

Advanced Solid-State Photonics (ASSP)

Topical Meeting and Tabletop Exhibit

Technical Conference: January 31–February 3, 2010

Exhibition: February 1–3, 2010

[The Westin San Diego](#)

[San Diego, CA, USA](#)

[Postdeadline Submission Deadline](#): January 13, 2010 12:00 p.m. noon EST (17.00 GMT)

[Hotel Reservation Deadline](#): Extended through January 7, 2010

Lower Hotel Rate Now Available!

[Pre-Registration Deadline](#): January 12, 2010

Part of Lasers, Sources and Related Photonic Devices:

OSA Optics & Photonics Congress

Featuring Three Collocated Topical Meetings:

Advanced Solid-State Photonics (ASSP)

[Applications of Lasers for Sensing and Free Space Communications \(LS&C\)](#)

[Laser Applications to Chemical, Security and Environmental Analysis \(LACSEA\)](#)

About ASSP

Advances in solid-state lasers, parametric devices and nonlinear frequency conversion provide powerful tools for an increasingly broad range of applications including spectroscopy, metrology, remote sensing, communications, material processing, astronomy, medicine, biology and entertainment.

Now in its 25th year, the Advanced Solid-State Photonics Topical Meeting remains the world's premier forum for discussing new developments in laser and nonlinear optical materials and devices.

Topics to be Considered

- Diode-Pumped Lasers
- Fiber Lasers
- Ceramic Lasers
- High-Power Lasers
- Short-Pulse Lasers
- Frequency-Stable Lasers
- Microchip and Compact Lasers
- Tunable and New Wavelength Solid-State Lasers
- Optically Pumped Semiconductor Lasers
- High-Brightness Diodes
- Optical Sources Based on Nonlinear Frequency Conversion, including OPO, OPA, OPG, SHG, SFG, DFG and Raman
- Laser Media
- Nonlinear Optical Materials
- Engineered and Meta-materials Materials
- Applications of Laser Sources in:
 - Science
 - Metrology, including optical frequency combs
 - Astronomy, including gravity wave detection and laser guide star
 - Medicine and Biology
 - Remote Sensing
 - Industry
 - Entertainment, including laser display technology

Program Committee

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Ingmar Hartl, *IMRA America, Inc., USA*

Program Chairs

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Takunori Taira, *Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan*

Konstantin L. Vodopyanov, *Stanford Univ., USA*

Exhibiting at ASSP

Exhibitor Information

Now in its 25th year, the Advanced Solid-State Photonics Topical Meeting remains the world's premier forum for discussing new developments in laser and nonlinear optical materials and devices. ASSP is collocated with Applications of Lasers for Sensing and Free Space Communications (LS&C) and Laser Applications to Chemical, Security and Environmental Analysis (LACSEA).

Exhibition Dates: February 1–3, 2010

[The Westin San Diego](#)
[San Diego, CA, USA](#)

For information on exhibiting or sponsorships, please call +1 202.416.1942 or email sales@osa.org.

Exhibit rates are as follows:

	Exhibit Pricing 10x10 Booth Tabletop Display	
OSA Corporate Member Rates	\$1,390	\$1,120
Non-member Rates	\$1,600	\$1,290

Special Events

[Conference Banquet](#)
[Joint Symposium](#)
[San Diego Harbor Cruise](#)

Conference Banquet

Tuesday, February 2, 2010
7:30 p.m.–10:00 p.m.
Emerald Ballroom

Banquet Speaker

Early Developments in Laser Science, Orazio Svelto; *Politecnico di Milano, Italy*



Orazio Svelto is professor of Physics of Matter at the Polytechnic Institute of Milan. His research has covered a wide range of activity in the field of Laser Physics and Photonics, starting from the early beginning (1962) of these disciplines. This activity includes ultrashort-pulse generation and applications, physics of laser resonators and techniques of mode selection, laser applications in biology and biomedicine, and physics of solid-state lasers. Professor Svelto is the author of more than 200 scientific papers and holds 3 patents; his researches have been the subject of more than 60 invited papers at international conferences. He is also the author of the book *Principles of Lasers* (Springer, 5th Ed., 2009) which has currently been adopted at several universities in Europe and United States and whose previous editions were also translated in Russian, Chinese, Greek, Farsi and Arabic languages.

He served as a Program Chairman, Conference Chairman or Honorary Chairman at several international conferences; in particular, he was program chair of the IX International Quantum Electronics Conference (Amsterdam, 1976), general co-chair of the first CLEO-Europe Conference (Amsterdam, 1994) and program co-chair for 2002 International Quantum Electronics Conference (Moscow).

He is the recipient of several awards including the Italgas prize for research and technology innovation, the Quantum Electronics Prize of the European Physical Society, and the Charles H. Townes Award of The Optical Society.

He is fellow of The Optical Society and of the Institute of Electrical and Electronics Engineers and he is an elected member of several Italian academies including the National Academy of Sciences and the “Accademia dei Lincei.”

Joint Symposium

Tuesday, February 2, 2010
8:00 a.m.–10:00 a.m.

JTuA1, External Cavity Quantum Cascade Lasers: Recent Advances, Applications, and Comparisons with Alternative Sources in the MIR, Timothy Day; *Daylight Solutions, USA*

JTuA2, Applications of High-Repetition Rate Diode-Pumped Solid-State Lasers for Combustion Diagnostics, W. Meier¹, I. Boxx¹, C. Arndt¹, C. D. Carter², M. Stöhr¹, A. Steinberg¹, J. H. Frank³; ¹*German Aerospace Ctr. (DLR), Germany*, ²*AFRL, USA*, ³*Sandia Natl. Labs, USA*

[JTuA3, Progress in Laser Communications](#), Larry B. Stotts¹, Sherman Karp², Alan Pike³, Paul Kolodzy⁴; ¹*DARPA, USA*, ²*Consultant, USA*, ³*Defense Strategies and Systems, Inc., USA*, ⁴*Kolodzy Consulting, USA*

JTuA4, Multi-Disciplinary Lidar Applications, Kerstin Barup, Mikkel Brydegaard, Zuguang Guan, Anders Hedenström, Jenny Hellström, Märta Lewander, Patrik Lundin, Christer Löfstedt, Aboma Merdasa, Annika Olsson, Anna Runemark, Gabriel Somesfalean, Erik Svensson, Maren Wellenreuther, Susanne Åkesson, Sune Svanberg; *Lund Univ., Sweden*

San Diego Harbor Cruise

Come and see the sights and sound of San Diego Bay! This is a great opportunity to network with colleagues or enjoy San Diego with your friends and family. There is a one and two hour cruise option available.

The Hornblower Harbor cruise is a great way to see San Diego from a unique perspective, the rails of a yacht! See more than 50 landmarks and historic sights, all narrated by Hornblower’s seasoned captains. You can take a brief 1 hour cruise of the North Bay or stay longer to see the South Bay. Sights of the North Bay include historic ships, a nuclear submarine base, Cabrillo National Monument and the Point Loma Lighthouse, America’s Cup Harbor and a colony of California Sea Lions, permanent bay residents. The South Bay includes the Midway Aircraft Carrier, Navy SEAL training

grounds, a variety of Navy ships and ship repair facilities and includes a cruise under the famous Coronado Bay Bridge. Drinks and snacks are available for purchase onboard.

Booking

The Tuesday, February 2, 2010, 3:00 p.m.–5:15 p.m. 2-hour cruise has been unofficially designated the ASSP tour. Please arrive 15 minutes prior to departure.

2 Hour Cruise: \$25 US per person.

Meeting Discount! Please enter discount code **APS10** when making your reservations to receive \$10 off your cruise price.

Reserve Now

Attendees will need to book directly with Hornblower Cruises. Reservations can be made by visiting their [website](#) or calling +1 888.467.6256.

Reservations may be made online up to three hours prior to the tour start time. For any reservations less than three hours prior, please call Hornblower Cruises directly at +1 888.467.6256 and be sure to mention the discount code.

International Attendees

International attendees may have difficulty booking through the website. If you experience difficulties booking, please use below form to make your reservation. You will need to supply a credit card which will be charged upon processing. A confirmation will be sent to you. Please email or fax your form Julie Muldoon at +1 619.686.8733 or jmuldoon@hornblower.com. Forms will not be accepted 24 hours prior to the cruise.

Hornblower Cruises is located at the end of Broadway on N Harbor Drive, approximately 5 blocks from the Westin San Diego.

Students

Student members are an important and active part of the OSA community. Student benefits are built around the unique needs of those preparing to enter the professional world of optics. As an OSA Student Member, you join a worldwide community of optics and photonics scientists, engineers and business leaders. [Join us today.](#)

Student Members attend OSA conferences, exhibits and educational sessions at reduced rates. [Frontiers in Optics](#) (OSA's Annual Meeting), the [Optical Fiber Communication Conference & Exposition and National Fiber Optic Engineers Conference](#) (OFC/NFOEC), the [Conference on Lasers and Electro-Optics](#) (CLEO) and more than 20 topical meetings are among the many annual events hosted by OSA.

Best Student Paper Award

The ASSP Best Student Oral Paper Award was established in 2001 to encourage excellence in research and scientific presentation skills in the student optics community. The award is sponsored by Lockheed Martin Coherent Technologies and includes a \$1000 cash prize and a plaque.

There will also be a competition for the ASSP Best Student Poster Paper Award. The recipient of this award will be presented with a \$500 cash prize and a certificate. Students submitting contributed papers who desire to compete for these awards must indicate this intention when submitting the paper. Papers actually presented by advisors or other non-students will not be scored. Student papers accepted for oral presentation will be scored by the ASSP Technical Program Committee with the scores weighted according to the following formula: technical content (50%), oral presentation quality and general poise (25% with no penalty for non-native English speakers) and graphical presentation quality (25%). Student papers accepted for poster presentation will be scheduled in a "Young Scientist Poster Session" and scored according to the same formula as the oral papers. ASSP attendees are highly encouraged to participate in this session to provide feedback to the students and encourage their work.

In order to be considered for this award, you must indicate in your submission record whether or not you are a Student Member or a Student Nonmember. You must also indicate whether or not you wish to be considered for this award. If you do not complete these two steps, your paper will not be considered for these awards.



OSA Foundation Student Travel Grants

The OSA Foundation is pleased to offer travel grants to students working or studying in a [qualifying developing nation](#) who plan to attend Advanced Solid-State Photonics (ASSP) 2010.

Congratulations to these grant recipients:

Huseyin Cankaya, Koc University, Turkey

Gaurav Shukla, Indian Institute of Technology Guwahati, India

Geetika Bajaj, IIT Delhi, India

Invited Speakers

[Joint Symposium](#)
[Banquet Speaker](#)
[Invited Speakers](#)

Banquet Speaker

Early Developments in Laser Science, Orazio Svelto; *Politecnico di Milano, Italy*



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researches have been the subject of more than 60 invited papers at international conferences. He is also the author of the book *Principles of Lasers* (Springer, 5th Ed., 2009) which has currently been adopted at several universities in Europe and United States and whose previous editions were also translated in Russian, Chinese, Greek, Farsi and Arabic languages. He served as a Program Chairman, Conference Chairman or Honorary Chairman at several international conferences; in particular, he was program chair of the IX International Quantum Electronics Conference (Amsterdam, 1976), general co-chair of the first CLEO-Europe Conference (Amsterdam, 1994) and program co-chair for 2002 International Quantum Electronics Conference (Moscow). He is the recipient of several awards including the Italgas prize for research and technology innovation, the Quantum Electronics Prize of the European Physical Society, and the Charles H. Townes Award of The Optical Society. He is fellow of The Optical Society and of the Institute of Electrical and Electronics Engineers and he is an elected member of several Italian academies including the National Academy of Sciences and the "Accademia dei Lincei."

Invited Speakers

AMA1, Phasing of High Power Fiber Amplifier Arrays, Thomas M. Shay¹, J. T. Baker², Anthony D. Sancheza¹, C. A. Robin¹, C. L. Vergien¹, Angel Flores¹, C.

Zerique¹, D. Gallant², Chunte A. Lu¹, Benjamin Pulford¹, T. J. Bronder¹, Arthur Lucero²;
¹AFRL, USA, ²Boeing LTS Inc., USA

AMA5, Recent Advances of Table-Top Soft X-ray Lasers, J. J. Rocca, F. J. Furch, B. A. Reagan, Y. Wang, D. Alessi, D. Martz, B. M. Luther, A. H. Curtis, S. P. Meehan, S. Domingue, D. Kemp; *Colorado State Univ. at Fort Collins, USA*

ATuB1, Fifty Years of Advances in Solid-State Laser Materials, Georges Boulon^{1,2};
¹Univ. of Lyon, France, ²Tohoku Univ., Japan

AWA1, Diffraction Limited Ultra-High-Power Fiber Lasers, Valentin Gapontsev, V. Fomin, A. Ferin, M. Abramov; *IPG Photonics Corp., USA*

AWD1, CW Crystalline Raman Lasers: Multi-Watt and Multi-Wavelength Operation in the Visible, Helen M. Pask, Andrew J. Lee, David J. Spence, James A. Piper;
Macquarie Univ., Australia

AWE1, Ultrafast, High Power Laser Technologies: Challenges and Perspectives, Koichi Yamakawa; *Japan Atomic Energy Agency, Japan*

Short Courses

Short Courses are a wonderful way to enhance your knowledge of the optical field. ASSP selects experts in their fields to provide you with an in-depth look at intriguing topics. The courses are designed to increase your knowledge of a specific subject while offering you the experience of knowledgeable teachers. An added benefit of the courses is the availability of continuing education units (CEUs).

CEUs are awarded to each participant who successfully completes the course. The CEU is a nationally recognized unit of measure for continuing education and training programs that meet established criteria. To earn CEUs, a participant must complete the CEU credit form and course evaluation and return it to the course instructor at the end of the course. CEUs will be calculated and certificates will be mailed to participants.

- Tuition for the Short Course is a separate fee, and advance registration is recommended. The number of seats in the course is limited.
- The Short Courses will sell out quickly! There will be no waiting list for the Short Courses.
- Short Course Notes are not available for purchase.

Schedule

Sunday, January 31, 2010

8:00 a.m.–12:00 p.m.

[SC343](#) High-Power Solid-State Laser Technologies, Rüdiger Paschotta; *RP Photonics Consulting GmbH, Switzerland*

Level: Advanced Beginner (basic understanding of topic is necessary to follow course material)

[SC351](#) THz Technology for Sensing Applications, René Beigang, *Fraunhofer IPM Standort Kaiserslautern, Germany*

2:00 p.m.–6:00 p.m.

[SC290](#) High Power Fiber Lasers and Amplifiers, Johan Nilsson; *Univ. of Southampton, UK*

Level: Advanced Beginner (basic understanding of topic is necessary to follow course material)

[SC344 Quasi-Phasematching: Materials and Devices](#), Martin M. Fejer; *Stanford Univ., USA*

[SC350 Tunable Laser Spectroscopy for Combustion](#), Scott Sanders; *Univ. of Wisconsin-Madison, USA*

Level: Intermediate (prior knowledge of topic is necessary to appreciate course material)

Course Descriptions

SC290 **High Power Fiber Lasers and Amplifiers**, Johan Nilsson; *Univ. of Southampton, UK*

Level: Advanced Beginner (basic understanding of topic is necessary to follow course material)

Course Description

This course describes the principles and capabilities of high power fiber lasers and amplifiers, with output powers that can exceed a kilowatt. It describes the fundamentals of such devices and discusses current state of the art and research directions of this rapidly advancing field. Fiber technology, pump laser requirements and input coupling will be addressed. Rare-earth-doped fiber devices are the focus of the course, but Raman lasers and amplifiers will be considered, too, if time allows. This includes Yb-doped fibers at 1.0 - 1.1 μm , Er-doped fibers at 1.5 - 1.6 μm , and Tm-doped fibers at around 2 μm . Operating regimes extending from continuous-wave single-frequency to short pulses will be considered. Key equations will be introduced to find limits and identify critical parameters. For example, pump brightness is a critical parameter for some devices in some regimes but not always. Important limitations relate to nonlinear and thermal effects, as well as damage, energy storage and, of course, materials. Methods to mitigate limitations in different operating regimes will be discussed. Fiber, laser and amplifiers designs for different operating regimes will be described.

Benefits and Learning Objectives

This course should enable you to:

- Describe the fundamentals of high power fiber lasers and amplifiers.
- List key strengths, relative merits, and specific capabilities of high power fiber lasers and amplifiers.
- Assess performance limitations and describe the underlying physical reasons in different operating regimes.
- Design or specify basic fiber properties for specific operating regimes.
- Describe the possibilities, limitations, and implications of current technology regarding core size and rare earth concentration of doped fibers.
- Discuss different options for suppressing detrimental nonlinearities.

- Design basic high power fiber lasers and amplifier systems.
- List strengths and weaknesses of different pumping schemes.

Intended Audience

This course is intended for scientists and engineers involved or interested in commercial and military high power fiber systems. This includes system designers, laser designers, fiber fabricators, and users. A basic knowledge of fibers and lasers is needed.

Biography

Johan Nilsson is a professor in the Optoelectronics Research Centre (ORC), University of Southampton, England. He received a doctorate in engineering sciences from the Royal Institute of Technology, Stockholm, Sweden, in 1994, for research on optical amplification. Since then, he has worked on optical amplifiers and amplified lightwave systems, optical communications, guided-wave lasers and nonlinear optics, first at Samsung Electronics and now at the ORC, where he is leading a research group in the field of high-power fiber devices and applications. His research has primarily focused on devices but has also covered system, fabrication and materials aspects. He has given courses on high-power fiber sources at Photonics West and OFC.

SC343 High-Power Solid-State Laser Technologies, Rüdiger Paschotta; *RP Photonics Consulting GmbH, Switzerland*

Level: Advanced Beginner (basic understanding of topic is necessary to follow course material)

Course Description

This course starts with an overview on competing technologies for high-power solid-state laser sources, including bulk lasers, amplified and fiber-based sources. The primary topic is the analysis of performance potentials of different technologies in situations with different boundary conditions, such as continuous-wave operation with no restrictions or with high beam quality and/or a limited emission bandwidth, and the generation of intense laser pulses with nanosecond, picosecond or femtosecond durations. In this context, the concept of power scaling is given a meaningful basis, and scaling considerations are demonstrated in example cases.

Benefits and Learning Objectives

This course should enable you to:

- List and categorize different laser technologies for the generation of high optical powers or energies
- Understand the basic physical performance limitations for different laser types
- Understand a methodology for comparing performance potentials

- Explain the principle of power scaling, and apply scaling considerations to concrete cases

Intended Audience

This course is designed for researchers and engineers who are interested in the development of high-power laser sources. It should be particularly useful for those who need to compare different laser technologies.

Biography

Rüdiger Paschotta started his career in scientific research. In 2002, he achieved the habilitation in applied physics at ETH Zürich and received the Fresnel Prize of the European Physical Society (EPS). In 2004, he started RP Photonics Consulting GmbH in Zürich, Switzerland. His full-time occupation is now to serve companies in the photonics industry worldwide. Typical tasks are to work out feasibility studies and designs for lasers and other photonic devices, to identify and solve technical problems, to find suitable laser sources for specific applications, and to do tailored staff training courses on specialized subjects.

SC344 **Quasi-Phasematching: Materials and Devices**, Martin M. Fejer; *Stanford Univ., USA*

Course Description

Quasi-phasematching (QPM) has become an important technique for nonlinear optical frequency conversion, and more recently for optical signal processing devices. In addition to large nonlinear susceptibilities, and noncritical phasematching across broad wavelength ranges, QPM offers control over parameters that allow engineering of properties such as the spectral and spatial distribution of gain. Well known applications in parametric frequency conversion devices such as harmonic generators and parametric oscillators are now complemented by developments for signal processing applications such as wavelength convertors and gated mixers for communication systems, and attojoule autocorrelators and time lenses for ultrafast signal analysis. Recent developments such as supercontinuum generation and single-photon devices for quantum optics, including photon-counting with efficient up-conversion and correlated photon generation by parametric down conversion will also be discussed. The success of QPM is fundamentally tied to developments in microstructured nonlinear materials, such as periodically-poled ferroelectrics and patterned III-V semiconductors, whose properties will be reviewed as part of the course.

Benefits and Learning Objectives

This course will enable participants to:

- Explain the basic ideas of QPM and methods for analyzing QPM interactions
- Relate properties of QPM interactions to the more familiar birefringent phasematching
- Discuss qualitative insights and quantitative data on QPM materials like PPLN and OPGaAs
- Review coherent source applications of QPM media
- Explain novel methods such as generation and manipulation of ultrafast pulses based on aperiodic QPM
- Understand waveguide devices for nonlinear interactions at low power levels

Intended Audience

This course is intended for individuals with at least a basic knowledge of lasers and nonlinear optical frequency conversion, though background information necessary for understanding the material in the course will be covered. No prior knowledge of optical signal processing necessary for optical communications topics.

Biography

Martin Fejer is a professor of Applied Physics and Senior Associate Dean of Natural Sciences at Stanford University. His research focuses on microstructured nonlinear materials, guided wave optics, and devices for generating coherent radiation and for optical signal processing. He received the OSA's Wood prize in 1998 for his work in quasi-phasematched nonlinear optics.

SC350 Tunable Laser Spectroscopy for Combustion, Scott Sanders; *Univ. of Wisconsin-Madison, USA*

Level: Intermediate (prior knowledge of topic is necessary to appreciate course material)

Course Description

This course covers hyperspectral light sources including tunable diode lasers and their application to measurements of gas properties in combustion test articles.

Benefits and Learning Objectives

This course should enable you to:

- Understand the strengths and weaknesses of the various laser sources available for combustion spectroscopy
- Gain familiarity with spectroscopic simulation, particularly at high temperatures using databases including HITRAN, HITEMP, BT2, and CDSD
- Gain familiarity with strategies for selecting the optimum wavelengths for various measurement goals
- Predict the precision of measured gas temperature and absorber mole fraction from experimental noise levels

- Gain familiarity with strategies for optical access to combustion devices, and understand the associated compromises in measurement fidelity

Intended Audience

Researchers, students, managers, product developers, etc. interested in learning more about the topics listed above.

Biography

Prof. Scott Sanders joined the faculty at the University of Wisconsin in 2001 as a member of the school's Engine Research Center, having obtained his PhD at Stanford University. His research work includes the development of advanced optical diagnostics and sensors for combustion applications. Specifically, his research group designs hyperspectral sources and spectrometers, and applies them to measure gas properties in environments ranging from internal combustion engines to hospital intensive care units. He has published widely and has received 6 patents on his light source technologies. More information is available at http://www.engr.wisc.edu/me/faculty/sanders_scott.html.

SC351 THz Technology for Sensing Applications, René Beigang, *Fraunhofer IPM Standort Kaiserslautern, Germany*

Level: Advanced Beginner (basic understanding of topic is necessary to follow course material)

Course Description

This course covers the field of generation and application of photonic terahertz (THz) radiation. It starts with an overview of photonic THz technologies including pulsed and continuous-wave systems. Also competing technologies based on electronic sources are discussed briefly. The primary topic is the application of pulsed broadband THz sources for industrial and fundamental sensing applications, including applications in non-destructive testing, thickness measurements, biological and biomedical sensing, gas analysis and sensing of drugs and explosives under real world conditions. Performance potentials, application possibilities and limits of this technology will be critically evaluated.

Benefits and Learning Objectives

This course should enable you to:

- Understand the basic operation principles of photonic THz systems, in particular, broadband THz systems based on femtosecond laser technology
- Understand the strengths and weaknesses of the various THz systems for specific applications

- Understand the basic physical performance limitations for different terahertz systems
- Understand a methodology for comparing performance potentials
- Decide which THz system is applicable for a specific type of application

Intended Audience

This course is designed for researchers and engineers who are interested in the application of THz sources. It should be useful for those who need to evaluate the possibilities and benefits of THz technologies for their particular application.

Biography

Rene Beigang got his PhD from the University of Hannover in Hannover, Germany. He spent 3 years as a post doc and visiting scientist at the IBM TJ Watson Research Center in Yorktown Heights, NY, USA. He is now a full professor at the Department of Physics of the University of Kaiserslautern. Since 2005 he is also head of the department Terahertz Measurement and Systems of the Fraunhofer Institute for Physical Measurement Techniques. His current research interests include nonlinear optics, generation and application of THz radiation, THz spectroscopy and applications of THz radiation in science and technology. More information is available at <http://www.physik.uni-kl.de/beigang>.

	ASSP <i>Emerald Ballroom</i>	LS&C <i>Topaz Room</i>	LACSEA <i>Diamond Room</i>
Sunday, January 31			
7:00 a.m.–6:00 p.m.	Registration Open, <i>Ballroom Foyer</i>		
8:00 a.m.–12:00 p.m.	SC343: High-Power Solid-State Laser Technologies, <i>Rüdiger Paschotta; RP Photonics Consulting GmbH, Switzerland</i> SC351: THz Technology for Sensing Applications, <i>René Beigang; Fraunhofer IPM Standort Kaiserslautern, Germany</i>		
2:00 p.m.–6:00 p.m.	SC290: High Power Fiber Lasers and Amplifiers, <i>Johan Nilsson; Univ. of Southampton, UK</i> SC344: Quasi-Phased Matched (QPM) Devices, <i>Martin M. Fejer; Stanford Univ., USA</i> SC350: Tunable Laser Spectroscopy for Combustion, <i>Scott Sanders; Univ. of Wisconsin-Madison, USA</i>		
Monday, February 1			
7:00 a.m.–5:00 p.m.	Registration Open, <i>Ballroom Foyer</i>		
8:00 a.m.–10:00 a.m.	Opening Remarks (8:00 a.m.–8:15 a.m.)	LSMA • Performance Analysis of Experimental FSO Systems	LMA • Advances in Mid-IR Sources for Spectroscopy
	AMA • Novel Sources (8:15 a.m.–10:00 a.m.)		
10:00 a.m.–5:00 p.m.	Exhibit Open, <i>Crystal Ballroom</i>		
10:00 a.m.–10:30 a.m.	Coffee Break/Exhibits, <i>Crystal Ballroom</i>		
10:00 a.m.–11:30 a.m.	AMB • ASSP Poster Session I, <i>Ballroom Foyer</i>		
10:30 a.m.–1:00 p.m.	AMC • Infrared Lasers (starts at 11:30 a.m.)	LSMB • Laser Communication Systems and Channel Characterization for Laser Comm Systems	LMB • Cavity-Enhanced and Advanced Detection Strategies (ends at 12:30 p.m.)
1:00 p.m.–2:30 p.m.	Lunch Break (<i>on your own</i>)		
2:30 p.m.–4:00 p.m.	AMD • Ultrafast Lasers I	LSMC • Free Space Optics Modulation Techniques (2:00 p.m.–4:30 p.m.)	LMC • Trace Gas and Remote Sensing (starts at 2:00 p.m.)
4:00 p.m.–5:00 p.m.	Coffee Break/Exhibits, <i>Crystal Ballroom</i>		
4:00 p.m.–6:00 p.m.	LMD • LACSEA Poster Session, <i>Ballroom Foyer</i>		
4:30 p.m.–6:00 p.m.	LSMD • LS&C Poster Session, <i>Ballroom Foyer</i>		
4:30 p.m.–6:00 p.m.	AME • Optical Parametric Chirped Pulse Amplifiers		
6:00 p.m.–8:00 p.m.	Dinner Break (<i>on your own</i>)		
8:00 p.m.–10:00 p.m.	Postdeadline Paper Presentations		Postdeadline Paper Presentations

Key to Shading	
ASSP Sessions	
LS&C Sessions	
LACSEA Sessions	

	ASSP <i>Emerald Ballroom</i>	LS&C <i>Topaz Room</i>	LACSEA <i>Diamond Room</i>
Tuesday, February 2			
7:30 a.m.–5:00 p.m.	Registration Open, <i>Ballroom Foyer</i>		
8:00 a.m.–10:00 a.m.	JTUA • ASSP/LACSEA/LS&C Joint Session, <i>Emerald Ballroom</i>		
10:00 a.m.–5:00 p.m.	Exhibit Open, <i>Crystal Ballroom</i>		
10:00 a.m.–10:30 a.m.	Coffee Break/Exhibits, <i>Crystal Ballroom</i>		
10:00 a.m.–11:30 a.m.	ATuA: ASSP Poster Session II, <i>Ballroom Foyer</i>		
10:30 a.m.–12:30 p.m.	ATuB • New Laser Materials (11:30 a.m. – 1:30 p.m.)	LSTuA • Optical Receivers	LTuA • THz and Pulse Shaping Techniques
12:30 p.m.–1:30 p.m.	Lunch Break (<i>on your own</i>)		
1:30 p.m.–3:30 p.m.	Afternoon Off	LSTuB • Naval Laser Applications	LTuB • Coherent Anti-Stokes Raman Scattering in Flames
3:30 p.m.–4:00 p.m.		Coffee Break, <i>Ballroom Foyer</i>	
4:00 p.m.–6:00 p.m.		LSTuC • Optical Communications – Theoretical vs. Experimental	LTuC • Multiparameter Gas and Chemical Sensing (ends at 5:30 p.m.)
5:30 p.m.–6:00 p.m.		LACSEA Coffee Break, <i>Ballroom Foyer</i>	
6:00 p.m.–7:15 p.m.		LTuD • Applications of MIR Spectroscopy	
7:30 p.m.–10:00 p.m.	Conference Banquet, <i>Emerald Ballroom</i>		
Wednesday, February 3			
7:30 a.m.–5:00 p.m.	Registration Open, <i>Ballroom Foyer</i>		
8:00 a.m.–10:00 a.m.	AWA • Fiber Lasers (ends at 9:30 a.m.)	LSWA • Ladar Systems I	LWA • New Combustion Imaging Strategies
9:30 a.m.–4:00 p.m.	Exhibit Open, <i>Crystal Ballroom</i>		
9:30 a.m.–10:30 a.m.	Coffee Break/Exhibits, <i>Crystal Ballroom</i>		
9:30 a.m.–11:00 a.m.	AWB • ASSP Poster Session III, <i>Ballroom Foyer</i>		
10:30 a.m.–12:30 p.m.	AWC • Optical Combs and Harmonics (11:00 a.m. – 1:00 p.m.)	LSWB • Ladar Systems II (ends at 12:00 p.m.)	LWB • Spectroscopy for Combustion Applications
12:30 a.m.–1:30 p.m.	Lunch Break (<i>on your own</i>)		
1:30 p.m.–3:30 p.m.	AWD • Nonlinear Optics (2:30 p.m. – 4:00 p.m.)	LSWC • Advanced Systems (1:00 p.m. – 2:30 p.m.)	LWC • Spectroscopy for Security and Biochemical Sensing
		LSWD • Laser Technology I (2:30 p.m. – 3:30 p.m.)	
3:30 p.m.–4:30 p.m.	Coffee Break/Exhibits, <i>Crystal Ballroom</i>		
4:00 p.m.–6:00 p.m.	AWE • Ultrafast Lasers II (4:30 p.m. – 6:30 p.m.)	LSWE • Laser Technology II (ends at 5:30 p.m.)	LWD • LIBS and Standoff Detection of Hazardous Materials
6:30 p.m.–6:45 p.m.	Closing Remarks		

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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7:00 a.m.–5:00 p.m. Registration Open, Ballroom Foyer
10:00 a.m.–5:00 p.m. Exhibit Open, Crystal Ballroom

AMA • Novel Sources	LSMA • Performance Analysis of Experimental FSO Systems	LMA • Advances in Mid-IR Sources for Spectroscopy
<p>Monday, February 1 8:00 a.m.–10:00 a.m. <i>Ingmar Hartl; IMRA America, Inc., USA, Presider</i></p> <p>8:00 a.m.–8:15 a.m. Opening Remarks</p>	<p>Monday, February 1 8:00 a.m.–10:00 a.m. <i>Steve Koutsoutis; US Army CERDEC, USA, Presider</i> <i>Linda Thomas; NRL, USA, Presider</i></p>	<p>Monday, February 1 8:00 a.m.–10:00 a.m. <i>Presider to Be Announced</i></p>
<p>AMA1 • 8:15 a.m. Invited Phasing of High Power Fiber Amplifier Arrays, <i>Thomas M. Shay¹, J. T. Baker², Anthony D. Sanchez¹, C. A. Robin¹, C. L. Vergien¹, Angel Flores¹, C. Zerinque¹, D. Gallant², Chunte A. Lu¹, Benjamin Pulford¹, T. J. Bronder¹, Arthur Lucero²; ¹AFRL, USA, ²Boeing LTS Inc., USA. We report locking the phase of a five element 725-W amplifier array and in addition we report phase locking off the backscatter from a remote object. The rms phase error was measured to be $\lambda/60$.</i></p>	<p>LSMA1 • 8:00 a.m. Invited Adaptive Optics for Free Space Laser Communications, <i>Mikhail Vorontsov¹, Thomas Weyrauch¹, Gary Carhart², Leonid Beresnev²; ¹School of Engineering, Univ. of Dayton, USA, ²ARL, USA. We discuss adaptive optics (AO) role in free-space laser communications with focus on two major challenges: The high cost of AO deployment, and high intensity scintillation levels that are typical for most communication scenarios.</i></p>	<p>LMA1 • 8:00 a.m. Invited On Recent Progress Using QCLs for Molecular Trace Gas Detection - from Basic Research to Industrial Applications, <i>Jürgen Röpcke¹, Paul Davies², Frank Hempel¹, Marko Huebner¹, Sven Glitsch¹, Norbert Lang¹, Markus Naegele³, Antoine Rousseau⁴, Stephan Wege⁵, Stefan Welzel^{1,6}; ¹INP Greifswald, Germany, ²Univ. of Cambridge, UK, ³OptoPrecision GmbH, Germany, ⁴LPTP, Ecole Polytechnique, France, ⁵Qimonda Dresden GmbH & Co. OHG, Germany, ⁶Eindhoven Univ. of Technology, Netherlands. Quantum Cascade Lasers offer attractive options for applications of MIR absorption spectroscopy for basic research and industrial process control. The contribution reviews applications for plasma diagnostics and trace gas monitoring in research and industry.</i></p>
<p>AMA2 • 8:45 a.m. Coherent Combining of a 1.26-kW Fiber Amplifier, <i>Stuart J. McNaught, Joshua E. Rothenberg, Peter A. Thielen, Michael G. Wickham, Mark E. Weber, Gregory D. Goodno; Northrop Grumman Aerospace Systems, USA. A 1.26-kW, multi-stage Yb fiber MOPA was coherently combined using active polarization and phase control with 94% visibility to a second fiber amplifier, consistent with estimated decoherence effects from fiber nonlinearity, linewidth, and phasing accuracy.</i></p>	<p>LSMA2 • 8:30 a.m. Invited Presentation to Be Announced</p>	<p>LMA2 • 8:30 a.m. Invited Single-Mode Room-Temperature CW Interband Cascade Lasers Covering the $\lambda = 3\text{-}4\ \mu\text{m}$ Spectral Band, <i>Mijin Kim, William W. Bewley, J. R. Lindle, Chulsoo Kim, Chadwick L. Canedy, Joshua Abell, Igor Vurgaftman, Jerry Meyer; NRL, USA. Interband cascade lasers emitting at 3.6 μm operated to a maximum temperature of 335 K and produced 59 mW of cw power at room temperature. Single-mode cw emission with 12 mW of power was demonstrated.</i></p>
<p>AMA3 • 9:00 a.m. Diffraction-Limited Operation from Multimode and Multi-Core Fibers Using Active Digital Holography Precompensation, <i>Mathieu Paurisse¹, Marc Hanna¹, Frederic Druon¹, Patrick Georges¹, Cindy Bellanger², Arnaud Brignon², Jean-Pierre Huignard²; ¹Lab Charles Fabry de l'Inst. d'Optique, France, ²Thalès Res. and Technology, France. We demonstrate beam pre-compensation shaping using digital holography allowing diffraction limited operation out of a multimode LMA fiber and a multi-core fiber in CW and pulsed regime.</i></p>	<p>LSMA3 • 9:00 a.m. Invited Air to Ground Lasercom System Demonstration, <i>George Nowak; United States Military Acad., USA. Abstract not available.</i></p>	<p>LMA3 • 9:00 a.m. Spectroscopic Applications of External Cavity Quantum Cascade Laser with Fast Tuning, <i>Tracy R. Tsai, Gerard Wysocki; Princeton Univ., USA. Littrow-based folded external cavity QCL capable of tuning up to 7cm-1 at kHz rates is presented. Laser capabilities in pulsed and cw modes are demonstrated by performing absorption spectroscopy of ammonia and ethylene at $\sim 10\ \mu\text{m}$.</i></p>

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AMA • Novel Sources—Continued

AMA4 • 9:15 a.m.
High Repetition Rate Fiber Laser Systems for High Field Physics, Steffen Hädrich¹, Manuel Krebs¹, Stefan Nolte¹, Jens Limpert¹, Andreas Tünnermann^{1,2}; ¹Friedrich Schiller Univ. Jena, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany. We show generation of XUV radiation at 23.9 nm at 50 kHz via HHG of a fiber amplification system. Postcompression of this system to 70 fs, 200 μJ, 2 GW pulses shows further scaling potential.

AMA5 • 9:30 a.m. **Invited**
Recent Advances of Table-Top Soft X-ray Lasers, J. J. Rocca, F. J. Furch, B. A. Reagan, Y. Wang, D. Alessi, D. Martz, B. M. Luther, A. H. Curtis, S. P. Meehan, S. Domingue, D. Kemp; Colorado State Univ. at Fort Collins, USA. We review recent advances in the development of high repetition rate table-top soft X-ray lasers that includes their extension to wavelengths down to 10.9 nm and the first demonstration of an all-diode-pumped soft x-ray laser.

LSMA • Performance Analysis of Experimental FSO Systems—Continued

LSMA4 • 9:30 a.m. **Invited**
Differential Phase-Shift Keying in Multi-Wavelength Spatial Diversity Links, Todd Ullmer, Scott R. Henion, Frederick G. Walther, Peter A. Schulz; MIT Lincoln Lab, USA. We investigate the use of differential phase-shift keying in multi-wavelength spatial diversity transmitters that mitigate atmospheric fading.

LMA • Advances in Mid-IR Sources for Spectroscopy—Continued

LMA4 • 9:15 a.m.
Invited
Tunable Difference Frequency Generation Laser Spectrometers: Successes, Challenges, and Opportunities, Dirk Richter¹, Petter Weibring¹, Alan Fried¹, Lars Rippe¹, Märta Lewander^{1,2}, Oscar Batet^{1,3}, James G. Walega¹, Scott Spuler¹; ¹Natl. Ctr. for Atmospheric Res., USA, ²Atomic Physics Div., Lund Univ., Sweden, ³Dept. of Signal Theory and Communications, Technical Univ. of Catalonia, Spain. We will review the state of development and applications of difference-frequency generation based laser spectrometers to atmospheric research and discuss the operating conditions and techniques that enable high precision performance for ground and airborne environments.

LMA5 • 9:45 a.m.
Characterization of Highly Stable Mid-IR, GaSb-Based Laser Diodes, Andrey V. Okishev¹, Ding Wang², David Westerfeld³, Leon Shterengas², Gregory Belenky²; ¹Univ. of Rochester, USA, ²SUNY Stony Brook, USA, ³Power Photonic Corp., USA. Highly stable, room-temperature mid-IR, GaSb-based laser diodes have been characterized at various temperatures and driver currents. Up to 54 mW of output power was demonstrated in a 3150-3180-nm wavelength range with <20-nm FWHM spectral width.

10:00 a.m.–10:30 a.m. Coffee Break/Exhibits, Crystal Ballroom

AMB1

High-Energy Femtosecond Er-Doped Fiber Laser at 1.6 μm : Influence of Pumping Scheme, Franck Morin, Frédéric Druon, Marc Hanna, Patrick Georges; Lab Charles Fabry de l'Inst. d'Optique, CNRS, Univ. Paris-Sud, France. We present the first microjoule-class sub-picosecond erbium-doped fiber laser at 1600 nm, and demonstrate the generation of 1.5 μJ , 605 fs pulses at 300 kHz. Both 980 nm and 1540 nm pumping schemes are investigated.

AMB2

Thulium Fiber Lasers Stabilized by a Volume Bragg Grating in High Power, Tunable and Q-Switched Configurations, Timothy S. McComb, Lawrence Shah, Christina C. C. Willis, R. Andrew Sims, Pankaj K. Kadwani, Vikas Sudesh, Martin Richardson; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA. Thulium fiber lasers are spectrally stabilized using a volume Bragg grating. 159 W power and >100 nm tuning range are achieved in CW configurations, and pulses <115 ns with >350 μJ are generated when Q-switched.

AMB3

Beam Quality and Spectral Evolution in Large-Core Cladding-Pumped Cascaded-Raman Fiber Converter, Junhua Ji, Christophe A. Codemard, Alexander Boyland, Jayanta K. Sahu, Johan Nilsson; Optoelectronics Res. Ctr., Univ. of Southampton, UK. We fabricate the first large-core double-clad Raman fiber and use it for efficient pulsed cladding-pumped fiber Raman amplification. The beam-quality of the output beam improves to diffraction-limited through cascaded Raman scattering.

AMB4

Pulse Quality Improvement in Nonlinear Fiber-Amplifiers by Using Circularly Polarized Light, Enrico Seise¹, Damian N. Schimpff¹, Tino Eidam¹, Steffen Hädrich¹, Jens Limpert¹, Andreas Tünnermann²; ¹Inst. of Applied Physics, Friedrich Schiller Univ. Jena, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany. We experimentally present the advantage of using circularly polarized light during laser amplification to reduce the accumulated Kerr-nonlinearity. The theoretical value of 2/3 for the reduction of the B-integral is verified in a fiber CPA-system.

AMB5

Diode Side Pumping of a Gain Guided, Index Anti-Guided Large Mode Area Neodymium Fiber Laser, William B. Hageman¹, Ying Chen¹, Michael Bass¹, Vikas Sudesh¹, Tim McComb¹, Martin Richardson¹, Gyu Kim²; ¹CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA, ²Kumoh Natl. Inst. of Technology, Republic of Korea. Diode side pumping of a gain guided, index anti-guided neodymium doped fiber laser is demonstrated. This method of pumping may lead to a scalable

approach to create high power, extremely large mode area fiber lasers.

AMB6

Spectral Beam Combining of 2 μm Tm Fiber Laser Systems, Robert A. Sims¹, Christina C. C. Willis¹, Pankaj Kadwani¹, Timothy S. McComb¹, Lawrence Shah¹, Vikas Sudesh¹, Zachary A. Roth², Menelaos K. Poutous², Eric G. Johnson², Martin Richardson²; ¹CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, ²Ctr. for Optoelectronics and Optical Communications, Univ. of North Carolina at Charlotte, USA. We report spectral beam combining of three 2- μm Tm fiber lasers each locked to slightly different wavelengths, using a new spectral-limiting device, providing a path forward to beam-combining at the multi-kW level.

AMB7

Over 20W Pico-second Vortex Output from a Large-Mode-Area Fiber MOPA System, Yuichi Tanaka, Mio Koyama, Masahito Okida, Katsuhiko Miyamoto, Takashige Omatsu; Chiba Univ., Japan. We scale the power of a pico-second vortex master-oscillator power amplifier system based on a stressed large-mode-area fiber amplifier. The vortex output power of >20 W with the corresponding peak power of >30kW was obtained.

AMB8

All-Fiber Q-Switched and Cavity Dumped Laser Using an Electrically Addressed Microstructured Fiber, Mikael Malmström¹, Walter Margulis^{2,1}, Zhanwei Yu¹, Oleksander Tarasenko², Fredrik Laurell¹; ¹Dept. of Applied Physics, Royal Inst. of Technology (KTH), Sweden, ²Dept. of Fiber Photonics, Acreo AB, Sweden. We report on a pulsed fiber laser with two regimes of operation, one where cavity-roundtrip pulse durations are produced (85 ns long, 40 Wpp) and one with high power pulses (2 ns long, 148 Wpp).

AMB9

Pump-Seed Synchronization Measurements for High-Power Short-Pulse Pumped Few-Cycle OPCPA System, Izhar Ahmad¹, Sandro Klingebiel¹, Christoph Skrobel¹, Christoph Wandt¹, Sergei Trushin¹, Zsuzsanna Major^{1,2}, Ferenc Krausz^{1,2}, Stefan Karsch^{1,2}; ¹Max-Planck Inst. for Quantum Optics, Germany, ²Ludwig-Maximilians-Univ. München, Germany. We present the development of an optically synchronized frontend of a high-power short-pulse pumped few-cycle OPCPA system and single shot pump-seed timing jitter measurements at the position of its first OPCPA stage.

AMB10

Amplification of Picosecond Pulses Generated in a Carbon Nanotube Modelocked Thulium Fiber Laser, Timothy S. McComb¹, Pankaj Kadwani¹, Robert Andrew Sims¹, Lawrence Shah¹, Christina C. C. Willis¹, Gavin Frith², Vikas Sudesh¹, Bryce Samson³, Martin Richardson²; ¹Townes Laser Inst., CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, ²Macquarie Univ., Australia, ³Nufen Inc., USA. Generation of 5ps, 32pJ pulses from a carbon nanotube modelocked thulium fiber oscillator and their amplification to 0.6W average power, 2.6kW peak power, 13nJ pulses by an LMA thulium fiber amplifier is discussed.

AMB11

Amplification of a Passively Q-Switched Nd:YAG Microlaser in a Crystal Fiber, Igor Martial¹, Heather Ferguson¹, Nabil Douiri¹, Damien Sangla¹, François Balembois¹, Julien Didierjean², Patrick Georges¹; ¹Lab Charles Fabry de l'Inst. d'Optique, France, ²Fibercryst SAS, France. A passively Q-switched Nd:YAG microchip laser generating 18.6 μJ , 5.5 ns pulses with a repetition rate of 29 kHz was efficiently amplified by a diode-pumped Nd:YAG crystal fiber amplifier to obtain 250 μJ pulses.

AMB12

High Performances in Continuous-Wave and Q-Switch Operation of a Narrow Linewidth Nd:YVO₄ Oscillator Using a Volume Bragg Grating, Michaël Hemmer, Martin Richardson; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA. A quasi-single-longitudinal mode Nd:YVO₄ oscillator providing up to 11 W CW is presented. In Q-switched regime, up to 1.2 mJ output energy with spectral linewidth narrower than 20 pm at 1kHz repetition rate were obtained.

AMB13

High-Power Ho:YAG Laser in-Band Pumped by Laser Diodes at 1.9 μm and Wavelength-Stabilized by a Volume Bragg Grating, Samir Lamrini¹, Philipp Koopmann¹, Karsten Scholle¹, Peter Fuhrberg¹, Martin Hofmann²; ¹LISA laser products OHG, Germany, ²Ruhr-Univ. Bochum, Germany. The first high-power Ho:YAG laser wavelength-stabilized by a volume Bragg grating is reported. A maximum output power of 15 W and a slope-efficiency of 37% were achieved using in-band diode pumping.

AMB14

High Efficient Q-Switched Ho:LuAG Laser with High Repetition Rates, Xiaoming Duan, Baoquan Yao, Gang Li, Youlun Ju, Yuezhu Wang; Harbin Inst. of Technology, China. We present the high efficient Q-switched Ho:LuAG laser at 2.1 μ m pumped by diode-pumped Tm:YLF laser. The average output power at 10kHz of 9.9W with slope efficiency of 69.9% relative to absorbed pump power was obtained.

AMB15

Inband Pumped Er:Lu₂O₃ and (Er,Yb):YVO₄ Lasers near 1.6 μ m for CO₂ LIDAR, Christian Brandt¹, Nikolai A. Tolstik², Nikolai V. Kuleshov², Klaus Petermann¹, Guenter Huber¹; ¹Inst. of Laser-Physics, Univ. of Hamburg, Germany, ²Inst. for Optical Materials and Technologies, Belarus Natl. Technical Univ., Belarus. Er:Lu₂O₃ and (Er,Yb):YVO₄ provide suitable spectra for CO₂-LIDAR systems around 1.6 μ m. First inband pumped laser experiments show output powers up to 1.26W and slope efficiencies of up to 48% with respect to absorbed pump power.

AMB16

Estimation of Gain Bandwidth Limitation of Short Pulse Duration Based on Competition of Gain Saturation, Masaki Tokurakawa, Akira Ahirakawa, Ken-ichi Ueda; Univ. of Electro-Communications, Japan. We show the gain bandwidth limitation of the short pulse duration by time independent rate equations including the reabsorption effect, laser mode diameters and wavelength integration parts. The necessary conditions for mode-locked operation are obtained.

AMB17

Relation between Group Delay and Energy Storage in Dispersive Dielectric Mirror Coatings, Peter Gyula Antal, Robert Szipocs; Res. Inst. for Solid State Physics and Optics, Hungary. We show that the reflection group delay of a highly reflective, dielectric multilayer mirror is proportional to the energy stored by the standing wave electromagnetic field built up in such 1D photonic bandgap (PBG) structures.

AMB18

Multi Photon Absorption Induced Amplified Ultraviolet Emission from Hydrothermally Grown ZnO Nanorods, Gaurav Shukla, Alika Khare; Indian Inst. of Technology Guwahati, India. Multi photon absorption induced ultra-violet (UV) photoluminescence, second harmonic generation at 532 nm and amplified spontaneous emission at 392 nm from hydrothermally grown ZnO nanorods arrays upon nano-second infrared excitation is reported in the paper.

AMB19

Intrinsic Reduction of the Depolarization in Nd:YAG Crystals, Henrik Tünnermann¹, Oliver Puncken¹, Peter Weßels^{1,2}, Maik Frede^{1,2}, Dietmar Kracht^{1,2}, Jörg Neumann^{1,2}; ¹Laser Zentrum Hannover e.V., Germany, ²Ctr. for Quantum Engineering and

Space-Time Res. (QUEST), Leibniz Univ. Hannover, Germany. Thermally induced depolarization in Nd:YAG lasers can be reduced by choice of the crystal cut. Experimental results and corresponding simulations at pump powers around 140W are presented for [111]-, [100]- and [110]-cut crystals.

AMB20

Generation of Cylindrical Vector Beams of a Single Higher Order Transverse Mode, Akihiko Ito, Yuichi Kozawa, Shunichi Sato; Tohoku Univ., Japan. Generation of cylindrical vector beams of a single higher order transverse mode is demonstrated using a rear mirror with a low reflectivity area near the beam axis. Both Laguerre-Gaussian and Bessel-Gaussian vector beams are identified.

AMB21

Cavity Length Resonances in a Singly Resonant Optical Parametric Oscillator with a Volume Bragg Grating, Markus Henriksson^{1,2}, Lars Sjöqvist¹, Valdas Pasiskevicius², Fredrik Laurell²; ¹FOI, Swedish Defence Res. Agency, Sweden, ²Royal Inst. of Technology (KTH), Sweden. Resonant output energy enhancement in a singly resonant nondegenerate type-I optical parametric oscillator with a volume Bragg grating output coupler is demonstrated

when there is a low fraction cavity length ratio between laser and OPO.

AMB22

Phase Locking Control of the Multichannel Holographic Laser System with the Help of Passive Q-Switch, Tasoltan T. Basiev¹, Alexander V. Fedin², Andrey V. Gavrilov², Sergey N. Smetanin²; ¹A.M. Prokhorov General Physics Inst. of RAS, Russian Federation, ²Kovrov State Technological Acad., Russian Federation. Method of phase-locking control of the multichannel laser system by use of a passive Q-switch is proposed. For the first time a phase-locked and Q-switched oscillation of the multichannel Nd:YAG-laser system is realized.

AMB23

Coherent Picosecond Pulse Stacking by Cascaded Fiber Bragg Gratings for Flat-Top Pulse Generation, Jan Rothhardt¹, Steffen Hädrich¹, Thomas Gottschall¹, T. Clausnitzer¹, Jens Limpert¹, Andreas Tünnermann^{1,2}, Manfred Rothhardt³, Martin Becker³, Sven Brückner³, Hartmut Bartelt³; ¹Friedrich-Schiller-Univ. Jena, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany, ³Inst. of Photonic Technology, Germany. We present a simple and robust pulse shaping device based on coherent pulse stacking. The device is based on fiber Bragg gratings written in a polarisation maintaining step index fiber and a fiber optical circulator.

AMB24

Fiber Amplified Q-Switched ns-Sources Spectrally Combined by the Use of Interference Filters, Oliver Schmidt¹, Christian Wirth¹, Dirk Nodop¹, Jens Limpert¹, Thomas Schreiber², Ramona Eberhardt², Andreas Tünnermann^{2,1}; ¹Friedrich-Schiller-Univ. Jena, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany. We report on a simple scheme to spectrally combine four ns-pulsed sources using three off-the-shelf dielectric interference-filters as combining elements. 208W of average power and 6.3mJ of pulse energy are obtained at different repetition frequencies.

AMB25**Dynamic Multimode Analysis of High-Power Lasers with Super-Gaussian Beam Profile Using Precombined Gaussian Modes, Matthias**

Wohlmuth¹, Konrad Altmann², Michael Hemmer³, Mario Goehre⁴, Christoph Pflaum¹, Martin Richardson³; ¹Univ. Erlangen-Nuremberg, Germany, ²LAS-CAD GmbH, Germany, ³Townes Laser Inst., CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, ⁴Clean-Laserysteme GmbH, Germany. Dynamic Multimode Analysis investigates mode competition including thermal, spatial, and dynamic effects. However, the computational effort increases dramatically for super-gaussian beams in high-power lasers. We explain how this can be solved by precombining Gaussian modes.

AMB26**Experimental Confirmation of Quasi-Soliton Pulse Formation in Ultrafast VECSELS, Oliver D.**

Sieber, Martin Hoffmann, Deran J. H. C. Maas, Valentin J. Wittwer, Matthias Golling, Thomas Südmeyer, Ursula Keller; ETH Zurich, Switzerland. A detailed experimental study on pulse formation in ultrafast VECSELS confirms that shortest pulses require slightly positive dispersion to balance saturation effects. These results are in good agreement with simulations, confirming the quasi-soliton pulse-formation theory.

AMB27**Waveguide Devices Produced by Adaptive Femtosecond Laser Writing, Matthias Pospiech¹,**

Moritz Emons¹, Benjamin Vackenstedt¹, Roberto Osellame², Nicola Bellini², Giulio Cerullo², Uwe Morgner^{1,3}; ¹Inst. of Quantum Optics, Leibniz Univ. Hannover, Germany, ²Inst. di Fotonica e Nanotecnologie - CNR, Dept. di Fisica, Politecnico di Milano, Italy, ³Laser Zentrum Hannover e.V., Germany. We report a novel method to create waveguide devices such as couplers in fused silica. A combination of adaptive beam shaping with femtosecond laser writing is used to simultaneously write two waveguides with changing separation.

AMB28**The Effect of the Longitudinal Electric Field of a Radially Polarized Laser Beam for Second Harmonic Generation, Yuichi Kozawa, Akihiko**

Ohtsu, Shunichi Sato; Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan. Second harmonic generation is demonstrated for radially and azimuthally polarized beams. The contribution of longitudinal electric field generated by a focused radially polarized beam is clearly distinguished from that by an azimuthally polarized beam.

AMB29**Power Scaling of a Compact and Efficient Blue Diode Pumped Solid State Laser Emitting Green**

Light, Michael Strotkamp, Thomas Schwarz, Bernd Jungbluth; Fraunhofer Inst. For Laser Technology, Germany. A green, efficient bDPSSL for use in digital projectors has been developed. The use of Pr:YLF in an extremely short resonator and the power scaling with new pump diodes is shown.

AMB30**Stable Half-watt 355 nm generation with**

PPMgSLT, Junji Hirohashi, Tatsuo Fukui, Yasunori Furukawa; OXIDE corp., Japan. A half-watt of 355nm laser is achieved from PPMgSLT by sum-frequency generation of fundamental and second harmonic of pulsed Nd:YVO₄ laser. Over 24 hours stable generation was confirmed.

NOTES

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AMC • Infrared Lasers

Monday, February 1
11:30 a.m.–1:00 p.m.
Upendra Singh; NASA Langley Res. Ctr., USA, Presider

LSMB • Laser Communication Systems and Channel Characterization for Laser Comm Systems

Monday, February 1
10:30 a.m.–1:00 p.m.
Larry Andrews; Univ. of Central Florida, USA, Presider
Presider to Be Announced

LMB • Cavity-Enhanced and Advanced Detection Strategies

Monday, February 1
10:30 a.m.–12:30 p.m.
Anatoliy A. Kosterev; Rice Univ., USA, Presider
Houston Miller; George Washington Univ., USA, Presider

LSMB1 • 10:30 a.m. Invited

Coherent Free-Space Optical Communication Using Electronic Wavefront Correction, *Guifang Li; Univ. of Central Florida, USA*. Mitigation of wavefront distortion due to atmospheric turbulence using coherent detection and digital signal processing will be presented. The advantages of this electronic wavefront correction technique over adaptive optics will be described.

LMB1 • 10:30 a.m. Invited

Applications of cw Cavity Ring-Down Spectroscopy to the Study of Trace Atmospheric Constituents, *R. Grilli, D. Mellon, J. Kim, M. S. I. Aziz, D. Hamilton, A. J. Orr-Ewing; Univ. of Bristol, UK*. Diode laser cavity ring-down spectroscopy is a versatile method for quantitative determination of trace atmospheric constituents. Examples include measurement of mixing ratios of small organic compounds, isotopologue-specific spectroscopy, and optical extinction by atmospheric aerosol particles.

LSMB2 • 11:00 a.m. Invited

On the Achievable Performance of Non-Line-of-Sight Ultraviolet Communications, *Qunfeng He¹, Brian Sadler², Zhengyuan Xu¹; ¹Univ. of California, USA, ²US ARL, USA*. We show achievable data rates for outdoor non-line-of-sight communications in the deep UV (UV-C) band as a function of modulation scheme, power, range, background noise, and pointing geometry. Both theoretical and numerical results are presented.

LMB2 • 11:00 a.m.

Broadband Cavity Enhanced Trace Sensing Using Supercontinuum Light Sources, *Toni K. Laurila¹, Rosalynne S. Watt¹, Clemens F. Kaminski^{1,2}; ¹Dept. of Chemical Engineering and Biotechnology, Univ. of Cambridge, UK, ²School of Advanced Optical Technologies, Max-Planck-Inst. for the Science of Light, Germany*. Broadband multi-species detection at low concentrations in the gas and liquid phase has been achieved by coupling supercontinuum radiation and cavity enhanced absorption spectroscopy.

LMB3 • 11:15 a.m.

Pseudo-Random Modulation Methods for Cavity-Enhanced Spectroscopy, *David C. Hoode, Steve M. Massick, David S. Bomse; Southwest Sciences, USA*. Both pseudo-random amplitude modulation and pseudo-random tone-burst modulation methods were applied to determine range resolved cavity losses in a cylindrical-mirror cavity excited by a distributed feedback laser. Gas concentrations were determined.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AMC • Infrared Lasers—Continued

AMC1 • 11:30 a.m.

Single-Frequency Narrow-Linewidth 2 μ m Fiber Laser Using Tm-Doped Silicate Glass Fiber, *Jihong Geng¹, Qing Wang¹, Tao Luo¹, Shibin Jiang¹, Farzin Amzajerdian²; ¹AdValue Photonics Inc., USA, ²NASA Langley Res. Ctr., USA.* Single-frequency laser operation near 2 μ m has been demonstrated in an all-fiber DBR cavity using both cladding- and core-pump configurations in newly developed heavily Tm-doped silicate fiber with laser linewidth as narrow as 3 kHz.

AMC2 • 11:45 a.m.

Ultrabroad Continuous-Wave Tuning of Ceramic Cr:ZnSe and Cr:ZnS Lasers, *Evgeni Sorokin¹, Irina T. Sorokina², Mike S. Mirov³, Vladimir V. Fedorov⁴, Igor S. Moskalev^{3,4}, Sergey B. Mirov^{4,3}; ¹Technische Univ. Vienna, Austria, ²Norwegian Univ. of Science and Technology, Norway, ³Photonics Innovations, Inc., USA, ⁴Univ. of Alabama at Birmingham, USA.* Using a single set of optics, we demonstrate ultrabroad tuning over more than 1300 nm from 1973 to 3349 nm in Cr:ZnSe and from 1962 to 3195 nm in Cr:ZnS at <10 GHz linewidth.

AMC3 • 12:00 p.m.

Diode-Pumped Er³⁺:Y₂O₃ Ceramic Laser at ~3- μ m, *Tigran Sanamyan, Jed F. Simmons, Mark Dubinskii; US ARL, USA.* We report on spectroscopy and diode-pumped ~3- μ m laser operation of Er³⁺:Y₂O₃ ceramic resonantly pumped into upper level. This is believed to be the first laser based on ⁴I_{1/2} \Rightarrow ⁴I_{3/2} transitions of Er³⁺ in Y₂O₃.

LSMB • Laser Communication Systems and Channel Characterization for Laser Comm Systems—Continued

LSMB3 • 11:30 a.m.

Invited

Observations of Power-in-Fiber Statistics in Two Recent Free-Space Communication Link Experiments, *Ron Parenti, Steven Michael, Jeffrey M. Roth, Timothy M. Yarnall; MIT Lincoln Lab, USA.* Lincoln Laboratory conducted two free-space optical communication experiments designed to test the ability of beam diversity, symbol encoding, and interleaving to reduce the effects of turbulence induced scintillation. This article presents a small sample of the power-in-fiber data obtained from those experiments.

LSMB4 • 12:00 p.m.

Invited

Characterization of Free-Space Optical Paths with Lidar, *Gary G. Gimmestad; Georgia Tech Res. Inst., USA.* The utility of free-space optical communication channels is often limited by atmospheric turbulence and turbidity. Lidar techniques are described for characterizing such optical paths, in support of both field measurements and modeling.

LMB • Cavity-Enhanced and Advanced Detection Strategies—Continued

LMB4 • 11:30 a.m.

Invited

Quartz Enhanced Photoacoustic Spectroscopy: Today and Beyond, *Anatoliy A. Kosterev; Rice Univ., USA.* Current theoretical understanding and practical applications of the trace gas sensing technique called quartz enhanced photoacoustic spectroscopy (QEPAS) will be presented. Work in progress and planned QEPAS developments will be discussed.

LMB5 • 12:00 p.m.

Real Time Determination of Water Isotope Ratios by Laser Absorption Spectroscopy at 2.73 μ m Using Kalman Filter, *Tao Wu^{1,2}, Weidong Chen¹, Eirk Kerstel³, Eric Fertein¹, Pascal Masselin¹, Xiaoming Gao², Johannes Koeth⁴, Karl Rößner⁴, Daniela Bruekner⁴; ¹Lab de Physicochimie de l'Atmosphère, Univ. du Littoral, France, ²Anhui Inst. of Optics and Fine Mechanics, Chinese Acad. of Sciences, China, ³Univ. of Groningen, Netherlands, ⁴Nanoplus Nanosystems and Technologies GmbH, Germany.* Kalman filter was applied to measurements of water isotopologue ratios by laser spectroscopy at 2.73 μ m. The results obtained in 1-s showed a 1 σ precision that required ~30-s averaging when using a simple average approach.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AMC • Infrared Lasers—Continued

AMC4 • 12:15 p.m.

Reduction of Timing-Jitter in a Passively Q-Switched Microchip Laser Using Self-Injection Seeding, Alexander Steinmetz, Dirk Nodop, Jens Limpert, Andreas Tümmernann; *Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany*. We present a simple technique for the timing jitter reduction in passively Q-switched microchip-lasers by self-injection seeding using a fiber delay line. The jitter is reduced by several orders of magnitude.

AMC5 • 12:30 p.m.

Semiconductor Q-Switched, Short-Pulse, High-Power, MHz-Rate Laser, Alex Dergachev¹, Peter F. Moulton¹, Gale S. Petrich², Leslie A. Kolodziejski², Franz X. Kärtner²; ¹Q-Peak, Inc., USA, ²MIT, USA. We report a 0.8-5.0 ns-width, 0.1-2 MHz-rate Nd-MOPA laser passively Q-switched with a semiconductor saturable Bragg reflector producing 7.5 W of average power at 532 nm in a diffraction limited beam.

AMC6 • 12:45 p.m.

Periodically Poled KTiOAsO₄ for Mid-Infrared Light Generation, Andrius Zukauskas, Nicky Thilmann, Valdas Pasiskevicius, Fredrik Laurell, Carlota Canalias; *Royal Inst. of Technology, Sweden*. A periodically poled KTiOAsO₄ crystal was fabricated at room temperature. The poled crystal shows a d_{eff} of 10.1 pm/V and gives a parametric conversion efficiency of 45%.

LSMB • Laser Communication Systems and Channel Characterization for Laser Comm Systems—Continued

LSMB5 • 12:30 p.m.

Measurements of Atmospheric Turbulence Characteristics for Laser Channel Characterization, Mikhail Belenkii; *Trex Enterprises Corp., USA*. A novel LIDAR technique for turbulence profile determination with high spatial and temporal resolution is presented. An overview of measurements of turbulence inner scale, anisotropy coefficient, and outer scale on space-to-ground propagation paths is given.

Invited

LMB • Cavity-Enhanced and Advanced Detection Strategies—Continued

LMB6 • 12:15 p.m.

Fast Multispecies Gas Monitoring Based on a Single Modulated Grating Y-Branch Diode Laser Operating between 1529 nm and 1565 nm, Märta L. Lewander^{1,2,3}, Alan Fried², Dirk Richter², Petter Weibring², Lars Rippe^{2,3}; ¹Lund Univ., Sweden, ²Earth Observing Lab, Natl. Ctr. for Atmospheric Res., USA, ³Advanced Study Program, Natl. Ctr. for Atmospheric Res., USA. A multispecies sensor based on one single modulated grating Y-branch diode laser is presented. Sequential scanning of three gases with absorption lines separated 30 nm in less than 20 ms is demonstrated.

1:00 p.m.–2:30 p.m. Lunch Break (on your own)

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AMD • Ultrafast Lasers I

Monday, February 1
 2:30 p.m.–4:00 p.m.
Takunori Taira; Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan, Presider

AMD1 • 2:30 p.m.
Continuous-Wave Yb-Doped Sesquioxide Thin Disk Lasers with up to 300 W Output Power and 74% Efficiency, *Oliver H. Heckl¹, Rigo Peters², Christian Kränkel¹, Cyrill R. E. Baer¹, Clara J. Saraceno¹, Thomas Südmeyer¹, Klaus Petermann², Ursula Keller¹, Günter Huber²; ¹ETH Zurich, Switzerland, ²Univ. of Hamburg, Germany*. We obtained 301W of output power, 88% slope efficiency, and 74% optical-to-optical efficiency with VBG-diode-pumped Yb:Lu₂O₃ thin disk lasers. Yb:Sc₂O₃ and Yb:LuScO₃ showed comparable performance, delivering 264W and 250W of output power, respectively.

AMD2 • 2:45 p.m.
Efficient Mode-Locked Yb:Lu₂O₃ Thin Disk Laser with an Average Power of 103 W, *Cyrrill R. E. Baer¹, Christian Kränkel¹, Clara J. Saraceno¹, Oliver H. Heckl¹, Matthias Golling¹, Thomas Südmeyer¹, Ursula Keller¹, Rigo Peters², Klaus Petermann², Günter Huber²; ¹Dept. of Physics, Inst. of Quantum Electronics, ETH Zurich, Switzerland, ²Inst. of Laser-Physics, Univ. of Hamburg, Germany*. We demonstrate power scaling of an Yb:Lu₂O₃ thin-disk laser to an average power of 103 W setting a new record for mode-locked laser oscillators. The laser generates 885-fs pulses with an optical-to-optical efficiency of 42%.

LSMC • Free Space Optics Modulation Techniques

Monday, February 1
 2:00 p.m.–4:30 p.m.
David Hughes; US AFRL, Italy, Presider
Brian Stadler; US AFRL, USA, Presider

LSMC1 • 2:00 p.m. Invited
Role of Quantum Noise and Entanglement in Free-Space Optical Communications, *Prem Kumar; Northwestern Univ., USA*. Fundamental photonic granularity of light embedded in its quantum state can instill new features in free-space optical communications. Photon number-phase uncertainty enables physical-layer security, whereas entangled photons allow key generation between link terminals.

LSMC2 • 2:30 p.m. Invited
Application of Adaptive Optics to Lasercom, *Malcolm Northcott; Aoptix Technologies, USA*. Lasercom technology offers the provision very high data rates over long distances. A unique set of capabilities, but multiple challenges. I will describe Lasercom architectures, and the benefits of AO correction in the lasercom context.

LMC • Trace Gas and Remote Sensing

Monday, February 1
 2:00 p.m.–4:00 p.m.
Markus W. Sigrist; ETH Zurich, Switzerland., Presider

LMC1 • 2:00 p.m. Invited
Coherent Detection Schemes for Ultra-Sensitive Molecular Spectroscopy in the Mid-IR, *Gerard Wysocki; Princeton Univ., USA*. Different coherent detection schemes and their impact on sensitivity of mid-infrared laser spectrometers used for chemical detection will be discussed. Several example applications will be given.

LMC2 • 2:30 p.m.
Broadband High-Resolution Spectroscopy Based on Adjustable Vernier-Frequency-Scale Sliding - Application to CO₂ Remote Sensing, *Lucile Mussio, Bertrand Hardy, Myriam Raybaut, Antoine Godard, Ajmal K. Mohamed, Michel Lefebvre; ONERA, France*. We present a novel method for broadband spectroscopy. Due to the entanglement of two cavities within an optical parametric oscillator, frequency resolution and span are widely adjustable. The technique is applied to CO₂ remote sensing.

LMC3 • 2:45 p.m.
A Laser Sounder for Global Measurements of CO₂ from Space, *Haris Riris¹, Jim Abshire¹, Graham Allan², William Hasselbrack², Clark Weaver³, Jianping Mao³; ¹NASA Goddard Space Flight Ctr., USA, ²Sigma Space Corp., USA, ³Goddard Earth Sciences and Technology Ctr., Univ. of Maryland, Baltimore County, USA*. We have developed a laser technique for the remote measurement of the tropospheric CO₂ concentrations from space. Our goal is to develop a space instrument and mission approach for active CO₂ measurements.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AMD • Ultrafast Lasers I—Continued

AMD3 • 3:00 p.m.

Directly Chirped Laser Source for Chirped-Pulse Amplification, *Ran Xin, Jonathan D. Zuegel; Univ. of Rochester, USA.* A programmable, all-fiber, chirped-pulse seed laser system based on direct phase modulation produces 2.5-ns optical pulses with 0.78-nm bandwidth centered at 1053 nm that are suitable for chirped-pulse amplification.

AMD4 • 3:15 p.m.

Spatio-Temporal Behaviour of fs Laser Pulses in a Freely Suspended Silica Glass Nanoweb, *Christine Kreuzer, Alexander Podlipensky, Philip St.J. Russell; Max-Planck Inst. for the Science of Light, Germany.* The spatio-temporal propagation of fs laser pulses is studied in an optical fibre containing a freely suspended silica nanoweb. Self-focusing leads to beam collapse, resulting in the creation of damage tracks.

AMD5 • 3:30 p.m.

Compression of mJ-Scale Chirped-Amplified Pulses to sub-20 fs Using High-Dispersive Mirrors, *Izhar Ahmad¹, Vladimir Pervak², Sergei Trushin¹, Zsuzsanna Major^{1,2}, Stefan Karsch^{1,2}, Ferenc Krausz^{1,2}; ¹Max-Planck Inst. for Quantum Optics, Germany, ²Ludwig-Maximilians-Univ. München, Germany.* We presented the development of an all-dispersive-mirror compressor for sub-TW CPA systems. The compression of 4.8-ps 1.4-mJ amplified stretched pulses to 19.1 fs is demonstrated, using 52 reflections on high-dispersive mirrors with ~90% throughput.

AMD6 • 3:45 p.m.

0.4 µJ, Sub-10-fs Pulses from a MHz-NOPA, *Moritz Emons¹, Andy Steinmann^{1,2}, Thomas Binhammer³, Guido Palmer¹, Uwe Morgner^{1,4}; ¹Inst. of Quantum Optics, Leibniz Univ. Hannover, Germany, ²4th Physics Inst., Univ. of Stuttgart, Germany, ³VENTEON Femtosecond Laser Technologies GmbH, Germany, ⁴Laser Zentrum Hannover (LZH), Germany.* We present a non collinear optical parametric amplifier (NOPA) delivering sub-10-fs pulses with 420nJ of pulse energy. The system is driven by pulse trains at 1-MHz repetition rate from an amplified Yb:KYW oscillator with cavity-dumping.

LSMC • Free Space Optics Modulation Techniques—Continued

LSMC3 • 3:00 p.m.

Invited

Free-Space Quantum Key Distribution with Multilevel Encoding via Transverse Field Modulation, *Mark T. Gruneisen; AFRL, USA.* Transverse modulation of the complex optical field defines sets of orthogonal states for multilevel quantum key distribution. Principles of holography are evaluated as a means of generating and sorting the single photon states.

LSMC4 • 3:30 p.m.

Invited

Free-Space Analog Optical Links: Systems, Performance and Statistical Properties, *Frank Bucholtz¹, C. I. Moore¹, H. R. Burris¹, C. S. McDermitt¹, R. Mahon¹, M. R. Suite¹, J. V. Michalowicz², G. C. Gilbreath¹, W. S. Rabinovich¹; ¹NRL, USA, ²Global Strategies Group, North America, Inc., USA.* We review properties of free-space optical links for analog transmission including RF performance for various photoreceiver configurations and experimental results at 1 GHz over a 32 km link.

LMC • Trace Gas and Remote Sensing—Continued

LMC4 • 3:00 p.m.

Detecting Trace Species in Air Using Radar REMPI, *Arthur Dogariu¹, Patrick M. Madden², Richard B. Miles¹; ¹Princeton Univ., USA, ²Yale Univ., USA.* Microwave scattering based REMPI is used to detect NO, CO, Xe, and Ar in pure form and in atmospheric air. The spectra, dynamics, and the detection limits of trace species in air are studied.

LMC5 • 3:15 p.m.

High Brightness, Parametric Frequency Conversion Based, 2 µm Laser Transmitter for CO₂ DIAL, *Myriam Raybau¹, Antoine Godard¹, Ajmal K. Mohamed¹, Michel Lefebvre¹, Fabien Marnas², Pierre Flamant², Axel Bohman³, Peter Geiser³, Peter Kaspersen³; ¹ONERA, France, ²Lab de Météorologie Dynamique, École Polytechnique, France, ³Norsk Elektro Optikk A/S, Norway.* A novel, high brightness, transmitter for CO₂ DIAL is presented. The single-mode output of a frequency controlled, entangled-cavity nanosecond OPO is amplified to >10 mJ at 2.05µm, with 3MHz frequency stability and M₂ < 1.5.

LMC6 • 3:30 p.m.

LIDAR Technology for Measuring Trace Gases on Mars and Earth, *Haris Riris, Steve Li, Kenji Numata, Stewart Wu, Anthony Yu, John Burris, Michael Krainak, Jim Abshire; NASA Goddard Space Flight Ctr., USA.* We report remote sensing measurements of methane using optical parametric generation at 1.65 µm and 3.3 µm for trace gas monitoring on Earth and Mars.

LMC7 • 3:45 p.m.

Atmospheric Propagation and LIDAR Modeling of LITE Remote Sensing of Distant Compounds, *Denis V. Plutov, Dennis K. Killinger; Univ. of South Florida, USA.* Atmospheric propagation simulations of Stand-off Laser-Induced-Thermal-Emission spectroscopy (Stand-off LITE) have been carried out taking into account molecular and aerosol attenuation of the atmosphere and a modified lidar equation.

<p align="center">Emerald Ballroom Advanced Solid-State Photonics (ASSP)</p>	<p align="center">Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)</p>	<p align="center">Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)</p>
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AMD • Ultrafast Lasers I–Continued

LSMC • Free Space Optics Modulation Techniques–Continued

LMC • Trace Gas and Remote Sensing–Continued

LSMC5 • 4:00 p.m.
Performance Analysis of Free Space Optical Communication Based on DPSK Modulation,
Guodong Xie, Anhong Dang, Hong Guo; Peking Univ., China. Coherent differential phase-shift keying (DPSK) transmission system is very suitable for atmosphere channels. Based on Gamma-Gamma channel model, the error probability expressions of three different detection schemes associated with DPSK are derived in this paper.

4:00 p.m.–5:00 p.m. Coffee Break/Exhibits, Crystal Ballroom

NOTES

AME • Optical Parametric Chirped Pulse Amplifiers

Monday, February 1

Emerald Ballroom

4:30 p.m.–6:00 p.m.

Andrius Baltuska; Vienna Univ. of Technology, Austria, Presider

AME1 • 4:30 p.m.

Novel Ultra Broadband Front-End System for Vulcan 10 PW OPCPA Project, Yunxin Tang, A. Lyachev, C. Hernandez-Gomez, I. Musgrave, I. N. Ross, O. Chekhlov, P. Matousek, J. Collier; Rutherford Appleton Lab, UK. We report the recent progress in the development of a novel broadband front-end system, capable of producing sub-30fs pulses centered at ~910nm with 0.4J pulse energy at 2Hz for the Vulcan 10 PW OPCPA project.

AME2 • 4:45 p.m.

Gigawatt Peak Power - 35 fs Pulses Delivered by Fiber Amplifier Pumped OPCPA System, Jan Rothhardt¹, Steffen Hädrich¹, Thomas Gottschall¹, Tina Clausnitzer¹, Jens Limpert¹, Andreas Tünnermann^{1,2}; ¹Friedrich-Schiller-Univ. Jena, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany. We report on an OPCPA system, seeded by a broadband Ti:Sa oscillator and pumped by a frequency doubled picosecond fiber amplifier. The system delivers 35 fs, 53 μ J pulses with 1.1 GW peak power.

AME3 • 5:00 p.m.

First Experimental Demonstration of Optical Parametric Chirped Pulse Amplification in an Optical Fiber, Damien Bigourd¹, Christophe Caucheteur^{2,3}, Emmanuel Hugonnot¹, Pascal Szriftgiser², Alexandre Kudlinski², Arnaud Musso²; ¹Commissariat à l'Energie Atomique, Ctr. d'Etudes Scientifiques et Techniques d'Aquitaine, France, ²Lab PhLAM, Univ. des Sciences et Technologies de Lille, France, ³Electromagnetism and Telecom Unit, Univ. de Mons, Belgium. Optical parametric chirped pulse amplification is experimentally demonstrated in an all fibered optical system. A single chirped fiber Bragg grating achieving the stretching/compression stages is combined to a continuous wave pumped Fiber optical parametric amplifier.

AME4 • 5:15 p.m.

Ultra-Broadband Optical Parametric Chirped-Pulse Amplifier Based on Aperiodically Poled Mg:LiNbO₃ in the Mid-Infrared at High Repetition Rates, Clemens Heese¹, Lukas Gallmann¹, Ursula Keller¹, Christopher R. Phillips², Martin M. Fejer²; ¹ETH Zurich, Switzerland, ²Stanford Univ., USA. We present an ultra-broadband optical parametric amplification system based on aperiodically poled Mg:LiNbO₃ providing 800 nm bandwidth around 3.4 μ m in a 7.4-mm long medium. It delivers pulse energies of 1.5 μ J and 75 fs.

AME5 • 5:30 p.m.

High-Resolution Spatio-Spectral Characterization of Noncollinear Optical Parametric Amplifiers, Jake Bromage, Christophe Dorrer, Jonathan D. Zuegel; Univ. of Rochester, USA. A MHz-repetition-rate noncollinear optical parametric amplifier is characterized using spatially resolved spectral interferometry. High-resolution images of the frequency-dependent amplitude and phase reveal high-order spatio-spectral coupling, corresponding to spatiotemporal Strehl values as large as 0.86.

AME6 • 5:45 p.m.

Tunable Near Transform Limited Pulses From a cw Seeded Optical Parametric Amplifier, Steffen Hädrich¹, Thomas Gottschall¹, Jan Rothhardt¹, Jens Limpert¹, Andreas Tünnermann^{1,2}; ¹Friedrich Schiller Univ. Jena, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany. Tunable (993nm-1070nm) near transform limited pulses with durations between 190 and 230 fs and up to 7.2 μ J pulse energy are obtained by a cw seeded optical parametric amplifier that also offers variable pulse lengths.

LSMD • LS&C Poster Session

Monday, February 1

Ballroom Foyer

4:30 p.m. – 6:00 p.m.

LSMD1

Mirror Steering with Carbon Nanotube Actuator for Free Space Laser Communications, Yoshihisa Takayama, Morio Toyoshima; Natl. Inst. of Information and Communications Technology, Japan. A trial production of an actuator using the carbon nanotube is introduced to control the reflection angle of a mirror for free space laser communications. The production processes and the measured reflection angles are shown.

LSMD2

Optimum Transmitter Radius for Ground-to-Satellite Laser Uplink Communication Systems in the Presence of Beam Wander Effect, Siman Zhao, Bin Luo, Anhong Dang, Hong Guo; Peking Univ., China. Based on weak fluctuation theory and gamma-gamma irradiance distribution model, the combined effect of scintillation and beam wander on ground-to-satellite laser uplink communication systems is analyzed and optimum transmitter radius for the system is proposed.

LSMD3

A Novel Beacon Detection Scheme for Free-Space Optical Communications, Yaoqiang Han, Anhong Dang, Junxiong Tang, Hong Guo; Peking Univ., China. In this paper, we propose a correlation beacon detection scheme for optical wireless link establishment under strong interference conditions. An outdoor experiment is demonstrated and validates that the beacon can be effectively detected.

LSMD4

Towards the Minimum Pulse-Duration from mJ-class Fiber CPA-Systems, Damian N. Schimpf, Jens Limpert, Andreas Tünnermann; Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany. An extended bandwidth of the amplified pulse is a key option to increase the peak-power from Yb-doped fiber CPA-systems. We analyze the gain characteristics of state-of-the-art Yb-doped fiber amplifiers with regard to the broadest gain-bandwidth.

LMD • LACSEA Poster Session

Monday, February 1

Ballroom Foyer

4:00 p.m. – 6:00 p.m.

LMD1

Improved Wavelength Tuning of CW Optical Parametric Oscillators, Markku M. Vainio^{1,2}, Mikael Siltanen¹, Jari Peltola¹, Lauri Halonen¹; ¹Univ. of Helsinki, Finland, ²Cent. for Metrology and Accreditation (MIKES), Finland. We discuss a new method for controlled wavelength tuning of cw singly resonant optical parametric oscillators. The method uses a grating for fast and broad wavelength scanning.

LMD2

Gas Diagnostics by Laser-Induced Breakdown Spectroscopy Employing Polarization Filtering, Johannes Kiefer¹, Johannes W. Tröger¹, Thomas Seeger¹, Alfred Leipertz¹, Bo Li², Zhongshan Li², Marcus Aldén²; ¹Lehrstuhl für Technische Thermodynamik, Univ. Erlangen-Nürnberg, Germany, ²Div. of Combustion Physics, Lund Univ., Sweden. In this work we present a setup for laser-induced breakdown spectroscopy (LIBS) employing a polarization filtering approach and use it for gas diagnostics. A one parts-per-million (ppm) detection sensitivity is achieved for hydrogen atoms.

LMD3

A Widely Tunable CW Mid-Infrared Spectrometer Based on Difference Frequency Generation in Orientation-Patterned GaAs, Peter Geiser¹, Sergey Vasilyev², Axel Bohman¹, Zhaowei Zhang³, Alexander Nevsky², Stephan Schiller², Morten Ibsen³, Andy Clarkson³, Arnaud Grisard⁴, David Faye⁴, Eric Lallier⁴, Peter Kaspersen¹; ¹Norsk Elektro Optikk AS, Norway, ²Inst. für Experimentalphysik, Heinrich-Heine Univ. Düsseldorf, Germany, ³Optoelectronics Res. Ctr., Univ. of Southampton, UK, ⁴Thales Res. and Technology, France. A widely tunable difference frequency generation based mid-infrared spectrometer for the detection of sulfur dioxide (SO₂), nitrous oxide (N₂O), and methane (CH₄) above 7 μm has been developed for industrial applications.

LMD4

OF-CEAS Detects Leak Rates down to 5·10⁻⁹ mbar.L/s, Agnes Pailloux¹, Julien Cousin¹, Daniele Romanini², Marc Chenevier³, Titus Gherman³, Catherine Gallou¹, Jean-Marc Weulersse¹; ¹CEA Saclay, France, ²Univ. Joseph Fourier, France, ³FLORALIS, France. Leak detection and localization is an issue for facility and population security. The paper shows that low leak rates of methane, down to 5·10⁻⁹mbar.L/s, are detected by OF-CEAS technique under atmospheric pressure.

LMD5

Comparison of Quartz-Enhanced Photoacoustic Spectroscopy and Conventional Photoacoustic Spectroscopy Based Detectors, Lei Dong, Rafal Lewicki, Frank Tittel, Anatoliy Kosterev; Rice Univ., USA. Performance of quartz-enhanced photoacoustic spectroscopy and conventional photoacoustic spectroscopy based detectors applied to trace gas sensing was compared. Nitrogen with 10 ppmv of acetylene and a diode laser accessing 6529.17 cm⁻¹ absorption line were used.

LMD6

Analytical Use of Controlled Photon Source Based on Parametric down Conversion, Dániel Oszetzky, Aladár Czitrovsky; Res. Inst. for Solid State Physics and Optics, Hungarian Acad. of Sciences, Hungary. We have developed our previous experimental setup using correlated photon pairs to realize a controllable photon source. In this paper we propose the analytical use of this unique light source.

6:00 p.m.–8:00 p.m. Dinner Break (on your own)

8:00 p.m.–10:00 p.m. Postdeadline Presentations

NOTES

7:30 a.m.–5:00 p.m. Registration Open, Ballroom Foyer

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

JTuA • ASSP/LACSEA/LS&C Joint Session

Tuesday, February 2

Emerald Ballroom

8:00 a.m.–10:00 a.m.

Alphan Semmaroglu; Koç Univ., Turkey, Presider

Frank K. Tittel; Rice Univ., USA, Presider

JTuA1 • 8:00 a.m.

Invited

External Cavity Quantum Cascade Lasers: Recent Advances, Applications, and Comparisons with Alternative Sources in the MIR, *Timothy Day; Daylight Solutions, USA*. The performance of external cavity quantum/interband cascade lasers (ECQCL/ECiCL) in molecular detection and imaging applications will be discussed. Alternative MIR laser technologies such as OPO and DFG will also be compared.

JTuA3 • 9:00 a.m.

Invited

Progress in Laser Communications, *Larry B. Stotts; DARPA, USA*. Two major military applications have been heavily investigated over the last 40 years: Free Space Optical Communication (FSOC) and Submarine Laser Communication (SLC). This paper will highlight progress made in these two important applications.

JTuA2 • 8:30 a.m.

Invited

Applications of High-Repetition Rate Diode-Pumped Solid-State Lasers for Combustion Diagnostics, *W. Meier¹, I. Boxx¹, C. Arndt¹, C. D. Carter², M. Stöhr¹, A. Steinberg¹, J. H. Frank³; ¹German Aerospace Ctr. (DLR), Germany, ²AFRL, USA, ³Sandia Natl. Labs, USA*. A high-speed imaging system consisting of solid-state and dye lasers and CMOS cameras was used for simultaneous measurements of flowfield by PIV and reaction zones by PLIF in turbulent flames at repetition rates ≤ 10 kHz.

JTuA4 • 9:30 a.m.

Invited

Multi-Disciplinary Lidar Applications, *Kerstin Barup, Mikkel Brydegaard, Zuguang Guan, Anders Hedenström, Jenny Hellström, Märta Lewander, Patrik Lundin, Christer Löfstedt, Aboma Merdasa, Annika Olsson, Anna Runemark, Gabriel Somesfalean, Erik Svensson, Maren Wellenreuther, Susanne Åkesson, Sune Svanberg; Lund Univ., Sweden*. Lidar is a powerful technique normally associated with atmospheric monitoring. However, lidar-techniques, also of the laser-induced fluorescence and laser-induced breakdown spectroscopy varieties, provide many new possibilities in unconventional fields including cultural heritage and ecological applications.

10:00 a.m.–10:30 a.m. Coffee/Exhibits. Crystal Ballroom

NOTES

ATuA1**Femtosecond Mode Locking of a Tm,Ho:KYW Laser near 2 μm ,**

Alexander A. Lagatsky¹, Flavio Fusari¹, Christian T. A. Brown¹, Wilson Sibbett¹, Stephane Calvez², Martin D. Dawson², Viktor E. Kisel³, S. V. Kurilchik³, Nikolai V. Kuleshov³, J. A. Gupta⁴; ¹School of Physics and Astronomy, Univ. of St. Andrews, UK, ²Inst. of Photonics, Univ. of Strathclyde, UK, ³Inst. for Optical Materials and Technologies, Belarus Natl. Technical Univ., Belarus, ⁴Inst. for Microstructural Sciences, Natl. Res. Council of Canada, Canada. Passive mode locking of a

Tm³⁺,Ho³⁺:KY(WO₄)₂ laser with an InGaAsSb-based saturable absorber is reported. Transform-limited 570-fs pulses were generated at 2055nm with an average power of 130mW at a pulse repetition frequency of 118MHz.

ATuA2**High Efficiency, High Power 2.097- μm Ho:YAG**

Laser, Xiaodong Mu, Helmuth Meissner, Huai-Chuan Lee; Onyx Optics, Inc., USA. Maximum power of 18.6 W has been measured at pump power of 23.7 W in Tm: fiber laser pumped adhesive-free bonded YAG/Ho:YAG/YAG composite. The corresponding slope efficiency is over 81% for both cw and Q-switched operations.

ATuA3**Single-Walled Carbon Nanotube Saturable Absorber Mode-Locking of a Tm:KLuW Laser Near 2 μm ,**

Won Bae Cho¹, Jong Hyuk Yim¹, Sun Young Choi¹, Soonil Lee¹, Fabian Rotermund¹, Andreas Schmid², Valentin Petrov², Günter Steinmeyer², Uwe Griebner², Xavier Mateos³, Maria C. Pujol³, Joan J. Carvajal³, Magdalena Aguilo³, Francesc Diaz³; ¹Ajou Univ., Republic of Korea, ²Max-Born-Inst., Germany, ³Univ. Rovira i Virgili, Spain. Stable and self-starting mode-locking of a Tm:KLu(WO₄)₂ laser using a single-walled carbon nanotubes based saturable absorber is demonstrated generating ~10-ps pulses near 2 μm with powers up to 220 mW at 126 MHz.

ATuA4**Laser Properties of Na⁺ Ions Co-Doped**

PbGa₂S₄:Dy³⁺ Crystal, Tasoltan T. Basiev¹, Maxim E. Doroshenko¹, Vyacheslav V. Osiko¹, Valerii V. Badikov², Dmitrii V. Badikov²; ¹Laser Materials and Technology Res. Ctr., General Physics Inst., Russian Federation, ²Kuban State Univ., Russian Federation. New Na⁺ ions co-doped PbGa₂S₄:Dy³⁺ crystals were synthesized and their lasing properties under 1.318 μm excitation were investigated. Output energies at 4.3 μm up to 7.5 mJ with slope efficiency up to 2% were demonstrated.

ATuA5**Continuous-Wave Laser Operation of Tm and Ho Co-Doped NaY(WO₄)₂ and NaLu(WO₄)₂ Crystals, X.**

Han¹, M. D. Serrano¹, J. M. Cano-Torres¹, C. Zaldo¹, F. Fusari², Alexander A. Lagatsky², C. T. A. Brown², W. Sibbett²; ¹Inst. de Ciencia de Materiales de Madrid, Consejo Superior de Investigaciones Científicas, Spain, ²School of Physics and Astronomy, Univ. of St. Andrews, UK.

Spectroscopy and continuous-wave laser operation of Tm,Ho co-doped NaY(WO₄)₂ and NaLu(WO₄)₂ crystals are reported. A tunability range of 1830-2080nm is demonstrated with a maximum output power up to 290mW at around 2040nm during room-temperature operation.

ATuA6**Diode-Pumped Passively Q-Switched Tm:KLuW**

Laser with a Cr²⁺:ZnSe Saturable Absorber, Martha Segura¹, Xavier Mateos¹, Maria Cinta Pujol¹, Joan Josep Carvajal¹, Magdalena Aguilo¹, Francesc Diaz¹, Vladimir Panyutin², Uwe Griebner², Valentin Petrov²; ¹Univ. Rovira i Virgili, Spain, ²Max-Born-Inst., Germany. A passively Q-switched Tm:KLuW laser using Cr²⁺:ZnSe as saturable absorber delivered pulse energies as high as 16 μJ at a repetition rate of 6.5 kHz around 2 μm .

ATuA7**Compact Post-Compression System for Peak Power Enhancement of an Ultrafast Diode-Pumped Laser,**

Antoine Courjaud¹, Eric Mével², Eric Constant², Eric Mottay¹; ¹Amplitude Systèmes, France, ²CELIA, Univ. de Bordeaux I, France. We report on a compact system based on post-compression of an ytterbium ultrafast laser, using Nitrogen-filled hollow fiber, delivering 60fs pulses with 330 μJ energy at 2kHz and 200 μJ at 5kHz.

ATuA8**Idler Pulse Compression with an Identical Positive Dispersive Media to Signal Pulse Stretcher in Ultrafast Optical-Parametric Chirped Pulse**

Amplification, Yutaka Akahane, Kanade Ogawa, Koichi Tsuchi, Makoto Aoyama, Koichi Yamakawa; Japan Atomic Energy Agency, Japan. Optical-parametric chirped-pulse amplification with a positive dispersive media for both signal pulse stretcher and idler pulse compressor was demonstrated. By compressing negatively-chirped idler pulses, high power sub-100 fs pulses were successfully obtained in this manner.

ATuA9**Q-Switched Ho:YAG Laser Intracavity Side-Pumped by a Diode-Pumped Tm:YLF Slab Laser,**

Martin Schellhorn, Michael von Salisch, Thierry Ibach; French-German Res. Inst., ISL, France. We observed stable Q-

switch operation from a Ho:YAG laser based on intracavity side-pumping by a Tm:YLF slab laser. At 400 Hz pulse energies of 1.6 mJ were obtained with pulse durations of 160 ns.

ATuA10**589nm Multi-Watt Narrow Linewidth Optically Pumped Semiconductor Laser for Laser Guide Stars,**

Tomi Leinonen¹, Anti Härkönen¹, Ville-Markus Korpijärvi¹, Mircea Guina¹, Ryan J. Epstein², James T. Murray², Gregory J. Fetzter²; ¹Optoelectronics Res. Ctr., Tampere Univ. of Technology, Korkeakoulunkatu, Finland, ²Arete Associates, USA. We demonstrate >2W of 589nm output from an intra-cavity frequency doubled, optically-pumped GaInNAs/GaAs laser. Single longitudinal mode-operation with linewidths < 50 MHz are shown. Output powers are currently limited by available pump-power and spot size.

ATuA11**Highly-Efficient, Widely-Tunable, Mid-IR Cr:ZnS and Cr:ZnSe CW Lasers Pumped by 1685 nm InP**

Laser Diode, Igor S. Moskalev¹, Vladimir V. Fedorov¹, Sergey B. Mirov^{1,2}; ¹Univ. of Alabama at Birmingham, USA, ²Photonics Innovations, Inc., USA. We demonstrate compact, highly-efficient, widely-tunable, CW Cr²⁺:ZnSe and Cr²⁺:ZnS lasers (35% and 44% slope efficiencies, 2200-2650 nm, and 2100-2650 nm tuning ranges, respectively) pumped by a single-emitter 1.5 W 1685 nm InP semiconductor laser diode.

ATuA12**Deep Blue Nd:LiYF₄ Laser in Quasi-Continuous and Continous Operation,**

Jonas Jakutis Neto, Fabíola A. Camargo, Niklaus Ursus Wetter; Ctr. de Lasers e Aplicações - IPEN/SP, Brazil. In this work we present continuous and quasi-continuous operation of Nd:YLF operating at 908 nm and frequency conversion to 454 nm using LBO and BIBO nonlinear crystals with different sizes.

ATuA13**High Power SHG at 515 nm by Means of Extracavity Frequency Conversion of Sub-Picosecond Pulses**

from a Mode-Locked Innoslab MOPA, Bastian Gronloh, Torsten Mans, Peter Ruffbüldt, Bernd Jungbluth, Rolf Wester, Dieter Hoffmann; Fraunhofer Inst. for Laser Technology, Germany. 190 W output power at 515 nm were achieved by extracavity frequency conversion of sub700 fs pulses at 76 MHz. Numerical simulations considering thermal effects and group velocity dispersion are applied to model the conversion.

ATuA14

20W, Quasi-cw GaSb-Based Semiconductor Disk Laser, Nils Hempler¹, John-Mark Hopkins¹, Alan Kemp¹, Benno Rösener², Marcel Rattunde², Joachim Wagner², David Burns¹; ¹Inst. of Photonics, Univ. of Strathclyde, UK, ²Fraunhofer Inst. for Applied Solid State Physics, Germany. Quasi-cw operation of a 1.9 μ m semiconductor disk laser with pulses of 1.3 μ s duration and 20W output power is demonstrated. The thermally-induced spectral shift of the device was found to reach equilibrium after ~200ns.

ATuA15

Intracavity Semiconductor Disk Laser Pumped Continuous-Wave, Singly-Resonant Mid-IR Optical Parametric Oscillator, John-Mark Hopkins¹, David J. M. Stothard², Malcolm H. Dunn², David Burns¹; ¹Univ. of Strathclyde, UK, ²Univ. of St Andrews, UK. A relaxation oscillation free cw-OPO pumped in a semiconductor disk laser with 1.4W extracted down converted radiation is described. A simplified cavity geometry led to enhanced output power of 1.6W at the cost of stability.

ATuA16

Bend-Effects on Brillouin Gain in Large Mode Area Fiber Amplifiers with Acoustic Antiguided, Johan Nilsson, Seongwoo Yoo, Christophe A. Codemard, Yoonchan Jeong, Francesca Mountfort, Jayanta K. Sahu; Optoelectronics Res. Ctr., Univ. of Southampton, UK. Model calculations show that a bend radius of 10 cm degrades the Brillouin threshold by 8 dB for a large mode area fiber with an antiguiding acoustic waveguide designed to minimize the straight-fiber Brillouin gain.

ATuA17

High-Efficiency 532-nm Generation with PPSLT, Bhabana Pati, Kevin F. Wall, Peter F. Moulton; Q-Peak, Inc., USA. We report 62% and 56% SHG conversion efficiency in generating 532-nm using MgO-doped and undoped PPSLT crystals, respectively. We compare SHG obtained using both materials and discuss their suitability for the generation of Watt-level green-radiation.

ATuA18

A High Contrast Dual OPCPA Pre-Amplifier System Using Both Picosecond and Nanosecond Pump Pulses for the Vulcan Petawatt Facility, Waseem Shaikh, Ian Musgrave, C. Hernandez-Gomez, B. Parry, D. Johnson; Central Laser Facility, STFC Rutherford Appleton Lab, UK. We construct a dual OPCPA scheme with a picosecond OPA for seeding the Vulcan pre-amplifier demonstrating a 103 nanosecond contrast improvement. We provide evidence that the nanosecond contrast of this pre-amplifier is ~5*10⁻¹⁰.

ATuA19

$\chi(2)$ Induced Non-Reciprocal Loss and/or Phase Shift for Unidirectional Operation of Ring Lasers, Peter Tidemand-Lichtenberg, Haynes P. H. Cheng, Christian Pedersen; Technical Univ. of Denmark, Denmark. Numerical modelling and experimental validation of sum-frequency mixing enforcing stable unidirectional operation of a diode pumped solid-state 1342 nm ring laser with improved stability toward feedback.

ATuA20

KGW and Diamond Picosecond Visible Raman Lasers, David J. Spence, Eduardo Granados, Helen M. Pask, Richard P. Mildren; Macquarie Univ., Australia. We present three synchronously pumped Raman lasers generating picosecond visible laser pulses. Using KGW and diamond, we efficiently convert the wavelength of standard neodymium picosecond laser sources, as well as substantially compressing the pulse duration.

ATuA21

Free Standing Single Crystal LiNbO₃ Micro-wires Fabricated by Ion Slicing, Transferred and Bonded to SiO₂/Si, Yoo Seung Lee, Sang Shin Lee, William H. Steier; Univ. of Southern California, USA. Free standing mm long, 1 micron crystalline LiNbO₃ micro-wires have been obtained by ion-slicing. They can be lifted, positioned, and bonded onto SiO₂/Si. This is a promising approach for bringing LiNbO₃ into the SOI technology.

ATuA22

Generation of Yellow, Continuous-Wave Emission from an Intracavity, Frequency-Doubled Nd:KGW Self-Raman Laser, Andrew J. Lee, Helen M. Pask, David J. Spence, James A. Piper; Macquarie Univ., Australia. We report generation of 450 mW continuous-wave emission at 590 nm from an intra-cavity, frequency-doubled, self-Raman laser utilising Nd:KGW. Power scaling is limited by secondary emission lines, astigmatic thermal lensing and thermally-induced fracture.

ATuA23

Performance Trade-Offs for High-Repetition-Rate Noncollinear Optical Parametric Amplifiers, Jake Bromage, Christophe Dorrer, Jonathan D. Zuegel; Univ. of Rochester, USA. MHz-repetition-rate noncollinear optical parametric amplifiers are experimentally evaluated, focusing on the trade-offs that depend on pump-signal spatial walk-off in beta-barium borate. Walk-off compensation improves beam uniformity, but parasitic second-harmonic generation limits the signal tuning range.

ATuA24

Very High Efficiency High-Energy Frequency Doubling in the Alisé Facility, Gabriel Mennerat, Jacques Rault, Odile Bonville, Philippe Canal, Olivier Hartmann, Elisabeth Mazataud, Laurent Marmande, Loïc Patissou, Jean-François Charrier, Christian Lepage; CEA - Commissariat à l'Energie Atomique, France. Merits of frequency doublers in single-shot régime are discussed. The choice of KDP for short pulses is illustrated with 86% efficiency of 100J/1ns- and 3ns-pulses. With 12ns-pulses, 217J was demonstrated in LBO with efficiency >90%.

ATuA25

Mid-Infrared Optical Parametric Oscillator Pumped by a Femtosecond Erbium-Doped Fiber Laser, Magnus W. Haakestad, Helge Fonnum, Espen Lippert, Knut Stenersen; FFI, Norwegian Defence Res. Establishment, Norway. We report a synchronously pumped optical parametric oscillator, driven by a femtosecond erbium-doped fiber laser. The idler is tunable from 3.96-4.71 μ m, with a maximum power of 22 mW at 3.96 μ m.

ATuA26

Optical Parametric Oscillations in Walk-off Compensated Adhesive-Free Bond KTP Composites, Xiaodong Mu, Helmuth Meissner, Huai-Chuan Lee; Onyx Optics, Inc., USA. Quasi-noncritical phase-matched and quasi-phase-matched 2- μ m optical parametric oscillations have been demonstrated and characterized in adhesive-free bonded multilayer walk-off compensated KTP composites with low pulse energy 1.064- μ m pump laser.

ATuA27

Room Temperature Operation of CW Diode Pumped Er:YVO₄ Laser at 1.6 μ m, Jan Šulc¹, Helena Jelínková¹, Michal Němec¹, Witold Ryba-Romanowski², Tadeusz Lukaszewicz³; ¹Czech Technical Univ. in Prague, Czech Republic, ²Polish Acad. of Sciences, Poland, ³Inst. of Electronic Materials Technology, Poland. Power 0.38 W at wavelength 1602 nm was obtained from Er:YVO₄ laser, continuously pumped by laser diode operating at wavelength 976 nm. The laser slope efficiency in respect to absorbed pumping power was 24 %.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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ATuB • New Laser Materials

Tuesday, February 2
11:30 a.m.–1:30 p.m.
Mark Dubinskii; US ARL, USA, *Presider*

LSTuA • Optical Receivers

Tuesday, February 2
10:30 a.m.–12:30 p.m.
Presider to Be Announced

LTuA • THz and Pulse Shaping Techniques

Tuesday, February 2
10:30 a.m.–12:30 p.m.
Dwight Woolard; U.S. Army Res. Office, USA.

LSTuA1 • 10:30 a.m. Invited

Analysis of a Field-Conjugation Adaptive Array for Coherent Free-Space Optical Links, *Aniceto Belmonte¹, Joseph M. Kahn²; ¹Dept. of Signal Theory and Communications, Technical Univ. of Catalonia, Spain, ²Stanford Univ., USA.* We study the performance of diversity combining techniques applied to synchronous laser communication through the turbulent atmosphere. We assume that a single information bearing signal is transmitted over statistically independent fading channels, and that the multiple replicas are combined at the receiver to improve detection efficiency.

LTuA1 • 10:30 a.m. Invited

Spectroscopy with Shaped Laser Pulses, *B. von Vacano^{1,2}, Marcus Motzkus^{1,3}; ¹Philipps Univ. Marburg, Germany, ²Polymer Physics, BASF SE, Germany, ³Ruprecht-Karls Univ. Heidelberg, Germany.* The combination of ultrabroadband laser pulses and pulse shaping techniques allows the photonic integration of functions such as excitation, probing and interferometry making sophisticated nonlinear spectroscopy like Coherent Anti-Stokes Raman scattering (CARS) extremely simple.

LSTuA2 • 11:00 a.m. Invited

A Review of Vertical Cavity Semiconductor Optical Amplifiers and Applications, *Michael Sánchez; CENTRA Technology, USA.* Vertical cavity semiconductor optical amplifiers are a versatile and unique class of devices with a wide range of possible applications in free-space optics and remote sensing. This paper reviews their properties, recent progress, and applications.

LTuA2 • 11:00 a.m.

Atmospheric Pressure Femtosecond Laser Imaging Mass Spectrometry, *Yves Coello, A. Daniel Jones, Tissa C. Gunaratne, Marcos Dantus; Michigan State Univ., USA.* We demonstrate a novel imaging mass spectrometry technique that uses femtosecond laser pulses to ionize the sample at ambient conditions. The technique provides 10 μ m resolution, as demonstrated here with a chemical image of vegetable cells.

LTuA3 • 11:15 a.m.

Infrared Time Domain Spectroscopy with Synchronized Frequency Combs, *Nathan R. Newbury, Ian Coddington, William C. Swann; NIST, USA.* We describe a frequency-comb based system for time-domain spectroscopy in the near infrared. Our configuration implements synchronous, repetitive sampling of the time domain signature for real-time coherent signal averaging and improved signal-to-noise ratio.

ATuB1 • 11:30 a.m. Invited

Fifty Years of Advances in Solid-State Laser Materials, *Georges Boulon^{1,2}; ¹Univ. of Lyon, France, ²Tohoku Univ., Japan.* Advances in the multidisciplinary field of solid-state laser-type materials based on transition metal or rare earth ions in insulator hosts (crystals, glasses, ceramic) will be presented. Diode-pumped Yb³⁺ lasers will be emphasized.

LSTuA3 • 11:30 a.m.

Free Space Quantum Communication with Continuous Polarization Variables, *Bettina Heim, Dominique Elser, Tim Bartley, Metin Sabuncu, Christoffer Wittmann, Denis Sych, Christoph Marquardt, Gerd Leuchs; Inst. of Optics, Information and Photonics, Univ. of Erlangen-Nuremberg, Max Planck Inst. for the Science of Light, Germany.* We experimentally investigate atmospheric influences on quantum communication with continuous polarization variables. Signal and local oscillator are combined in one spatial mode, which leads to perfect interference at the homodyne detection. Fluctuations are thus auto-compensated.

LTuA4 • 11:30 a.m. Invited

Terahertz Time Domain Spectroscopy for Nondestructive Testing and Sensing Applications, *F. Ellrich¹, M. Herrmann¹, J. Jonuscheit¹, M. Theuer², G. Torosyan¹, D. Molter¹, S. Wiegand², S. Wohnsiedler¹, René Beigang^{1,2,3}; ¹Fraunhofer Inst. for Physical Measuring Techniques, Germany, ²Dept. of Physics, Univ. of Kaiserslautern, Germany, ³Res. Ctr. OPTIMAS, Univ. of Kaiserslautern, Germany.* Terahertz spectroscopy and imaging using innovative photonic THz sources and detectors have turned out to be very useful techniques for applications in nondestructive testing and sensing. Typical examples of THz imaging and spectroscopy are presented.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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ATuB • New Laser Materials—Continued

ATuB2 • 12:00 p.m.
Low-Threshold and Highly Efficient Gd³⁺, Lu³⁺ Co-doped KY(WO₄):Yb³⁺ Planar Waveguide Lasers, Dimitri Geskus¹, Shanmugam Aravazhi¹, Edward Bernhardt¹, Christos Grivas^{1,2}, Kerstin Wörhoff, Markus Pollnau¹; ¹Univ. of Twente, Netherlands, ²Opoelectronics Res. Ctr., UK. Co-doping with optically inert Gd³⁺ and Lu³⁺ ions improves refractive-index contrast and light confinement in KY(WO₄):Yb³⁺ planar waveguides. Lasing with 18 mW threshold and record-high slope efficiency of 82.3% versus absorbed pump power is demonstrated

ATuB3 • 12:15 p.m.
Development of Anisotropic Transparent Ceramics for Laser Media, Jun Akiyama, Takunori Taira; Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan. Rare earth doped anisotropic transparent ceramics with oriented micro-domain structure have been developed by means of advanced electromagnetic processing. The cavity loss of Nd:FAP ceramics was significantly improved from $\alpha=3.54\text{cm}^{-1}$ (previous report) to 1.14cm^{-1} .

ATuB4 • 12:30 p.m.
Recent Advances in Fluoride Crystal Based GaN-Diode-Pumped Green Praseodymium Lasers, Nils-Owe Hansen¹, Matthias Fechner¹, Klaus Petermann¹, Günter Huber¹, Daniela Parisi², Mauro Tonelli²; ¹Inst. of Laser Physics, Univ. of Hamburg, Germany, ²NEST - CNR - INFN - Dept. di Fisica, Univ. di Pisa, Italy. We report the first diode-pumped laser oscillation of Pr:BaY₂F₈ in the green spectral range, related crystal growth and basic spectroscopic properties. Furthermore, recent results of experiments with Pr:LiYF₄, showing efficient green laser action, are presented.

ATuB5 • 12:45 p.m.
Cerium Lasers Generate Ultrafast Deep Ultraviolet Pulses, Eduardo Granados, David W. Coutts, David J. Spence; Macquarie Univ., Australia. We demonstrate for the first time that the DUV laser material cerium LiCAF can be mode-locked to produce picosecond pulses in this hard-to-access spectral range, and we discuss the potential to directly generate sub-femtosecond pulses.

LSTuA • Optical Receivers—Continued

LSTuA4 • 12:00 p.m.
BER of Annular Beams in Strong Turbulence, Hamza Gerçekcioğlu¹, Yahya K. Baykal², Halil T. Eyyuboğlu²; ¹Prime Ministry Undersecretariat for Maritime Affairs, Turkey, ²Çankaya Univ., Turkey. Bit error rate (BER) of annular beams is found in strong turbulence. Examining effects of beam and medium parameters on BER reveal that annular beams become favorable in stronger turbulence and at smaller focal lengths.

LTuA • THz and Pulse Shaping Techniques—Continued

LTuA5 • 12:00 p.m. **Invited**
Slits, Curves, Chains and Rings: How to Mix the Right Ingredients for Surface-Emitting THz Quantum Cascade Lasers, Alessandro Tredicucci; NEST, CNR-INFN and Scuola Normale Superiore, Italy. Mechanisms and structures to achieve surface emission in terahertz quantum cascade lasers are discussed. The necessary symmetry breaking is produced in gratings with a base, or curved, or quasiperiodic, and by the finite device length.

<p align="center">Emerald Ballroom Advanced Solid-State Photonics (ASSP)</p>	<p align="center">Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)</p>	<p align="center">Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)</p>
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ATuB • New Laser Materials—Continued

ATuB6 • 1:00 p.m.

Highly Efficient Nd:YVO₄ Laser by Direct In-Band Diode Pumping at 914 nm, *Damien Sangla^{1,2}, Marc Castaing^{1,3}, François Balembois¹, Patrick Georges¹; ¹Lab Charles Fabry de l'Inst. d'Optique, France, ²Lab de Physico-Chimie des Matériaux Luminescents, France, ³Oxxius, France.* We present the first demonstration of Nd:YVO₄ laser diode-pumped directly in-band at 914-nm. We achieved a slope efficiency of 80.7 % by extracting 11.5W at 1064-nm for 14.6W of absorbed pump power at 914-nm.

ATuB7 • 1:15 p.m.

Modelocked Integrated External-Cavity Surface Emitting Laser (MIXSEL) Generates 660 mW Average Power in 23-ps Pulses at 3 GHz Repetition Rate, *Valentin J. Wittwer, Benjamin Rudin, Deran J. H. C. Maas, Yohan Barbarin, Martin Hoffmann, Matthias Golling, Thomas Südmeyer, Ursula Keller; ETH Zurich, Switzerland.* We present an advanced MIXSEL, a semiconductor disk laser with integrated saturable absorber. Improved thermal management by wafer removal substantially increased the output power. The novel antiresonant design is growth-error tolerant and enables shorter pulses.

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Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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LSTuB • Naval Laser Applications

Topaz Room
1:30 p.m.–3:30 p.m.
Michael Lovern; SPAWAR Systems Ctr. Pacific, USA, Presider
Peter Poirier; SPAWAR Systems Ctr., USA, Presider

LSTuB1 • 1:30 p.m. Invited

Underwater Optical Modulating Retro-Reflector Links, William S. Rabinovich¹, Rita Mahon¹, Mike Ferraro¹, James Murphy¹, Linda Mullen², Brandon Cohenour², John Muth³, Leah Ziph-Schatzberg⁴; ¹NRL, USA, ²Electro-Optics and Special Mission Sensors Div., Naval Air Systems Command, NAVAIR, USA, ³North Carolina State Univ., USA, ⁴Photonics Ctr., Boston Univ., USA. We will present experimental tank measurements of an underwater optical modulating retro-reflector link, as well as a theoretical link budget that predicts performance in natural waters.

LSTuB3 • 2:10 p.m. Invited

Blue Green Laser Communications, Dennis G. Harris, Frederick Vachss; Boeing Co., USA. An approach to generating blue green wavelengths for submarine laser communications, relying on a Yb:YAG laser and an efficient Optical Parametric Amplifier is presented.

LTuB • Coherent Anti-Stokes Raman Scattering in Flames

Diamond Room
1:30 p.m.–3:30 p.m.
Sukesh Roy; Spectral Energies, LLC, USA, Presider

LTuB1 • 1:30 p.m.

Application of a Dual-Pump Vibrational and Pure Rotational CARS System for Temperature and Multi-Species Measurements inside a Porous Burner, Thomas Seeger¹, Markus Weikl¹, Sarah Tedder², Frank Beyrau³, Johannes Kiefer¹, Alfred Leipertz¹; ¹Lehrstuhl für Technische Thermodynamik, Univ. Erlangen-Nürnberg, Germany, ²NASA Langley Res. Ctr., USA, ³Imperial College London, UK. Dual-pump vibrational and dual-broadband rotational coherent anti-Stokes Raman scattering is applied to a porous burner with limited optical access. Temperature and species concentration were determined inside the burner ceramic.

LTuB2 • 1:45 p.m.

Time-Resolved Picosecond Pure-Rotational Coherent Anti-Stokes Raman Spectroscopy for Thermometry and Species Concentration in Combustion Environments, Christopher J. Kliewer¹, Thomas Seeger², Johannes Kiefer², Brian D. Patterson¹, Thomas B. Settersten¹; ¹Sandia Natl. Labs, USA, ²Lehrstuhl für Technische Thermodynamik and Erlangen Graduate School in Advanced Optical Technologies, Univ. Erlangen-Nuernberg, Germany. Time-resolved picosecond pure-rotational coherent anti-Stokes Raman spectroscopy is applied for thermometry and 1-D imaging in flames. Time-delaying the probe pulse enables successful suppression of unwanted resonant and non-resonant four wave mixing background signals.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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LSTuB • Naval Laser Applications—Continued

LSTuB4 • 2:30 p.m. Invited
Blue-Green Laser Technology, *Jeremy Young, Brian Mathason, Fran Fitzpatrick, Floyd Hovis, Ralph Burnham; Fibertek Inc., USA.* Advancements in solid-state laser-technology including diode-pumping and availability of high-quality laser materials has enabled a variety of previously unattainable applications. We will review recent developments in solid-state lasers operating in the bluegreen-region of the spectrum.

LSTuB5 • 2:50 p.m. Invited
Optical Filter for Submarine Laser Communications, *Fred Levinton; NovaPhotonics, USA.* Optical filters for submarine laser communications (SLC) have been under development for some time. We have developed a wavelength-tunable, wide field-of-view, narrow passband, large aperture filter to address the needs for SLC.

LSTuB6 • 3:10 p.m. Invited
A Review of Submarine Laser Communications to Achieve Comms at Speed and Depth, *Greg Mooradian; QinetiQ, USA.* Blue-green Submarine Laser Communications (SLC) has the potential to revolutionize connectivity with submarine assets. To be effective, submarines need communications at speed and depth (CSD). This paper will review both airborne and spaceborne architectures, including downlink, uplink and duplex employments.

LTuB • Coherent Anti-Stokes Raman Scattering in Flames—Continued

LTuB4 • 2:30 p.m. Invited
Effects of Molecular Interference on Femtosecond-CARS Spectroscopy, *Waruna D. Kulatilaka¹, Suresh Roy¹, Robert P. Lucht², James R. Gord³; ¹AFRL / Spectral Energies LLC, USA, ²School of Mechanical Engineering, Purdue Univ., USA, ³AFRL, USA.* We investigate effects of molecular interference resulting from broad bandwidth excitation in femtosecond coherent anti-Stokes Raman scattering (fs-CARS) of N₂ and O₂. Particularly considered are the N₂-CO and O₂-CO₂ polarization beatings in time-resolved fs-CARS thermometry.

LTuB5 • 3:00 p.m.
Theory of Chirped-Probe Pulse Single-Shot Femtosecond Coherent Anti-Stokes Raman Scattering Thermometry in Flames at 1000 Hz, *Daniel R. Richardson¹, Robert P. Lucht¹, Waruna D. Kulatilaka², Suresh Roy², James R. Gord³; ¹Purdue Univ., USA, ²Spectral Energies, LLC, USA, ³AFRL, USA.* A theoretical model and fitting routine for analyzing single-shot femtosecond coherent anti-Stokes Raman scattering (CARS) temperature measurements in flames is discussed. The model is validated in a heated gas cell and laminar H₂-air flames.

LTuB6 • 3:15 p.m.
Hybrid fs/ps Coherent Anti-Stokes Raman Scattering for Time- and Frequency-Domain Spectroscopy in Flames, *Joseph D. Miller¹, Mikhail N. Slipchenko², Terrence R. Meyer¹, Hans U. Stauffer³, James R. Gord³; ¹Iowa State Univ., USA, ²Purdue Univ., USA, ³AFRL, USA.* Hybrid fs/ps CARS is employed for time- and frequency-domain spectroscopy in reacting flows. Advantages include nonresonant background suppression, chemical specificity, detection at high pressures, potential for kHz-rate thermometry, and ability to resolve energy transfer phenomena.

3:30 p.m.–4:00 p.m. Coffee Break/Exhibits, Ballroom Foyer

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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LSTuC • Optical Communications—Theoretical vs. Experimental

Tuesday, February 2
4:00 p.m.–6:00 p.m.
Arun Majumdar; Naval Air Warfare Ctr, USA, Presider
Frederick Walther; MIT Lincoln Labs, USA, Presider

LSTuC1 • 4:00 p.m. Invited

Free Space Optical Communications Link Budget Estimation, *Alan Pike; Defense Strategies & Systems, Inc., USA*. We will describe techniques for estimating power levels to be expected in long range optical communications through strong turbulence with adaptive optics systems. Comparison with measurements will be made.

LSTuC2 • 4:30 p.m. Invited

Performance Evaluation of an Air Optical Communications Demonstration Air-to-Ground, *Steven Michael, Frederick Walther, Ronald R. Parenti; MIT Lincoln Labs, USA*. MIT Lincoln Laboratory has fielded a 2.67-Gbps optical link between an aircraft and a ground station, demonstrating communications at ranges beyond 50 km. We discuss tracking and communications performance against the atmospheric channel.

LSTuC3 • 5:00 p.m. Invited

Moon to Earth FSO Links, *Don Boroson, Bryan Robinson; MIT Lincoln Lab, USA*. NASA is presently overseeing a project to create the world's first free-space laser communications system that can be operated over a range ten times larger than the near-earth ranges that have been demonstrated to date.

LTuC • Multiparameter Gas and Chemical Sensing

Tuesday, February 2
4:00 p.m.–5:30 p.m.
Dirk Richter; NCAR, USA, Presider

LTuC1 • 4:00 p.m. Invited

Linear and Nonlinear Optical Methods for Multi-Gas and Multi-Parameter Sensing, *P. Ewart, B. Williams, Y. Arita, M. Hamilton, G. A. D. Ritchie; Oxford Univ., UK*. Linear multi-mode absorption spectroscopy, MUMAS, enhanced by wavelength modulation and cavity methods for simultaneous detection of multiple transitions is reported. Nonlinear laser induced gratings are shown to provide measurements of multiple parameters relevant to combustion.

LTuC2 • 4:30 p.m. Invited

Low Cost, High Performance TDL Gas Sensors for Widespread Network Deployment, *David M. Sonnenfroh, Krishnan Parameswaran; Physical Sciences Inc., USA*. We discuss the development of high precision, low cost diode laser-based sensors for monitoring ambient CO₂ in networks. Sensor performance metrics will be highlighted and examples of sensors under development discussed.

LTuC3 • 5:00 p.m. Invited

Optical Fiber Setups for the Improvement of Chemical Sensing, *Christoph Bauer¹, Ulrike Willer¹, Wolfgang Schade^{1,2}; ¹Laser Application Ctr., Clausthal Univ. of Technology, Germany, ²Fraunhofer Heinrich-Hertz-Inst., Germany*. Recent developments on optical fibers have impact on online chemical sensing. The uses of active optical fibers for amplifying short pulses and of passive fibers which are suitable for the coupling of QC-lasers are discussed.

LTuC4 • 5:15 p.m.

A New Raman Spectra Analyzer to Measure Isotope Ratios with High Spectral Resolution, *Manfred K. Fink¹, Philip Varghese¹, Jacek Borysow²; ¹Univ. of Texas at Austin, USA, ²Michigan Technological Univ., USA*. A novel Raman spectral analyzer is presented which measures the concentrations of dilute species with high resolutions (0.3 cm⁻¹), high sensitivity (0.1 Pa) within minutes. Examples are: standard mixtures, breathalyzers, and aqueous dissolved gases.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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LTuC4 • 5:15 p.m.

A New Raman Spectra Analyzer to Measure Isotope Ratios with High Spectral Resolution, *Manfred K. Fink¹, Philip Varghese¹, Jacek Borysow²; ¹Univ. of Texas at Austin, USA, ²Michigan Technological Univ., USA.* A novel Raman spectral analyzer is presented which measures the concentrations of dilute species with high resolutions (0.3 cm⁻¹), high sensitivity (0.1 Pa) within minutes. Examples are: standard mixtures, breathalyzers, and aqueous dissolved gases.

LSTuC • Optical Communications—Theoretical vs. Experimental—Continued

LSTuC4 • 5:30 p.m. Invited

Submarine Laser Communication Uplinks, *Gary M. Lee; Consultant, USA.* Paper discusses SLC uplink design trade-offs and compares uplinks with downlinks. Modulation formats, receivers, transmitter and optical filters for uplinks are discussed. Uplink radiance profiles under various environmental conditions are determined.

LTuC • Multiparameter Gas and Chemical Sensing—Continued

Coffee Break, 5:30 p.m.–6:00 p.m., Ballroom Foyer

LSTuD • Applications of MIR Spectroscopy

Tuesday, February 2
6:00 p.m.–7:15 p.m.
Wolfgang Schade; Technische Univ. Clausthal, Germany, Presider

LSTuD1 • 6:00 p.m. Invited

High Precision Trace Gas Measurements with Quantum Cascade Laser Spectroscopic Instruments, *J. Barry McManus¹, Mark Zahniser¹, David D. Nelson¹, Joanne H. Shorter¹, Rick A. Wehr², Greg W. Santoni³, Ben H. Lee³; ¹Aerodyne Res. Inc., USA, ²Univ. of Arizona, USA, ³Harvard Univ., USA.* Newly developed quantum cascade laser spectroscopic instrumentation allows high precision measurements of atmospheric trace gases, including measurements of small fractional (<10⁻³) changes in stable gases (e.g. N₂O), and isotopic ratios (e.g. ¹³CO₂/¹²CO₂, ¹³CH₄/¹²CH₄).

LTuD2 • 6:30 p.m.

Ammonia Sensor for Environmental Monitoring Based on a 10.4 μm External-Cavity Quantum Cascade Laser, *Rafal Lewicki¹, Anatoliy Kosterev¹, David M. Thomazy¹, Longwen Gong¹, Robert Griffin¹, Timothy Day², Frank K. Tittel¹; ¹Rice Univ., USA, ²Daylight Solutions, USA.* An EC-QCL based sensor employing photo-acoustic spectroscopy as a detection technique for monitoring of atmospheric ammonia will be reported. For the NH₃ absorption line at 965.35 cm⁻¹ a detection limit of 3.3 ppbv was obtained.

<p align="center">Emerald Ballroom Advanced Solid-State Photonics (ASSP)</p>	<p align="center">Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)</p>	<p align="center">Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)</p>
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LTuD3 • 6:45 p.m.

Determining Total Hemoglobin Mass by Means of ¹³CO Breath Analysis, Marcus Sowa, Peter Hering; *Inst. for Laser Medicine, Heinrich-Heine-Univ., Germany*. Our aim is the development of a method for determining the total hemoglobin mass with a non-invasive method using Cavity Leak-Out Spectroscopy in the mid-infrared region. A possible application would be detection of blood doping.

LTuD4 • 7:00 p.m.

Application of Mid-IR Laser Spectroscopy for the Analysis of Surgical Smoke, Michele Gianella, Markus W. Sgrist; *ETH Zurich, Inst. for Quantum Electronics, Switzerland*. The composition of surgical smoke was quantitatively analyzed by employing infrared laser spectroscopy. *In vitro* and *in vivo* samples were compared. In addition to smoke components, the anesthetic sevoflurane was identified in samples from laparoscopy.

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Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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7:30 a.m.–5:00 p.m. Registration Open, Ballroom Foyer
9:30 a.m.–4:00 p.m. Exhibit Open, Crystal Ballroom

AWA • Fiber Lasers

Wednesday, February 3

8:00 a.m.–9:30 a.m.

Gregory D. Goodno; Northrop Grumman Corp., USA, Presider

AWA1 • 8:00 a.m. Invited

Diffraction Limited Ultra-High-Power Fiber Lasers, Valentin Gapontsev, V. Fomin, A. Ferin, M. Abramov; IPG Photonics Corp., USA. Power scaling of high power single-mode fiber lasers is limited primarily by three inter-dependent obstacles: Insufficient pump brightness, excess heat generation, and non-linearities in the fiber. In this paper, we review these challenges and describe a novel pumping approach which serves to overcome them.

AWA2 • 8:30 a.m.

830 W Average Power Femtosecond Fiber CPA System, Tino Eidam¹, Stefan Hanf, Thomas V. Andersen², Enrico Seise¹, Christian Wirth³, Thomas Schreiber³, Thomas Gabler⁴, Jens Limpert¹, Andreas Tünnermann^{1,3}; ¹Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, ²NKT Photonics, Denmark, ³Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany, ⁴JT Optical Engine, Germany. We report on the generation of 830 W of compressed average power at 78 MHz pulse repetition frequency from an ultrashort pulse fiber chirped pulse amplification system. The pulses are as short as 640 fs.

LSWA • Ladar Systems I

Wednesday, February 3

8:00 a.m.–10:00 a.m.

Presider to Be Announced

LSWA1 • 8:00 a.m. Invited

Tomographic Lidar, James T. Murray, Joseph Triscari, Gregory Fetzler, Ryan Epstein, Jeff Plath, William Ryder, Neil Van Lieu; Areté Associates, USA. High resolution imaging of unresolved targets is achieved using a combination of digital range compression and tomography principles. Image reconstruction of a meter sized target at 22.4 km range with 15 cm resolution is reported.

LSWA2 • 8:30 a.m.

Laser Gas Sensing by Remotely Monitored Porous Silicon Sensor Arrays, Tanya Hutter, Moran Horesh, Shlomo Ruschin; Tel-Aviv Univ., Israel. An optical porous silicon sensor array configuration interrogated by a single laser beam is presented. Graded array sensitization and the definition of a normalized correlation coefficient allow reliable identification and enhanced monitoring range.

LWA • New Combustion Imaging Strategies

Wednesday, February 3

8:00 a.m.–10:00 a.m.

Jiayao "Yao" Zhang; Sandia Natl. Labs, USA, Presider

LWA1 • 8:00 a.m.

High-Resolution Imaging of Turbulence Structures in Jet Flames and Non-Reacting Jets with Laser Rayleigh Scattering, Jonathan H. Frank, Sebastian A. Kaiser; Combustion Res. Facility, Sandia Natl. Labs, USA. Turbulence structures in jet flames and non-reacting jets are studied with laser Rayleigh imaging. Comparisons of length scales and morphology of dissipation structures in reacting and non-reacting flows reveal effects of heat release on turbulence.

LWA2 • 8:15 a.m. Invited

Ultra High Framing-Rate Laser Diagnostics for High-Speed Reacting and Non-Reacting Flows, Naibo Jiang¹, Matthew C. Webster¹, Kathryn N. Gabel¹, Randy L. Patton¹, Igor Adamovich¹, Jeffrey A. Sutton¹, Walter R. Lempert¹, Joseph D. Miller², Terrence R. Meyer², Jenifer A. Inman³, Brett Bathel³, Steve B. Jones³, Paul M. Danehy²; ¹Ohio State Univ., USA, ²Dept. of Mechanical Engineering, Iowa State Univ., USA, ³NASA Langley Res. Ctr., USA. The critical features of a burst mode diagnostic imaging system is described, along with representative NO PLIF measurements at 1MHz, in a Mach 10 hypersonic flow, and Rayleigh imaging at 10kHz in a turbulent flame.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWA • Fiber Lasers—Continued

AWA3 • 8:45 a.m.
Tandem Pumping of Large-Core Double-Clad Ytterbium-Doped Fiber for Control of Excess Gain, *Christophe A. Codemard, Johan Nilsson, Jayanta K. Sahu; Optoelectronics Res. Ctr., Univ. of Southampton, UK*. We explain and experimentally verify how to control unwanted excess gain of higher-order modes in cladding-pumped large-core ytterbium-doped fiber amplifiers through high-brightness tandem-pumping with wavelengths close to the signal wavelength.

AWA4 • 9:00 a.m.
Microjoule Pulse Energies at 1 MHz Repetition Rate from an All-Fiber Nonlinear Chirped-Pulse Amplifier, *Bulent Oktem, Hamit Kalaycıoğlu, Fatih Ömer İlday; Bilkent Univ., Turkey*. We report a 1-MHz robust, all-fiber amplifier-oscillator system. Amplified pulses of 3.1 uJ are externally compressed to 140 fs. The highest peak power from an integrated fiber source, up to 50 kW, is obtained.

AWA5 • 9:15 a.m.
High Average Power, High Energy Fiber Laser System: Operation at 977 nm and Frequency Doubling at 488 nm, *Johan Boulette¹, Romain Dubrasquet², Ramatou Bello-Doua², Nicholas Traynor¹, Eric Cormier¹; ¹Ctr. des Lasers Intenses et Applications, Univ. de Bordeaux, France, ²Alphanov, Ctr. Technologique Optique et Lasers, France*. A pulsed fiber laser operating at 977 nm generating >0.75 mJ, 12 ns pulses at adjustable multi-10kHz of repetition rate is reported. Generation of 16 W of blue light by frequency conversion is also demonstrated.

LSWA • Ladar Systems I—Continued

LSWA3 • 9:00 a.m. Invited

Multi-Pixel (Matrix) Laser Vibrometer, *James Kilpatrick, Vladimir Markov; MetroLaser Inc., USA*. We describe a new optical sensor for real-time 2-D solid-body vibration imaging. Exemplary data reveal previously unobserved transient phenomenon which could elucidate instability in linear dynamic systems or aid development of new non-linear dynamic sensors.

LSWA4 • 9:30 a.m. Invited

Photon Counting Lidars for Airborne and Spaceborne Topographic Mapping, *John J. Degnan; Sigma Space Corp., USA*. Photon-counting topographic lidars are the most efficient possible since they require only one detected photon per surface measurement. Daytime images obtained with an airborne photon-counting lidar are presented, and upcoming space applications are discussed.

LWA • New Combustion Imaging Strategies—Continued

LWA3 • 8:45 a.m. Invited

High Speed Imaging in Reactive Flows Using Hyperspectral Tomography and Photodissociation Spectroscopy, *Lin Ma; Clemson Univ., USA*. Two techniques are discussed for high speed imaging in reactive flows: a hyperspectral tomography sensor for measuring distributions of temperature and chemical species, and a photodissociation-based diagnostic for imaging two-dimensional mixture fraction.

LWA4 • 9:15 a.m.

Demonstration of Tomographic Imaging of Chemical Species Using THz Time-Domain Absorption Spectroscopy, *Lin Ma¹, Sebastian B. Zhang¹, Weiwei Cai¹, James R. Gord², Sukesh Roy³, Nicholas Schroeder⁴, Satya Ganti⁵, Stanley Smith, IV⁶, Jason A. Deibel⁷; ¹Clemson Univ., USA, ²AFRL, USA, ³Spectral Energies LLC, USA, ⁴Wright State Univ., USA*. A technique has been developed to image chemical species using THz time-domain absorption spectroscopy. Preliminary demonstration on a jet flow of steam is reported.

LWA5 • 9:30 a.m.

Phosphor Thermometry at an Optically Accessible Internal Combustion Engine, *Jan Brübach, Thilo Kissel, Andreas Dreizler; FG Energie- und Kraftwerkstechnik, Technische Univ. Darmstadt, Germany*. Two-dimensional phosphor thermometry based on the temperature-dependent luminescence lifetime using a CMOS high-speed camera was characterized and applied to an optically accessible diesel engine. A temperature transient was monitored in trailed and in fired operation.

<p align="center">Emerald Ballroom Advanced Solid-State Photonics (ASSP)</p>	<p align="center">Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)</p>	<p align="center">Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)</p>
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LWA • New Combustion Imaging Strategies—Continued

LWA6 • 9:45 a.m.
Measurements of Liquid Film Thickness by Tracer LIF, Raman Scattering and Diode Laser Absorption Spectroscopy, *Daniel Greszik, Huinan Yang, Thomas Dreier, Christof Schulz; Univ. of Duisburg-Essen, Germany.* Three different diagnostics techniques are compared to measure the liquid film thickness on a transparent quartz glass plate. The comparison shows a consistent trend and reveals application potentials.

9:30 a.m.–10:30 a.m. Coffee Break/Exhibits, *Crystal Ballroom*

NOTES

Wednesday, February 3

Ballroom Foyer

9:30 a.m.–11:00 a.m.

AWB1

Efficient Resonantly-Pumped Eye-Safe Composite Ceramic Er:YAG Laser, Nikolay Ter-Gabrielyan¹, Larry D. Merkle¹, Mark Dubinski¹, E. R. Kupp², Gary L. Messing²; ¹US ARL, USA, ²Penn State Univ., USA. Laser operation of a composite ceramic Er:YAG rod is demonstrated at 1645 nm with a slope efficiency of 56.9% under resonant pumping. This is believed to be the first reported composite ceramic Er:YAG laser.

AWB2

50W Pico-Second Nd:GdVO₄ Bounce Laser with a Phase-Conjugate Mirror, Yasuhiro Morimoto, Katsuhiko Miyamoto, Yuichi Maeda, Takashi Omatsu; Chiba Univ., Japan. A 50W pico-second dual Nd:GdVO₄ bounce amplifier system with a phase-conjugate mirror is demonstrated. The system has also been extended to generate pico-second mid-infrared radiation with frequency ranges of 1.55–1.57 μm and 3.4–3.3 μm.

AWB3

Intracavity Synthetic Diamond: Underpinning Wavelength Diversity in Semiconductor Disk Lasers, Alan J. Kemp, Alexander J. Maclean, John-Mark Hopkins, Jennifer E. Hastie, Stephane Calvez, Martin D. Dawson, David Burns; Inst. of Photonics, Univ. of Strathclyde, United Kingdom. Semiconductor disk lasers are diode-pumped solid-state lasers offering broad spectral coverage. An approach to thermal management that is similarly adaptable is thus required: finite element analysis shows that intracavity diamond heatspreaders are such an approach.

AWB4

Progress Towards Monolithic Microchip Lasers Incorporating Diamond, Rolf B. Birch, Patricia Millar, Yanfeng Zhang, Erdan Gu, Alan J. Kemp, Martin D. Dawson, David Burns; Inst. of Photonics, Univ. of Strathclyde, United Kingdom. Microchip lasers are robust, alignment-free sources; however, output powers are limited by excessive thermal lensing and stress fracture. The bonding of gain media to diamond is discussed as a means to circumvent this drawback.

AWB5

Semiconductor Disk Lasers Incorporating InP/GaN Quantum Dots for 716-755 nm Emission, Peter J. Schlosser¹, Jennifer E. Hastie¹, Stephane Calvez¹, Andrey B. Krysa², Martin D. Dawson¹; ¹Inst. of Photonics, Univ. of Strathclyde, United Kingdom, ²EPSRC Natl. Ctr. for III-V Technologies, Univ. of Sheffield, United Kingdom. We report demonstration of semiconductor disk lasers based on InP/GaN quantum dots for TEM₀₀ emission from 716–755 nm, and up to 25 nm tuning from a single source. Maximum output power of 52 mW was achieved at 739 nm.

AWB6

High Gain, High Energy Single Stage Chirped Pulse Amplifier System Based on a Short Length

Yb-doped Rod Type Fibre, Yoann Zaouter, Antoine Courjaud, Clemens Hönninger, Eric Mottay; Amplitude Systemes, France. We report the generation of 90 μJ, 255 fs and > 250 MW peak power pulses from a single stage 47 dB of gain Yb-doped rod type photonic crystal fibre chirped pulse amplifier in double-pass configuration.

AWB7

Ultrafast Laser Inscription of a High Gain Er-Doped Bismuthate Glass Waveguide Amplifier, Robert R. Thomson, Stephen Beecher, Nicholas D. Psaila, Ajoy K. Kar; Heriot Watt Univ., United Kingdom. An Er-doped bismuthate glass waveguide amplifier has been fabricated using ultrafast laser inscription. The amplifier exhibits a peak net gain of ≈ 16.5 dB, and > 10.0 dB of net gain across the C-telecommunications band.

AWB8

Waveguide Microchip YAG:Nd/YAG:Cr⁴⁺ Laser Fabricated by the Femtosecond Writing, Andrey Okhrimchuk^{1,2}, Alexander Shestakov³, Ian Bennion¹; ¹Aston Univ., United Kingdom, ²Fiber Optics Res. Ctr. of RAS, Russian Federation, ³Elements of Laser Systems Co., Russian Federation. Waveguide is fabricated by femtosecond pulses in diffusion bonded YAG:Nd³⁺/YAG:Cr⁴⁺ crystals. An efficient Q-switch operation of new microchip laser is obtained under pump with a fiber directly coupled to the waveguide and a laser diode.

AWB9

0.5 MHz 50fs μJ-class Ultrafast Laser Amplifier System, Xiaoshi Zhang, Sterling J. Backus, Hsiao-hua Liu, Iain T. McKinnie, Henry C. Kapteyn, Margaret M. Murnane; Kapteyn-Murnane Labs Inc., USA. We report an innovative and robust ultrafast Ti:sapphire regenerative amplifier system accessing a new operating regime tunable from 50 kHz up to 500 kHz-repetition-rate, up to 10 μJ, 50 fs pulses, enabling applications in micromachining, imaging, and spectroscopy.

AWB10

Passive All-Fiber Transversal Mode Filter for High-Power CW Fiber Laser Applications, Cesar Jauregui¹, Fabian Stutzki¹, Jens U. Thomas¹, Christian Voigtländer¹, Stefan Nolte¹, Jens Limpert¹, Andreas Tünnermann^{1,2}; ¹Inst. of Applied Physics, Friedrich-Schiller-Universität Jena, Germany, ²Inst. for Applied Optics and Precision Engineering, Fraunhofer IOF, Germany. It is shown that monolithic CW LMA-fiber lasers inherently operate in a transversally multimode regime. Accordingly, a novel all-fiber passive transversal mode filter to improve the performance of CW fiber lasers is proposed.

AWB11

Mode-Locked Thulium-Doped Silicate Fiber Laser with Saturable Absorber Mirror, Qing Wang, Jihong Geng, Tao Luo, Shibin Jiang; AdValue Photonics Inc., USA. We report a passively mode-locked fiber laser using a 30-cm long newly developed Tm-doped silicate glass fiber. The mode-locked pulses

operate at 1980 nm with duration of 1.5 ps and energy of 0.76 nJ.

AWB12

Single-Frequency Wavelength-Tunable Erbium-Doped Fiber Laser with Simple Ring Scheme, Chien-Hung Yeh¹, Chi-Wai Chow²; ¹Industrial Technology Res. Inst., Taiwan, ²Dept. of Photonics, Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan. We demonstrate a single-longitudinal-mode wavelength-tunable erbium-doped fiber ring laser using simple ring cavity design. Based on the fiber ring design, the mode hopping can be avoided to achieve single-frequency output in C-band operation.

AWB13

Suppression of Parasitic Laser Processes in Cladding Pumped Er:Yb-Codoped Fiber Amplifier via Auxiliary Signal at 1.0 μm, Vincent Kuhn^{1,2}, Peter Weßels^{1,2}, Jörg Neumann^{1,2}, Dietmar Kracht^{1,2}; ¹Laser Zentrum Hannover e.V., Germany, ²Ctr. for Quantum-Engineering and Space-Time Res. – QUEST, Germany. We report on an Er:Yb-codoped cladding pumped fiber amplifier simultaneously seeded at 1556 nm and 1064 nm. We were able to demonstrate stable output power of 8.7 W at 1556 nm with an amplifier gain of >22 dB.

AWB14

Model-Based Phase-Shaping for SPM-Compensation in mJ-Pulse-Energy Fiber CPA-systems, Damian N. Schimpf, Tino Eidam, Enrico Seise, Jens Limpert, Andreas Tünnermann; Inst. of Applied Physics, Friedrich Schiller Univ. Jena, Germany. Based on an analytical model for the impact of SPM on stretched ultrashort pulses, the influence of SPM is experimentally controlled in a mJ-pulse-energy fiber-based CPA-system at B-integral as high as 8 rad.

AWB15

All-Fiber Regenerative Amplification of Low Energy 40 ps Seed Pulses from a Gain-Switched Laser Diode at Low Repetition Rates, Sebastian Kanzelmeyer, Matthias Hildebrandt, Thomas Theeg, Maik Frede, Joerg Neumann, Dietmar Kracht; Laser Zentrum Hannover e.V., Germany. All-fiber acousto-optic modulator controlled regenerative amplification of low-energy 40 ps pulses from a gain-switched laser diode is demonstrated. Unwanted amplified spontaneous emission is suppressed effectively and gain values of more than 37 dB were achieved.

AWB16

Pump Induced Loss in Directly-Diode Laser Pumped Ti:Sapphire Lasers, Alexander J. Maclean¹, Peter W. Roth¹, David Burns¹, Alan J. Kemp¹, Peter F. Moulton²; ¹Inst. of Photonics, Univ. of Strathclyde, United Kingdom, ²Q-Peak Inc., USA. Pump wavelengths of less than 460 nm compromise the performance of Ti:sapphire lasers by inducing loss. This - and not pump brightness or absorption - is the primary performance limitation for these lasers.

AWB17**Cavity-Dumped Picosecond Mode-Locked Nd:YVO₄ Laser for Micro-Machining Applications**

Joachim Meier, Ulrike Wegner, Max J. Lederer; High Q Laser Innovation GmbH, Austria. We present a Nd:YVO₄ cavity-dumper with average power of 10W at 1MHz and pulse energies up to 15.6μJ at 10ps. These parameters render it a compact source for picosecond micro-machining, alternative to more complex schemes.

AWB18**Passively Q-Switched Nd:YAG/Cr⁴⁺:YAG Laser with a Volume Bragg Gratings Output Coupler**

Nicolae Pavel^{1,2}, Masaki Tsunekane², Takunori Taira²; ¹Natl. Inst. for Laser, Plasma and Radiation Physics, Romania, ²Inst. for Molecular Science, Laser Res. Ctr., Japan. A passively Q-switched Nd:YAG/Cr⁴⁺:YAG laser with a volume Bragg gratings optical element as output coupler was build and characterized. The laser operated on a limited range of temperature when the pump pulse energy was constant.

AWB19**Efficiency, Energy, and Power Scaling of Diode-Pumped, Short-Pulse Laser Amplifiers Using Yb-Doped Gain Media**

Mathias Siebold¹, Markus Loeser¹, Joerg Koerner^{2,3}, Markus Wolf^{2,3}, Joachim Heintz^{2,3}, Christoph Wandt⁴, Sandro Klingebiel⁴, Stefan Karsch⁴, Ulrich Schramm¹; ¹Res. Ctr. Dresden-Rossendorf, Germany, ²Inst. for Optics and Quantum Electronics, Friedrich-Schiller-Univ. Jena, Germany, ³Helmholtz Inst. Jena, Germany, ⁴Max-Planck-Inst. for Quantum Optics, Germany. We present a novel approach to overcome efficiency limitations of nanosecond lasers based on Yb-doped materials. Furthermore, we introduce a combination of bulk and thin-disk design for power scaling of diode-pumped lasers.

AWB20**Concept for Cryogenic kJ-Class Yb:YAG**

Amplifier, Klaus Ertel, Cristina Hernandez-Gomez, Paul D. Mason, Ian O. Musgrave, Ian N. Ross, John L. Collier; Science and Technology Facilities Council, Rutherford Appleton Lab, United Kingdom. More and more projects and applications require the development of ns, kJ-class DPSSL systems with

multi-Hz repetition rate. We present an amplifier concept based on cryogenically cooled Yb:YAG, promising high optical-to-optical efficiency and high gain.

AWB21**Zig-Zag Active-Mirror Laser with Cryogenic**

Yb:YAG, Hiroaki Furuse¹, Junji Kawanaka², Noriaki Miyanaga², Taku Saiki¹, Masayuki Fujita¹, Kazuo Imasaki¹, Kenji Takeshita³, Shinya Ishii³, Yasukazu Izawa¹; ¹Inst. for Laser Technology, Japan, ²Inst. of Laser Engineering, Osaka Univ., Japan, ³Mitsubishi Heavy Industries, Japan. We report on a multiple total-reflection active-mirror laser with cryogenic Yb:YAG ceramics using zigzag optical path. A 214W output power with 62% slope efficiency has been demonstrated.

AWB22**High-Power, Actively Modelocked Cryogenic**

Yb:YAG Laser, Juliet T. Gopinath¹, Kevin F. Wall², John Hybl³, Peter F. Moulton², T. Y. Fan³; ¹Univ. of Colorado, USA, ²Q-Peak, USA, ³MIT Lincoln Lab, USA. A high-power, actively modelocked, cryogenically cooled Yb:YAG laser has been demonstrated. At a repetition rate of 80 MHz, 214-ps pulses with 55 W of output power have been measured.

AWB23**Comparison of Structural and Optical Properties in the Yb³⁺-doped (Gd_{0.5}Y_{0.5})₂SiO₅ (Yb:GYSO) Crystals**

Lihe Zheng¹, Jun Xu¹, Witold Ryba-Romanowski², R. Lisiecki²; ¹Shanghai Inst. of Ceramics, Chinese Acad. of Sciences, China, ²Inst. of Low Temperature and Structure Res., Polish Acad. of Sciences, Poland. Yb:GYSO laser crystals were obtained with different crystal structure by Czochralski method from different seed crystal of Yb:GSO and Yb:YSO, respectively. Low-temperature absorption and emission spectra, as well as lifetime were compared.

AWB24**Design of High Average Power Mode-Locked**

Oscillator Based on Edge-Pumped All Ceramic Yb:YAG/YAG Microchip, Atsushi Sugita¹, Tomonori Matsushita², Takunori Taira²; ¹Shizuoka Univ., Japan,

²Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan. We report the first high-power mode-locked ceramic laser in Yb:YAG/YAG composite microchip. The primal result of 1.0 μJ-pulse energy for 21W-average power was successfully obtained. The future issue of power-scalability and downsizing was also discussed.

AWB25**Profile Analysis of a Yb:YAG Chirped-Pulse**

Oscillator, Sadao Uemura, Kenji Torizuka; Natl. Inst. of Advanced Industrial Science and Technology, Japan. We report a Yb:YAG chirped-pulse oscillator that delivers a pulse energy of 2.1 μJ, and analyze the temporal and spectral profiles of the laser pulse using a chip parameter, which is calculated to be 1.50.

AWB26**Broadband Yb:CaF₂ Regenerative Amplifier for**

Millijoule Range Ultrashort Pulse Amplification, Sandrine Ricaud¹, Martin Delaigüe¹, Antoine Courjaud¹, Frédéric Druon², Patrick Georges², Patrice Camy³, Abdelmjid Benayad³, Jean-Louis Doualan³, Richard Moncorgé³, Eric Mottay³; ¹Amplitude Systemes, France, ²Lab Charles Fabry de l'Inst. d'Optique, CNRS, Univ Paris-Sud, France, ³Cent. Interdisciplinaire de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), Univ. de Caen, France. We report a diode-pumped regenerative amplifier based on Yb:CaF₂ material delivering up to 1.8mJ at 100Hz. The pulses have a spectral bandwidth of 16nm, indicating a good potential for millijoule range sub 100fs pulse duration.

AWB27**Milli-Joules, Kilo-Hertz Regenerative Amplifier Using Total-Reflection Active-Mirror with**

Cryogenic Yb:YAG, Takuya Nakanishi¹, Yasuki Takeuchi¹, Akira Yoshida¹, Junji Kawanaka¹, Ryo Yasuhara², Toshiyuki Kawashima², Hirofumi Kan²; ¹Osaka Univ., Japan, ²Hamamatsu Photonics K. K., Japan. A regenerative amplifier by using total-reflection active-mirror with a cryogenic YAG/Yb:YAG composite ceramics has been demonstrated up to kHz repetition rate. A 6.5-mJ pulse energy and a 9.3% optical efficiency were obtained at 200-Hz.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWC • Optical Combs and Harmonics

Wednesday, February 3
11:00 a.m.–1:00 p.m.
Kaoru Minoshima; AIST, Japan, Presider

AWC1 • 11:00 a.m.

First CEO Frequency Measurement of a SESAM-Modelocked 1.5- μ m Solid-State Laser Oscillator, Selina Pekarek¹, Max C. Stumpf¹, Andreas E. H. Oehler¹, Thomas Südmeyer¹, John M. Dudley², Ursula Keller¹; ¹ETH Zurich, Switzerland, ²Inst. FEMTO-ST, CNRS, Univ. de Franche-Comté, France. We present a self-referencable frequency comb by optimized octave-spanning supercontinuum generation of a diode-pumped 170-fs Er:Yb:glass-laser with 110 mW power. The f-to-2f CEO frequency has 49-dB signal-to-noise and >10-times narrower bandwidth than free-running 1.5- μ m fiber-systems.

AWC2 • 11:15 a.m.

Oscillator Pulse Train with Constant Carrier-Envelope-Offset Phase and 65 Attosecond CE Jitter, Stefan Rausch¹, Thomas Binhammer², Anne Harth¹, Uwe Morgner^{1,3}; ¹Inst. of Quantum Optics, Leibniz Univ. Hannover, Germany, ²VENTEON Laser Technologies GmbH, Germany, ³Laser Zentrum Hannover (LZH), Germany. We present an octave-spanning Ti:sapphire laser oscillator stabilized to carrier-envelope-offset frequency zero, generating a pulse train with constant CE-phase and 65 attosecond jitter. The stabilization is realized using a modified f-to-2f-interferometer and phase-coherent locking.

LSWB • Ladar Systems II

Wednesday, February 3
10:30 a.m.–12:00 p.m.
Brian Miles; FastMetrix, Inc., USA, Presider

LSWB1 • 10:30 a.m. Invited

Combating Atmospheric Scintillation and Dispersion on a Laser Imaging Link Using Multiple Parallel Beams, Mohsen Kavehrad, Zeinab Hajjarian, Jarir Fadlullah; Pennsylvania State Univ., USA. Inspired by Yun and Kavehrad's multi-spot diffuse indoor wireless optical communications link, a spatially multiplexed MIMO imaging system is proposed and the corresponding performance and image quality is analyzed in a turbid and turbulent atmosphere.

LSWB2 • 11:00 a.m. Invited

3-D Passive Sensing and Multiview Imaging, B. Javidi¹, E. A. Watson², P. F. McManamon³; ¹Univ. of Connecticut, USA, ²U.S. AFRL, Sensors Directorate, USA, ³Exciting Technology LLC, USA. We present overview of our work on three-dimensional imaging for object visualization and classification. 3-D imaging presents many benefits for object visualization and identification. Benefits and disadvantages of active and passive sensing-imaging are presented.

LWB • Spectroscopy for Combustion Applications

Wednesday, February 3
10:30 a.m.–12:30 p.m.
Presider to Be Announced

LWB1 • 10:30 a.m. Invited

Real-Time Diagnostics in Exhaust Plumes, Flames, and the Atmosphere Using an Intra-Pulse Quantum Cascade Laser Spectrometer, Geoffrey Duxbury, Kenneth G. Hay, Paul Black, Nigel Langford; Univ. of Strathclyde, UK. Quantitative measurements of real-time variations of the chemical composition of a jet engine plume, laminar flame and ambient atmosphere are demonstrated using 5 and 8 μ m intra-pulse quantum cascade laser spectrometers.

LWB2 • 11:00 a.m.

In situ Laser Diagnostics of Temperature, Intermediate Species Concentration and Particle Sizes in Gas-Phase Nanoparticle Synthesis, Christian Hecht, Huinan Yang, Thomas Dreier, Christof Schulz; Univ. of Duisburg-Essen, Germany. The development of gas-phase synthesis strategies for specific nanoparticles requires detailed knowledge about the conditions of precursor decomposition, particle inception, and growth. LIF and NIR absorption provide crucial data for understanding and simulating these processes.

LWB3 • 11:15 a.m. Invited

Laser Diagnostic Techniques for Shock Tube Studies of Combustion Chemistry, Ron K. Hanson; Stanford Univ., USA. Laser-based absorption techniques, used to probe species time-histories in shock tube experiments of combustion chemistry, are described. A variety of laser sources are used, providing wavelengths from the deep UV to the mid-IR.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWC • Optical Combs and Harmonics—Continued
AWC3 • 11:30 a.m.

Self-Referenced and Optically Stabilized 10 GHz Frequency Comb, Dirk C. Heinecke^{1,2}, Albrecht Bartels^{2,3}, Tara M. Fortier¹, Danielle A. Braje¹, Leo Hollberg¹, Scott A. Diddams¹; ¹NIST, USA, ²Univ. of Konstanz, Germany, ³Gigaoptics GmbH, Germany. We demonstrate a self-referenced 10 GHz Ti:sapphire frequency comb where the continuum is generated in microstructured fiber. In addition, we discuss optical stabilization of the comb via saturated absorption in ⁸⁷Rb with a single mode.

AWC4 • 11:45 a.m.

Visible Spectrum Frequency Comb for Astronomical Spectrograph Calibration, Andrew Benedict¹, Guoqing Chang¹, Alex Glenday², Chi-Hao Li², David Phillips², Ronald Walsworth², Franz Kärtner¹; ¹MIT, USA, ²Harvard-Smithsonian Ctr. for Astrophysics, Harvard Univ., USA. We have developed a visible wavelength frequency comb at 420nm with a 21GHz mode spacing to calibrate astronomical spectrographs used in searches for planets similar to the Earth near stars similar to the Sun.

AWC5 • 12:00 p.m.

Pressure-Controlled Phase-Matching to the Third Harmonic in Ar-Filled Hollow Core PCF, Johannes Nold, Nicolas Y. Joly, Philipp Hölzer, Alexander Podlipensky, Philip Russell; Max Planck Inst. for the Science of Light, Germany. Hollow core photonic crystal fibre filled with Ar at pressures of 5 bar offers long interaction lengths and high nonlinearity. Pressure-tuned phase-matched third harmonic and supercontinua are generated from 30 fs pulses at 800 nm.

LSWB • Ladar Systems II—Continued
LSWB3 • 11:30 a.m.

Laser Radar Experiment Using a Signal with Three Sparse, Linearly Chirped Frequencies, Eric S. Bailey¹, Matthew P. Dierking², Peter E. Powers^{1,3}, Joseph W. Haus¹; ¹Ladar and Optical Communications Inst. and Electro-Optics Program, Univ. of Dayton, USA, ²AFRL, AFRL_RYJM, USA, ³Physics Dept., Univ. of Dayton, USA. Experiments using three tunable and separate laser lines that are linearly frequency modulated are compared to numerical modeling. Our modeling predicts an increase in the effective bandwidth, which improves the range resolution.

LWB • Spectroscopy for Combustion Applications—Continued
LWB4 • 11:45 a.m.
Invited

Towards Quantitative Measurements of Soot Concentrations in Strongly Sooting Turbulent Jet Diffusion Flames, Christopher R. Shaddix, Jiayao Zhang, Robert W. Schefer; Sandia Natl. Labs, USA. Two-dimensional laser-induced incandescence has been used to quantify soot properties in strongly sooting turbulent nonpremixed flames fueled by ethylene and JP-8 surrogate, despite strong laser attenuation and signal trapping.

12:30 p.m.–1:30 p.m. Lunch Break (on your own)

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWC • Optical Combs and Harmonics—Continued
AWC6 • 12:15 p.m.

Femtosecond High Repetition Rate External Cavity beyond the Average Power Limit for Linear Enhancement, *Ioachim Pupezza^{1,2}, Tino Eidam³, Oleg Pronin^{1,2}, Jens Rauschenberger^{1,2}, Birgitta Bernhardt¹, Akira Ozawa¹, Thomas Udem¹, Ronald Holzwarth¹, Jens Limpert³, Alexander Apolonski², Theodor Hänsch¹, Andreas Tünnermann³, Ferenc Krausz^{1,2}; ¹Max-Planck-Inst. for Quantum Optics, Germany, ²Dept. für Physik, Ludwig-Maximilians-Univ. München, Germany, ³Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany.* We report on the cavity enhancement of a 78MHz, 200fs ytterbium-fiber laser system. Linear enhancement up to a record intra-cavity power of 18kW has been observed. In a non-linear enhancement regime 40kW have been reached.

AWC7 • 12:30 p.m.

High-Power Yb-Frequency Comb Using Fiber Stretcher/Grating Compressor and Linear Amplification, *Axel Ruehl, Ingmar Hartl, Andrius Marcinkevicius, Martin E. Fermann; IMRA America, Inc., USA.* We report on an Yb-fiber frequency comb laser delivering 155fs pulses with 65W. By designing the group-delay between fiber-stretcher and compressor, a compression factor of 4100 could be demonstrated allowing for linear amplification.

AWC8 • 12:45 p.m.

Fully Phase and Amplitude-Locked Multicolor Coherent Pulse Synthesis from a fs Yb:KGW-Driven IR-OPA, *Giedrius Andriukaitis¹, Oliver D. Mücke¹, Aart J. Verhoeft, Audrius Pugžlys¹, Andrius Baltuška¹, Darius Mikalauskas², Linas Giniūnas², Romualdas Danielius²; ¹Vienna Univ. of Technology, Austria, ²Light Conversion, Ltd., Lithuania.* Combining active CEP-locking of an Yb-DPSS amplifier with a passive CEP-lock on the idler, we demonstrate a 40-kHz 10-μJ OPA with a shot-to-shot-stable coherent superposition of the signal, idler and pump pulses and their harmonics.

LWB • Spectroscopy for Combustion Applications—Continued
LWB5 • 12:15 p.m.

Fiber Lasers as a Source for Laser-Induced Incandescence in Practical Applications, *John D. Black; Univ. of Manchester, UK.* Laser-induced incandescence (LII) using a fiber laser has been demonstrated in an engine exhaust and ambient air. There are advantages over Nd:YAG in practical applications, but a new model for long pulse LII is required.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWD • Nonlinear Optics

Wednesday, February 3
 2:30 p.m.–4:00 p.m.
Presider to Be Announced

LSWC • Advanced Systems

Wednesday, February 3
 1:00 p.m.–2:30 p.m.
Leaf Jiang; MIT Lincoln Lab, USA, Presider
Nathan R. Newbury; NIST, USA, Presider

LWC • Spectroscopy for Security and Biochemical Sensing

Wednesday, February 3
 1:30 p.m.–3:30 p.m.
Presider to Be Announced

LSWC1 • 1:00 p.m. Invited

Arrays of Geiger-Mode Avalanche Photodiodes for Ladar and Laser Communications, *Alex McIntosh; MIT Lincoln Lab, USA*. Arrays of photon-counting Geiger-mode avalanche photodiodes bump-bonded to CMOS read-out integrated circuits with per-pixel timing and counting capabilities have been developed for both deep-space laser-communications and for laser radars.

LSWC2 • 1:30 p.m. Invited

Coherent Imaging, *Joseph Marron; Lockheed Martin Coherent Technologies, USA*. Experimental results demonstrating coherent imaging at extended ranges are presented. Digital holographic detection is used to record the coherent data. Results presented include 3-D images of dynamic scenes recorded using a pulsed source.

LSWC3 • 2:00 p.m. Invited

Phased-Array Laser Radar System Based on Slow Light, *Robert W. Boyd¹, George M. Gehring¹, M. A. Martinez Gamez¹, Aaron Schweinsberg¹, Zhimin Shi¹, Joseph E. Vornehm, Jr.¹, Edward A. Watson², Lawrence Barnes²; ¹Univ. of Rochester, USA, ²AFRL, USA*. We describe an electronically steerable laser-radar system based on a sparse phased array and the use of slow-light methods to ensure synchronization of the light leaving each subaperture.

LWC1 • 1:30 p.m. Invited

Germany Perspectives of Laser Spectroscopic Methods for Security, Industrial and Biochemical Applications, *Reinhard Noll; Fraunhofer-Inst. für Lasertechnik Aachen, Germany*. Abstract not available.

LWC2 • 2:00 p.m.

Tm-Fiber 2 μm Laser for Laser-Induced Plasma Spectroscopy of Organic and Biological Materials, *Matthieu Baudelet, Christina Willis, Lawrence Shah, Martin Richardson; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA*. This study applies a Tm-fiber laser emitting at 2 μm for LIBS analysis of organic samples and discusses the benefits of the use of this fiber laser for analytical applications towards biological samples.

LWC3 • 2:15 p.m.

Withdrawn

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWD • Nonlinear Optics—Continued

AWD1 • 2:30 p.m. Invited
CW Crystalline Raman Lasers: Multi-Watt and Multi-Wavelength Operation in the Visible, Helen M. Pask, Andrew J. Lee, David J. Spence, James A. Piper; *Macquarie Univ., Australia*. We report the generation of high power, continuous-wave yellow emission from a frequency-doubled, self-Raman laser. Output power of 2.25 W at 586.5 nm is achieved with a diode to yellow conversion efficiency of 13.2%.

AWD2 • 3:00 p.m.
Novel Concept for Generating High Beam Quality from High Pulse Energy Optical Parametric Oscillators, Øystein Farsund, Gunnar Arisholm, Gunnar Rustad; *FFI (Norwegian Defence Res. Establishment), Norway*. Highly improved beam quality from a high pulse energy OPO is demonstrated by using a resonator with two different types of crystals type 2 phase matched for the same interaction, but with orthogonal walk-off directions.

AWD3 • 3:15 p.m.
Generation of Powerful Tunable Mid-Infrared Picosecond Laser Radiation Using Frequency Conversion in Periodically Poled Lithium Niobate, Gregor Anstett¹, Felix Ruebel², Johannes L'huillier²; ¹*Fraunhofer-FOM, Germany*, ²*Photonics Ctr. Kaiserslautern, Germany*. The generation of tunable mid-infrared picosecond laser radiation in the spectral range from 3-5 μ m by nonlinear frequency conversion in PPLN is reported. More than 3W output power at 3 μ m and 1W at 4.5 μ m were achieved.

LSWD • Laser Technology I

Wednesday, February 3
 2:30 p.m.–3:30 p.m.
Presider to Be Announced

LSWD1 • 2:30 p.m. Invited
Higher-Order-Mode Fiber Amplifiers, Jeff Nicholson; *OFS Labs, USA*. Higher order modes for large-mode-area high power fiber amplifiers are reviewed. Results from amplification in both Yb-doped HOM fiber at 1083 nm and Er-doped HOM fibers at 1550 nm are presented.

LSWD2 • 3:00 p.m. Invited
Photonic Crystal Mirrors for Free-Space Communication and Fiber-Optic Sensors, S. Hadzialic, I. W. Jung, O. Kilic, S. Kim, J. Provine, R. T. Howe, O. Solgaard; *Edward L. Ginzton Lab, Stanford Univ., USA*. Use of Photonic Crystals (PCs) to control electromagnetic fields enables-unprecedented scaling of low-loss, free-space optical devices. In this paper, we describe the operation, design, and fabrication of PC mirrors, and demonstrate their applications in microoptical-systems.

LWC • Spectroscopy for Security and Biochemical Sensing—Continued

LWC4 • 2:30 p.m.
Photonic Microring-Chip-Sensor for Explosive Detection, Rozalia Orghici¹, Peter Lützow², Jörg Burgmeier¹, Wolfgang Schade^{1,2}, Nina Welschoff³, Siegfried Waldvogel³; ¹*Clausthal Univ. of Technology, Germany*, ²*Fraunhofer Heinrich Hertz Inst., Germany*, ³*Kekulé Inst. for Organic Chemistry and Biochemistry, Univ. Bonn, Germany*. A microring resonator sensor for selective and sensitive detection of the explosive TNT (trinitrotoluene) is discussed. The combination of integrated optics and specially developed receptor molecules is used for this optical sensing.

LWC5 • 2:45 p.m. Invited
Quantum Cascade Lasers for the Detection of Hazardous Materials, Ulrike Willer¹, Christoph Bauer¹, Wolfgang Schade^{1,2}; ¹*Laser Application Ctr., Clausthal Univ. of Technology, Germany*, ²*Fraunhofer Heinrich-Hertz Inst., Germany*. The use of quantum cascade lasers for detection of hazardous materials, esp. explosives is discussed. Different schemes for sensitive measurement of trace amounts are described for different classes of materials with substantial different vapor pressure.

LWC6 • 3:15 p.m.
Optimization of an External Cavity Quantum Cascade Laser for Chemical Sensing Applications, Mark C. Phillips, Bruce E. Bernacki, Matthew S. Taubman, Bret D. Cannon, John T. Schiffern, Tanya L. Myers; *Pacific Northwest Natl. Lab, USA*. We describe and characterize an external cavity quantum cascade laser designed for detection of multiple airborne chemicals, and used with a compact astigmatic Herriott cell for sensing of acetone and hydrogen peroxide.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWD • Nonlinear Optics–Continued

LSWD • Laser Technology I–Continued

**LWC • Spectroscopy for Security and
Biochemical Sensing–Continued**

AWD4 • 3:30 p.m.

High Power Picosecond Mid-Infrared and Visible Source Based on Degenerated Four-Wave-Mixing in a Large Mode Area Photonic Crystal Fiber, Dirk Nodop¹, Cesar Jauregui², Damian Schimpf¹, Alexander Steinmetz¹, Jens Limpert¹, Andreas Tünnermann²; ¹Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, ²Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany. An endlessly-single-mode LMA PCF enables the conversion of a 8W, 1MHz fiber amplified 200ps, 1064nm microchip laser to 3W @ 673nm and 450mW @ 2.539µm by degenerated FWM. Numerical simulations are discussed in theoretical detail.

AWD5 • 3:45 p.m.

Passive Mode-Locking of a Nd:GdVO₄ Laser by Intracavity SHG in Periodically-Poled Stoichiometric Lithium Tantalate, Hristo Iliev¹, Danail Chuchumishev¹, Ivan Buchvarov¹, Sunao Kurimura², Valentin Petrov³, Uwe Griebner³; ¹Sofia Univ., Bulgaria, ²Natl. Inst. for Materials Science, Japan, ³Max-Born-Inst., Germany. Stable and self-starting mode-locking is achieved by cascaded second order nonlinearity using PPMgSLT nonlinear crystal in a Nd:GdVO₄ laser, achieving average powers up to 5.1 W and pulse durations as short as 3.8 ps.

3:30 p.m.–4:30 p.m Coffee Break, Crystal Ballroom

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWE • Ultrafast Lasers II

Wednesday, February 3
4:30 p.m.–6:30 p.m.
Iain T. McKinnie; Kapteyn-Murnane Labs, USA, President

LSWE • Laser Technology II

Wednesday, February 3
4:00 p.m.–5:30 p.m.
President to Be Announced

LWD • LIBS and Standoff Detection of Hazardous Materials

Wednesday, February 3
4:00 p.m.–6:00 p.m.
Thomas A. Reichardt; Sandia Natl. Labs, USA, President

AWE1 • 4:30 p.m. Invited

Ultrafast, High Power Laser Technologies: Challenges and Perspectives, *Koichi Yamakawa; Japan Atomic Energy Agency, Japan*. Recent advances in ultrafast, high power lasers using chirped-pulse amplification (CPA) are reviewed. Further development of emerging diode-pumped, cryogenically-cooled Yb-doped solid-state CPA lasers is also described.

LSWE2 • 4:30 p.m. Invited

Controlling Light-Matter Interactions Using Photonic Crystal Fibers, *Philip Russell; Max Planck Inst. for the Science of Light, Germany*. The hollow microstructure of photonic crystal fiber permits low-loss single-mode guidance in both solid and hollow cores, opening up many opportunities for improved control of light-matter interactions in, e.g., gas-laser devices, optical microfluidics and sensors.

LWD2 • 4:30 p.m.

Progress in Standoff LIBS Detection and Identification of Residue Materials, *Andrzej Miziolek, Frank DeLucia, Jennifer Gottfried, Chase Munson; ARL, USA*. The LIBS group at ARL/APG continues to advance the use of Laser Induced Breakdown Spectroscopy (LIBS) for standoff detection and identification of various residue materials, both hazardous and benign. Progress will be presented.

LSWE1 • 4:00 p.m.

Efficient THz Generation via Triply-Resonant Nonlinear Frequency Mixing: Towards On-Chip Turn-Key THz Sources, *Jorge Bravo-Abad¹, Alex W. Rodriguez¹, Peter T. Rakich², John D. Joannopoulos¹, Steven G. Johnson¹, Marin Soljačić¹; ¹MIT, USA, ²Sandia Natl. Labs, USA*. We show how the light-confining properties of triply-resonant photonic resonators enable dramatic enhancements of the conversion efficiency of THz generation via nonlinear frequency down-conversion processes, opening the way to room-temperature on-chip turn-key THz sources.

LWD1 • 4:00 p.m. Invited

Laser-Induced Breakdown Spectroscopy (LIBS) for the Rapid Field Identification and Classification of Pathogenic Bacteria, *Steven J. Rehse, Qassem Mohaidat, Sunil Palchoudhuri; Wayne State Univ., USA*. LIBS has been utilized to spectrally fingerprint multiple species of bacteria. Differences in the atomic composition of these bacteria allow a real-time classification and identification of unknown samples after a computerized chemometric analysis.

LWD3 • 4:45 p.m.

Nd:YAG-CO₂ Double-Pulse Laser Induced Breakdown Spectroscopy for Explosive Detection, *Matthew Weidman¹, Matthieu Baudelet¹, Michael E. Sigman², Paul J. Dagdigan³, Martin Richardson¹; ¹CREOL, College of Optics of Optics and Photonics, Univ. of Central Florida, USA, ²Natl. Ctr. for Forensic Science, Univ. of Central Florida, USA, ³Dept. of Chemistry, Johns Hopkins Univ., USA*. A double-pulse Nd:YAG-CO₂ LIBS scheme was applied to the analysis of an organic film of polystyrene and tested on 2,4,6-TNT residues. Different behaviors in atomic and molecular signals are interpreted and discussed for discrimination application.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWE • Ultrafast Lasers II—Continued

AWE2 • 5:00 p.m.

Demonstration of a 1 J Diode-Pumped Yb:YAG Chirped Pulse Amplification Laser System, *Brendan A. Reagan, Federico J. Furch, Bradley M. Luther, Alden H. Curtis, Shaun P. Meehan, Jorge J. Rocca; Colorado State Univ., USA.* We have demonstrated a compact diode-pumped chirped pulse amplification laser based on cryogenically-cooled Yb:YAG that produces 1 J, 8.5 ps duration pulses at 10 Hz repetition rate.

AWE3 • 5:15 p.m.

80-nJ Multipass-Cavity Chirped-Pulse Cr⁴⁺:Forsterite Laser, *Huseyin Cankaya¹, James G. Fujimoto², Alphan Sennaroglu¹; ¹Koc Univ., Turkey, ²MIT, USA.* By using 8.5 W of incident pump power, we obtained 80-nJ, 5.5-ps pulses at 1260 nm with a spectral width of 17 nm from a multipass-cavity, chirped-pulse Cr⁴⁺:forsterite laser operated at 4.9-MHz repetition rate

AWE4 • 5:30 p.m.

Ultra-Broadband (> 500 nm) Single-Walled Carbon Nanotube Saturable Absorber Mode-Locking of Bulk Solid-State Lasers, *Won Bae Cho¹, Jong Hyuk Yim¹, Sun Young Choi¹, Soonil Lee¹, Dong-Il Yeom¹, Kihong Kim¹, Fabian Rotermund¹, Andreas Schmid², Günter Steinmeyer², Valentin Petrov², Utwe Griebner²; ¹Ajou Univ., Republic of Korea, ²Max-Born-Inst., Germany.* Femtosecond mode-locking of Yb:KYW at 1.04 μ m, Cr:forsterite at 1.25 μ m and Cr:YAG at 1.50 μ m lasers using one and the same transmission-type single-walled carbon nanotube saturable absorber is demonstrated.

LSWE • Laser Technology II—Continued

LSWE3 • 5:00 p.m.

Invited

Title to Be Announced, *Peter Moulton; Q-Peak Inc., USA.* Abstract not available.

LWD • LIBS and Standoff Detection of Hazardous Materials—Continued

LWD4 • 5:00 p.m.

Spatial Confinement Effects in Laser-Induced Breakdown Spectroscopy, *X. K. Shen, X. N. He, H. Huang, Y.F. Lu; Univ. of Nebraska, USA.* It is very important to improve the detection sensitivity of laser-induced breakdown spectroscopy. In this work, spatial confinement effects of laser-induced Al plasmas using cylindrical walls have been investigated by emission spectra and fast imaging.

LWD5 • 5:15 p.m.

Invited

Standoff Detection of Vapor and Trace Amounts of Explosives by Raman Technique, *Henric Östmark, Sara Wallin, Anna Pettersson, Anneli Ehlerding, Ida Johansson, Markus Nordberg; FOI, Swedish Defence Res. Agency, Sweden.* The large distances required pose several physical difficulties: The intensity of the return light decreases inversely with the distance squared, absorption losses in air (wavelength dependent) and scattering losses in air (wavelength dependent).

LWD6 • 5:45 p.m.

Detection of Surface-Bound Organophosphate Compounds with Dual-Pulse Photofragmentation / Laser-Induced Fluorescence, *Jeffrey M. Headrick, Roger L. Farrow, Scott E. Bisson, Thomas A. Reichardt, Thomas J. Kulp; Sandia Natl. Labs, USA.* We present a new method for remotely detecting organophosphate-containing chemicals on surfaces. The approach employs two laser pulses - the first to fragment the analyte; the second to measure a selected fragment using laser-induced fluorescence.

Emerald Ballroom Advanced Solid-State Photonics (ASSP)	Topaz Room Applications of Lasers for Sensing and Free Space Communications (LS&C)	Diamond Room Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)
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AWE • Ultrafast Lasers II—Continued
AWE5 • 5:45 p.m.

200 W Picosecond Fiber Laser for External Cavity Enhancement: Toward 1 MW Average Power, *Loïc Meignien¹, François Labay², Johan Bouillet², Ronic Chiche¹, Didier Jehanno¹, Viktor Soskov¹, Fabian Zomer¹, Eric Cormier²; ¹Lab de l'Accélérateur Linéaire, Univ. Paris Sud, France, ²CELI, Univ. de Bordeaux I, France.* We demonstrate a picosecond amplifier generating 202 W of average power at 1032 nm with narrow linewidth. We achieve a diffraction limited and stable beam suitable for Fabry-Perrot enhanced Compton scattering based X/γ-rays production.

AWE6 • 6:00 p.m.

Picosecond Fiber Source for Coherent Raman Microscopy, *Khanh Kieu^{1,2}, Brian G. Saar³, Gary R. Holtom³, X. Sunney Xie³, Frank W. Wise²; ¹College of Optical Sciences, Univ. of Arizona, USA, ²Cornell Univ., USA, ³Harvard Univ., USA.* We report a high power picosecond fiber laser system for coherent Raman microscopy (CRM). The laser system was used to pump an optical parametric oscillator to produce the pump and the Stokes beams for CRM.

AWE7 • 6:15 p.m.

Efficient Ignition of a Real Automobile Engine by a High Brightness, Passively Q-Switched Cr:YAG/Nd:YAG Micro-Laser, *Masaki Tsunekane¹, Takunori Taira¹, Takayuki Inohara², Kenji Kanehara²; ¹Inst. for Molecular Science, Japan, ²Nippon Soken Inc., Japan.* A 0.3PW/sr-cm², high brightness passively Q-switched Cr:YAG/Nd:YAG micro-laser was tested for ignition of a real automobile engine. Stable engine operation was demonstrated with an ignition optical energy of 2.3mJ, lowest ever reported.

NOTES

• **Monday, February 1, 2010** •

Emerald Ballroom

8:00 p.m.–9:36 p.m.

APDP • ASSP Postdeadline Session

James Kafka; Newport/Spectra-Physics., USA, Presider

APDP1 • 8:00 p.m.

Generation of 2-kHz, 40-mJ Picosecond Pulses from a Cryogenic Yb:YAG Chirped-Pulse Amplifier for OPCPA Pumping, *Kyung-Han Hong¹, Juliet Gopinath², Darren Rand², Aleem Siddiqui¹, Shu-Wei Huang¹, Enbang Li³, Benjamin Eggleton³, John Hybl², Tso Yee Fan², Franz X. Kärtner¹*; ¹MIT, USA, ²MIT Lincoln Lab, USA, ³Univ. of Sydney, Australia. A 2-kHz, 40-mJ picosecond laser system based on chirped-pulse amplification with cryogenic Yb:YAG is demonstrated. 6.5-mJ, ~15-ps pulses with ~0.3% rms energy-stability are obtained from a regenerative amplifier and amplified to 80-W average power.

APDP2 • 8:12 p.m.

400W Resonantly Pumped Cryogenic Er:YAG Slab Laser at 1645nm, *Michael J. Shaw, Scott D. Setzler, Kenneth M. Dimndorf, James A. Beattie, Mark J. Kukla, Evan P. Chicklis*; BAE Systems, Inc., USA. We report a diode face-pumped, face-cooled, Er:YAG slab cryo-oscillator producing 420W quasi-cw at 50% duty-cycle and 386W cw near 1645nm with 0.16nm linewidth, believed to be the highest average power reported for any Er:YAG laser.

APDP3 • 8:24 p.m.

First Theoretical and Experimental Demonstration of Quantum Correlations of Triple Photons, *Audrey Dot¹, Kamel Bencheikh², Benoît Boulanger¹, Ariel Levenson², Patricia Segonds¹, Antoine Gérardin¹, Corinne Félix¹*; ¹Inst. Neel, Joseph Fourier Univ., France, ²Lab de Photonique et Nanostructures CNRS, France. We give prominence to the first experimental and theoretical demonstration of quantum correlations of triple photons produced by a true phase-matched third order non linear process in a KTP crystal pumped at 532 nm.

APDP4 • 8:36 p.m.

High Average Power 5 GW Peak Power Fiber Laser Pumped Few-Cycle OPCPA System, *J. Rothhardt¹, S. Hädrich¹, E. Seise¹, F. Tavella², A. Willner², S. Düstere², H. Schlarb², J. Feldhaus², J. Limpert^{1,3}, J. Rossbach^{2,4}, A. Tünnermann^{1,3}*; ¹Institute of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, ²Deutsches Elektronensynchrotron DESY, Germany, ³Helmholtz-Institut Jena, Germany, ⁴Univ. Hamburg, Germany. We report on a few-cycle OPCPA-system delivering 8 fs, 70 μ J pulses at 96 kHz repetition rate. Furthermore CEP stabilization is implemented and high harmonic generation up to the 35th order is demonstrated.

APDP5 • 8:48 p.m.

Few-Cycle OPCPA System at 143 kHz with More than 1 μ J of Pulse Energy, *Marcel Schultze¹, Thomas Binhammer², Andy Steinmann¹, Guido Palmer¹, Moritz Emons¹, Uwe Morgner^{1,3,4}*; ¹Leibniz Univ. Hannover, Germany, ²VENTEON Laser Technologies GmbH, Germany, ³Ctr. for Quantum Engineering and Space-Time Research (QUEST), Germany, ⁴Laser Zentrum Hannover e.V., Germany. An OPCPA system delivering 8.8 fs pulses with 1.3 μ J of energy at 143 kHz repetition rate is presented. Pump and seed for the parametric amplification are simultaneously generated by a broadband Ti:sapphire oscillator.

APDP6 • 9:00 p.m.

Power-Scalable Photonic Bandgap Fiber Sources with 167 W, 1178 nm and 14.5 W, 589 nm Radiations, *Akira Shirakawa¹, Christina B. T. Olausson¹, Meishin Chen¹, Ken-ichi Ueda¹, Jens K. Lyngsø², Jes Broeng²*; ¹Inst. for Laser Science, Univ. of Electro-Communications, Japan, ²NKT Photonics A/S, Denmark. 1178nm ytterbium-doped photonic bandgap fiber amplifier with strictly amplified-spontaneous-emission-free, 167W output has been achieved with 61% slope efficiency. Single-pass frequency doubling to 14.5W 589nm light was also demonstrated with 34% conversion efficiency.

APDP7 • 9:12 p.m.

20-fs 1.6-mJ Pulses from a cw-Diode-Pumped Single-Stage 1-kHz Yb Amplifier, *Giedrius Andriukaitis¹, Daniil Kartashov¹, Audrius Pugžlys¹, Dušan Lorenč¹, Andrius Baltuška¹, Linas Gimiūnas², Romualdas Danielius², Ömer F. Ilday³*; ¹Photonics Inst., Univ. of Technology, Austria, ²Light Conversion Ltd., Lithuania, ³Bilkent Univ., Turkey. 200-fs 2.5-mJ pulses from a fiber-oscillator-seeded DPSS Yb:CaF₂ MOPA are spectrally broadened in Ar and recompressed to 20 fs using a pair of LAK14 prisms. Multi-millijoule 12-fs pulses are feasible upon higher-order spectral phase correction.

APDP8 • 9:24 p.m.

High Efficiency Mid-IR Second Harmonic Generation in Orientation Patterned GaAs Waveguides, *Moshe B Oron, Shaul Pearl, Pinhas Blau*; Soreq NRC, Israel. 21%W⁻¹ SHG efficiency at 4 μ m was demonstrated in OPGaAs waveguides. The high efficiency is attributed to record low waveguide loss of 1.0db/cm, high material quality periodically grown structure and accurate modeling of waveguide effective indices.

• **Monday, February 1, 2010** •

Diamond Room

8:00 p.m.–9:00 p.m.

LPDP • LACSEA Postdeadline Session

Gerard Wysocki; Princeton Univ., USA, Presider

LPDP1 • 8:00 p.m.

Mid Infrared Tunable Diode Laser Spectrometer for Sensitive Detection of Acetylene, *Stefan H. Lundqvist, Pawel Kluczynski; Siemens AB, Sweden*. A Mid Infrared Tunable Diode Laser spectrometer utilizing Wavelength Modulation Spectroscopy for sensitive detection of acetylene has been designed. A sensitivity of 18 ppb m at an integration time of 3 seconds was achieved.

LPDP2 • 8:15 p.m.

Sensors at ppb Sensitivity or Better Based on Multiple Line Integration Spectroscopy Techniques, *Gottipaty N. Rao, Andreas Karpf; Adelphi Univ., USA*. Employing integrated absorption of multiple lines or summation of the absolute values of the wavelength modulation spectroscopy signals, we report sensitivities of ppb for the detection of trace gases.

LPDP3 • 8:30 p.m.

Frequency-Dependent Lower-State Energy: A New Spectroscopic Parameter Useful for Designing Laser-Based Thermometers, *Xinliang An¹, Andrew W. Caswell², and Scott T. Sanders¹; ¹Univ. of Wisconsin, USA, ²Spectral Energies, LLC, USA*. A spectroscopic transition's temperature sensitivity is characterized by its lower-state energy. Here, we define a related parameter that is not fundamental but is a continuous function of frequency and applies to broadened and blended spectra.

LPDP4 • 8:45 p.m.

Vertical Cavity Laser Hygrometer for the National Science Foundation Research Jet, *Mark E. Paige¹, Steven M. Massick¹, Joel A. Silver¹, Mark A. Zondlo²; ¹Southwest Sciences, Inc., USA, ²Dept. of Civil and Environmental Engineering, Ctr. for Mid-Infrared Technologies for Health and the Environment, Princeton Univ., USA*. A vertical cavity diode laser hygrometer has been constructed for performing atmospheric measurements on the National Science Foundation research jet. The design of the hygrometer and its flight performance are presented.

• **Wednesday, February 3, 2010** •

Diamond Room

1:30 p.m.–3:30 p.m.

LWC • Spectroscopy for Security and Biochemical Sensing

Wolfgang Schade; Technische Univ. Clausthal, Germany, Presider

LWC3P

Microwave-Assisted LIBS: Towards a New Tool for Trace Element Detection and Molecular Plasma Spectrochemistry, *Yuan Liu, Matthieu Baudelet, Martin Richardson; CREOL, College of Optics of Optics and Photonics, USA*. This study shows the modification of molecular and atomic signals in microwave-assisted laser-induced plasma spectroscopy and the potential for trace element detection and molecular plasma spectroscopy.

Key to Authors and Presidents

(**Bold** denotes President or Presenting Authors)

A

Abell, Joshua—LMA2
Abramov, M.—AWA1
Abshire, Jim—LMC3, LMC6
Adamovich, Igor—LWA2
Aguiló, Magdalena—ATuA3, ATuA6
Ahirakawa, Akira—AMB16
Ahmad, Izhar—**AMB9, AMD5**
Akahane, Yutaka—**ATuA8**
Åkesson, Susanne—JTua4
Akiyama, Jun—**ATuB3**
Akpovo, Charlemagne C.—LMD7, **LMD8**
Aldén, Marcus—LMD2
Alessi, D.—AMA5
Allan, Graham—LMC3
Altmann, Konrad—AMB25
Amzajerdian, Farzin—AMC1, **LSWE**
Andersen, Thomas V.—AWA2
Andriukaitis, Giedrius—**AWC8**
Anstett, Gregor—**AWD3**
Antal, Peter Gyula—**AMB17**
Aoyama, Makoto—ATuA8
Apolonski, Alexander—AWC6
Aravazhi, Shanmugam—ATuB2
Arisholm, Gunnar—AWD2
Arita, Y.—LTuC1
Arndt, C.—JTua2
Aziz, M. S. I.—LMB1

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Backus, Sterling J.—AWB9
Badikov, Dmitrii V.—ATuA4
Badikov, Valerii V.—ATuA4
Baer, Cyrill R. E.—AMD1, **AMD2**
Bailey, Eric S.—**LSWB3**
Baker, J. T.—AMA1
Balembois, François—AMB11, ATuB6
Baltuška, Andrius—**AME**, AWC8
Barbarin, Yohan—ATuB7
Barnes, Lawrence—LSWC3
Barnett, Cleon—LMD8
Bartels, Albrecht—AWC3
Bartelt, Hartmut—AMB23
Bartley, Tim—LSTuA3
Barup, Kerstin—JTua4
Basiev, Tasoltan T.—**AMB22**, ATuA4
Bass, Michael—AMB5
Batet, Oscar—LMA4
Bathel, Brett—LWA2
Baudelet, Matthieu—**LWC2, LWD3**
Bauer, Christoph—**LTuC3**, LWC5
Baykal, Yahya K.—**LSTuA4**
Becker, Martin—AMB23
Beecher, Stephen—AWB7
Beigang, René—**LTuA4, SC351**

Belenkii, Mikhail—**LSMB5**
Belenky, Gregory—LMA5
Bellanger, Cindy—AMA3
Bellini, Nicola—AMB27
Bello-Doua, Ramatou—AWA5
Belmonte, Aniceto—**LSTuA1**
Benayad, Abdelmjid—AWB26
Benedick, Andrew—**AWC4**
Bennion, Ian—AWB8
Beresnev, Leonid—LSMA1
Bernacki, Bruce E.—LWC6
Bernhardi, Edward—ATuB2
Bernhardt, Birgitta—AWC6
Bewley, William W.—LMA2
Beyrau, Frank—LTuB1
Bigourd, Damien—**AME3**
Binhammer, Thomas—AMD6, AWC2
Birch, Rolf B.—AWB4
Bisson, Scott E.—LWD6
Black, John D.—**LWB5**
Black, Paul—LWB1
Bohman, Axel—LMC5, LMD3
Bomse, Daivd S.—LMB3
Bonville, Odile—ATuA24
Boroson, Don—**LSTuC3**
Borysow, Jacek—LTuC4
Boullet, Johan—**AWA5**, AWE5
Boulon, Georges—**ATuB1**
Boxx, I.—JTua2
Boyd, Robert W.—**LSWC3**
Boyland, Alexander—AMB3
Braje, Danielle A.—AWC3
Branch, John W.—**LMD7**
Brandt, Christian—**AMB15**
Bravo-Abad, Jorge—**LSWE1**
Brignon, Arnaud—AMA3
Bromage, Jake—**AME5, ATuA23**
Bronder, T. J.—AMA1
Brown, Christian T. A.—ATuA1, ATuA5
Brown, Staci—LMD8
Brübach, Jan—**LWA5**
Brückner, Sven—AMB23
Bruekner, Daniela—LMB5
Brydegaard, Mikkel—JTua4
Bucholtz, Frank—**LSMC4**
Buchvarov, Ivan—AWD5
Burgmeier, Jörg—LWC4
Burnham, Ralph—**LSTuB4**
Burns, David—ATuA14, ATuA15, AWB16,
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Burris, Harris—LSMA2, **LSMC4**
Burris, John—LMC6

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Cai, Weiwei—LWA4
Calvez, Stephane—ATuA1, AWB3, AWB5
Camargo, Fabiöla A.—ATuA12
Camy, Patrice—AWB26
Canal, Philippe—ATuA24
Canalias, Carlota—AMC6
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Cankaya, Huseyin—AWE3
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Carter, C. D.—JTua2
Carvajal, Joan Josep—ATuA3, ATuA6
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Chen, Ying—AMB5
Chenevier, Marc—LMD4
Cheng, Haynes P. H.—ATuA19
Chiche, Ronic—AWE5
Cho, Won Bae—ATuA3, AWE4
Choi, Sun Young—ATuA3, AWE4
Chow, Chi-Wai—AWB12
Chuchumishev, Danail—AWD5
Clarkson, Andy—LMD3
Clausnitzer, Tina—AMB23, AME2
Coddington, Ian—LTuA3
Codemard, Christophe A.—AMB3, ATuA16,
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Collier, John L.—AME1, AWB20
Constant, Eric—ATuA7
Cormier, Eric—AWA5, AWE5
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Cousin, Julien—LMD4
Coutts, David W.—**ATuB5**
Curtis, Alden H.—AMA5, AWE2
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Danehy, Paul M.—LWA2
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Dantus, Marcos—LTuA2
Das, Santanu—**LSTuB**
Daugherty, Dave—LSTuC1
Davies, Paul—LMA1

Dawson, Martin D.—ATuA1, AWB3, AWB4, AWB5
 Day, Timothy—**JTuA1**, LTuD2
 Degnan, John J.—**LSWA4**
 Deibel, Jason A.—LWA4
 Delaigue, Martin—**AWB26**
 DeLucia, Frank—LWD2
 Dergachev, Alex—**AMC5**
 Díaz, Francesc—ATuA3, ATuA6
 Diddams, Scott A.—AWC3
 Didierjean, Julien—AMB11
 Dierking, Matthew P.—LSWB3
 Dogariu, Arthur—**LMC4**
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 Dong, Lei—**LMD5**
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 Douglas, Jeff—LSTuC1
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 Dubinskii, Mark—**AMC3**, **ATuB**, **AWB1**
 Dubrasquet, Romain—AWA5
 Dudley, John M.—AWC1
 Dunn, Malcolm H.—ATuA15
 Duxbury, Geoffrey—**LWB1**

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Eberhardt, Ramona—AMB24
 Ehlerding, Anneli—LWD5
 Eidam, Tino—AMB4, **AWA2**, AWB14, AWC6
 Ellrich, F.—LTuA4
 Elser, Dominique—LSTuA3
 Emons, Moritz—AMB27, **AMD6**
 Epstein, Ryan J.—ATuA10, LSWA1
 Ertel, Klaus—**AWB20**
 Ewart, P.—**LTuC1**
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 Fan, T. Y.—AWB22
 Farrow, Roger L.—LWD6
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 Faye, David—LMD3
 Fechner, Matthias—ATuB4
 Fedin, Alexander V.—AMB22
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 Fejer, Martin M.—AME4, **SC344**
 Ferguson, Heather—AMB11
 Ferin, A.—AWA1
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 Fetzer, Gregory J.—ATuA10, LSWA1
 Fink, Manfred K.—**LTuC4**

Fitzpatrick, Fran—LSTuB4
 Flamant, Pierre—LMC5
 Flores, Angel—AMA1
 Foley, Elizabeth L.—LSTuB5
 Fomin, V.—AWA1
 Fonnum, Helge—ATuA25
 Fortier, Tara M.—AWC3
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 Fried, Alan—LMA4, LMB6
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 Fujita, Masayuki—AWB21
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 Gabler, Thomas—AWA2
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 Gianella, Michele—LTuD4
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 Gimmetstad, Gary G.—**LSMB4**
 Giniūnas, Linas—AWC8
 Glenday, Alex—AWC4
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 Graves, Buzz—LSTuC1
 Greszik, Daniel—**LWA6**
 Griebner, Uwe—**ATuA3**, ATuA6, AWD5, **AWE4**
 Griffin, Robert—LTuD2

Grilli, R.—LMB1
 Grisard, Arnaud—LMD3
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 Gruneisen, Mark T.—**LSMC3**
 Gu, Erdan—AWB4
 Guan, Zuguang—JTU4
 Guina, Mircea—ATuA10
 Gunaratne, Tissa C.—LTuA2
 Guo, Hong—LSMC5, **LSMD2**, LSMD3
 Gupta, J. A.—ATuA1

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 Hädrich, Steffen—**AMA4**, AMB23, AMB4, AME2, AME6
 Hadzialic, S.—LSWD2
 Hageman, William B.—**AMB5**
 Hajjarian, Zeinab—LSWB1
 Halonen, Lauri—LMD1
 Hamilton, D.—LMB1
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 Han, X.—ATuA5
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 Hanf, Stefan—AWA2
 Hanna, Marc—AMA3, AMB1
 Hänsch, Theodor—AWC6
 Hansen, Nils-Owe—**ATuB4**
 Hanson, Ron K.—**LWB3**
 Hardy, Bertrand—LMC2
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 Hartmann, Olivier—ATuA24
 Hasselbrack, William—LMC3
 Hastie, Jennifer E.—AWB3, **AWB5**
 Haus, Joseph W.—LSWB3
 Hay, Kenneth G.—LWB1
 He, Qunfeng—LSMB2
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 Headrick, Jeffrey M.—**LWD6**
 Hecht, Christian—LWB2
 Heckl, Oliver H.—**AMD1**, AMD2
 Hedenström, Anders—JTU4
 Heese, Clemens—**AME4**
 Heim, Bettina—**LSTuA3**
 Hein, Joachim—AWB19
 Heinecke, Dirk C.—**AWC3**
 Hellström, Jenny—JTU4
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 Henion, Scott R.—LSMA4
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 Hernandez-Gomez, Cristina—AME1, ATuA18, AWB20
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 Hoffmann, Dieter—**ATuA13**
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 Hollberg, Leo—**AWC3**
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 Hopkins, John-Mark—**ATuA14, ATuA15, AWB3**
 Horesh, Moran—**LSWA2**
 Hovde, David C.—**LMB3**
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 Hugonnot, Emmanuel—**AME3**
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 Jakutis Neto, Jonas—**ATuA12**
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 Javidi, B.—**LSWB2**
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 Jelínková, Helena—**ATuA27**
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 Kahn, Joseph M.—**LSTuA1**
 Kaiser, Sebastian A.—**LWA1**
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 Kaminski, Clemens F.—**LMB2**
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 Kärtner, Franz X.—**AMC5, AWC4**
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 Kisel, Viktor E.—**ATuA1**
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- I**
Ilday, Ömer F.–APDP7
- K**
Kärtner, Franz X.–APDP1
Kafka, James–**APDP**
Karpf, Andreas–LPDP2
Kartashov, Daniil–APDP7
Kluczynski, Pawel–LPDP1
Kukla, Mark J.–APDP2
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Levenson, Ariel–APDP3
Li, Enbang–APDP1
Limpert, Jens–APDP4
Liu, Yuan–LWC3P
Lorenc, Dušan–APDP7
Lundqvist, Stefan H.–**LPDP1**
Lyngsø, Jens K.–APDP6
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Massick, Steven M.–LPDP4
Morgner, Uwe–APDP5
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Olausson, Christina B. T.–APDP6
Oron, Moshe B–APDP8
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Paige, Mark E.–**LPDP4**
Palmer, Guido–APDP5
Pearl, Shaul–**APDP8**
Pugžlys, Audrius–APDP7
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Rand, Darren–APDP1
Rao, Gottipaty N.–**LPDP2**
Richardson, Martin–LWC3P
Rossbach, Jörg–APDP4
Rothhardt, Jan–**APDP4**
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Sanders, Scott T.–**LPDP3**
Schlarb, Holger–APDP4
Schultze, Marcel–**APDP5**
Segonds, Patricia–APDP3
Seise, Enrico–APDP4
Setzler, Scott D.–APDP2
Shaw, Michael J.–**APDP2**
Shirakawa, Akira–**APDP6**
Siddiqui, Aleem–APDP1
Silver, Joel A.–LPDP4
Steinmann, Andy–APDP5
- T**
Tavella, Franz–APDP4
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- U**
Ueda, Ken-ichi–APDP6
- W**
Willner, Arik–APDP4
Wysocki, Gerard–**LPDP**
- Z**
Zondlo, Mark A.–LPDP4

Lasers, Sources and Related Photonic Devices

January 31 – February 3, 2010
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Boston Electronics are specialists in photodetectors, in light sources associated with photodetectors, and in related signal processing electronics. Boston Electronics is exclusive North American agent for IR Quantum Cascade Lasers from Alpes Lasers SA in Switzerland and for fast non-cryogenic IR Detectors from Vigo System S.A. in Poland. In the UV, visible and NIR we have solid state UV photodiodes, single photon counting visible-NIR APDs, and Time Correlated Single Photon Counting electronics modules.

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EKSMA Optics is a global supplier of precision optical components with laser quality coatings and laser & nonlinear crystals for UV, VIS and IR applications. EKSMA Optics quality control labs and polishing facility ensure high-quality and consistent performance. Product range includes optical components made of FS, BK7, Quartz, Calcite, CaF₂, BaF₂, LiF, ZnSe, Sapphire and crystals including Yb:KGW, Yb:KYW, LBO, BBO, KTP, KD*P, LiIO₃, AgGaSe₂, AgGaS₂, ZnGeP₂, GaSe, ZnTe, KGW, Ba(NO₃)₂.

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[IPG Photonics Corporation](http://www.ipgphotonics.com) is the world leader in fiber lasers and amplifiers. IPG, headquartered in Oxford, Massachusetts, has offices throughout the world. IPG manufactures active fiber lasers, direct diodes and fiber amplifiers operating at 0.5 – 2 microns. We have shipped more than 1,000 fiber lasers for scientific applications to universities and laboratories worldwide. IPG's 1um and 1.5um fiber lasers and amplifiers are particularly popular in single-frequency and linearly-polarized variants; providing products having the best available combination of performance, reliability and price. For more information, please contact Diana Ferreira at dferreira@ipgphotonics.com, or 508.373.1271.

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LAS-CAD GmbH presents new version 3.6 of the program LASCAD, which provides a unique combination of simulation tools for LASer Cavity Analysis and Design. Thermal and Structural Finite Element Analysis, Gaussian ABCD Algorithm, and Physical Optics BPM Code are integrated for the first time in one software package to analyze thermal lensing, stability, power output and beam quality of solid state lasers. Version 3.6.1 offers new tool DMA for dynamic analysis of multimode and Q-switched operation. Konrad Altmann, President, dr.altmann@las-cad.com; Harry Skolnik, US sales, hskolnik@comcast.net.

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Laser Operations LLC, manufacturer of the industry leading QPC Lasers product line, is a vertically integrated laser diode manufacturer shipping high brightness lasers globally into several markets including medical, defense, industrial, and consumer displays, from its high volume 40,000 sq. ft. laser manufacturing facility located in Sylmar, CA. Laurent Vaissie, VP of Marketing and Sales, lvaissie@laseroperations.net; Ed McIntyre, Director of North American Sales, emcintyre@laseroperations.net

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Nufern® is a leading U.S. manufacturer of specialty optical fibers, fiber lasers and amplifiers serving diverse markets. Current products include over 300 standard fibers and range from sub-assemblies to complete turn-key fiber lasers and amplifiers. From its headquarters in East Granby, Conn., USA, Nufern's integrated fiber and fiber laser teams also provide rapid and cost-effective OEM fiber laser design, assembly and contract manufacturing services.

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Sacher Lasertechnik is leading manufacturer of high power tunable external cavity diode lasers. Intellectual property is covered by several patent families. Products include tunable external cavity diode lasers in Littman/Metcalf configuration and in Littrow configuration, DFB laser systems, low noise laser controllers, Frequency Doubled Laser Systems (SHG, FHG), and Argon Ion Lasers. Highlights are high power single mode and narrow linewidth tunable diode lasers with output power above 2500mW.

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Lasers, Sources and Related Photonic Devices OSA Optics & Photonics Congress 2010 Update Sheet

Withdrawals:

AWB8
AWE5
LSTuB2

Presider Updates:

Iain T. McKinnie; Kapteyn-Murnane Labs, USA, will preside over session **AMD • Ultrafast Lasers I**, on Monday, February 1, 2:30 p.m.– 4:00 p.m. in the Emerald Ballroom.

Larry Andrews; Univ. of Central Florida, USA, will preside over session **LSMB • Laser Communication Systems and Channel Characterization for Laser Comm Systems**, on Monday, February 1, 10:30 a.m.–1:00 p.m. in the Topaz Room.

Paul McManamon; Exciting Technology LLC, USA, will preside over session **LSTuA • Optical Receivers**, on Tuesday, February 2, 10:30 a.m.–12:30 p.m. in the Topaz Room.

Axel Ruehl; IMRA America, Inc., USA, will preside over session **AWD. Nonlinear Optics**, on Wednesday, February 3, 2:30 p.m.– 4:00 p.m. in the Emerald Ballroom.

Takunori Taira; Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan, will preside over session **AWE • Ultrafast Lasers II**, on Wednesday, February 3, 4:30 p.m.–6:30 p.m. in the Emerald Ballroom.

Dennis K. Killinger; Univ. of South Florida, USA, will preside over session **LSWA • Ladar Systems I**, on Wednesday, February 3, 8:00 a.m.–10:00 a.m. in the Topaz Room.

Paul McManamon; Exciting Technology LLC, USA, will preside over session **LSWB • Ladar Systems II**, on Wednesday, February 3, 10:30 a.m.–12:00 p.m. in the Topaz Room.

Peter Moulton; Q-Peak Inc., USA, will preside over session **LSWD • Laser Technology I**, on Wednesday, February 03, 2:30 p.m.–3:30 p.m. in the Topaz Room.

Edward Watson; AFRL, USA, will preside over session **LSWE • Laser Technology II**, on Wednesday, February 3, 4:00 p.m.–5:30 p.m. in the Topaz Room.

Substituted Papers:

The following paper will be presented in the **LSMA2** time slot: **Lasercom Demonstration in Maritime Environment for Tactical Applications**, *Juan C. Juarez¹, Joseph E. Sluz¹, David W. Young¹, Raymond M. Sove¹, Charles Nelson², Frederic M. Davidson²; ¹Applied Physics Lab, Johns Hopkins Univ., USA, ²Johns Hopkins Univ., USA*. Results of a lasercom demonstration in the maritime environment conducted off the mid-Atlantic coast near Wallops Island, VA, in July and September 2009 will be presented and performance of the optical channel will be discussed.

Presenter Changes:

AWD2, Novel Concept for Generating High Beam Quality from High Pulse Energy Optical Parametric Oscillators will now be presented by *Øystein Farsund; FFI, Norwegian Defence Res. Establishment, Norway*.

The following presentation's title and presenter have been changed: **LWC1, Perspectives of Laser Spectroscopic Methods for Security, Industrial and Biochemical Applications** will now be presented by *Peter Jander; Fraunhofer-Inst. für Lasertechnik Aachen, Germany*.

Postdeadline Paper Programs:

Postdeadline Paper Programs are available at Registration.

Lasers, Sources and Related Photonic Devices

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Update Sheet

Withdrawals:

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Larry Andrews; Univ. of Central Florida, USA, will preside over session **LSMB • Laser Communication Systems and Channel Characterization for Laser Comm Systems**, on Monday, February 1, 10:30 a.m.–1:00 p.m. in the Topaz Room.

Paul McManamon; Exciting Technology LLC, USA, will preside over session **LSTuA • Optical Receivers**, on Tuesday, February 2, 10:30 a.m.–12:30 p.m. in the Topaz Room.

Axel Ruehl; IMRA America, Inc., USA, will preside over session **AWD. Nonlinear Optics**, on Wednesday, February 3, 2:30 p.m.– 4:00 p.m. in the Emerald Ballroom.

Takunori Taira; Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan, will preside over session **AWE • Ultrafast Lasers II**, on Wednesday, February 3, 4:30 p.m.–6:30 p.m. in the Emerald Ballroom.

Dennis K. Killinger; Univ. of South Florida, USA, will preside over session **LSWA • Ladar Systems I**, on Wednesday, February 3, 8:00 a.m.–10:00 a.m. in the Topaz Room.

Paul McManamon; Exciting Technology LLC, USA, will preside over session **LSWB • Ladar Systems II**, on Wednesday, February 3, 10:30 a.m.–12:00 p.m. in the Topaz Room.

Peter Moulton; Q-Peak Inc., USA, will preside over session **LSWD • Laser Technology I**, on Wednesday, February 03, 2:30 p.m.–3:30 p.m. in the Topaz Room.

Edward Watson; AFRL, USA, will preside over session **LSWE • Laser Technology II**, on Wednesday, February 3, 4:00 p.m.–5:30 p.m. in the Topaz Room.

Substituted Papers:

The following paper will be presented in the **LSMA2** time slot: **Lasercom Demonstration in Maritime Environment for Tactical Applications**, *Juan C. Juarez¹, Joseph E. Sluz¹, David W. Young¹, Raymond M. Sove¹, Charles Nelson², Frederic M. Davidson²; ¹Applied Physics Lab, Johns Hopkins Univ., USA, ²Johns Hopkins Univ., USA*. Results of a lasercom demonstration in the maritime environment conducted off the mid-Atlantic coast near Wallops Island, VA, in July and September 2009 will be presented and performance of the optical channel will be discussed.

Presenter Changes:

AWD2, Novel Concept for Generating High Beam Quality from High Pulse Energy Optical Parametric Oscillators will now be presented by *Øystein Farsund; FFI, Norwegian Defence Res. Establishment, Norway*.

The following presentation's title and presenter have been changed: **LWC1, Perspectives of Laser Spectroscopic Methods for Security, Industrial and Biochemical Applications** will now be presented by *Peter Jander; Fraunhofer-Inst. für Lasertechnik Aachen, Germany*.

Postdeadline Paper Programs:

Postdeadline Paper Programs are available at Registration.