OSA Advanced Solid State Lasers Conference and Exhibition (ASSL)

04 - 09 October 2015

WISTA-Technology Park

Adlershof-Berlin, Germany

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www.osa.org/assl

Willkommen to the Advanced Solid State Lasers Conference and Exhibition (ASSL)! We are excited to have you join us to share your latest research results, while hearing from your colleagues.

The ASSL Conference features a robust technical program with 33 invited speakers, more than 80 contributed talks and 3 poster sessions featuring 140 poster papers. The Plenary sessions feature Denis Balitsky from Cristal Laser in France, Roberto Osellame from Istituto di Fotonica e Nanotecnologie in Italy and Bedřich Rus from ELI Beamlines in Prague. In addition Holger Moench from Philips Photonics in Germany will join us at the banquet to present an entertaining talk about light in celebration of the International Year of Light.

ASSL is the only international event presenting materials, sources, and applications all in one meeting, in a single-track format. It builds on 30 years of the OSA-managed, former TSSL (1985-1989), ASSL (1990-2002), ASSP/AIOM/FILAS (2003-2012) meetings, including the last two years of the current-format, ASSL conference. The Materials program brings together international experts and researchers to review and discuss the advances in optics, materials science, condensed matter physics and chemistry relevant to the development, characterization and applications of new materials for lasers and photonics. The Sources program provides the world's premier forum for presenting advances in the source science and technology, aimed at some combination of improved power, efficiency and brightness, increased wavelength coverage, narrower and more stable frequencies and, for pulsed sources, shorter pulse widths. The Applications program connects the technical advances covered by Sources and Materials to applications of significance for attendees with prime interest in advancing the use, rather than the development of lasers and other coherent sources. Applications cover ways in which the advances in materials and sources highlighted by ASSL have an important impact on science and industry.

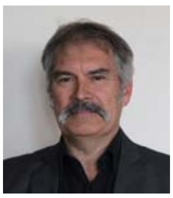
In addition to the technical program we have included various industry programs: an Industry Program Panel Discussion, an Industry Keynote presentation by Fredrich Dausinger the CEO of Dausinger + Giesen GmbH, a special workshop on how to communicate high tech for marketing and PR professional and the ASSL Exhibition. Be sure to spend time during the coffee breaks and lunch visiting and learning from the ASSL exhibitors as they represent all aspects of solid-state laser system design and implementation.

We all are very pleased to have you join this important yearly event and we look forward to a great meeting.

Ruxin Li

Shanghai Inst. of Optics and Fine Mechanics, China

General Chair



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Université de Caen, France

General Chair

Peter Moulton

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Hans Joachim Eichler, *Technische Universität Berlin, Institut für Optik, Germany*
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Beth Cohen, *IPG Photonics, USA*
Bjorn Wedel, *PT Photonic Tools GmbH, Germany*

Thank you to all the Advanced Solid State Lasers Committee Members for contributing many hours to maintain the high technical quality standards of OSA meetings.

General Information

Registration

The registration desk is located in the *Foyer A.*

Sunday, 4 October	09:30—19:00
Monday, 5 October	07:00—18:00
Tuesday, 6 October	07:00—18:30
Wednesday, 7 October	07:30—18:00
Thursday, 8 October	07:30—14:00
Friday, 9 October	07:30—15:00

Exhibition

The Exhibition is located throughout the venue and is open to all registered attendees. Visit a diverse group of companies, representing all aspects of solid-state laser system design and implementation. Coffee breaks, lunches and poster sessions will be held in conjunction with the exhibition.

Monday, 5 October Exhibition & Coffee Break Exhibition & Lunch Exhibition & Coffee Break	10:05—10:30 12:30—14:00 16:00—16:30
Tuesday, 6 October Exhibition, Posters & Coffee Break Exhibition & Lunch Exhibition & Coffee Break	10:10—11:40 12:30—14:00 16:00—16:30
Wednesday, 7 October Exhibition & Coffee Break Exhibition & Lunch Exhibition & Coffee Break	09:45—10:15 12:20—13:50 15:45—16:15
Thursday, 8 October Exhibition & Coffee Break	10:10—11:40

Lunch

Lunches are included with the technical registration from Monday, 5 October— Wednesday, 7 October and will be held in conjunction with the exhibition. This is an excellent time to visit with participating companies and see the latest products and innovations.
Additional lunch tickets are available for purchase at the registration desk for $45 USD.

Access to the Wireless Internet

1. Select the Wireless Network "OSA"
2. Enter the access code/password "ASSL2015"
3. Begin surfing the web to any website

The above access code and password are case sensitive.

Online Access to Technical Digest

Full Technical Attendees have both EARLY and FREE continuous online access to the ASSL technical digest and Postdeadline papers through OSA Publishing's Digital Library. The presented papers can be downloaded individually or by downloading .zip files (.zip files are available for 60 days).

1. Visit the conference website at www.osa.org/ASSL.
2. Select the "Access digest papers" link on the right hand navigation.
3. Log in using your email address and password used for registration. You will be directed to the conference page where you will see the .zip file link at the top of this page.
   [Note: if you are logged in successfully, you will see your name in the upper right-hand corner.]

Access is limited to Full Technical Attendees only. If you need assistance with your login information, please use the "forgot password" utility or "Contact Help" link.

Poster Presentation PDFs

Authors presenting posters have the option to submit the PDF of their poster, which will be attached to their papers in OSA Publishing's Digital Library. If submitted, poster PDFs will be available about two weeks after the meeting. While accessing the papers in OSA Publishing's Digital Library look for the multimedia symbol shown above.

About OSA Publishing's Digital Library

Registrants and current subscribers can access all of the meeting papers, posters and postdeadline papers on OSA Publishing's Digital Library. The OSA Publishing's Digital Library is a cutting-edge repository that contains OSA Publishing's content, including 16 flagship, partnered and co-published peer reviewed journals and 1 magazine. With more than 240,000 articles including papers from over 450 conferences, OSA Publishing's Digital Library is the largest peer-reviewed collection of optics and photonics.

Conference Program Update Sheet

All technical program changes will be communicated in the on-site Conference Program Update Sheet. All attendees receive this information with registration materials and we encourage you to review it carefully to stay informed to changes in the program.

Awards

OSA Foundation Travel Grant

In keeping with its mission to *promote the generation, application, archiving and worldwide dissemination of knowledge in optics and photonics*, The Optical Society (OSA) established the OSA Foundation in 2002 to carry out a wide range of charitable activities. The OSA Foundation benefits more than 7,000 people a year. The Foundation inspires future optics innovators, supports career development for optics students, recent graduates and young professionals, and recognizes distinguished achievement in the field through the presentation of awards and honors.

The OSA Foundation Student Travel Grant Program is designed to provide career development opportunities by assisting students who wish to attend conferences and meetings. The grants are given to students working or studying science in qualifying developing nations so they can attend OSA-managed technical meetings and conferences

We are pleased to announce The OSA Foundation Travel Grant recipient for
Advanced Solid State Lasers Conference
Konstantin Gorbachenya
Belarusian National Technical University, Belarus

IPG Student Paper Contest

IPG, ASSL's Premier Corporate Sponsor, provides funding for various paper presentation awards, which are determined by the General and Program Chair. All current students presenting a paper are eligible for these awards.

Lockheed Martin Student Paper Award

Lockheed Martin sponsors the Best Student Presentation Award. All papers presented by a current student are considered for this award.

Short Courses

Short Courses cover a broad range of topic areas at a variety of educational levels. The courses are taught by highly regarded industry experts in a variety of specialties. Short Courses are an excellent opportunity to learn about new products, cutting-edge technology and vital information at the forefront of your field. They are designed to increase your knowledge of a specific subject while offering you the experience of knowledgeable teachers. **Separate registration is required to attend.**

Short Courses are complimentary for Student Technical attendees. To ensure admittance to your preferred course register as soon as possible. Space is limit and the complimentary seats will sell out.

SC290 High Power Fiber Lasers and Amplifiers

Johan Nilsson; *Univ. of Southampton, UK*
Sunday, 4 October, 10:00—13:00

Course Level: Advanced Beginner
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
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.

SC426 Micro-structuring of Transparent Materials with Short and Ultra-short Laser Pulses

David Ashkenasi; *Technische Universität Berlin, Institut für Optik, Germany*
Sunday, 4 October, 10:00—13:00

Course Level: Advanced Beginner
Course Description: Goal of the course is to outline the principles in pulsed laser-interaction with transparent materials such as glass, quartz and sapphire. It will address the large variety of laser sources and processing schemes in laser micro machining of transparent work pieces. The structuring topics will cover several machining tasks such as precise cutting, drilling, bulk modifications, surface grooving and ripple formation. The course will concentrate on the influence of relevant laser parameters such as wavelength, pulse width, peak intensity and fluence that influence excitation and material reaction. Main intention of the course is to bridge between physical fundamentals and application-near innovation. In this context, one important aim of the course is to initiate a discussion in the audience, inquiring and comparing main advantages of different laser processing strategies in micro structuring of transparent materials.

Benefits and Learning Objectives

- Describe the fundamentals of laser-interaction with transparent materials.
- List key factors related to high peak power and non-linear optical effects.
- Discuss the influence of material properties, such as band width, impurities, thermal diffusion and mechanical strength.
- Assess processing limitations and describe the underlying physical reasons.
- Describe the possibilities, limitations, and implications of current and future technology for laser micro structuring of transparent materials.
- Compile and discuss several examples in laser micro structuring of different glass types, quartz and sapphire.

Intended Audience: This course is intended for scientists and engineers involved or interested in micro machining of glass and other optical materials. This includes students from applied science and universities, processing engineers, laser system designers, service and solution providers and end-users for fabrication. A basic knowledge of diode-pumped laser systems generating short or ultra-short laser pulses is of advantage.

Short Courses

SC419 Crystal Parametric Nonlinear Optics: Modelling, Materials and Devices

Benoit Boulanger; *Grenoble Univ., CNRS-NEEL Institute, France*
Sunday, 4 October, 14:00—18:00

Course level: Intermediate
Course Description: This lecture focuses on fundamental crystal parametric optics that is one of the most fascinating field of nonlinear optics involving corpuscular and wave aspects of light in strong interaction with the electrons of matter, and leading to optical frequency synthesis and mixing at the origin of numerous applications.

- Constitutive relations and Maxwell equations.
- Classification of the nonlinear interactions through the corpuscular approach: fusion and splitting involving three or four photons, spontaneous and stimulated processes.
- Calculation of the electric susceptibility by Lorentz model: perturbation approach leading to the definition of the different orders of the electric susceptibility, wavelength dispersion, intrinsic symmetries (Kleinman and ABDP), implications of spatial symmetry on the susceptibility tensors (Neumann principle).
- Tensor algebra and calculation of the first, second and third order polarizations.
- Modelling of the macroscopic nonlinearities of matter from the microscopic scale using the bond charge model and *ab initio* calculation, Miller index.
- Basics in linear crystal optics: propagation equation, index surface, birefringence, double refraction, eigenmodes.
- Amplitude equations in the nonlinear regime, Manley-Rowe relations.
- Calculation of the effective coefficient based on the field tensor formalism.
- Types and topology of collinear and non-collinear Birefringence Phase-matching and Quasi-Phase-Matching in bulk media and whispering-gallery-mode resonators.
- Conversion efficiency calculation of second harmonic generation (SHG), direct and cascaded third harmonic generation (THG), and optical parametric interactions: fluorescence, amplification (OPA), chirped pulse amplification (OPCPA), generation (OPG), oscillation (OPO).
- Angular, spectral and thermal acceptances.
- Techniques of characterization of nonlinear crystals for the determination of phase-matching and quasi-phase-matching loci, magnitude and relative signs of the nonlinear coefficients, acceptances.

Benefits and Learning Objectives
This new course aims at giving guidelines and tools for the design, characterization and use of crystals for parametric generation. This course should enable participants to:

- Explain the main lines and key parameters of fundamental crystal parametric optics.
- Compare the figures of merit of various nonlinear materials.
- Compute phase-matching directions, quasi-phase-matching periodicities, angular and spectral acceptances, effective coefficients, conversion efficiencies.
- Measure nonlinear coefficients, phase-matching directions, spectral and angular acceptances, a figure of merit, a conversion efficiency.
- Define the relevant parameters for the design of new nonlinear crystal.
- List the main nonlinear materials enabling parametric generation.
- Identify the right crystal corresponding to the targeted application.
- Design up-conversion and down-conversion parametric devices.

Intended Audience: This course is specifically built for physicists as well as chemists interested in crystal parametric optics: crystal growers and designers wanting to identify the relevant parameters, laser physicists aiming at working in nonlinear optics or users willing to go deeper in the field at the frontier of crystal physics, coming from industry or universities and other academic institutes. Various job levels are concerned: PhD students, postdocs, engineers, researchers, professors. The basics of electromagnetism, solid state and laser physics are recommended.

SC427 Frequency Combs and Applications

Ingmar Hartl; DESY, Germany
Sunday, 4 October, 14:00 —18:00

Course Level: Advanced Beginner
Course Description: At the beginning of this century frequency combs revolutionized optical frequency metrology by providing a direct link between optical and microwave oscillators, ultimately leading to the Nobel Prize of John Hall and Ted Hänsch. This course will give an introduction in optical frequency combs. The course focuses on modelocked-laser based comb sources, non-oscillator based combs will be discussed only briefly. First the basic principles of the frequency comb spectrum of a modelocked laser oscillator will be given. Different designs of frequency comb lasers, carrier-envelope offset frequency measurement, passive and active stabilization and feedback control techniques and noise considerations will be explained. Techniques to the extent of the spectral coverage beyond the gain spectrum of the laser medium will be described, including XUV and mid-infrared frequency comb sources. The second half of the course will focus on applications: Optical frequency measurement, optical clocks, astrocombs, distance-measurement, low-noise microwave generation, transfer of timing and frequency information in optical fibers, different methods of frequency comb spectroscopy, time-domain applications and others.

Benefits and Learning Objectives

- Explain frequency comb sources and frequency comb techniques.
- Construct a basic frequency comb laser with carrier-envelope-offset sensing and feedback control circuitry.
- Characterize noise properties of a frequency comb source.
- Become familiar with numerous applications of frequency combs
- Identify the important comb parameters for a specific application.

Intended Audience:
This course is intended for persons familiar with basic laser and ultrafast optics principles who intend to construct a frequency comb, characterize a frequency comb or use a frequency comb laser.

Special Events

Industry Workshop: How to Communicate HighTech to the Market: Marketing and PR Workshop for Scientists and Startups

Sunday, 4 October; 14:00—17:00
Fireplace Room

Winning customers for a new high-tech product is far from easy. But it has been done many times. This workshop gives hands-on advice for the communication of new technologies to prospective markets. Attendees will learn how to set up an efficient integrated communication strategy for a given technology or product and what they have to do to implement this strategy and to meet the respective targets. Two experts with a proven track record in the field share their experience and respond to the ever growing need to communicate complex technologies efficiently. *This workshop is complimentary but those interested in attending must register.*

Presenters:
Andreas Thoss, *Thoss Media GmbH, Germany*
Susanne Hellwage, *Hellwage Wissenschaftskommunikation, Germany*

Workshop Objectives

- Addressing industry: What is different?
- Selecting the right media: How to win your target audiences efficiently?
- Setting up a toolbox: Texts and channels for communication.
- Your company's website: Chance and challenge.
- Social media: What they can (can't) do.

Who Should Attend

- Scientists & engineers with interest in technology transfer
- Potential HighTech Startup founders
- PR people from scientific institutions
- PR and marketing people from high-tech industry

Welcome Refreshments

Sunday, 4 October, 19:00—20:00
Bistro Esswirtschaft, Rudower Chaussee 24 (across the street from the hall)

Join us for a welcome drink and light appetizers with your fellow colleagues to kick off the 2015 Advanced Solid State Laser Conference and Exhibition!

OSA CAM Lounge

OSA is turning 100 in 2016! We're asking all OSA members to be a part of our celebration by participating in short videos. CAM (Centennial Authentic Moments) is an ongoing program of collecting scientific selfies where members talk about what it means to be an OSA Member, how has OSA helped in their careers, what inspired them to get into the field of optics and what excites them about their current work in three minutes or less. The collection of these short videos will be featured on OSA's centennial website.

Special Events

Opening Remarks and Plenary Session

Monday, 5 October, 08:30—10:05

Bedřich Rus, *ELI Beamlines Laser Systems, Czech Republic*

Overview of ELI Beamlines Laser Systems: At the Frontier of Ultra-High-Power Lasers

Abstract: Overview of the laser systems being developed for ELI-Beamlines will be presented. The systems will provide high-repetition rate ultra-high-power PW and multi-PW pulses and will extensively employ the technology of diode-pumped solid state lasers (DPSSL).

Biography: Bedrich Rus is the chief laser scientist of the ELI-Beamlines project. He studied at the Czech Technical University in Prague and obtained his PhD in laser physics at the University Paris-South. He was working on plasma x-ray lasers where he developed devices providing strong amplification at 21.2 nm and demonstrated the first polarized x-ray laser. Between 1998 and 2007 he also worked on development of kJ laser technologies, adaptive optics and Ti:sapphire lasers. Since 2008 he has been involved in the ELI-Beamlines project where he leads the team developing diode-pumped laser systems, broadband amplifiers, pulse dispersion systems and laser diagnostics.

Denis V. Balitsky, *CRISTAL LASER S.A., France*

Growth of Large Scale Nonlinear LBO and Electro-optic RTP Crystals: State of the Art and Applications

Abstract: A new generation of high pulse power lasers needs optics with a large aperture and a high damage resistance for high efficient non-linear optics and for electro-optic Q-switching. Two of the most promising materials satisfying such applications are lithium triborate (LiB3O5 - LBO) and rubidium titanyl phosphate (RbTiOPO4 - RTP). The step-by-step increasing of weight of crystals preserving high structural and optic homogeneity, high transmission and high damage resistance will be discussed. Regarding the production yield of large scale crystals it becomes a mass-production, because of development of green and UV lasers for medical and electronic applications as well as laser telemetry tools.

Biography: Denis V. Balitsky received a PhD degree at Moscow State University in 2000, and was appointed as Associate Professor at the University of Montpellier (France) in 2005. Currently he is a senior scientist in crystal growth at Cristal Laser SA in France. Balitsky is an expert in crystallography and crystal chemistry. He worked initially on the hydrothermal growth of several types of oxide materials for piezoelectric, optic and electro-optic applications. At Cristal Laser, Balitsky is more specifically involved in the development of large size non-linear and electro-optic materials for laser applications.

Poster Sessions

Monday, 5 October—Thursday, 8 October
Throughout the Venue

Posters are an integral part of the technical program and offer a unique opportunity where presenters can discuss their results one-to-one with interested parties. Each author is provided with a board to display the summary and results of his or her paper.

Monday, 5 October	18:30—20:00
Tuesday, 6 October	10:10—11:40
Thursday, 8 October	10:10—11:40

Poster Set-Up and Removal
All posters must be set by the start of the poster session. The presenter must remain in the vicinity of their poster for the duration of the session. All presenters must remove their posters at the conclusion of the session. Management will remove and discard any remaining posters after the time listed below.

Student Poster Session and Reception

Monday, 5 October, 18:30—20:00
Throughout the Venue

Sponsored by IPG PHOTONICS

Selected student presenters will be presenting their research during this poster session. All attendees are welcome to network with students and join the reception.

Special Events

Industry Panel Discussion: What are the Limitations of Technology?

Tuesday, 6 October, 11:30—12:30
Bunsen Hall (Bunsensaal)

Panelists from companies that represent the different types of lasers will discuss challenges and what the limits of their technology are.

Klaus Löffler, *Managing Director TRUMPF Laser und Systemtechnik GmbH, Germany*
Klaus Löffler's expertise in lasers extends from resonator design, excitation methods, beam delivery, sensor systems to laser material processing into Sales and Corporate Management. Since June 2014, he has been a member of the management board of the business field Lasertechnology at TRUMPF. Klaus started at TRUMPF in 1991 in the CO2 development department. He started the TRUMPF Laser Technology Center in Plymouth Michigan, USA in 1996. During this time, more than 500 TRUMPF lasers were implemented in North America. In 2002 he took over the position as manager of the joining group at Volkswagen Group, where he was responsible for the implementation of more than 500 High Power Lasers into production. In 2006 he served in different international sales responsibilities and in 2011 was promoted to the Head of International Sales for TRUMPF Laser.
After serving in different responsibilities at the Laser Institute of America (LIA) he was elected in 2013 as the President of the LIA, where he is also a Fellow. He served on several advisory boards including BLZ Bavarian Laser Center, SAOT School of advanced optical technology, ZEMA Center for mechatronics Fraunhofer Institute for Machine Tools and Forming Technology, and Safety Network International.

Torsten Mans, *Managing Partner, Amphos, Germany*
Torsten Mans studied physics at RWTH Aachen and Manchester University. During his thesis he built the first ultrafast laser amplifier which utilizes the InnoSlab concept and obtained his PhD at Fraunhofer ILT / RWTH Aachen. He is co-founder and currently managing partner at Amphos GmbH.

Eric Mottay, *CEO, Amplitude Systems, France*
Eric Mottay is the president and CEO of Amplitude Systemes, France, a company he founded in 2001 and which is now a leader in diode-pumped ultrafast lasers. Eric graduated from the Ecole Superieure d'Optique, Orsay, in 1985, and has since specialized in laser development and manufacturing. During his career, he developed and brought to the market numerous solid-state lasers, is the author of many scientific papers and holds several patents in the field.

Bojan Resan, *Advanced Technology Group Manager, JDSU Ultrafast Laser AG, Switzerland*
Bojan Resan received his BS in physics from University of Zagreb, Croatia; MS degree in photonics from ENSPS Strasbourg/Institute of Theoretical and Applied Optics Paris, France and his PhD in optics from College of Optics and Photonics/CREOL, Orlando, USA in 2004. Following CREOL, Bojan was with Coherent in Santa Clara, USA. In 2008, he joined Time-Bandwidth Products in Zurich, Switzerland, which was acquired by JDSU in 2014. He is currently managing Advanced Technology Group in JDSU Ultrafast Lasers, Zurich, and is also leading ultrafast laser development activities at University of Applied Sciences and Arts Northwestern Switzerland since 2015.

Industry Keynote: The History of Disk Lasers from the Perspective of a Contemporary Witness

Wednesday, 7 October; 10:15—11:15
Bunsen Hall (Bunsensaal)

Friedrich Dausinger, *CEO, Dausinger + Giesen GmbH, Germany*
Abstract: Since its invention in 1991 by Adolf Giesen the thin disk technology found numerous applications in industrial production processes and scientific applications by substituting rod and gas lasers and competing successfully with fiber lasers. The contribution will review the history of the disk laser from the early years of its invention to today's challenges as a promising tool for science.

Biography: Friedrich Dausinger is managing partner of Dausinger + Giesen GmbH, a company whose business model is to expand the application of thin disk technology in science and industry. He has about 35 years of experience with the application and development of high power lasers, and more than 20 years specially on disk lasers, in industrial (Bosch, Daimler, D+G) and academic (Stuttgart University) setting. He was chairman of national project initiatives in the field of ultrafast laser science, a Fellow of LIA (Laser Institute of America) and corresponding member of the Russian Academy of Engineering.

Special Events

Conference Banquet

Wednesday, 7 October; 19:30—22:00
InterContinental Hotel-Berlin
Budapester St. 2

Sponsored by IPG PHOTONICS

INTERNATIONAL YEAR OF LIGHT 2015

Buses will be provide from Foyer C at 18:15 to transport attendees from the conference location to the InterContinental Hotel.

Join your fellow attendees for a festive evening. Holger Moench, Manager of Technology & Strategy for Philips Photonic, will give a lively talk in celebration of the International Year of Light.

Light: A Light Dinner Talk

Holger Moench, *Philips Photonics, Germany*

Abstract: Electric lighting improved our vision of the world, the new applications of light in Datacom, sensing and manufacturing change the world. The frontiers of research have moved from brighter light sources to the smallest lasers integrated into objects of daily life.

Biography: Holger Moench joined Philips Research in 1991 after his Ph.D. in High Energy Physics at RWTH Aachen. He has been working on various high brightness and highly efficient light sources and their application in optical systems. He is now technology manager of Philips Photonics and his interests include the integration of semiconductors and optics, the design of advanced VCSEL structures and new applications for optoelectronic systems.

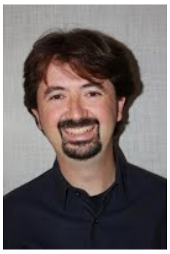
Postdeadline Papers Session

Thursday, 8 October, 11:40–12:50
Bunsen Hall (Bunsensaal)

The Technical Program Committee has accepted a limited number of postdeadline papers for oral presentations. The purpose of postdeadline papers is to give participants the opportunity to hear new and significant material in rapidly advancing areas. See page 46 for the Postdeadline Paper program.
The Postdeadline Papers can be found in OSA Publishing's Digital Library by visiting www.osa.org/ASSL and select "Access Digest Papers" link on the right hand navigation.

Plenary Session

Friday, 9 October, 08:00—08:40
Bunsen Hall (Bunsensaal)



Femtosecond-laser-based Microstructuring and Modification of Transparent Materials

Roberto Osellame, *Istituto di Fotonica e Nanotecnologie (IFN) - CNR, Italy*

Abstract: Femtosecond laser micromachining of transparent materials is a powerful tool in basic science and industrial applications. Its unique 3D capabilities and process versatility enables compact and effective device layouts for integrated photonics, microfluidics and nanotechnology.

Biography: Roberto Osellame received the Laurea Degree in Electronic Engineering from the Politecnico di Milano and his PhD in Physics from the Politecnico di Torino. Since 2001 he was a Staff Researcher of the Institute for Photonics and Nanotechnologies (IFN) of the Italian National Research Council (CNR), where he became Senior Researcher in 2007. He is also a Contract Professor of the Politecnico di Milano. Osellame has been one of the pioneers in femtosecond laser micromachining of transparent materials. His research activity includes the development of photonic circuits for quantum computing, the fabrication by two-photon-polymerization of micro/nano-structures of arbitrary geometry, and the integration of optical waveguides and microchannels for optofluidic lab-on-a-chip. He is co-author of more than 130 publications on ISI journals and holds 4 patents in the field of optics and photonics technology. He has been involved in several European projects and has been the Co-ordinator of FP7-STREP project 'microFLUID'.

Call for Papers

2015 Advanced Solid State Lasers Feature Issue in *Optics Express* and *Optical Materials Express*

Submission Deadline: 1 November 2015

- Invited talks, oral presentations, posters, post-deadline papers are all eligible
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AMS Technologies is a leading solution provider and distributor of high-tech, leading-edge components, systems and equipment, with more than 30 years of experience to date and currently serving more than 2000 European customers.

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URL: www.asldweb.com

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CryLaS GmbH

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URL: www.cryslaser.com

Cryslaser is one of the largest and most professional optical (laser) crystal manufacturers in China. Cryslaser also repairs laser rods and other amplifying materials. After eight years of high speed development, Cryslaser has successfully expanded to manufacturing NLO crystals and IR optics.

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CMS offers a groundbreaking coating technology. Our proprietary process enables the integration of single-crystal multilayers onto arbitrary (including curved) substrates, generating "Crystalline Supermirrors" with ultra-low Brownian noise, minimal (<100 ppm) optical losses in the mid-infrared, as well as a thermal conductivity 50x greater than dielectric mirrors.

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Email: info@dausinger-giesen.de
URL: www.dausinger-giesen.de

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URL: www.DILAS.com

DILAS manufactures high-power diode laser components and systems in a wide range of output powers and wavelengths including fiber-coupled, direct beam and integrated solutions.

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EKSMA Optics is a manufacturer of laser components for high power laser applications. We produce laser optics, laser and frequency conversion crystals for 193-20.000nm range, pockels cells and ultrafast pulse picking systems. The company owns IBS coating, optics and crystals polishing facilities, spherical and aspherical lens production and clean room facilities.

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URL: www.eotech.com

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neoLASE is a solid state laser company focused on the development and manufacturing of industrial, high brilliance optical amplifiers, customized MOPA systems or fully integrated picosecond lasers.

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Founded in 1916, The Optical Society (OSA) is the leading professional society for scientists, engineers, students and business leaders who fuel discoveries, shape real-world applications and accelerate achievements in the science of light. Through world-renowned publications, meetings and membership programs, OSA provides quality research, inspired interactions and dedicated resources.

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URL: www.picoquant.com

PicoQuant GmbH is a research and development company in the field of optoelectronics. The company is a worldwide leader in the field of single photon counting applications. The product line includes pulsed diode lasers and LEDs, photon counting instrumentation, fluorescence lifetime spectrometers and time-resolved confocal microscopes.

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Bad Dürrheim, 78073 Germany
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URL: www.rp-photonics.com

RP Photonics Consulting GmbH offers technical consulting services and simulation and design software for the photonics industry and for scientific research.

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Southern Photonics manufactures one micron wavelength femtosecond fiber laser systems at a range of powers and pulse repetition rates. These all PM lasers offer unprecedented stability and reliability and do not contain any saturable absorbers or free space optics.

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URL: www.trumpf-scientific-lasers.com

TRUMPF Scientific Lasers is a joint venture between the TRUMPF group, world leader in machine tools and industrial lasers and Professor Ferenc Krausz, director of the Max-Planck-Institute of Quantum Optics. TRUMPF Scientific Lasers focuses on high-power, high-energy femtosecond and picosecond lasers. Base technology is the TRUMPF thin disk laser technology.

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Notes

Explanation of Session Codes

AM2A.4

Meeting Name
A = ASSL

Day of the Week
M = Monday
Tu = Tuesday
W = Wednesday
Th = Thursday
F = Friday

Series Number
1 = First Series of Session
2 = Second Series of Session
3 = Third Series of Session
4 = Forth Series of Session
5 = Fifth Series of Session

Session Designation
Alphabetically

Number
Presentations order within the session

The first letter of the code designates the meeting. The second element denotes the day of the week (M= Monday, Tu=Tuesday, W=Wednesday, Th=Thursday, F=Friday). The third element indicates the session series in that day (for instance, 1 would denote the first sessions in that day). Each day begins with the letter A in the fourth element. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded AM2A.4 indicates that this paper is being presented on Monday (M) in the second series of sessions (2), and is the first session (A) and the fourth paper (4) presented in that session.

Plenary papers are noted with **Plenary**

Invited papers are noted with **Invited**

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Agenda of Sessions

Sunday, 4 October		
09:30—19:00	Registration, *Foyer A*	
10:00—13:00	SC290 • High Power Fiber Lasers and Amplifiers	SC426 • Micro-structuring of Transparent Materials with Short and Ultra-short Laser Pulses
14:00—17:00	Industry Workshop: How to Communicate High Tech to the Market: Marketing and PR Workshop for Scientists and Startups	
14:00—18:00	SC427 • Frequency Combs and Applications	SC419 • Crystal Parametric Nonlinear Optics: Modelling, Materials and Devices
19:00—20:00	Welcome Refreshments *Bistro Esswirtschaft, Rudower Chaussee 24 (across the street from the hall)*	

Monday, 5 October		
07:00—18:00	Registration, *Foyer A*	
08:30—10:05	AM1A • Opening Remarks and Plenary Session, *Bunsen Hall (Bunsensaal)*	
10:05—10:30	Coffee Break and Exhibits *Throughout the Venue*	*Coffee Break* Sponsored by IPG PHOTONICS
10:30—12:30	AM2A • Nonlinear Crystals, *Bunsen Hall (Bunsensaal)*	
12:30—14:00	Lunch with the Exhibitors, *Throughout the Venue*	
14:00—16:00	AM3A • Mid-Infrared Sources I, *Bunsen Hall (Bunsensaal)*	
16:00—16:30	Coffee Break and Exhibits *Throughout the Venue*	*Coffee Break* Sponsored by IPG PHOTONICS
16:30—18:30	AM4A • Fibers, *Bunsen Hall (Bunsensaal)*	
18:30—20:00	AM5A • Student Poster Session and Student Receptions *Throughout the Venue*	Student Reception Sponsored by IPG PHOTONICS

Agenda of Sessions

Tuesday, 6 October	
07:00—18:30	Registration, *Foyer A*
08:00—10:10	ATu1A • Rare-Earth Doped Materials, *Bunsen Hall (Bunsensaal)*
10:10—11:40	ATu2A • Poster Session II and Coffee Break with Exhibits *Throughout the Venue* — *Coffee Break* Sponsored by IPG PHOTONICS
11:30—12:30	Industry Panel Discussion: What are the Limitations of Technology?, *Bunsen Hall (Bunsensaal)*
12:30—14:00	Lunch with the Exhibitors *Throughout the Venue* — *Lunch* Sponsored by IPG PHOTONICS
14:00—16:00	ATu3A • Source & Materials Joint Session, *Bunsen Hall (Bunsensaal)*
16:00—16:30	Coffee Break and Exhibits *Throughout the Venue* — *Coffee Break* Sponsored by IPG PHOTONICS
16:30—18:30	ATu4A • Novel Ultrafast Sources, *Bunsen Hall (Bunsensaal)*

Notes

Agenda of Sessions

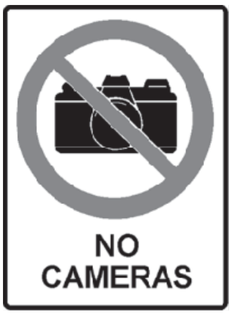
Wednesday, 7 October	
07:30—18:00	Registration, *Foyer A*
08:00—09:45	AW1A • Nanomaterials and Waveguides, *Bunsen Hall (Bunsensaal)*
09:45—10:15	Coffee Break and Exhibits *Throughout the Venue* *Coffee Break* Sponsored by IPG PHOTONICS
10:15—11:15	Industry Keynote: The History of Disk Lasers from the Perspective of a Contemporary Witness, *Bunsen Hall (Bunsensaal)*
11:15—12:20	AW2A • Novel Fiber-based Sources, *Bunsen Hall (Bunsensaal)*
12:20—13:50	Lunch with the Exhibitors, *Throughout the Venue*
13:50—15:45	AW3A • Ultrafast Amplifiers, *Bunsen Hall (Bunsensaal)*
15:45—16:15	Coffee Break and Exhibits *Throughout the Venue* *Coffee Break* Sponsored by IPG PHOTONICS
16:15—18:15	AW4A • Mid-Infrared Sources II, *Bunsen Hall (Bunsensaal)*
19:30—22:00	Conference Banquet *InterContinental Hotel-Berlin* *Budapester St. 2* *Buses depart at 18:15 from Foyer C* Sponsored by IPG PHOTONICS INTERNATIONAL YEAR OF LIGHT 2015

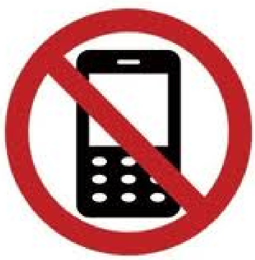
Notes

Agenda of Sessions

Thursday, 8 October	
07:30—14:00	Registration, *Foyer A*
08:00—10:10	ATh1A • Sensing, Spectrometry and Waveguiding, *Bunsen Hall (Bunsensaal)*
10:10—11:40	ATh2A • Poster Session III and Coffee Break with Exhibits *Throughout the Venue* — *Coffee Break* Sponsored by IPG Photonics
11:40—12:50	ATh3A • Postdeadline Papers Session, *Bunsen Hall (Bunsensaal)*
12:50—13:50	Lunch *(on your own)*
13:50—16:00	ATh4A • Frequency Combs and Modelocked Sources, *Bunsen Hall (Bunsensaal)*

Friday, 9 October	
07:30—15:00	Registration, *Foyer A*
08:00—10:00	AF1A • Applications & Sources Joint Session with Plenary Speaker *Bunsen Hall (Bunsensaal)*
10:00—10:30	Coffee Break, *Foyer C* — Sponsored by IPG Photonics
10:30—12:30	AF2A • Advanced ps, fs and MIR Processing, *Bunsen Hall (Bunsensaal)*
12:30—14:00	Lunch *(on your own)*
14:00—15:45	AF3A • Ultrafast Processing in the Electronics Industry, *Bunsen Hall (Bunsensaal)*





07:00—18:00 • Registration, *Foyer A*

08:30—10:05
AM1A • Opening Remarks and Plenary Session
Bunsen Hall (Bunsensaal)

AM1A.1 • 08:45 Plenary
Overview of ELI Beamlines Laser Systems: At the Frontier of Ultra-High-Power Lasers, Bedrich Rus[1]; [1]*ELI-Beamlines, Czech Republic.* Overview of the laser systems being developed for ELI-Beamlines will be presented. The systems will provide high-repetition rate ultra-high-power PW and multi-PW pulses and will extensively employ the technology of diode-pumped solid state lasers (DPSSL).

AM1A.2 • 09:25 Plenary
Growth of Large Scale Nonlinear LBO and Electro-optic RTP Crystals: State of the Art and Applications, Denis Balitsky[1], Ph Villeval[1], D Lupinski[1]; [1]*Cristal Laser SA, France.* A new generation of high pulse power lasers needs optics with a large aperture and a high damage resistance for high efficient non-linear optics and for electro-optic Q-switching. Two of the most promising materials satisfying such applications are lithium triborate (LiB3O5 - LBO) and rubidium titanyl phosphate (RbTiOPO4 - RTP). The step-by-step increasing of weight of crystals preserving high structural and optic homogeneity, high transmission and high damage resistance will be discussed. Regarding the production yield of large scale crystals it becomes a mass-production, because of development of green and UV lasers for medical and electronic applications as well laser telemetry tools.

10:00—10:30 • Coffee Break and Exhibits, *Throughout the Venue*

10:30—12:30
AM2A • Nonlinear Crystals
Bunsen Hall (Bunsensaal)
Presider: Katia Gallo, Royal Inst. of Tech. - KTH, Sweden

AM2A.1 • 10:30 Invited
Recent Study on Nonlinear Crystals, Ludmila I. Isaenko[1,2]; [1]*V.S. Sobolev Inst. of Geology and Mineralogy, Russia;* [2]*Novosibirsk State Univ., Russia.* The analysis of new promising wide-bandgap IR-nonlinear crystals based on ternary and quaternary (with Ge) chalcogenides is given. Crystal characteristics which determine the efficiency of nonlinear convertors and the ways to improve them are discussed.

AM2A.2 • 10:50 Invited
New Nonlinear Optical Crystals for the Mid-Infrared, Peter G. Schunemann[1]; [1]*BAE Systems Inc, USA.* Continued quality improvements in the birefringent crystals $ZnGeP_2$ and $CdSiP_2$, as well as all-epitaxial processing of orientation-patterned semiconductors GaAs (OP-GaAs) and GaP (OP-GaP), are extending efficient solid-state laser performance to the mid-infrared and beyond.

AM2A.3 • 11:10 Invited
Recent Theoretical Studies in Nonlinear Crystals: Towards the Design of New Materials, Valérie Véniard[1]; [1]*Laboratoire des Solides Irradiés, Ecole Polytechnique, CNRS, CEA-DSM, France.* New development of theoretical and numerical approaches to describe the nonlinear optical properties of bulk materials and nanostructures will be presented. We will focus on systems interesting for their fundamental aspects and high technological impact.

AM2A.4 • 11:30
Angular noncritical phase-matched second harmonic generation in $BaGa_4Se_7$, Elodie Boursier[1], Patricia Segonds[1], A Jérôme Debray[1], Patricia Loren Inacio[1], Vladimir Panyutin[2], Valeriy Badikov[3], Dmitrii Badikov[3], Valentin Petrov[2], Benoit Boulanger[1]; [1]*Neel Inst., France;* [2]*Max-Born-Inst. for Nonlinear Optics and Ultrafast Spectroscopy, Germany;* [3]*High technologies Lab, Russia.* We performed a complete study of angular noncritical phase-matched second harmonic generation in the monoclinic $BaGa_4Se_7$ (BGSe). We determined the corresponding wavelengths, conversion efficiencies and acceptances, as well as the involved nonlinear coefficients.

AM2A.5 • 11:42
Non-collinear phase-matched 355 nm UV generation in prism-coupled $CsLiB_6O_{10}$ crystal, Kentaro Ueda[1], Masashi Yoshimura[1], Chen Qu[1], Yoshinori Takahashi[1], Yusuke Mori[1]; [1]*Osaka Univ., Japan.* A walk-off compensated prism-coupled device based on non-collinear phase-matching in $CsLiB_6O_{10}$ (CLBO) generates 2.55 W output of 355 nm UV light with 52.8% conversion efficiency from the geometric mean of input infrared and green powers.

AM2A.6 • 11:54
Non-walk-off second harmonic 532 nm generation by PP-LBGO at room temperature operation, Junji . Hirohashi[1], Tetsuo Taniuchi[2], Koichi Imai[1], Yasunori Furukawa[1]; [1]*Oxide Corporation, Japan;* [2]*FRIS, Tohoku Univ., Japan.* Non-walk-off second harmonic 532nm generation were demonstrated at room temperature by PP-LBGO. More than 1.5 W of 532 nm were confirmed by PP-LBGO with wider temperature tolerances (ΔT(FWHM)=24 K-cm) based on nonlinear coefficients of d_{33}.

AM2A.7 • 12:06
Thermo-Optic Dispersion Formulas for YCOB and GdCOB Laser Host Crystals, Pavel Loiko[1], Xavier Mateos[2], Yicheng Wang[3], Zhongben Pan[4], Konstantin V. Yumashev[1], Huaijin Zhang[5], Haohai Yu[5], Uwe Griebner[3], Valentin Petrov[3]; [1]*Center for Optical Materials and Technologies, Belarusian National Technical Univ., Belarus;* [2]*Física i Cristallografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV), Spain;* [3]*Max Born Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany;* [4]*Inst. of Chemical Materials and Advanced Materials Center, China Academy of Engineering Physics, China;* [5]*State Key Lab of Crystal Materials and Inst. of Crystal Materials, Shandong Univ., China.* Anisotropy and dispersion of thermo-optic coefficients, dn/dT, and thermal coefficients of the optical path (TCOP) are studied for monoclinic oxoborate YCOB and GdCOB laser host crystals. Thermo-optic dispersion formulas are derived for these crystals.

AM2A.8 • 12:18
Laser-Induced Damage Study at 1.064 and 2.09 µm of High Optical Quality $CdSiP_2$ Crystal, Anne Dhollande[1], Christelle Kieleck[1], Georgi Marchev[2], Peter G. Schunemann[3], Kevin T. Zawilski[3], Valentin Petrov[2], Marc Eichhorn[1]; [1]*ISL, France;* [2]*Max-Born-Inst., Germany;* [3]*BAE Systems, USA.* Recent advances in crystal growth and surface preparation result in an increased laser-induced damage threshold (LIDT) of $CdSiP_2$ (CSP) of 1.7 J/cm² at 2.09 µm (1 kHz) and 0.35 J/cm² at 1.064 µm (100 Hz).

12:30—14:00 • Lunch with the Exhibitors *Throughout the Venue*

14:00—16:00
AM3A • Mid-Infraded Sources I
Bunsen Hall (Bunsensaal)
Presider: Alphan Sennaroglu, Koc Univ., Turkey

AM3A.1 • 14:00 **Invited**
Multi-millijoule Few-Optical-Cycle Pulses in Mid-IR: Scaling Power, Energy and Wavelength, Audrius Pugzlys[1,6], V Shumakova[1], P Malevich[1], Tsuneto Kanai[1], S Alisauskas[1], Giedrius Andriukaitis[1], Edgar Kaksis[1], T Balciunas[1], Guangyu Fan[1], A Voronin[2], A M. Zheltikov[2,3], D Faccio[4], D Kartashov[5], Andrius Baltuska[1,6]; [1]*Photonics Inst. Vienna Univ. of Tech., Austria;* [2]*International Laser Center, M.V. Lomonosov Moscow State Univ., Russia;* [3]*Texas A&M Univ., USA;* [4]*Heriot-Watt Univ., UK;* [5]*Inst. for Optics and Quantum Electronics, Friedrich-Schiller Univ. Jena, Germany;* [6]*Center for Physical Sciences & Tech., Lithuania.* We discuss prospects of the generation of high power mid-IR pulses by analyzing soliton self-compression of multi-mJ 4-μm pulses and the development of few-optical-cycle 6-μm optical parametric amplifier. Scalability of pump lasers is addressed.

AM3A.2 • 14:20 **Invited**
High Energy Mid-IR OPCPA at 7 μm with 2 μm Pump, Jens Biegert[1,2], Daniel Sanchez[1], Michaël Hemmer[4], Matthias Baudisch[1], Kevin T. Zawilski[5], Peter G. Schunemann[5], Olivier Chalus[3], Christophe Simon-Boisson[3], Heinar Hoogland[6], Ronald Holzwarth[6]; [1]*ICFO -The Inst. of Photonic Sciences, Spain;* [2]*ICREA, Spain;* [3]*Thales Optronique, France;* [4]*CFEL, Germany;* [5]*BAE Systems, USA;* [6]*Menlo Systems, Germany.* A novel class of high energy ultrafast OPCPA system at 7 μm, pumped by an optically synchronized and Tm:fiber pumped 2 μm picosecond Ho:YLF CPA system, delivers mJ-level pulses supporting a sub-4 optical cycle duration.

AM3A.3 • 14:40
Development of a high-power mid-IR parametric amplifier for multicolor driving of high harmonic generation, Tsuneto Kanai[1], Tadas Balčiunas[1], Guangyu Fan[1], Edgar Kaksis[1], Giedrius Andriukaitis[1], Audrius Pugzlys[1], Andrius Baltuška[1]; [1]*Vienna Univ. of Tech., Austria.* We developed a multicolour, high-peak-power mid-IR parametric amplifier with the base period corresponding to 3.1 μm and a combined pulse energy >15 mJ, which is aimed at a "perfect wave" driver for high harmonic generation.

AM3A.4 • 14:52
Mid-Infrared Optical-Parametric Generation Pumped by Sub-Nanosecond Microchip Laser, Hideki Ishizuki[1], Takunori Taira[1]; [1]*Inst. for Molecular Science, Japan.* We demonstrated single-pass MIR-OPG by microchip laser with sub-nanosecond duration. Effective single-pass OPG with 1mJ output energy using conventional PPMgLN could be realized. Broadband single-pass OPG could be also realized using chirped PPMgLN.

AM3A.5 • 15:04
Multiwavelength Ultrafast $LiNbO_3$ Raman Laser with Cascaded Terahertz-Wave Generation, Aravindan M. Warrier[1], Jipeng Lin[1], Helen M. Pask[1], Andrew Lee[1], David Spence[1]; [1]*Macquarie Univ., Australia.* We demonstrate an ultrafast LiNbO-$_3$ Raman laser to extend the wavelength versatility of a 1064 nm mode-locked laser. We generate new wavelengths in the infrared, as well as using polariton scattering to generate terahertz output.

AM3A.6 • 15:16 **Invited**
Advances in Mid-infrared Nanosecond OPOs Directly Pumped by Tm^{3+}-doped and Tm^{3+},Ho^{3+}-codoped Fiber Lasers, Christelle Kieleck[1], Brenda Donelan[1], Anne Dhollande[1], Christian Kneis[1], Martin Schellhorn[1], Marc Eichhorn[1]; [1]*Deutsch-Französisches Forschungs Inst, France.* Recent work on Tm^{3+}-doped and Tm^{3+},Ho^{3+}-codoped 2 μm fiber lasers and efficient pumping of mid-infrared nanosecond OPOs based on $ZnGeP_2$ or OP-GaAs non-linear crystals with watt-level output power is presented.

AM3A.7 • 15:36
Watt-level Megahertz-rate Femtosecond Mid-Infrared Source, Marcus Seidel[1], Xiao Xiao[1], Gunnar Arisholm[2], Alexander Hartung[3], Oleg Pronin[1], Ferenc Krausz[1,4]; [1]*Max-Planck-Inst. of Quantum Optics, Germany;* [2]*FFI (Norwegian Defence Research Establishment), Norway;* [3]*Leibniz-Inst. of Photonic Tech. (IPHT), Germany;* [4]*Ludwig-Maximilians-Universität, Germany.* 0.9-W average power at 4.1-μm wavelength is generated through optical parametric amplification in lithium niobate. The crystal is directly pumped by a mode-locked thin-disk oscillator and seeded with a continuum from an all-normal dispersion fiber.

AM3A.8 • 15:48
High-Power, Widely Tunable, Room-Temperture, Picosecond Optical Parametric Oscillator Based on Cylindrical MgO:PPLN, Suddapalli Chaitanya Kumar[1], J W. Wei[1], A Jérôme Debray[2], Vincent Kemlin[3], Benoit Boulanger[2], Hishizuki[4], Takunori Taira[4], Majid Ebrahim-Zadeh[1,5]; [1]*ICFO -The Inst. of Photonic Sciences, Spain;* [2]*Institut Néel Centre National de la Recherche Scientifique, Université Joseph Fourier, , France;* [3]*Laboratoire d'Optique et Biosciences, Ecole Polytechnique, , France;* [4]*Laser Research Center for Molecular Science, Inst. for Molecular Science, 38 Nishigonaka, Myodaiji, , Japan;* [5]*Institucio Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, , Spain.* We report the first room-temperature synchronously-pumped picosecond OPO based on MgO:PPLN partial cylinder, providing broad and continuous tuning in the near-mid-IR with >4 W total average power, excellent output stability, and high beam quality.

16:00— 6:30 • Coffee Break and Exhibits, *Throughout the Venue*

16:30—18:26
AM4A • Fibers
Bunsen Hall (Bunsensaal)
Presider: Stefano Taccheo, Swansea Univ., UK

AM4A.1 • 16:30 Invited
Challenges for Further Power Scaling of Single-Mode Fiber Lasers, Liang Dong[1], Fanting Kong[1], Guancheng Gu[1], Thomas Hawkins[1], Maxwell Jones[1], Joshua Parsons[1], Monica Kalichevsky-Dong[1], Kunimasa Saitoh[2], Benjamin Pulford[3], Iyad Dajani[3]; *[1]Clemson Univ., USA; [2]Hokkaido Univ., Japan; [3]Air Force Research Lab, USA.* Further advances in mode control and mitigation of quantum defect heating are essential for further progress of single-mode fiber lasers. We will report on our recent works on advanced fibers, materials and fiber lasers.

AM4A.2 • 16:50
MCVD Based Fabrication of Low-NA Fibers for High Power Fiber Laser Application, Christian Hupel[1], Stefan Kuhn[1], Sigrun Hein[1], Nicoletta Haarlammert[1], Johannes Nold[1], Franz Beier[1,2], Bettina Sattler[1], Thomas Schreiber[1], Ramona Eberhardt[1], Andreas Tünnermann[1,2]; *[1]Fraunhofer IOF, Germany; [2]Inst. of Applied Physics, Germany.* The fabrication of Yb doped fibers with low-NA (0.04) for high-power fiber laser applications in the multi-kW class is presented and discussed. Laser tests with ~3 kW output power and excellent beam quality are demonstrated.

AM4A.3 • 17:02 Invited
Power Scaling Potential of Er-doped Fiber Lasers Based on Advanced Fiber Materials, Mark A. Dubinskii[1], E. Joseph Friebele[2], Shibin Jiang[3], John Ballato[4], Peter Dragic[5]; *[1]US Army Research Lab, USA; [2]Naval Research Lab, USA; [3]AdValue Photonics, USA; [4]Clemson Univeristy, USA; [5]Univ. of Illinois at Urbana-Champaign, USA.* Er-doped lasers are currently well behind Yb-doped in power scalability, which is due to critical spectroscopic differences between Er and Yb ions. We demonstrate several approaches to major improvement in Er-doped fiber laser power scaling based on recent advances in laser fiber material development.

AM4A.4 • 17:22
Cladding Pumped Single Crystal Yb:YAG Fiber Amplifier, Brandon Shaw[1], Charles Askins[1], Woohong Kim[1], Shyam Bayya[1], John Peele[2], Rajesh Thapa[2], Steve R. Bowman[1], Rafael R. Gattass[1], Jas S. Sanghera[1]; *[1]NRL, USA; [2]Sotera Defense Solutions, USA.* We report on fabrication and optical properties of double clad single crystal Yb:YAG core fiber. For the first time, net gain is demonstrated in a cladding pumped Yb:YAG single crystal fiber structure.

AM4A.5 • 17:34
All-Solution Doping Technique for Tailoring Core Composition toward Yb:$AlPO_4$:SiO_2, Stefan Kuhn[1], Sigrun Hein[1], Christian Hupel[1], Janka Ihring[1], Johannes Nold[1], Nicoletta Haarlammert[1], Thomas Schreiber[1], Ramona Eberhardt[1], Andreas Tünnermann[1,2]; *[1]Fraunhofer IOF, Germany; [2]Inst. of Applied Physics, Friedrich-Schiller-Universitaet, Germany.* A modified solution doping approach for incorporating appropriate amounts of Yb, Al and P in fused silica is shown. The mitigation of phosphorus evaporation is intended by the initial formation of $AlPO_4$ from solution.

AM4A.6 • 17:46 Invited
Microstructured Chalcogenide Glass Fibers, Johann Troles[1], Laurent Brilland[2]; *[1]Univ. of Rennes 1, France; [2]Perfos, France.* Various chalcogenide microstructured optical fibers operating in the Mid-IR range have been elaborated in order to associate the high non-linear properties of these glasses and the original microstructured optical fibers properties.

AM4A.7 • 18:06 Invited
Deep-ultraviolet Light Generation in ZBLAN Photonic Crystal Fibre Pumped at 800 nm and 1042 nm, Xin Jiang[1], Nicolas Y. Joly[1], Fehim Babic[1], Rafal Sopalla[1], John C. Travers[1], Philip S. Russell[1]; *[1]Max-Planck-Inst. for the Science of Light, Germany.* We report recent progress on the fabrication of photonic crystal fibre from ZBLAN glass and its application to generate deep-ultraviolet to mid-infrared supercontinua from short-pulse infrared pump lasers.

Notes

18:30—20:00 • Student Reception
Throughout the Venue

Sponsored by IPG PHOTONICS

18:30—20:00
AM5A • Student Poster Session
Throughout the Venue

AM5A.1 • Experimental study of mixed-mode in laser-based optoelectronic oscillators based on van der Pol oscillators with intermediate frequencies, Alain Francis Talla[1]; [1]*Universite de Yaounde I, Cameroon.* We investigate experimentally a novel optoelectronic oscillator based on the self-sustained oscillator that converts continuous light into stable and spectrally pure microwave in the intermediate frequency. The result presents the mixed-mode oscillations characterized by the laser injection current.

AM5A.2 • Laser Melting of Metal Powders Using Nd:yag and Compact Diode Laser for Micro Particle Deposition, Mohammad Hossein Azhdast[3,1], Oliver Lux[1], Haro Fritsche[2,1], Hans J. Eichler[1], Ghassem Azdasht[3], Heinrich Lüdeke[3], Veronika Glaw[4], Klaus-Dieter Lang[1]; [1]*Technical Univ. of Berlin, Germany;* [2]*DirectPhotonics Industries GmbH, Germany;* [3]*PacTech, Germany;* [4]*Fraunhofer, Germany.* Laser melting of different metal powders is investigated using a Nd:YAG laser system and a compact diode laser. The influence of various process parameters on the physical properties of the molten particles is studied.

AM5A.3 • Nano particle production by laser ablation and metal sputtering on Si-Wafer substrate, Mohammad Hossein Azhdast[31,2], Ghassem Azdasht[1], Heinrich Lüdeke[1], Veronika Glaw[3], Klaus-Dieter Lang[2]; [1]*PacTech, Germany;* [2]*Technical Univ. of Berlin, Germany;* [3]*Fraunhofer, Germany.* This research relates to methods of deposition and patterning a surface with nano sputtered particles by Laser. The method is mask-less and without vacuum requirement which can be used in wire bonding and microelectronics devices.

AM5A.4 • Exploring Air Breakdown Threshold and Temporal Dynamics by a Q-switched Mode-locked Nd:YAG Laser in a Statistical Approach, P. H. Tuan[1], C. Y. Cho[1], C. H. Wu[1], J. C. Tung[1], Kuan-Wei Su[1], Yung-Fu Chen[1]; [1]*National Chiao Tung Univ., Taiwan.* A Q-switched mode-locked Nd:YAG laser is utilized to explore air breakdown threshold in a statistical approach to be 0.64 TW/cm^2. The temporal dynamics of induced plasma shows a sub-nanosecond delay to the incident Q-switched pulse.

AM5A.5 • High-peak-power Optically-pumped AlGaInAs Eye-safe Laser with a Sandwiched Gain Chip Structure and a Silicon Wafer Output Coupler to Form a Compact Cavity, P. H. Tuan[1], C. Y. Cho[1], Chi-Ping Wen[1], Hsing-Chih Liang[2], Kuan-Wei Su[1], Kai-Feng Huang[1], Yung-Fu Chen[1]; [1]*National Chiao Tung Univ., Taiwan;* [2]*National Taiwan Ocean Univ., Taiwan.* An intrinsic silicon wafer is exploited as an output-coupler to develop a high-peak-power optically-pumped AlGaInAs laser at 1.52 mm. The gain chip is sandwiched between diamond heat-spreaders and Si-wafer to form a compactly stack cavity.

AM5A.6 • Design of a solid state laser for low noise upconversion detection of near infrared light, Lasse Høgstedt[1], Peter Tidemand-Lichtenberg[1], Christian Pedersen[1]; [1]*Technical Univ. of Denmark, Denmark.* To maximize signal-to-noise ratio for upconversion of near-infrared light we show that the mixing intensity should be 3 GW/m^2. With emphasis on the noise contribution from random duty-cycle errors the optimum design parameters is discussed.

AM5A.7 • Self-frequency Doubling of Electric Field Periodically Poling Nd^{3+} and Mg^{2+} Co-doped Lithium Niobate, Dongzhou Wang[1,2], Yong Bi[2], Hong Liu[1]; [1]*Shandong Univ., China;* [2]*Technical Inst. of Physics and Chemistry, Chinese Academy of Sciences, China.* Periodically poled Nd:Mg:$LiNbO_3$ (PPNdMgLN) was achieved by an electric-field poling method. 80 mW green laser emitting at 542 nm was obtained by self-frequency doubling in a 16 mm long PPNdMgLN.

AM5A.8 • Anisotropy of Bulk Degradation of LBO Crystal Induced by DUV Laser Radiation at 266 nm, Dmitriy Nikitin[1,2], Oleg Vershinin[2], Valentin Tyrtyshnyy[2], Oleg Byalkovskiy[2,1]; [1]*MIPT, Russia;* [2]*NTO "IRE-Polus", Russia.* Dependence of degradation time of LBO crystal on UV propagation direction, polarization and power was investigated at different crystal temperatures. Anisotropy of bulk degradation induced by DUV radiation at 266 nm was observed.

AM5A.9 • Studies about relationships between the symmetries of ferroelectric crystal and frequency-doubled patterns, Tianxiang Xu[1], Dazhi Lu[1], Haohai Yu[1], Huaijin Zhang[1], Jiyang Wang[1]; [1]*Shandong Univ., China.* The broadband quasi-phase-matching process in $Ca_{0.28}Ba_{0.72}Nb_2O_6$ was demonstrated and the relationships between crystal symmetries and second-harmonic patterns were studied. Considering the light-matter interaction, the frequency-doubled photons were found to be trapped by a centripetal force.

AM5A.10 • M-lines characterization of the refractive index of GaSb and $Al_xGa_{1-x}AsSb$ lattice-matched onto GaSb in the mid-infrared, Sophie Roux[1], Pierre Barritault[2], Olivier Lartigue[2], Laurent Cerutti[3,4], Eric Tournié[3,4], Bruno Gérard[5], Arnaud Grisard[1]; [1]*Thales Research & Technology, France;* [2]*CEA-LETI, France;* [3]*Université de Montpellier, France;* [4]*CNRS, UMR 5214, IES, France;* [5]*III-V Lab, France.* We have performed M-lines measurements of GaSb and $Al_xGa_{1-x}AsSb$ refractive index in the 2.15-7.35 μm range and established the variation laws versus wavelength and aluminum fraction. These laws are in good agreement with the single-oscillator-model.

AM5A.11 • Ultraviolet laser-induced degradation of $CsLiB_6O_{10}$, Masashi Yoshimura[1,2], Yuichi Oeki[1], Yoshinori Takahashi[1,2], Hiroaki Adachi[1,2], Yusuke Mori[1,2]; [1]*Osaka Univ., Japan;* [2]*SOSHO Inc., Japan.* We measured the correlation between the brightness of green light scattering in CLBO and the 266 nm UV lifetimes. A continuous reciprocal motion of CLBO shows drastic improvement of UV-induced degradation resistance.

AM5A.12 • WITHDRAWN

AM5A.13 • Growth and optical characterization of Ho^{3+}/Yb^{3+}-codoped PbF_2 single crystal, Peixiong Zhang[1], Baitao Zhang[2], Lianhan Zhang[1], Jiaqi Hong[1], Jinglian He[2], Yin Hang[1]; [1]*Shanghai Inst of Optics & Fine Mechanics, China;* [2]*State Key Lab of Crystal Materials, Shandong Univ., Jinan 250100, China, China.* An enhanced 2.86 μm emission was observed for the first time in a novel Ho^{3+}/Yb^{3+} codoped PbF_2 crystal under 970 nm LD pump, which may be a promising material for 2.86 μm laser applications.

AM5A.14 • Er:KY(WO4)2 and Er:LiYF4 Crystals for Eye-Safe In-Band Pumped Lasers, Konstantin Gorbachenya[1], Viktor E. Kisel[1], Sergey V. Kurilchik[1], Anatol S. Yasukevich[1], Stella Korableva[2], Vadim V. Semashko[2], Anatoliy A. Pavlyuk[3], Nikolai V. Kuleshov[1]; [1]*Center for optical materials and technol, Belarus;* [2]*Kazan Federal Univ., Russia;* [3]*Nikolaev Inst. for Inorganic Chemistry, Siberian Branch of Russian Academy of Sciences, Russia.* Laser operation of in-band pumped Er:KY(WO4)2 and, for the first time to our knowledge, Er:LiYF4 crystals was demonstrated. The maximal slope efficiencies of 40% and 21% were obtained for Er:KY (WO4)2 and Er:LiYF4 crystals, respectively.

AM5A.15 • Energy Transfer Parameters and Microchip Diode-Pumped CW Laser Performance of Tm,Ho:KYW Crystal, Natali Gusakova[1,3], Sergei V. Kurilchik[1,3], Maxim Demesh[1,3], Anatol S. Yasukevich[1,3], Viktor E. Kisel[1,3], Anatoliy A. Pavlyuk[2], Nikolai V. Kuleshov[1,3]; [1]*BNTU, Belarus;* [2]*Inst. of Inorganic Chemistry, Russia;* [3]*Center OMT, Belarus.* Energy transfer parameters of Tm(5at.%),Ho(0.4at.%):KYW single crystal were investigated. A diode-pumped CW Tm,Ho:KYW microchip laser was realized. Maximum output power of 77 mW at 2070 nm was achieved in the fundamental TEM_{00} mode.

AM5A.16 • Investigations on $Yb^{3+}:ScBO_3$- a novel laser crystal in rare-earth ions doped orthoborate systems, Dazhi Lu[1], Tianxiang Xu[1], Zhongben Pan[2], Haohai Yu[1], Huaijin Zhang[1], Jiyang Wang[1]; [1]*Shandong Univ., China;* [2]*Inst. of Chemical Materials and Advanced Materials Research Center, China Academy of Engineering Physics, China.* Optical-quality $Yb^{3+}:ScBO_3$ crystal has been grown by the Czochralski method. The thermal and spectral properties were studied. The continuous-wave $Yb^{3+}:ScBO_3$ crystal laser has been demonstrated which indicates its promising utilization in moderate-power lasers.

AM5A.17 • The Concentration Effect on Spectroscopic Properties of $Er:CaF_2$ crystals, Weiwei Ma[1,2], Liangbi Su[1], Jingya Wang[1], Dapeng Jiang[1], Xiaodong Xu[1], Jun Xu[3]; [1]*Shanghai Inst. of Ceramics, Chinese Academy of Sciences, China;* [2]*Univ. of Chinese Academy of Sciences, China;* [3]*Inst. for Advanced Study, Tongji Univ., China.* The concentration effect on spectroscopic properties of $Er:CaF_2$ crystals was investigated. Lifetime of $^4I_{13/2}$ decreased faster than $^4I_{11/2}$. 8at.%$Er:CaF_2$ had the highest absorption and emission cross-section and a relatively favorable lifetime for 2.73μm emission.

AM5A.18 • High gain low temperature active mirror Yb:YAG laser amplifier qualification, Samuel Marrazzo[1], Thierry Gonçalves-Novo[1], Bernard Vincent[1], Jean-Christophe Chanteloup[1]; [1]*Laboratoire LULI, USA.* Gains as high as 20 for a 77mm ceramic Yb:YAG disks are recorded in the 80-200K temperature range on a laser amplifier cooled through a static low pressure helium gas cell operated in the 1 to 10 Hz regime.

AM5A.19 • Thermally Induced Distortions of the Temporal Phase Of Optical Pulses In Phosphorous-doped Silica Fibers, Yutong Feng[1], Betty Meng Zhang[1], Achar Harish[1], Johan Nilsson[1]; [1]*Univ. of Southampton, UK.* We study the phase distortion induced in optical pulses due to thermal effects in Sm doped silica fibers. We experimentally measure the phase change accurately using an interferometric technique.

AM5A.20 • Fiber Absorption Measurement Errors Resulting from Re-emission of Radiation, Betty M. Zhang[1,2], Junqing Zhao[1], Yutong Feng[1], Sheng Zhu[1], Jonathan H. Price[1], Johan Nilsson[1]; [1]*Optoelectronics Research Centre, Univ. of Southampton, UK;* [2]*School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore*. We show that errors in the absorption measured in rare-earth-doped fibers can exceed 50% and severely distort the spectral shape. This is a result of re-emission in fibers with overlapping absorption and emission spectra.

AM5A.21 • Cavity-dumped mode-locked picosecond $Nd:GdVO_4$ oscillator, Peng Gao[3], Jie Guo[1], Jinfeng Li[1], Xiaoyan Liang[1,2]; [1]*Shanghai Inst of Optics & Fine Mechanics, China;* [2]*Shanghai Tech Univ., China;* [3]*Shanghai Inst of Optics & Fine Mechanics, China.* We report on a passively mode-locked solid-state picosecond $Nd:GdVO_4$ oscillator with cavity-dumping. Pulse energies of 8 uJ and 16.7 uJ with sub-10 ps have been achieved at 1 MHz and 300 kHz, respectively.

AM5A.22 • 1.94 GHz CW Modelocked Ytterbium-Doped Bismuthate Glass Waveguide Laser, Adam Lancaster[1], Amol Choudhary[2,3], Jha S. Nitin[1], Rose Mary[1], David P. Shepherd[2], Ajoy K. Kar[1]; [1]*Inst. of Photonics and Quantum Sciences, Heriot-Watt Univ., UK;* [2]*Optoelectronics Research Centre, Univ. of Southampton, UK;* [3]*School of Physics, Univ. of Sydney, Austria.* A 1.94 GHz CW modelocked ytterbium-doped bismuthate waveguide laser is presented. The waveguide was fabricated using the ultrafast laser inscription technique. Pulse energy of 30.9 pJ and pulse duration of 1.1 ps are inferred from the spectral width.

AM5A.23 • Sub-40-fs pulses generated from a diode-pumped Kerr-lens mode-locked Yb:YCOB laser, Ziye Gao[1], Jiangfeng Zhu[1], Ke Wang[1], Junli Wang[1], Zhaohua Wang[2], Zhiyi Wei[2], Haohai Yu[3], Huaijin Zhang[3], Jiyang Wang[3]; [1]*Xidian Univ., China;* [2]*Beijing National Lab for Condensed Matter Physics, Chinese Academy of Sciences Inst. of Physics,, China;* [3]*Shandong Univ., China.* We demonstrate a diode-pumped Kerr-lens mode-locked $Yb:Ca_4YO(BO_3)_3$ laser, generating sub-40 fs pulses directly from the oscillator without extracavity compression. The laser is centered at 1049-nm with 35-nm bandwidth and delivers 53-mW average output power.

AM5A.24 • Graphene Mode-Locked Femtosecond Cr:LiSAF Laser, Ferda Canbaz[1], Nurbek Kakenov[2], Coskun Kocabas[2], Umit Demirbas[3], Alphan Sennaroglu[1]; [1]*Koç Univ., Turkey;* [2]*Bilkent Univ., Turkey;* [3]*Antalya International Univ., Turkey.* We report the first demonstration of femtosecond pulse generation from a Cr:LiSAF laser mode-locked with a monolayer graphene saturable absorber. Nearly transform-limited 72-fs pulses were generated at 850 nm with only two 135-mW pump diodes.

AM5A.25 • Kerr-lens mode-locked $Yb^{3+}:CaYAlO_4$ laser and octave-spanning supercontinuum generation, Zijiao Yu[1], Hainian Han[1], Jinwei Zhang[1], Lei Hou[1], Yang Xie[2], Zhiyi Wei[1]; [1]*Inst. of Physics, CAS, China;* [2]*School of Physics and Optoelectronics Engineering, Xidian Univ., China.* We reported a stable Kerr-lens mode-locked $Yb^{3+}:CaYAlO_4$ oscillator. The shortest pulse duration was measured to be 57fs and the maximum mode-locked power was more than 1W. An octave-spanning supercontinuum in a PCF was also generated.

AM5A.26 • High power dual-wavelength Kerr-lens mode-locked Yb:YAG thin disk laser, Yingnan Peng[1], Jinwei Zhang[2], Dehua Li[2], Zhiyi Wei[2]; [1]*School of Physics and Optoelectronics Engineering, Xidian Univ., China;* [2]*CAS Inst. of Physics, China.* We demonstrated a dual-wavelength Kerr-lens mode-locked Yb:YAG thin disk laser centered at the wavelengths of 1031 nm and 1049 nm, respectively. Total average output power was 12.9 W with typical pulse duration of 220 fs.

AM5A.27 • Cryogenically-Cooled Mode-Locked Yb:YGAG Ceramic Laser, Jiri Muzik[2,1], Michal Jelinek[2], Taisuke Miura[1], Martin Smrz[1], Akira Endo[1], Tomas Mocek[1], Vaclav Kubecek[2]; [1]*HiLASE Center, Inst. of Physics CAS, Czech Republic;* [2]*Faculty of Nuclear Sciences and Physical Engineering, Czech Technical Univ., Czech Republic.* We demonstrate a passively mode-locked Yb:YGAG ($Yb:Y_3Ga_2Al_3O_{12}$) ceramic laser generating picosecond pulses at 83-K temperature. In free-running regime at cryogenic temperature, 55% optical-to-optical efficiency and 8-nm wide tuning range were achieved.

AM5A.28 • Enhancing the Gain-bandwidth of a Kerr-lens Mode-locked Yb:YAG Thin-disk Oscillator Through Increased Nonlinearities, Jonathan Brons[1], Vladimir Pervak[2], Dominik Bauer[3], Dirk Sutter[3], Alexander Apolonski[1,2], Oleg Pronin[1], Ferenc Krausz[1,2]; [1]*Max-Planck-Institut für Quantenoptik, Germany;* [2]*Ludwig-Maximilians-Universität München, Germany;* [3]*TRUMPF Laser GmbH, Germany.* The full emission-bandwidth of Yb :YAG is exploited by ensuring suitably high self-phase-modulation inside a Kerr-lens mode-locked oscillator. Applying a previously reported power-scaling scheme we reach 145 W, 140 fs pulses with 59 MW peak-power.

AM5A.29 • Ultrahigh-repetition-rate femtosecond optical parametric oscillator, Wenlong Tian[2], Zhaohua Wang[1], Jiangfeng Zhu[2], Zhiyi Wei[1]; [1]*Chinese Academy of Sciences , China;* [2]*school of technical and optoelectronics engineering, Xidian Univ., China.* We reported a synchronously pumped femtosecond optical parametric oscillator (OPO) with a record-high repetition rate of 1.37 THz by fractionally changing the OPO cavity length, which generating 138 fs signal pulses with 175 mW average power.

AM5A.30 • Passively Q-switched Tm:YAP laser and in-band pumped Cr:ZnSe polycrystalline crystal laser, Xiao Zou[1], Yuxin Leng[1], Yanyan Li[1], Yapei Peng[1], Yongjun Dong[1], Benxue Jiang[1], Long Zhang[1]; [1]*Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences , China.* A passively Q-switched Tm:YAP laser was demonstrated with the maximum average output power of 1.32W. Moreover, we demonstrate a polycrystalline Cr:ZnSe crystal laser in-band pumped at 2000nm. Compared to the results for pumping at 1918nm, the slope efficiency was enhanced around 40%.

AM5A.31 • High-repetition-rate, high-peak-power passively Q-switched ceramic Nd:YAG 946 nm laser, Renpeng Yan[1], Xin Yu[1], Xudong Li[1], Zhi-Wei Dong[1], Yufei Ma[1], Jiang Li[2], Yubai Pan[2]; [1]*Harbin Inst. of Technology, China;* [2]*Shanghai Inst. of Ceramics, China.* We demonstrate a high-repetition-rate, high-peak-power diode-pumped passively Q-switched ceramic Nd:YAG quasi-three-level laser at 946 nm. The maximum peak power reaches 12.4 kW with a pulse width of 13.0 ns at 3.3 kHz.

AM5A.32 • 750-nm LED-pumped Nd:YAG laser, Kuan-Yan Huang [1], YU-CHUNG CHIU[1], Cheng-Kuo Su[1], Meng-Wei Lin[1], Yen-Chieh Huang[1]; [1]*National Tsing Hua Univ., Taiwan.* We report a Nd:YAG laser pumped by a broadband 750 nm LED. By pulsing the LED with a current 3 times above the maximum allowed CW current, the laser generates ~1 mW peak power from a 1.5% output coupler.

AM5A.33 • Thin-tapered-rod Yb:YAG single-crystal laser amplifier, Ivan Kuznetsov[1], Ivan Mukhin[1], Olga Vadimova[1], Oleg Palashov[1], Ken-Ichi Ueda[1,2]; [1]*Inst. of Applied Physics of the RAS, Russia;* [2]*Inst. for Laser Science, Univ. of Electro-Communications, Japan.* Thin-tapered-rod single-crystal active element is proposed to use in laser amplifiers. Numerical and experimental investigation of small signal gain in thin-rod and thin-tapered-rod geometries is performed and advantages of thin-tapered-rod active element are shown.

AM5A.34 • Tunable CW Solid-State Mid-IR $Cr^{2+}:CdSe$ Single Crystal Laser with Diode Laser Array Pumping, Mikhail K. Tarabrin[1,2], Alexander Kovtun[1], Vladimir Lazarev[1], Valeriy Karasik[1], Alexey Kireev[2], Vladimir Kozlovsky[2], Yuri Korostelin[2], Yuriy Podmar'kov[2,3], Mikhail Frolov[2,3], Mikhail Gubin[2,4]; [1]*Bauman Moscow State Technical Univ., Russia;* [2]*Lebedev Physical Inst. of the Russian Academy of Sciences, Russia;* [3]*Moscow Inst. of Physics and Technology, Russia.* We demonstrate the first $Cr^{2+}:CdSe$ single crystal laser with diode laser array pumping. Laser efficiency of 12% with output power of 280 mW was obtained. Tunable CW operation was observed in 2450 – 3060 nm range.

AM5A.35 • Harmonic generation of Kerr-lens mode-locked Polycrystalline Cr:ZnS laser, Xintong Sun[1], Long Wei[1], Zhaohua Wang[2], Zhiyi Wei[2]; *[1]Xidian Univ., China; [2]Inst. of physics, China.* We demonstrated a Kerr-Lens mode-locked Polycrystalline Cr:ZnS laser pumped by a all-solid-state Er:YAG laser which yields at 1645 nm. Harmonic waves from second to fourth of the mode-locked were observed simultaneously for the first time.

AM5A.36 • Study on Synchronously pumped KGW solid-state Raman laser, Xiaoqiang Gao[1], Mingliang Long[1], Gang Li[1], Meng Chen[1]; *[1]Beijing Univ. of Technology, China.* Up to 270mW multi-wavelength collinear Raman output and 7.429% overall efficiency are observed through developed synchronously pumped technology which has never been reported before. The developed technology also can be employed to the IR band.

AM5A.37 • High energy dissipative Raman soliton laser through XPM stabilization, Emre Ergecen[1], Ugur Tegin[2], Parviz Elahi[2], Cagri Senel[3], F Omer Ilday[2,4]; *[1]Middle East Technical Univ., Turkey; [2]Dept. of Physics, Bilkent Univ., Turkey; [3]TUBITAK National Metrology Inst. (UME), Turkey; [4]Dept. of Electrical and Electronics Engineering, Bilkent Univ.,Turkey.* Dispersion, nonlinearity and gain determine the intracavity pulse behaviour. We show that pump depletion and XPM play a significant role in the stabilization of high energy dissipative Raman solitons. Using this theoretical knowledge, we predict and demonstrate 7-nJ femtosecond pulses at 1120 nm.

AM5A.38 • Optimal Temperature for the Cryogenically Cooled 946-nm Nd:YAG Laser with Monolithic Resonator, C. Y. Cho[1], T. L. Huang[1], P. H. Tuan[1], J. C. Tung[1], Yung-Fu Chen[1,2]; *[1]Electrophysics, National Chiao Tung Univ., Taiwan; [2]Electronic Engineering, National Chiao Tung Univ., Taiwan.* An optimal temperature of 130 K is observed for the cryogenic 946-nm monolithic Nd:YAG laser. The pump criterion is discussed and the output power is up to 24 W with conversion efficiency of 71%.

AM5A.39 • Wavelength Control by Angle-Tuning of the Laser Radiation in an Intra-Cavity Pumped Yb:YAG Thin-Disk Laser, Christian Vorholt[1], Ulrich Wittrock[1]; *[1]Photonics Lab, Muenster Univ. of Applied Sciences, Germany.* In an intra-cavity pumped thin-disk laser the pump radiation forms a standing wave pattern inside the intra-cavity pumped disk. We demonstrate experimentally that the grating period of the standing wave pattern of the pump radiation can control the laser wavelength.

AM5A.40 • Master Oscillator Power Amplifier Systems for Ion Beam Cooling, Daniel Kiefer[1], Tobias Beck[1], Thomas Walther[1]; *[1]Inst. of Applied Physics, TU Darmstadt, Germany.* We present a fiber amplifier based laser at 1028 nm frequency converted to 257 nm. A pulse expansion currently set up for the system is also presented. The systems are used in cooling of highly relativitsic ion beams at storage rings.

AM5A.41 • Intensity Noise Quantification of Regenerative Amplifiers, Martin A. Finger[1], Nicolas Y. Joly[2,1], Maria V. Chekhova[1,2], Philip S. Russell[1,2]; *[1]Max Planck Inst. for the Science of Light, Germany; [2]Dept. of Physics, Univ. of Erlangen-Nuremberg, Germany.* We quantify pulse-energy fluctuations of a regenerative amplifier by online measurement of the coefficient of variation and use this to optimize the cavity dumper. Applying this method, noise influence on an OPA is studied.

AM5A.42 • Controlling the Output Phase and Coherence of Degenerate Cavity Solid-State Lasers, Vishwa Pal[1], Chene Tradonsky[1], Ronen Chriki[1], Asher A. Friesem[1], Nir Davidson[1]; *[1]Weizmann Inst. of Science, Israel.* Recent experimental results on controlling the output phase distributions and coherence of Nd:YAG solid-state lasers are presented. The control is achieved with a degenerate cavity configuration, diffractive coupling and intracavity spatial filters.

AM5A.43 • Single- and two-color laser generation from etalon out-coupled Nd:YVO_4 laser, Yu-Chung Chiu[1], Bo-Chang Wang[1], Ming-Hsiung Wu[1], Yen-Chieh Huang[1]; *[1]National Tsing Hua Univ., Taiwan.* We demonstrate single and two-color laser from a c-cut Nd:YVO_4 crystal using a 114 -um thick etalon as an output coupler. Wavelength selection is achieved by tilting the etalon to cause gain competition and suppression.

AM5A.44 • Pulse Stabilization in Multi-longitudinal Mode Passively Q-Switched Microchip Laser, Dimeng Chen[1], Ying Cheng[1], Jun Dong[1]; *[1]Xiamen Univ., China.* Pulse stabilization in multi-longitudinal mode Yb:YAG enhanced Cr,Yb:YAG passively Q-switched microchip lasers has been achieved by carefully controlling the number, intensities of longitudinal modes and applied pump power intensity.

AM5A.45 • The Longitudinal Temperature Distribution in Active Fibers under Lasing Condition, Konstantin Prusakov[1], Oleg Ryabushkin[1], Victor Sypin[1]; *[1]Moscow Inst. of Physics and Technology, Russia.* Novel method for precise temperature measurement of active fibers under conditions of laser generation and amplification is introduced. Measurements of temperature kinetics of active fibers allow determination of heat transfer coefficient at polymer air boundary.

AM5A.46 • Achieving Room Temperature Orange Lasing Using InGaP/InAlGaP Diode Laser, Ahmad A. Al-Jabr[1], Mohammed Abdulmajed[1], Mohammed S. Bin Alias[1], Tienkhee Ng[1], Boon Ooi[1]; *[1]King Abdullah Univ of Sci & Technology, Saudi Arabia.* We demonstrated the first orange laser diode at room temperature with a decent total output power of ~46mW and lasing wavelength of 608nm, using a novel strain-induced quantum well intermixing in InGaP/InAlGaP red laser structure.

AM5A.47 • Continuous-wave Semiconductor Disk Laser Emitting at 224 nm via Intracavity Frequency Tripling, Julio M. Rodríguez García [1], David Pabœuf[1], Jennifer E. Hastie[1]; *[1]Univ. of Strathclyde, UK.* We present frequency tripling of a tunable continuous-wave red AlGaInP semiconductor disk laser. From a fundamental beam at 674 nm, output power up to ~100 μW and laser tunability over 1.8 nm are reported.

AM5A.48 • Generation and Characterization of High Power and Higher Order Ultrafast Optical Vortices, Apurv Chaitanya N[1,2], A. Aadhi[1,2], M. V. Jabir[1], M. R. Pathak[1], N. U. Shaikh[1], G. K. Samanta[1]; *[1]Physical Research Lab, India; [2]Indian Inst. of Technology-Gandhinagar, India.* We report on generation of high-power and high-order ultrafast optical vortex beams. Frequency-doubling of optical vortices at 1064nm in BIBO crystal, we have generated vortices of maximum power and order of ~900mW and 12 respectively.

AM5A.49 • Fiber Laser Based High Power, Ultrafast Source for 355 nm, Apurv Chaitanya N[1,2], A. Aadhi[1,2], M. V. Jabir[1], G. K. Samanta[1]; *[1]Physical Research Lab, India; [2]Indian Inst. of Technology-Gandhinagar, India.* We report a high powers, high repetition rate fiber laser based UV source providing output power as high as 1.06W at 355nm. The source has output pulses of width ~576fs and spectral width of 1.6nm.

AM5A.50 • 736 W Average Power All-fiber Nanosecond MOPA Based on Ultra-low NA Ytterbium Doped Fiber, Liangjin Huang[1], Haiyue Sun[1], Jinyong Leng[1], Shengping Chen[1], Pu Zhou[1], Shaofeng Guo[1], Xiang'ai Cheng[1]; *[1]College of Optoelectronic Science and Engineering,National Univ. of Defense Technology, China; [2]Optoelectronic Research Center, Univ. of Southampton, UK.* We report an all-fiberized high average power pulsed fiber amplifier based on ultra-low NA step-index Yb-doped double-clad fiber. An output power of 736W with M^2~1.35 is obtained, which corresponds to 64kW peak-power and 0.39mJ pulse-energy.

AM5A.51 • Nonlinearity Management of Fiber Oscillator with Multiple Gain Segments, Tesfay Teamir[1]; *[1]Bilkent Univ., Turkey.* Oscillator with two gain segments is used to manage nonlinearity level and distribution. Results suggest that pulse evolution subject to an effective negative nonlinearity arising from complex interaction of gain filtering, dispersion, SFM and chirp.

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Notes

07:00—18:30 • Registration, *Foyer A*

08:00—10:08
ATu1A • Rare-Earth Doped Materials
Bunsen Hall (Bunsensaal)
Presider: Jacob Mackenzie, Univ. of Southampton, UK

ATu1A.1 • 08:00
High Power Continuous Wave Tb^{3+}:$LiLuF_4$ Laser, Philip W. Metz[1], Daniel-Timo Marzahl[1], Ahmad Majid[1], Christian Kraenkel[1,2], Günter Huber[1,2]; [1]*Institut für Laser-Physik, Universität Hamburg, Germany;* [2]*Universität Hamburg, The Hamburg Centre for Ultrafast Imaging, Germany.* We obtained up to 0.9 W of cw green output at 544 nm with highly Tb^{3+}-doped $LiLuF_4$ under pumping with a 2ω-OPSL at 486 nm and investigated the laser performance at different doping concentrations.

ATu1A.2 • 08:12
Record laser wavelength tunability of Pr:$LiYF_4$ around 900nm, Biao Qu[1], Richard Moncorge[2], Zhiping Cai[3], Jean-Louis Doualan[4], Bin Xu[3], Huying Xu[3], Alain Braud[2], Patrice Camy[2]; [1]*Univ. of Caen, CIMAP, France;* [3]*Xiamen Univ., China;* [4]*CIMAP, CNRS, France.* CW laser wavelength tunability of 70 nm is demonstrated in the 900nm spectral range by pumping a Pr:$LiYF_4$ single crystal with an OPSL laser and by using a V-shape resonator and a quartz birefringent plate.

ATu1A.3 • 08:24
Polarization effects in Pr^{3+}-doped cubic KY_3F_{10} and stable dual wavelength lasing, Philip W. Metz[1], Thomas Calmano[1,2], Daniel-Timo Marzahl[1], Christian Kraenkel[1,2], Günter Huber[1,2]; [1]*Institut für Laser-Physik, Universität Hamburg, Germany;* [2]*The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Germany.* By proper selection of pump light wavelength, polarization, and crystal orientation, linearly polarized laser output, independent dual wavelength operation, and intracavity frequency doubling can be obtained in the cubic crystal Pr^{3+}:KY_3F_{10}.

ATu1A.4 • 08:36
Visible Laser Emissions from Pr^{3+}:$LiLuF_4$ Single Crystal Grown with the µ-Pulling Down Technique, Stefano Veronesi[1,2], Alberto Sottile[1], Zhonghan Zhang[1], Daniela Parisi[2,1], Alberto Di Lieto[1,2], Mauro Tonelli[1,2]; [1]*Fisica, Universita' di Pisa, Italy;* [2]*Istituto Nanoscienze - CNR, Italy.* We report the first laser emissions from a fiber-shaped crystal of Pr^{3+}:$LiLuF_4$, grown with the micro-Pulling Down method, achieving high-grade slopes with diffraction-limited output beams. Segregation in the crystal was remarkably high for Praseodymium ions.

ATu1A.5 • 08:48
CW and Q-switched Diode-Pumped Laser Operation of Er,Yb:GdAl3(BO3)4 Crystal, Konstantin Gorbachenya[1], Viktor E. Kisel[1], Anatol S. Yasukevich[1], Viktor V. Maltsev[2], Nikolai I. Leonyuk[2], Nikolai V. Kuleshov[1]; [1]*Center for optical materials and technologies, Belarus;* [2]*Geological Faculty, Moscow State Univ., Russia.* We report high-power CW and, for the first time to our knowledge, passively Q-switched Er,Yb:GdAl3(BO3)4 laser with pulse energies of 4.5-44 µJ, pulse durations of 5-14.5 ns, and repetition rates of 5-100 kHz.

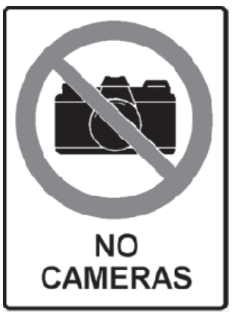
ATu1A.6 • 09:00
Lasing in Nd^{3+}-doped Sapphire, Sven H. Waeselmann[1], Sebastian Heinrich[1], Christian Kraenkel[1,2], Günter Huber[1,2]; [1]*Institut für Laser-Physik, Universität Hamburg, Germany;* [2]*The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Germany.* We present the first Nd^{3+}:sapphire laser with a quasi-continuous wave output of 80 mW at 1092 nm and 3.9% slope efficiency in a 2.6 µm thick planar waveguide geometry.

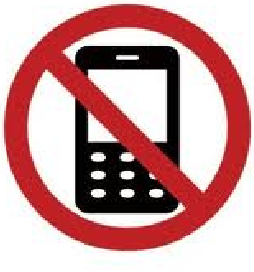
ATu1A.7 • 09:12
Exploring a Diffusion-Bonded Nd:YVO_4/Nd:$GdVO_4$ Crystal for Generating an Efficient Diode-End-Pumped Dual-Spectral-Band Laser, Yu-Jen Huang[1], Hsin-Ham Cho[1], Kuan-Wei Su[1], Yung-Fu Chen[1,2]; [1]*Dept. of Electrophysics, National Chiao Tung Univ., Taiwan;* [2]*Dept. of Electronics Engineering, National Chiao Tung Univ., Taiwan.* A diffusion-bonded Nd:YVO_4/Nd:$GdVO_4$ crystal is designed to generate a diode-end-pumped dual-spectral-band laser around 1.06 µm in Q-switched and mode-locked operations. Wavelength extension to eye-safe region via intracavity optical parametric oscillation is also demonstrated with this material.

ATu1A.8 • WITHDRAWN

ATu1A.9 • 09:36 Invited
Growth and Initial Experiments Demonstrating Watt Level Output From Yb:YAG Planar Waveguides Grown by Pulsed Laser Deposition, Stephen J. Beecher[1], James Grant-Jacob[1], Tina L. Parsonage[1], Ping Hua[1], Amol Choudhary[2], Jacob I. Mackenzie[1], David P. Shepherd[1], Robert Eason[1]; [1]*Optoelectronics Research Centre, UK;* [2]*School of Physics, Univ. of Sydney, Australia.* We report on the growth and initial characterization of pulsed laser deposited Yb:YAG. When used as a planar waveguide laser slope efficiencies of at least 34% are observed for a 45% reflectivity output coupler.

ATu1A.10 • 09:56
Energy-transfer enhanced anti-Stokes cooling efficiency in Yb doped fluoride single crystals, Mauro Tonelli[1,2], Alberto Di Lieto[1,2], Azzurra Volpi[1,2]; [1]*Università degli Studi di Pisa, Italy;* [2]*NEST Istituto Nanoscienza-CNR, Italy.* Optical cooling is investigated in Yb doped fluoride single crystals. Efficiency enhancement via Yb-Tm energy-transfer assisted anti-Stokes cooling is achieved in co-doped $LiYF_4$ single crystals.





ATu2A.1 • Thermal stability of ferroelectric domain gratings in Rb-doped $KTiOPO_4$, Gustav Lindgren[1], Alexandra Pena[2], Andrius Zakauskas[1], Charlotte Liljestrand[1], Bertrand Ménaert[2], Benoit Boulanger[2], Carlota Canalias[1]; [1]*Laser Physics, KTH, Sweden;* [2]*MCMF, Institut Néel/UJF/CNRS, France.* We study the thermal stability of domain walls in periodically poled Rb-doped KTP crystals as a function of domain grating periodicity. Complete back-switching was observed by optical microscopy for sub-micrometer domains annealed at 730 °C.

ATu2A.2 • Laser-Induced Photonic Waveguides and Systems in Ferroelectric Crystals, Vladimir Shandarov[1], Anton Perin[1], Vladimir Ryabchenok[1], Feng Chen[2]; [1]*State Univ. of Control Systems and, Russia;* [2]*School of Physics, Shandong Univ., China.* Photonic waveguides and waveguide systems are created in ferroelectric crystals of lithium niobate and potassium sodium strontium barium niobate exploiting their pyroelectric properties and optical absorption at light wavelengths of 532 and 633 nm.

ATu2A.3 • Advanced NLO Crystals for Efficient Blue Laser Sources Based on SHG Processes, Lucian Gheorghe[1], Alexandru Achim[1], Flavius Voicu[1], George Stanciu[1]; [1]*INFLPR, Romania.* $La(Ca_{1-x}Sr_x)_4O(BO_3)_3$ - LaSrCOB crystals (x = 0.0, 0.1, 0.3, 0.4) of good optical quality were grown by the Czochralski method and characterized. By a proper choice of the compositional parameter x, we can obtain blue light in the range of 495 - 473 nm through type-I NCPM SHG in LaSrCOB crystals.

ATu2A.4 • High-Average-Power, Picosecond Laser Induced Damage Behavior of Blank Lithium Niobate Crystals at 1030 nm, Florian Bach[1], Mark Mero[1], Ming-Hsien Chou[2], Frank Noack[1], Valentin Petrov[1]; [1]*Max Born Inst., Germany;* [2]*HC Photonics Corp., Taiwan.* R-on-1 laser induced breakdown thresholds are reported for a wide range of coated and uncoated lithium niobate crystals obtained at the laser parameters of 1030 nm, 1 ps, 10 and 100 kHz.

ATu2A.5 • Measurement of Continuous-Wave and Pulsed Laser Damage Thresholds of Nonlinear Optical Crystals at Various Wavelengths, Shekhar Guha[1]; [1]*US Air Force Research Lab, USA.* Laser damage thresholds of state-of-the art nonlinear optical crystals including GaAs, GaP, $CdSiP_2$ and $ZnGeP_2$ measured at 1064 nm, 1550 nm and 1940 nm using continuous wave and pulsed lasers will be presented.

ATu2A.6 • Laser Induced Damage Threshold of CVD-Grown Single Crystal Diamond Surfaces with Various Surface Finishes, Sean Reilly[1], Vasili Savitski[1], Hangyu Liu[1], Stuart Reid[2], Des Gibson[2], Harpreet Dhillon[3], Stefan Olsson Robbie[3], Erdan Gu[1], Martin Dawson[1], Andrew Bennett[3], Alan Kemp[1]; [1]*Inst. of Photonics, Univ. of Strathclyde, UK;* [2]*Univ. of West of Scotland, UK;* [3]*Element 6, UK.* The laser induced damage threshold of diamond surfaces is presented and that of surfaces with various mechanical and chemical etch compared. The LIDT of the diamond surfaces was found to be around 26 Jcm^{-2}.

ATu2A.7 • Temperature dependence of magneto-optic effect in a Ti-doped terbium aluminum garnet (TAG) ceramic, Hiroaki Furuse[1], Ryo Yasuhara[2], Keijiro Hiraga[1], Shengming Zhou[3]; [1]*Kitami Inst. of Technology, Japan;* [2]*National Inst. for Fusion Science, Japan;* [3]*Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China.* The Verdet constant of a 0.8 at.% Ti-doped TAG ceramic was investigated between 5 and 296 K. A high value of the Verdet constant was obtained as 184.2 rad/Tm at 296 K for 632.8 nm.

ATu2A.8 • Next generation of Faraday isolators for IR high-power lasers and UV-visible LDs, Encarnacion G. Villora[1]; [1]*National Inst. for Materials Science, Japan.* The oxide garnet $\{Tb_3\}[Sc_{2-x}Lu_x](Al_3)O_{12}$ (TSLAG) is developed as alternative to $Tb_3Ga_5O_{12}$ (TGG). TSLAG exhibits better transmittance, Verdet constant, and radiation resistance. Further, PrF_3 and CeF_3 fluoride crystals are investigated as unique Faraday rotators for the UV-visible region.

ATu2A.9 • Thermally Induced Beam Distortions in CaF_2 and Other Elastically Anisotropic Cubic Single Crystals, Anton G. Vyatkin[1], Efim A. Khazanov[1]; [1]*Inst. of Applied Physics RAS, Russia.* Thermally induced beam distortions in cubic single crystals with anisotropic elastic properties were calculated analytically and numerically. The isotropic expressions for birefringence and arithmetic mean phase have been generalized.

ATu2A.10 • Sandwich concept for absolute photo-thermal absorption measurements in nonlinear crystals and laser materials, Christian Muehlig[1], Simon Bublitz[1]; [1]*Leibniz Institut of Photonic Technology, Germany.* A new concept enhances the capability of absolute photo-thermal absorption measurements with transversal probe beam guiding. The so-called sandwich concept is particularly designed to investigate nonlinear and laser crystals as well as high reflective coatings.

ATu2A.11 • High-order nonlinearities in Tb^{3+} doped calcium aluminosilicate glasses, Tomaz . Catunda[1], Jessica F. dos Santos[1], Luiz A. Nunes[1], Nelson . Astrath[2], Mauro L. Baesso[2], Richard Moncorgé[3]; [1]*USP Inst de Fisica de Sao Carlos, Brazil;* [2]*Física, Universidade Estadual de Maringá, Brazil;* [3]*Université de Caen, France.* Very high order nonlinearites were observed in Tb^{3+} doped glasses, using the time resolved Z-scan technique. Our results indicates that these nonlinearities are related to the intensity of the 4f5d transitions of the Tb^{3+} ion.

ATu2A.12 • Optimization of Resonantly Pumped Er:YAG Lasers by Modeling Energy Transfer Up-Conversion Processes, Xin Wang[1,2], Oliver Lux[2], Haro Fritsche[2], Hans J. Eichler[2]; [1]*Beijing Inst. of Technology, China;* [2]*Inst. of Optics and Atomic Physics, Technische Universität Berlin, Germany.* A theoretical model describing the performance of anEr:YAG laser under the influence of energy transfer up-conversion (ETU) is derived. The model was used to optimize an efficient diode-pumped Er:YAG laser at 1645 nm.

ATu2A.13 • Spectral-Luminescence Investigation of Strontium Molybdate Crystal Doped with $Ho^{3+}$and Tm^{3+} Ions, Liudmila Ivleva[1], Elizaveta Dunaeva[1], Maxim E. Doroshenko[1], Petr Zverev[1], Anastasia Nekhoroshikh[1], Vjatcheslav Osiko[1]; [1]*A.M.Prokhorov General Physics Inst., Russia.* The absorption, fluorescence properties and laser oscillations of $SrMoO_4$ crystals doped with Tm^{3+} and Ho^{3+} were studied to develop the active medium for mid-IR lasers with self-Raman conversion of radiation.

ATu2A.14 • Thermal characteristics of Nd-doped disordered Nd: $BaLaGa_3O_7$ crystal, Yuanyuan Zhang[1], Xuping Wang[1], Yuguo Yang[1], Bing Liu[1], Xianshun Lv[1], Lei Wei[1], Haohai Yu[2], Huaijin Zhang[2]; [1]*Shandong Academy of Sciences, China;* [2]*Shandong Univ., China.* At room temperature, the specific heat, thermal diffusion coefficient and thermal conductivity were determined to be 0.365 J/g/K, 0.97 mm/s and 1.96 W/m/K. The conductivity increases with increasing temperature, which makes high power scaling possible.

ATu2A.15 • Spectroscopic and Laser Properties of Fe^{2+} Ions in Solid Solutions Based on ZnSe Crystal, Maxim E. Doroshenko[1], Vyacheslav Osiko[1], Helena Jelinkova[2], Michal Jelinek[2], Michal Nemec[2], Nazar Kovalenko[3], Andrii Gerasimenko[3]; [1]*A.M. Prokhorov General Physics Inst RAS, Russia;* [2]*Czech Technical Univ., Czech Republic;* [3]*Inst. for Single Crystals NAN, Ukraine.* Investigations of the spectroscopic and laser properties of Fe^{2+} ions in $Zn_{1-x}Mg_xSe$ and $Zn_{1-x}Mn_xSe$ solid solutions with different content x are carried out in the 77-300 K temperature range. The influence of the matrix material on the Fe^{2+} ion properties is discussed.

ATu2A.16 • Iron-doped CdxMn1-xTe Active Material for Mid-IR lasers, Helena Jelinkova[1], Jan Sulc[1], Michal Jelinek[1], Michal Nemec[1], David Vyhlidal[1], Maxim E. Doroshenko[2], Vyacheslav Osiko[2], Nazar Kovalenko[3], Andrii Gerasimenko[3]; [1]*Czech Technical Univ. Prague, Czech Republic;* [2]*Laser Mat and Tech. Research Center, AM Prokhorov General Physics Inst of RAS, Russia;* [3]*Inst for Single Crystals, NAS of Ukraine, Ukraine.* Spectral characteristics of Fe:CdMnTe active material with different Cd-Mn composition are presented as well as the temperature dependence of fluorescence spectra and decay time.

ATu2A.17 • Lasing of Low-doped Tm:CaF_2 Ceramics and Single Crystal, Jan Sulc[1], Michal Nemec[1], Martin Fibrich[1], Helena Jelinkova[1], Maxim E. Doroshenko[2], Vasily A. Konjushkin[2], Andrei Nakladov[2], Vyacheslav Osiko[2]; [1]*Czech Technical Univ. in Prague, Czech Republic;* [2]*A.M. Prokhorov General Physics Inst RAS, Russia.* The Tm(0.4 wt.%):CaF_2 crystal and ceramics were investigated. Possible forming of new Tm^{3+}optical centers during the hot-forming procedure was observed. Broad laser tunability in range 1820 -1910 nm was obtained.

ATu2A.18 • Grain size distribution for optimized random laser emission in Nd^{3+}:YVO_4 powder pellets, Niklaus U. Wetter[1], Julia M. Ghiel[1]; [1]*Centro de Lasers e Aplicações - IPEN/SP, Brazil.* This work demonstrates a fivefold increase in laser efficiency of an Nd^{3+}:YVO_4 random laser by using mixtures of grain sizes.

ATu2A.19 • Modeling of an Edge-Emitting strained-Ge laser, Giovanni Capellini[1], Michele Virgilio[2], Yuji Yamamoto[1], Lars Zimmermann[1], Bernd Tillack[1], Dirk Peschka[3], Marita Thomas[3], Annagret Glitzky[3], Reiner Nürnberg[3], Klaus Gärtner[4], Thomas Koprucki[3], Thomas Schroeder[1]; [1]*IHP Frankfurt (Oder), Germany;* [2]*Università Pisa, Italy;* [3]*WIAS, Germany;* [4]*Università della Svizzera Italiana, Switzerland.* By using fully-coupled 2D optoelectronic simulations with embedded microscopic gain calculations, we study the optoelectronic performance of a monolithically integrated edge-emitting laser based on strained germanium microstrips fabricated using CMOS standard processes.

ATu2A.20 • Q-switched pulse waveguide laser modulated by two-dimension materials, Yang Tan[1]; [1]*Shandong Univ., China.* Two-dimension materials were utilized as the saturable absorber for the stable Q-switched pulse laser emission from the rare earth doped waveguide. The laser operation was at both the visible and near-infrared region, with a repetition rate ranging in the order of megahertz.

ATu2A.21 • Spectroscopy of Colour Centres in Diamond for Possible Laser Applications, Elisabeth Fraczek[1], Vasili Savitski[1], Svyatoslav Shcheka[4], Matthew Dale[2], Ben Breeze[2], Harpreet Dhillon[3], Andrew Bennett[3], Dan J. Frost[4], Mark Newton[2], Alan Kemp[1]; [1]*Univ. of Strathclyde, UK;* [2]*Univ. of Warwick, UK;* [3]*Element Six, UK;* [4]*Bayerisches Geoinstitut, Universität Bayreuth, Germany.* The emission and absorption characteristics of synthetic diamonds containing H3 colour centres with the luminescence lifetime of 10.5 ns at 520 nm are presented.

ATu2A.22 • Optical Parametric Oscillator Based on Degenerate Four Wave Mixing in Tellurite Microstructured Optical Fiber, Lei Zhang[1], Hoang Tuan Tong[1], Harutaka Kawamura[1], Takenobu Suzuki[1], Yasutake Ohishi[1]; [1]*Toyato Technological Inst., Japan.* Four-wave mixing-based optical parametric oscillator is achieved in a tellurite microstructured optical fiber. The oscillated signal can be tuned from 1606 to 1743.5 nm, and the idler can be tuned from 1526.8 to 1395 nm.

ATu2A.23 • Enhanced Pump Absorption Efficiency in Coiled and Twisted Double-Clad Thulium-Doped Fibers, Pavel Koška[1,2], Pavel Peterka[1], Jan Aubrecht[1], Ondrej Podrazky[1], Filip Todorov[1], Yauhen Baravets[1,2], Pavel Honzatko[1], Ivan Kasik[1]; [1]*Inst. of Photonics and Electronics, Czech Republic;* [2]*Czech Technical Univ., Czech Republic.* Experimental demonstration of recently proposed pump-absorption-efficiency improvement technique in double-clad fibers is presented. The peak absorption (14 dB) of 3-m long hexagonal thulium-doped fiber was increased by 8 dB by its simultaneous coiling and twisting.

ATu2A.24 • Research progress of Yb doped LMA fiber by sol-gel method combined with powder sintering technique, Chunlei Yu[1]; [1]*Shanghai Inst of Optics & Fine Mechanics, China.* The new progress of sol-gel method combined with high temperature sintering for the preparation of rare earth ion doped silica core glass and large mode area fiber have been proposed.

ATu2A.25 • Large-Core Fused-Silica Waveguides for High Power Applications, Gil Atar[1,2], Idan Casif[2], David Eger[1], Ariel Bruner[1], Bruno Sfez[1], Shlomo Ruschin[2]; [1]*Applied Physics, Soreq, Israel;* [2]*Electrical Engineering—Physical Electronics, Faculty of Engineering, Tel Aviv Univ., Israel.* Silica-on-Silica technology enables fabrication of on-chip devices for high-power applications. We demonstrate a 20X20µm Yb/Al-codoped fused-silica waveguide with <0.5dB/cm loss and 0.6dB/cm gain, showing near-single-mode operation and low propagation loss despite significant sidewall-roughness.

ATu2A.26 • Core/clad Tellurite Glass Pairs for Mid Infrared Supercontinuum Generation in High Numerical Aperture Step Index Optical Fiber, Joris Lousteau[1], Diego Pugliese[2], Nadia G. Boetti[2], Petr Janicek[3], Edoardo Ceci Ginistrelli[2], Francesco Poletti[1], Daniel Milanese[2]; [1]*Optoelectronics Research Centre, Univ. of Southampton, UK;* [2]*DISAT, Politecnico di Torino, Italy;* [3]*Faculty of Chemical Technology, Univ. of Pardubice, Czech Republic.* We report on the design and fabrication of two tellurite glass compositions as core and cladding glasses for a high numerical aperture optical fiber for mid-infrared supercontinuum generation. Preform and fiber fabrications are also reported.

ATu2A.27 • Fabrication of an Optical Fiber Doped with Amorphous Yttrium Aluminosilicate Nanoparticles in the Core for Supercontinuum Generation, Tonglei Cheng[1], Meisong Liao[2], Xiaojie Xue[1], Jiang Li[3], Dinghuan Deng[1], Xia Li[2], Danping Chen[2], Shupei Zheng[2], Takenobu Suzuki[1], Yasutake Ohishi[1]; [1]*ofmlab, Japan;* [2]*Chinese academy of sciences, Key Lab of Materials for High Power Laser Shanghai Inst. of Optics and Fine Mechanics, China;* [3]*Chinese Academy of Sciences, Key Lab of Transparent Opto-functional Inorganic Materials, China.* We design and fabricate an optical fiber doped with amorphous yttrium aluminosilicate (YAS, Y_2O_3-Al_2O_3-SiO_2) nanoparticles in the core, and investigate its supercontinuum (SC) generation at different pump wavelength.

ATu2A.28 • 2-D materials-based passively Q-switched 635 nm Pr^{3+}-doped ZBLAN fiber lasers, Duanduan Wu[1], Jian Peng[2], Yile Zhong[1], Yongjie Cheng[1], Biao QU[1], Jian Weng[2], Zhengqian Luo[1], Bin Xu[1], Nan Chen[1], Huiying Xu[1], Zhiping Cai[1]; [1]*Xiamen Univ., China;* [2]*Biomaterials, Biomaterials, China.* Passively Q-switched 635 nm Pr^{3+}-doped down-conversion fiber lasers have been successfully demonstrated with BP, TMD and TIs saturable absorbers, respectively. The Q-switching lasers all have ~200 kHz tunable repetition rate range and ns-level pulse duration.

ATu2A.29 • The research of dispersion mirrors for ultrafast laser applications, Yanzhi Wang[1], Yu Chen[2], Kui Yi[1], Hongji Qi[1], Guohang Hu[1], Jianda Shao[1]; [1]*Shanghai Inst of Optics & Fine Mechanics, China;* [2]*Shanghai Univ., China.* One of the key techniques of generating ultrafast pulse is the perfect management of different dispersions. Three types of dispersion mirrors, broadband chirped mirror, high dispersion mirror, and low dispersion mirror, are discussed for different dispersion requirements.

ATu2A.30 • Progress in Reflective Diffraction Gratings Used in High Power Laser System, Jin Yunxia[1]; [1]*Key Lab of Materials for High Power Laser,, Shanghai Inst. of Optics and Fine Mechanics, China.* Reflective diffraction gratings are driving the development of high power chirped pulse amplification technology and high power fiber laser spectral beam combining. Near half-meter (metal) multilayer dielectric gratings, and polarization-independent spectral combining gratings have made a big step.

ATu2A.31 • WITHDRAWN

ATu2A.32 • Mid-infrared Supercontinuum Covering 3-10 µm Using a As_2Se_3 Core and As_2S_5 Cladding Step-index Chalcogenide Fiber, Dinghuan Deng[1], Lai Liu[1], Tong H. Tuan[1], Yasuhiro Kanou[1], Morio Matsumoto[2], Hiroshige Tezuka[2], Takenobu Suzuki[1], Yasutake Ohishi[1]; [1]*Toyota Technological Inst., Japan;* [2]*Furukawa Denshi Co., Ltd., Japan.* A mid-infrared supercontinuum source covering 3-10 µm is successfully demonstrated in a 4-cm-long core and cladding step-index chalcogenide fiber pumped with the MIR pulse generated by difference frequency generation.

ATu2A.33 • 400W Ytterbium-doped fiber oscillator at 1018nm, Chu Perng Seah[1], Tze Yang Ng[1], Song-Liang Chua[1]; [1]*DSO National Labs, Singapore.* We present a Yb-doped fiber laser with 403W output power operating at 1018nm. The laser had an optical efficiency of 66% and M^2=1.51. Laser displayed excellent spectral purity with no sign of ASE.

ATu2A.34 • Stretched-pulse Kerr Mode-locked Generation in Erbium-doped Ring Laser with Highly Nonlinear All-fiber Resonator, Dmitriy A. Dvoretskiy[1], Vladimir Lazarev[1], Vasiliy S. Voropaev[1], Zhanna N. Rodnova[1], Stanislav G. Sazonkin[1], Stanislav O. Leonov[1], Alexey B. Pnev[1], Valeriy Karasik[1], Alexander A. Krylov[2]; [1]*Bauman Moscow State Technical Univ., Russia;* [2]*Fiber Optic Research Center, Russian Academy of Sciences, Russia.* We obtained stretched pulse generation with 12 MHz repetition rate, average output power 16.7 mW and 48.1 nm spectral pulse width in the All-fiber Kerr Mode-locked Erbium-doped Ring Laser with a high nonlinear fiber inside the resonator with slightly positive net-cavity GVD.

ATu2A.35 • 70 fs hybrid mode-locked Erbium-doped fiber laser with topological insulator, Wen Liu[1,2], Lihui Pang[2], Hainian Han[2], Wenlong Tian[2], Peiguang Yan[3], Hao Chen[3], ming lei[1], Zhiyi Wei[2]; [1]*School of Science, Beijing Univ. of Posts and Telecommunications, China;* [2]*Inst. of Physics, Chinese Academy of Sciences, China;* [3]*College of Optoelectronic Engineering, Shenzhen Univ., China.* The hybrid mode-locked Erbium-doped fiber laser with fiber-taper TI: Sb_2Te_3 saturable absorber is presented for the first time. With 57mW average power, the 3-dB spectral width and pulse duration are measured 63 nm and 70fs, respectively.

ATu2A.36 • Generation of Supercontinuum LP_{0n} Modes in Highly Multimode Gradient-Index Fiber, Geoffroy Granger[1], Christian Röhrer[1], Götz Kleem[1], Marwan Abdou-Ahmed[1], Thomas Graf[1]; [1]*IFSW, Germany.* We report, for the first time, on the generation, in a highly multimode gradient-index fiber, of supercontinuum (from visible to near infrared) with up to 54 mW of average power and emitting in LP_{0n} modes.

ATu2A.37 • Reducing ASE in Burst-Mode, Low Repetition Rate Fiber Amplifiers, Jaka Petelin[2], Bostjan Podobnik[2], Rok Petkovsek[1]; [1]*Univ. of Ljubljana, Slovenia;* [2]*LPKF, Slovenia.* The effect of pulsed-pumping on amplified spontaneous emission (ASE) in low repetition rate fiber amplifiers is presented. The experimental data is compared to numerical model, showing a significant suppression of ASE at low repetition rates.

ATu2A.38 • All-Solid-State Continuous-wave Yellow-Green Ceramic Laser at 0.56 µm, Jing Gao[1], Wenming Yao[1], Long Shang[1], Jiang Li[2], Yubing Tian[2], Yufei Ma[3], Xiaodong Wu[1], Gangfei Ma[1], Jianming Yang[1], Yubai Pan[2], Xianjin Dai[1]; [1]*Jiangsu Key Lab of Medical Optics, Suzhou Inst. of Biomedical Engineering and Technology, Chinese Academy of Sciences, China;* [2]*Key Lab of Transparent Opto-Functional Inorganic Materials, Shanghai Inst. of Ceramics, Chinese Academy of Sciences, China;* [3]*National Key Lab of Science and Technology on Tunable Laser, Harbin Inst. of Technology, China.* We demonstrate an all-solid-state continuous-wave yellow-green ceramic laser at 0.56 µm. The highest cw output powers of 1.4, 0.5 and 1.1 W at 556, 558 and 561 nm are achieved, respectively.

ATu2A.39 • Final EDP Ti: Sapphire Amplifiers for New Generation of Ultra -High Power Laser Systems, Vladimir V. Chvykov[1], Mikhail Kalashnikov[1], Károly Osvay[1]; [1]*ELI-ALPS, Hungary.* We studied the concept of EDP amplification for the 10-100 PW level of the three ELI-pillars laser systems. The design of EDP – duty amplifiers required to achieve these parameters was done and will be reported.

ATu2A.40 • Thermal Dynamics of Petawatt Class Ti:Sapphire EDP Thin Disk Amplifiers, Roland Nagymihály[1], Vladimir V. Chvykov[1]; [1]*ELI-HU Non-Profit Ltd., Hungary.* Thermal simulations on petawatt scale Ti:Sapphire amplifiers were performed to investigate the thermal limits of thin disk amplification by using finite element method. Several amplifier parameters were investigated, including crystal, cooling, and pump beam properties.

ATu2A.41 • kW-class Zig-Zag Active-Mirror Laser Amplifier with Jet Impingement Cooling, Koichi Hamamoto[1], Tomoya Morioka[1], Shingo Nishikata[1], Naoki Inoue[1], Junnosuke Nakatani[1], Seiji Taniguchi[2], Haik Chosrowjan[2], Yasukazu Izawa[2]; [1]*Mitsubishi Heavy Industries, Japan;* [2]*Inst. for Laser Technology, Japan.* We developed a Yb:YAG Zig-Zag Active-Mirror laser amplifier with jet impingement cooling system for high average power laser systems. The output power of laser was beyond 1kW which was stable nearly 30 minutes.

ATu2A.42 • High power efficient SESAM-mode-locked Yb:KGW bulk laser, Viktor E. Kisel[1], Alexander S. Rudenkov[1], Anatoliy A. Pavlyuk[2], Alexander Kovalyov[3], Valeri Preobrazhenskii[3], Mikhail Putyato[3], Natalia Rubtsova[3], Boris Semyagin[3], Nikolai V. Kuleshov[1]; [1]*Center for Optical Materials and Technologies, Belarusian National Technical Univ., Belarus;* [2]*Nikolaev Inst. for Inorganic Chemistry, Siberian Branch of RussianAcademy of Sciences, Russia;* [3]*RzhanovInst. of Semiconductor Physics, Siberian Branch of Russian Academy of Sciences, Russia.* Diode-pumped SESAM mode-locked Yb:KGW bulk laser was demonstrated with average output powers up to 8.8W, pulse durations as short as 162fs and optical-to-optical efficiency up to 37.5%.

ATu2A.43 • Picosecond 1342 nm Nd:YVO_4 Laser with 10 W Output at 300 kHz and Conversion to 671, 447, 224 and 192 nm, Aleksej Rodin[1,2], Mikhail Grishin[1,2], Nortautas Ulevicius[1], Andrejus Michailovas[1,2]; [1]*Center for Physical Sciences and Technology, Lithuania;* [2]*Ekspla Ltd, Lithuania.* Regenerative amplifier based on composite multiply Nd doping level vanadate rod pumped with 880 nm provides 13 ps pulses of 11 W average power at 1342 nm wavelength with M^2 ~ 1.1 beam quality. High peak power facilitates efficient harmonics conversion.

ATu2A.44 • Injection Seeded Nd:YAG Pulsed Laser with Sinusoidal Modulation Voltage, Yongfei Gao[1,2], Junxuan Zhang[2,3], Huaguo Zang[2], Xiaolei Zhu[2], Yingjie Yu[1], Weibiao Chen[2]; [1]*Shanghai Univ., China;* [2]*Shanghai Inst of Optics and Fine Mech, China;* [3]*Univ. of Chinese Academy of Sciences, China.* Appling a sinusoidal modulation voltage to the piezoactuator, seeder injection by ramp-and-fire method is successfully realized, and stable single frequency laser pulse output is achieved from a laser diode pumped Nd:YAG laser at a repetition rate of 400Hz.

ATu2A.45 • Simultaneous Amplification of Multiple 2 µm Vortex Beams, Yuan Li[1], Zeyu Zhang[1], Wenzhe Li[1], Keith Miller[1], Eric Johnson[1]; [1]*The Holcombe Dept. of Electrical and Computer Engineering, Clemson Univ., USA.* The generation and simultaneous amplification of multiple 2 µm vortex beams with orbital angular momentum is demonstrated in a Ho:YAG rod amplifier. Simulations predict the amplifier's potential in power scaling and in spatial division multiplexing.

11:30—12:30
Industry Panel Discussion: What are the Limitations of Technology?
Bunsen Hall (Bunsensaal)

Panelists: Klaus Löffler, *TRUMPF Laser und Systemtechnik GmbH, Germany*
Torsten Mans, *Amphos, Germany*
Eric Mottay, *Amplitude Systems, France*
Bojan Resan, *JDSU Ultrafast Laser AG, Switzerland*

(See page 10 for more information)

12:30—14:00 • Lunch with the Exhibitors, *Throughout the Venue*

14:00—15:52
ATu3A • Source & Materials Joint Session
Bunsen Hall (Bunsensaal)
Presider: Jay Dawson, Lawrence Livermore National Lab, USA

ATu3A.1 • 14:00 Invited
Real-time Terahertz-wave Imaging Based on Nonlinear Optical Up-conversion, Hiroaki Minamide[1]; [1]*RIKEN, Japan.* We demonstrate a terahertz-wave imaging at video-rate by nonlinear frequency up-conversion in an organic nonlinear crystal. The sensitive imaging supported by efficient conversion from terahertz-wave to near-infrared light is presented.

ATu3A.2 • 14:20 Invited
Recent Developments on the Lithium Niobate Material Platform: The Silicon of Nonlinear Optics?, Katia Gallo[1], Mohammad Amin Baghban[1]; [1]*Applied Physics, KTH - Royal Inst. of Tech., Sweden.* The talk addresses current challenges and future prospects in combining nanoTech., ferroelectric domain structuring and integrated optics in $LiNbO_3$ materials to develop small-footprint devices for telecom and quantum optics, and potentially also life-science, applications.

ATu3A.3 • 14:40
Competition Effects Between Stimulated Raman and Polariton Scattering in Intracavity $KTiOPO_4$ Crystal, Tiago Ortega[1], Helen M. Pask[1], David Spence[1], Andrew Lee[1]; [1]*Dept. of Physics and Astronomy, Macquarie Univ., Australia.* Wavelength-tunable stimulated polariton scattering (SPS) in intracavity $KTiOPO_4$ (KTP) crystal is demonstrated for the first time. Fundamental 1064nm and SRS-first-stokes-shifted 1095.5nm laser lines produced, simultaneously, tunable SPS output from 1080 to 1087nm and 1112 to 1119nm, respectively.

ATu3A.4 • 14:52
Pulsed visible lasers with low dimensional semiconductors, Haohai Yu[1], Yuxia Zhang[1], Shuxian Wang[1], Huaijin Zhang[1], Yanxue Chen[2], Liangmo Mei[2], Alberto Di Lieto[3], Mauro Tonelli[3], Jiyang Wang[1]; [1]*State Key Lab of Crystal Materials and Inst. of Crystal Materials, Shandong Univ., China;* [2]*School of Physics, Shandong Univ., China;* [3]*NEST Istituto Nanoscienze-CNR and Dipartimento di Fisica dell', Università di Pisa, Italy.* Pulsed lasers in the visible range are playing important roles in our daily life and modern Tech.. Here, we demonstrated the pulsed visible lasers based on atomic-layer molybdenum sulfide (MoS_2), which was an ultrathin two-dimensional material.

ATu3A.5 • 15:04
Microchip Laser Operation of Yb-Doped Gallium Garnets, Josep Maria Serres[1], Venkatesan Jambunathan[2], Pavel Loiko[1,3], Xavier Mateos[1,4], Haohai Yu[5], Huaijin Zhang[5], Junhai Liu[6], Antonio Lucianetti[2], Tomas Mocek[2], Konstantin V. Yumashev[3], Uwe Griebner[4], Valentin Petrov[4], Magdalena Aguiló[1], Francesc Díaz[1]; [1]*Física i Cristallografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV), Spain;* [2]*HiLASE Centre, Inst. of Physics ASCR, Czech Republic;* [3]*Center for Optical Materials and Technologies, Belarusian National Technical Univ., Belarus;* [4]*Max Born Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany;* [5]*State Key Lab of Crystal Materials, Shandong Univ., China;* [6]*College of Physics, Qingdao Univ., China.* Thermal lens and microchip laser operation were studied for Yb:YGG, Yb:LuGG, Yb:CNGG and Yb:CLNGG. A diode-pumped Yb:LuGG laser generated a maximum output power of 9.0 W at 1040 nm with 75% slope efficiency.

ATu3A.6 • 15:16
Continuous wave four-wave mixing at 2 micron in Chalcogenide microstructured fiber, Davide Grassani[1], Sida Xing[1], Svyatoslav Kharitonov[1], Adrien Billat[1], Steevy Cordette[1], Armand Vedadi[1], Camille-Sophie Brès[1]; [1]*Photonic System Lab, EPFL, Switzerland.* We present the first demonstration of continuous wave four -wave mixing at 2µm in a short chalcogenide microstructure fiber. Idlers over approximately 15nm were measured for a coupled pump power of 94mW.

ATu3A.7 • 15:28
High Energy Q-switching and Cavity Dumped Q-switching of a Diode-pumped Alexandrite Laser, Gabrielle M. Thomas[1], Ara Minassian[2], Achaya Teppitaksak[1], Michael J. Damzen[1]; [1]*Imperial College London, UK;* [2]*Bessemer Building, Prince Consort Rd, Unilase Ltd., UK.* We present 3mJ Q-switched and 0.5mJ cavity dumped Q-switched pulse energies from a diode-pumped Alexandrite laser operating at 758nm. Preliminary results of second harmonic generation to the UV (379nm) with ~47% conversion efficiency are reported.

ATu3A.8 • 15:40
New Levels of Dispersion of Highly Dispersive Mirrors, Elena Fedulova[1], Kilian Fritsch[2], Jonathan Brons[1], Oleg Pronin[1,2], Tatiana Amotchkina[3], Michael Trubetskov[1,3], Ferenc Krausz[1,2], Vladimir Pervak[2]; [1]*Max Planck Inst. of Quantum Optics, Germany;* [2]*Ludwig Maximilians Univ., Germany;* [3]*Research Computing Center, Moscow State Univ., Russia.* Here we report a highly-dispersive mirror with a group delay dispersion of -10000 fs^2 for wavelengths 1025 -1035 nm. This allows power scaling in a 300-fs Yb:YAG oscillator.

16:00— 16:30 • Coffee Break and Exhibits
Throughout the Venue

Tuesday, 6 October

16:30—18:26
ATu4A • Novel Ultrafast Source
Bunsen Hall (Bunsensaal)
Presider: Thomas Sudmeyer, Université de Neuchâtel, Switzerland

ATu4A.1 • 16:30 Invited
Industrial Ultrafast Lasers: Tech. and Economics, Eric Mottay[1]; [1]*Amplitude Systemes, France.* Ultrafast lasers are today an important part of many industrial processes, due to their ability for high quality material processing. We will present recent applications showing that they offer as well cost effective industrial solutions.

ATu4A.2 • 16:50
Average Power Scaling of Sub-2 cycle Lasers to the Kilowatt Regime, Jan Rothhardt[1,2], Steffen Hädrich[1,2], Robert Klas[1], Getnet K. Tadesse[1,2], Armin Hoffmann[1], Maxim Tschernajew[1,2], Arno Klenke[1,2], Zoltan Várallyay[3], András Drozdy[3], Eric Cormier[3], Andreas Liem[4], Thomas Schreiber[4], Jens Limpert[1,2], Andreas Tünnermann[1,4]; [1]*Inst. of Applied Physics, Germany;* [2]*Helmholtz-Inst. Jena, Germany;* [3]*ELI-ALPS, ELI-HU Non-Profit Ltd., Hungary;* [4]*Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* A comprehensive study on power scaling of nonlinear compression towards kilowatt sub-2 cycle pulses is presented. Kilowatt level transmission through standard glass capillaries and the development of suitable high-power capable few-cycle optics are discussed.

ATu4A.3 • 17:02
High-contrast 10-fs OPCPA-based Front-End for the Apollon-10PW laser, Dimitris N. papadopoulos[2], Patricia Ramirez[1], Alain Pellegrina[2,1], Nathalie Lebas[2,1], Catherine Leblanc[2], Gilles Chériaux[2], Ji Ping Zou[2], Gabriel Mennerat[3], Pascal Monot[3], François Mathieu[2], Patrick Audebert[2], Patrick Georges[1], Frederic P. Druon[1]; [1]*Laboratoire Charles Fabry, France;* [2]*LULI, France;* [3]*CEA, France.* We present a high-contrast 10-fs Front-End for Ti:sapphire PW-lasers within the Apollon-10PW project. This injector uses OPCPA pumped at 100Hz by Yb-based CPA chain. Combination of OPCPA and XPW permits a >10^{12} contrast ratio.

ATu4A.4 • 17:14
340W Femtosecond Burst-mode Non-collinear Optical Parametric Amplifier for the European XFEL Pump-probe-laser, Mikhail Pergament[1], Martin Kellert[1], Kai Kruse[1], Jinxiong Wang[1], Guido Palmer[1], Laurens Wissmann[1], Ulrike Wegner[1], Moritz Emons[1], Max J. Lederer[1]; [1]*European XFEL, Germany.* The burst-mode NOPA produces up to 340W burst-power and 1.57mJ single pulse energy at rep-rates between 188kHz and 4.5MHz. The pulses are compressible to <15fs and the output beam at 800nm is diffraction limited.

ATu4A.5 • 17:26
Oscillator-Driven High Harmonic Generation, Florian Emaury[1], Andreas Diebold[1], Clara Saraceno[1], Ursula Keller[1]; [1]*ETH Zurich, Switzerland.* We present high harmonic generation at 2.4 MHz from the compressed output of a thin-disk-oscillator for the first time. Reaching >5×10^7 photons/s (19^{th} harmonic), this result opens the path towards compact high-repetition rate XUV sources.

ATu4A.6 • 17:38
65 fs SESAM Mode-Locked Diode-Pumped Yb:CaF_2 Laser, Federico Pirzio[1], Samuele D. Di Dio Cafiso[1,2], Matthias Kemnitzer[2], Florian Kienle[2], Annalisa Guandalini[2], Juerg Aus der Au[2], Antonio Agnesi[1]; [1]*Universita degli Studi di Pavia, Italy;* [2]*Spectra-Physics Rankweil, Austria.* We present an efficient, single-mode diode-pumped SESAM-mode-locked Yb:CaF_2 laser with pulses as short as 65 fs. Higher average output power up to 1.4 W with 87-fs-long almost Fourier-transform limited pulses were demonstrated as well.

ATu4A.7 • 17:50
200-MHz Repetition-Rate, All-Fiber Soliton Er-Laser Mode-Locked by a Planar Lightwave Circuit-Based Carbon Nanotube Saturable Absorber, Chur Kim[1], Dohyun Kim[1], YeonJoon Cheong[1], Dohyeon Kwon[1], Sunyoung Choi[2], Hwanseong Jeong[2], Sang Jun Cha[3], Jeong-Woo Lee[4], Dong-Il Yeom[2], Fabian Rotermund[2], Jungwon Kim[1]; [1]*School of Mechanical and Aerospace Engineering, Korea Advanced Inst. Science and Tech., Korea (the Republic of);* [2]*Dept. of Energy Systems Research & Dept. of Physics, Ajou Univ., Korea (the Republic of);* [3]*FIBERPRO Inc., Korea (the Republic of);* [4]*FM Solution Inc., Korea (the Republic of).* We fabricate an evanescent-field-interacting carbon nanotube saturable absorber (CNT-SA) based on standard planar lightwave circuit (PLC) fabrication process. A 200-MHz repetition-rate all-fiber soliton Er-laser is demonstrated using this PLC-based CNT-SA.

ATu4A.8 • 18:02
Diamond Raman laser generating 25.5 fs pulses, Jipeng Lin[1], David Spence[2]; [1]*Macquarie Univ., Australia.* We have demonstrated a 25.5 fs diamond Raman laser, which was synchronously-pumped by a 128 fs Ti:sapphire laser. The bandwidth of the Raman laser was significantly broadened by self-phase-modulation, with the effect maximized by compensating the intracavity dispersion using chirped mirrors.

ATu4A.9 • 18:14
Widely tunable optical parametric oscillator based on four-wave mixing, Thomas Gottschall[2], Jens Limpert[2], Andreas Tünnermann[2,1]; [1]*Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany;* [2]*Inst. of Applied Physics, Abbe Center of Photonics, Germany.* A broadly tunable, synchronously pumped optical parametric oscillator based on four-wave mixing in a PCF fiber is demonstrated. The setup generates signal wavelengths between 800 and 975nm and idler wavelengths 1125 and 1420 nm.

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Notes

Wednesday, 7 October

07:00—18:00 • Registration, *Foyer A*

08:00—09:44
AW1A • Nanomaterials and Waveguides
Bunsen Hall (Bunsensaal)
Presider: Christian Kraenkel, Universität Hamburg, Germany

AW1A.1 • 08:00
Graphene-Gold Supercapacitor As a Voltage-Controlled Saturable Absorber for Femtosecond Pulse Generation, Isinsu Baylam[1], Osman Balci[2], Nurbek Kakenov[2], Coskun Kocabas[2], Alphan Sennaroglu[1]; *[1]Koc Univ., Turkey; [2]Bilkent Univ., Turkey.* We report, for the first time to our knowledge, a voltage-controlled graphene-gold supercapacitor saturable absorber, as a modulator with adjustable insertion loss for low-gain mode-locked lasers. Nearly transform-limited, 80-fs pulses were generated near 1240 nm.

AW1A.2 • 08:12
SESAM mode-locked Tm:CALGO laser at 2 µm, Yicheng Wang[1], Guoqiang Xie[3], Xiaodong Xu[4], Juqing Di[5], Zhipeng Qin[3], Soile Suomalainen[6], Mircea Guina[6], Antti Härkönen[6], Antonio Agnesi[7], Uwe Griebner[1], Xavier Mateos[1,2], Pavel Loiko[8], Valentin Petrov[1]; *[1]Max Born Inst., Germany; [2]Universitat Rovira i Virgili, Spain; [3]Shanghai Jiao Tong Univ., China; [4]Jiangsu Normal Univ., China; [5]Vital Materials Co., China; [6]Tampere Univ. of Tech., Finland; [7]Universita di Pavia, Italy; [8]Belarusian National Technical Univ., Belarus.* GaSb-based SESAM is successfully employed for passive mode locking of a Tm^{3+}: $CaGdAlO_4$ laser operating near 2 µm. The pulse duration is around 650 fs at a repetition rate ~100 MHz.

AW1A.3 • 08:24
Oriented Single-Walled Carbon Nanotubes as Saturable Absorber for Passive Q-Switching of a Tm:KLuW Microchip Laser, Josep Maria Serres[1], Xavier Mateos[1,2], Pavel Loiko[1,3], Joan Rosell-Llompart[4,5], Luis B. Modesto-López[4], Konstantin V. Yumashev[3], Uwe Griebner[2], Valentin Petrov[2], Joan J. Carvajal[1], Magdalena Aguiló[1], Francesc Díaz[1]; *[1]Física i Cristallografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV), Spain; [2]Max Born Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany; [3]Center for Optical Materials and Technologies, Belarusian National Technical Univ., Belarus; [4]Chemical Engineering Dept., Universitat Rovira i Virgili, Spain; [5]ICREA - Catalan Institution for Research and Advanced Studies, Spain.* A Tm:KLuW laser is Q-switched with a saturable absorber based on aligned SWCNTs, generating a maximum average output power of 260 mW with a slope efficiency of 12%. The shortest pulse duration is 97 ns.

AW1A.4 • 08:36 Invited
Advances in Femtosecond Laser Nanostructuring in Glass: From Printed Geometrical Phase Optics to Eternal Data Storage, Peter Kazansky[1]; *[1]Univ. of Southampton, UK.* Formation of sub-wavelength periodic structures in bulk transparent materials during irradiation with intense ultrashort light pulses remains a mystery. Nevertheless the phenomenon has enabled unique applications ranging from printed flat optics to eternal data storage.

AW1A.5 • 08:56
Ultrafast Laser Inscribed $Pr:KY_3F_{10}$ Waveguides for Dual Wavelength and Switchable Waveguide Lasers in the Visible, Thomas Calmano[1,2], Alberto Sottile[3], Philip W. Metz[1], Daniela Parisi[3,4], Christian Kraenkel[1,2], Mauro Tonelli[3,4], Günter Huber[1,2]; *[1]Institut für Laser-Physik, Universität Hamburg, Germany; [2]The Hamburg Centre for Ultrafast Imaging, Germany; [3]Dipartimento di Fisica, Università di Pisa, Italy; [4]Nest, Istituto Nanoscienze – CNR, Italy.* Diode pumped fs-laser written $Pr:KY_3F_{10}$ waveguide lasers with 42 mW output power in the visible spectral region are presented. Utilizing polarization dependent spectroscopic properties of cubic $Pr:KY_3F_{10}$ dual wavelength and switchable laser operation was achieved.

AW1A.6 • 09:08
7 W Diode-End-Pumped PLD-Grown $Yb:Lu_2O_3$ Planar Waveguide Laser, Tina L. Parsonage[1], Stephen J. Beecher[1], Amol Choudhary[2], James Grant-Jacob[1], Ping Hua[1], Jacob I. Mackenzie[1], David P. Shepherd[1], Robert Eason[1]; *[1]Univ. of Southampton, UK; [2]CUDOS School of Physics and Astronomy, Univ. of Sydney, Australia.* An $Yb:Lu_2O_3$ planar waveguide laser fabricated by pulsed laser deposition has reached on output power in excess of 7 W, with a slope efficiency of 38%, end-pumped by a diode bar.

AW1A.7 • 09:20
Mid-infrared compact Cr:ZnS helical cladding waveguide laser, Ya-Pei Peng[1,2], Zhengyuan Bai[1,2], Benxue Jiang[1], Long Zhang[1], Xiao Zou[1,2], Yuxin Leng[1]; *[1]Shanghai Inst Optics & Fine Mech, CAS, USA; [2]Univ. of Chinese Academy of Sciences, Beijing 100039, China, China.* A mid-infrared helical cladding waveguide laser in Cr:ZnS operating at 2244nm is demonstrated. A maximum power output of 78mW and optical-optical slope efficiency of 8.6% are achieved.

AW1A.8 • 09:32
18 dB cw Raman on-off Gain in Silicon-On-Insulator Nanowire Waveguide Laser Amplifiers, Shaimaa Mahdi[1], Hanjo Rhee[1], Aws Al-Saadi[1], Christoph Theiss[1], Bülent A. Franke[1], Sebastian Kupijai[1], David Selicke[1], Lars Zimmermann[2], Bernd Tillack[2], Harald Richter[2], Hans J Eichler[1], Stefan Meister[1]; *[1]Technical Univ. berlin, Germany; [2]IHP - Innovations for High Performance Microelectronics, Germany.* Optical cw Raman gain of 18.4dB in SOI-nano-rib waveguides was obtained at 45mW internal pump power. Nonlinear on-off-gain increase at about 30mW pump power indicates that the Raman amplifier approaches the lasing threshold.

09:45—10:15 • Coffee Break and Exhibits, *Throughout the Venue*

10:15—11:15
Industry Keynote: The History of Disk Lasers from the Perspective of a Contemporary Witness
Bunsen Hall (Bunsensaal)

Keynote: Friedrich Dausinger, *Dausinger + Giesen GmbH, Germany*

(See page 11 for more information)

11:15—12:19
AW2A • Novel Fiber-based Sources
Bunsen Hall (Bunsensaal)
Presider: Almantas Galvanauskas, Univ. of Michigan, USA

AW2A.1 • 11:15 Invited
Mitigation Strategies for Optical Nonlinearities in Kilowatt-class Narrow-linewidth Fiber Amplifiers, Iyad Dajani[1], Angel Flores[1], Benjamin Pulford[1], Nader Naderi[1]; [1]*US Air Force Research Lab, USA.* We discuss mitigation strategies for optical nonlinearities in high-power fiber amplifiers suitable for coherent or spectral beam combining. The optical nonlinearities include SBS, SRS, XPM and modal instability. Both conventional and microstructured amplifiers are considered.

AW2A.2 • 11:35
New solid fully-aperiodic large pitch fibers with non-filamented core for high-power singlemode emission, Romain Dauliat[1,2], Aurélien Benoît[1], Dia Darwich[1], Jens Kobelke[2], Kay Schuster[2], Stephan Grimm[2], Raphaël Jamier[1], François Salin[3], Philippe Roy[1]; [1]*Laboratoire Xlim, USA;* [2]*Optical fiber group, Leibniz Inst. for Photonic Tech., Germany;* [3]*Eolite lasers, France.* We report on the first high power laser emission of a solid triple-clad fully-aperiodic large mode area fiber with non-filamented core based on Repusil process. The average power is 184 W with a singlemode fashion.

AW2A.3 • 11:47
CW and Q-switched tunable Neodymium fiber laser sources at short IR wavelengths near 900nm, Mathieu Laroche[1], Baptiste Leconte[1], Benoît Cadier[2], Hervé Gilles[1], Sylvain Girard[1], Thierry Robin[2]; [1]*CIMAP, France;* [2]*Ixfiber, France.* We report results on high-power and tunable three-level Nd-doped fiber lasers. Using a reflective VBG, laser wavelengths as short as 872 nm are achieved in CW regime with a narrow linewidth of 35 pm.

AW2A.4 • 11:59 Invited
Cladding-pumped Radially-polarized Fiber Lasers, W. Andrew Clarkson[1], Di Lin[1], Martynas Beresna[1], Peter Kazansky[1], Peter Shardlow[1]; [1]*Univ. of Southampton, UK.* Direct excitation of the radially-polarized TM_{01} mode in cladding-pumped ytterbium-doped and thulium-doped fiber lasers using a novel mode selection scheme is reported. The prospects for scaling to very high power levels are discussed.

12:20—13:50 • Lunch with the Exhibitors, *Throughout the Venue*

Notes

13:50—15:46
AW3A • Ultrafast Amplifiers
Bunsen Hall (Bunsensaal)
Presider: Thomas Schreiber, Fraunhofer IOF, Germany

AW3A.1 • 13:50 Invited

High Repetition Rate kJ-class Nanosecond to Femtosecond Lasers, Todd Ditmire[1,2], E Gaul[1,2], M. Martinez[1,2], S Feldman[1], M Donovan[1,2], W White[1], C Frederickson[1], W Grigsby[1], G Dyer[1,2], A Bernstein[1,2], J Norby[3], Gilles Cheriaux[4], J. P. Chambaret[4], B Legarrec[5]; *[1]National Energetics, USA; [2]Center for High Energy Density Science, Univ. of Texas, USA; [3]Continuum, USA; [4]LOA-ENSTA, France; [5]ELI-Beams, Czech Republic.* Using novel liquid cooled slab laser amplifier Tech. we have developed laser systems capable of amplifying nanosecond laser pulses to energy of ~1 kJ at repetition rate up to 0.1 Hz. The design and performance of these liquid cooled amplifiers at 18 cm aperture will be described along with plans to scale this Tech. to larger aperture and higher repetition rate.

AW3A.2 • 14:10

Yb^{3+}:YVO_4 Chirped Pulse Regenerative Amplifier, Alexander S. Rudenkov[1], Viktor E. Kisel[1], Vladimir Matrosov[2], Nikolai V. Kuleshov[1]; *[1]Center for Optical Materials and Technologies, Belarusian National Technical Univ., Belarus; [2]Solix Ltd., Belarus.* Yb:YVO_4 chirped pulse regenerative amplifier with 4.2W output power and 200fs-pulse duration at 200kHz repetition rate at central wavelength of 1018nm was demonstrated. A novel wavelength-independent off-axis pumping technique provided low quantum defect of 3.5%.

AW3A.3 • 14:22

Short-IR GW peak power OPCPA system with record average power at 100 kHz for high field physics, Yariv Shamir[2,1], Jan Rothhardt[3], Steffen Hädrich[2,3], Stefan Demmler[2], Maxim Tschernajew[2], Jens Limpert[2,3], Andreas Tünnermann[2,3]; *[1]SNRC, Applied physics, Israel; [2]Inst. of Applied Physics, Friedrich Schiller Univ., Germany; [3]Helmholtz-Inst., Germany.* We report on double-stage OPCPA system generated record short-IR average power of 7.5W and 6W at 1.5µm and 2µm respectively, with pulse durations of down to 33fs and GW-scale peak powers. Strategy for achieving multi-10 W of average power is discussed.

AW3A.4 • 14:34

Cascading of Coherent Pulse Stacking Using Multiple Gires-Tournois Interferometers, John Ruppe[1], Tong Zhou[1], Cheng Zhu[1], John Nees[1], Russell Wilcox[2], Almantas Galvanauskas[1]; *[1]Univ. of Michigan, USA; [2]Lawrence Berkely National Lab, USA.* Coherent pulse stacking utilizing cascaded Gires-Tournois interferometers to coherently stack multiple equal amplitude pulses in the time domain is experimentally demonstrated with a fiber chirped pulse amplification system.

AW3A.5 • 14:46

Single-stage Yb:YAG booster amplifier producing 2.3 mJ, 520 fs pulses at 10 kHz, Julien Pouysegur[1,2], Florent Guichard[1,2], Birgit Weichelt[2], Martin Delaigue[2], Yoann Zaouter[2], Clemens Hoenninger[2], Eric Mottay[2], Patrick Georges[1], Frederic P. Druon[1]; *[1]Institut d'Optique Graduate School, France; [2]Amplitude Systemes, France.* 520fs, 2.3-mJ pulses are demonstrated in a Yb:YAG booster amplifier delivering peak powers up to 4.4GW. To avoid damage and nonlinear-effect issues, passive divided pulse amplification is studied for the first time for bulk-amplifier.

AW3A.6 • 14:58

Development of a kW-level Picosecond Light Source Using Two-Stage Thin-Disk Regenerative Amplifier, Jiri Muzik[1,2], Martin Smrz[1], Taisuke Miura[1], Akira Endo[1], Vaclav Kubecek[2], Tomas Mocek[1]; *[1]HiLASE Center, Inst. of Physics CAS, Czech Republic; [2]Faculty of Nuclear Sciences and Physical Engineering, Czech Technical Univ., Czech Republic.* We report on a 100-kHz, 5-mJ picosecond system based on a two-stage thin-disk regenerative amplifier. With a compact ring cavity, we obtained 565 W with 46.7% optical-to-optical efficiency in continuous-wave operation without any sign of roll-over.

AW3A.7 • 15:10

Two-Channel Thin-Disk Laser for High Pulse Energy, Robert Jung[1], Johannes Tümmler[1], Thomas Nubbemeyer[2], Ingo Will[1]; *[1]Max Born Inst., Germany; [2]LMU Munich, LEX Photonics, Germany.* We report on a CPA system providing two synchronized pulses with more than 500 mJ, each. We also report on a special thin-disk ring amplifier that delivers 1 J pulse energy.

AW3A.8 • 15:22

160 mJ Energy, 100 Hz Repetition Rate Cryogenic Yb:YAG Composite Thin-Disk High Gain Amplifier, Michaël Hemmer[1], Luis Zapata[1], Fabian Reichert[1], Kelly Zapata[1], Anne-Laure Calendron[2], Kyung-Han Hong[3], Huseyin Cankaya[1], Franz Kaertner[1,3]; *[1]DESY - Deutsches Elektronen Synchrotron, Germany; [2]Dept. of Physics, Univ. of Hamburg, Germany; [3]Dept. of Electrical Engineering, Massachussets Inst. of Tech., USA.* We report on a cryogenic composite thin-disk amplifier featuring ASE mitigation and 8-dB gain per bounce delivering up to 160 mJ energy diffraction-limited pulses with 5 ps transform-limited pulse duration at 100 Hz repetition rate.

AW3A.9 • 15:34

High power single crystal fiber amplifiers for linearly and cylindrically polarized picosecond lasers, Fabien Lesparre[1], Jean-Thomas Gomes[1], Xavier Delen[1], Igor Martial[1], Julien Didierjean[2], Wolfgang Pallmann[3], Bojan Resan[3], Michael Eckerle[4], Thomas Graf[4], Marwan Abdou-Ahmed[4], Frederic P. Druon[1], François Balembois[1], Patrick Georges[1]; *[1]Institut d'Optique Graduate School, France; [2]Fibercryst, France; [3]JDSU, Switzerland; [4]IFSW, Germany.* We demonstrated a three-stage diode-pumped Yb:YAG single-crystal-fiber amplifier to generate femtosecond pulses at high average powers with linear or cylindrical (i.e. radial or azimuthal) polarization.

15:45—16:15 • Coffee Break and Exhibits
Throughout the Venue

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16:15—18:15
AW4A • Mid-Infrared Sources II
Bunsen Hall (Bunsensaal)
Presider: Valentin Petrov, Max Born Inst., Germany

Wednesday, 7 October

AW4A.1 • 16:15
High Average Power Fe:ZnSe and Cr:ZnSe Mid-IR Solid State Lasers, Sergey B. Mirov[1], Vladimir Fedorov [1], Dmitry Martyshkin[1], Igor Moskalev[1], Mike Mirov[1], Sergey Vasilyev[1]; [1]*IPG Photonics, Mid-IR Lasers, USA.* We report on novel design of tunable mid-IR Fe:ZnSe and Cr:ZnSe solid state lasers which provided significant increase of output average power up to 35W@4.1 μm and 57W@2.5 μm and 20W@2.94 μm.

AW4A.2 • 16:27
Octave-spanning Supercontinuum From As_2S_3-silica Double-nanospike Waveguide Pumped by Femtosecond Cr:ZnS Laser at 2.35 μm, Nikolai Tolstik[1,2], Shangran Xie[3], Evgeni Sorokin[2], John C. Travers[3], Johann Troles[4], Philip S. Russell[3], Irina T. Sorokina[1]; [1]*Dept. of physics, Norwegian Univ. of Science and Tech., Norway;* [2]*Inst. for Photonics, Vienna Univ. of Tech., Austria;* [3]*Max Planck Inst. for the Science of Light, Germany;* [4]*Universite de Rennes I, France.* We generate a 1.2 to 3.6 μm supercontinuum using a As_2S_3-silica double-nanospike waveguide pumped by femtosecond Cr:ZnS laser. Varying the core diameter allows the group velocity dispersion to be fine-tuned, thus maximizing supercontinuum bandwidth.

AW4A.3 • 16:39
Mid-IR Kerr-Lens Mode-Locked Polycrystalline Cr^{2+}:ZnS Laser with 0.5 MW Peak Power, Sergey Vasilyev[1], Mike Mirov[1], Valentin Gapontsev[2]; [1]*IPG Photonics Corp., Mid-IR Lasers, USA;* [2]*IPG Photonics Corporation, USA.* We report femtosecond polycrystalline Cr^{2+}:ZnS laser at 2.4 μm central wavelength with 41 fs pulse duration, 1.9 W average power and 79 MHz pulse repetition rate that corresponds to 0.5 MW peak optical power.

AW4A.4 • 16:51
All-Fiber, Single-Mode Spectral Beam Combining of High Power Tm-Doped Fiber Lasers, Sinem Yilmaz[1], Christoph Ottenhues[2], Mateusz Wysmolek[2], Thomas Theeg[2], Samir Lamrini[3], Carsten Scholle[3], Peter Fuhrberg[3], Hakan Sayinc[2], F Omer Ilday[1,4], Jörg Neumann[2], Ludger Overmeyer[5], Dietmar Kracht[2]; [1]*Physics Dept., Bilkent Univ., USA;* [2]*Laser Development, Laser Zentrum Hannover e.v., Germany;* [3]*Lisa Laser Product, Germany;* [4]*Dept. of Electrical and Electronics Engineering, Bilkent Univ., Turkey;* [5]*Institut für Transport und Automatisierungstechnik, Germany.* We demonstrate an all-fiber integrated dual-wavelength Tm-doped fiber laser with an output power of 36 W by using the spectral beam combining method. In-house-made WDM is used for combination of TM-doped fiber lasers with different wavelengths while maintaining the single mode beam quality.

AW4A.5 • 17:03
Multi-Wavelength, Narrow Bandwidth Diode Lasers for Power Scaling of Resonantly Pumped Er:YAG Lasers, Haro Fritsche[1,2], Oliver Lux[1], Martin Gärtner[1], Andreas Grohe[2], Wolfgang Gries[2], Hans-Joachim Eichler[1]; [1]*Technical Univ. of Berlin, Germany;* [2]*R&D, DirectPhotonics Industries, Germany.* Eye-safe laser operation is realized by a resonantly pumped Er:YAG laser emitting at 1645 nm. The application of a multi-wavelength, narrow bandwidth diode lasers as pump sources allows for high optical efficiency of 48%.

AW4A.6 • 17:15
Nonlinear compression of ultrashort pulses from a high repetition rate Tm-doped fiber laser to sub-5 cycle duration, Martin Gebhardt[1,2], Christian Gaida[1], Fabian Stutzki[1], Steffen Hädrich[1,2], Cesar Jauregui[1], Jens Limpert[1,2], Andreas Tünnermann[3,1]; [1]*Inst. of Applied Physics, USA;* [2]*Helmholtz-Inst. Jena, Germany;* [3]*Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We present nonlinear pulse compression in the wavelength region around 2 μm using two different approaches. Pulse-shortening to sub-30 fs at 26.5 W of average power or 200 MW peak power is presented, respectively.

AW4A.7 • 17:27
Single-Frequency Q-Switched Operation of a Resonantly Pumped Ho:KY_3F_{10} Laser With a Twisted Mode Cavity Using Prelase Control, Martin Schellhorn[1], Christoph Bollig[2], Daniela Parisi[3], Mauro Tonelli[3], Marc Eichhorn[1]; [1]*ISL, French-German Research Inst., France;* [2]*Abacus Laser, Germany;* [3]*NEST-Istituto Nanoscience-CNR, Italy.* We report on a Q-switched Ho:KY_3F_{10} laser with a twisted mode cavity. Using prelase control, single-longitudinal-mode laser output at 1, 2, 5, and 10 kHz was obtained, with a maximum average power of 6.1 W.

AW4A.8 • 17:39
8 mJ, 1 kHz, Picosecond Ho:YLF Regenerative Amplifier, Lorenz von Grafenstein[1], Martin Bock[1], Uwe Griebner[1], Thomas Elsaesser[1]; [1]*Max Born Inst., Germany.* High-gain, continuous-wave pumped Ho:YLF regenerative amplifiers are reported, delivering up to 8 mJ picosecond pulses at 2050 nm, with energy fluctuations of the 1 kHz pulse train as low as 2% rms.

AW4A.9 • 17:51
Compact Fiber Based 2.05 μm All-PM CPA System at 1 MHz and 1 MW Peak Power, Heinar Hoogland[1,2], Ronald Holzwarth[1,3]; [1]*Menlo Systems GmbH, Germany;* [2]*Dept. of Physics, Univ. of Erlangen-Nuremberg, Germany;* [3]*Max-Planck-Inst. of Quantum Optics, Germany.* We report on an oscillator seeded all-PM fiber based 2.05 μm CPA system emitting 371 fs pulses at 0.95 MHz and 1.1 MW peak power without the need of LMA amplifier or complex temporal management.

AW4A.10 • 18:03
Mid-IR Supercontinuum Generation in ZBLAN Fibers with High Output Power and High Conversion Efficiency, Christian Kneis[4,1], Thierry Robin[2], Benoît Cadier[2], Franck Joulain[3], Marcel Poulain[3], Inka Manek-Hönninger[1], Marc Eichhorn[4], Christelle Kieleck[4]; [1]*Centre Lasers Intenses et Applications (CELIA), Univ. of Bordeaux, France;* [2]*iXFiber, France;* [3]*Le Verre Fluoré, France;* [4]*French-German Research Inst. ISL, France.* Supercontinuum generation is performed in ZrF_4-BaF_2-LaF_3-AlF_3-NaF (ZBLAN) fibers pumped by a thulium (Tm^{3+})-doped silica fiber laser, which is simultaneously actively Q-switched and actively mode-locked. High power operation and efficient broadening towards the mid-IR wavelength region is presented.

INTERNATIONAL YEAR OF LIGHT 2015

19:30—22:00
Conference Banquet

Buses will depart from Foyer C at 18:15 to the banquet location, InterContineтal Hotel—Berlin

(See page 11 for more information)

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07:30—14:00 • **Registration,** *Foyer A*

08:00—10:08
ATh1A • Sensing, Spectrometry and Waveguiding
Bunsen Hall (Bunsensaal)
Presider: Dieter Hoffmann, Fraunhofer Inst. for Laser Tech, Germany

ATh1A.1 • 08:00 **Invited**
Fiber-Based Laser Transmitter Tech. at 1.57 µm for Atmospheric Carbon Dioxide Satellite Remote Sensing, Anthony W. Yu[1], James B. Abshire[1], Mark Stephen[1], Jeffrey R. Chen[1], Stewart Wu[1], Brayler Gonzalez[1], Lawrence Han[1], Kenji Numata[2], Graham R. Allan[3], William Hasselbrack[3], Jeffrey W. Nicholson[4], Man Yan[4], Patrick Wisk[4], Anthony DeSantolo[4], Brian Mangan[4], Gabe Puc[4], Doruk Engin[5], Brian Mathason[5], Mark Storm[5]; *[1]NASA Goddard Space Flight C , USA; [2]Univ. of Maryland, USA; [3]Sigma Space Corporation, USA; [4]OFS, USA; [5]Fibertek inc, USA.* In this paper we will review our progress on maturing the Tech. and improving the technical readiness of a fiber-based laser transmitter at 1.57 µm for use in atmospheric carbon dioxide (CO2) satellite remote-sensing.

ATh1A.2 • 08:20 **Invited**
Development and First Results of A New Near-ir Airborne Greenhouse Gas Lidar, Andreas Fix[1], Axel Amediek[1], Christian Büdenbender[1], Gerhard Ehret[1], Mathieu Quatrevalet[1], Martin Wirth[1], Jens Löhring[2], Raphael Kasemann[2], Jürgen Klein[2], Dieter Hoffmann[2], Volker Klein[3]; *[1]Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Germany; [2]Fraunhofer Institut für Lasertechnik (ILT), Germany; [3]OHB-System AG, Germany.* An airborne lidar system has been developed to measure columns of the two most important anthropogenic greenhouse gases, CO2 and methane. Results from the first deployment onboard the German research aircraft HALO are presented.

ATh1A.3 • 08:40 **Invited**
Ultra-Fast Laser Beam Delivery and Pulse Compression with Kagome Hollow-core Pcf, Fetah Benabid[1]; *[1]Xlim Research Insititute, France.* We review the recent progress on ultra-short pulse laser beam delivery and compression using hypocycloid-shaped core-contour (i.e. negative curvature) hollow-core photonic-crystal-fibre.

ATh1A.4 • 09:00 **Invited**
Ion Migration Assisted Femtosecond Laser Writing of Refractive Structures, Javier Solis[1]; *[1]Instituto de Optica-CSIC, Spain.* In this presentation we will review our recent results regarding ion migration processes induced by fs-laser irradiation of glasses and the production of light guiding structures based on this effect.

ATh1A.5 • 09:20
Dual-Comb Spectrometer for Direct Phase Spectroscopy of Greenhouse Gases across an Open Air Path, Esther Baumann[1], Fabrizio R. Giorgetta[1], Greg B. Rieker [2], Laura C. Sinclair[1], Ian Coddington[1], William C. Swann[1], Nathan R. Newbury[1]; *[1]NIST, USA; [2]Univ. of Colorado, USA.* Direct phase spectroscopy of greenhouse gases over a turbulent open air path is reported. The intrinsic fast up-date rate of a dual-comb spectrometer makes it possible to obtain molecular phase spectra at 0.6 mrad level.

ATh1A.6 • 09:32
Femtosecond-Level Synchronization of Clocks across a turbulent open-path link, Fabrizio R. Giorgetta[1], Jean-Daniel Deschenes[2], Laura C. Sinclair[1], William C. Swann[1], Esther Baumann[1], Ian Coddington[1], Nathan R. Newbury[1]; *[1]NIST, USA; [2]Universite Laval, Canada.* We show time synchronization between two optical oscillators to less than ±20 fs over 50 hours over a turbulent 4 km open-path link. Synchronization is retained even in the case of link interruptions.

ATh1A.7 • 09:44
Characterizing the Carrier-Envelop Offset in an Optical Frequency Comb without Direct Detection, Pierre Brochard[1], Stephane Schilt[1], Valentin J. Wittwer[1], Thomas Sudmeyer[1]; *[1]Univ. of Neuchatel, Switzerland.* We present a new method to measure CEO frequency noise and modulation response and obtain excellent agreement with the standard f-to-2f method for a commercial fiber comb. Future applications include semiconductor, micro-resonator, and GHz-laser comb characterization.

ATh1A.8 • 09:56
Tunable 1.9µm Laser System for Mid-IR Upconversion Detection, Rasmus Pedersen[1], Peter Tidemand-Lichtenberg[1], Lasse Høgstedt[1]; *[1]Technical Univ. of Denmark, Denmark.* A tunable 1.9µm Tm:YLF laser was built for low noise infrared up conversion imaging and spectroscopy. Its noise properties are compared to that obtained using a 1064nm mixing laser, focusing on spontaneous parametric down conversion generated noise.

ATh2A.1 • Mandelstam-Brillouin Mirrors for Chirped Pulse Fiber Laser Networks., Alex Okulov[1]; [1]*Russian Academy of Sciences, Russia.* Phase conjugating Brillouin mirrors are well suited for phase-locking of multi-channel lasers. We study possibility of a single beam chirped pulse output from a bundle of large mode area photonic crystal Yb fiber amplifiers.

ATh2A.2 • Laser Ignition of an Automobile Engine by a High-Peak Power Nd:YAG/Cr^{4+}:YAG Laser, Nicolaie I. Pavel[1], Traian Dascalu[1], Mihai Dinca[2], Gabriela Salamu[1], Niculae Boicea[3], Adrian Birtas[3]; [1]*Lab of Solid-State Quantum Electronics, National Inst. for Laser, Plasma and Radiation Physics, Romania;* [2]*Univ. of Bucharest, Faculty of Physics, Romania;* [3]*Renault Technologie Roumanie, Romania.* High-peak power passively Q-switched Nd:YAG/Cr^{4+}:YAG lasers were employed to operate the engine of a Renault automobile. Improved engine stability and decreased CO and HC emissions were measured in comparison with ignition by electrical spark plugs.

ATh2A.3 • Performance Analysis of Adaptive Compensation Techniques in Satellite-to-Ground Coherent Laser Communication Links, Siyuan Yu[1], Fangdi Bao[1], Zhongtian Ma[1], Jing Ma[1], Liying Tan[1]; [1]*Harbin Inst. of Tech., China.* In this paper, we try to derive exact expressions for the probability density function of the mixing efficiency in the presence of turbulence. The distribution of the mixing efficiency is given in different phase residual variance after using adaptive compensation techniques (ACT).

ATh2A.4 • Mid-IR Laser System for Muounic-Hydrogen Spectroscopy, Lyubomir I. Stoychev[2,1], Miltcho B. Danailov[3], Alexander Demidovich[3], Ivaylo Nikolov[3], Dimitar Bakalov[4], Andrea Vacchi[2,5]; [1]*Abdus Salam Intl Ctr Theoretical Physics, Italy;* [2]*Istituto Nazionale di Fisica Nucleare, sezione Trieste, Italy;* [3]*Elettra-Sincrotrone Trieste S.C.p.A, Italy;* [4]*Inst. for Nuclear Research and Nuclear Energy, Bulgaria;* [5]*Mathematics and Informatics Depertement, Udine Univ., Italy.* A laser system based on difference frequency generation in non-oxide nonlinear crystals ($LiInS_2$) emitting narrow linewidth mid-IR radiation at ~ 6.8 µm is presented. The system is developed as a prototype of the laser system needed for the purposes of muonic-hydrogen spectroscopy.

ATh2A.5 • Field-of-View Enhancement in Infrared-to-Visible Up-Conversion of Images Illuminated by an ASE Source, Adrian J. Torregrosa[1], Haroldo Maestre[1], Maria Luisa Rico[2], Juan Capmany[1]; [1]*Miguel Hernandez Univ., Spain;* [2]*Univ. of Alicante, Spain.* We propose the use of incoherent ASE illumination to enhance the field of view of up-converted images illuminated in the infrared as compared with the use of narrow-band laser illumination.

ATh2A.6 • Development of Nd:YGAG for efficient Lyman-α generation, Satoshi Wada[1], Takayo Ogawa[1], Norihito Saito[1], Yoshiharu Urata[1], Yu Oishi[1], Koji Miyazaki[1], Kotaro Okamura[1], Masahiko Iwasaki[1]; [1]*RIKEN, Japan.* We have developed Nd:YGAG for amplification at 1062.78nm. The fifth harmonics generation was used for two photon resonant four-wave mixing in Kr gas. Efficient Lyman-a generation at 122nm was successfully demonstrated. Efficiency reached to $3x10^{-3}$.

ATh2A.7 • Progress In The Development Of Kilowatt-class Diode Laser Bars For Pump Applications, Agnieszka Pietrzak[1], Martin W. Woelz[1], Ralf Huelsewede[1], Martin Zorn[1], Olaf Hirsekorn[1], Jens Meusel[3], Alex Kindsvater[3], Matthias Schröder[3], Veit Bluemel[3], Juergen Sebastian[1], Carlo Frevert[2], Frank Bugge[2], Steffen Knigge[2], Arnim Ginolas[2], Goetz Erbert[2], Paul Crump[2]; [1]*JENOPTIK Diode Lab GmbH, Germany;* [2]*Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, Germany;* [3]*JENOPTIK Laser GmbH, Germany.* Progress in diode laser pump bars is presented. Powers above 1kW per bar are confirmed at 880nm, and 940…980nm, with operating efficiency ~50%. Operation at 200K increases the efficiency at 1kW to >60%.

ATh2A.8 • Spectroscopic and Laser Properties of Tm^{3+} Ions Optical Centers in CaF_2 Crystal at $^3F_4$-$^3H_6$ Transition Under 795 nm Diode Laser Excitation., Maxim E. Doroshenko[1], Olimkhon Alimov[1], Alexander Papashvili[1], Kseniya Martynova[1], Vasilii Konyushkin[1], Andrei Nakladov[1], Vyacheslav Osiko[1]; [1]*A.M. Prokhorov General Physics Inst RAS, Russia.* The dynamics of Tm^{3+} optical centers formation with increasing concentration and the influence of different optical centers on the fluorescence and laser properties of the 2-mm $^3F_4$-$^3H_6$ transition under ~795 nm laser diode excitation is studied.

ATh2A.9 • Luminescence-Z-scan, Tomaz Catunda[1], Tarcio Vieira[1]; [1]*USP Inst de Fisica de Sao Carlos, Brazil.* The Luminescence Z-scan technique is introduced for the determination of the pump saturation intensities and up-conversion losses. Results are presented for Cr^{3+}:Al_2O_3, Cr^{3+}:YAG and Nd^{3+}:YAG.

ATh2A.10 • Passive Q-switching Of A Diode-pumped Pr:liyf$_4$ Visible Laser Using WS_2 As Saturable Absorber, Yongjie Cheng[1], Han Yang[1], Bin Xu[1], Huiying Xu[1], Zhiping Cai[1], Richard Moncorge[2]; [1]*Xiamen Univ., China;* [2]*Université de Caen, France.* Stable Q-switched laser operation (0.25 µJ, 630 ns, 88 kHz) of a diode-pumped Pr:$LiYF_4$ laser is obtained at 640nm by using a tungsten disulfide (WS_2) solid-state nanosheet material as saturable absorber.

ATh2A.11 • Sub-nanosecond Tm:KLuW Microchip Laser Q-switched by a Cr:ZnS Saturable Absorber, Pavel Loiko[1,2], Josep Maria Serres[2], Xavier Mateos[2], Konstantin V. Yumashev[1], Anatol S. Yasukevich[1], Uwe Griebner[3], Valentin Petrov[3], Magdalena Aguiló[2], Francesc Díaz[2]; [1]*Center for Optical Materials and Technologies, Belarusian National Technical Univ., Belarus;* [2]*FiCMA-FiCNA, Universitat Rovira i Virgili, Spain;* [3]*Max Born Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany.* A Tm:KLu$(WO_4)_2$ microchip laser Q-switched by a Cr^{2+}:ZnS saturable absorber generates 780 ps / 26 µJ pulses at 1846.6 nm. The maximum output power is 146 mW with a slope efficiency of 21%.

ATh2A.12 • High Order Hermit-Gaussian Mode Passively Q-Switched Nd:YVO_4 Microchip Laser, Jun Dong[1], Yu He[1], Shengchuang Bai[1]; [1]*Xiamen Univ., China.* Versatile high order Hermit-Gaussian mode lasers with peak power of over 720 W have been generated in passively Q-switched Nd:YVO_4 microchip laser by applying tilted large pump beam diameter incident on Nd:YVO_4 crystal.

ATh2A.13 • Microchip Laser Operation of Yb:YCOB Crystals, Xavier Mateos[1,2], Josep Maria Serres[1], Pavel Loiko[3], Haohai Yu[4], Huaijin Zhang[4], Junhai Liu[5], Konstantin V. Yumashev[3], Uwe Griebner[2], Valentin Petrov[2], Magdalena Aguiló[1], Francesc Díaz[1]; [1]*Universitat Rovira i Virgili, Spain;* [2]*Max Born Inst., Germany;* [3]*Center for Optical Materials and Technologies, Belarusian National Technical Univ., Belarus;* [4]*Shandong Univ., China;* [5]*Qingdao Univ., China.* Microchip lasers are realized with Yb:YCOB crystals cut along the optical indicatrix axes. Using a Z-cut crystal, a maximum output power of 8.35 W is achieved at ~1040 nm with a slope efficiency of 70%.

ATh2A.14 • Laser Characteristics of Nd:YAG/diamond and Nd:YVO_4/diamond Composite Devices Fabricated with the Room-temperature-bonding Technique, Ichiro Shoji[1], Yohei Okuyama[1], Hiromasa Ichikawa[1], Yoshimi Ariga[1], Tomomi Onda[1]; [1]*Chuo Univ., Japan.* We have developed Nd:YAG/diamond and Nd:YVO_4/diamond composites using the room-temperature-bonding technique. Higher-power operation at higher pump power is possible for the composites than for non-composites, in spite of the Fresnel loss at the bonded interfaces.

ATh2A.15 • Optimization of diode-side-pumped, passively Q-switched Yb:LuAG slab laser, Mateusz Kaskow[1], Jan K. Jabczynski[1], Waldemar Zendzian[1], Jan Sulc[2], Michal Nemec[2], Helena Jelinkova[2]; [1]*Inst. of Optoelectronics, Military Univ. of Tech., Poland;* [2]*Faculty of Nuclear Sciences and Physical Engineering, Czech Technical Univ., Czech Republic.* We demonstrate optimization of passively Q-switched Yb:LuAG laser. Pulse energy of 10.1 mJ corresponding to peak power of 2.5 MW was achieved. Above 100 mJ with 23% efficiency in free-running operation was obtained.

ATh2A.16 • High Gain Broadband Yb:CaF2 Booster Amplifier Pumped by a 976 nm High Power Fiber Laser, Pierre Sevillano[1,2], Patrice Camy[3], Jean-Louis Doualan[3], Jens Limpert[4], Richard Moncorge[3], Dominique Descamps[1], Eric Cormier[1]; [1]*Université de Bordeaux I, France;* [2]*CEA, France;* [3]*Université de Caen, France;* [4]*Friedrich Schiller Univ. Jena, France.* We demonstrate a broadband booster amplifier operating at 96 MHz based on a 29 mm Yb:CaF2 crystal pumped by a fiber laser at 976 nm. Pulses as short as 70 fs have been directly amplified up to 16.5 W in a single-pass configuration with 34 % efficiently and an optical gain of 5.7.

ATh2A.17 • Continuous yellow-orange laser based on a diode-side-pumped Nd^{3+}:YVO_4 self-Raman laser, Cristine C. Kores[1], Jonas Jakutis Neto[2], Helen M. Pask[3], Niklaus U. Wetter[1]; [1]*Centro de Lasers e Aplicações - IPEN/SP, Brazil;* [2]*Instituto de Estudos Avançados – IEAv, Brazil;* [3]*Macquarie Univ., Australia.* In this work we report the operation of the first diode-side-pumped continuous-wave (cw) self-Raman laser at 588 nm. The very cost-effective design allows for efficient stimulated Raman scattering using a grazing incidence configuration.

ATh2A.18 • Dual-Wavelength Eye-Safe Generation in a Diode-Pumped Nd:YAP Raman Laser, Yu-Jen Huang[1], Kuan-Wei Su[1], Yung-Fu Chen[1,2], Weidong Chen[3], Ge Zhang[3]; [1]*Dept. of Electrophysics, National Chiao Tung Univ., Taiwan;* [2]*Dept. of Electronics Engineering, National Chiao Tung Univ., Taiwan;* [3]*Key Lab of Optoelectronic Materials Chemistry and Physics, Fujian Inst. of Research on the Structure of Matter, Chinese Academy of Sciences, China.* A compact efficient dual-wavelength eye-safe Nd:YAP Raman laser at 1478 (1474) and 1503 (1480) nm is originally demonstrated based on simultaneous excitations of the cascaded 267- (233) cm^{-1} mode and the 694- (671) cm^{-1} shift in the KTP (KTA) crystal.

ATh2A.19 • Intracavity-Pumped, Cascaded Mid-IR Optical Parametric Oscillator Based on $AgGaSe_2$, Andrey Boyko[1,3], Georgi Marchev[2], Valentin Petrov[2], Valdas Pasiskevicius[4], Dmitry Kolker[1], Andrius Zukauskas[4], Nadezhda Kostyukova[3,1]; [1]*Novosibirsk State Univ., Russia;* [2]*Max Born Inst., Germany;* [3]*Special Technologies, Ltd., Russia;* [4]*Royal Inst. of Tech., Sweden.* We report on an $AgGaSe_2$ optical parametric oscillator (OPO), intracavity pumped by the 1.85-μm signal pulses from a 1.064-μm pumped Rb:PPKTP OPO. It operates at 100 Hz with idler tunability from 5.8 to 8.3 μm.

ATh2A.20 • Tm:YAP Pumped Intracavity Pulsed OPO Based on Orientation-Patterned Gallium Arsenide (OP-GaAs), Daniel Kane[1,2], John-Mark Hopkins[1], Malcolm Dunn[3], Peter G. Schunemann[4], David J. Stothard[1]; [1]*Fraunhofer CAP, UK;* [2]*Univ. of Strathclyde, UK;* [3]*Univ. of St Andrews, UK;* [4]*BAE Systems Inc., USA.* We present a long-wavelength singly-resonant optical parametric oscillator (OPO) based upon orientation-patterned gallium arsenide (OP-GaAs) pumped internal to a high-repetition-rate, Q-switched Tm:YAP laser. We demonstrate up to 120mW of extracted idler and tuning from 2.5-6.8μm.

ATh2A.21 • Numerical Investigation of Coherent Mid-infrared Supercontinuum Generation in Tapered Chalcogenide Fibers, Lai Liu[1], Yasutake Ohishi[1], Takenobu Suzuki[1], Kenshiro Nagasaka[1]; [1]*Toyota Technological Inst., Japan.* The coherence property of mid-infrared supercontinuum generation in a tapered chalcogenide step-index fiber pumped by a 4 μm femtosecond laser is numerically investigated by using the complex degree of coherence and second order coherence theory.

ATh2A.22 • Continuum generation in the 2 microns wavelength interval using high-order mode propagation, Stefano Taccheo[1], Cosimo D'Andrea[2], Ilaria Bargigia[3], Silvia Soria[4], Jens Kobelke[5], Kay Schuster[5]; [1]*Swansea Univ - Coll Engin, UK;* [2]*Politecnico di Milano, Italy;* [3]*IIT, Italy;* [4]*IFAC CNR, Italy;* [5]*IPHT, Germany.* We demonstrate efficient continuum generation in the 2 micron wavelength interval using a new scheme of off-axis pumping and high-order mode propagation in a photonic crystal fiber pumped at around 780 nm.

ATh2A.23 • Determination of Thermal Load from Core Temperature Measurements in Single Mode Ytterbium-Doped Fiber Amplifiers, Franz Beier[1,2], Matthias Heinzig[1], Till Walbaum[1], Stefan Kuhn[1], Christian Hupel[1], Nicoletta Haarlammert[1], Thomas Schreiber[1], Ramona Eberhardt[1], Andreas Tünnermann[1,2]; [1]*Precision Engineering, Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany;* [2]*Inst. of Applied Physics, Germany.* In this contribution we demonstrate an approach to determine the longitudinal resolved thermal load in the core of an ytterbium-doped amplifier-fiber. The temperature distribution was measured by an OFDR in a single-mode amplifier in operation.

ATh2A.24 • Mode Instabilities in High-Power Bidirectional Fiber Amplifiers and Lasers, Cesar Jauregui[1], Hans J. Otto[1], Jens Limpert[1], Andreas Tünnermann[2,1]; [1]*Friedrich-Schiller-Universität Jena, Germany;* [2]*Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* In this contribution we present the first study on the behavior of the mode instability threshold in bidirectional fiber amplifiers and lasers taking into account the impact of photodarkening.

ATh2A.25 • Pump beam propagation and absorption distribution in single crystal fibers, Xavier Delen[1], Adrien Aubourg[1,2], François Balembois[1], Patrick Georges[1]; [1]*Institut d'Optique Graduate School, France;* [2]*Laboratoire Photonique Numérique et Nanosciences, France.* This paper presents numerical simulations and experimental results about the propagation of highly multi-mode pump beams in single crystal fibers. Pump to signal overlap is also quantified taking into account saturation effects.

ATh2A.26 • 547 kHz repetition rate all-fiber mode-locked laser delivering picoseconds pulse at 1 μm wavelength, Simon Boivinet[1,2], Yves Hernandez[1], Jean-Bernard Lecourt[1], Marc Wuilpart[2], Andrei Fotiadi[2], Patrice Mégret[2]; [1]*Applied Photonics Dept., Multitel, Belgium;* [2]*Electromagnetism and Telecommunication Dept., Faculty of Engineering, Univ. of Mons, Belgium.* An all-PM fiber mode-locked oscillator delivering directly 14.2 ps pulse duration at 547 kHz is reported. The laser is based on nonlinear polarization evolution in birefringent fiber and uses an electronic all-PM polarization controller.

ATh2A.27 • High energy sub-nanosecond thulium-doped all-fibre laser based on a rod-type photonic-crystal fibre amplifier, Sebastien Guillemet[1], Yves Hernandez[1], Dirk Mortag[2], Frithjof Haxsen[2], Andreas Wienke[2], Dieter Wandt[2], Lasse Leick[3], Wolfgang Richter[4]; [1]*Multitel, Belgium;* [2]*Laser Zentrum Hannover, Germany;* [3]*NKT Photonics, Denmark;* [4]*Batop, Germany.* We report a thulium-doped fibre amplified mode-lock laser at 1950 nm using a large mode area rod-type PCF for reaching up to 120 μJ energy at 50 kHz repetition rate and 520 ps pulses duration.

ATh2A.28 • Optimization of a Diode-Pumped Thulium Fiber Laser with a Monolithic Cavity towards 278 W at 1967 nm, Till Walbaum[1], Matthias Heinzig[1], Andreas Liem[1], Thomas Schreiber[1], Ramona Eberhardt[1], Andreas Tünnermann[1]; [1]*Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We present a thulium fiber laser with a monolithic cavity emitting at 1967 nm. The output power of 278 W is the highest presented so far for a diode-pumped thulium fiber laser below 2 μm.

ATh2A.29 • Discretely tunable Tm-doped fiber laser using FBG arrays as spectral filters, Tobias Tiess[1], Saher Junaid[1], Martin Becker[1], Sonja Unger[1], Manfred Rothhardt[1], Hartmut Bartelt[1,2], Matthias Jäger[1]; [1]*Fiber Optics, Leibniz Inst. of Photonic Tech., Germany;* [2]*Abbe Center of Photonics, Germany.* We present two configurations of a discretely tunable Thulium-doped fiber laser using FBG arrays as versatile spectral filters for tailored tuning ranges. With pulses in the nanosecond regime, a tuning range of 84nm has been realized.

ATh2A.30 • Q-switched Nd:YAG laser at 946 nm based on single crystal fiber pumped at 885 nm, Jean-Thomas Gomes[1], Xavier Delen[1], Igor Martial[2], Julien Didierjean[2], François Balembois[1], Patrick Georges[1]; [1]*Laboratoire Charles Fabry, USA;* [2]*Fibercryst SAS, France.* We report on a 946nm Q-switched oscillator based on Nd:YAG single crystal fiber. We demonstrate 15W, 40kHz, 51ns pulses and a maximum average power of 28.4W in continuous regime with a M^2 under 1.3.

ATh2A.31 • Enhancement of Fundamental Mode Third Harmonic Generation Efficiency in Microfibres, Xiujuan Jiang[1,2], Timothy Lee[2], Zhanbiao Wei[1], Yifan Tang[1], Gilberto Brambilla[2]; [1]*School of Electro-mechanical Engineering, Guangdong Univ. of Tech., China;* [2]*Optoelectronics Research Centre, Univ. of Southampton, UK.* We present a scheme to generate the third harmonic in the fundamental mode using microfibres, by introducing a counter-propagating pump field to partly compensate the phase mismatch and thus enhance the harmonic conversion efficiency.

ATh2A.32 • High Power Fiber Laser Delivering Pulses with Arbitrary Duration and Repetition Rate, Rok Petkovsek[1], Vid Novak[2], Vid Agrez[1], Bostjan Podobnik[2]; [1]*Univ. of Ljubljana, Slovenia;* [2]*LPKF, Slovenia.* MOPA fiber laser capable of delivering pulses on demand having arbitrary duration at high modulation bandwidth is presented. The laser features a dual wavelength seed source and a double stage YDF amplifier.

ATh2A.33 • Hybrid Fiber/Solid-State Picosecond Pulse Burst Laser with Diffraction-Limited Beam Quality in the Deep Ultraviolet, Vincent Roy[1], Louis Desbiens[1], Yves Taillon[1]; [1]*Institut National d'Optique, Canada.* Picosecond pulse bursts generated by an Yb-doped fiber laser are further amplified up to the mJ level in an Nd-doped vanadate amplifier. Highly efficient frequency tripling (38%) and quadrupling (23%) in lithium triborate crystals is shown to yield near diffraction-limited beam quality ($M^2 <$ 1.2).

ATh2A.34 • Influence of Pump Noise on Mode-locked Fiber Oscillators, Parviz Elahi[1], Tesfay G Teamir[1], Levent Budunoglu[1], Kutan Gurel[1], F Omer Ilday[1,2]; [1]*Physics Dept., Bilkent Universitesi, Turkey;* [2]*Electrical and Electronics, Bilkent Univ., Turkey.* Pump modulation transfer function and its dependence on pump power are investigated for all normal dispersion, dispersion managed and soliton-like mode-locked oscillator both in experiment and simulation.

ATh2A.35 • Study of nanosecond polarization maintaining Ytterbium-doped fiber amplifier in pulsed pump regime, Gabriel Amiard-Hudebine[1,2], Guillaume Tison[1,2], Eric Freysz[1,2]; [1]*Université de Bordeaux, France;* [2]*CNRS-UMR 5798, France.* Nanosecond pulses are amplified from 5 µJ to 230 µJ at 1064 nm in a short LMA-PM-Yb-doped fiber pumped at 915 nm. Experimental limitations introduced by pulsed-pump, ASE and nonlinear effects agree with our numerical simulations.

ATh2A.36 • Subpicosecond Diode-pumped Nd,Y-codoped:SrF_2 Laser, Vaclav Kubecek[1], Michal Jelinek[1], Miroslav Cech[1], David Vyhlidal[1], Liangbi Su[2], Dapeng Jiang[2], Fengkai Ma[2], Xiaobo Qian[2], Jingya Wang[2], Jun Xu[2]; [1]*Czech Technical Univ. in Prague, Czech Republic;* [2]*Shanghai Inst. of Ceramics, China.* Passively mode-locked operation of a Nd,Y:SrF_2 laser pumped by low power laser diode at 796nm is reported. The continuous train of 0.9 ps long pulses with total output power of 80 mW at repetition rate of 142 MHz was generated.

ATh2A.37 • Pulsed Diode Side-pumped Mode-locked Nd:YVO_4 Laser in Double-bounce Configuration, Jitka Cernohorska[1], Michal Jelinek[1], David Vyhlidal[1], Vaclav Kubecek[1]; [1]*Czech Technical Univ. in Prague, Czech Republic.* Passively mode-locked Nd:YVO_4 laser in the double-bounce grazing-incidence geometry under pulsed diode-pumping is presented. Q-switched pulse-trains of 16 ps pulses at 1.06um were generated at repetition rate of 50Hz with low timing jitter of 140ns.

ATh2A.38 • Passively Mode-locked 2 µm Bulk Laser with > 1 Watt Output, Kejian Yang[1], Tianli Feng[1], Shengzhi Zhao[1], Thomas Dekorsy[2], Lihe Zheng[3], Jun Xu[3]; [1]*Shandong Univ., China;* [2]*Konstanz Univ., Germany;* [3]*Shanghai Inst. of Ceramics, China.* In this paper, we reported a passively mode-locked 2 µm bulk laser with >1 W output. A maximum laser output power exceeding 1.2 W with a minimum pulse duration of 38.4 ps was achieved around 2 µm.

ATh2A.39 • Comparison Between Tm:YAP and Ho:YAG Ultrashort Pulse Regenerative Amplification, Andreas Wienke[1], Dieter Wandt[1], Uwe Morgner[1,2], Jörg Neumann[1], Dietmar Kracht[1]; [1]*Laser Zentrum Hannover e.V., Germany;* [2]*Institut für Quantenoptik, Leibniz Universität Hannover, Germany.* We compare the performance characteristics of Tm:YAP and Ho:YAG in ultrashort pulse regenerative amplification. Both systems follow the same amplification concept and use nearly the same experimental setup reaching similar output energies of >700 µJ.

ATh2A.40 • $\chi^{(2)}$-Lens Mode-Locking of a Yb:YAG Laser Using Intracavity SHG in a LBO crystal, Veselin S. Aleksandrov[1], Hristo Iliev[2], Ivan Buchvarov[1]; [1]*Sofia Univ. St. Kliment Ohridski , Bulgaria;* [2]*IBPhotonics Ltd., Bulgaria.* We demonstrate a diode-pumped Yb:YAG laser mode-locked by intra-cavity $\chi^{(2)}$-lens formation in a LBO crystal. Stable operation is achieved with output power of 260 mW, pulse duration of 1.4 ps at 105 MHz repetition rate.

ATh2A.41 • Total Self-Mode-Locking of Multi-Pass Geometric Modes Localized on Hyperbolic Caustics in Diode-Pumped Nd:YVO4 Lasers, Jung-Chen Tung[1], P. H. Tuan[1], Hsing-Chih Liang[2], Kuan-Wei Su[1], Kai-Feng Huang[1], Yung-Fu Chen[1]; [1]*National Chiao Tung Univ., Taiwan;* [2]*National Taiwan Ocean Univ., Taiwan.* We experimentally explore simultaneous self-phase-locking of longitudinal and transverse modes in a diode-pumped Nd:YVO_4 laser with off-axis pumping. The mode-locked states produce wave packets traveling along ray paths localized on hyperbolic caustics in degenerate cavities.

ATh2A.42 • High-power self-mode-locked Nd:YVO_4 laser at wavelength of 1342 nm with simultaneously orthogonal polarizations, Hsing-Chih Liang[1], Tai-Wei Wu[2], Chia-Han Tsou[2], Yung-Fu Chen[2]; [1]*National Taiwan Ocean Univ. , Taiwan;* [2]*National Chiao Tung Universiity, Taiwan.* We demonstrate an orthogonally polarized dual-comb Nd:YVO_4 laser by exploiting the birefringence of a wedge gain crystal and the alignment sensitivity of an optical resonator. The pulse duration are found to be 15.1 ps and 16.9 ps for π-polarization and σ-polarization.

ATh2A.43 • Wide-Range Peak Power Control in the Diode-Pumped Multiloop Self-Phase-Conjugate Nd:YAG Laser by Different Passive Q-Switches, Anastasiya Pogoda[1], Georgy V. Burkovsky[1], Pavel Makarchuk[1], Ivan Khakhalin[1], Sergey Smetanin[2], Anatoliy Boreysho[1]; [1]*BSTU VOENMEKH, Russia;* [2]*Prokhorov General Physics Inst. of Russian Academy of Sciences, Russia.* The possibility of wide-range control by generation of the diode-pumped multiloop self-phase-conjugate Nd:YAG laser using different passive Q-switches with variable initial transmittances are experimentally investigated changing the peak power by 100 times up to 28 MW at semipermanent output energy.

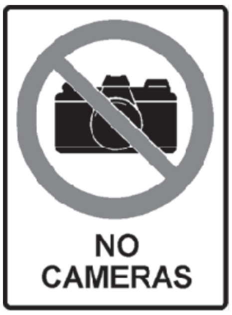
ATh2A.44 • WITHDRAWN

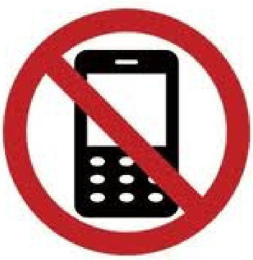
ATh2A.45 • Color Centers Transient Absorption and Ultra-short Pulse Lasing from $LiLu_{0.7}Y_{0.3}F_4:Ce^{3+}$ Active Medium, Alexey Nizamutdinov[1], Ilnur Farukhshin[1], Vadim Semashko[1], Stella Korableva[1]; [1]*Kazan Federal Univ., Russia.* We have obtained the single pulse laser oscillation with 400±10 ps pulse duration at 311 nm from $LiLu_{0.7}Y_{0.3}F4:Ce^{3+}$ crystal due to passive Q-switch by means of pump induced color centers absorption. In this work we discuss the role of intrinsic transient color centers on losses dynamics.

ATh2A.46 •Diode-pumped Alexandrite Ring Laser, Alexander Munk[1], B Jungbluth[1], M Strotkamp[1], S Gaussmann[1], Dieter Hoffmann[1], R Poprawe[1,2], J Hoeffner[3]; [1]*Fraunhofer-Inst. for Laser Technolog, Germany;* [2]*RWTH Aachen Univ., Germany;* [3]*Leibniz Inst. of Atmospheric Physics, Germany.* We present design and performance data of a linear Alexandrite laser in q-switched operation and an Alexandrite ring laser in quasi-cw mode, both longitudinally pumped by laser diode bar modules in the red spectral range.

ATh2A.47 •Method for Spectral Interrogation of the Fiber Bragg Gratings Using a Tunable Narrowband Light Source, Mikhail Belikin[1], Andrei Kulikov[1], Igor Meshkovsky[1]; [1]*ITMO Univ., Russia.* We present results of the research work of low-cost interrogation system investigating for fiber Bragg grating sensor using 1550nm VCSEL. Interrogation principles are based on VCSEL operating principle and minimize additional optical and electronic components.

ATh2A.48 • Pulse-burst Laser for Laser-induced Plasma Ignition, Yufei Ma[1], Ying He[1], Xin Yu[1], Renpeng Yan[1], Xudong Li[1], Jiangbo Peng[1], Zhiwei Dong[1], Rongwei Fan[1], Rui Sun[1]; [1]*Harbin Inst. of Tech., China.* This paper showed that a small size passively Q-switched pulse-burst laser without amplifier can produce high repetition rate (higher than 20 kHz) and high pulse energy (higher than 10 mJ) simultaneously in a short period.





11:40—12:50
ATh3A • Postdeadline Papers
Bunsen Hall (Bunsensaal)
Presider: Alphan Sennaroglu, Koc Univ., Turkey

ATh3A.1 • 11:40
Amplification-free, 145 MW, 16 MHz Scalable Ultrafast Light-source for XUV and MIR Generation, Jonathan Brons[1], Vladimir Pervak[2], Marcus Seidel[1], Dominik Bauer[3], Dirk Sutter[3], Oleg Pronin[1], Ferenc Krausz[1,2]; *[1]Max-Planck-Institut für Quantenoptik, Germany; [2]Ludwig-Maximilians-Universität, Germany; [3]TRUMPF Laser GmbH, Germany;* . We describe an Yb:YAG KLM thin-disk oscillator with enhanced nonlinearity directly providing 140 fs 160 W. This output is successfully compressed down to 30 fs in a scalable crystalline bulk-material setup, without need for fibers.

ATh3A.2 • 11:50
Exploiting Spatial-Hole-Burning-Free Raman Gain to Realize High-Power Single-Longitudinal Mode Oscillators, *Oliver* Lux[1,2], Soumya Sarang[1], Ondrej Kitzler[1], Richard P. Mildren[1]; *[1]MQ Photonics Research Centre, Department of Physics and Astronomy, Macquarie University, Australia; [2]Institute of Optics and Atomic Physics, Technische Universität Berlin, Germany*. Single-longitudinal mode operation of a continuous wave diamond Raman oscillator with power of 3.5 W is demonstrated. Frequency-stable and narrowband output which is tunable from 1238 to 1242 nm is obtained without intra-cavity frequency-selective elements.

ATh3A.3 • 12:00
A 265W and 782 fs Amplified Radially Polarized Beam Emitted by a Thin-disk Multipass Amplifier, Marwan Abdou Ahmed[1], Jan-Philipp Negel[1], André Loescher[1], Thomas Graf[1];*[1]Universität Stuttgart, Germany*. The amplification of a high-power radially polarized beam in a thin-disk multipass amplifier is presented. Up to 265W output power at a pulse duration of 782 fs and a high degree of radial polarization is achieved.

ATh3A.4 • 12:10
Ho:YLF Regenerative Amplifier with 6.9 mJ at 1 kHz Overcoming Bifurcation Instability, Peter Kroetz[1,2], Axel Ruehl[3], Gourab Chatterjee[1,2], Peng Li[3], Krishna Murari[3,2], Huseyin Cankaya[3,4], Anne-Laure Calendron[3,4], Franz Kaertner[3,4], Ingmar Hartl[3], R. J. Dwayne Miller[1,5]; *[1]Max-Planck Institute MPSD, Germany; [2]CFEL - Center for Free Electron Laser Science, Germany; [3]Deutsches Elektronen Synchrotron (DESY), Germany; [4]Center for Ultrafast Imaging (CUI), Germany; [5]University of Toronto - Chemistry and Physics, Canada*. We demonstrate a Ho:YLF regenerative amplifier overcoming bifurcation instability and consequently achieving record-high extraction energies of 6.9 mJ at a repetition rate of 1 kHz with pulse-to-pulse fluctuations of 1.1%.

ATh3A.5 • 12:20
High-repetition-rate, 90-µJ ultrafast chirped-pulse parametric amplifier front-end at 1.55 µm, Mark Mero[1], Frank Noack[1], Florian Bach[1], Valentin Petrov[1], Marc J. Vrakking[1]; *[1]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Germany*. 90-µJ, ~50-fs, 1.55-µm pulses were generated at 100 kHz by a two-stage optical parametric chirped pulse amplifier, permitting the development of novel experimental strategies towards laser-based imaging of molecular structures and chemical reactivity.

ATh3A.6 • 12:30
> MW, mJ-High-Brightness Giant-Pulse Nd:YVO4 Microchip Laser by Cross-Section Control, Arvydas Kausas[1], Takunori Taira[1]; *[1]IMS, Japan*. In this work a Q-switched Nd:YVO$_4$/Cr^{4+}:YAG laser was developed with the peak power and output energy of 1.17 MW and 1.03 mJ correspondingly. By changing the temperature of Nd:YVO$_4$ crystal control of the emission cross-section σ_{em} of the gain medium and thus Q-switch output was possible.

ATh3A.7 • 12:40
Continuous-wave ultraviolet Ce:LiCAF laser, Ondrej Kitzler[1], Barbara Wellmann[1], David Spence[1], David Coutts[1]; *[1]Macquarie University, Australia*. We report a first demonstration and characterization of a 289.9 nm continuous-wave (cw) Ce:LiCAF laser pumped by a cw 266 nm laser. This direct-UV laser has the potential to be tuned from 285-315 nm, and to generate few-fs pulses.

12:50—13:50 • Lunch, *On Your Own*

13:50—16:00
ATh4A • Frequency Combs and Modelocked Sources
Bunsen Hall (Bunsensaal)
Presider: Irina Sorokina, Norwegian Univ. of Science and Technology, Norway

ATh4A.1 • 13:50
Recent Progress in High-Power Femtosecond Semiconductor Disk Lasers, Cesare Alfieri[1], Dominik Waldburger[1], Sandro M. Link[1], Emilio Gini[1], Mario Mangold[1], Bauke Tilma[1], Matthias Golling[1], Ursula Keller[1]; [1]*ETH Zürich, Switzerland.* We present recent progress towards high-power femtosecond semiconductor disk lasers (SDLs): sub-150-fs SESAM-modelocked VECSEL with 300 W of peak power, sub-300-fs MIXSEL with high peak power and the first entirely MOVPE-grown MIXSEL.

ATh4A.2 • 14:02
Ultra-low phase noise all-PM Er:fiber optical frequency comb, Wolfgang Hänsel[1], Michele Giunta[1,2], Katja Beha[1], Matthias Lezius[1], Marc Fischer[1], Ronald Holzwarth[1,2]; [1]*Menlo Systems GmbH, Italy;* [2]*Max-Planck-Inst. for Quantum Optics, Germany.* We have locked fceo and frep of an all-PM 250 MHz Er:fiber femtosecond frequency comb with a bandwidth exceeding 1 MHz. This results in record-low integrated phase noise of 68 mrad and 55 mrad respectively.

ATh4.3 • 14:14
Modelocked Dual-Comb Lasers, Sandro M. Link[1], Mario Mangold[1], Matthias Golling[1], Alexander Klenner[1], Ursula Keller[1]; [1]*ETH Zurich, Switzerland.* We present a simple way of generating simultaneously two modelocked pulse trains with both a semiconductor disk laser and a Nd:YAG laser, establishing a simple link from the optical domain to a microwave frequency comb.

ATh4A.4 • 14:26
Pulse Picking Scheme with Synchronized Acousto-Optic Modulator Carrier Frequency, Oliver de Vries[1], Tobias Saule[2], Marco Plötner[1], Fabian Lücking[3], Tino Eidam[4], Jens Limpert[5,4], Simon Holzberger[2], Thomas Schreiber[1], Ramona Eberhardt[1], Ioachim Pupeza[2], Andreas Tünnermann[1,5]; [1]*Fraunhofer IOF, Germany;* [2]*Max-Planck-Institut für Quantenoptik, Germany;* [3]*Femtolasers Produktions GmbH, Austria;* [4]*Active Fiber Systems GmbH, Germany;* [5]*Friedrich-Schiller-Univ., Germany.* We demonstrate an alternative approach facilitating the use of a travelling-wave type acousto-optic modulator to pick pulses from a high-repetition-rate carrier-envelope phase stable pulse train where Pockels cells cannot be applied due to piezoelectric ringing.

ATh4A.5 • 14:38
Low-Noise Gigahertz Frequency Comb from Diode-Pumped Solid-State Laser using Silicon Nitride Waveguides, Aline Sophie Mayer[1], Alexander Klenner[1], Adrea Johnson[2], Kevin Luke[2], Michael Lamont[2], Yoshitomo Okawachi[2], Michal Lipson[2], Alexander Gaeta[2], Ursula Keller[1]; [1]*ETH Zurich, Switzerland;* [2]*Cornell Univ., USA.* We present the first self-referenced f_{CEO}-stabilization based on Si_3N_4-waveguides, using only 36 pJ of coupled pulse energy. In addition, pump wavelength stabilization leads to record low noise performance of our 1-GHz diode-pumped solid-state laser.

ATh4A.6 • 14:50 **Invited**
Femtosecond Lasers as Universal Sources for Chemical Sensing and Biomedical Applications, Marcos Dantus[1]; [1]*Michigan State Univ., USA.* We use spectral-temporal shaping to convert ultrashort femtosecond lasers into universal sources ideal for chemical sensing and biomedical imaging. Our work on automated adaptive pulse characterization and compression is making these sources and applications practical.

ATh4A.7 • 15:10
Generation of 49-fs pulses directly from distributed Kerr-lens mode-locked Yb:YAG thin-disk oscillator, Jinwei Zhang[1,2], Jonathan Brons[1], Marcus Seidel[1], Dominik Bauer[3], Dirk Sutter[3], Vladimir Pervak[4], Vladimir Kalashnikov[5], Zhiyi Wei[2], Alexander Apolonski[4,1], Ferenc Krausz[1,4], Oleg Pronin[1]; [1]*Max Planck Inst. of Quantum Optics, Germany;* [2]*Beijing National Lab for Condensed Matter Physics and Inst. of Physics, Chinese Academy of Sciences, China;* [3]*TRUMPF Laser GmbH, Germany;* [4]*Ludwig Maximilian Univ. of Munich, Germany;* [5]*Aston Inst. of Photonic Technologies, UK.* The concept of distributed Kerr-lens mode-locking and a thin-disk Yb:YAG oscillator based on this concept are presented. The described oscillator directly generates pulses with a duration of 49 fs and spectral width of 33 nm.

ATh4A.8 • 15:22
Diode-Pumped Kerr-Lens Modelocked Ti:Sapphire Laser Generating 450 mW in 58 fs Pulses and 350 mW in 39 fs Pulses, Kutan Gurel[1], Valentin J. Wittwer[1], Martin Hoffmann[1], Stéphane Schilt[1], Thomas Sudmeyer[1]; [1]*Universite de Neuchatel, Switzerland.* We present the highest average power from a green diode-pumped Ti:Sapphire laser. In CW-operation, we achieve 650 mW. Using Kerr-lens-modelocking (KLM) we obtain 450 mW in 58-fs pulses and 350 mW in 39-fs pulses.

ATh4A.9 • 15:34
Nonlinear Polarization Rotation Mode-locking via Phase-mismatched Type I SHG of a Thin Disk Femtosecond Laser, Bastian Borchers[1], Christoph Schaefer[1], Christian Fries[2], Mikhail Larionov[3], Ralf Knappe[1]; [1]*Coherent Kaiserslautern GmbH, Germany;* [2]*Photonikzentrum Kaiserslautern e.V., Germany;* [3]*Dausinger + Giesen GmbH, Germany.* We present a novel two-crystal approach rendering polarization rotation mode-locking via cascaded chi^2-nonlinearities applicable to broadband lasers sources. This technique is demonstrated at a thin disk oscillator reaching >40W average power and <500fs pulse duration.

ATh4A.10 • 15:46
193 fs from an Yb:YAG Oscillator Mode-Locked Using Nonlinear Polarization Rotation via Type I SHG with Intrinsic Dispersion Compensation, Christian Fries[1], Christoph Schaefer[2], Christian Theobald[1], Johannes A. L'huillier[1]; [1]*Photonik-Zentrum Kaiserslautern e.V., Germany;* [2]*Coherent Kaiserslautern GmbH, Germany.* We present mode-locking via nonlinear polarization rotation (NPR) in Yb:YAG. Intrinsic dispersion compensation via negative SPM and normal dispersion in the NPR crystal allowed for 193 fs pulses. The group-velocity-mismatch effects allowed for adjusting the pulse duration between 193 fs - 1 ps.

07:30—15:00 • Registration, *Foyer A*

08:00—09:56
AF1A • Applications & Sources Joint Session with Plenary Speaker
Bunsen Hall (Bunsensaal)
Presider: Clemens Hoenninger; Amplitude Systemes, France

Friday, 9 October

Plenary

AF1A.1 • 08:00
Femtosecond-laser-based Microstructuring and Modification of Transparent Materials, Roberto Osellame[1]; [1]*Inst. for Photonics and Nanotechnologies - National Research Council (CNR), Italy.* Femtosecond laser micromachining of transparent materials is a powerful tool in basic science and industrial applications. Its unique 3D capabilities and process versatility enables compact and effective device layouts for integrated photonics, microfluidics and nanoTech.

Invited

AF1A.2 • 08:40
Nonlinear optical waveguide for GaN-laser pumping, Sunao Kurimura[1], Hwan Hong Lim[1], Shigeki Takeuchi[2]; [1]*National Inst. for Materials Science, Japan;* [2]*Graduate School of Engineering, Kyoto Univ., Japan.* NLO waveguide based on low-absorption Mg:SLT is presented for efficient wavelength conversion. GaN-laser-pumped optical parametric generation produces arbitrary spectral components and shapes in the visible to near infrared range by designing QPM structures.

Invited

AF1A.3 • 09:00
Nonlinearity Engineering of Ultrafast Lasers and Laser-Material Interactions, F Omer Ilday[1]; [1]*Bilkent Univ., Turkey.* From novel mode-locking regimes to laser-induced self-assembly of nanostructures, it is not only possible, but highly rewarding to exploit the underlying nonlinear dynamics of photonic systems towards achieving superior technical functionality. These different dissipative systems manifest similar phenomena, such as nonlinear gain, feedback, and modulation instability.

AF1A.4 • 09:20
High-power and High-efficiency Frequency-doubled Fundamental-mode Thin-disk Laser, Tom Dietrich[1], Stefan Piehler[1], Martin Rumpel[1], Thomas Graf[1], Marwan Abdou-Ahmed[1]; [1]*Institut fuer Strahlwerkzeuge - IFSW, Germany.* A highly efficient grating mirror for intra-cavity wavelength and polarization stabilization in a frequency-doubled Yb:YAG thin-disk laser enables up to 403 W of output power at an unprecedented efficiency of 40.7% in close-to fundamental-mode operation.

AF1A.5 • 09:32
High Power Nd:YAG Spinning Disk Laser, Andrew Ongstad[1], Matthew Guy[1], Joeseph R. Chavez[1]; [1]*RDLTD, Air Force Research Lab, USA.* We report on a high power Nd:YAG spinning disk laser. The 6 cm diameter disk generated 181 W CW output with 300 W of absorbed pump. The power conversion efficiency was 67%.

AF1A.6 • 09:44
Dense Wavelength Multiplexing and 35 µm-Fiber Coupling of Wavelength Chirped High Power Diode Laser Bars, Ulrich Witte[1], David Rubel[1], Martin Traub[1], Marcus Hamann[1], Stefan Hengesbach[1], Dieter Hoffmann[1]; [1]*Fraunhofer Inst. for Laser Tech., USA.* We present a flexible, modular and cross-talk free concept for dense wavelength beam combining of HPDL by use of ultra-steep dielectric filters. Five emitters of one mini bar are coupled into a 35 µm fiber. Experimental results of internally and externally stabilized HPDL are presented.

10:00—10:30 • Coffee Break, *Foyer C*

Notes

10:30—12:26
AF2A • Advanced ps, fs and MIR processing
Bunsen Hall (Bunsensaal)
Presider: Arnold Gillner, Fraunhofer-Institut für Lasertechnik ILT, Germany

AF2A.1 • 10:30 Invited
Picosecond Infrared Laser (PIRL) Scalpel: Achieving the Fundamental Limits to Minimally Invasive Surgery and Biodiagnostics, R. J. Dwayne Miller[1,2]; [1]*MPI - the Structure and Dynamics/Matter, Germany;* [2]*Dept.s of Chemistry and Physics, Univ. of Toronto, Canada.* A new mechanism has been discovered that completely arrests nucleation growth and eliminates associated shock wave damage to adjacent tissue with no scar tissue formation while simultaneously providing intact molecular signatures for in situ biodiagnostics.

AF2A.2 • 10:50 Invited
Efficient High-quality Processing of CFRP with a kW Ultrafast Thin-disk Laser, Thomas Graf[1], Rudolf Weber[1], Marwan Abdou-Ahmed[1], Volkher Onuseit[1], Christian Freitag[1], Margit Weidenmann[1], Jan-Philipp Negel[1], Andrea Löscher[1]; [1]*Universität Stuttgart, Germany.* We report on the efficient processing of CFRP with negligible thermal damage which was enabled by the application of a thin-disk laser system that generates ps pulses at an average output power exceeding 1 kW.

AF2A.3 • 11:10 Invited
Two-Beam Two-photon Lithography for Nanophotonics, Min Gu[1]; [1]*Centre for Micro-Photonics and CUDOS, Swinburne Univ. of Tech., Australia.* We show our recent progress on two-beam two-photon lithography in polymerization and metal-polymer hybrid materials. The application of this super-resolution direct laser writing method in optical big data storage and biomimetic nanophotonic devices are presented.

AF2A.4 • WITHDRAWN

AF2A.5 • 11:50
Ablation-cooled material removal at high speed with femtosecond pulse bursts, Can Kerse[1], Hamit Kalaycioglu[1], Parviz Elahi[1], Önder Akçaalan[1], Seydi Yavas[1], Mehmet D. Asik[2], Denizhan K. Kesim[1], Koray Yavuz[1], Barbaros Çetin[1], F Omer Ilday[1]; [1]*Bilkent Univ., Turkey;* [2]*NanoTech. and Nanomedicine Departmen, Hacettepe Univ., Turkey.* We report exploitation of ablation cooling, well-known in rocket design, to remove materials, including metals, silicon, hard and soft tissue. Exciting possibilities include ablation using sub-microjoule pulses with efficiencies of 100-µJ pulses.

AF2A.6 • 12:02
Femtosecond laser for glass processing, Konstantin Mishchik[2], John Lopez[2], Clementine Javaux[3], Rainer Kling[3], Guillaume Machinet[1], Clemens Hoenninger[1], Eric Mottay[1]; [1]*Amplitude Systemes, France;* [2]*CELIA, Univ. of Bordeaux, France;* [3]*Alphanov, France.* A compact and flexible femtosecond laser with pulse duration of ~400-fs and pulse energy up to 100 µJ is presented. The femtosecond laser source is applied to glass processing applications.

AF2A.7 • 12:14
Passively Q-switched 2 µm Tm-doped laser for medical applications, Salman Noach[1], Daniel Sebbag[1], Arik Korenfeld[1]; [1]*Jerusalem College of Tech., Israel.* Tm-based lasers at 1936nm and 1885nm in CW and passive Q-switch pulsed operation were developed. High pulse energies, peak powers and good agreement with the model were achieved. Laser interaction with tissue tested and showed successful ablation.

12:30—14:00 • **Lunch,** *On your Own*

Notes

14:00—15:44
AF3A • Ultrafast Processing in the Electroncs Industry
Bunsen Hall (Bunsensaal)
Presider: Karsten Koenig, Universität des Saarlandes, Germany

Friday, 9 October

AF3A.1 • 14:00 Invited
Present Status and Trend of Femtosecond Laser Processing in Next Generation Display AMOLED Manufacturing Industry of Korea, Sung-Hak Cho[1,2]; [1]*Laser & Electron Beam Application, KIMM(Korea Inst. of Machinery & Materials), Korea;* [2]*Nanomechatronics, UST (Korea Univ. of Science & Tech.), Korea.* Trend of femtosecond laser processing in South Korea will be presented. The presentation is mostly about display AMOLED manufacturing industry in Korea.

AF3A.2 • 14:20 Invited
Ultrafast Lasers enable Next Generation Batteries, Joris van Nunen[1]; [1]*Coherent Inc, USA.* We present on a high-speed laser structuring technique, which enables a significant improvement of electrode and separator wetting and battery performance and revealed higher capacities and increased cycle numbers compared to standard cells.

AF3A.3 • 14:40 Invited
Ultrafast Laser Machining of Transparent Materials: Process Development Supported by In-Situ Diagnostics, Malte Kumkar[1], Myriam Kaiser[1], Jonas Kleiner[1], Daniel Flamm[1], Daniel Grossmann[1,3], Klaus Bergner[2], Stefan Nolte[2]; [1]*TRUMPF Laser- und Systemtechnik GmbH, Germany;* [2]*Intitute of Applied Physics, Friedrich -Schiller-Universitaet Jena, Germany;* [3]*Chair for Laser Tech., Technical Univ. Aachen, Germany.* Controlling the nonlinear absorption and accumulation effects is crucial for machining of transparent materials by ultrafast lasers. Examples illustrate the benefit of in-situ diagnostics for the process development using spatial and temporal beam shaping.

AF3A.4 • 15:00 Invited
Guidelines for Efficient Direct Ablation of Dielectrics with Single Femtosecond Pulses, Marc Sentis[1], Maxime Lebugle[1], Nicolas Sanner[1], Olivier Uteza[1]; [1]*CNRS, France.* Guidelines to femtosecond laser users to select laser parameters (fluence and pulse duration from 7 to 300 fs), in the context of the development of ablation processes at the surface of dielectrics using single femtosecond pulses will be presented. Results and discussion are based on a comprehensive experimental and theoretical analysis of the energy deposition process at the surface of fused silica samples, in the range of intensities from 10^{13} to 10^{15} W/cm^2.

AF3A.5 • 15:20
Multi Parallel Ultrashort Pulse Laser Processing, Arnold Gillner[1], Michael Jüngst[1], Patrick Gretzki[1]; [1]*Ablation and Joining, Fraunhofer Inst. for Laser Tech., Germany.* Ultra-short pulse lasers present a new class within high-performance laser beam sources for industrial applications. For large scale processing with high power ultrashort pulsed lasers a new Tech. for beam irradiation using diffractive optical elements and spatial light modulatos is presented.

AF3A.6 • 15:32
Innovative Laser Technologies for Cutting, Drilling and Structuring of Glass and Other Transparent, Brittle Materials, Roland Mayerhofer[1]; [1]*ROFIN-BAASEL Lasertech, Germany.* Laser filamentation is one of the most promising processing technologies to separate glass and other transparent brittle materials at high speed and very good surface quality. The principle will be described and compared to other laser processes, like fusion cutting or ultrafast laser ablation.

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