negative refraction and Negative-index Metamaterials, cloaking at optical frequencies and sub-wavelength plasmonic lasers.

CFI2 • 10:45 a.m.
Plasmonically-Enhanced Localization of Light into Photoconductive Antennas, ***Christopher W. Berry****, Mona Jarrahi; Univ. of Michigan, USA.* We present plasmonically-enhanced photoconductive antenna arrays and experimentally demonstrate enhanced light localization into device dimensions less than one-tenth of the wavelength. We present the fabrication and characterization of the device.

CFI3 • 11:00 a.m.
Hybrid Nanophotonic Components Integrating Plasmonic and Photonic Nanowires, ***Xin Guo****, Qing Yang, Xining Zhang, Limin Tong; Dept. of Optical Engineering, Zhejiang Univ., China.* We demonstrate the direct coupling of plasmonic and photonic nanowires via subwavelength-scale near-field interaction. Hybrid nanophotonic components, including splitters and micro-ring cavities, are fabricated out of coupled Ag and ZnO nanowires in a complementary scheme.

Room A3

10:15 a.m.–12:00 p.m.
CFJ • Optical Networks
Giampiero Contestabile; Scuola Superiore Sant'Anna Pisa, Italy, Presider

CFJ1 • 10:15 a.m. Invited
Multi-Granularity Waveband- and Wavelength Path Network, ***Ken-ichi Sato****; Nagoya Univ., Japan.* Future enhancements in optical path layer enabling technologies are highlighted. The role of waveband paths in creating the next generation transport network is discussed. Some state-of-the-art key enabling technologies are demonstrated.

CFJ2 • 10:45 a.m. Invited
1.16 µs Continuously Tunable Optical Delay of a 100-Gb/s DQPSK Signal Using Wavelength Conversion and Chromatic Dispersion in an HNLF, ***Scott R. Nuccio****, Omer F. Yilmaz, Xue Wang, Jian Wang, Xiaoxia Wu, Alan E. Willner; Univ. of Southern California, USA.* We demonstrate a tunable optical delay using wavelength-conversion in a highly-nonlinear-fiber, dispersion-compensating-fiber, and optical-phase-conjugation. A continuous delay of up to 1.16-µs equaling >55,000 symbols at 50-Gb/s, for 100-Gb/s NRZ-DQPSK and 50-Gb/s NRZ-DPSK formats, is demonstrated.

Room A4

10:15 a.m.–12:15 p.m.
CFK • Yb and Tm Ultrafast Fiber Oscillators
Axel Ruehl; IMRA America, Inc., USA, Presider

CFK1 • 10:15 a.m.
Experimental Study of Pulse Evolution in a 30-fs Mode-Locked Yb-Fiber Oscillator, ***Naoya Kuse*****[1]***, Makoto Kuwata-Gonokami[1], Yutaka Nomura[2], Shuntaro Watanabe[2], Yohei Kobayashi[2]; [1]Dept. of Applied Physics, Univ. of Tokyo, Japan, [2]Inst. for Solid State Physics, Univ. of Tokyo, Japan.* We have investigated the pulse evolution in a 30-fs Yb-doped mode-locked oscillator experimentally. We found that nonlinear-phase shift plays an important role for the passive third-order dispersion compensation.

CFK2 • 10:30 a.m.
High Rpetition Rate, Tunable Femtosecond Yb-Fiber Laser, ***Tobias Wilken*****[1]***, Phillip Vilar Welter[1], Theodor W. Haensch[1], Thomas Udem[1], Tilo Steinmetz[1,2], Ronald Holzwarth[1,2]; [1]Max-Planck-Inst. of Quantum Optics, Germany, [2]Menlosystems GmbH, Germany.* Using only a short piece of gain fiber, a 570 MHz Yb-fiber oscillator was set up and mode-locked via NPE, assisted by spectral filtering. Tuning the filter enables changing both center wavelength or optical bandwidth.

CFK3 • 10:45 a.m.
130 nJ 77 fs Dissipative Soliton Fiber Laser, ***Martin Baumgartl*****[1,2]***, Bülend Ortaç[1,3], Caroline Lecaplain[4], Ammar Hideur[4], Jens Limpert[1,2], Andreas Tünnermann[1,2,5]; [1]Inst. of Applied Physics, Germany, [2]Helmholtz-Inst. Jena, Germany, [3]UNAM-Inst. of Material Science and Nanotechnology, Turkey, [4]InCNRS UMR CORIA, Univ. de Rouen, France, [5]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We report on ultrashort high-energy pulse generation from an all-normal-dispersion fiber oscillator. The watt-level laser directly emits chirped pulses with a duration of 1ps and 163nJ of pulse energy. These can be compressed to 77fs.

CFK4 • 11:00 a.m.
Photonic Crystal Fiber Based Dissipative Soliton Laser for Multi-Watt Femtosecond Mode-Locking, ***Simon Lefrancois*****[1]***, Khanh Kieu[1], Frank W. Wise[1], Yujun Deng[2], James D. Kafka[2]; [1]Cornell Applied Physics, USA, [2]Spectra-Physics Laser Div., Newport Corp., USA.* We report on photonic crystal fiber based scaling of the mode-area of a dissipative soliton laser. The laser delivers 142 nJ chirped pulses with 12 W average power, dechirping to 105 fs after extra-cavity compression.

Room A5 | **Room A6** | **Room A7**

QELS

10:15 a.m.–12:00 p.m.
QFF • Quantum State Reconstruction
James Franson; Univ. of Maryland Baltimore County, USA, Presider

QFF1 • 10:15 a.m. Tutorial
Measuring and Characterizing Quantum States and Processes, *Daniel F. V. James*; *Univ. of Toronto, Canada.* I will give an introductory overview of current experimental techniques used to characterize the density matrix of a system and the quantum process describing a device, with emphasis on applications in quantum optics.

Daniel James received his Ph.D. from the Institute of Optics, University of Rochester under the tutelage of Prof. Emil Wolf in 1992. After a decade in the Theoretical Division of Los Alamos National Laboratory, he moved to the Dept. of Physics, University of Toronto in 2005, where he holds the Tier-1 Canada Research Chair in Atomic and Optical Physics, and is Director of the Centre for Quantum Information and Quantum Control. He is the author of over 80 scientific papers in theoretical quantum and optical physics, and was elected Fellow of the Optical Society of America in 2002.

10:15 a.m.–12:00 p.m.
QFG • Laser Cooling and Terahertz Applications
Koichiro Tanaka; Kyoto Univ., Japan, Presider

QFG1 • 10:15 a.m. Invited
Laser Cooling of a Semiconductor Load to 165 K, *Denis V. Seletskiy*[1], *Seth D. Melgaard[1], Mansoor Sheik-Bahae[1], Stefano Bigotta[2], Alberto Di Lieto[2], Mauro Tonelli[2]; [1]Univ. of New Mexico, USA, [2]Univ. di Pisa, Italy.* We demonstrate cooling of a 2 micron thick GaAs/InGaP double-heterostructure to 165 K by means of an optical refrigerator. Cooler is comprised of Yb-doped YLF crystal, pumped by 9 Watt near E4-E5 Stark manifold transition.

QFG2 • 10:45 a.m.
Investigation of Symmetries of Second-Order Nonlinear Susceptibility Tensor Based on THz Generation, *Guibao Xu*[1], *Guan Sun[1], Yujie J. Ding[1], Ioulia B. Zotova[2], Krishna C. Mandal[3], Alket Mertiri[3], Gary Pabst[3], Nils Fernelius[4]; [1]Lehigh Univ., USA, [2]ArkLight, USA, [3]EIC Labs, Inc., USA, [4]AFRL, USA.* We demonstrate that THz generation can be a sensitive technique for investigating symmetries of second-order nonlinear susceptibility tensor.

QFG3 • 11:00 a.m.
Two-Color Two-Dimensional Terahertz Spectroscopy on Intersubband Transitions of Coupled Quantum Wells, *Wilhelm Kuehn*[1], *Klaus Reimann[1], Michael Woerner[1], Thomas Elsaesser[1], Rudolf Hey[2]; [1]Max-Born-Inst., Germany, [2]Paul-Drude-Inst., Germany.* Fully phase-resolved 2-D intersubband spectroscopy reveals an ultrafast coherent charge transport between coupled quantum wells. A resonance between two excited quantum well subbands and the LO phonon leads to a transfer within 350 fs.

10:15 a.m.–12:00 p.m.
QFH • Photonic Crystals and Cavity Phenomena
Mikael Rechtsman; Courant Inst. of Mathematical Sciences, USA, Presider

QFH1 • 10:15 a.m. Invited
Physics and Applications of One-Way Magneto-Optical Photonic Crystals, *Zheng Wang*, *Yidong Chong, John Joannopoulos, Marin Soljačić; MIT, USA.* We demonstrate experimentally one-way waveguiding in a gyromagnetic photonic crystal. The complete suppression of back-scattering, even in the presence of very large scatterers, allows intriguing applications such as slow light.

QFH2 • 10:45 a.m.
Time-Domain Demonstrations of Slow-Light in Multi-Coupled Photonic Crystal Cavities, *Serdar Kocaman*[1], *Xiaodong Yang[2], James F. McMillan[1], Tingyi Gu[1], Mingbin Yu[3], Dim-Lee Kwong[3], Chee Wei Wong[1]; [1]Columbia Univ., USA, [2]Univ. of California at Berkeley, USA, [3]Inst. of Microelectronics, Singapore.* We demonstrate tunable temporal delays in coherently-coupled multi-cavity photonic crystals, in analogue to EIT. We report deterministic control of the group delay, up to 7x the single cavity lifetime, in our CMOS-fabricated chip.

QFH3 • 11:00 a.m.
Weak Exciton-Photon Coupling of PbS Nanocrystals in Air-Slot Mode-Gap Si Photonic Crystal Nanocavities in the Near-Infrared, *Jie Gao*[1], *Felice Gesuele[1], Weon-kyu Koh[2], Christopher B. Murray[2], Solomon Assefa[3], Chee Wei Wong[1]; [1]Columbia Univ., USA, [2]Univ. of Pennsylvania, USA, [3]IBM T. J. Watson Res. Ctr., USA.* We demonstrate micro-photoluminescence measurements of PbS nanocrystals coupled to air-slot mode-gap photonic crystal nanocavities with Q~15,000 and V_{eff} ~0.02 $(\lambda/n_{air})^3$. The ultrahigh Q/V ratios are critical for applications in cavity QED, nonlinear optics and sensing.

Room A8	Room C1&2	Room C3&4	San Jose Ballroom IV (San Jose Marriott)

QELS — **CLEO**

10:15 a.m.–12:00 p.m.
QFI • Excitons
Andreas Wacker; Lund Univ., Sweden, Presider

QFI1 • 10:15 a.m.
All-Optical Excitonic Switch, ***Yuliya Y. Kuznetsova***[1], *Mikas Remeika*[1], *Alex A. High*[1], *Aaron T. Hammack*[1], *Leonid V. Butov*[1], *Micah Hanson*[2], *Arthur C. Gossard*[2]; [1]*Dept. of Physics, Univ. of California at San Diego, USA,* [2]*Dept. of Materials, Univ. of California at Santa Barbara, USA.* We demonstrate experimental proof of principle for all-optical excitonic switches where light controls light using excitons as intermediate medium.

QFI2 • 10:30 a.m.
Temperature-Dependent Coupling of GaAs Quantum Well and Interfacial Quantum Dots Studied with Optical 2-D Fourier-Transform Spectroscopy, ***Galan Moody***[1,2], *Mark E. Siemens*[1], *Alan D. Bristow*[1], *Xingcan Dai*[1], *Allan S. Bracker*[3], *Daniel Gammon*[3], *Steven T. Cundiff*[1,2]; [1]*JILA, NIST, Univ. of Colorado, USA,* [2]*Dept. of Physics, Univ. of Colorado, USA,* [3]*NRL, USA.* Optical 2-D Fourier-transform spectra reveal time and temperature dependent relaxation from GaAs quantum well states into the interfacial quantum dot ensemble. We attribute the increased rate of relaxation at higher temperature to stimulated phonon emission.

QFI3 • 10:45 a.m.
Electrostatic Conveyer for Excitons, ***A.G. Winbow***[1], *J.R. Leonard*[1], *M. Remeika*[1], *A.A. High*[1], *E. Green*[1], *A.T. Hammack*[1], *L.V. Butov*[1], *M. Hanson*[2], *A.C. Gossard*[2]; [1]*Univ. of California at San Diego, USA,* [2]*Univ. of California at Santa Barbara, USA.* We report on the realization of electrostatic conveyers for indirect excitons and observation of a dynamical localization-delocalization transition for the excitons in the conveyer with varying exciton density and amplitude of the conveyer potential.

QFI4 • 11:00 a.m.
Probing Heavy-Hole and Light-Hole Excitonic Beats in a GaAs Quantum well with Phase-Locked Raman Pulse Pairs, ***Timothy M. Sweeney***, *Thomas Baldwin, Hailin Wang; Dept. of Physics and Oregon Ctr. for Optics, Univ. of Oregon, USA.* Transient pump-probe studies using phase-locked Raman pulse pairs as the pump reveal a new interpretation for the heavy-hole and light-hole excitonic beats in transient differential transmission of a GaAs quantum well.

10:15 a.m.–12:00 p.m.
QFJ • Correlations and Coherence
Steven Cundiff; JILA, NIST, Univ. of Colorado, USA, Presider

QFJ1 • 10:15 a.m.
Pulsed and Continuous-Wave Squeezed Vacuum in a Rubidium Vapor, ***Imad H. Agha***, *Gaetan Messin, Philippe Grangier; Univ. Paris-Sud, France.* We present studies on the generation of continuous-wave and pulsed squeezed vacuum via nonlinear polarization rotation in a rubidium vapor, with a value of -1.4 dB (-2.0 corrected, continuous-wave) and -1.0 dB (-1.4 corrected, pulsed).

QFJ2 • 10:30 a.m.
Sum-Frequency Generation as an Ultrafast Quantum Detector for Heisenberg Scaled Phase Measurement, ***Avi Pe'er***; *Bar Ilan Univ., Israel.* We describe ultrafast detection of quantum correlations using broadband sum-frequency generation as a physical two-mode detector. We apply the detection scheme to measurement of broadband squeezing and to phase estimation at the Heisenber limit.

QFJ3 • 10:45 a.m.
Frequency Verniers of Ti:sapphire Comb Laser, *Chien-Ming Wu,* ***Wang-Yau Cheng***, *You-Huan Chen, Tze-Wei Liu; Inst. of Atomic and Molecular Science, Academia Sinica, Taiwan.* By precisely controlling the comb laser repetition rate, we resolved a dark state of exceptionally narrow linewidth (5.6 Hz) in cesium gas buffered by neon atoms. We theoretically interpreted our experimental data.

QFJ4 • 11:00 a.m.
Observing Photonic de Broglie Waves without the NOON State, ***Osung Kwon***, *Young-Sik Ra, Yoon-Ho Kim; Dept. of Physics, Pohang Univ. of Science and Technology, Republic of Korea.* We report an intriguing new observation of wavelength/2 photonic de Broglie wave interference that has no classical interpretation and is not associated with the NOON state.

10:15 a.m.–12:00 p.m.
CFL • Optical Signal Processing
Paul Matthews; Northrop Grumman Corp., USA, Presider

CFL1 • 10:15 a.m.
An Etalon Based Optoelectronic Oscillator, ***Ibrahim T. Ozdur***, *Mehmetcan Akbulut, Nazanin Hoghooghi, Dimitrios Mandridis, Mohammad U. Piracha, Peter J. Delfyett; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* A 10.287 GHz optoelectronic oscillator is demonstrated which uses a 1000 finesse Fabry-Perot etalon as the mode selector instead of an RF filter. The new OEO has higher RF frequency stability and lower phase noise.

CFL2 • 10:30 a.m.
Ultra-Fast Integrated All-Optical Integrator, ***Marcello Ferrera***[1], *Yongwoo Park*[1], *Luca Razzari*[1,2], *Brent Little*[3], *Sai Chu*[3], *Roberto Morandotti*[1], *David J. Moss*[4], *Jose Azaña*[1]; [1]*Énergie, Matériaux et Télécommunications, INRS, Canada,* [2]*Dept. di Elettronica, Univ. di Pavia, Italy,* [3]*Infinera Ltd., USA,* [4]*CUDOS, School of Physics, Univ. of Sydney, Australia.* We report on the experimental demonstration of ultra-high speed temporal integration of optical complex waveforms by using an integrated and CMOS compatible micro-ring resonator. The device offers an unprecedented processing speed > 400GHz.

CFL3 • 10:45 a.m.
Ultrafast All-Optical Temporal Differentiation in Integrated Silicon-on-Insulator Bragg Gratings, ***Katarzyna A. Rutkowska***[1,2], *David Duchesne*[1], *Michael J. Strain*[3], *Jose Azaña*[1], *Roberto Morandotti*[1], *Marc Sorel*[3]; [1]*Énergie, Matériaux et Télécommunications, INRS, Canada,* [2]*Faculty of Physics, Warsaw Univ. of Technology, Poland,* [3]*Univ. of Glasgow, UK.* We report the theoretical and experimental demonstration of an all-optical temporal differentiator based on π-phase-shifted Bragg gratings fabricated in Silicon-on-Insulator waveguides. All-optical processing of sub-picosecond pulses was performed.

CFL4 • 11:00 a.m.
Microwave Photonic Filter Based on Optical Comb and Line-by-Line Optical Pulse Shaping, ***Ehsan Hamidi***, *Daniel E. Leaird, Andrew M. Weiner; Purdue Univ., USA.* We demonstrate microwave photonic filters based on optical combs with large number of taps and more than 30-dB sidelobe suppression. We program and tune the filter's bandpass by utilizing line-by-line pulse shaping and optical delay.

10:15 a.m.–12:00 p.m.
CFM • Fabrication and Characterization
Svetlana G. Lukishova; Univ. of Rochester, USA, Presider

CFM1 • 10:15 a.m.
Application of Anisotropic Metamaerials: Imaging Visible Light with Slab Lens, ***Jie Yao***[1], *Kun-Tong Tsai*[2], *Yuan Wang*[1], *Zhaowei Liu*[3], *Guy Bartal*[1], *Yuh-Lin Wang*[2,4], *Xiang Zhang*[1,5]; [1]*Univ. of California at Berkeley, USA,* [2]*Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan,* [3]*Univ. of California at San Diego, USA,* [4]*Dept. of Physics, Natl. Taiwan Univ., Taiwan,* [5]*Materials Sciences Div., Lawrence Berkeley Natl. Lab, USA.* Using anisotropic metamaterial, we were able to achieve lensing action with micron-thick slab and demonstrate imaging of a slit object. The details of the focused light beam in 3-dimensional space have been mapped with NSOM.

CFM2 • 10:30 a.m.
Acousto-Plasmonic Coupling In Engineered Metal Nanocomposites, *Nicolas Large*[1,2], *Adnen Mlayah*[1], *Lucien Saviot*[3], *Jeremie Margueritat*[1,4], *Jose Gonzalo*[4], ***Carmen N. Afonso***[4], *Javier Aizpurua*[2]; [1]*Ctr. d'Elaboration des Matériaux et d'Etudes Structurales CEMES – CNRS, France,* [2]*Donostia Intl. Physics Ctr. DIPC & Ctr. Mixto de Fisica de Materiales CSIC-UPV/EHU, Spain,* [3]*Lab Interdisciplinaire Carnot de Bourgogne, France,* [4]*Laser Processing Group, Inst. de Optica, CSIC, Spain.* This work shows the production of self-assembled elongated nano-objects embedded in an oxide host oriented perpendicular to the substrate and their acousto-plasmonic dynamics. Electromagnetic "hot spots" are created that activate anomalous Raman vibrational modes.

CFM3 • 10:45 a.m.
Anomalous Dispersion in Plasmonic Nanostructures, ***Pierpaolo A. Porta***[1], *Brian Corbett*[2], *John G. McInerney*[1,2]; [1]*Univ. College Cork, Ireland,* [2]*Tyndall Natl. Inst., Ireland.* We studied plasmonic surface modes in irregular metal-dielectric interfaces not supporting waveguide modes. We found anomalous dispersion in the off-axis scattered emission whose origin is explained as enhanced backscattering mediated by plasmonic surface modes.

CFM4 • 11:00 a.m.
Resonant Transmission and Effective Medium Response of Subwavelength H and H-Fractal Apertures, ***Bo Hou***, *Xin Qing Liao, Joyce K. S. Poon; Univ. of Toronto, Canada.* The transmission of infrared light through subwavelength H-shaped aperture arrays in gold is measured. To increase the resonant wavelength relative to the aperture size, H-fractal aperture arrays and their effective medium parameters are investigated.

Room B2-B3
CLEO: Applications

10:15 a.m.–11:45 a.m.
AFB • Novel Devices and Methods
Christopher Wood; Precision Photonics Corp., USA, Presider

AFB1 • 10:15 a.m. Invited
Optical Damage Testing Using High-Power Lasers, *Robert Seaver, Ronald Brady, Joni Pentony, **Ramesh Shori**; Naval Air Systems Command, USA.* One of the key limitations to power scaling lasers is the lack of reproducible, high damage threshold optical coatings needed in laser resonators and optical beam train elements. Results from a multi-year effort systematically investigating coating designs, deposition, and damage mechanism(s) involving cw lasers will be presented.

AFB2 • 10:45 a.m.
Achromatic Circular Polarization Generation for Ultra-Intense Lasers, ***Patrick K. Rambo**, Mark Kimmel, Guy Bennett, Jens Schwarz, Marius Schollmeier, Briggs Atherton; Sandia Natl. Labs, USA.* Generating circular polarization for ultra-intense lasers requires solutions beyond traditional transmissive waveplates which have insufficient bandwidth and pose nonlinear phase (B-integral) problems. We demonstrate a reflective design employing 3 metallic mirrors to generate circular polarization.

AFB3 • 11:00 a.m.
One Telescope per Pixel, ***Anna Pyayt**[1], Gary K. Starkweather[2], Mike Sinclair[2]; [1]Stanford Univ., USA, [2]Microsoft, USA.* This paper presents ultra-efficient transmissive display technology based on telescopic pixel design. The backlight transmission efficiency was measured to be 36% compared to 5±10% achieved by LCD.

San Jose Salon I & II (San Jose Marriott)
CLEO

10:15 a.m.–12:00 p.m.
CFN • Optical Parametric Amplifiers and Optical Parametric Generation
Andrew Schober; Lockheed Martin Coherent Technologies, USA, Presider

CFN1 • 10:15 a.m.
Optical Parametric Amplification of a Distributed Feedback Quantum Cascade Laser in Orientation-Patterned GaAs, ***Guillaume Bloom**[1], Arnaud Grisard[1], Eric Lallier[1], Christian Larat[1], Mathieu Carras[2], Xavier Marcadet[2], Bruno Gerard[2]; [1]Thales Res. and Technology, France, [2]Alcatel Thales III-V Lab, France.* We demonstrate an optical parametric amplifier in orientation-patterned GaAs amplifying the emission of a quantum cascade laser with a distributed feedback structure. We report a gain as high as 53dB in good agreement with theory.

CFN2 • 10:30 a.m.
Broadband Optical Parametric Generation in Periodically Poled Stoichiometric $LiTaO_3$, ***Martin Levenius**, Valdas Pasiskevicius, Fredrik Laurell, Katia Gallo; Royal Inst. of Technology, Sweden.* We experimentally investigate parametric downconversion approaching zero group velocity dispersion in Mg-doped stoichiometric $LiTaO_3$. Pumping in the 820-842 nm range yields a 14 THz gain bandwidth with signal (idler) wavelengths around 1.23 µm (2.66 µm).

CFN3 • 10:45 a.m. Invited
Advances in Fiber-optic Parametric Amplifiers, ***John Harvey**, S. G. Murdoch, R. Leonhardt; Univ. of Auckland, New Zealand.* This paper discusses recent developments which have led to dramatic improvements in the performance of optical parametric amplifiers, utilising both highly nonlinear fibers and photonic crystal fibers.

San Jose Salon III (San Jose Marriott)
JOINT

10:15 a.m.–12:00 p.m.
JFB • Laser Particle Acceleration
Csaba Toth; Lawrence Berkeley Natl. Lab, USA, Presider

JFB1 • 10:15 a.m.
Laser - Ion Acceleration in the Laser Transparency Regime, ***Sven Steinke**[1], Andreas Henig[2], Matthias Schnuerer[1], Thomas Sokollik[1], Rainer Hoerlein[2], Daniel Kiefer[2], Daniel Jung[2,3], Joerg Schreiber[2,4], B. M. Hegelich[3], X. Q. Yan[2,5], J. Meyer-ter-Vehn[2], T. Tajima[2,6], P. V. Nickles[1,7], Wolfgang Sandner[1], Dietrich Habs[2]; [1]Max-Born-Inst. for Non-Linear Optics, Germany, [2]Max-Planck-Inst. für Quantenoptik, Germany, [3]Los Alamos Natl. Lab, USA, [4]Imperial College London, UK, [5]Beijing Univ., China, [6]Photomedical Res. Ctr., JAEA, Japan, [7]Gwangju Inst. of Science and Technology, Republic of Korea.* Experiments on laser-induced ion acceleration from ultra-thin (nm) foil targets reveal a dramatic increase in the conversion efficiency and the acceleration of C^{6+} ions in a phase stable way by the laser radiation pressure.

JFB2 • 10:30 a.m.
MeV Proton Beams Generated by 3 mJ Ultrafast Laser Pulses at 0.5 kHz, ***Bixue Hou**[1], John Nees[1], James Easter[1], Zhaohan He[1], Jack Davis[2], George Petrov[2], Alexander Thomas[1], Karl Krushelnick[1]; [1]Univ. of Michigan, USA, [2]NRL, USA.* Well-collimated proton beams are generated from bulk glass along the target normal direction by tightly focused 3mJ ultrafast laser pulses at intensities of $2x10^{18}W/cm^2$ at 0.5kHz. Spectral measurements indicate maximum proton energy is around 0.5MeV.

JFB3 • 10:45 a.m.
Water Micro Droplets for Generation of Mono Energetic Proton Beams, ***Jens Polz**, Sven Herzer, Wolfgang Ziegler, Oliver Jäckel, Malte Christoph Kaluza; Friedrich-Schiller-Univ. Jena, Germany.* We report experimental results proving the possibility to use water micro droplets for generation of mono energetic proton beams in laser driven ion acceleration.

JFB4 • 11:00 a.m.
Formation of Optical Bullets in Laser-Driven Plasma Bubble Accelerators, ***P. Dong**[1], S. Reed[1], S. A. Yi[1], S. Kalmykov[1], G. Shvets[1], N. Matlis[2], C. McGuffey[3], S. S. Bulanov[3], V. Chvykov[3], G. Kalintchenko[3], K. Krushelnick[3], A. Maksimchuk[3], T. Matsuoka[3], A. G. R. Thomas[3], V. Yanovsky[3], M. C. Downer[1]; [1]Dept. of Physics, Univ. of Texas at Austin, USA, [2]Lawrence Berkeley Natl. Lab, USA, [3]Ctr. for Ultrafast Optical Science, Univ. of Michigan, USA.* We visualize laser-generated electron density "bubbles" by observing "bullets" of light that they trap, focus and compress from co-propagating probe pulses. We correlate these bullets with relativistic electrons that the bubble captured and accelerated.

Room A1	Room A2	Room A3	Room A4

CLEO

CFH • Fiber Optic Sensing—Continued

CFH5 • 11:15 a.m.
Temperature Compensated Sub-Metre Spatial Resolution Distributed Strain Sensor, *Belal Mohammad*; *Optoelectronics Res. Ctr., Univ. of Southampton, UK.* Temperature compensated strain sensor measurements are demonstrated with strain resolution of 86uε and spatial resolution of 26cms, utilising temperature dependence of spontaneous Raman scattering for temperature compensated sub-metre spatial resolution Brillouin frequency based strain sensor.

CFH6 • 11:30 a.m.
Automated Suppression of Polarization-Fluctuation in Resonator Fiber Optic Gyro with Twin 90° Polarization-Axis Rotated Splices, *Xijing Wang*, *Zuyuan He, Kazuo Hotate; Univ. of Tokyo, Japan.* Automated suppression of polarization-fluctuation in a fiber optic gyro made of a polarization-maintaining fiber resonator with twin 90° polarization-axis rotated splices is experimentally demonstrated by adjusting the fiber length difference between the two splicing points.

CFH7 • 11:45 a.m.
In-Line Chemical Sensing Device with C-Type Fiber and Photonic Crystal Fiber, *Jiyoung Park*[1], *Yongmin Jung[2], Jens Kobelke[3], Kyunghwan Oh[1]; [1]Yonsei Univ., Republic of Korea, [2]Univ. of Southampton, UK, [3]Inst. of Photonic Technology, Germany.* We fabricated the in-line chemical sensing device with novel 'C-type' with only cleaving/splicing process, which supplemented the previous devices' drawbacks. The great potential of this device was also confirmed through acetylene gas sensing experiment.

CFI • Plasmonic Devices—Continued

CFI4 • 11:15 a.m.
Characterization of Extended Width Optical Dipole Antennas, *Tae Joon Seok*, *Arash Jamshidi, Amit Lakhani, Kyoungsik Yu, Hyuck Choo, Owen Miller, Eli Yablonovitch, Ming C. Wu; Univ. of California at Berkeley, USA.* Optical dipole antennas with varying length and width are fabricated using e-beam lithography. Antennas with wider width are shown to exhibit stronger scattering while preserving the same resonance frequency.

CFI5 • 11:30 a.m.
Three-Dimensional Optical Transformer - Highly Efficient Nanofocusing Device, *Hyuck Choo*[1,2], *Matteo Stafarroni[2], Tae Joon Seok[2], Jeffrey Bokor[1,2], Ming Wu[2], P. J. Schuck[1], S. Cabrini[1], Eli Yablonovitch[2]; [1]Molecular Foundry, Lawrence Berkeley Natl. Lab, USA, [2]Dept. of Electrical Engineering and Computer Sciences, Univ. of California at Berkeley, USA.* Using electron-beam-induced deposition and focused-ion-beam milling, we have fabricated and demonstrated a nanofocusing optical transformer with a 3-dimensionally tapered tip. At the tip, the light is confined to 13-by-80-nm area with intensity enhancement exceeding 1500.

CFI6 • 11:45 a.m.
Asymmetric Transmission of Linearly Polarized Light through Low Symmetry Metamaterials, *Christoph Menzel*[1], *Carsten Rockstuhl[1], Thomas Paul[1], Christian Helgert[2,3], Jörg Petschulat[2,3], Ernst-Bernhard Kley[2], Falk Eilenberger[2,3], Thomas Pertsch[2,3], Falk Lederer[1]; [1]Inst. of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Univ. Jena, Germany, [2]Inst. of Applied Physics, Germany, [3]ZIK ultra-optics, Germany.* Based on a systematic analysis of the symmetry properties of metamaterial unit cells, we show experimentally and theoretically that asymmetric transmission for linearly polarized, visible light can be observed for suitably designed unit cells.

CFJ • Optical Networks—Continued

CFJ3 • 11:15 a.m.
Fast Low-Cost FIR Filter Processed ECDM Labels for Optical Label Switching, *Jose B. Rosas-Fernandez*, *Jonathan D. Ingham, Yu Yu, Richard V. Penty, Ian H. White; Dept. of Engineering, Univ. of Cambridge, UK.* A code-label recognition time of less than 500ps is demonstrated using low-cost FIR-filters. The electronically-processed label provides a control signal from an auto-correlated label. Error-free electronic code-label switching of an optical 10Gb/s signal is demonstrated.

CFJ4 • 11:30 a.m.
Optically Controlled Variable Optical Buffer for Data Packet Storage in Optical Packet Switching Networks, *Gianluca Meloni*[1], *Gianluca Berrettini[1], Luca Potì[2], Antonella Bogoni[2]; [1]Scuola Superiore Sant'Anna, Italy, [2]CNIT, Italy.* A novel solution for all optical packets buffering is proposed. Variable delays are performed by exploiting a fiber based re-circulating loop configuration. XGM in SOAs allows optical controlling of the packets storage time.

CFJ5 • 11:45 a.m.
Data Traffic Grooming/Exchange of a Single 10-Gbit/s TDM Tributary Channel between Two Pol-Muxed 80-Gbit/s DPSK Channels, *Jian Wang*, *Omer Yilmaz, Scott Nuccio, Xiaoxia Wu, Zahra Bakhtiari, Yinying Xiao Li, Jeng-Yuan Yang, Hao Huang, Yang Yue, Irfan Fazal, Robert Hellwarth, Alan Willner; Univ. of Southern California, USA.* We report tributary channel data traffic grooming/exchange of pol-muxed DPSK signal based on Kerr-induced nonlinear polarization rotation. 8 tributary channel data grooming between two pol-muxed 80-Gbit/s DPSK channels is demonstrated with a penalty <4 dB.

CFK • Yb and Tm Ultrafast Fiber Oscillators—Continued

CFK5 • 11:15 a.m.
High-Energy Femtosecond Pulses from a Dissipative Soliton Fiber Laser, *Caroline Lecaplain*[1], *Bülend Ortaç[2], Ammar Hideur[1]; [1]UMR CNRS 6614 CORIA, Univ. de Rouen, France, [2]Inst. of Applied Physics, Friedrich-Schiller-Univ., Germany.* We report on the generation of high-energy femtosecond pulses from an ytterbium-doped photonic crystal fiber oscillator. Sub-150 fs pulses are obtained at low-cavity dispersion. By increasing the normal cavity dispersion, pulse energy exceeds 100 nJ.

CFK6 • 11:30 a.m.
Fiber Amplification of 2 μm Picoseconds Pulses, *Robert Andrew Sims*, *Pankaj Kadwani, Timothy S. McComb, Christina C. C. Willis, Lawrence Shah, Martin Richardson; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Ultrashort pulses were generated by a carbon nanotube mode-locked Tm fiber laser and subsequently amplified. Amplified pulses had an average power of 0.6 W, 2.6 kW peak power, and 13 nJ of energy.

CFK7 • 11:45 a.m.
Mode-Locked Ultrafast Thulium Fiber Laser with All-Fiber Dispersion Management, *QingQing Wang, Tong Chen,* ***Kevin P. Chen****; Univ. of Pittsburgh, USA.* We report a mode-locked Thulium fiber oscillator that generates 4.8-nJ pulses at center wavelength of 1935nm with duration of 235fs. The anomalous dispersion in the cavity is compensated with the insertion of Er-doped fiber.

CFK8 • 12:00 p.m.
Experimental Realisation of a Mode-Locked Parabolic Raman Fiber Oscillator, *Claude Aguergaray*, *Vladimir I. Kruglov, David Méchin, John D. Harvey; Univ. of Auckland, New Zealand.* We present the first experimental demonstration of mode-locked parabolic pulses in Raman gain oscillator. The laser delivers 22 nJ linearly chirped pulses with 2.4 nm bandwidth recompressed down to 6 ps close to the Fourier-Limit.

NOTES

Room A5 | Room A6 | Room A7

QELS

QFF • Quantum State Reconstruction—Continued

QFF2 • 11:15 a.m.
Optimal Experiment Design for Minimal Tomography, *Joshua A. S. Nunn*[1], *Brian J. Smith*[1], *Graciana Puentes*[1], *Jeff S. Lundeen*[2], *Ian A. Walmsley*[1]; [1]*Oxford Univ., UK,* [2]*Natl. Res. Council Canada, Canada.* Given an experimental set-up and a fixed number of measurements, how should one take data in order to optimally reconstruct the state of a quantum system? We show how to calculate the optimal design explicitly.

QFF3 • 11:30 a.m.
Entangled Photon Polarimetry, *Neal N. Oza*[1], *Joseph B. Altepeter*[1], *Milja Medic*[1], *Evan R. Jeffrey*[2], *Prem Kumar*[1]; [1]*Northwestern Univ., USA,* [2]*Leiden Inst. of Physics, Netherlands.* We construct an entangled photon polarimeter capable of displaying an evolving quantum state in real time. We use it to record a 3 frame-per-second live video of a two-photon state's transition from separability to entanglement.

QFF4 • 11:45 a.m.
Characterizing a Qutrit Directly with Symmetric Informationally Complete (SIC) POVMs, *Zachari E. D. Medendorp*[1], *Fabian A. Torres-Ruiz*[2], *Krister Shalm*[1], *Chris Fuchs*[3], *Aephraim Steinberg*[1]; [1]*Univ. of Toronto, Canada,* [2]*Univ. de Concepción, Chile,* [3]*Perimeter Inst. for Theoretical Physics, Canada.* Imagine...a world without density matrices! A scheme to perform arbitrary POVMs is proposed and a SIC-POVM is implemented on a qutrit. The Quantum Law of Total Probability is verified.

QFG • Laser Cooling and Terahertz Applications—Continued

QFG4 • 11:15 a.m.
THz Generation from Highly-Lossy Second-Order Nonlinear Medium at Polariton Resonance in Transverse-Pumping Geometry, *Yujie J. Ding*; *Lehigh Univ., USA.* We show that transverse-pumping geometry can be exploited for THz generation when a second-order nonlinear medium is highly lossy at its polariton resonance. High conversion efficiencies can be achieved via such a novel configuration.

QFG5 • 11:30 a.m.
Terahertz Bandwidths Extending to 100 THz from a Two-Color-Photoinduced Air Plasma, *Volker Blank*, ***Mark D. Thomson***, *Hartmut G. Roskos; Physikalisches Inst., Johann Wolfgang Goethe-Univ., Germany.* We present the generation of terahertz pulses with a continuous bandwidth up to 100 THz from a plasma with sub-20-fs two-color femtosecond excitation, and demonstrate its potential for spectroscopic measurements.

QFG6 • 11:45 a.m.
Nonperturbative Excitonic Interaction with Intense THz Pulses in ZnSe/ZnMgSSe Multiple Quantum Wells, *Hideki Hirori*[1,2], *Masaya Nagai*[3], *Koichiro Tanaka*[1,2,3]; [1]*Inst. for Integrated Cell-Material Sciences (iCeMS), Kyoto Univ., Japan,* [2]*CREST, Japan Science and Technology Agency, Japan,* [3]*Dept. of Physics, Graduate School of Science, Kyoto Univ., Japan.* The excitonic interaction in ZnSe/ZnMgSSe multi-quantum wells with intense terahertz pulses (around 70 kV/cm) has been studied. Our results show a dynamical Stark effect on the excitonic absorption with a subpicosecond response time.

QFH • Photonic Crystals and Cavity Phenomena—Continued

QFH4 • 11:15 a.m.
Three-Dimensional Rhombicuboctahedral Photonic Quasicrystals, *Alexandra Ledermann*, *Martin Wegener, Georg von Freymann; Karlsruhe Inst. of Technology, Germany.* Studies on three-dimensional quasicrystals have been restricted to the icosahedral class so far. We rationally construct the blueprint of a novel, namely the rhombicuboctahedral class. Corresponding polymer microstructures are characterized by visible-light Laue diffraction experiments.

QFH5 • 11:30 a.m.
Split Band Edge Resonance in a 2-Dimensional Square Lattice Structure, *Heeso Noh*[1], *Jin-Kyu Yang*[1], *Alexander Figotin*[2], *Ilya Vitebskiy*[2], *Hui Cao*[1]; [1]*Yale Univ., USA,* [2]*Univ. of California at Irvine, USA.* We find for the first time the split band edge resonance in a two-dimensional photonic crystal. Its Q factor is much higher than that of the regular band edge mode in the same structure.

QFH6 • 11:45 a.m.
Transformation-Optical Cavities for Subwavelength Confinement of Light, *Vincent Ginis*[1], ***Philippe Tassin***[1,2], *Costas M. Soukoulis*[2,3], *Irina Veretennicoff*[1]; [1]*Vrije Univ. Brussel, Belgium,* [2]*Iowa State Univ., USA,* [3]*Univ. of Crete-FORTH, Greece.* We use transformation optics to design an optical cavity that allows for the subwavelength confinement of light. Our cavity combines a deep subwavelength mode volume with the absence of intrinsic (bending) losses.

NOTES

Room A8 | Room C1&2 | Room C3&4 | San Jose Ballroom IV (San Jose Marriott)

QELS | CLEO

QFI • Excitons—Continued

QFI5 • 11:15 a.m.
Excitonic Switches Operating at Around 100 K, *Gabriele Grosso[1], Joe C. Graves[1], Aaron T. Hammack[1],* ***Alex A. High***[1], *Leonid V. Butov[1], Micah Hanson[2], Arthur Gossard[2]; [1]Univ. of California at San Diego, USA, [2]Univ. of California at Santa Barbara, USA.* We report on experimental proof of principle for the operation of excitonic switches at temperatures around 100 K. The devices include the exciton optoelectronic transistor, the excitonic bridge modulator, and the excitonic pinch-off modulator.

QFI6 • 11:30 a.m.
Transient Optical Response of Quantum Well Excitons to Intense Few-Cycle Terahertz Pulses, *Andrew D. Jameson[1], Joseph L. Tomaino[1],* ***Yun-Shik Lee***[1], *John P. Prineas[2], Johannes T. Steiner[3], Mackillo Kira[3], Stephan W. Koch[3]; [1]Oregon State Univ., USA, [2]Univ. of Iowa, USA, [3]Philips Univ., Germany.* Interaction of strong few-cycle THz pulses with QW excitons produces pronounced nonlinear optical transients. With THz radiation tuned near the 1*s*-to-2*p* intraexciton transition, the exciton resonances exhibit Rabi sidebands revealing the 2*p*-dephasing time.

QFI7 • 11:45 a.m.
Kinetics of the Exciton Inner Ring Pattern Formation and Thermalization Properties of the Exciton Cloud under One- and Two-Color Pump-Probe Experiments, ***Aaron T. Hammack***[1], *Leonid V. Butov[1], Joe Wilkes[2], Leonidas Mouchliadis[2], Egor A. Muljarov[2], Alex L. Ivanov[2], Arthur C. Gossard[3]; [1]Univ. of California at San Diego, USA, [2]Cardiff Univ., UK, [3]Univ. of California at Santa Barbara, USA.* We report on spatially resolved kinetics and spatially resolved pump-probe studies of transport and thermalization of indirect excitons in GaAs/AlGaAs coupled quantum well structures.

QFJ • Correlations and Coherence—Continued

QFJ5 • 11:15 a.m.
Propagation Dynamics of Controllable Cross-Talk in Double-Ladder System, *Paul S. Hsu[1,2], George R. Welch[1],* ***Anil Patnaik***[1,2]; *[1]Texas A&M Univ., USA, [2]Wright State Univ., USA.* We theoretically and experimentally investigate the propagation dynamics and controllability of cross-talk between two probes in a double-ladder system via interplay of $\chi^{(1)}$ and $\chi^{(3)}$ processes.

QFJ6 • 11:30 a.m.
Observation of Optical Precursors with Electromagnetically Induced Transparency, ***Shengwang Du***, *Jiefei Chen, Dong Wei, Michael M. T. Loy, George K. L. Wong; Dept. of Physics, Hong Kong Univ. of Science and Technology, Hong Kong.* We generate Sommerfeld-Brillouin precursors from a square-modulated laser pulse through a cold atomic ensemble with electromagnetically induced transparency. At a high optical depth, the precursor forerunner is clearly separated from the delayed main pulse.

QFJ7 • 11:45 a.m.
Two-Dimensional Fourier-Transform Spectroscopy of Potassium Vapor, ***Xingcan Dai***, *Alan D. Bristow, Denis Karaiskaj, Steven T. Cundiff; JILA, NIST, Univ. of Colorado, USA.* Various two-dimensional Fourier-transform spectra of potassium vapor have been obtained to show coherent interactions and isolate Raman-like coherences. The experimental results agree well with numerical calculation based on optical Bloch equations.

CFL • Optical Signal Processing—Continued

CFL5 • 11:15 a.m.
Fully Reconfigurable Silicon Photonic Interleaver, ***Lian-Wee Luo***[1], *Salah Ibrahim[2], Carl B. Poitras[1], Stevan S. Djordjevic[2], Hugo L. R. Lira[1], Linjie Zhou[2], Jaime Cardenas[1], Binbin Guan[2], Arthur Nitkowski[1], Zhi Ding[2], S. J. Ben Yoo[2], Michal Lipson[1]; [1]Cornell Univ., USA, [2]Univ. of California at Davis, USA.* We demonstrate a fully reconfigurable 125 GHz flat passband silicon photonic interleaver with a box-like spectral response and 20 dB extinction ratio.

CFL6 • 11:30 a.m.
Time Domain SPE/SPD and DPSK Data Modulation Using Single Phase Modulator, *Zhensen Gao[1],* ***Xu Wang***[1], *Nobuyuki Kataoka[2], Naoya Wada[2]; [1]Heriot-Watt Univ., UK, [2]NICT, Japan.* A novel scheme using single phase modulator for simultaneous generating and decoding of time domain spectral phase encoded signal and DPSK data modulation is proposed and experimentally demonstrated for five 16-chip, 40GHz/chip optical code patterns.

CFL7 • 11:45 a.m.
160-Gb/s Optical DQPSK Signal Generation Using a Thin-$LiNbO_3$-Substrate Modulator with a Ridge-Type Optical Waveguide Structure, ***Atsushi Kanno***[1], *Takahide Sakamoto[1], Akito Chiba[1], Tetsuya Kawanishi[1], Kaoru Higuma[2], Masaaki Sudou[2], Junichiro Ichikawa[2]; [1]NICTJapan, [2]Sumitomo Osaka Cement Co. Ltd., Japan.* 160-Gb/s NRZ-DQPSK modulation is demonstrated with a thin-$LiNbO_3$-substrate modulator. Using this substrate with a ridge-type waveguide structure can help realize an extension of a bandwidth and a decrease of a half-wave voltage of the modulator.

CFM • Fabrication and Characterization—Continued

CFM5 • 11:15 a.m.
Geometrical and Fluidic Tuning of Nanoscale Split-Ring Resonators, ***Claus Jeppesen***, *Anders Kristensen, Sanshui Xiao, Niels A. Mortensen; Technical Univ. of Denmark, Denmark.* We investigate the capacitance tuning of nanoscale split-ring resonators. An LC-model predicts a simple dependence of resonance frequency on slit aspect ratio. Experimental and numerical data follow the predictions of the LC-model.

CFM6 • 11:30 a.m.
Effects of the Substrate on the Optical Properties of Plasmonic Subwavelength Apertures, ***Olena Lopatiuk-Tirpak***, *Sasan Fathpour; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* It is shown that the optical properties of metallic nano-apertures on dielectric substrates exhibit dramatically different behaviors than apertures immersed in dielectrics and scale with refractive index more complicatedly than predicted by analytical models.

CFM7 • 11:45 a.m.
Nano-Optic of Metamaterials by Spatially Resolved Electron Energy Loss Spectroscopy, ***Guillaume Boudarham***[1], *Mathieu Kociak[1], O. Stéphan[1], C. Colliex[1], N. Feth[2], S. Linden[2,3], M. Wegener[2,3,4], V. Myroshnychenko[5], F. J. Garcia de Abajo[5]; [1]Lab de Physique des Solides, Univ. Paris-Sud, France, [2]Inst. für Nanotechnologie, Karlsruhe Inst. of Technology, Germany, [3]DFG-Ctr. for Functional Nanostructures, Karlsruhe Inst. of Technology, Germany, [4]Inst. für Angewandte Physik, Karlsruhe Inst. of Technology, Germany, [5]Inst. de Optica, CSIC, Spain.* This work shows the experimental results we have achieved by STEM-EELS. This technique allowed us to map the first surface plasmon resonances of a SRR U-shaped in the NIR/visible spectral range.

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Room B2-B3

CLEO: Applications

AFB • Novel Devices and Methods—Continued

AFB4 • 11:15 a.m. Invited

Optical Coatings for MEMS Devices, ***Michael Helmbrecht****; Iris AO, Inc., USA.* Microelectromechanical systems (MEMS) devices pose unique constraints for optical coatings. This paper discusses issues unique to coating MEMS devices and describes design changes necessary to coat a deformable mirror with 99.9% reflective dielectric coatings at 532 nm.

San Jose Salon I & II (San Jose Marriott)

CLEO

CFN • Optical Parametric Amplifiers and Optical Parametric Generation—Continued

CFN4 • 11:15 a.m.

Synthesis of Phase-Locked Counter-Phase Modulated Pumps for SBS-Suppressed Fiber Parametric Amplifiers, ***Joseph Kakande****, Radan Slavik, Francesca Parmigiani, Periklis Petropoulos, David J. Richardson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We propose and experimentally demonstrate a new all-optical technique for the generation of two optical pumps with oppositely varying carrier phases for mitigating SBS in parametric amplifiers without phase-dither transfer from pumps to signal.

CFN5 • 11:30 a.m.

Generation of Tunable, Ultrashort Pulses in the near-IR with an OPA System Based on BIBO, ***Masood Ghotbi****, Valentin Petrov, Frank Noack; Max-Born-Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany.* Using a two stage, white-light seeded, collinear, femtosecond optical parametric amplifier based on BIBO crystal, sub-30-fs signal pulses tunable across the whole spectral range of 1150-1600 nm with energies exceeding 80-μJ are generated.

CFN6 • 11:45 a.m.

Temporal Phase Manipulation by Phase-Sensitive Parametric Amplification, ***Douglas C. French****, Igor Jovanovic; Purdue Univ., USA.* We present the results of a numerical model and proof-of-principle experiment for temporal phase control using phase-sensitive parametric amplification. Under certain conditions, temporal phase amplification can be achieved in this process

San Jose Salon III (San Jose Marriott)

JOINT

JFB • Laser Particle Acceleration—Continued

JFB5 • 11:15 a.m.

Attosecond Electron Bunches from Laser Wakefield Accelerators, ***Mark J. H. Luttikhof****, Arsen G. Khachatryan, Fred A. van Goor, Klaus J. Boller; Univ. of Twente, Netherlands.* Femtosecond electron bunches with ultra-relativistic energies were recently generated by laser wakefield accelerators. Here we predict that such accelerators can generate stable attosecond bunches, due to betatron phase mixing within a femtosecond electron bunch.

JFB6 • 11:30 a.m.

High Quality Electron Beams from a Laser Wakefield Accelerator, ***Mark Wiggins***[1]*, Richard Shanks*[1]*, Riju Issac*[1]*, Gregor Welsh*[1]*, Maria Pia Anania*[1]*, Enrico Brunetti*[1]*, Gregory Vieux*[1]*, Silvia Cipiccia*[1]*, Bernhard Ersfeld*[1]*, Ranaul Islam*[1]*, Ronan Burgess*[1]*, Grace Manahan*[1]*, Constantin Aniculaesei*[1]*, Allan Gillespie*[2]*, Allan MacLeod*[3]*, Dino Jaroszynski*[1]*;* [1]*Univ. of Strathclyde, UK,* [2]*Univ. of Dundee, UK,* [3]*Univ. of Abertay Dundee, UK.* Very stable, high quality electron beams (current ~ 10 kA, energy spread < 1%, emittance ~ 1π mm mrad) have been generated in a laser-plasma accelerator driven by 25 TW femtosecond laser pulses.

JFB7 • 11:45 a.m.

Photonic Structure Based Acceleration of Non-Relativistic Electrons—Simulations and Proof-of-Concept Experiment, *John Breuer*[1]*, Christopher M. S. Sears*[1]*, Tomas Plettner*[2]*,* ***Peter Hommelhoff***[1]*;* [1]*Max-Planck-Inst. für Quantenoptik, Germany,* [2]*Applied Physics, Stanford Univ., USA.* We simulate the acceleration of 30-keV electrons passing in 30 nm distance over a grating that is illuminated by femtosecond laser pulses. Acceleration gradients of 100 MeV/m can be achieved. Experimental realization will be reported.

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