

CLEO/IQEC 2009

Explore Innovation. Build Applications.

Technical Conference: May 31 – June 5, 2009

Baltimore Convention Center, Baltimore, MD, USA

CLEO/IQEC, *PhAST* and the debut PhotonXpo again stood out as the leading events in the optoelectronics and laser community. With nearly 1,800 technical presentations spanning the entire field, there were critical advances in every discipline. From papers on using LED lights to make lettuce more nutritious to the world's first laser TV to finding distant Earth-like planets, the research revealed at this year's conference reflected some of today's most important technical developments. The timely and relevant plenary sessions – including Ed Moses' plenary address providing an update on the recently launched National Ignition Facility—acted as the perfect complement to the overall program.

PhotonXpo—the exhibit at CLEO—kicked off to much success, featuring 300 of the field's leading companies from around the globe. With numerous new product announcements and corporate revelations—including news about an Oclaro/Newport asset exchange and NTT Advanced Technologies' introduction of the first fully-adjustable, multi-directional beam-steering scanner—PhotonXpo was a key source of industry excitement and new information. This corporate news was reiterated in the *PhAST* Market Focus sessions on the floor, revealing the ongoing evolution of today's top vertical markets.

Bringing together the foremost authorities in optics and photonics, CLEO/IQEC, *PhAST* and PhotonXpo were attended by 4,500 of the field's leaders from around the globe, with more than one-quarter of attendees coming from outside the U.S. Mark your calendars for the 2010 event in San Jose, Calif., May 16–21—the only broad-reaching photonics show in Silicon Valley next year.

Conference Program

CLEO/IQEC Abstracts

[Monday, June 1, 2009](#)

[Tuesday, June 2, 2009](#)

[Wednesday, June 3, 2009](#)

[Thursday, June 4, 2009](#)

[Friday, June 5, 2009](#)

[Postdeadline Paper Abstracts](#)

Agenda of Sessions and Key to Authors and Presiders

[Agenda of Sessions](#)

[Key to Authors and Presiders](#)

[Postdeadline Paper Key to Authors and Presiders](#)

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Franz Kaertner, *MIT, USA*

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Kaoru Minoshima, *Natl. Inst. of Advanced Industrial Science and Technology, Japan*

CLEO 01 - Laser Processing of Materials: Fundamentals and Applications

Craig Arnold, *Princeton Univ., USA, Chair*

Tommaso Baldacchini, *Newport Corp., USA*

Malcolm Gower, *Nanophoton Technologies, UK*

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CLEO 02 - Solid-State, Liquid and Gas Lasers

Hagop Injeyan, *Northrop Grumman Corp., USA, Chair*
William J. Alford, *Lockheed Martin Coherent Technologies, USA*
Andy Bayramian, *Lawrence Livermore National Lab, USA*
Jean-Christophe Chanteloup, *Ctr. Natl. de la Res. Scientifique, France*
Mark Dubinskii, *US ARL, USA*
Eric Honea, *Lockheed Martin Aculight, USA*
Junji Kawanaka, *Osaka Univ., Japan*
Ara Minassian, *Imperial College, UK*
Jesper Munch, *Univ. of Adelaide, Australia*
Martin Ostermeyer, *Inst. of Physics and Astronomy, Univ. of Potsdam, Germany*
Dan Ripin, *MIT, USA*
Ramesh Shori, *Naval Air Warfare Ctr., USA*

CLEO 03 - Semiconductor Lasers

A. Catrina Bryce, *Univ. of Glasgow, UK, Chair*
Seth Bank, *Univ. of Texas at Austin, USA*
In Kim, *Samsung Electronics, Korea*
Nobu Nishiyama, *Tokyo Inst. of Technology, Japan*
Jim Raftery, *U.S. Military Acad., USA*
David Roh, *Coherent Inc., USA*
Peter Smowton, *Cardiff Univ., UK*
Adrienne D. Stiff-Roberts, *Duke Univ., USA*
Shinji Tsuji, *Hitachi Central Res. Lab, Japan*
Igor Vurgaftman, *NRL, USA*
Dan Yanson, *SemiConductor Devices, Israel*

CLEO 04 - Applications of Nonlinear Optics

Vladimir Shkunov, *Raytheon Corp., USA, Chair*
Arnaud Brignon, *Thales Res. and Technology, France*
Judith Dawes, *Macquarie Univ., Australia*
Jean-Claude Diels, *Univ. of New Mexico, USA*
Majid Ebrahim-Zadeh, *ICFO, Inst. of Photonic Sciences, Spain*
Jason Fleischer, *Princeton Univ., USA*
Takashige Omatsu, *Chiba Univ., Japan*
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Takunori Taira, *Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan*
George Ke Lun Wong, *Hong Kong Univ., Hong Kong*
Vladislav V. Yakovlev, *Univ. of Wisconsin, USA*

CLEO 05 - Terahertz Technologies and Applications

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CLEO 06 - Optical Materials, Fabrication and Characterization

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CLEO 08 - Ultrafast Optics, Optoelectronics and Applications

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CLEO 09 - Components, Integration, Interconnects and Signal Processing

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CLEO 10 - Medical and Biological Applications

James W. Tunnell, *Univ. of Texas at Austin, USA, Chair*
Brian Applegate, *Texas A&M Univ., USA*
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Alberto Bilenca, *Swiss Federal Inst. of Technology, Switzerland*
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Min Gu, *Swinburne Univ. of Technology, Australia*
Changhuei Yang, *Caltech, USA*
Seok Hyun Yun, *Harvard Univ., USA*

CLEO 11 - Fiber Amplifiers, Lasers and Devices

Ingmar Hartl, *IMRA America, Inc., USA, Chair*
Jacques Albert, *Carleton Univ., Canada*
Martijn de Sterke, *Univ. of Sydney, Australia*
John Dudley, *Univ. of Franche-Comté, France*
Shibin Jiang, *AdValue Photonics, USA*
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CLEO 12 - Lightwave Communications and Networks

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CLEO 13 - Active Optical Sensing

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CLEO 14 - Optical Metrology

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CLEO 15 - Visible and Ultraviolet LEDs and OLEDs

Michael Wraback, *US ARL, USA, Chair*
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Mary Crawford, *Sandia Natl. Labs, USA*
Nicolas Grandjean, *Ecole Polytechnique Federale de Lausanne, Switzerland*
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Leo J. Schowalter, *Crystal IS, Inc., USA*
Franky So, *Univ. of Florida, USA*
Yoshitaka Taniyasu, *NTT Basic Res. Lab, Japan*

CLEO 16 - Micro- and Nano-Photonics Devices

Keren Bergman, *Columbia Univ., USA, Chair*
Harold M. H. Chong, *Univ. of Southampton, UK*
William M. J. Green, *IBM, USA*
Siegfried Janz, *Natl. Res. Council Canada, Canada*
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IQEC 01 - Quantum Optics of Atoms, Molecules and Solids

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IQEC 02 - Quantum Science, Engineering and Technology

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IQEC 03 - Fundamentals of Metamaterials, Periodic and Random Media

Mikhail Noginov, *Norfolk State Univ., USA, Chair*

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IQEC 04 - Optical Interactions with Condensed Matter and Ultrafast Phenomena

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Weng Chow, *Sandia Natl. Labs, USA*
Jianming Dai, *Rensselaer Polytechnic Inst., USA*
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Cun-Zheng Ning, *Arizona State Univ., USA*
Ted Norris, *Univ. of Michigan, USA*

IQEC 05 - Nonlinear Optics and Novel Phenomena

Demetrios Christodoulides, *CREOL, Univ. of Central Florida, USA, Chair*
Neil Broderick, *Univ. of Southampton, UK*
Dave Hagan, *CREOL, Univ. of Central Florida, USA*
Detlef Kip, *Clausthal Univ., Germany*
Roberto Morandotti, *INRS, Canada*
Ewan Wright, *Univ. of Arizona, USA*

IQEC 06 - Nano-Optics and Plasmonics

Martin Wegener, *Univ. of Karlsruhe, Germany, Chair*
Nader Engheta, *Univ. of Pennsylvania, USA*
Naomi J. Halas, *Rice Univ., USA*
Stefan Hell, *Max Planck Inst. Göttingen, Germany*
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Romaine Quidant, *ICFO, Inst of Photonic Sciences, Spain*
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CLEO/IQEC 07 - Joint Subcommittee on High-Field Physics and High-Intensity Lasers

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Szu-yuan Chen, *Academia Sinica, Taiwan*

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Guiseppe Sansone, *Politecnico de Milano, Italy*
Csaba Toth, *Lawrence Berkeley Natl. Lab, USA*
David Villeneuve, *Natl. Res. Council of Canada, Canada*
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Randall Wilcox, *Lightspeed Technologies, USA*

Don Wilson, *OFR, Division of Thorlabs, USA*

Invited Speakers

CLEO 01 - Laser Processing of Materials: Fundamentals and Applications

Tutorial Speaker

CThG1, Laser Processing: Basics to Advanced Applications, *Peter Herman; Univ. of Toronto, Canada.*

Invited Speakers

CThP3, The Art of Femtosecond Laser Writing, *Peter G. Kazansky¹, Weijia Yang¹, Yasuhiko Shimotsuma², Kazuyuki Hirao², Alan Arai³, Yuri Svirko⁴; ¹Optoelectronics Res. Ctr., Univ. of*

Southampton, UK, ²of Material Chemistry, Graduate School of Engineering, Kyoto Univ., Japan, ³Applications Res. Lab, IMRA America, Inc., USA, ⁴Dept. of Physics and Mathematics, Univ. of Joensuu, Finland.

CFT1, Femtosecond Laser Direct Writing of Waveguide Lattices, Stefan Nolte^{1,2}, Alexander Szameit¹, Andreas Tünnermann^{1,2}; ¹Friedrich Schiller Univ. Jena, Inst. of Applied Physics, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering IOF, Germany.

CLEO 02 - Solid-State, Liquid and Gas Lasers

Tutorial Speaker

CTuX1, Space Qualification of Solid State Lasers, Anne-Marie d. Novo-Gradac¹, John F. Cavanaugh²; ¹NASA Headquarters, USA, ²NASA Goddard Space Flight Ctr., USA.

Invited Speakers

CWA3, High Power Eye-Safe Lasers, Scott D. Setzler; BAE Systems, USA.

CFD6, Laser Particle Acceleration, Peter Norreys, A. P. L. Robinson; Rutherford Appleton Lab, UK.

CLEO 03 - Semiconductor Lasers

Tutorial Speaker

CMK1, Commercialization of QD Lasers, Mitsuru Sugawara; Fujitsu Labs Ltd., Japan.

Invited Speakers

CMGG1, Recent Progress in Electrically Pumped Blue GaN-Based VCSELs, Shing Chung Wang; Natl. Chiao Tung Univ., Taiwan.

CMV1, Studies on the Relative Advantages of Quantum-Dot and Quantum-Well Gain Media in Lasers and Amplifiers, Weng Chow; Sandia Natl. Labs, USA.

CTuGG1, GaSb-Based Laser Diodes Operating within Spectral Range of 2 - 3.5 μm , Gregory Belenky¹, Leon Shterengas¹, Gela Kipshidze¹, Takashi Hosoda¹, Jianfeng Chen¹, Sergej Suchalkin^{1,2}; ¹Stony Brook Univ., SUNY, USA, ²Power Photonic Corp., USA.

CTuH1, Surface-Emitting Photonic-Crystal Laser with 35W Peak Power, Takui Sakaguchi^{1,2}, Wataru Kunishi^{1,2,3}, Soichiro Arimura¹, Kazuya Nagase¹, Eiji Miyai^{1,2,3}, Dai Ohnishi^{1,2,3}, Kyosuke Sakai^{2,3}, Susumu Noda^{2,3}; ¹ROHM Co., Ltd., Japan, ²JST, Japan, ³Kyoto Univ., Japan.

CWF1, Coherently Combined Diode Laser Arrays and Stacks, *Robin K. Huang¹, Bien Chann¹, Leo J. Missaggia¹, Steven J. Augst¹, Michael K. Connors¹, George W. Turner¹, Antonio Sanchez-Rubio¹, Joseph P. Donnelly¹, John L. Hostetler², Carl Miester², Friedhelm Dorsch²; ¹MIT, USA, ²TRUMPF Photonics, USA.*

CLEO 04 - Applications of Nonlinear Optics

Tutorial Speaker

CTuHH3, Discreteness in Optics: Spatial Solitons, *George Stegeman, Demetrios Cristodoulides; Univ. of Central Florida, USA.*

Invited Speakers

CMFF1, Ultra-Low Power Frequency Conversion in High-Index Doped Silica Glass Micro-Ring Resonators, *David J. Moss¹, Marcello Ferrara², Luca Razzari², David Duchesne², Roberto Morandotti², Z. Yang³, Marco Liscidini³, John Sipe³, Sai Chu⁴, Brent E. Little⁴; ¹Univ. of Sydney, Australia, Australia, ²INRS-EMT, Canada, ³Dept. of Physics, Univ. of Toronto, Canada, ⁴Infinera Ltd., USA.*

CMJ1, Ultra-Wide THz-Wave Generation by DAST and BNA, *Hiromasa Ito^{1,2}; ¹RIKEN Sendai, Japan, ²Tohoku Univ., Japan.*

CTuZ5, Imaging with Ultrashort Shaped Pulses, *Yair Andegeko¹, Dmitry Pestov¹, Yves Coello¹, Vadim V. Lozovoy¹, Marcos Dantus^{1,2}; ¹Michigan State Univ., USA, ²BioPhotonic Solutions, Inc., USA.*

CFR2, Low-Power and Fast Switching in III-V Photonic Crystals, *S. Combrié¹, C. Husko², Q. Tran¹, P. Colman^{3,4}, F. Raineri^{3,4}, C. W. Wong², Alfredo De Rossi¹; ¹Thales Res. and Technology, France, ²Columbia Univ., USA, ³CNRS, France, ⁴Univ. Paris Diderot, France.*

CFR4, Frequency Conversion in Silicon Waveguides over Two-Thirds of an Octave, *Amy C. Turner-Foster, Mark A. Foster, Reza Salem, Alexander L. Gaeta, Michal Lipson; Cornell Univ., USA.*

CLEO 05 - Terahertz Technologies and Applications

Tutorial Speaker

CMX1, Scientific and Technical Accomplishments of THz Photonics, *Daniel Grischkowsky; Oklahoma State Univ., USA.*

Invited Speakers

CMI5, Terahertz-Comb-Referenced Spectrum Analyzer, *Takeshi Yasui; Osaka Univ., Japan.*

CMT1, Terahertz Electrical Measurement of Single-Walled Carbon Nanotube Transistors, Zhaohui Zhong¹, Nathaniel M. Gabor², Jay E. Sharping³, Alexander L. Gaeta², Paul McEuen²; ¹Univ. of Michigan, USA, ²Cornell Univ., USA, ³Univ. of California at Merced, USA.

CMT3, THz Studies of Charge and Exciton Dynamics in Semiconductor Nanostructures, Mischa Bonn; FOM-Inst. for Atomic and Molecular Physics, Netherlands.

CThH6, Surface-Emitting Photonic Crystal Terahertz Semiconductor Lasers, Y. Chassagneux¹, Raffaele Colombelli¹, W. Maineult², S. Barbieri², H. Beere³, D. Ritchie³, S. P. Khanna⁴, A. G. Davies⁴, E. Linfield⁴; ¹Univ. Paris-Sud, Inst. d'Electronique Fondamentale, France, ²Univ. Paris 7, MPQ, France, ³Cambridge Univ., UK, ⁴Univ. of Leeds, UK.

CLEO 06 - Optical Materials, Fabrication and Characterization

Tutorial Speaker

CFF1, Silicon Photonic Waveguides and Devices, Goran Mashanovich; Univ. of Surrey, UK.

Invited Speakers

CTuF1, Low-Refractive-Index Materials: A New Class of Optical Thin-Film Materials, E. Fred Schubert, Jong Kyu Kim; Rensselaer Polytechnic Inst., USA.

CTuW1, Chaotic Microcavity Laser with High Quality and Unidirectional Output, Hui Cao¹, Qinghai Song¹, Boyang Liu², Seng T. Ho², Wei Fang³, Glenn S. Solomon³; ¹Yale Univ., USA, ²Northwestern Univ., USA, ³NIST, USA.

CThD4, Semiconductor Guided-Wave Wavelength Conversion Devices, Takashi Kondo; Univ. of Tokyo, Japan.

CThV1, Femtosecond Nonlinear Frequency Conversion Using BiB₃O₆ Crystals from 250 nm in the UV to 3000 nm in the Near-IR, Valentin Petrov; Max-Born-Inst., Germany.

CLEO/IQEC 07 - Joint Subcommittee on High-Field Physics and High-Intensity Lasers

Tutorial Speaker

JWB1, AMO Research at the LCLS X-Ray Laser, Philip H. Bucksbaum; Stanford Univ., USA.

Invited Speakers

JWD1, Laser Based Synchrotron Light Sources, *Heinrich Schwöerer¹, Hans-Peter Schlenvoigt², Kerstin Haupt¹, Fabian Budde², Erich Rohwer¹, Jordan Gallacher³, Dino Jaroszynski³; ¹Laser Res. Inst., Stellenbosch Univ., South Africa, ²Inst. für Optik und Quantenelektronik, Friedrich-Schiller-Univ., Germany, ³Univ. of Strathclyde, UK.*

JThB1, Laser Induced Tunneling in Less Than 12 Attoseconds: Instantaneous or Invalid Concept? *Adrian N. Pfeiffer¹, Petrisa Eckle¹, Claudio Cirelli¹, André Staudte², Reinhard Dörner³, Harm Geert Muller⁴, Ursula Keller¹; ¹Physics Dept., ETH Zürich, Switzerland, ²Steacie Inst. for Molecular Sciences, C Germany, ⁴FOM Inst. for Atomic and Molecular Physics, Netherlands.*

JThD1, Ultrafast Hydrogen Migration in Hydrocarbon Molecules in Ultrashort Intense Laser Fields, *Kaoru Yamanouchi; Univ. of Tokyo, Japan.*

CLEO 08 - Ultrafast Optics, Optoelectronics and Applications

Invited Speakers

CME1, Multifocal, Multi-Modal, Photon Counting, Multiphoton Microscopy, *Jeffrey Squier, W. Amir, Ramon Carriles, E. Chandler, J. J. Field, Erich E. Hoover, D. Schafer, Kraig E. Sheetz; Colorado School of Mines, USA.*

CThF4, Ultrafast and Nanoscale Optics, *Yeshaiahu Fainman; Univ. of California at San Diego, USA.*

CThO5, Ultrafast Imaging with Electron Pulses, *Martin Centurion¹, Peter Reckenthaeler¹, Werner Fuss¹, Sergei Trushin¹, Alexander Apolonski², Ferenc Krausz^{1,2}, Ernst E. Fill¹; ¹Max-Planck-Inst. für Quantenoptik, Germany, ²Ludwig-Maximilians-Univ. Muenchen, Germany.*

CThW1, Progress Towards the Solid-State All-Optical Streak Camera, *John E. Heebner¹, Chris H. Sarantos^{1,2}; ¹Lawrence Livermore Natl. Lab, USA, ²Univ. of California at Santa Barbara, USA.*

CLEO 09 - Components, Integration, Interconnects and Signal Processing

Tutorial Speaker

CTuL3, Modulation and Multiplexing in Optical Communications, *Peter J. Winzer; Bell Labs, Alcatel-Lucent, USA.*

Invited Speakers

CTuC3, Manycore Processor Networks with Monolithic Integrated CMOS Photonics, Vladimir Stojanovic¹, Ajay Joshi¹, Christopher Batten¹, Young-Jin Kwon², Krste Asanovic²; ¹MIT, USA, ²Univ. of California at Berkeley, USA.

CTuT3, Optical Processing to Enhance UWB Transmission and Reception, Leslie A. Rusch, Mohammad Abtahi; Univ. Laval, Canada.

CThB1, Tunable VCSEL Using High Contrast Grating, Connie J. Chang-Hasnain, Ye Zhou, M. C. Y. Huang, C. Chase, Vadim Karagodsky, Bala Pesala; Univ. of California at Berkeley, USA.

CLEO 10 - Medical and Biological Applications

Tutorial Speaker

CMR1, Advances in Optical Coherence Tomography for Biological Imaging, Johannes F. de Boer; VU Univ. Amsterdam, Netherlands.

Invited Speakers

CMF5, Mesoscopic Imaging Using Multi Spectral Optoacoustic Tomography (MSOT), Vasilis Ntziachristos, Daniel Razansky; Technische Univ. München, Germany.

CFL1, Quantifying Binding of Focal Adhesion Proteins Using Fluorescent Spectral Microscopy, Peter T. So; MIT, USA.

CLEO 11 - Fiber Amplifiers, Lasers and Devices

Invited Speakers

CMHH1, A Chirped Photonic Crystal Fiber for High-Fidelity Guiding of Sub-100 fs Pulses, Julia S. Skibina¹, Rumen Iliev², Jens Bethge³, Martin Bock³, Dorit Fischer³, Valentin I. Beloglasov⁴, Reiner Wedell⁵, Sven Burger⁶, Günter Steinmeyer³; ¹Saratov State Univ., Russian Federation, ²Inst. für Festkörpertheorie und -optik, Friedrich-Schiller-Univ. Jena, Germany, ³Max Born Inst., Germany, ⁴Nanostructured Glass Technology Comp., Russian Federation, ⁵Inst. für Angewandte Photonik e.V., Germany, ⁶Zuse Inst. Berlin, Germany.

CMW1, Controlled Dispersion in Photonic Crystal Fibres, Jonathan Knight, M. G. Welch, C. E. de Nobrega, R. Amezcua Correa; Univ. of Bath, UK.

CWD6, What Are the Essential Technical Requirements for the New Bend Insensitive Fiber? David Z. Chen; Verizon, USA.

CThGG3, 30W, 1178nm Yb-Doped Photonic Bandgap Fiber Amplifier, Akira Shirakawa¹, Hiroki Maruyama¹, Ken-ichi Ueda¹, Christina B. Olausson², Jens Kristian Lyngsø², Jes Broeng²; ¹Inst. for Laser Science, Univ. of Electro-Communications, Japan, ²Crystal Fibre A/S, Denmark.

CThN3, Recent Advances in Phosphate Glass Fiber Lasers, Axel Schülzgen¹, L. Li¹, X. Zhu¹, J. Albert², N. Peyghambarian¹; ¹Univ. of Arizona, USA, ²Carleton Univ., Canada.

CFH2, Emerging Optical Fibers: New Fiber Materials and Structures, Tanya Monro, S. Afshar, H. Ebendorff-Heidepriem, W. Q. Zhang, Y. Ruan; Univ. of Adelaide, Australia.

CLEO 12 - Lightwave Communications and Networks

Tutorial Speaker

CMO4, Quantum Communication: Real-World Applications and Academic Research, Nicolas Gisin; Univ. de Genève, Switzerland.

Invited Speakers

CMC1, Forward Error Correction in Next Generation Optical Communication Systems, Takashi Mizuoichi; Mitsubishi Electric Corp., Japan.

CMJJ1, Recent Advances in Microstructured Fibers for Power Delivery, David Richardson, Marco Petrovich, John Hayes, Franceso Poletti, Sonali Dasgupta, Xian Feng, Wei Loh, Neil Broderick; Optoelectronics Res. Ctr., Univ. of Southampton, UK.

CLEO 13 - Active Optical Sensing

Tutorial Speaker

CTuA1, Probing Gas-Phase Collisional Energy Transfer with Picosecond Laser Spectroscopy, Thomas B. Settersten; Sandia Natl. Labs, USA.

Invited Speaker

CMDD1, Time and Frequency-Domain Spectroscopy with Dual Frequency Combs, Nathan R. Newbury, Ian Coddington, William C. Swann; NIST, USA.

CMS1, Characterizing Particulate and Droplet Size Distributions: Exhaust Emissions to Cloud Research, William D. Bachalo; Artium Technologies, Inc., USA.

CThI3, Challenges and Opportunities for Next-Generation Diode Laser Active Sensing, Mark G. Allen; Physical Sciences Inc., USA.

CFU1, Standoff Chemical Detection Using Single-Beam CARS, *Steven Wolf, Paul J. Wrzesinski, Marcos Dantus; Michigan State Univ., USA.*

CLEO 14 - Optical Metrology

Tutorial Speaker

CTuB1, Entanglement for Metrology with Atomic Ensembles, *Eugene Polzik; Univ. of Copenhagen, The Niels Bohr Inst., Denmark.*

Invited Speakers

CMII1, Femtosecond Laser Frequency Comb for Precision Astrophysical Spectroscopy, *Chih-Hao Li¹, Andrew J. Benedick², Claire E. Cramer¹, Guoqing Chang², Li-Jin Chen², Peter Fendel², Gabor Furesz¹, Alexander G. Glenday¹, Franz X. Kaertner², David F. Phillips¹, Dimitar Sasselov¹, Andrew Szentgyorgyi¹, Ronald Walsworth¹; ¹Harvard-Smithsonian Ctr. for Astrophysics, USA, ²MIT, USA.*

CWI1, Optical Interferometers with Reduced Sensitivity to Thermal Noise, *H. Jeff Kimble¹, Benjamin L. Lev², Jun Ye³; ¹Caltech, USA, ²Univ. of Illinois, USA, ³Univ. of Colorado, USA.*

CLEO 15 - Visible and Ultraviolet LEDs and OLEDs

Tutorial Speaker

CMM1, Progress in the Growth, Characterization and Device Performance for Nonpolar and Semipolar GaN-Based Materials, *James Speck; Univ. of California at Santa Barbara, USA.*

Invited Speakers

CMEE1, Recent Progresses of AlGaIn and InAlGaIn-Based Deep-UV LEDs, *Hideki Hirayama^{1,2}; ¹RIKEN, Japan, ²JST, CREST, Japan.*

CMOO1, Status and Prognosis for Solid-State Lighting Technology, *Michael Krames; Philips Lumileds Lighting Co., USA.*

CLEO 16 - Micro and Nano-Photonics Devices

Tutorial Speaker

CTuN1, Light Emission from Silicon Nanostructures: Past, Present and Future Perspectives, *Luca Dal Negro; Boston Univ., USA.*

Invited Speakers

CMAA1, Silicon Photonics in Quantum Communications, Hiroki Takesue¹, Ken-ichi Harada¹, Hiroshi Fukuda², Tai Tsuchizawa², Toshifumi Watanabe², Koji Yamada², Yasuhiro Tokura¹, Sei-ichi Itabashi²; ¹NTT Basic Res. Labs, Japan, ²NTT Microsystem Integration Labs, Japan.

CMAA2, Nanophotonic Devices for Optical Networks-On-Chip, Dries Van Thourhout¹, Ian O'Connor², Alberto Scandurra³, Liu Liu¹, Wim Bogaerts¹, Shankar Selvaraja¹, Gunther Roelkens¹; ¹Ghent Univ.- IMEC, Belgium, ²Lyon Inst. of Nanotechnology, Ecole Centrale de Lyon, France, ³ST Microelectronics, Italy.

CMD1, Lasing in Metal-Clad Nano-Cavities, Martin T. Hill; Eindhoven Univ. of Technology, Netherlands.

CMKK1, Opto-Mechanical Oscillations in a Double-Disk Microcavity, Qiang Lin, Xiaoshun Jiang, Matt Eichenfield, Ryan Camacho, Patrick Herring, Kerry Vahala, Oskar Painter; Caltech, USA.

CMP1, Photonic Crystal Nanocavity Laser with Single Quantum Dot Gain, Masahiro Nomura, Naoto Kumagai, Satoshi Iwamoto, Yasutomo Ota, Yasuhiko Arakawa; Univ. of Tokyo, Japan.

CTuV1, CMOS-Integrated High-Speed Germanium Waveguide Photodetector for Optical Interconnects, Solomon Assefa¹, Fengnian Xia¹, Stephen W. Bedell¹, Ying Zhang¹, Teya Topuria², Philip M. Rice², Yurii A. Vlasov¹; ¹IBM T.J. Watson Res. Ctr., USA, ²IBM Almaden Res. Ctr., USA.

IQEC 01 - Quantum Optics of Atoms, Molecules and Solids

Tutorial Speaker

IMA1, Atomic Physics and Quantum Information Processing with Superconducting Circuits, Franco Nori^{1,2}; ¹RIKEN, Japan, ²Univ. of Michigan, USA.

Invited Speakers

IWG2, Quantum Information Processing with Double-Well Optical Lattices, Nathan Lundblad, James V. Porto; NIST, USA.

IThH1, Coherent State Preparation and Observation of Rabi Oscillations in a Single Molecule, Ilja Gerhardt^{1,2}, Gert Wrigge¹, Jaesuk Hwang¹, Gert Zumofen¹, Alois Renn¹, Vahid Sandoghdar¹; ¹ETH Zurich, Switzerland, ²Ctr. for Quantum Technologies, Singapore.

IFB1, Cavity QED Experiments with Ion Coulomb Crystals, *P. F. Herskind, A. Dantan, J. P. Marler, M. Albert, Michael Drewsen; Aarhus Univ., Denmark.*

IFB2, A Heralded Quantum Gate between Remote Atoms, *David L. Hayes¹, D. N. Matsukevich¹, P. Maunz¹, S. Olmschenk¹, L. M. Duan², C. Monroe¹; ¹Joint Quantum Inst. and Dept. of Physics, Univ. of Maryland, USA, ²FOCUS Ctr. and Dept. of Physics, Univ. of Michigan, USA.*

IFB3, Quantum Information with Trapped Ions, *Hartmut Häffner, Thomas Monz, Philipp Schindler, Michael Chwalla, Markus Hennrich, Wolfgang Hänsel, Christian Roos, Rainer Blatt; Univ. Innsbruck, Austria.*

IFD1, Cooling and Measurement of a Micromechanical Oscillator Close to the Quantum Limit, *Albert Schliesser¹, Remi Rivière¹, Olivier Arcizet¹, Tobias J. Kippenberg^{1,2}; ¹Max-Planck-Inst. of Quantum Optics, Germany, ²Ecole Polytechnique de Lausanne (EPFL), Switzerland.*

IFD2, Sideband Opto-Mechanical Cooling of a Silica Micro-Resonator in a Cryogenic Environment, *Young-Shin Park, Hailin Wang; Univ. of Oregon, USA.*

IQEC 02 - Quantum Science, Engineering and Technology

Tutorial Speaker

IMJ4, Quantum Information Processing with Individual Atoms in Optical Tweezers, *Philippe Grangier; Lab Charles Fabry, Inst. d'Optique, France.*

Invited Speakers

IMF1, Efficient Routing of Single Photons with One Atom and a Microtoroidal Cavity, *Takao Aoki¹, A. S. Parkins², D. J. Alton³, C. A. Regal³, Barak Dayan⁴, E. Ostby³, K. J. Vahala³, H. J. Kimble³; ¹Kyoto Univ., Japan, ²Univ. of Auckland, New Zealand, ³Caltech, USA, ⁴Weizmann Inst. of Science, Israel.*

IMF2, Quantum State Preparation with Waveguides and Photon Counting, *Christine Silberhorn; Max-Planck-Inst. fuer Optik, Germany.*

IMF4, Demonstration of Two-Qubit Quantum Algorithms with a Solid-State Electronic Processor, *Leonardo DiCarlo¹, Jerry Chow¹, Jay Gambetta², Lev Bishop¹, Johannes Majer³, Alexandre Blais⁴, Luigi Frunzio¹, Steven Girvin¹, Robert J. Schoelkopf¹; ¹Yale Univ., USA, ²Univ. of Waterloo, Canada, ³Technische Univ. Wien, Austria, ⁴Univ. de Sherbrooke, Canada.*

ITuB3, Recent Advances in Non-Gaussian Control of Optical Continuous Variables, *Masahide Sasaki¹, H. Takahashi^{1,2}, K. Wakui¹, M. Takeoka¹, K. Hayasaka¹; ¹NICT, Japan, ²Univ. of Tokyo, Japan.*

ITuI2, Megabit per Second Quantum Key Distribution Using Practical InGaAs APDs, *Alexander R. Dixon^{1,2}, Zhiliang L. Yuan², James F. Dynes², Andrew W. Sharpe², Andrew J. Shields²; ¹Univ. of Cambridge, UK, ²Toshiba Res. Europe Ltd, UK.*

ITuM5, Third- and Fourth-Order Coherences Measured with a Multi-Element Superconducting Nanowire Single-Photon Detector, *Martin J. Stevens¹, Burm Baek¹, Eric A. Dauler^{2,3}, Andrew J. Kerman³, Richard J. Molnar³, Scott A. Hamilton³, Karl K. Berggren², Richard P. Mirin¹, Sae Woo Nam¹; ¹NIST, USA, ²MIT, USA, ³MIT Lincoln Lab, USA.*

IQEC 03 - Fundamentals of Metamaterials, Periodic and Random Media

Tutorial Speaker

ITuA1, Phononic Metamaterials with Negative Dynamic Mass Density, *Ping Sheng; Hong Kong Univ. of Science and Technology, Hong Kong.*

Invited Speakers

ITuG1, Routing Light with Nematicons: Light Localization and Steering in Liquid Crystals, *Gaetano Assanto¹, Marco Peccianti², Alessandro Alberucci¹, Armando Piccardi¹; ¹Univ. of Rome, Italy, ²Univ. of Quebec, Canada.*

IThD1, Lasing in Chaotic and Random Scattering Media, *Hakan E. Türeci¹, Li Ge², A. Douglas Stone², Robert J. Tandy², Stefan Rotter³; ¹ETH Zurich, Switzerland, ²Yale Univ., USA, ³Vienna Univ. of Technology, Austria.*

IThG1, Mapping Electron Excitations in the Visible-UV Range Using Sub-nm Resolved STEM-EELS Spectrum Imaging, *Mathieu Kociak; Lab de Physique des Solides, Univ. Paris-Sud, France.*

IQEC 04 - Optical Interactions with Condensed Matter and Ultrafast Phenomena

Tutorial Speaker

ITuH1, Four-Wave Mixing and Many-Particle Effects in Semiconductors, *Rolf Binder; Univ. of Arizona, USA.*

Invited Speaker

IThF3, High-Order Optical Nonlinearities from Collinear Time-Resolved Two-Dimensional Spectroscopy, *Wilhelm Kuehn¹, Klaus Reimann¹, Michael Woerner¹, Thomas*

Elsaesser¹, R. Hey²; ¹Max-Born-Inst., Germany, ²Paul-Drude-Inst. für Festkörperelektronik, Germany.

IThI5, Ultrafast Coherent Photoelectron Emission Effects and Their Application for Time-Domain Studies of Current Transport, *Ulrich Höfer¹, Jens Güdde¹, Marcus Rohleder¹, Torsten Meier², Stephan W. Koch¹; ¹Fachbereich Physik und Zentrum für Materialwissenschaften, Philipps-Univ., Germany, ²Dept. Physik, Univ. Paderborn, Germany.*

IThN6, Switch-on of Ultrastrong Light-Matter Interaction Faster than a Cycle of Light, *Aji A. Anappara^{1,2}, Georg Günter¹, Jakob Hees¹, Giorgio Biasiol³, Lucia Sorba^{2,3}, Alessandro Tredicucci², Alfred Leitenstorfer¹, Rupert Huber¹; ¹Univ. of Konstanz, Germany, ²NEST CNR-INFN and Scuola Normale Superiore, Italy, ³Lab Nazionale TASC CNR-INFN, Italy.*

IQEC 05 - Nonlinear Optics and Novel Phenomena

Tutorial Speaker

IWE1, Cavity Optomechanics, *Kerry Vahala; Caltech, USA.*

Invited Speakers

IMC1, Large-Area Linear and Nonlinear Nanophotonics, *Steven R. Brueck; Univ. of New Mexico, USA.*

IML3, Terahertz Generation and Detection Using Frequency Conversion, *Jerry C. Chen¹, Ka-Lo Yeh², M. J. Khan¹, Janos Hebling², Matthias C. Hoffmann², Sumanth Kaushik¹, Keith A. Nelson²; ¹MIT Lincoln Lab, USA, ²MIT, USA.*

IQEC 06 - Nano-Optics and Plasmonics

Tutorial Speaker

ITuK1, Recent Theoretical Progress in Nanoplasmonics, *Mark I. Stockman; Georgia State Univ., USA.*

Invited Speakers

IMB3, Frequency Conversion of Spontaneously Emitted Photons in a Nonlinear Photonic Crystal Nanocavity, *Murray W. McCutcheon¹, Darrick E. Chang², Yinan Zhang¹, Mikhail D. Lukin¹; ¹Sc E A Sc c H SA
²Inst. for Quantum Information, Caltech, USA, ³Physics Dept., Harvard Univ., USA.*

IThL1, Two-Photon Fabrication of Three-Dimensional Metamaterials, *Satoshi Kawata^{1,2}, Takuo Tanaka¹, Nobuyuki Takeyasu¹; ¹RIKEN Advanced Science Inst., Japan, ²Osaka Univ., Japan.*

IFA6, Imaging Plasmonic Nanoparticles with a Narrow-Band Single-Photon Source, Robert Lettow, Philipp Kukura, Michele Celebrano, Yves Rezus, Stephan Götzinger, Vahid Sandoghdar; *ETH Zurich, Switzerland.*

CLEO/IQEC 07 - Joint Subcommittee on High-Field Physics and High-Intensity Lasers

Tutorial Speaker

JWB1, AMO Research at the LCLS X-Ray Laser, Philip H. Bucksbaum; *Stanford Univ., USA.*

Invited Speakers

JWD1, Laser Based Synchrotron Light Sources, Heinrich Schwöerer¹, Hans-Peter Schlenvoigt², Kerstin Haupt¹, Fabian Budde², Erich Rohwer¹, Jordan Gallacher³, Dino Jaroszynski³; ¹Laser Res. Inst., Stellenbosch Univ., South Africa, ²Inst. für Optik und Quantenelektronik, Friedrich-Schiller-Univ., Germany, ³Univ. of Strathclyde, UK.

JThB1, Laser Induced Tunneling in Less Than 12 Attoseconds: Instantaneous or Invalid Concept? Adrian N. Pfeiffer¹, Petriša Eckle¹, Claudio Cirelli¹, André Staudte², Reinhard Dörner³, Harm Geert Muller⁴; ¹Max-Planck-Institut für Quantenoptik, Garching, Germany, ²ETH Zurich, Switzerland, ³University of Oxford, UK, ⁴FOM Inst. for Atomic and Molecular Physics, Netherlands.

JThD1, Ultrafast Hydrogen Migration in Hydrocarbon Molecules in Ultrashort Intense Laser Fields, Kaoru Yamanouchi; *Univ. of Tokyo, Japan.*

Special Symposia

Daniel Chemla Joint CLEO/IQEC Symposium: Coherent Interactions of Light and Condensed Matter

Organizers: Jacob Khurgin, *Johns Hopkins Univ., USA*; Theodore Norris; *Univ. of Michigan, USA*; Martin Wegener; *Univ. of Karlsruhe, Germany*

This symposium honors the work of Daniel Chemla (1940-2008) who was one of the true leaders in condensed matter opto-electronics. Chemla made seminal contributions in such diverse areas as nonlinear optics of organic molecules, excitonic phenomena in semiconductor heterostructures, ultrafast optics of semiconductors and many others. This symposium will bring together leading researchers in fields for which Chemla's work had enormous impact. They

will give a historical perspective of significant developments in their fields, the current state of research, and also their personal reminiscences of Daniel Chemla.

Invited Speakers

JTuA1, From Molecular Nonlinear Optics to Nano-Biophotonics, *Joseph Zyss; Ecole Normale Supérieure de Cachan, France.*

JTuA2, Bioimaging and the Inspiration of Daniel Chemla, *Charles Shank; Lawrence Berkeley Natl. Lab, Univ. of California at Berkeley, USA.*

JTuA4, Quantum Wells and Nanophotonics: Physics, Applications and Limits, *David A. B. Miller; Stanford Univ., USA.*

JTuC1, Excitons in the Family: Working with Daniel Chemla, *Wayne H. Knox; Inst. of Optics, Univ. of Rochester, USA.*

JTuC2, Nonlinear Terahertz Spectroscopy of Semiconductors, *Stephan W. Koch, M. Kira, J. T. Steiner, D. Golde; Philipps Univ. Marburg, Germany.*

JTuC4, Coherence Control of Spin and Charge Currents, *Henry M. van Driel; Univ. of Toronto, Canada.*

Nanophotonics and Metamaterials Joint CLEO/IQEC Symposium

Organizers: Keren Bergman¹, Sunao Kurimura², Mikhail Noginov³, Martin Wegener⁴;
¹Columbia Univ. USA, ²Natl. Inst. for Material Science, Japan, ³Norfolk State Univ., USA, ⁴Univ. of Karlsruhe, Germany

Nanophotonics and metamaterials are two interrelated hot research topics, which are particularly important because of their interesting physics and exciting applications, including ultra-fast and ultra-compact electronics and communication systems, imaging and sensing with sub-wavelength resolution, invisibility cloaking, and many more. The symposium will feature the best papers on nanophotonics, nanoplasmonics and metamaterials, which will be submitted to the corresponding CLEO and IQEC/QELS technical subcommittees.

Invited Speakers

JThA1, Coherent Metamaterials: From —Optical Ferromagnetism to the Lasing Spaser, *N. Papasimakis, V. A. Fedotov, Nikolay I. Zheludev; Univ. of Southampton, UK.*

JThA3, Nanostructure-Based Optoelectronics and Plasmonics, *Hongkun Park; Harvard Univ., USA.*

JThC1, Non-Euclidean Ideas for Broadband Invisibility, *Ulf Leonhardt*^{1,2}, *Tomas Tyc*^{1,3}, *Huanyang Chen*⁴; ¹*Univ. of St. Andrews, UK*, ²*Natl. Univ. of Singapore, Singapore*, ³*Masaryk Univ., Czech Republic*, ⁴*Hong Kong Univ. of Science and Technology, Hong Kong*.

JThC3, Diacritical Analysis of Light, Electrons, and Sound Scattering by Particles and Holes, *Javier Garcia de Abajo*; *Inst. de Optica, Spain*.

JThF1, Sub-Wavelength Imaging Using Infrared Metamaterials, *Gennady Shvets*¹, *S. Trendafilov*¹, *H. Moussavi*¹, *A. Pena*², *A. A. Chabanov*², *J. B. Pendry*³, *A. K. Sarychev*⁴; ¹*Univ. of Texas at Austin, USA*, ²*Univ. of Texas at San Antonio, USA*, ³*Blackett Lab, Imperial College, UK*, ⁴*Inst. of Theoretical and Applied Electrodynamics, Russian Federation*.

JWC1, ‘Trapped Rainbow’ Schemes for Storing Light in Engineered Waveguides, *Kosmas L. Tsakmakidis*, *Ortwin Hess*; *Advanced Technology Inst., School of Electronics and Physical Sciences, Univ. of Surrey, UK*.

JWE1, Negative Radiation-Pressure Response of a Left-Handed Plasmonic Metamaterial, *Henri Lezec*¹, *Kenneth J. Chau*^{1,2}; ¹*NIST, USA*, ²*School of Engineering, Univ. of British Columbia, Canada*.

Slow/Fast Light and its Applications Joint CLEO/IQEC Symposium

Organizers: *Jean Toulouse*¹, *Jacob Khurgin*²; ¹*Lehigh Univ., USA*, ²*Johns Hopkins Univ., USA*

When light strongly interacts with a medium, as through a resonance, it can be slowed down. The phenomenon of slow light epitomizes some of the most basic elements of light-matter interaction. It also offers new ways to control the propagation of light. Many manifestations of Slow Light have now been reported, in media ranging from atomic vapors, through atomic resonances, to photonic crystal waveguides, because of resonances with a periodic structure, to optical fibers in the presence of Stimulated Brillouin or Raman Scattering. This symposium offers a look at what can be done with this new level of all-optical control of signals and images.

Tutorial Speaker

JTuB1, Capabilities and Limitations of Slow Light Optical Buffers: Searching for the Killer Application, *Rodney Stuart Tucker*; *Univ. of Melbourne, Australia*.

Invited Speakers

JTuE1, Slow and Fast Light in Optical Fibers: Review and Perspectives, *Luc Thévenaz*; *Swiss Federal Inst. of Technology, Ecole Polytechnique Fédérale de Lausanne, Switzerland*.

JTuE4, Slow and Stopped Images, *John Howell*; *Univ. of Rochester, USA*.

JTuF1, Slow Light in Dispersion-Engineered Photonic Crystal Waveguides, *Thomas Krauss; Univ. of St. Andrews, UK.*

JTuF4, Controlling the Speed of Light in Semiconductor Waveguides: Physics and Applications, *Jesper Mørk¹, Weiqi Xue¹, Yaohui Chen¹, Søren Blaaberg¹, Salvador Sales², José Capmany²; ¹Technical Univ. of Denmark, Denmark, ²Univ. Politécnica de Valencia, Spain.*

10 Years of Frequency Combs CLEO Symposium

Organizer: Thomas R. Schibli; *JILA, Univ. of Colorado, USA*

Since the first demonstration of full phase stabilization of an optical frequency comb 10 years ago, we have experienced unprecedented developments in a large variety of disciplines ranging from fundamental science to commercial products. During these 10 years, optical clocks have advanced by nearly six orders of magnitudes, optical metrology now relies on a compact, phase stable link between optical and microwave domains, optical arbitrary waveform generation enables precise engineering of electromagnetic waves at hundreds of THz, and last but not least, optical frequency combs might help unravel the mysteries of dark energy. This symposium will provide a historical background of the development of this revolutionary technology as well as discuss emerging, interdisciplinary applications of frequency comb technology. This symposium will consist of invited and contributed papers. Submissions of contributed papers to CLEO SC14: Optical Metrology are strongly encouraged to be considered for inclusion in this symposium.

Tutorial Speaker

CMB1, Frequency Combs-At the Frontier of Precision Measurements, *Theodor Hänsch; Univ. of Munich, Germany.*

Invited Speaker

CMY1, 10 Years of Femtosecond Combs in Boulder, *Steven Cundiff; JILA, NIST, Univ. of Colorado, USA.*

Optofluidics for Biosensing and Analysis CLEO Symposium

Organizers: *David Erickson¹, Holger Schmidt², Peter Domachuck³; ¹Cornell Univ., USA, ²Univ. of California at Santa Cruz, USA, ³Tufts Univ. USA*

–Optofluidics represents the marriage of optics and photonics with micro- and nanofluidics. While optical devices incorporating liquids as a fundamental part of their structure date back at least a few hundred years, recent advancements in small scale fluid dynamics have enabled entirely new approaches to these old ideas. Such integration allows for new approaches for: the dynamic manipulation of optical properties in photonic devices, ultra-precise biochemical detection and analysis, and single molecule biophotonics. The aim of the symposium will be to unite these fields and others related to biosensing and biophotonics into a single set of sessions.

Submissions of contributed papers to CLEO SC10: Medical and Biological Applications are strongly encouraged to be considered for inclusion in this symposium.

Invited Speakers

CTuD1, Reconfigurable Photonic Crystal Circuits and Fibers Using Microfluidics, *Benjamin J. Eggleton; Univ. of Sydney, Australia.*

CTuM1, Optofluidic Fabrication of Functional Particles with Controlled Sizes, Shapes and Structures, *Seung-Man Yang, Shin-Hyun Kim, Seung-Kon Lee, Hyo Sung Park; KAIST, Republic of Korea.*

CTuU1, Functional Measurement of Biological Parts, *Matthew Lang; MIT, USA.*

High Power Solid-State Lasers CLEO Symposium

Organizers: Ingmar Hartl¹, Hagop Injeyan²; ¹*IMRA America Inc. USA*, ²*Northrop Grumman Corp, USA*

Solid state lasers in both bulk and fiber form have made dramatic recent advances in average power and brightness, opening the door for exciting new applications. Recognizing that the concept of high power varies for lasers using different architectures and operational formats, the Symposium showcases work from groups that have achieved record performance over the entire spectrum of fiber and bulk solid state lasers ranging from femtosecond operation to CW. Submissions of contributed papers to CLEO SC 2: Solid-State, Liquid and Gas Lasers and SC11: Fiber Amplifiers, Lasers and Devices are strongly encouraged to be considered for inclusion in this symposium.

Invited Speakers

CThA1, 100 kW Coherently Combined Slab MOPAs, *Stuart J. McNaught, Hiroshi Komine, S. Benjamin Weiss, Randy Simpson, Adam M. F. Johnson, Jason Machan, Charles P. Asman, Mark Weber, Gina C. Jones, Marcy M. Valley, Andrew Jankevics, David Burchman, Michael McClellan, Jeff Sollee, Jay Marmo, Hagop Injeyan; Northrop Grumman Corp., USA.*

CThA2, Physics of High Performance Yb:YAG Thin Disk Lasers, *Petras V. Avizonis¹, David J. Bossert¹, Mark S. Curtin¹, Alexander Killi²; ¹Boeing Co., USA, ²Trumpf GmbH, Germany.*

CThA3, Power Scaling of SM Fiber Lasers toward 10kW, *Michael O'Connor, V. Gapontsev, V. Fomin, M. Abramov, A. Ferin; IPG Photonics Corp., USA.*

CThJ1, High Time for Fibers-Towards kW Class Laser Systems with GW Peak Power, *Fabian Röser, Tino Eidam, Jan Rothhardt, Steffen Hädrich, Damian Nikolaus Schimpf, Jens Limpert, Andreas Tünnermann; Univ. Jena, Germany.*

CThJ3, Femtosecond High-Power Thin Disc Laser Oscillators, *Thomas Dekorsy¹, Joerg Neuhaus¹, Dominik Bauer^{1,2}, Christoph Scharfenberg², Jochen Kleinbauer², Alexander Killi², Sascha Weiler², Dirk H. Sutter²; ¹Univ. Konstanz, Germany, ²TRUMPF-Laser GmbH + Co. KG, Germany.*

CThJ4, High-Average-Power Cryogenically-Cooled Picosecond Yb:YAG Amplifier Seeded by a Fiber CPA System, *Kyung-Han Hong¹, Juliet Gopinath², Aleem Siddiqui¹, Jeffrey Moses¹, Chien-Jen Lai¹, John Hybl², Tso Yee Fan²; ¹MIT, USA, ²MIT Lincoln Lab, USA.*

CThR1, 2.3 kW Cryogenically Cooled Yb:YAG Laser, *Jason K. Brasseur, Akheesh K. Abeeluck, Andrew R. Awtry, Lei S. Meng, Kevin E. Shortoff, Nicholas J. Miller, Richard K. Hampton, Michael H. Cuchiara, David K. Neumann; Directed Energy Solutions, USA*

CLEO/IQEC Plenary



The National Ignition Facility: Exploring Matter Under Extreme Conditions

Edward I. Moses

Lawrence Livermore Natl. Lab, USA

[Moses Presentation \(PDF\)](#)

[Moses Video Part 1](#)

[Moses Video Part 2](#)

[Moses Video Part 3](#)

[Moses Video Part 4](#)

[Moses Video Part 5](#)

[Moses Video Part 6](#)

Abstract: The focus of this talk will be on NIF technical capabilities, the National Ignition Campaign, and the new scientific opportunities in material science, astrophysics, and other areas of high energy density science made available by NIF. The LIFE (Laser Inertial Fission-Fusion Energy) scheme, a fission-fusion hybrid capable of generating energy by coupling fusion neutrons to fissile material such as spent reactor fuel and excess weapon nuclear material, will also be discussed. LIFE, a once-through closed fuel cycle that will provide a sustainable, carbon-free source of energy has the potential of revolutionizing our energy future.

Biography: Dr. Ed Moses is the Principal Associate Director for the National Ignition Facility and Photon Science Directorate at Lawrence Livermore National Laboratory (LLNL) in Livermore, California. In this role he is responsible for completing construction and activation of the National

Ignition Facility (NIF) and transforming it into a national user facility. When complete, NIF will be the world's largest and most energetic laser system. Experiments on NIF will access high energy density and fusion regimes with direct application to national security, fusion energy research, high energy density science, and astrophysics. Dr. Moses is also the National Director of the National Ignition Campaign, a multi-institutional effort with a goal of achieving fusion ignition in the laboratory—the culmination of a 50-year quest.

Dr. Moses is internationally recognized in laser and optical sciences. He holds a BS and a PhD degree in Electrical Engineering from Cornell University. He has received many honors, including the National Nuclear Security Administration Defense Programs Award of Excellence for Significant Contribution to the Stockpile Stewardship Program and the Memorial D.S. Rozhdestvensky Medal for Outstanding Contributions to Lasers and Optical Sciences. Dr. Moses holds seven patents in laser technology and computational physics and an R&D100 Award for the Peregrine radiation therapy program.



Quantum Cascade Lasers: Compact Widely Tailorable Light Sources from 3 to 300 μm Wavelength

Federico Capasso
Harvard Univ., USA

[Capasso Video Part 1](#)

[Capasso Video Part 2](#)

[Capasso Video Part 3](#)

[Capasso Video Part 4](#)

[Capasso Video Part 5](#)

Abstract: I will trace the path from invention to exciting advances in the physics, applications and commercialization of these revolutionary lasers which cover the mid- and far-ir spectrum and are broadly impacting sensing, spectroscopy, and sub-wavelength photonics.

Biography: Federico Capasso is the Robert L. Wallace Professor of Applied Physics at Harvard University, which he joined in 2003 after a 26 year career at Bell Labs where he rose from postdoc to Vice President for Physical Research. He holds a Doctor of Physics degree from the University of Rome, Italy, 1973. His research includes the design of new artificial materials and novel devices, plasmonics, nanophotonics, and the investigation of Casimir forces. He is co-inventor of the quantum cascade laser, a fundamentally new light source, which has now been commercialized.

He has co-authored over 300 papers, edited four volumes, and holds over 65 US patents. He is a member of the National Academy of Sciences, the National Academy of Engineering, a Fellow of the American Academy of Arts and Sciences and a Fellow of OSA, IEEE, SPIE, APS and AAAS. His awards include the King Faisal International Prize for Science, the American

Physical Society Arthur Schawlow Prize, the IEEE Edison Medal, the IEEE/LEOS Streifer Award, the Wetherill Medal of the Franklin Institute, the OSA Robert Wood prize, the Rank Prize in Optoelectronics, the Material Research Society Medal, the IEEE D. Sarnoff Award, the Welker Medal, the Duddell Medal and Prize of the Institute of Physics (UK), the Newcomb Cleveland Prize of the American Association for the Advancement of Science.

IQEC Plenary Speaker



From Bell's Inequalities to Entangled Qubits: A New Quantum Age?

Alain Aspect

Inst. d'Optique, France

[Aspect Presentation \(PDF\)](#)

[Aspect Video Part 1](#)

[Aspect Video Part 2](#)

[Aspect Video Part 3](#)

[Aspect Video Part 4](#)

[Aspect Video Part 5](#)

Abstract: Bell's theorem has drawn physicists' attention onto the revolutionary character of entanglement. Based on that concept, a new field has emerged, quantum information, where one uses entanglement between qubits to develop conceptually new methods for processing and transmitting information.

Biography: Alain Aspect, born in 1947, studied physics at ENS de Cachan and Université d'Orsay, and taught in Cameroon for his military service. In 1974 he started at Institut d'Optique on a series of experiments on the foundations of quantum mechanics, known as –Experimental Tests of Bell's Inequalities with Entangled Photons, completed in 1982 and the subject of his –thèse d'Etat (PhD). Then, with his student Philippe Grangier, he developed and characterized the first source of heralded single photons, and performed an experiment on wave particle duality. A modern implementation has recently permitted the realization of the Wheeler's delayed choice experiment.

From 1985 to 1992 he worked at ENS Paris with Claude Cohen-Tannoudji on atom cooling; in particular –Laser Cooling below the One Photon Recoil.

Since 1992, he is the head of the Atom Optics Group that he has established at the Institut d'Optique, with main activity on Bose Einstein Condensates, Atom Lasers, and Quantum Atom Optics. Recent results include: discovery of metastable helium BEC, comparison of the Hanbury Brown and Twiss effect for bosonic and fermionic atoms, and direct observation of Anderson

localisation of matter waves.

Alain Aspect is a CNRS senior scientist at Institut d'Optique, and a Professor at Ecole Polytechnique, Palaiseau.

He is a member of the Académie des Sciences and of the Académie des Technologies (France), and foreign associate of the National Academy of Sciences (USA).

He is a fellow of the OSA, EOS, APS, and has received several international awards. In 2005, he received the CNRS gold medal, the highest research distinction in France.

Short Course Schedule by Time

Sunday, May 31, 2009

9:00 a.m.–6:00 p.m.

Cancelled SC136 **Understanding Lasers and Critical Optical Components**, *Shaoul Ezekiel; MIT, USA*

SC200 **Laser Remote Sensing**, *Timothy Carrig, Phillip Gatt; Lockheed Martin Coherent Technologies, USA*

10:30 a.m.–1:30 p.m.

NEW! SC336 **Green Photonics**, *S. J. Ben Yoo; Univ. of California at Davis, USA*

NEW! SC338 **Fiber-Based Parametric Devices**, *Colin J. McKinstrie; Bell Labs, Alcatel-Lucent, USA*

2:00 p.m.–6:00 p.m.

SC154 **Quantum Well Devices for Optics and Optoelectronics**, *David A. B. Miller; Stanford Univ., USA*

SC198 **Packaging of Optoelectronic Components**, *Andreas Rose; Photonics Res. Corp., USA*

SC271 **Quantum Information—Technologies and Applications**, *Prem Kumar¹, Paul Toliver²; ¹Northwestern Univ., USA, ²Telcordia, USA*

3:00 p.m.–6:00 p.m.

SC164 **THz Technology**, *Alan Cheville; Oklahoma State Univ., USA*

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

NEW! SC334 **The Art of Modeling Optical Systems**, *Curtis Menyuk; Univ. of Maryland, Baltimore County, USA*

NEW! SC339 **A Guide to Building an Optical Clock**, *Scott Diddams, Chris Oats; NIST, USA*

Monday, June 1, 2009

8:00 a.m.–12:00 p.m.

SC153 **Quasi-Phasematching for Wavelength Conversion and All-Optical Nonlinear Processing**, *Peter G. R. Smith; Univ. of Southampton, UK*

Cancelled SC166 **Design, Fabrication and Application of Photonic Crystals**, *Dennis Prather; Univ. of Delaware, USA*

SC167 **Fundamentals of Semiconductor Lasers: Edge-Emitters to Micro Cavity Devices**, *Kent Choquette¹, Weng Chow²; ¹Univ. of Illinois, USA, ²Sandia Natl. Labs, USA*

SC182 **Biomedical Optical Diagnostics and Sensing**, *Thomas Huser; Univ. of California at Davis, USA*

9:00 a.m.–12:00 p.m.

SC147 **Optical Fiber Communication Systems**, *Alan Willner; Univ. of Southern California, USA*

Cancelled SC165 **Laser Diode-Pumped Solid-State Lasers**, *Larry Marshall; Arasor, USA*
SC302 **MetaMaterials**, *Vladimir M. Shalaev; Purdue Univ., USA*

1:00 p.m.–5:00 p.m.

SC149 **Foundations of Nonlinear Optics**, *Robert Fisher; R. A. Fisher Associates, USA*

SC160 **Microwave Photonics**, *Keith Williams; NRL, USA*

Cancelled SC191 **Tissue Optics: Fundamentals and Applications to Biomedical Optical and Laser Diagnostics**, *Valery V. Tuchin¹, Kirill Larin²; ¹Saratov State Univ., Russian Federation, ²Univ. of Houston, USA*

SC194 **Photonic Crystal Fibers and Devices**, *Benjamin J. Eggleton; Univ. of Sydney, Australia*

SC316 **Organic Photonic Devices**, *Marc Baldo, Vladimir Bulovic; MIT, USA*

SC318 **Laser Beam Combining: Theory and Methods**, *James R. Leger; Univ. of Minnesota, USA*

NEW! SC333 **Intellectual Property in Academia: Nuts and Bolts of Patenting**, *Nadya Reingand; Celight Inc., USA*

Tuesday, June 2, 2009

8:30 a.m.–12:30 p.m.

SC157 **Laser Beam Analysis, Propagation and Shaping Techniques**, *James R. Leger; Univ. of Minnesota, USA*

Cancelled SC163 **Practical OPOs**, *Majid Ebrahim-Zadeh; Inst. Catalana de Recerca i Estudis Avançats, Inst. de Ciències Fotòniques, Spain*

SC270 **High Power Fiber Lasers and Amplifiers**, *W. Andrew Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, UK*

9:30 a.m.–12:30 p.m.

SC221 **Nano-Photonics: Physics and Techniques**, *Axel Scherer; Caltech, USA*
SC300 **Silicon Photonics**, *Bahram Jalali; Univ. of California at Los Angeles, USA*
SC301 **Quantum Cascade Lasers: From Band Structure Engineering to Commercialization**, *Federico Capasso; Harvard Univ., USA*
NEW! SC337 **Single Photon Detection** *Mark A. Itzler; Princeton Lightwave Inc., USA*

1:30 p.m.–5:30 p.m.

SC123 **Erbium-Doped Fiber Amplifiers and Raman Fiber Amplifiers**, *John Zyskind; JDS Uniphase, USA*
Cancelled SC143 **Introductory and Intermediate Topics in Polarized Light**, *Robert Fisher; R. A. Fisher Associates, USA*
SC155 **Ultrashort Laser Pulse Measurement**, *Rick Trebino; Georgia Tech, USA*
Cancelled SC247 **Ultrafast Optics: Nanoscale Microscopy, Metrology and Patterning Using Compact and Large Scale Soft X-Ray Sources**, *Margaret Murnane¹, David Attwood², Jorge J. Rocca³; ¹Univ. of Colorado, USA, ²Lawrence Berkeley Natl. Lab, USA, ³Colorado State Univ., USA*
SC317 **Laser Tweezers: Moving Tiny Things with Light**, *Kristian Helmerson; NIST, USA*
SC319 **Quantum Dot Laser Diodes**, *Peter Blood; Cardiff Univ., UK*
NEW! SC335 **Super-Resolution Optical Microscopy**, *Stephen Lane^{1,2}, Thomas Huser²; ¹Lawrence Livermore Natl. Lab, USA, ²Univ. of California at Davis, USA*

Short Course Schedule by Topic Category

CLEO 01: Laser Processing of Materials: Fundamentals and Applications

SC317 **Laser Tweezers: Moving Tiny Things with Light**, *Kristian Helmerson; NIST, USA*

CLEO 02: Solid-State, Liquid and Gas Lasers

Cancelled SC136 **Understanding Lasers and Critical Optical Components**, *Shaoul Ezekiel; MIT, USA*

Cancelled SC165 **Laser Diode-Pumped Solid-State Lasers**, *Larry Marshall; Arasor, USA*
SC318 **Laser Beam Combining: Theory and Methods**, *James R. Leger; Univ. of Minnesota, USA*

CLEO 03: Semiconductor Lasers

SC167 **Fundamentals of Semiconductor Lasers: Edge-Emitters to Micro Cavity Devices**, Kent Choquette¹, Weng Chow²; ¹Univ. of Illinois, USA, ²Sandia Natl. Labs, USA
SC301 **Quantum Cascade Lasers: From Band Structure Engineering to Commercialization**, Federico Capasso; Harvard Univ., USA
SC319 **Quantum Dot Laser Diodes**, Peter Blood; Cardiff Univ., UK

CLEO 04: Applications of Nonlinear Optics

SC149 **Foundations of Nonlinear Optics**, Robert Fisher; R. A. Fisher Associates, USA
SC153 **Quasi-Phasematching for Wavelength Conversion and All-Optical Nonlinear Processing**, Peter G. R. Smith; Univ. of Southampton, UK
Cancelled SC163 **Practical OPOs**, Majid Ebrahim-Zadeh; Inst. Catalana de Recerca i Estudis Avançats, Inst. de Ciències Fotoniques, Spain

CLEO 05: Terahertz Technologies and Applications

SC164 **THz Technology**, Alan Cheville; Oklahoma State Univ., USA

CLEO/IQEC 07: Joint Subcommittee on High-Field Physics and High-Intensity Lasers

Cancelled SC247 **Ultrafast Optics: Nanoscale Microscopy, Metrology and Patterning Using Compact and Large Scale Soft X-Ray Sources**, Margaret Murnane¹, David Attwood², Jorge J. Rocca³; ¹Univ. of Colorado, USA, ²Lawrence Berkeley Natl. Lab, USA, ³Colorado State Univ., USA

CLEO 08: Ultrafast Optics, Optoelectronics and Applications

SC155 **Ultrashort Laser Pulse Measurement**, Rick Trebino; Georgia Tech, USA

CLEO 09: Components, Integration, Interconnects and Signal Processing

SC154 **Quantum Well Devices for Optics and Optoelectronics**, David A. B. Miller; Stanford Univ., USA
SC160 **Microwave Photonics**, Keith Williams; NRL, USA
NEW! SC337 **Single Photon Detection**, Mark A. Itzler; Princeton Lightwave Inc., USA

CLEO 10: Medical and Biological Applications

SC182 **Biomedical Optical Diagnostics and Sensing**, *Thomas Huser; Univ. of California at Davis, USA*

Cancelled SC191 **Tissue Optics: Fundamentals and Applications to Biomedical Optical and Laser Diagnostics**, *Valery V. Tuchin¹, Kirill Larin²; ¹Saratov State Univ., Russian Federation, ²Univ. of Houston, USA*

NEW! SC335 **Super-Resolution Optical Microscopy**, *Stephen Lane^{1,2}, Thomas Huser²; ¹Lawrence Livermore Natl. Lab, USA, ²Univ. of California at Davis, USA*

CLEO 11: Fiber Amplifiers, Lasers and Devices

SC123 **Erbium-Doped Fiber Amplifiers and Raman Fiber Amplifiers**, *John Zyskind; JDS Uniphase, USA*

SC194 **Photonic Crystal Fibers and Devices**, *Benjamin J. Eggleton; Univ. of Sydney, Australia*

SC270 **High Power Fiber Lasers and Amplifiers**, *W. Andrew Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, UK*

NEW! SC338 **Fiber-Based Parametric Devices**, *Colin J. McKinstrie; Bell Labs, Alcatel-Lucent, USA*

CLEO 12: Lightwave Communications and Networks

SC147 **Optical Fiber Communication Systems**, *Alan Willner; Univ. of Southern California, USA*

SC198 **Packaging of Optoelectronic Components**, *Andreas Rose; Photonics Res. Corp., USA*

NEW! SC336 **Green Photonics**, *S. J. Ben Yoo; Univ. of California at Davis, USA*

CLEO 13: Active Optical Sensing

SC200 **Laser Remote Sensing**, *Timothy Carrig, Phillip Gatt; Lockheed Martin Coherent Technologies, USA*

CLEO 14: Optical Metrology

NEW! SC339A **Guide to Building an Optical Clock**, *Scott Diddams, Chris Oats; NIST, USA*

CLEO 15: Organic and Inorganic LEDs for Solid State Lighting and Displays

SC316 **Organic Photonic Devices**, *Marc Baldo, Vladimir Bulovic; MIT, USA*

CLEO 16: Micro- and Nano-Photonics Devices

Cancelled SC166 **Design, Fabrication and Application of Photonic Crystals**, *Dennis Prather; Univ. of Delaware, USA*
SC300 **Silicon Photonics**, *Bahram Jalali; Univ. of California at Los Angeles, USA*

IQEC 02: Quantum Science, Engineering and Technology

SC189 **Quantum-Enhanced Technologies**, *Ian Walmsley; Univ. of Oxford, UK*
SC271 **Quantum Information—Technologies and Applications**, *Prem Kumar¹, Paul Toliver²*;
¹*Northwestern Univ., USA*, ²*Telcordia, USA*

IQEC 03: Fundamentals of Metamaterials, Periodic and Random Media

SC302 **MetaMaterials**, *Vladimir M. Shalaev; Purdue Univ., USA*

IQEC 06: Nano-Optics and Plasmonics

SC221 **Nano-Photonics: Physics and Techniques**, *Axel Scherer; Caltech, USA*

IQEC 08: Other Topics in Quantum Electronics and Laser Science

NEW! SC334 **The Art of Modeling Optical Systems**, *Curtis Menyuk; Univ. of Maryland, Baltimore County, USA*

Fundamental Optical Science and Technologies

Cancelled SC143 **Introductory and Intermediate Topics in Polarized Light**, *Robert Fisher; R. A. Fisher Associates, USA*

SC157 **Laser Beam Analysis, Propagation and Shaping Techniques**, *James R. Leger; Univ. of Minnesota, USA*

NEW! SC333 **Intellectual Property in Academia: Nuts and Bolts of Patenting**, *Nadya Reingand; Celight Inc., USA*