

8th EPS-QEOD Europhoton Conference

EUROPHOTON

SOLID-STATE, FIBRE, AND WAVEGUIDE COHERENT LIGHT SOURCES



CONFERENCE DIGEST

PRBB,
Carrer del Dr. Aiguader, 88,
08003 Barcelona, Spain

02-07 September 2018

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Digest and Copyright Information

The papers included in this digest comprise the short summaries of the 8th EPS-QEOD Europhoton Conference held in Barcelona, Spain from 2 to 7 September 2018. The extended version of the papers (1-page summary in pdf format) will be made available on line within 2 months after the conference. A link with login and password is provided on a separate sheet.

All web browsers (Firefox, Internet Explorer, Safari or similar) will allow you to download the digest.

A .pdf viewer (tested with Adobe Acrobat) will be necessary to view the papers. This software can be downloaded from <http://www.adobe.com>

The papers reflect the authors' opinion and are published as presented and without any change in the interest of timely dissemination. Their inclusion in these publications does not necessarily constitute endorsement by the editors, the European Physical Society.

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TABLE OF CONTENTS

Partners and Sponsors	02
------------------------------	-----------

List of Exhibitors	03
---------------------------	-----------

General Information	07
----------------------------	-----------

Introduction	07
Conference Topics	07
Tabletop Exhibit	07
Exhibitor Information	07
Summer School	07
Poster Sessions	07
Speakers' Information	08
Conference Language	08
Technical Digest	08
Social Programme	08
Conference Venue	08
On-Site Facilities	09
Registration Information	09
Conference Registration Hours	09
Conference Hours	09
Special Event: EPL Invited Talk	09
Conference Committees	09
Conference Management	10
Barcelona	10

Technical Programme	11
----------------------------	-----------

Programme at a Glance	11
Summer School – Technical Programme	12
Keynote and Invited Speakers	14
EPS QEOD Prize	16
Sunday Sessions	18
Monday Sessions	18
Tuesday Sessions	18
Wednesday Sessions	25
Thursday Sessions	32
Friday Sessions	41

Authors' Index	43
-----------------------	-----------



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NETWORK

Young Minds is a project of the **European Physical Society** open to all enthusiastic young researchers in Europe and around the World, oriented to support the next generation of leaders in physics.

More than **100** active members all over Europe in **18** Sections are working together with EPS to promote physics, setting up a bright, brave, creative, determined, passionate and focused environment through their outreach, seminars and networking activities.

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International networking creates an environment of exchanges between local Sections, at European-level student conferences, and due to interaction with student groups of other organization

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Seminars and colloquia can help broaden the knowledge of young scientists. Visits to industries can boost the integration with research, while providing an outlook on possible employment.

OUTREACH

Educational outreach programs to local schools and communities can provide a stimulus for new generations of scientists and increase the awareness for the importance of scientific research

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List of Exhibitors

ALPhA NOV

Optics & Lasers Technology Center

ALPhANOV is the center of the Lasers & Microwaves French Cluster ALPHA-RLH, located in Bordeaux, France. ALPhANOV aims to boost innovation through collaboration between research and industry. It offers multiple modes of action which enable it to act all along the value chain: collaborative projects, feasibility studies, access to shared technical facilities, dedicated resources for companies and laboratories, technical support of entrepreneurship. It offers an array of services and products notably in laser sources, fiber components and optical systems.

<http://www.alphanov.com/>



Amplitude is a leading manufacturer of ultrafast lasers for scientific, medical and industrial applications. From ultrafast industrial fiber lasers to petawatt-class high intensity lasers, Amplitude is focused on helping its customers with advanced solutions. Amplitude offers a unique and distinct product portfolio : diode-pumped ultrafast solid-state lasers, ultra-high energy Ti:Sapphire ultrafast lasers and a full line of high energy solid state laser products.

<http://www.amplitude-laser.com>



Located in Berlin, **APE** is a worldwide leading supplier in the field of ultrashort laser pulse diagnostic and tuneable wavelength conversion. Since 1992, APE is passionately supporting customers to get the best out of their ultrafast lasers, applications, and processes. That is why we develop and produce devices for our customers to measure, modify and improve their ultrafast laser solutions. Our product portfolio includes optical parametric oscillators (OPOs), optical parametric amplifiers (OPAs), and systems for harmonic generation (HarmoniXX series). Our ultrashort pulse diagnostics line covers autocorrelators for pulse width measurements, spectrometers, and other equipment for measuring and characterizing femtosecond and picosecond laser pulses.

<http://www.ape-berlin.de/>



Founded in 1966, **Coherent, Inc.** is one of the world's leading providers of lasers and laser-based technology for scientific, commercial and industrial customers. With headquarters in the heart of Silicon Valley, California, and offices spanning the globe, Coherent offers a unique and distinct product portfolio and services. Coherent Shared Services B.V., Dieselstr. 5b, 64807 Dieburg, Germany
Tel. 0049 (0) 6071-968-0 - Fax 0049 (0) 6071-968-499

<http://www.coherent.com>

List of Exhibitors



EKSPLA Innovative manufacturer of solid state and fiber lasers, systems and components from unique custom system for basic research to small OEM series. In-house R&D team and more than 25 years' experience enable to tailor products for specific applications and/or according to specific requirements. Main products are: femtosecond, picosecond and nanosecond lasers, tunable wavelength systems, ultrafast fiber lasers, spectroscopy systems and laser electronics. EKSPLA uab, Savanoriu Ave 237, LT - 02300 Vilnius, Lithuania Phone: +370 5 264 96 29 - Email: sales@ekspla.com

<http://www.ekspla.com>



Fuhrberg laser products (Fu-laser) is a spin-off company from LISA laser products OHG and is located in Katlenburg-Lindau, Germany. Various laser systems have been developed as an outcome of nationally and European funded research projects, introduced to the laser market, and sold worldwide. Fu-laser covers knowledge about solid-state lasers, fiber lasers, and semiconductor lasers. The main operating area are customized 2 µm single-mode fiber laser systems for scientific and technical applications, e.g. processing of transparent plastics. Currently, Fu-laser offers four Thulium fiber laser models with different output power levels up to 200 W.

<http://www.fuhrberg-laser.de>



InnoLas lasers combine innovative laser technology and precise construction, offering you powerful, reliable and stable-value tools for your application. The monolithic design of all InnoLas laser heads ensures highest thermal and mechanical stability. The alignment of the resonator, all other optical components as well as the power supply and regulation optimize the laser sources.

<http://www.innolas-photonics.com>



Innova Scientific is a company dedicated to the distribution market of laser technology and other photonics devices in Spain and Portugal. It works with the market leaders in all the photonics areas and offers a big deal of experience in many fields. A group of highly specialized professionals will offer you advice and will give you the best solution for your application. All you need for your laser application.

<http://www.innovasci.com>

List of Exhibitors



HCP specializes in custom solutions of optical wavelength converters for initial development and commercialization of project and product based on Periodically Poled nonlinear Materials-MgO:P-PLN/PPLT Bulk/Waveguide crystals and fiber packaged mixers. HCP provides cost-effective and fast turnaround products for full spectrum applications range from UV to mid-IR and THz, enabling scientific and industrial applications, *e.g.* Quantum Information, Organic Gas sensing, Bio-medical surgeon and *etc.*

<http://www.hcphotonics.com>



Laser Quantum is a world-class manufacturer of revolutionary continuous wave and ultrafast laser sources. Our products lead the industry in their performance specifications, reliability, compactness and operational lifetimes. You will find Laser Quantum lasers, with their patented technology, in laboratories and integrated into systems and machines worldwide. Our lasers are helping scientists to break new ground in many applications ranging from attosecond physics to forensics and genomics. Laser Quantum is now part of the Novanta group, a trusted technology partner to OEMs in the medical and advanced industrial technology markets, with deep proprietary expertise in photonics, vision and precision motion technologies.

<http://www.laserquantum.com>



Light Conversion presents OPCPA (optical parametric chirped pulse amplification) frontend setups, based on the industrial-grade femtosecond PHAROS lasers and compact industrial optical parametric amplifier. It features: repetition rate up to 200 kHz, passive CEP stabilization, ASE free background, high energy >100μJ twin-output frontend for OPCPA seed and pump.

<http://www.lightcon.com>



LUMIBIRD is one of the world's leading specialists in lasers. With 50 years of experience and expertise in solid-state lasers, laser diodes and fiber laser technologies, the Group designs, manufactures and markets high performance lasers for scientific (laboratories and universities), industrial (manufacturing, defense, Lidar sensors) and medical (ophthalmology) markets.

<http://www.lumibird.com>

List of Exhibitors



OptiGrate is a pioneer of commercial Volume Bragg Gratings and supplies VBGs to more than 500 customers on 6 continents for laser line narrowing, spectroscopy, laser pulse stretching and compression, etc. Nowadays, OptiGrate is a leading manufacturer of VBG-based filters and components. Since May, 2017 OptiGrate is a part of the IPG Photonics Family.

Website : <http://www.optigrate.com>



Radiantis is a specialist manufacturer of advanced frequency conversion systems covering broad spectral regions from the UV to mid-IR. The Company focuses on compact, fully-automated and reliable solid-state laser systems based on optical parametric oscillators (OPOs) and harmonic generators. Radiantis was established in 2005 with the goal of enriching the photonics market by providing state-of-the-art, robust, easy-to-use frequency conversion systems and diagnostic instrumentation. Radiantis offers OPOs and frequency conversion systems across the CW, pulsed and ultrafast time-scales, and its current product portfolio includes femtosecond and picosecond instruments with high conversion efficiencies at MHz repetition rates, high-power CW systems covering a broad spectral range from 200 to 8000 nm, and diagnostics products including spectrometers. Today, the Company is well integrated in the scientific community and has a large number of satisfied end-users around the world.

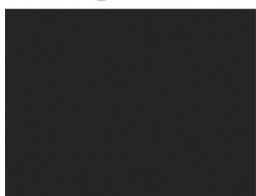
<http://www.radiantis.com>



Thorlabs, a vertically integrated photonics products manufacturer, was founded in 1989 to serve the laser and electro-optics research market. As that market has spawned a multitude of technical innovations, Thorlabs has extended its core competencies in an effort to play an ever increasing role serving the Photonics Industry at the research end, as well as the industrial, life science, medical, and defense segments. The organization's highly integrated and diverse manufacturing assets include semiconductor fabrication of laser diodes, optical amplifiers, lithium niobate modulators, quantum cascade/interband cascade lasers, and VCSEL lasers; fiber towers for drawing both silica and fluoride glass optical fibers; MBE/MOCVD epitaxial wafer growth reactors; extensive glass and metal fabrication facilities; advanced thin film deposition capabilities; and optomechanical and optoelectronic shops.

<http://www.thorlabs.com>

TRUMPF



TRUMPF Scientific Lasers focuses on high-energy picosecond lasers and on high-power femtosecond laser technology especially on optic parametric amplifiers. Base technology is the TRUMPF thin-disk laser technology. TRUMPF Scientific Lasers offers customized, innovative and high quality products for scientific and industrial applications.

www.trumpf-scientific-lasers.com

General Information

Introduction

Welcome to Barcelona and to the 8th International Conference on Solid-State, Fibre, and Waveguide Coherent Light Sources!

The Europhoton conference will be held in the **PRBB Congress Centre** (Barcelona Biomedical Research Park, C/Doctor Aiguader 88, 08003 Barcelona, Spain) located seafront Hospital del Mar and the Arts Hotel in the Olympic Port of Barcelona. The research park is well connected with the rest of Barcelona by metro (line 4), tram (line T4) and bus.

The 8th EPS-QEOD Europhoton Conference 2018 technical programme includes world-renowned researchers discussion on the latest developments in the scientific community accompanied by **Summer School** sessions at the PhD student and postdoctoral level, and by informal **breakthrough session** for discussion (EurophysicsLetters). This conference will also feature a **special Symposium** on where prominent **Keynote and Invited Speakers** will discuss state of the art and future visions for this fascinating field. The conference will also remit the **"EPS Prize for Research in Laser Science and Applications"** award and the talk of the winner.

Short abstracts of the papers to be presented at the EPS-QEOD Europhoton Conference 2018 appear in this programme. 214 presentations (4 Summer School lectures, 2 keynotes, 11 invited speakers including 2 speakers for the Special Symposium, 74 orals, and 122 poster presentations from Europe and overseas) have been selected for presentation at the Conference.

A tabletop exhibit featuring leading companies will be held in conjunction with the meeting.

The eighth in a row, the Europhoton conference series has shown to be very popular among the scientists and engineers who have continued to place it on their calendars.

The conference is organised by the **European Physical Society** in cooperation with the **Quantum Electronics and Optics Division (QEOD)** of EPS and ICFO.

Conference Topics

Solid State Lasers

Novel laser material concepts. Growth, characterisation, and spectroscopic investigations of solid-state laser materials. Rare-earth-ion and transition-metal-ion lasers. Upconversion, tunable, and ultrafast solid-state lasers. Second and higher harmonic generation and optical parametric conversion of solid-state lasers. Modelling of solid-state lasers and resonators. Demonstration of novel pump sources and resonator geometries. Thermal and thermo-optical effects in solid-state lasers. High-power, diode-pumped, and ultra-stable systems. Non-linear materials. Non-linear optical sources. Metrology applications. Optically-pumped semiconductor lasers. Mid-infrared sources and materials.

Fibre and waveguide Devices

Novel fibre and waveguide concepts. Fibre materials, fabrication, and characterisation. CW and pulsed fibre lasers. Bragg-grating fibre lasers. Amplification in doped fibres. Waveguide fabrication and characterisation. Waveguide lasers and amplifiers. Rare-earth doped amplifiers. Raman amplifiers. High-power fibre and waveguide lasers. Power-scaling concepts for fibre and waveguide lasers. Ultrafast fibre and waveguide sources. Photonic crystal and fibre light sources. Waveguided broadband and super-continuum light sources. Non-linear materials. Non-linear optical sources. Microcavity lasers.

Materials Processing : Emerging opportunities and requirements (half day Symposium)

Materials processing is the leading application for high-power lasers and a key driver for laser development. Whereas laser scientists may well be familiar with the requirements on the laser, they are often less familiar with the requirements on the processing itself, e.g., in terms of parameters relating to quality and speed. The symposium aims to present these requirements and highlight improvement trends in order to enable laser scientists to understand where and how improvements in lasers can contribute to improvements in processing.

Tabletop Exhibit

A **tabletop exhibit** will be organised from **Tuesday 4 September (morning) to Thursday, 6 September 2018 (afternoon)**. It will take place at the PRBB on the ground floor nearby the Auditorium and the Poster panels. It will be co-located with coffee breaks. This exhibition will allow laser and photonics related companies to present and promote their new products among attendees.

Exhibitor Information

Exhibitors will be allowed to prepare their stands beginning from Monday 3 September. Exhibitors are invited to the welcome reception organised on Monday evening at the PRBB terrace.

Summer School

The Europhoton Conference includes a Summer School on **"Frontiers of Solid-State Light Sources"**. The Summer School will be held **from Sunday 2 September (afternoon) to Monday 3 September (morning), 2018**. PhD Students and Postdocs who have paid the conference fee are especially invited to attend the Summer School. They will receive free entrance to the School. The same rule will be applied for the full paying conference participants. Lecturers who are internationally renowned in their research subjects will present the lecture programme. The Summer School will give students a chance to get introduced into various laser related subjects, covering the basics up to the latest research results.

Poster Sessions and Instructions for Poster presenters'

122 posters will be presented. **3 sessions are organised** to allow participants to see as many posters as possible, as:

- **Tuesday 4 September 2018**
from 15:45 to 17:00
- **Wednesday 5 September 2018**
from 09:45 to 11:00
- **Thursday 6 September 2018**
from 09:30 to 11:00

Poster sessions for contributed papers have been a major attraction at recent conferences. Poster presentations provide a direct interaction between the presenter and the viewer.

All posters will be displayed in the ground level next to the exhibition. There will be no oral presentations during this time. Each author is provided with one bulletin board. Poster size should be portrait format A0 (200 cm high x 100 cm wide). The boards will be marked with the paper session code (**ex TuP.N°/WeP.N°/ThuP.N°**)

All authors are requested to display posters on their allocated boards in the morning of the day of their presentation. Fixing material (tape or pins) will be provided. Posters still in their places in the evening will be removed and discarded by the conference organization. In order to present their work and answer questions, authors are requested to be present in the vicinity of their poster during the poster session. The schedule of the poster sessions is presented on the respective pages of this programme.

Posters, which will participate in the poster competition, will be marked by a red mark.

Speakers' Information

Durations of oral presentations are:

Keynote presentations: 45 minutes presentation including 10 minutes for discussion
Invited presentations: 30 minutes presentation including 10 minutes for discussion.
Oral presentations: 15 minutes including 5 minutes for discussion.

WARNING: Speakers are asked to check-in with the session presider in the conference room ten minutes before the session begins.

Speakers will be able to transfer their presentation files by USB memory stick. It will also be possible to give your presentation from your own notebook with VGA connection. Individual notebooks will need to be connected to the box during the breaks. The conference room is equipped with microphone, beamer and computer.

All oral sessions take place in the main auditorium.

Conference Language

English will be the official conference language.

Technical Digest

The registration fee includes an on line technical digest including the one-page summaries. The link to upload the material will be given on site and will be available within 2 months after the conference.

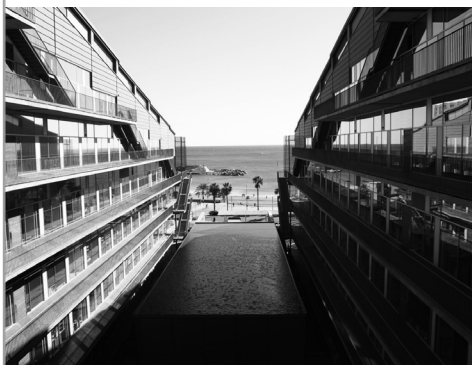
Social Programme

Each registered participant is cordially invited to attend the social programme as detailed below

WELCOME RECEPTION

Monday 3 September 2018, 18:45.

The welcome reception will take place on the PRBB terrace



CONFERENCE DINNER INCLUDING EXCURSION

Wednesday 5 September 2018, from 17:30

The conference dinner will take place at the **Cavas Codorniu** (Avda Jaume de Codorniu s/n, Sant Sadurni d'Anoia (Barcelona) one of the oldest winegrowers family in the world. Codorniu, is the best wine tourism center in the world.



The conference dinner can be booked at an additional cost of 40€ per attendee (drinks included) and 80€ per accompanying person. An excursion of the cellar and wine tasting are foreseen before the dinner. Shuttle buses will be organised.

Conference Venue

The conference will take place at the Barcelona Biomedical Research Park (PRBB)

Address: C/ Doctor Aiguader, 88, E-08003 Barcelona

Phone: +34 93 316 0000

Website: <http://www.prbb.org/parc>



The PRBB is located on Barceloneta seafont between Hospital del Mar and the Arts Hotel in the Olympic Port of Barcelona. The research park is well connected with the rest of Barcelona by metro (**line 4**), tram (**line T4**) and bus.

Arriving by plane

Take the AeroBus to **Plaza Catalonia** (25-30 min) and then the metro at Urquinaona towards the stop **Ciutadella/Vila Olímpica**.

Barcelona public transportation

Subway Line 4 : Ciutadella/Vila Olímpica station (you should turn into the Ramon Trias fargas street where you will then be able to see Arts Hotel on the left and the PRBB building on the right).

TRAM BESÒS Line 4: Vila Olímpica Stop



What's around PRBB:

Restaurant Carpe Diem Lounge Club, Zoo (open 10:00-17:00), Ciutadella park, Barceloneta.

Or Nova Icària platja (beaches), Olympic port, Arco de Triunfo (Arc of Triumf),

Picasso Museum, Museum of Catalan history, Museum de la Xocolata, Museo del Mamut, Aquarium, Commercial.

Centre Maremagnum, World Trade Centre Barcelona, la Sagrada Familia, la Pedrera,

The oral sessions will be held in the **Auditorium**.

Poster sessions and exhibition take place in the **Foyer ground floor**.

Coffee breaks take place either at the Auditorium 1st floor or ground level.

On-Site Facilities

Wireless Internet is available inside the building of the conference centre with free access.

Net: PRBB

Password: darwin1809

Lunches

Lunches are not included in the registration fees.

No lunch (in any form) is possible inside the conference room.

Several restaurants are located at a short walking distance from the conference venue.

Registration Information

The registration fees for the meeting include:

- ▶ Admission to all technical sessions of the main conference on "Solid-State, Fibre, and Waveguide Coherent Light Sources", as well as an half-day Special Symposium session which will take place on Thursday, 6 morning September 2018.
- ▶ Admission to the Summer School on "Frontiers of Solid-State Light Sources":
- ▶ PhD Students and Postdocs who have paid the conference fee are especially invited to attend the Summer School. They will receive free entrance to the School. The same rule will be applied for the full paying conference participants.
- ▶ On line technical digest including the one-page summaries.
- ▶ Welcome Reception as mentioned in the Social Programme
- ▶ Entrance to the exhibition.
- ▶ Coffee breaks as mentioned in the programme.

Lunches are not included. Tickets for public transports are not included.

An excursion to the Caves Codorniu will take place on Wednesday 5 September, beginning from 17:30 followed by the conference dinner. An additional cost of 40€ is requested per participant, 80€ per guest. Space is limited to 180.

As a rule, due to space limitations and necessary advance reservation, on site registrants may not be able to attend the social programme. No fee reduction will be applied in case of cancellation. Also, no guest tickets can be obtained on site.

Conference Registration Hours:

Sunday 2	13:00–17:00
Monday 3	07:30–12:00 // 13:15–17:00
Tuesday 4	08:00–12:00 // 13:00–17:00
Wednesday 5	08:00–12:00 // 13:30–14:30
Thursday 6	08:00–12:00 // 13:45–16:00
Friday 7	08:00–10:00

Conference Hours

Sunday 2	13:45–18:15*
Monday 3	08:00–12:30* // 13:45–18:30* (18:45 Welcome Reception)
Tuesday 4	08:15–12:30 // 13:30–18:30**
Wednesday 5	08:15–12:30 // 14:00–15:00 (17:30 Excursion and Banquet)
Thursday 6	08:15–12:30 // 14:00–18:30
Friday 7	08:15–12:30 // 14:00–15:45

* Summer School

** Including Post deadline session

Coffee Breaks

Sunday 2	15:45–16:15
Monday 3	10:00–10:30 // 16:00–16:30
Tuesday 4	10:00–10:30 // 15:45–17:15** 18:15–18:45
Wednesday 5	09:45–11:00**
Thursday 6	09:30–11:00** // 16:00–16:30 18:15–18:45
Friday 7	10:00–10:30

** held in conjunction with the poster session

Lunch Breaks

Sunday 2	12:30–13:45
Monday 3	12:30–13:45
Tuesday 4	12:30–14:00
Wednesday 5	12:30–14:00
Thursday 6	12:30–14:00
Friday 7	12:30–14:00

Social Programme

WELCOME RECEPTION

Monday 3 September 2018

18:45 – 21:00 // PRBB, Barcelona

EXCURSION AND CONFERENCE DINNER AT CAVAS CODORNIU

Wednesday 5 September 2018

17:30 – 22:00 // Caves Codorniu, Sant Sadurn d'Anoia, Barcelona

Special Event

EPL INVITED TALK

DR GONZALO MUGA

Tuesday 4 September 2018

13:45 – 14:00 // Auditorium

EPS QEOD PRIZE FOR RESEARCH IN LASER SCIENCE AND APPLICATIONS CEREMONY

PROF. R.J. DWAYNE MILLER

Tuesday 4 September 2018

17:15 – 18:15 // Auditorium

Conference Committees

GENERAL CHAIR:

Majid Ebrahim-Zadeh,

ICFO-The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain

PROGRAMME CHAIR:

Johan Nilsson,

University of Southampton, Southampton, United Kingdom

Programme Chair Sub-Committee "Solid-State Lasers"

CHAIR: Václav Kubeček,

Czech Zentrum Hannover, Hannover, Germany

Antonio Agnesi,

Universita di Pavia, Pavia, Italy

Jens Biegert,

ICFO-The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain

Eric Cormier,

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Max Born Institute, Berlin, Germany

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Andrejus Michailovas,
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Uwe Morgner,
*University of Hannover, Laser Zentrum
Hannover, Hannover, Germany*

Nikolaie Pavel,
*National Institute for Laser, Plasma and
Radiation Physics, Bucharest, Romania*

S. Chaitanya Kumar,
Radiantis, Barcelona, Spain

Programme Chair Sub-Committee "Fibre and Waveguide Devices"

CHAIR: Philippe Grelu,
University of Bourgogne, Dijon, France (Chair)

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*Institute of Automation and Electrometry &
Novosibirsk State University, Russia*

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*Fraunhofer Institute for Applied Optics,
Jena, Germany*

John Travers,
*Heriot-Watt University in Scotland,
United Kingdom*

Yoann Zaouter,
Amplitude Systèmes, Evry, France

Steering Committee

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Photonics Institute, TU Wien, Vienna, Austria

Andy Clarkson,
*University of Southampton, Southampton,
United Kingdom (QEOD Representative)*

Majid Ebrahim Zadeh,
*ICFO, The Institute of Photonic Sciences,
Castelldefels (Barcelona), Spain (ex officio)*

Patrick Georges,
Institut d'Optique, Palaiseau, France

Johan Nilsson,
*University of Southampton, Southampton,
United Kingdom (ex officio)*

Valdas Pasiskevicius,
*Royal Institute of Technology,
Stockholm, Sweden*

Thomas Südmeyer,
*University of Neuchâtel,
Neuchâtel, Switzerland*

Conference Management

The European Physical Society provides the Conference Management, 6 rue des Frères Lumière, 68200 Mulhouse, France. This programme is edited by O. Fornari and A. Wobst.

Barcelona, Spain

Barcelona is the capital city of the autonomous community of Catalonia in Spain and Spain's second most populated city, with a population of 1.6 million within its administrative limits. Its urban area extends beyond the administrative city limits with a population of around 4.7 million people, being the sixth-most populous urban area in the European Union after Paris, London, Madrid, the Ruhr area and Milan.

It is the largest metropolis on the Mediterranean Sea, located on the coast between the mouths of the rivers Llobregat and Besòs, and bounded to the west by the Serra de Collserola mountain range, the tallest peak of which is 512 metres (1,680 ft) high. Founded as a Roman city, in the Middle Ages Barcelona became the capital of the County of Barcelona. After merging with the Kingdom of Aragon, Barcelona continued to be an important city in the Crown of Aragon. Besieged several times during its history, Barcelona has a rich cultural heritage and is today an important cultural center and a major tourist destination. Particularly renowned are the architectural works of Antoni Gaudí and Lluís Domènech i Montaner, which have been designated UNESCO World Heritage Sites.

Currency

The Euro is the official currency in Spain. Major credit cards (VISA, Mastercard/Eurocard, American Express, Diners) are generally accepted in airports, train stations, hotels, shops, restaurants, and transportation including taxis.

Electricity

Voltage is 220V, 50 Hz (cycles). One needs to use a transformer (converter) if the appliance one wants to use is 110V. The voltage in the U.S. is 110V, 60 Hz. The wattage of the transformer must match the wattage of the appliance. The electric plug has two round pins. One needs an adapter plug if one's appliance comes from the US, where two flat pins are used. The adapter plug can be bought at Amazon or at many travel stores.

Time Zone

Central European Time zone; Greenwich (GMT) +1 hour; Daylight Saving Time: GMT +2 hours from last Sunday in March to last Sunday in October.



Programme at a Glance

Sunday 2 September 2018 (Summer School)

- 13:00 – 17:00 Begin of registration
- 13:45 – 15:45 Summer School Lecture 1
Kerry Vahala, *Caltech, Pasadena, CA, USA*
"High-Q Microcavities for Gyroscopes and Soliton Microcombs »
- 15:45 - 16:15 Coffee Break
- 16:15 - 18:15 Summer School Lecture 2
Eleftherios Goulielmakis, *Max-Planck Institute, Garching, Germany*
"Attosecond Photonics : an introduction"

Monday 3 September 2018 (Summer School and Main Conference)

- 08:00 - 10:00 Summer School Lecture 3
Takunori Taira, *Institute for Molecular Science, Okasaki, Japan*
"Giant Micro-photonics for Tiny Integrated Power Lasers"
- 10:00 - 10:30 Coffee Break
- 10:30 - 12:30 Summer School Lecture 4
Eric Potma, *University of California, Irvine, USA*
"Label-Free optical Imaging"
- 12:30 - 13:45 Lunch Break
- 13:45 - 14:00 Chairs' Welcome
by M. Ebrahim-Zadeh and J. Nilsson
- MoA1** 14:00 - 16:00 Ultrafast Fiber Lasers (oral session)
- 16:00 - 16:30 Coffee Break
- MoA2** 16:30 – 18:00 Short Pulse Generation (oral session)
- 18:45 Welcome Reception

Tuesday 4 September 2018 (Main Conference)

- TuM1** 08:15 - 10:00 High-power Fiber Sources-Coherent beam Combining (oral session)
- 10:00 - 10:30 Exhibition and Coffee Break
- TuM2** 10:30 - 12:30 High-power Laser Systems (oral session)
- 12:30 -12:40 EPL Invited Talk
- 12:40 – 14:00 Lunch Break
- TuA1** 14:00 – 15:45 Waveguide Lasers and Microresonators (oral session)
- TuP** 15:45 - 17:00 Poster Session 1 with Coffee Break
- 17:15 - 18:15 EPS Prize for Research in Laser Science and Applications

- 18:15 – 18:45 Coffee Break
- 18:45 – 20:00 Postdeadline Session (oral session)

Wednesday 5 September 2018 (Main Conference)

- WeM1** 08:15 – 09:45 Special Fibers and Multimode Dynamics (oral session)
- WeP** 09:45 - 11:00 Poster Session 2
with Exhibition and Coffee Break
- WeM2** 11:00 – 12:30 OPOs OPCPAs (oral session)
- 12:30 - 14:00 Lunch Break
- WeA1** 14:00 – 15:00 Innovative Fiber Laser Sources (oral session)
- 17:30 Excursion to Cavas Codorniu
- 19:30 Conference Dinner in Cavas Codorniu

Thursday 6 September 2018 (Main Conference)

- ThM1** 08:15 - 09:30 Special Symposium 1 (oral session)
- ThP** 09:30 – 11:00 Poster Session 3
with Exhibition and Coffee Break
- ThM2** 11:00 – 12:30 Special Symposium 2 (oral session)
- 12:30 - 14:00 Lunch Break
- ThA1** 14:00 – 16:00 THz, and XUV Generation (oral session)
- 16:00 - 16:30 Exhibition and Coffee Break
- ThA2** 16:30 – 18:30 Novel Active Materials (oral session)

Friday 7 September 2018 (Main Conference)

- FrM1** 08:15 - 10:00 Fiber Lasers and Amplifiers – Novel Design, mid-IR (oral session)
- 10:00 - 10:30 Coffee Break
- FrM2** 10:30 - 12:30 Thin Disk Oscillators (oral session)
- 12:30 - 14:00 Lunch Break
- FrA1** 14:00 – 15:30 Few Cycle Mid IR Sources (oral session)
- 15:30 - 15:45 Closing Remarks

NOTES

Summer School – Technical Programme**Sunday 2 September 2018****Summer School Lecture 1****13:45 - 15:45**

13:45-14:30	Summer School Lecture 1
14:30-14:45	Break
14:45-15:30	Summer School Lecture 1, continued
15:30-15:45	Discussion 1



Kerry Vahala
Caltech, Pasadena, CA, USA

Topic: High-Q Microcavities for Gyroscopes and Soliton Microcombs

In the last 15 years there has been remarkable progress in boosting optical storage time in micro and millimeter-scale optical resonators. Chip-based devices attain Q factors of nearly 1 billion and micro-machined crystalline devices provide Qs exceeding 100 billion. Extremely large resonant build-up effects are possible in these devices. And these have created new perspectives for access to a wide range of nonlinear phenomena at very low power. Whole new classes of chip-integrated devices have resulted, including stable optical soliton sources for frequency-comb generation and high-coherence Brillouin lasers for rotation measurement. This course will first review microresonator physics and examples of nonlinear optical phenomena accessible using these devices. Then, two major areas of research that apply nonlinear resonator physics will be discussed in detail.

In the first, the generation of highly coherent light in Brillouin microlaser systems will be examined. Beginning with fundamental limits to laser coherence caused by microwave-rate thermo-mechanical quanta, the demonstration of sub-Hertz Schawlow-Townes linewidths in chip-based Brillouin lasers is discussed. Application of these systems for highly stable microwave generation and rotation sensing is then described. In the second application area, the generation of microresonator optical solitons using the Kerr nonlinearity will be overviewed. Beginning with essential soliton physics, resonator design principles required to form stable solitons will be discussed. The formation of bi-soliton systems that result from Raman interaction with the solitons is also reviewed as well as the stability of the resulting frequency comb ('microcomb'). Finally, current efforts to miniaturize time standards and stable frequency sources for metrology and spectroscopy will be described. This will include developments towards a new generation of compact optical clocks and recent demonstrations of dual-comb spectroscopy systems using chip-based microcombs.

15:45 - 16:15 Coffee Break

Summer School Lecture 2**16:15 - 18:15**

16:15-17:00	Summer School Lecture 2
17:00-17:15	Break
17:15-18:00	Summer School Lecture 2, continued
18:00-18:15	Discussion 2



Eleftherios Goulielmakis
Max-Planck Institute,
Garching, Germany

Topic: Attosecond Photonics: An Introduction

The course will focus on the basic ideas, methods and techniques developed over the last 15 years in the area of attosecond physics. Methods for the measurement of light waves and attosecond pulses, the synthesis of light fields with sub-cycle precision, measurement and understanding of attosecond phenomena in gasses and solids. An important part of the course will focus on the new possibilities that emerge by driving electrons in solids with intense and fast laser fields. How can we now make solid-state photonic sources of attosecond extreme ultraviolet radiation. We will discuss also how strong optical field driving of electrons in bulk solids allow the establishment of new microscopies with sub-angstrom resolution.

Monday 3 September 2018**Summer School Lecture 3****08:00 - 10:00**

08:00-08:45	Summer School Lecture 3
08:45-09:00	Break
09:00-09:45	Summer School Lecture 3, continued
09:45-10:00	Discussion 3



Takunori Taira
Institute for Molecular Science,
Okazaki, Japan

Topic: Giant Micro-photonics for Tiny Integrated Power Lasers

This course will discuss the impact and principle of Giant

Micro-photonics based on micro-domain structure and boundary controlled materials for creation of new functions for tiny integrated power lasers, such as the transparent polycrystalline ceramics and periodically poled ferro-electric devices. The advanced engineered compact solid-state lasers and nonlinear optics are reliable, efficient and multi-functional light sources. Moreover, their micro domain causes a new interaction for coherent radiation. This effect should be enhanced by a micro cavity or a periodic structure. These micro and/or microchip lasers attained by using advanced ceramics can provide extreme performances as a new generation of solid-state lasers. The high-brightness nature of these downsized lasers has allowed the ubiquitous power lasers for new innovation and science.

10:00 - 10:30 **Coffee Break**

Summer School Lecture 4

10:30 - 12:30

10:30-11:15 **Summer School Lecture 4**

11:15-11:30 Break

11:30-12:15 **Summer School Lecture 4, continued**

12:15-12:30 Discussion



Eric Potma

University of California, Irvine, USA

Topic: Label-Free Optical Imaging

This course discusses the principles behind optical microscopes that are capable of generating images with molecular selectivity without the use of fluorescent labels. An emphasis will be placed on the underlying light-matter interactions that allow molecular selective imaging in a non-invasive and non-perturbing fashion. Nonlinear optical techniques are an important class of label-free imaging techniques, and the basics and capabilities of these techniques will be discussed, along with examples of their application in biology and the biomedical sciences. Overall, this course illuminates these selected topics from a physics and engineering point of view.

Objectives: By the end of this course the students will:

- Understand the importance and advantages of label-free imaging in the biomedical sciences.
- Have a basic understanding of the light-matter interactions that allow label-free contrast.
- Be familiar with criteria that govern light source selection and microscope design.
- Be acquainted with nonlinear optical methods and how these technologies have advanced biomedical imaging.

12:30 - 13:45 **Lunch Break**

NOTES

Keynote and Invited Speakers

Monday 3 September 2018

MoA1: Ultrafast Fiber

Lasers 14:00–16:00

14:00 – 14:45 (Keynote Speaker)

New Approaches to Ultrafast Fiber Lasers

Frank Wise, Cornell University, Ithaca, NY, USA

Recent developments in ultrafast fiber lasers based on Mamyshev regeneration and spatiotemporal mode-locking will be presented. Prospects for future scientific investigation and demonstration of high-performance instruments will be discussed.

MoA2: Short Pulse

Generation 16:30–18:30

16:30 – 17:0 (Invited)

Advancements of ultra-short pulse generators based on self-phase modulation and alternating spectral filtering

*Kęstutis Regelskis, Department of Laser**Technology, Center for Physical Sciences**& Technology, Savanoriu Ave. 231,**Vilnius, Lithuania*

We investigate conditions allowing for self-starting operation of optical pulse generators. By control of filters-reflectors spectral band overlap, self-starting operation was achieved in two different setups. According to numerical calculations, material dispersion stabilizes pulse generation for broader range of gain parameter values and this allows for more reliable self-starting.

TuM2: High-power Laser

Systems 10:30 – 12:30

10:30 – 11:15 (Keynote)

Science Opportunities with Intense Ultrafast Lasers: Reaching for the Brightest Light

*Philip. H. Bucksbaum, Stanford PULSE Institute,**Stanford University and SLAC, Menlo Park, USA*

Focused laser intensities up to a zettawatt/cm² or more are now possible, creating unique opportunities for science in extreme conditions. These laser fields can accelerate and collide elementary particles, drive nuclear reactions, heat matter to conditions found in stars, or even create matter out of the empty vacuum.

11:45 – 12:15

(Invited)

Ultrafast lasers for sensors

*Jean-Claude Diels, Center for High Technology**Material, Albuquerque, USA*

A mode locked laser in which two pulses circulate, emit two correlated frequency combs. The frequency of the beat note produced by these two combs is proportional to the phase difference between the two combs. We demonstrate a phase sensitivity enhancement beyond the present value of 10^{-8} \$.

12:30 – 12:40

(Invited)

Asymmetrical optical devices and non-Hermitian Hamiltonians in EPL

*Gonzalo Muga, Universidad del País Vasco, UPV/**EHU, Bilbao, Spain & EPL Deputy Director*

PT-symmetry has become one of the fastest growing fields in optics. And yet PT-symmetry is only one among a group of possible symmetries of Non-Hermitian Hamiltonians. We review these symmetries and their selection rules to construct different asymmetric devices. Among six possible types of asymmetric devices (considering asymmetries in reflection and transmission), PT-symmetry can only produce one of them. Non-Hermitian, non-PT optics holds promise of many interesting and useful effects and applications. EPL has supported this research and welcomes Perspective articles in the field.

TuA1: Waveguide Lasers and Microresonators 14:00 – 15:45

14:00 – 14:30

(Invited)

Guided-wave ZBLAN chip lasers, and their applications

*David Lancaster, School of Engineering and**Future Industries Institute, Mawson Lakes,**University of South Australia, Australia*

High performing lasers in rare-earth doped fluorozirconate glasses are achieved by fs laser inscription of multiple guiding channels in a chip. These are leaky-mode, core-pumped, ultra-large mode area lasers. Fabrication, visible to mid-infrared operation, mode-locking, and use of adjacent waveguide to realise a dual frequency-comb laser will be discussed.

15:15 – 15:45

(Invited)

A Kerr-microresonator optical clockwork

*Tara Drake, Time and Frequency Division,**National Institute of Standards and Technology, Boulder, CO, USA*

We report on a Kerr-microresonator optical clockwork for accurate generation of a microwave-frequency output from an ultrastable optical-frequency clock. We use precisely fabricated silicon nitride microrings to generate few-cycle soliton pulses with octave-spanning spectral bandwidth. Our experiments represent the first carrier-envelope-offset phase stabilization of a Kerr-microresonator optical frequency comb.

Tuesday 4 September 2018

17:15 – 18:15

EPS QEOD Prize for Research in Laser Science and Applications

17:15 – 18:15

(Keynote)

Picosecond Infrared Laser (PIRL) Scalpel: Achieving Fundamental (Single Cell) Limits to Minimally Invasive Surgery and Biodiagnostics

R.J. Dwayne Miller, Max Planck Institute for the Structure and Dynamics of Matter, Luruper Chaussee 149, Hamburg 22761, Germany - Departments of Chemistry and Physics, 80 St. George Street, University of Toronto, Toronto, Ontario M5S 3H6, Canada

The first atomic movie of strongly driven phase transitions revealed the means to limit nucleation growth and associated shock wave damage. This insight has led to the achievement of effectively scar free laser surgery with an intrinsic molecular bar code to accurately guide surgery with prospect to map cells.

Wednesday 5 September 2018

WeM1: Special Fibers and Multimode Dynamics 08:15 – 09:45

08:15 – 08:45

(Invited)

Spatiotemporal nonlinear dynamics in multimode optical fibers

Katarzyna Krupa, Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Brescia, via Branze 38, 25123, Brescia, Italy

We overview recent advances on spatiotemporal nonlinear dynamics of pulses

propagating in normally dispersed multi-mode optical fibers. We discuss Kerr and Raman beam cleaning, ultra-broadband frequency conversion and supercontinuum generation including second harmonic generation, as well as temporal reshaping and polarization evolution.

Thursday 6 September 2018

ThM1: Special Symposium 1

08:15 – 09:30

09:00 – 09:30 (Invited Special Symposium)

Digital Photonic Production as a key enabling technology for Industry 4.0

Christian Hinke, Chair for Laser Technology, Steinbachstr. 15, 52074 Aachen, Germany,

Digital Photonic Production summarises the integration of laser manufacturing technology in digital production chains and is characterised by a fundamentally different relation of cost, lot size and product complexity compared to conventional production. The talk will discuss the economic potential of that approach and in parallel highlight new requirements to actual and future laser based manufacturing processes.

ThM2: Special Symposium 2

11:00 – 12:30

11:00 – 11:30 (Invited Special Symposium)

Laser applications in the field of e-mobility

Berthold Schmidt, TRUMPF Lasertechnik GmbH, Johann-Maus-Street 2, 71254 Ditzingen, Germany
Advanced applications in the world of e-mobility are important drivers for the optimization of TRUMPF's laser systems. The latter allow e.g. defect-free and hermetic sealings, spatter-free welding of copper and of dissimilar materials. Combined with progressive sensor technologies and I4.0 readiness these laser systems yield perfect solutions for the next generation of industrial manufacturing.

11:30 – 12:00 (Invited Special Symposium)

Importance of Laser Parameter Control in Laser Material Processing

Stewart Williams, Cranfield University, College Road, Cranfield, Bedfordshire, U.K.

Laser are a perfect energy source in material processing due to their capability for being

controlled, both spatially and temporally. The usefulness of this controllability will be illustrated in new applications in both additive manufacture and welding. The importance of in stability of the laser parameters will be highlighted.

ThA2: Novel Active Materials

16:30 – 18:30

16:30 – 17:00 (invited)

Highly efficient Mid-infrared laser operation of Ho³⁺, Er³⁺ and Tm³⁺ doped fluorite single crystals

Lianbi Su, Synthetic Single Crystal Research Center (SSCRC), CAS Key Laboratory of Transparent and Opto-functional Inorganic Materials, Shanghai Institute of Ceramics, Chinese Academy of Sciences, Shanghai 201899, China

In this work, crystal growth, optical spectra properties, and highly-efficient laser performances of Ho, Er and Tm doped CaF₂ and SrF₂ single crystals were investigated, which were codoped with the local lattice structure regulators of Y, La or Gd ions.

Friday 7 September 2018

FrM1: Fiber Lasers and Amplifiers – Nove Design, mid-IR 08:15 – 10:00

08:15 – 08:45

(Invited)

Sub-cycle Quantum Physics with Ultrabroadband Fiber Laser

Daniele Bida - Department of Physics and Center for Applied Photonics, University of Konstanz, Konstanz, Germany

Single cycle pulses produced by a femto-second Er:fiber laser system display passive control of the carrier-envelope phase. The electric field of these pulses is exploited to drive fundamental physical phenomena at the sub-cycle timescale.

FrM2 : thin Disk Oscillators

10:30 – 12:30

10:30 – 11:00

(Invited)

Ultrafast thin-disk oscillators at 1 μm and 2 μm wavelengths

Oleg Pronin, Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany

Recent progress in the development of ultrafast thin-disk oscillators at 1 μm and 2 μm wavelengths will be reviewed. This will include an oscillator with the highest peak power operating in ambient air, novel CEP stabilization and all-bulk external spectral broadening techniques. Additionally, high-power ultrabroadband infrared frequency comb generation will be reported.

NOTES

13:45–14:00: Chairs' Welcome

MoA1: Ultrafast Fiber Lasers

Chaired by Philippe Grelu, Uni. Bourgogne Franche-Comté, Dijon, France

Time: Monday, 14:00–16:00

Location: Auditorium

Keynote

MoA1.1 14:00

New Approaches to Ultrafast Fiber Lasers — •FRANK WISE — Cornell University, Ithaca, NY, USA

Recent developments in ultrafast fiber lasers based on Mamyshev regeneration and spatiotemporal mode-locking will be presented. Prospects for future scientific investigation and demonstration of high-performance instruments will be discussed.

Oral

MoA1.2 14:45

Novel Methods for CEO Stabilization in Fiber Lasers: Opto-Optical Modulation and Cross Gain Modulation — •KUTAN GUREL, VALENTIN J. WITTEW, SARGIS HAKOBYAN, NAYARA JORNOD, STEPHANE SCHILT, and THOMAS SÜDMEYER — Laboratoire Temps-Fréquence, Université de Neuchâtel, 2000 Neuchâtel, Switzerland

We present the carrier-envelope-offset (CEO) frequency stabilization of a fiber laser using two new methods. The first method is based on cross gain modulation (XGM) of the intra-cavity power. The second is by opto-optical-modulation (OOM) of a semiconductor-absorber chip. Both methods are easy to integrate, yielding tight-lock of the CEO.

Oral

MoA1.3 15:00

A new approach to generate ultrashort pulses in fiber lasers — FOUED AMRANI^{1,2}, PHILIPPE GRELU¹, and •PATRICE TCHOFO-DINDA¹ — ¹Laboratoire ICB UMR 6303 CNRS, Université Bourgogne Franche-Comté, F-21000 Dijon, France — ²Laboratoire XLIM, UMR 7252, Université de Limoges, F-87060 Limoges, France

We present a new approach to generate ultrashort pulses in fiber lasers with repetition rates in the THz range. This approach is fundamentally based on four-wave mixing processes induced by cross-phase modulation between the polarization modes of a normally dispersive highly-birefringent fiber.

Oral

MoA1.4 15:15

Ultrafast, short-wavelength Thulium-doped fiber lasers — •ANDREAS WIENKE, OLIVER PUNCKEN, DIETER WANDT, JÖRG NEUMANN, and DIETMAR KRACHT — Laser Zentrum Hannover e.V., Laser Development Department, Hollerithallee 8, 30419 Hannover, Germany

We present our latest results for the generation and amplification of ultrashort pulses in the short wavelength region around 1750 nm in Thulium-doped fibers which is highly interesting for imaging applications like 3-photon microscopy. Several fiber laser setups with different filter techniques and their limitations are discussed.

Oral

MoA1.5 15:30

New lights from ultrafast fiber laser real-time recordings — •PHILIPPE GRELU¹, ZHIQIANG WANG¹, SAID HAMDI¹, K. NITHYANANDAN², KATARZYNA KRUPA³, AURÉLIEN COILLET¹, and PATRICE TCHOFO-DINDA¹ — ¹Laboratoire ICB UMR 6303 CNRS, Université Bourgogne Franche-Comté, F-21000 Dijon, France — ²Laboratoire LIPhy, Université Grenoble Alpes, F-38042 Grenoble, France — ³Università degli Studi di Brescia, I-25123 Brescia, Italy

Spectro-temporal imaging sheds new light on the diversity of ultrafast laser dynamics that can unfold in the close vicinity of conventional mode locking. It is combined with spectral interferometry to analyze the vibrations of optical soliton molecules and complexes generated from ultrafast fiber lasers, and the formation of incoherent pulses.

Oral

MoA1.6 15:45

Dual-comb generation from a laser cavity via spectral sub-division — •JAKOB FELLINGER, GEORG WINKLER, and OLIVER H. HECKL — Christian Doppler Laboratory for Mid-IR Spectroscopy and Semiconductor Optics, University of Vienna, Vienna, Austria

We introduce a new method to generate a single-cavity dual comb, exploiting independent mode-locking within two isolated spectral regions of the gain profile. By setting a non-zero cavity dispersion we generate stable pulse trains with different repetition rates. Successive spectral broadening leads to a compact coherent dual comb source.

16:00–16:30: Coffee Break

MoA2: Short Pulse Generation

Chaired by Chaitanya Kumar Suddapalli, Radiantis, Barcelona, Spain

Time: Monday, 16:30–18:30

Location: Auditorium

Invited

MoA2.1 16:30

Advancements of ultra-short pulse generators based on self-phase modulation and alternating spectral filtering —

•KĘSTUTIS REGELSKIS, JULIJANAS ŽELUDEVICĪUS, and MARIJUS MICKUS — Department of Laser Technology, Center for Physical Sciences & Technology, Savanoriu Ave. 231, Vilnius, Lithuania

We investigate conditions allowing for self-starting operation of optical pulse generators. By control of filters-reflectors spectral band overlap, self-starting operation was achieved in two different setups. According to numerical calculations, material dispersion stabilizes pulse generation for broader range of gain parameter values and this allows for more reliable self-starting.

Oral

MoA2.2 17:00

3GHz, 257nm Picosecond Source for Electron Guns — •CHEN LI, HONGWEN XUAN, LUTZ WINKELMANN, and INGMAR HARTL — Deutsches Elektronen Synchrotron(DESY)

We report a new photocathode laser with 3GHz repetition rate, generated by electro-optics modulator comb. The laser is amplified by an Yb: fiber amplifier to 10W and frequency converted to deep ultra-violet with an output power of more than 3mW.

Oral

MoA2.3 17:15

All solid state multipass spectral broadening down to sub-20 fs —•KILIAN FRITSCH¹, JONATHAN BRONS¹, MARKUS POETZLBERGER², VLADIMIR PERVAK¹, and OLEG PRONIN¹ — ¹Ludwig-Maximilians-Universität München, Am Coulombwall 1, D-85748 Garching, Germany — ²Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching, Germany

We present numerical simulations and experiments on an all bulk self-phase modulation pulse compression scheme using Herriott-type multipass cells driven by a 100 W-class Kerr-lens mode-locked Yb:YAG thin-disk laser. It delivers sub-20 fs pulse duration with 60 % efficiency, excellent beam quality as well as power and beam pointing stability.

Oral

MoA2.4 17:30

Supercontinuum generation and self-compression of femtosecond pulses at 1030 nm in KTP crystals —

•ANNE-LISE VIOTTI, FREDRIK LAURELL, and VALDAS PASISKEVICIUS — Royal Institute of Technology, Department of Applied Physics, Roslagstullsbacken 21, 106 91 Stockholm, Sweden

Supercontinuum generation from a 1030 nm pump source is numerically investigated in both periodically poled and bulk KTiOPO₄. Spectra spanning from 800 nm to 1.5 μ m are obtained together with pulse self-compression from an initial 220 fs-long pulse down to 17 fs.

Oral

MoA2.5 17:45

Variable Amplitude – Zero Added Phase Anti-Gain-Narrowing Filter —

•TOBIAS FLÖRY, EDGAR KAKSIS, AUDRIUS PUGZLYS, and ANDRIUS BALTUSKA — Photonik Institut, Technische Universität Wien, Gusshausstrasse 27, 1040 Vienna, Austria

We introduce a simple tunable spectral amplitude shaper for gain narrowing suppression in ultrashort-pulse amplifiers which is inherently free of spectral phase modulation. The arrangement is a modified birefringent filter configured for self-compensation of etalon-type pulse splitting. Theory of operation, design and experimental evidence for preserved pulse fidelity are presented.

Oral

MoA2.6 18:00

Absolute timing jitter of mode-locked lasers with ultra-low measurement floor —ALEXIS CASANOVA¹, BENOIT TROPHÈME¹, ANTOINE COURJAUD¹, and •GIORGIO SANTARELLI² — ¹Amplitude Laser Group, 11 avenue de Canteranne, 33600 Pessac, France — ²LP2N, IOGS CNRS Université de Bordeaux, 1 rue François Mitterrand, 33400 Talence, France

Ultralow timing jitter femtosecond mode-locked lasers can be used for timing synchronization, optical sampling and analog-to-digital conversion, low-noise microwave generation, photonic radars and metrology. For the first time we implement cross-spectrum techniques enabling absolute timing jitter measurement with unprecedented noise floor of $2 \times 10^{-14} \text{ fs}^2/\text{Hz}$

Oral

MoA2.7 18:15

Gain aperture for high-brightness micro-MOPA —

•VINCENT YAHIA and TAKUNORI TAIRA — Institute for Molecular Science, Okazaki, Japan

High brightness compact MOPA was realized. Implementing a gain aperture element into the system lead to excellent output beam quality ($M^2 = 1.4$). At maximum amplification level, 235 mJ (0.4 GW) of output energy (power) was measured corresponding to a brightness of 18 PW/sr.cm². System size was equivalent to A3 paper.

18:45–20:45: Welcome reception at the PRBB Terrace sea front

TuM1: High-power Fiber Sources - Coherent Beam Combining

Chaired by Yoann Zaouter, Amplitude Systèmes, Pessac, France

Time: Tuesday, 8:15–10:00

Location: Auditorium

Oral

TuM1.1 8:15

16-channel coherent pulse combination with a multicore fiber

— ARNO KLENKE^{1,2}, MICHAEL MÜLLER¹, •HENNING STARK¹, FABIAN STUTZKI³, CHRISTIAN HUPEL³, THOMAS SCHREIBER³, ANDREAS TÜNNERMANN^{1,2,3}, and JENS LIMPET^{1,2,3} — ¹Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller University Jena, Jena, Germany — ²Helmholtz-Institute Jena, Jena, Germany — ³Fraunhofer Institute of Applied Optics and Precision Engineering, Jena, Germany

We present a laser amplifier based on coherent combination of 16 channels from a multicore fiber employing compact components for beam splitting, combination and temporal phasing. 40 ps pulses were combined, resulting in a near-diffraction-limited output beam with 70 W average power at a combination efficiency of 80%.

Oral

TuM1.2 8:30

High-energy 1.9 kW 16-channel ultrafast fiber laser system

— •MICHAEL MÜLLER¹, ARNO KLENKE^{1,2}, HENNING STARK¹, JOACHIM BULDT¹, ANDREAS TÜNNERMANN^{1,2,3}, and JENS LIMPET^{1,2,3} — ¹Friedrich-Schiller-University Jena, Institute of Applied Physics, Albert-Einstein-Straße 15, 07745 Jena, Germany — ²Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — ³Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Straße 7, 07745 Jena, Germany

In this contribution, an Yb-doped ultrafast fiber chirped-pulse amplifier based on coherent beam combination of 16 amplifier channels is presented. An output power of 1.9 kW, a pulse energy of 4 mJ and a pulse duration of 230 fs almost diffraction limited beam quality is achieved.

Oral

TuM1.3 8:45

Femtosecond coherent beam combining of seven fiber amplifiers in tiled-aperture configuration

— •ANKE HEILMANN¹, JÉRÉMY LE DORTZ², LOUIS DANIAULT¹, IHSAN FSAIFES¹, SÉVERINE BELLANGER¹, MARIE ANTIER³, JÉRÔME BOURDERIONNET², ERIC DURAND³, CHRISTOPHE SIMON-BOISSON³, CHRISTIAN LARAT², ERIC LALLIER², ARNAUD BRIGNON², and JEAN-CHRISTOPHE CHANTELOUP¹ — ¹Ecole Polytechnique, Université Paris-Saclay, 91128 Palaiseau Cedex, France — ²Thales Research & Technology, 1 avenue Augustin Fresnel, 91767 Palaiseau Cedex, France — ³Thales Opttronique SAS, 2 avenue Gay Lussac, 78995 Elancourt Cedex, France

We report on the first coherent combination of seven fiber amplifiers in the femtosecond regime using an interferometric phase measurement method. A combination efficiency of 48 % was measured, and the combined beam was temporally compressed to 244 fs, delivering an average power of 71 W.

Oral

TuM1.4 9:00

High power single-mode 488 nm emission by second harmonic generation of coherently-combined high-brightness tapered lasers

— •PHILIPP ALBRODT¹, MUHAMMAD TAHIR JAMAL², ANDERS KRAGH HANSEN², OLE BJARLIN JENSEN², GUNNAR BLUME³, KATRIN PASCHKE³, PAUL CRUMP³, PATRICK GEORGES¹, and GAËLLE LUCAS-LECLIN¹ — ¹Laboratoire Charles

Fabry, Institut d'Optique Graduate School, CNRS, Université Paris Saclay, 91127 Palaiseau Cedex, France — ²DTU Fotonik, Department of Photonics Engineering, Technical University of Denmark, Frederiksborgvej 399, 4000 Roskilde, Denmark — ³Ferdinand-Braun-Institut, Leibniz Institut für Höchstfrequenztechnik, Gustav-Kirchhoff-Str. 4, 12489 Berlin, Germany

We demonstrate a high-brightness laser module based on the coherent combination of three tapered semiconductor amplifiers, with a power > 12 W. The infrared beam is converted into the visible by second-harmonic generation in a PPLN crystal with a power up to 2 W limited by thermal effects.

Oral

TuM1.5 9:15

4 kW-level all-fiberized and narrow-linewidth MOPA system by tandem pumping strategy for mode instability suppression

— •PENGFEI MA^{1,2}, PU ZHOU^{1,2}, HU XIAO^{1,2}, DAREN MENG¹, JINYONG LENG^{1,2}, YANXING MA^{1,2}, and RONGTAO SU^{1,2} — ¹College of Advanced Interdisciplinary Studies, National University of Defense Technology, Changsha, China — ²Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, National University of Defense Technology, Changsha, China

We demonstrate a record output power of 4 kW-level all-fiberized and narrow-linewidth MOPA system. Tandem pumping is employed for MI suppression, which scales the threshold of > 5 times compared with traditional 976 nm pumping. SBS threshold is scaled to be 25.9 dB by using filtered WNS phase modulation.

Oral

TuM1.6 9:30

Kilowatt level high power Raman fiber laser based on pure passive fiber

— •YIZHU CHEN¹, JINYONG LENG^{1,2}, HU XIAO^{1,2}, TIANFU YAO^{1,2}, and PU ZHOU^{1,2} — ¹College of Advanced Interdisciplinary Studies, National University of Defense Technology, Changsha 410073, China — ²Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, Changsha 410073, China

We will report a high-power Raman fiber laser based on passive fiber. With 1243.7 W pump laser, maximum signal laser of 987 W is obtained and corresponding optical-to-optical efficiency is 89.8%. To the best of our knowledge, this is the demonstrated first kilowatt level RFL based on pure passive fiber.

Oral

TuM1.7 9:45

Nonlinear pulse compression of Yb-doped fiber source in a gas-filled multipass cell

— •LOÏC LAVENU^{1,2}, MICHELE NATILE^{3,4}, FLORENT GUICHARD², YOANN ZAOUTER², XAVIER DÉLEN¹, MARC HANNA¹, ERIC MOTTAY², and PATRICK GEORGES¹ — ¹Laboratoire Charles Fabry, Institut d'Optique Graduate School, CNRS, Université Paris-Saclay, Palaiseau Cedex, France — ²Amplitude Systèmes, Pessac, France — ³Amplitude Technologies, Evry, France — ⁴LIDyL, CEA, CNRS, Université Paris-Saclay, CEA-SACLAY, Gif-sur-Yvette, France

We demonstrate nonlinear temporal compression of an Yb-doped fiber laser source in a multipass cell filled with argon. The 160 μJ 275 fs input pulses are compressed to 135 μJ 33 fs, corresponding to an overall transmission of 85%, while preserving beam quality and introducing no space-time couplings.

10:00–10:30: Exhibition and Coffee Break

TuM2: High-power Laser Systems

Chaired by Eric Cormier, University of Bordeaux, Bordeaux, France

Time: Tuesday, 10:30–12:30

Location: Auditorium

Keynote

TuM2.1 10:30

Science Opportunities with Intense Ultrafast Lasers: Reaching for the Brightest Light — •PHILIP H. BUCKSBAUM — Stanford PULSE Institute, Stanford University and SLAC, Menlo Park, USA

Focused laser intensities up to a zettawatt/cm² or more are now possible, creating unique opportunities for science in extreme conditions. These laser fields can accelerate and collide elementary particles, drive nuclear reactions, heat matter to conditions found in stars, or even create matter out of the empty vacuum.

Oral

TuM2.2 11:15

Horizon: towards a picosecond kilowatt laser at 1 kHz repetition rate — •STEPHANE PETIT, MARIE-CHRISTINE NADEAU, DENIS MARION, JEREMY BRANDAM, DOMINIQUE DESCAMPS, CHRISTOPHE FERAL, JEROME LHERMITE, ALEXANDRE MÊLET, and PHILIPPE BALCOU — Université de Bordeaux-C.N.R.S.-C.E.A., Centre Lasers Intenses et Applications (CELIA), 351 cours de la Libération F-33405 Talence, France

Our current laser developments based on Yb:YAG technologies aim to reach the 1J-1kHz-1ps new frontier. State-of-the art technologies such as divided pulse amplification, thin disk, liquid cooled disk are explored through original designs and the latest simulation and experimental results will be presented.

Oral

TuM2.3 11:30

1 TW-class OPCPA seeded and pumped with 1 ps pulses at 100 Hz from an amplifier-compressor based on Yb:YAG rods — •PAULIUS MACKONIS¹, AUGUSTINAS PETRULENAS¹, and ALEKSEJ M. RODIN^{1,2} — ¹Center for Physical Sciences and Technology, Vilnius, Lithuania — ²Ekspla Ltd, Vilnius, Lithuania

Fiber laser seeded two-stage double-pass chirped pulse amplifier-compressor based on Yb:YAG rods with scalable output energy from 20 mJ to 60 mJ at a repetition rate of 100 Hz, a pulsewidth of 1.15 ps and excellent beam quality is used to pump 1T W-class OPCPA.

Invited

TuM2.4 11:45

Ultrafast lasers for sensors — •JEAN-CLAUDE DIELS¹, JAMES HENDRIE¹, HANIEH AFKHAMARDAKANI¹, LUKE HORSTMAN¹, NING HSU¹, MATTHIAS LENZNER², and LADAN ARISSIAN¹ — ¹Center for High Technology Material, Albuquerque, USA — ²Lenzner Research, Arizona, USA

A mode locked laser in which two pulses circulate, emit two correlated frequency combs. The frequency of the beat note produced by these two combs is proportional to the phase difference between the two combs. We demonstrate a phase sensitivity enhancement beyond the present value of 10⁻⁸.

Oral

TuM2.5 12:15

Novel aspects of spontaneous and stimulated emission in coherent light sources — •MARKUS POLLNAU — University of Surrey, Guildford, UK

We derive that the phase of stimulated and spontaneous emission is 90 degrees ahead of an incident field. We explain the discrepancy between Einstein's rate-equation description and Heisenberg's quantum-harmonic oscillator, one versus one-half vacuum photon per mode, and the factor-of-two decrease of laser linewidth by the relation between counter-propagating modes.

EPL: EPL Presentation

Chaired by Gonzalo Muga, Universidad del País Vasco, Spain

Time: Tuesday, 12:30–12:40

Location: Auditorium

Invited

EPL.1 12:30

Asymmetrical optical devices and non-Hermitian Hamiltonians in EPL — •J. G. MUGA — Department of Physical Chemistry, UPV/EHU, Apdo 644 Bilbao 48080, Spain

PT-symmetry is one of the fastest growing fields in optics, but

it is only one among a group of possible symmetries of Non-Hermitian Hamiltonians. Non-Hermitian, non-PT symmetries lead to new, different families of asymmetric devices. EPL has supported this research and welcomes Perspective articles in the field

12:40–14:00: Lunch Break

TuA1: Waveguide Lasers and Microresonators

Chaired by Markus Pollnau, University of Surrey, Guildford, UK

Time: Tuesday, 14:00–15:45

Location: Auditorium

Invited

TuA1.1 14:00

Guided-wave ZBLAN chip lasers, and their applications — •DAVID LANCASTER — School of Engineering and Future Industries Institute, Mawson Lakes, University of South Australia, Australia

High performing lasers in rare-earth doped fluorozirconate glasses are achieved by fs laser inscription of multiple guiding channels in a chip. These are leaky-mode, core-pumped, ultra-large mode area lasers. Fabrication, visible to mid-infrared operation, mode-locking, and use of adjacent waveguide to realise a dual frequency-comb laser will be discussed.

Oral

TuA1.2 14:30

Characterization of rare-earth-doped distributed-feedback waveguide lasers — CRISTINE C. KORES¹, NUR ISMAIL¹, DIMITRI GESKUS¹, and •MARKUS POLLNAU² — ¹KTH-Royal Institute of Technology, Stockholm, Sweden — ²University of Surrey, Guildford, UK

We characterize the spectral response of an ytterbium-doped distributed-feedback-laser resonator with thermal chirp. The resonance wavelength depends only on the accumulated phase shift. The linewidth increase is related to the resonator outcoupling losses. With increasing gain, linewidth narrowing occurs due to loss compensation by gain and changes in longitudinal-mode structure.

Oral

TuA1.3 14:45

Efficient clad-pumped waveguide laser at 1050 nm with highly doped Yb:YAG core — VIKTOR FROMZEL, NIKOLAY TER-GABRIELIAN, and •MARK DUBINSKII — US Army Research Laboratory, Adelphi, Maryland, USA

We demonstrated a high power, efficient, continuous wave, cladding-pumped laser operation of a fiber-like waveguide with highly-doped (20%) Yb:YAG core. An output power of 42.5 W at 1050 nm and a slope efficiency of 68% wrt absorbed pump power have been achieved with diode laser pumping at 933 nm.

Oral

TuA1.4 15:00

Microresonator solitons for astronomical spectrograph calibration — •EWELINA OBRZUD^{1,2}, MONICA RAINER³, AVET HARUTYUNYAN⁴, MILES ANDERSON⁵, JUNQI LIU⁵, MICHAEL GEISELMANN^{5,6}, BRUNO CHAZELAS², STEFAN KUNDERMANN¹,

STEVE LECOMTE¹, ADRIANO GHEDINA⁴, MASSIMO CECCONI⁴, EMILIO MOLINARI^{4,7}, FRANCESCO PEPE², FRANÇOIS WILDI², FRANÇOIS BOUCHY², TOBIAS KIPPENBERG⁵, and TOBIAS HERR¹ — ¹Swiss Center for Electronic and Microtechnology (CSEM), Time and frequency, Rue de l'Observatoire 58, 2002 Neuchâtel, Switzerland — ²University of Geneva, Department of Astronomy & Geneva Observatory/PlanetS, Chemin des Maillettes 51, 1290 Versoix, Switzerland — ³National Institute of Astrophysics (INAF), Astronomical Observatory of Brera, Via Brera 28, 20121 Milano, Italy — ⁴National Institute of Astrophysics (INAF), Fundación Galileo Galilei, Rambla José Ana Fernández Pérez 7, 38712 Breña Baja, Santa Cruz de Tenerife, Spain — ⁵Swiss Federal Institute of Technology (EPFL), Photonics and Quantum Measurements, SB IPHYS LPQM1, PH D3, Station 3, 1015 Lausanne, Switzerland — ⁶Ligentec, EPFL Innovation Park, Bâtiment C, 1015 Lausanne, Switzerland — ⁷National Institute of Astrophysics (INAF), Osservatorio Astronomico di Cagliari, Via della Scienza 5 - 09047 Selargius (CA), Italy

Absolute calibration of an astronomical spectrometer via a microresonator soliton frequency comb is demonstrated. This novel approach intrinsically provides broadband resolvable calibration lines and in a first test achieves a calibration precision of 25 cm/s. This result establishes a novel class of wavelength calibrators relevant for exoplanet and cosmology research.

Invited

TuA1.5 15:15

A Kerr-microresonator optical clockwork — •TARA DRAKE¹, TRAVIS BRILES^{1,3}, DARYL SPENCER¹, JORDAN STONE^{1,3}, DAVID CARLSON¹, DANIEL HICKSTEIN¹, QING LI², DARON WESTLY², KARTIK SRINIVASAN², SCOTT DIDDAMS¹, and SCOTT PAPP¹ — ¹Time and Frequency Division, National Institute of Standards and Technology, Boulder, CO, USA — ²Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, MD, USA — ³Department of Physics, University of Colorado, Boulder, CO, USA

We report on a Kerr-microresonator optical clockwork for accurate generation of a microwave-frequency output from an ultra-stable optical-frequency clock. We use precisely fabricated silicon nitride microrings to generate few-cycle soliton pulses with octave-spanning spectral bandwidth. Our experiments represent the first carrier-envelope-offset phase stabilization of a Kerr-microresonator optical frequency comb.

TuP: Poster Session 1 with coffee break

Time: Tuesday, 15:45–17:00

Location: Foyer

Poster

TuP.1 15:45

Optimized all-PM-fiber oscillator mode-locked using nonlinear polarization evolution in polarization maintaining fibers — •JAN SZCZEPANEK¹, TOMASZ M. KARDAŚ¹, and YURIY STEPANENKO² — ¹Faculty of Physics, University of Warsaw, Pasteura 5, 02-093 Warsaw, Poland — ²Institute of Physical Chemistry Polish Academy of Sciences, Kasprzaka 44/52, 01-224 Warsaw, Poland

We demonstrate a novel ytterbium laser oscillator mode-locked by means of Nonlinear Polarization Evolution segmented method realized in Polarization Maintaining (PM). Careful fiber segments design inside the mode-locker allows to achieve ultra-

short pulse duration. The all-PM-fiber ultrafast laser generated pulses compressed down to 240 fs at 13.39 MHz repetition rate.

Poster

TuP.2 15:45

Optical soliton molecule vibrations in ultrafast thulium fiber laser around 2 μ m analyzed with an adapted spectro-temporal imaging technique — •SAÏD HAMDI, AURÉLIEN COILLET, and PHILIPPE GRELU — Laboratoire Interdisciplinaire Carnot de Bourgogne, UMR CNRS 6303, 9 av. Alain Savary 21078 Dijon, France

In this work, we report on the generation of vibrating soliton molecules in a mode-locked, ring-based fiber laser around 2 μ m. We characterize the real-time dynamics of various regimes of

soliton molecules using dispersive Fourier transformation (DFT) with a chirped Bragg grating.

Poster TuP.3 15:45

Coexistence of rectangular and Gaussian-shape noise-like pulses in a figure-eight fiber laser — GUAN-KAI ZHAO, HONG-JIE CHEN, •AI-PING LUO, ZHI-CHAO LUO, and WEN-CHENG XU — South China Normal University, Guangzhou, China

We report the coexistence of rectangular noise-like pulse (NLP) and Gaussian-shape NLP in a figure-eight fiber laser. The coexistent NLPs with various patterns are formed depending on cavity parameters setting. Particularly, the duration of rectangular pulse always increases, while Gaussian-shape pulse has almost no changes with the increasing pump power.

Poster TuP.4 15:45

Dynamics of dissipative soliton resonances in a figure-9 Tm-doped fiber laser — KANGJUN ZHAO, PAN WANG, YIHANG DING, SHUNYU YAO, XIAOSHENG XIAO, and •CHANGXI YANG — Department of Precision Instruments, Tsinghua University, Beijing 100084, China

We report the observation of stable dissipative soliton resonance (DSR) pulses with pulse energy of 713.2 nJ, rectangular noise-like pulses, harmonic DSR pulses, and period-doubling DSR pulses in a figure-9 Tm-doped fiber laser. Possible mechanisms of various dissipative soliton resonances will be discussed.

Poster TuP.5 15:45

Broadband supercontinuum generation pumped by dual bound-state pulses from a passively mode-locked fiber laser — DONG QIU, WEN-JING LIAO, HONG-JIE CHEN, •AI-PING LUO, ZHI-CHAO LUO, and WEN-CHENG XU — South China Normal University, Guangzhou, China

We demonstrate a broadband supercontinuum generation pumped by dual bound-state pulses in a highly nonlinear fiber. The spectrum covers from 1100 nm to 2300 nm with a 10-dB bandwidth of 1140 nm. It is worth noting that there is no spectral peak in the vicinity of pump wavelength.

Poster TuP.6 15:45

Generation of noise-like pulses in fiber nonlinear amplifier and pulse compression characteristics — •YANRONG SONG, RUNQIN XU, and JINRONG TIAN — College of Applied Sciences, Beijing University of Technology, Beijing 100124, China

A noise-like pulse (NLP) train was generated in an Yb-doped fiber nonlinear amplifier. After being compressed, the pulse width of the spike is 14.5 fs and that of the pedestal is 3.70 ps. The NLP generation was simulated and the compressibility associated with the chirp of the pulses was discussed.

Poster TuP.7 15:45

Self-starting optical pulse fiber generator providing picosecond pulses — •JULIJANAS ŽELUDEVICIUS, MARIJUS MICKUS, and KĘSTUTIS REGELSKIS — Center for Physical Sciences & Technology, Vilnius, Lithuania

We report simple fiber pulse generator setup providing narrow-band (<1 nm) optical pulses at 1064 nm center wavelength, with duration of tens of picoseconds and energy up to 2 nJ. The setup is self-starting and suitable for robust all-in-fiber implementation.

Poster TuP.8 15:45

Multi-layer graphene mode-locked Er-doped fiber laser as a test bed for targeting specific operating regimes —

•ROBERT LINDBERG¹, JAKUB BOGUSŁAWSKI^{2,3}, GRZEGORZ SOBON², ALEKSANDRA PRZEWŁOKA⁴, FREDRIK LAURELL¹, VALDAS PASISKEVICIUS¹, and JAROSŁAW SOTOR² — ¹Department of Applied Physics, Royal Institute of Technology, 106 91 Stockholm, Sweden — ²Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland — ³Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44/52, 01-224 Warsaw, Poland — ⁴Institute of Electronic Materials Technology, Wolczynska 133, 01-919 Warsaw, Poland

We present an all polarization-maintaining Er-doped fiber laser mode-locked by multi-layer graphene providing tunable dispersion through an intra-cavity compressor. Experimental output characteristics, when using a saturable absorber able to support three different operating regimes, are presented which show the utility of our source as a test bed for laser design.

Poster TuP.9 15:45

Mode-locking of holmium-doped fiber lasers using nanomaterial-based saturable absorbers —

•MARIA PAWLISZEWSKA¹, ALEKSANDRA PRZEWŁOKA², TADEUSZ MARTYNIEN³, HAN ZHANG⁴, and JAROSŁAW SOTOR¹ — ¹Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland — ²Institute of Electronic Materials Technology, Wolczynska 133, 01-919 Warsaw, Poland — ³Department of Optics and Photonics, Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland — ⁴College of Optoelectronic Engineering, Shenzhen University, Shenzhen 518060, China

We present the usage of graphene and black phosphorus as mode-lockers for holmium-doped fiber lasers. In solitonic dispersion regime both materials show similar performance - pulse durations are in the range of 787-870 fs. Graphene-based stretched-pulse laser is capable of generating 190 fs pulses.

Poster TuP.10 15:45

Low-noise 50 W single-frequency fiber MOPA at 1013 nm —

•BENOÎT GOUHIER¹, SERGIO ROTA-RODRIGO¹, GERMAIN GUIRAUD², NICHOLAS TRAYNOR², and GIORGIO SANTARELLI¹ — ¹LP2N, Institut d'Optique Graduate School, Université de Bordeaux, 1 rue François Mitterrand, 33400 Talence, France — ²Azur Light Systems, 11 avenue de Canteranne, 33600 Pessac, France

We present a 50W, low-noise, all-fiber, single frequency master oscillator power amplifier operating at 1013nm, with a record efficiency of 67%. The output signal has a OSNR of 50dB a RIN not exceeding -125dBc/Hz above 1kHz, rolling down to -160dBc/Hz at 10MHz.

Poster TuP.11 15:45

End-to-end reinforcement learning for coherent beam combination —

•HENRIK TÜNNERMANN and AKIRA SHIRAKAWA — Institute for Laser Science, University of Electro-Communications Phase control is the key component of coherent beam combining and its applications in beam steering, compensation of atmospheric turbulence, and mode control. We investigated the applicability of deep reinforcement learning for phase control by training a neural-network to realize phase control in a two-channel CBC system.

Poster

TuP.12 15:45

High power Q-switched mode-locked thulium fiber laser and its application on supercontinuum generation in nonlinear optical fibers — •GIUSEPPE SCURRIA^{1,2}, STEFANO BIGOTTA¹, NICOLAS DALLOZ¹, CHRISTELLE KIELECK¹, MARC EICHHORN¹, INKA MANEK-HÖNNINGER², and ANNE HILDENBRAND-DHOLLAND¹ — ¹Institut franco-allemand de recherches de Saint-Louis (ISL) - 68300 Saint Louis - France — ²CELIa University of Bordeaux-CNRS-CEA UMR5107 - 33405 Talence - France

In this research study, a pulsed thulium-doped silica fiber laser emitting around 2 μm is used as a pump source with the aim of generating mid-IR supercontinuum in nonlinear fibers with an average power in the range of several watts, covering the wavelength spectrum up to 5 μm

Poster

TuP.13 15:45

Temperature Dependence of Laser Radiation Absorption in Polymers Used in Fiber Laser Optics — •RENATA ISMAGILOVA¹, IVAN KHRAMOV¹, RENAT SHAIDULLIN^{1,2}, and OLEG RYABUSHKIN^{1,2} — ¹Moscow Institute of Physics and Technology, Dolgoprudnyy, Russia — ²Kotelnikov Institute of Radio-Engineering and Electronics of RAS, Fryazino, Russia

Optical transmission spectra of Wacker Silgel polymer were measured. Polymer absorption coefficients at wavelengths of Yb-doped laser generation (1064 nm) and optical pumping (960-970 nm) were determined. Increase of the polymer absorption coefficients with temperature was observed. Polymer heating in conventional fiber laser unit under laser generation conditions was investigated.

Poster

TuP.14 15:45

Study of a high efficiency 100 W class holmium fiber laser — •JULIEN LE GOUËT¹, FRANÇOIS GUSTAVE¹, PIERRE BOURDON¹, NICOLAS HOREZAN¹, DENIS BOIVIN¹, THIERRY ROBIN², and BENOIT CADIER² — ¹ONERA, Palaiseau, France — ²iXblue, Lannion, France

Holmium fiber lasers by resonant pumping can exhibit high power and high efficiency. En route towards a 100W all-fiber laser at 2 μm , we will present our preliminary work : fabrication of a Ho fiber with low absorption for pump and signal, fiber analysis, and comparison between numeric model and experiments.

Poster

TuP.15 15:45

The Optimization of Pulse Compression for Compact High Energy Femtosecond Fiber Laser with CVBG Compressor — •TADAS BARTULEVICIUS^{1,2}, LAURYNAS VESELIS^{1,2}, KAROLIS MADEIKIS^{1,2}, ANDREJUS MICHAİLOVAS^{1,2}, and NERIJUS RUSTEİKA^{1,2} — ¹Ekspla, Vilnius, Lithuania — ²Center for Physical Sciences and Technology, Vilnius, Lithuania

A compact high energy 26 MW peak power fiber laser employing matched pair of a chirped fiber Bragg grating stretcher and a chirped volume Bragg grating compressor is presented. The effect of higher order dispersion on ultrashort pulse compression was numerically investigated and optimized.

Poster

TuP.16 15:45

All-Optical Repetition Rate Stabilization of Ultrafast Yb Doped All Fiber Oscillator for High Intensity OPCPA Systems — •KAROLIS MADEIKIS^{1,2}, KAROLIS VISKONTAS¹, ROKAS DANILEVICIUS^{1,2}, TADAS BARTULEVICIUS^{1,2}, LAURYNAS VESELIS^{1,2}, ANDREJUS MICHAİLOVAS^{1,2}, and NERIJUS RUSTEİKA^{1,2} — ¹Ekspla, Vilnius, Lithuania — ²Center for Physical Sciences and Technology, Vilnius, Lithuania

We demonstrate all-fiber ultrafast optically repetition rate locked oscillator concept designed for high intensity OPCPA systems.

Pump induced refractive index change in the active erbium fiber for precise delay line was tested with 976nm and 1550nm wavelength pump. Measured jitter at the output of the system was ~1 ps.

Poster

TuP.17 15:45

Suppression of 2nd-order Stokes in high power random fiber laser through polarization rotation based Raman gain control — •JUN YE¹, JIANGMING XU^{1,2}, JIAXIN SONG¹, YIZHU CHEN¹, HANSHUO WU¹, HANWEI ZHANG^{1,2}, and PU ZHOU^{1,2} — ¹College of Advanced Interdisciplinary Studies, National University of Defense Technology, Changsha 410073, China — ²Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, Changsha 410073, China

The 2nd-order Stokes is a classical and typical limiting factor for power scaling of random fiber lasers. Here we demonstrate the suppression of 2nd-order Stokes through polarization rotation based Raman gain control for the first time, boosting the maximal operation power of random fiber laser by ~49.7%.

Poster

TuP.18 15:45

DUV Spatial Beam Shaping using Diffractive Elements for the European XFEL High Brightness Photoinjector — •SEBASTIAN PUMPE¹, LUTZ WINKELMANN¹, CHRISTOPH M. HEYL^{1,2}, HAYDAR S. SALMAN¹, HONGWEI CHU¹, VLADIMIR BALANDIN¹, YAUHEN KOT¹, FRANK BRINKER¹, and INGMAR HARTL¹ — ¹Deutsches Elektronen Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany — ²Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena

We present first results of deep ultraviolet spatial flat-top laser beam shaping for photocathode lasers of X-ray Free Electron Lasers using diffractive optical elements including 22 m beam transport. A significantly higher transmission and equal electron beam quality compared with the conventional hard aperture clipping technique was achieved.

Poster

TuP.19 15:45

Generation of harmonic frequencies from 2nd up to 5th of a picosecond diode-pumped thin-disk Yb:YAG laser system — •HANA TURCICOVA, ONDREJ NOVAK, MARTIN SMRZ, JIRI MUZIK, LUKAS ROSKOT, AKIRA ENDO, and TOMAS MOCEK — HiLASE Centre, Institute of Physics AS CR, Dolni Brezany, Czech Republic

A diode-pumped thin disk Yb:YAG laser is running at 100 kHz repetition rate at the output of >100 W on the fundamental wavelength 1030 nm with the pulse duration of 2 ps. The generation of second up to fifth (1H+4H) harmonic frequencies is studied experimentally and in simulations.

Poster

TuP.20 15:45

Design of a transportable 1 kW Thin Disk Amplifier with high pulse energy for laser range finding — •JOCHEN SPEISER, JÜRGEN KÄSTEL, DANIEL SAUDER, and BIRGIT WEICHELT — DLR Institute of Technical Physics, Stuttgart, Germany

The design of the Thin Disk main amplifier for a projected transportable pulsed laser system with 1 kW average power was optimized based on numerical modelling. The numerical models include spatially resolved ASE effects, thermomechanical modelling of the disk and beam propagation effects inside the amplifier.

Poster

TuP.21 15:45

Low Distortion, 42 m Beam Transport of 0.5 mJ, 15 fs NIR Pulses with Refractive Relay Optics — •THOMAS HÜLSENBUSCH, SKIRMANTAS ALIŠAUSKAS, TINO LANG, NORA SCHIRMEL, LUTZ WINKELMANN, JIAAN ZHENG, and INGMAR HARTL — Deutsches Elektronen-Synchrotron, Notkestraße 85, 22607 Hamburg

We present a low distortion in-vacuum transport system for positively chirped 0.5 mJ, ultra-broadband pulses with 15 fs transform limit, utilizing diffractive relay optics to cover distances up to 42 m. A compressor set-up with novel ultra-broadband, highly dispersive double chirped mirror pairs is shown compensating up to 10000 fs².

Poster

TuP.22 15:45

Ultrafast CPA laser system based on Yb fiber seeder and Yb:YAG amplifier — •LAURYNAS VESELIS^{1,2}, TADAS BARTULEVICIUS^{1,2}, KAROLIS MADEIKIS^{1,2}, ANDREJUS MICHAİLOVAS^{1,2}, and NERIJUS RUSTEİKA^{1,2} — ¹Ekspla Ltd., Vilnius, Lithuania — ²Center for Physical Sciences and Technology, Vilnius, Lithuania

In this work we present an ultrafast laser system based on Yb fiber seeder and Yb:YAG crystal rod power amplifier. Matched pair of chirped fiber Bragg grating stretcher and chirped volume Bragg grating compressor were used to obtain 764 fs duration 104 μJ energy pulses at 200 kHz repetition rate.

Poster

TuP.23 15:45

Piezoelectric resonance laser calorimetry for determination of low optical absorption of massive polyhedron nonlinear-optical crystal boules — •GEORGII ALOIAN¹, NIKITA KOVALENKO¹, IRINA SHEBARSHINA¹, DMITRII NIKITIN¹, ALEKSEY KONYASHKIN^{1,2}, and OLEG RYABUSHKIN^{1,2} — ¹Moscow Institute of Physics and Technology, Institutskiy per. 9, Dolgoprudny, Moscow region, 141700, Russia — ²Kotelnikov Institute of Radio-engineering and Electronics of RAS, Vvedensky Sq.1, Fryazino, Moscow region, 141190, Russia

Novel technique for measuring low optical absorption coefficients of massive crystal boules of arbitrary shape based on the concept of equivalent temperature is proposed. The accuracy of the method was theoretically estimated.

Poster

TuP.24 15:45

Longitudinal temperature distribution control of active medium during solid-state laser operation — •ANDREI KOROLKOV^{1,2}, DMITRII BELOGOLOVSKII¹, DMITRII NIKITIN¹, ALEKSEY KONYASHKIN^{1,2}, and OLEG RYABUSHKIN^{1,2} — ¹Moscow Institute of Physics and Technology, Dolgoprudny, Russia — ²Kotelnikov Institute of Radio-engineering and Electronics of RAS, Fryazino, Russia

We introduce a novel method for measuring the longitudinal temperature distribution of the end-pumped laser medium avoiding an additional heating of the temperature sensors by scattered radiation. Sensor is made of a tiny piezoelectric crystal, which temperature is determined directly by noncontact measurement of its piezoelectric resonance frequency shift.

Poster

TuP.25 15:45

Characterization of a chirped volume Bragg grating compressor in a high-power laser system — •DENISA ŠTĚPÁNKOVÁ^{1,2}, ONDŘEJ NOVÁK¹, JIŘÍ MUŽÍK¹, LUKÁŠ ROŠKOT^{1,2}, MICHAL CHYLA¹, MARTIN SMRŽ¹, MICHAL JELÍNEK², VADIM SMIRNOV³, LEONID GLEBOV³, AKIRA ENDO¹, and TOMÁŠ MOCEK¹ — ¹HiLASE Centre, Institute of Physics AS CR, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic — ²Faculty of Nuclear Sciences and Physical Engineering, Břehová 78/7, 115 19 Praha 1, Czech Republic — ³OptiGrate, 562 South Econ Circle, Oviedo, Florida 32765-4311, USA

We present an experimental study of CVBG compressor performance in a high-power (200W) laser. Thermal lensing and its effect on decreasing beam quality is studied. Further, we measured minimal decrease of diffraction efficiency at high power. We verified that the ~2 ps compressed pulse width remains almost unaffected.

Poster

TuP.26 15:45

Piezoelectric Resonance Spectroscopy of Ionic Conductivity in Nonlinear-Optical LBO Crystals — •D. G. NIKITIN¹, A. V. PIGAREV¹, YU. S. STIRMANOV^{1,2}, A. V. KONYASHKIN^{1,2}, and O. A. RYABUSHKIN^{1,2} — ¹Moscow Institute of Physics and Technology, Institutskiy per. 9, Dolgoprudny, Moscow Region, Russia — ²Kotelnikov Institute of Radio Engineering and Electronics of RAS, Vvedensky sq. 1, Fryazino, Moscow Region, Russia

Temperature dependence of the dielectric losses conditioned by the ionic conductivity was investigated for nonlinear-optical LBO crystals both theoretically and experimentally exploiting the variation of the line form of LBO piezoelectric resonances with temperature. Influence of the ionic conductivity on optical properties of LBO crystals is considered.

Poster

TuP.27 15:45

Flash-lamp Pumped Nd:Glass Active-Mirror Amplifier Design — •MUNADI AHMAD^{1,2}, IAN MUSGRAVE¹, and DANIEL M.J. ESSER² — ¹Central Laser Facility, Didcot, United Kingdom — ²School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom

Increasing the repetition rate of high peak power flash-lamp pumped Nd:Glass systems are often limited due to the thermal degradation of the focal beam quality. Presented is an active-mirror design which is pumped on both surfaces enhancing the uniformity in temperature and gain along all spatial dimensions.

Poster

TuP.28 15:45

Insignificant role of the thickness of nonlinear medium in characterization of 1.5-cycle pulses by XPW d-scan — •AYHAN TAJALLI¹, MARIE OUILLE², ALINE VERNIER², FREDERIK BÖHLE², ESMERANDO ESCOTO³, SVEN KLEINERT¹, ROSA ROMERO⁴, JANOS CSONTOS⁵, UWE MORGNER^{1,6,7}, GÜNTER STEINMEYER³, HELDER CRESPO^{4,8}, RODRIGO LOPEZ MARTENS², and TAMAS NAGY³ — ¹Institute of Quantum Optics, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany — ²Laboratoire d'Optique Appliquée, ENSTA-Paristech, Ecole Polytechnique, CNRS, Université Paris-Saclay, 91761 Palaiseau Cedex, France — ³Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2A, 12489 Berlin, Germany — ⁴Sphere Ultrafast Photonics, SA, R. Campo Alegre 1021, Edifício FC6, 4169-007 Porto, Portugal — ⁵ELI-HU Non-Profit Ltd., Budapesti út 5, 6728 Szeged, Hungary — ⁶Laser Zentrum Hannover e.V., Hollerithallee 8, 30419 Hannover, Germany — ⁷Hannoversches Zentrum für Optische Technologien, Leibniz Universität Hannover, Nienburger Straße 17, 30167 Hannover, Germany — ⁸IFIMUP-IN and Departamento de Física e Astronomia, Faculdade de Ciências, Universidade do Porto, R. Campo Alegre 687, 4169-007 Porto, Portugal

We demonstrate the capability of XPW d-scan technique for measuring 1.5-cycle near-IR pulses. This technique is suited for measuring few-cycle pulses due to its inherent near-perfect phase matching and its single-beam geometry. Furthermore, we demonstrate that XPW d-scan is surprisingly insensitive to the thickness of the nonlinear medium.

Poster

TuP.29 15:45

Efficient generation of nanosecond LG01 mode pulses with high purity — •QIYAO LIU^{1,2}, ROBIN UREN¹, PETER SHARDLOW¹, and ANDY CLARKSON¹ — ¹Optoelectronics Research Centre, University of Southampton, Southampton, SO17 1BJ, UK — ²Department of Optical Science and Engineering, Fudan University, No.220 Handan Rd, Shanghai 200433, China

A simple strategy for generating a high purity vortex beam from a passively Q-switched Nd:YVO4 laser based a novel end-pumping scheme and a custom spherical-mirror astigmatic mode con-

verter is described. The laser yielded pulses of 8.9ns duration at a repetition frequency of 182kHz and with an average power of 0.53W.

Poster TuP.30 15:45

Second Stokes oscillation and Raman gain-guiding in micro-lensed monolithic diamond Raman lasers — •VASILI SAVITSKI, GIORGOS DEMETRIOU, SEAN REILLY, HANGYU LIU, ERDAN GU, MARTIN DAWSON, and ALAN KEMP — Institute of Photonics, Department of Physics, SUPA, University of Strathclyde, Glasgow, UK

Second Stokes generation at 620nm in 2mm long micro-lensed monolithic diamond Raman lasers is reported with 63% conversion efficiency. The Raman intracavity mode radius was found to be half that expected from the ABCD calculations of the resonator mode. Raman gain-guiding mechanism is suggested as an explanation.

Poster TuP.31 15:45

Low coherence pumping of quasi-cw diamond Raman lasers at powers up to a kilowatt — •RICHARD MILDREN, Z. BAI, S. ANTIPOV, R.J. WILLIAMS, D.J. SPENCE, and R.P. MILDREN — MQ Photonics Research Centre, Macquarie University, NSW, 2109, Australia

We report first and second Stokes diamond Raman lasers capable of efficient high power generation with input beam of M^2 as high as 15. Brightness enhancement factors of up to 20 are obtained. A model is described for predicting threshold and efficiency as a function of M^2 .

Poster TuP.32 15:45

150- μ J, 60-ns single longitudinal mode passively Q-Switched Nd:YAG ring laser oscillator with external feedback — •JACOPO RUBENS NEGRI¹, FEDERICO PIRZIO¹, and ANTONIO AGNESI^{1,2} — ¹Dipartimento di Ingegneria Industriale e dell'Informazione - Università di Pavia, Pavia, Italy — ²Bright Solutions Srl, Cura Carpignano (PV), Italy

We present a quasi-cw diode-pumped, Cr:YAG passively Q-Switched Nd:YAG ring laser. By employing an external feedback mirror to force unidirectional oscillation and a 103-GHz, low-finesse etalon, we obtained 150- μ J, 60-ns TEM₀₀ single longitudinal mode laser pulses (13-MHz bandwidth) at a repetition rate selectable between 0.1 and 2 kHz.

Poster TuP.33 15:45

Multi-mJ, side-pumped, polarization coupled Nd:YAG Porro-prism laser in active and passive Q-switching regime — •LUIGI FREGNANI¹, FEDERICO PIRZIO¹, and ANTONIO AGNESI^{1,2} — ¹University of Pavia, Pavia, Italy — ²Bright Solutions, Cura Carpignano (PV), Italy

We present a Nd:YAG, diode-stack side-pumped, Porro-prism resonator. Laser performance was investigated both in Cr:YAG passive and KTP Pockels-cell active Q-Switching regimes. 10-mJ, 40-ns pulses were obtained at 20 Hz pulse-rate with $M^2 < 10$ and low jitter. The misalignment insensitivity guaranteed by crossed-Porro-prisms design is attractive for applications in harsh environment.

Poster TuP.34 15:45

Nonlinear generation of high power, higher order asymmetric vortices with broad orbital angular momentum modal distribution in the green — •A SRINIVASA RAO, SABIR UL ALAM, ANIRBAN GHOSH, PRAVIN VAITY, and G K SAMANTA — Photonic Sciences Lab, Physical Research Laboratory, Navarangpura, Ahmedabad 380009, Gujarat, India

We report on experimental generation of broad orbital angular

momentum (OAM) spectra in a single beam by incorporating the asymmetry in the vortex beam. Using frequency-doubling we have showed the asymmetric vortices of broad OAM spectra have higher single-pass conversion efficiency than the symmetric vortex beams pure OAM mode.

Poster TuP.35 15:45

Novel experimental scheme for simultaneous generation of high power, ultrafast, 1D and 2D Airy beams — •RAGHWINDER SINGH GREWAL, ANIRBAN GHOSH, and GOUTAM KUMAR SAMANTA — Physical Research Laboratory, Ahmedabad, India

We report on simultaneous generation of high power, 1D and 2D Airy beam using a pair of concave and convex cylindrical lenses in a novel experimental scheme and studied their frequency doubling characteristics.

Poster TuP.36 15:45

266 nm generation using quasi phase-matched quartz pumped by a microchip laser — •HIDEKI ISHIZUKI and TAKUNORI TAIRA — Institute for Molecular Science, Okazaki, Japan

Ultraviolet 266nm generation was demonstrated by quasi phase matched crystal quartz. QPM structure was constructed by multi quartz-plate stacking, and high-brightness microchip laser with sub-nanosecond pulse duration was used as a pump source.

Poster TuP.37 15:45

withdrawn

Poster TuP.38 15:45

Synchronously pumped BaWO₄ Raman laser with long and short frequency shifts with the 69% slope efficiency at 1179 nm or 3 ps pulses at 1227 nm — •MILAN FRANK¹, SERGEI N. SMETANIN², MICHAL JELÍNEK¹, LYUDMILA I. IVLEVA², PETR G. ZVEREV², and VÁCLAV KUBEČEK¹ — ¹Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Břehová 7, 115 19 Prague 1, Czech Republic — ²Prokhorov General Physics Institute of Russian Academy of Sciences, Vavilova 38, 119991, Moscow, Russian Federation

We present a highly efficient BaWO₄ Raman laser generating at both long-shifted ($\nu_1 = 925 \text{ cm}^{-1}$) and short-shifted ($\nu_2 = 332 \text{ cm}^{-1}$) Raman components. Very high slope efficiency of 68.8% at the ν_1 -shifted Stokes wavelength of 1179 nm and 38.6% at the ($\nu_1 + \nu_2$)-shifted Stokes wavelength of 1227 nm have been achieved.

Poster TuP.39 15:45

Broadband wavelength-swept source based on a self-modulated Yb : CaF₂ mode locked oscillator — •MACIEJ KOWALCZYK¹, TADEUSZ MARTYNIEN², PAWEŁ MERGO³, GRZEGORZ SOBÓŃ¹, and JAROSŁAW SOTOR¹ — ¹Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland — ²Department of Optics and Photonics, Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland — ³Laboratory of Optical Fiber Technology, Maria Curie-Skłodowska University, pl. M. Curie-Skłodowskiej 3, Lublin, Poland

We report on a broadband high speed wavelength-swept exploiting a Yb : CaF₂ mode-locked oscillator with TEM mode bifurcations. The output wavelength can be varied between 480 nm and 1800 nm with a tuning speed of 10 MHz. Such simple quasi-supercontinuum source can be employed in i.a. optical coherence tomography.

Poster

TuP.40 15:45

Generation at 9.2 & 4.6 μm using DFG in LiGaS_2 pumped by a 20-picosecond Nd:YAG/ CaCO_3 Raman laser — SERGEI SMETANIN¹, •MICHAL JELINEK², ALEKSEY KURUS³, LUDMILA ISAENKO^{3,4}, and VACLAV KUBECEK² — ¹Prokhorov General Physics Institute, Russian Academy of Sciences, Vavilova 38, Moscow, Russian Federation — ²FNSPE, Czech Technical University in Prague, Břehová 7, Prague, Czech Republic — ³Sobolev Institute of Geology and Mineralogy, Siberian Branch Russian Academy of Sci., Ac. Koptug 3, Novosibirsk, Russian Federation — ⁴Novosibirsk State University, Pirogova 2, Novosibirsk, Russian Federation

Single-pass frequency conversion of picosecond Nd:YAG/ CaCO_3 Raman laser (1.064 / 1.203 & 1.384 μm) into the mid-infrared wavelengths of 9.2 and 4.6 μm by the difference-frequency generation in a LiGaS_2 crystal is presented.

Poster

TuP.41 15:45

Calcite extra-cavity parametric Raman 954 nm anti-Stokes laser with collinear orthogonally-polarized beam interaction at tangential phase matching — •MICHAL JELINEK¹, SERGEI SMETANIN^{2,3}, DMITRIY TERESHCHENKO³, and VACLAV KUBECEK¹ — ¹FNSPE, Czech Technical University in Prague, Břehová 7, Prague, Czech Republic — ²Prokhorov General Physics Institute, Russian Academy of Sciences, Vavilova 38, Moscow, Russian Federation — ³National University of Science and Technology MISiS, Leninski Prospekt 4, Moscow, Russian Federation

Tangentially phase-matched parametric Raman CaCO_3 anti-Stokes laser at 954 nm with the extra-cavity 1064-nm 6-ns laser pumping was investigated. The highest optical-to-optical efficiency into the anti-Stokes of ~4 % and 0.3-mJ output energy was achieved.

EPS: EPS QEOD Prize for Research in Laser Science and Applications

Chaired by Valdas Pasiskevicius, KTH Royal Institute of Technology, Stockholm, Sweden

Time: Tuesday, 17:15–18:15

Location: Auditorium

Keynote

EPS.1 17:15

Picosecond Infrared Laser (PIRL) Scalpel: Achieving Fundamental (Single Cell) Limits to Minimally Invasive Surgery and Biodiagnostics — •R.J. DWAYNE MILLER — Max Planck Institute for the Structure and Dynamics of Matter, Luruper Chaussee 149, Hamburg 27761, Germany Departments of Chemistry and Physics, 80 St. George Street, University of Toronto, Toronto, Ontario M5S 3H6, Canada

The first atomic movie of strongly driven phase transitions revealed the means to limit nucleation growth and associated shock wave damage. This insight has led to the achievement of effectively scar free laser surgery with an intrinsic molecular bar code to accurately guide surgery with prospect to map cells.

18:15–18:45: Coffee Break

18:45–20:00: Postdeadline Session

WeM1: Special Fibers and Multimode Dynamics

Time: Wednesday, 8:15–9:45

Location: Auditorium

Invited

WeM1.1 8:15

Spatiotemporal nonlinear dynamics in multimode optical fibers — •KATARZYNA KRUPA¹, RICHARD DUPIOL^{2,3}, ETIENNE DELIANCOURT², ROMAIN GUENARD², ALESSANDRO TONELLO², MARC FABERT², JEAN-LOUIS AUGUSTE², AGNES DESFARGES-BERTHELEMY², VINCENT KERMENE², ALAIN BARTHÉLÉMY², UMBERTO MINONI¹, DANIELE MODOTTO¹, GUY MILLOT³, VINCENT COUDERC², and STEFAN WABNITZ^{1,4} — ¹Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Brescia, via Branze 38, 25123, Brescia, Italy — ²Université de Limoges, XLIM, UMR CNRS 7252, 123 Avenue A. Thomas, 87060 Limoges, France — ³Université Bourgogne Franche-Comté, ICB, UMR CNRS 6303, 9 Avenue A. Savary, 21078 Dijon, France — ⁴Istituto Nazionale di Ottica del Consiglio Nazionale delle Ricerche (INO-CNR), via Branze 38, 25123, Brescia, Italy

We overview recent advances on spatiotemporal nonlinear dynamics of pulses propagating in normally dispersed multimode optical fibers. We discuss Kerr and Raman beam cleaning, ultra-broadband frequency conversion and supercontinuum generation including second harmonic generation, as well as temporal reshaping and polarization evolution.

Oral

WeM1.2 8:45

MW peak power level fiber sources via Soliton Self-Mode Conversion for 3-photon biological imaging — •LARS RISHØJ, BOYIN TAI, and SIDDHARTH RAMACHANDRAN — Boston University, Boston, USA

We demonstrate ultrashort pulse conversion from 1045 to 1600 nm using Soliton Self-Mode Conversion (SSMC), a newly demonstrated mechanism relying on intermodal group-index matching. Using SSMC a 1.1 MW peak power source (80 nJ, 74 fs) at ~1300 nm is realized and used for three-photon mouse brain imaging.

Oral

WeM1.3 9:00

Experimental investigation of single mode operation in ultra-large mode area passive photonic crystal fibers — •ALBRECHT STEINKOPFF¹, CESAR JAUREGUI¹, FABIAN STUTZKI³, JOHANNES NOLD³, CHRISTIAN HUPEL³, ANDREAS TÜNNERMANN^{1,2,3}, and JENS LIMPET^{1,2,3} — ¹Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745 Jena, Germany — ²Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — ³Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

We present our results on the core scaling of passive Large Pitch Fibers (LPFs). Single mode operation at 1.03 μm wavelength in a 140 μm pitch fiber (220–240 μm mode field diameter) has been achieved. This is the largest mode size reported so far from an effectively single-mode fiber.

Oral

WeM1.4 9:15

Dynamics of the radiation power transfer between the core modes of a few-mode fiber amplifier after pump initiation and in steady-state regime — •VALENTIN TYRTYSHNYY¹, DMITRIY ALEKSEEV^{1,2}, MAXIM KUZNETSOV³, and OLEG ANTIPOV³ — ¹NTO “IRE-Polus”, Fryazino, Russia — ²Moscow Institute of Physics and Technology, Dolgoprudny, Russia — ³Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia

Transverse mode instability in the highly-doped active fiber with 10- μm core diameter was investigated in transient and steady-state pumping regimes. Fundamental and high-order modes dynamics was studied for different pump wavelengths and propagation directions. Simulations reveal mode coupling effect in the transient regime even below the instability threshold.

Oral

WeM1.5 9:30

Transverse mode instabilities in high-power fiber lasers: Experimental findings and new mitigation strategies — •CHRISTOPH STIHLER¹, CESAR JAUREGUI¹, ANDREAS TÜNNERMANN^{1,2,3}, and JENS LIMPET^{1,2,3} — ¹Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745 Jena, Germany — ²Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — ³Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

The current experimental findings on transverse mode instabilities in high-power fiber lasers are presented. Based on them new mitigation strategies are proposed, whose key feature is the control of the phase shift between the modal interference pattern and the thermally-induced refractive index grating.

WeP: Poster Session 2 with exhibitor and coffee break

Time: Wednesday, 9:45–11:00

Location: Foyer

Poster

WeP.1 9:45

Stable Watt-level Continuum Generation in Liquid Core Optical Fiber filled with CS₂ and C₂Cl₄ — •KAY SCHAARSCHMIDT^{1,4}, HONGWEN XUAN³, INGMAR HARTL³, and MARKUS A. SCHMIDT^{1,2} — ¹Leibniz Institute of Photonic Technology, Jena, Germany — ²Otto Schott Institute of Material Research, Jena, Germany — ³Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — ⁴Abbe School of Photonics, Jena, Germany

We report record average powers for continuum generation in CS₂ and C₂Cl₄ filled optical fibers of 400 mW. To explore the lim-

its of such fibers in terms of thermal degradation, a 20 μm core diameter fiber is used to deliver 1 Watt output power with high stability.

Poster

WeP.2 9:45

Multidimensional control over Mid-IR filaments in air — •CLAUDIA GOLLNER¹, VALENTINA SHUMAKOVA¹, ANDRIUS BALTUŠKA^{1,10}, VLADIMIR FEDOROV^{2,3}, STELIOS TZORTZAKIS^{2,4,5}, ALEXANDR VORONIN^{6,7}, ALEXANDER MITROFANOV^{6,7}, ALEXEY ZHELTIKOV^{6,7,8}, DANIIL KARTASHOV⁹, SKIRMAN-TAS ALISAUSKAS¹, PAVEL MALEVICH¹, DMITRI SIDOROV-BIRYUKOV^{6,7}, and AUDRIUS PUGZLYS^{1,10} — ¹Photonics Institute

TU Wien, Vienna, Austria — ²Science Program Texas A&M University at Qatar, Doha, Qatar — ³P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia — ⁴Institute of Electronic Structure and Laser, Heraklion, Greece — ⁵Department of Materials Science and Technology University of Crete, Heraklion, Greece — ⁶Physics Department M.V. Lomonosov Moscow State University, Moscow, Russia — ⁷Russian Quantum Center, Moscow, Russia — ⁸Department of Physics and Astronomy Texas A&M University, Texas, USA — ⁹Friedrich-Schiller University Jena, Jena, Germany — ¹⁰Center for Physical Sciences & Technology, Vilnius, Lithuania

We demonstrate controllability of the filament position, polarization state of the output pulse, energy throughput and pulse duration of mid-IR filaments with respect to the polarization and chirp of the initial input pulse

Poster WeP.3 9:45

Experimental measurement of phase refractive index of PCF mode and its dispersion — •JULIUS VENGELIS, VYGANDAS JARUTIS, and VALDAS SIRUTKAITIS — Laser Research Center Vilnius University, Vilnius, Lithuania

We present a new experimental technique for measurement of refractive index of photonic crystal fiber fundamental mode. We demonstrate that phase refractive index can be estimated by analyzing phase shift of interfering adjacent longitudinal laser modes of continuous wave laser corresponding to shift from constructive to destructive interference.

Poster WeP.4 9:45

Effect of zero nonlinearity point on the temporal trajectory of Raman soliton — •SURAJIT BOSE¹, UWE MORGNER^{1,2}, and AYHAN DEMIRCAN^{1,2} — ¹Institute of Quantum Optics, Leibniz University Hannover, Welfengarten 1, 30167 Hannover, Germany — ²Hannover Centre for Optical Technologies, 30167 Hannover, Germany

We demonstrate numerically the temporal bending of Raman soliton at different distances by shifting zero nonlinearity point, when an input pulse is launched close to zero dispersion wavelength in non-solitonic domain of silver nanoparticle doped photonic crystal fibre.

Poster WeP.5 9:45

Far-detuned parametric conversion in suspended core soft glass fiber by picosecond pumping — •ANUPAMAA RAMPUR^{1,2}, PIOTR CIĄČKA¹, JAROSŁAW CIMEK^{1,2}, RAFAŁ KASZTELANIC^{1,2}, RYSZARD BUCZYŃSKI^{1,2}, and MARIUSZ KLIMCZAK^{1,2} — ¹Institute of Electronic Materials Technology, Glass Department, Wólczyńska 133, 01-919 Warsaw, Poland — ²University of Warsaw, Faculty of Physics, Pasteura 5, 02-093 Warsaw, Poland

We discuss the feasibility of parametric conversion through degenerate four-wave mixing in a suspended core soft glass fibers. Numerical and experimental results confirm the potential of test fibers for conversion of 1100 nm signal to 2700–3500 nm idler wavelengths under pumping with an erbium subpicosecond or cw laser system.

Poster WeP.6 9:45

Development of highly nonlinear polarization maintaining fibers with normal dispersion across entire transmission window — •DOMINIK DOBRAKOWSKI^{1,2}, ANUPAMAA RAMPUR^{1,2}, GRZEGORZ STĘPNIEWSKI^{1,2}, ALICJA ANUSZKIEWICZ^{1,2}, JOLANTA LISOWSKA^{1,2}, DARIUSZ PYSZ¹, RAFAŁ KASZTELANIC^{1,2}, and MARIUSZ KLIMCZAK^{1,2} — ¹Institute of Electronic Materials Technology, Glass Department, Wólczyńska 133, 01-919 Warsaw, Poland — ²University of Warsaw, Faculty of Physics, Pasteura 5, 02-093 Warsaw, Poland

Feasibility of birefringence introduction into highly nonlinear all-normal dispersion photonic crystal fibers is investigated. Stress-induced birefringence in a “bow-tie” structure is considered by simultaneous mechanical and optical simulation. Elliptically-deformed fabricated structures allowed for group birefringence of the order of 10^{-4} . This result was confirmed both numerically and experimentally.

Poster WeP.7 9:45

Single-cycle pulse sources through self-compression of the high-spatial modes of a hollow-core fiber. — BORIS LOPEZ-ZUBIETA, ENRIQUE CONEJERO, IÑIGO SOLA, and •JULIO SAN ROMAN — Grupo de Investigación en Aplicaciones del Laser y Fotónica, Departamento de Física Aplicada, University of Salamanca, E-37008 Salamanca, Spain

We theoretically demonstrate the self-compression of pulses during their propagation through a hollow-core fiber filled with gas (air, argon or neon). We have been able to identify the spatial mode that optimizes the self-compression process and, moreover, the role of the different spatial modes that contributes to the phenomena.

Poster WeP.8 9:45

Self-focusing activation in hollow-core fiber sources — •AURORA CREGO, JULIO SAN ROMAN, and ENRIQUE CONEJERO — Grupo de Investigación en Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, University of Salamanca, E-37008, Salamanca, Spain

We study the collapse of a laser pulse propagating through a hollow-core fiber. We have developed a formula to estimate collapse distances according to the input pulse parameters, observing collapses for peak powers below the critical threshold when taking into account the temporal dynamics.

Poster WeP.9 9:45

Coherence properties of frequency-shifted solitons generated in highly nonlinear fibers — •GRZEGORZ SOBON¹, TADEUSZ MARTYŃKIEN², KAROL TARŃOWSKI², PAWEŁ MERGO³, ALEKSANDRA FOLTYNOWICZ⁴, and JAROSŁAW SOTOR¹ — ¹Laser & Fiber Electronics Group, Wrocław University of Science and Technology, Wrocław, Poland — ²Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Wrocław, Poland — ³Maria Curie-Skłodowska University, Lublin, Poland — ⁴Department of Physics, Umeå University, Umeå, Sweden

We present an experimental study on the coherence properties of ultrashort pulses generated via soliton self-frequency shift in silica-based microstructured fibers pumped at 1.05 and 1.56 μm . We show that the solitons are highly coherent over a very broad tuning range (up to 2.1 μm while pumped at 1.56 μm).

Poster WeP.10 9:45

Low-noise normal dispersion supercontinuum based on 3 self compressing red shifting solitons — •RASMUS DYBBRO ENGELSHOLM and OLE BANG — DTU Fotonik, Department of Photonics Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

We present a numerical investigation of a novel low noise supercontinuum source for optical coherence tomography. It is based on three solitons red shifting and then undergoing broadening in a flat normal dispersion fiber.

Poster

WeP.11 9:45

Signal to noise ratio (SNR) enhancement by an intermediate Tm-doped fiber in a cascaded supercontinuum source (SC) for IR spectroscopy — •KYEI KWARKYE, CHRISTIAN ROSENBERG PETERSEN, and OLE BANG — DTU Photonics Kongens Lyngby, Denmark

The signal-to-noise ratio of a long-pulse pumped cascaded supercontinuum source is studied experimentally in an intermediate Tm-doped fiber by the spectrometer based approach. The enhancement of the SNR by a few orders by the Tm doped fiber thus, adds to the advantages of the Tm doped fiber in the cascade.

Poster

WeP.12 9:45

Compact broadband NIR fiber lasers applied for sensitive multicomponent measurements of intracavity absorption — •PETER FJODOROW¹, VALERI M. BAEV², and CHRISTOF SCHULZ¹ — ¹University of Duisburg-Essen, Institute for Combustion and Gas Dynamics - Reactive Fluids, Duisburg, Germany — ²University of Hamburg, Institute of Laser Physics, Hamburg, Germany

We present several applications of broadband intracavity absorption spectroscopy based on homemade compact erbium- and thulium/holmium-doped fiber lasers. The developed lasers are tunable in the spectral ranges of $\lambda = 1.52 - 1.61 \mu\text{m}$ (Er) and $\lambda = 1.8 - 2.1 \mu\text{m}$ (Tm/Ho) and show high sensitivities for intracavity absorption.

Poster

WeP.13 9:45

A Metal-Clad Silica Fiber Sensor for Measurement of Fiber Laser Radiation Power — •IVAN KHRAMOV¹, RENATA ISMAGILOVA¹, NIKOLAY ISHMAMETIEV¹, RENAT SHAIDULLIN^{1,2}, and OLEG RYABUSHKIN^{1,2} — ¹Moscow Institute of Physics and Technology, Dolgoprudnyy, Russia — ²Kotelnikov Institute of Radio-Engineering and Electronics of RAS, Fryazino, Russia

A novel technique of fiber laser power measurement using a fiber sensor is presented. Optical power transmitting through a copper-coated silica fiber is determined by measuring the thermally induced electric resistance change of metal coating due to absorption of scattered in the fiber core radiation.

Poster

WeP.14 9:45

Reshaping of plasmonic nanoantennas in strong femtosecond fields — •LIPING SHI — Leibniz University Hannover, Germany

We demonstrate the subwavelength thermal-free ablation of nanoscale materials directly by low-fluence fs oscillator. The plasmonic nanoantennae are used to locally enhance the near-field, which assists the electron-driven electrostatic ablation of small materials at ultralow laser fluence. We also here demonstrate a method to deposit smooth low-density thin nanofilm.

Poster

WeP.15 9:45

Terahertz ferroelectric metasurfaces — •JINGYI TIAN^{1,2}, FREDRIK LAURELL¹, VALDAS PASISKEVICIUS¹, MIN QIU², and HOON JANG¹ — ¹Department of Applied Physics, KTH, Stockholm, Sweden — ²College of Optical Science and Engineering, Zhejiang University, China

We experimentally demonstrate ferroelectric metasurfaces based on multipolar resonances for efficient manipulation of terahertz (THz) radiation. The fabricated ferroelectric metasurface is composed of KTP micro-blocks, of which transmission spectrum is measured using THz time-domain spectroscopy. This result will lead to monolithic integration of THz generation and manipulation in ferroelectric crystals.

Poster

WeP.16 9:45

Passive Q-switch by Cr4+:YAG saturable absorber laser operation of circular, buried depressed-cladding waveguides inscribed by fs-laser beam in Nd:YAG and Nd:YVO4 — •GABRIELA CROITORU and NICOLAE PAVEL — National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics Magurele 077125, Ilfov, Romania

Q-switch operation with Cr4+:YAG is reported from depressed cladding waveguides (100- μm diameter) inscribed by fs-laser beam in Nd-based materials. A 4.5-mm long waveguide realized in 1.1-at.% Nd:YAG yielded pulses with 1.9- μJ energy at 295 kHz. Energy increased at 9.3- μJ at 83 kHz from a 3.5-mm long, 1.0-at.% Nd:YVO4 waveguide.

Poster

WeP.17 9:45

Influence of temperature and energy transfer on optical gain in a highly ytterbium-doped potassium double tungstate thin film — YEAN-SHENG YONG¹, SHANMUGAM ARAVAZH¹, SERGIO A. VAZQUEZ-CORDOVA¹, JENNIFER L. HEREK¹, SONIA M. GARCIA-BLANCO¹, and •MARKUS POLLNAU² — ¹University of Twente, Enschede, The Netherlands — ²University of Surrey, Guildford, UK

A 32- μm -thick, epitaxially grown potassium double tungstate layer with 57% ytterbium concentration delivers 800 dB/cm net gain at 981 nm. An unidentified energy-transfer mechanism manifests itself in luminescence decay curves. Additionally, quenched ions and thermal effects are detected. A gain model taking these issues into account confirms the measured gain.

Poster

WeP.18 9:45

Fabrication of Nd:KGd(WO4)2/SiO2 waveguides and laser operation — MARC MEDINA¹, AIRÁN RÓDENAS², •GINÉS LIFANTE³, EUGENIO CANTELAR³, CHRISTIAN E. RÜTER⁴, JAUME MASONS¹, DETLEF KIP⁴, MARÍA CINTA PUJOL¹, MAGDALENA AGUILÓ¹, and FRANCISCO DÍAZ¹ — ¹Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA-EMaS), Universitat Rovira i Virgili (URV), Tarragona, Spain — ²Istituto di Fotonica e Nanotecnologie (IFN)- Consiglio Nazionale delle Ricerche (CNR), Milano, Italy — ³Departamento de Física de Materiales, Facultad de Ciencias. Universidad Autónoma de Madrid, Madrid (Spain) — ⁴Faculty of Electrical Engineering, Helmut Schmidt University, Hamburg, Germany

A set of ridge waveguides on a Nd:KGd(WO4)2/SiO2 platform was fabricated by dicing saw. The ridge waveguides were trapezoidal, with average dimensions of 11 (width) x 10 (height) μm . Under Ti:Sapphire laser excitation, laser emission at 1067.2 nm shows a threshold of 11 mW, and a slope efficiency of 15%.

Poster

WeP.19 9:45

High power, ultrafast pulse amplification in Yb:YAG single crystal fibre and Yb:YAG planar waveguide double-pass amplifier — •KIMBERLY E TKALCEC, ROLF B BIRCH, HOWARD J BAKER, and M J DANIEL ESSER — School of Engineering and Physical Science, Heriot Watt University, Edinburgh

A power scalable Yb:YAG MOPA system is shown, incorporating a 1030 nm, 344 fs, 10 MHz seed laser, a dual-end-pumped single crystal fibre pre-amplifier and a planar waveguide amplifier, with double-pass amplification to 25 W with 550 fs pulses, and scope to scale to 5- and 7-pass amplification.

Poster

WeP.20 9:45

Compact, stable, high-average-power, integrated-mirror-fiber-feedback picosecond optical parametric oscillator for the near- and mid-infrared — •BIPLOB NANDY¹, CHAITANYA KUMAR SUDDAPALLI^{1,2}, JOSEP CANALS CASALS¹, CALLUM F. O'DONNELL^{1,2}, and MAJID EBRAHIM-ZADEH^{1,2,3} — ¹ICFO-Institut de Ciències Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — ²Radiantis, Polígon Camí Ral, 08850 Gavà, Barcelona, Spain — ³Institutio Catalana de Recerca i Estudis Avancats (ICREA), Pas-seig Lluís Companys 23, 08010 Barcelona, Spain

We report a compact, stable, high-average-power integrated-mirror fiber-feedback near- and mid-IR picosecond optical parametric oscillator based on MgO:PPLN, tunable across 1506-1565 nm (signal) and 3326-3625 nm (idler), generating >2 W of total power with high beam quality ($M^2 < 1.4$) and excellent a passive power stability of 0.3% rms over 1 hour.

Poster

WeP.21 9:45

Doubly-resonant 2 μm degenerate optical parametric-enhancement cavity — •CHRISTIAN MARKUS DIETRICH, IHAR BABUSHKIN, JOSÉ RICARDO CARDOSO DE ANDRADE, and UWE MORGNER — Institute for Quantum Optics, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany

Our work consists of the realization of an ultrashort doubly resonant 2 μm optical parametric oscillator (OPO) for spectroscopic studies of gases and solids via low harmonics. We will present the concept and first results concerning this OPO as an enhancement cavity and its challenges.

Poster

WeP.22 9:45

Noise transfer properties of CEP-stable white-light seeded OPAs — •MICHELE NATILE^{1,2}, LOIC LAVENU^{3,4}, FLORENT GUICHARD³, MARC HANNA⁴, YOANN ZAOUTER³, RONIC CHICHE⁵, XIAOWEI CHEN¹, JEAN-FRANÇOIS HERGOTT², WILLEM BOUTU², HAMED MERDJI², and PATRICK GEORGES⁴ — ¹Amplitude Technologies, Evry, France — ²LIDyL, CEA, CNRS, Gif-sur-Yvette, FRANCE — ³Amplitude Systèmes, Pessac, France — ⁴Laboratoire Charles Fabry, CNRS, Palaiseau, France — ⁵Laboratoire de l'Accélérateur Linéaire, CNRS, Orsay, France

A passively carrier envelope phase stable white-light seeded OPA delivering 400 nJ 200 fs pulses at 100 kHz and 1030 nm central wavelength is studied in terms of amplitude and phase noise. In particular, we show intensity-to-phase noise transfer during the white light generation process.

Poster

WeP.23 9:45

Generation of vector vortex beam from a doubly-resonant pulsed nanosecond optical parametric oscillator — •VARUN SHARMA¹, S. CHAITANYA KUMAR², A. AADHI¹, H. YE², G. K. SAMANTA¹, and M. EBRAHIM-ZADEH^{2,3} — ¹Physical Research Laboratory, Ahmedabad, India — ²ICFO-Institut de Ciències Fotoniques, The Barcelona Institute of Science and Technology, Barcelona, Spain — ³Institutio Catalana de Recerca i Estudis Avancats (ICREA), Barcelona, Spain

We demonstrate a novel experimental scheme to generate tunable vector vortex beam directly from an optical parametric oscillator (OPO). Using a nanosecond doubly resonant OPO, we produce vector vortex beam tunable across 964-990 nm.

Poster

WeP.24 9:45

High-order vortex beam generation using a singly-resonant ultrafast optical parametric oscillator — •VARUN SHARMA¹, S. CHAITANYA KUMAR², G. K. SAMANTA¹, and M. EBRAHIM-ZADEH^{2,3} — ¹Physical Research Laboratory, Ahmedabad, India — ²ICFO-Institut de Ciències Fotoniques, The Barcelona Institute of Science and Technology, Barcelona, Spain — ³Institutio Catalana de Recerca i Estudis Avancats (ICREA), Barcelona, Spain

We demonstrate the direct transfer of pump vortex mode to the idler beam in a singly-resonant optical parametric oscillator, generating ultrafast vortex beam of order as high as $l=3$, tunable across 1109-1209 nm.

Poster

WeP.25 9:45

Non-collinear Optical Parametric Oscillator for Video-Rate Stimulated Raman Spectroscopy of Microplastics — •LUISE BEICHERT¹, YULIYA BINHAMMER¹, JOSÉ RICARDO ANDRADE¹, ANN-KATHRIN KNIGGENDORF², and UWE MORGNER^{1,2} — ¹Institut für Quantenoptik, Hannover, Deutschland — ²Hannoversches Zentrum für optische Technologien, Hannover, Deutschland

We demonstrate a very fast tunable Non-collinear Optical Parametric Oscillator broadly tunable from 650-950 nm with more than 500 mW output power. It acts as light source for Stimulated Raman Spectroscopy of microplastic particles in a water flow and delivers up to 80 Raman spectra per second.

Poster

WeP.26 9:45

Scalability of an ultrabroadband non-collinear optical parametric oscillator (NOPO) in the visible — YULIYA BINHAMMER¹, •THOMAS BINHAMMER¹, LUISE BEICHERT¹, JOSE ANDRADE¹, AYHAN TAJALLI¹, and UWE MORGNER^{1,2} — ¹Institut für Quantenoptik, Leibniz Universität Hannover, Hannover, Germany — ²Laser Zentrum Hannover e.V

We present the scaling properties of an ultrabroad femtosecond non-collinear optical parametric oscillator (NOPO) in the visible, which is able to cover a range from 450 to 650 nm with ultrafast tuning speed > 100 nm/ms. This source enables novel spectroscopy and imaging techniques with video rates.

Poster

WeP.27 9:45

Broadband mid-IR femtosecond optical parametric oscillator exploiting zero-group-velocity-mismatch in MgO:PPLN — •CALLUM F. O'DONNELL^{1,2}, CHAITANYA KUMAR SUDDAPALLI^{1,2}, and MAJID EBRAHIM-ZADEH^{1,2,3} — ¹Radiantis, Barcelona, Spain — ²ICFO - The Institute of Photonic Sciences, Barcelona, Spain — ³Institutio Catalana de Recerca i Estudis Avancats (ICREA), Barcelona, Spain

We report a highly efficient synchronously pumped mid-infrared optical parametric oscillator based on MgO:PPLN, producing up to 65 mW across 3.2-4.2 μm with FWHM bandwidths of ~200 nm. By exploiting zero group velocity mismatch in the crystal, the oscillation threshold is only 5 mW. Broadband spectroscopy is also performed.

Poster

WeP.28 9:45

Ultrafast gating for the generation of optically synchronized OPCPA pump pulses — •XAVIER DÉLEN¹, CYPRIEN LOUIS DE CANONVILLE², FRÉDÉRIC DRUON¹, PATRICK GEORGES¹, and DIMITRIOS PAPADOPOULOS² — ¹Laboratoire Charles Fabry, Palaiseau, France — ²Laboratoire d'Utilisation des Lasers Intenses, Palaiseau, France

We propose a new technique to generate synchronized pump OPCPA pulses from an independent pump source and present a proof of principle experiment. Kerr induced birefringence from

the signal pulse is used to build an ultrafast switch which produces the synchronized pump pulse.

Poster

WeP.29 9:45

Ultrashort pulses from an OPCPA in the visible — •SVEN KLEINERT¹, AYHAN TAJALLI¹, BERNHARD KREIPE¹, DAVID ZUBER¹, JOSÉ R. C. ANDRADE¹, and UWE MORGNER^{1,2,3} — ¹Institut für Quantenoptik, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany — ²Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover, Germany — ³Hannoversches Zentrum für Optische Technologien, Leibniz Universität Hannover, Neinburger Straße 17, D-30167 Hannover, Germany

We present an optical parametric amplification system for the visible range pumped by a chirped pulse amplification system at 1 MHz repetition rate. It generates sub-10-fs pulses with more than 250nJ of pulse energy in Poynting vector walk-off compensation geometry and 600nJ 11fs pulses in tangential phase matching geometry.

Poster

WeP.30 9:45

Picosecond pulse driven supercontinuum as a seed for a wavelength tunable mid-IR parametric source — •LUKÁŠ ROŠKOT^{1,2}, ONDŘEJ NOVÁK¹, BIANKA CSANAKOVÁ¹, MICHAL VYVLEČKA¹, MARTIN SMRŽ¹, MICHAL JELÍNEK², AKIRA ENDO¹, and TOMÁŠ MOCEK¹ — ¹HiLASE Centre, Institute of Physics AS CR, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic — ²Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University, Břehová 7, 115 19 Praha 1, Czech Republic

Loose focusing of ~1 ps, 1030 nm pulses into a 13 cm long YAG crystal is used for supercontinuum generation, which seeds a mid-IR optical parametric source. Picosecond supercontinuum properties are studied. The ten-watt level wavelength tunable source will cover the range 1.45-2.1 μm (signal) and 2.1-3.5 μm (idler).

Poster

WeP.31 9:45

High-repetition-rate, high-beam-quality, narrow-bandwidth picosecond source at 2.1 μm — •JOSEP CANALS CASALS¹, SUDDAPALLI CHAITANYA KUMAR^{1,2}, and MAJID EBRAHIM-ZADEH^{1,2,3} — ¹ICFO-Institut de Ciències Fotòniques — ²Radiantis — ³ICREA-Institut Català de Recerca i Estudis Avançats

We report a high-power, high-repetition-rate, near-degenerate picosecond optical parametric oscillator at 2.1 μm with high spectral and power stability, high beam quality and narrow bandwidth below $\Delta\lambda$ ~2.2 nm. The results confirm this source to be a good candidate for many applications including pumping mid-infrared optical parametric oscillators.

Poster

WeP.32 9:45

Silicon Brewster plate wavelength separator for a mid-IR optical parametric source — •BIANKA CSANAKOVÁ, ONDŘEJ NOVÁK, MARTIN SMRŽ, MICHAL VYVLEČKA, JAROSLAV HUYNH, AKIRA ENDO, and TOMÁŠ MOCEK — HiLASE Centre, Institute of Physics AS CR, Dolní Břežany, Czech Republic

We propose a two-plate silicon Brewster polarizer intended for the signal and idler beam separation of a 1.4 – 3.5 μm mid-IR optical parametric source. Its contrast and its tolerance to angular misalignment is studied, taking into account the different powers of the signal and idler beam.

Poster

WeP.33 9:45

Broadband OPCPA system based on YCOB — •JOANA ALVES, HUGO PIRES, CELSO P. JOÃO, and GONÇALO FIGUEIRA — Instituto de Plasmas e Fusão Nuclear, Instituto Superior Técnico, Lisbon, Portugal

We report on the performance of a broadband OPCPA system based on YCOB as the nonlinear crystal. We discuss its design, energy scalability, wavelength tunability and compression of the output pulses, including extension to mid-IR operation. Preliminary results show approximately mJ pulses with a 100 nm bandwidth.

Poster

WeP.34 9:45

High-efficient almost degenerate two-stage optical parametric down-conversion of Yb fiber laser radiation into the mid-infrared region — IGOR LARIONOV^{1,2}, ALEXANDER GULYASHKO², and •VALENTIN TYRTYSHNY² — ¹Moscow Institute of Physics and Technology, Dolgoprudny, Russia — ²NTO "IRE-Polus", Fryazino, Russia

Application of two periodically poled lithium niobate crystals in the single-pass optical scheme for the degenerate parametric down-conversion of ytterbium fiber laser emission and erbium one used as the pump and seed respectively resulted in generation of 20 watts mid infrared radiation with more than 50 % efficiency

Poster

WeP.35 9:45

Attosecond pulses generation driven by one cycle pulses obtained by two chirped pulses interference — ENRIQUE NEYRA¹, FABIAN VIDELA¹, JOSE ANTONIO PÉREZ HERNÁNDEZ², MARCELO CIAPPINA³, LUIS ROSO², and •GUSTAVO TORCHIA¹ — ¹Centro de Investigaciones Ópticas, CONICET-CICBA-UNLP — ²Centro de Láseres Pulsados (CLPU) — ³Institute of Physics of the ASCR, ELI-Beamlines project

We present a new technique for the synthesis of one cycle pulses to produce High Order Harmonic Generation (HHG). The resultant pulses are obtained by means of two chirped pulses interference. Using these pulses an enhancement on the HHG cutoff and a noticeable increase of the yield is observed.

Poster

WeP.36 9:45

Influence of the coating layer in the Laser-induced damage threshold of thin disk lasers at hundred-picosecond pulses — •MARIA JOSE MILLA¹, ROMAN DIAZ¹, LOÏC DEYRA¹, DAMIEN SANGLA², MAGALI DURAND², PIERRE SEVILLANO², ANTOINE COURJAUD², and JOHAN BOULLET¹ — ¹ALPhANOV, Rue François Mitterrand, 33400 Talence — ²Amplitude Systèmes, Cité De La Photonics, Avenue de Canteranne, 33600 Pessac

Laser-induced damage threshold (LIDT) is the major limitation in high intensity lasers. We analyze the influence of the coating in the LIDT of Yb:YAG crystals using standard tests in stretched regime. We report the importance of the coating and LIDT characterization in the hundred-picoseconds regime for high energy lasers.

Poster

WeP.37 9:45

Towards an XUV frequency comb for precision measurements of trapped highly charged ions — •JAN-HENDRIK OELMANN, JANKO NAUTA, ALEXANDER ACKERMANN, JULIAN STARK, STEFFEN KÜHN, JOSÉ RAMON CRESPO LÓPEZ-URRUTIA, and THOMAS PFEIFER — Max-Planck-Institut für Kernphysik

We present recent progress in the development of an XUV frequency comb. Pulses from a stabilized Yb-based fiber laser are amplified in a CPA system to 100 W, sub-200 fs, 100 MHz. High-harmonics will be generated inside a femtosecond enhancement cavity for precision XUV spectroscopy of cold highly charged ions.

Poster

WeP.38 9:45

Femtosecond filamentation of mid-infrared pulses in bulk silicon — •AGNĖ MARCINKVIČIŪTĖ, VYTAUTAS JUKNA, ROSVILDA ŠUMINAS, SIGITA BALANDYTĖ, GINTARAS TAMOŠAUSKAS, and AUDRIUS DUBIETIS — Laser Research Center, Vilnius University, Saulėtekio ave. 10, LT-10223, Vilnius, Lithuania

We demonstrate filamentation and spectral broadening of mid-infrared, femtosecond laser pulses in crystalline silicon. A more than octave-spanning supercontinuum spectrum is measured with 4.7 μm input pulses. Numerical simulation shows a three-fold self-compression of the input pulses down to two optical-cycles at the axial part of the beam during filamentation.

Poster

WeP.39 9:45

Filamentation induced ultrabroadband nonlinear interactions in polycrystalline zinc-blende semiconductors — •ROSVALDAS ŠUMINAS, JULIUS LUKOŠIŪNAS, AGNĖ MARCINKA-VIČIŪTĖ, GINTARAS TAMOŠAUSKAS, and AUDRIUS DUBIETIS — Laser Research Center, Vilnius University, Saulėtekio Avenue 10, LT-10223 Vilnius, Lithuania

We demonstrate various nonlinear interactions such as sum- and difference-frequency generation, as well as efficient broadband harmonic generation of up to the seventh order accompanied by considerable spectral broadening around the fundamental wavelength in polycrystalline zinc-sulfide and zinc-selenide samples of various thickness using femtosecond infrared pulses.

WeM2: OPOs OPCPAs

Chaired by Uwe Morgner, University of Hannover, Laser Zentrum Hannover, Hannover, Germany

Time: Wednesday, 11:00–12:30

Location: Auditorium

Oral

WeM2.1 11:00

Soliton fibre-feedback femtosecond optical parametric oscillator — •CALLUM F. O'DONNELL^{1,2}, CHAITANYA KUMAR SUDDAPALLI^{1,2}, THERESE PAOLETTA², and MAJID EBRAHIM-ZADEH^{1,2,3} — ¹Radiantis, Barcelona, Spain — ²ICFO - The Institute of Photonic Sciences, Barcelona, Spain — ³Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

We report a synchronously pumped near-infrared optical parametric oscillator, exhibiting optical soliton formation. Most of the cavity is contained within a standard single mode fibre, and near transform limited 106 fs pulses are produced across 1380–1460 nm. Detailed simulations are performed, showing excellent agreement with experimental data.

Oral

WeM2.2 11:15

Widely tunable, green-pumped, visible and near-infrared continuous-wave optical parametric oscillator based on fan-out-grating PPKTP — KAVITA DEVI^{1,2}, •ANUJA PADHYE¹, SUKEERT SUKEERT¹, and MAJID EBRAHIM-ZADEH^{1,3} — ¹ICFO—Institut de Ciències Fotòniques, Castelldefels (Barcelona), Spain — ²Indian Institute of Technology Bhilai, Raipur, Chhattisgarh, India — ³Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

We report the first realization of cw OPO based on fan-out-grating PPKTP, providing widely-tunable output across 741–922nm(signal) and 1258–1884nm(idler) at room temperature with total output power of 1.6W, exhibiting passive power-stability of 3.2%rms(2.7mins) and frequency-stability of 194MHz(35secs) with an instantaneous linewidth of 7.5MHz in good-beam-quality.

Oral

WeM2.3 11:30

Narrowband, tunable, 2 μm optical parametric master-oscillator power amplifier with large-aperture periodically poled Rb:KTP — RIAAN COETZEE¹, XIONGHUA ZHENG², LUIGI FREGNANI³, FREDRIK LAURELL¹, and •VALDAS PASISKEVICIUS¹ — ¹Royal Institute of Technology (KTH), Stockholm, Sweden — ²Sun Yat-sen University, Guangzhou, China — ³Universita' di Pavia, Pavia, Italy

A narrow-linewidth optical parametric oscillator and amplifier system based on large aperture periodically poled Rb:KTP is presented. The OPO is locked with a transversely chirped volume Bragg grating, allowing a wavelength tuning of ~ 1.5 THz. A maximum output energy of 52 mJ and conversion efficiency of 36 %

was obtained.

Oral

WeM2.4 11:45

White-light-seeded, CEP-stable, high power 4-micron KTA parametric amplifier driven by a 1.4-ps Yb:YAG thin disk laser — •TSUNETO KANAI^{1,2}, YEON LEE^{1,2}, and DONG EON KIM^{1,2} — ¹Department of Physics, Center for Attosecond Science and Technology, Pohang University of Science and Technology, Pohang 37673, South Korea — ²Max Planck Center for Attosecond Science, Max Planck POSTECH/Korea Res. Init., Pohang 37673, South Korea

We demonstrate a white-light-seeded KTA optical parametric amplifier (OPA) at 2.3–4.5 micron driven by a 1.4 ps Yb:YAG thin disk laser, which gives the ultimate solution with a simplified setup, high conversion efficiency, passively stabilized carrier envelope phase (CEP) of idler, actively stabilized CEP of signal and pump.

Oral

WeM2.5 12:00

High-average-power, dual-beam, ultrafast OPCPA at 1.55/3.1 μm — •MARK MERO¹, ZSUZSANNA HEINER², VALENTIN PETROV¹, and MARC VRAKING¹ — ¹Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — ²School of Analytical Sciences Adlershof, Humboldt Universität zu Berlin, Berlin, Germany

We present a 100-kHz OPCPA developed for strong-field physics and soft-X-ray transient absorption experiments. The system is based on noncollinear KTA booster amplifiers and provides two optically synchronized, simultaneously available output beams: a 43-W, 51-fs, CEP-stable beam at 1.55 μm and an angular-dispersion-compensated, 12.5-W, 73-fs beam at 3.1 μm .

Oral

WeM2.6 12:15

Sub 10-fs drift stability feedback for broadband burst-mode OPCPA System at FLASH. — •NORA SCHIRMEL, SKIRMANTAS ALISAUSKAS, THOMAS HÜLSENBUSCH, JIAAN ZHENG, TINO LANG, and INGMAR HARTL — Deutsches Elektronen Synchrotron, Hamburg, Germany

We are currently developing a versatile optical OPCPA laser system at the XUV free electron laser facility FLASH. This system provides 500 μJ , 15fs NIR pulses for XUV-NIR pump-probe experiments. We present a feedback system for timing and wavelength stabilization of this laser, which is of critical importance for experiments.

12:30–14:00: Lunch Break

WeA1: Innovative Fiber Laser Sources

Chaired by Katarzyna Krupa, University of Brescia, Italy

Time: Wednesday, 14:00–15:00

Location: Auditorium

Oral

WeA1.1 14:00

A portable, all-fiber difference frequency generation system operating in 6-9 μm spectral range — •JAROSŁAW SOTOR¹, ALEKSANDER GLUSZEK¹, ARKADIUSZ HUDZIKOWSKI¹, TADEUSZ MARTYNKIEN², PETER SCHUNEMANN³, PAWEŁ MERGO⁴, and GRZEGORZ SOBOŃ¹ — ¹Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland — ²Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Wrocław, Poland — ³BAE Systems, Inc., Nashua, USA — ⁴Laboratory of Optical Fiber Technology, Maria Curie-Skłodowska University, Lublin, Poland

We present a portable, ultrafast DFG source based on an OP-GaP crystal and the entirely fiberized, built only from polarization maintaining (PM) fibers and components, pumping system. The generated idler can be tuned in the 6000 to 9000 nm spectral range with the maximum average power of 7.5 mW.

Oral

WeA1.2 14:15

Unidirectional lasing in a ring cavity without directive elements — M. ASSAD ARSHAD, ALEXANDER HARTUNG, HARTMUT BARTELT, and •MATTHIAS JÄGER — Leibniz Institute of Photonic Technology, Jena, Germany

We present an Yb-doped fiber ring laser with broadband CW emission up to 1700nm based on stimulated Raman scattering. Remarkable is the unidirectional emission at higher powers without any isolator and an optical bistable behavior. To the best of our knowledge, this is reported for the first time.

Oral

WeA1.3 14:30

Wavelength-Tuneable Linearly-Polarised Ytterbium-Doped Fibre Ring Laser — •FLORIAN LEROI, PETER C. SHARDLOW, and WILLIAM A. CLARKSON — Optoelectronics Research Centre, University of Southampton, Southampton, SO17 1BJ, United Kingdom

A wavelength-tuneable ytterbium-doped fibre laser employing a ring cavity configuration in conjunction with a Faraday mirror to yield a linearly-polarised output with high polarisation purity is described. The laser yielded a maximum output power of 32.7W and was tuneable from 1047nm to 1086nm with less than 5.1% variation in power.

Oral

WeA1.4 14:45

Monolithic tunable fiber laser for real-time S^2 -measurements — •SVEN HOCHHEIM^{1,2}, RACHID HOUSSAINI¹, MICHAEL STEINKE^{1,2}, JÖRG NEUMANN^{1,2}, and DIETMAR KRACHT^{1,2} — ¹Laser Zentrum Hannover e.V., Laser Development Department, Hollerithallee 8, 30419 Hannover, Germany — ²Centre for Quantum Engineering and Space-Time Research (QUEST), Welfengarten 1, 30167 Hannover, Germany

For investigations of the mode content in fiber amplifiers for gravitational wave detectors, a spatial and spectral (S^2) technique shall be used. We present a monolithic tunable fiber laser for real-time S^2 -measurements. Based on a Fabry-Perot tunable filter, the laser achieves a wavelength-tuning-range of 100 nm with a linewidth of 1.9 GHz.

17:30–21:30: Excursion to the Cavas Codorniu with wine tasting

19:30–22:30: Conference Dinner to the Cavas Codorniu

ThM1: Special Symposium 1

Chaired by Johan Nilsson, University of Southampton, Southampton, United Kingdom

Time: Thursday, 8:15–9:30

Location: Auditorium

Oral

ThM1.1 8:15

Passively Q-switched direct-laser-written thulium waveguide laser based on evanescent-field interaction with SWCNTs — •ESROM KIFLE¹, PAVEL LOIKO², JAVIER RODRÍGUEZ VÁZQUEZ DE ALDANA³, AIRÁN RÓDENAS^{1,4}, SUN YUNG CHOI⁵, JI EUN BAE⁵, FABIAN ROTHERMUND⁵, VIKTOR ZAKHAROV², ANDREY VENIAMINOV², MAGDALENA AGUILÓ¹, FRANCESC DÍAZ¹, UWE GRIEBNER⁶, VALENTIN PETROV⁶, and XAVIER MATEOS¹ — ¹Universitat Rovira i Virgili, Tarragona, Spain — ²ITMO University, St. Petersburg, Russia — ³University of Salamanca, Salamanca, Spain — ⁴Istituto di Fotonica e Nanotecnologie, Milano, Italy — ⁵KAIST, Daejeon, South Korea — ⁶Max Born Institute, Berlin, Germany

Depressed-index surface channel waveguides were fabricated in a bulk Tm:KLu(WO₄)₂ crystal by femtosecond direct-laser-writing. In CW mode, an output power of 171 mW at 1847.4 nm was achieved. The laser was passively Q-switched by evanescent field interaction using surface-deposited single-walled carbon nanotubes (105.6 nJ / 98 ns at 1.42 MHz).

Oral

ThM1.2 8:30

Novel direct-laser-written Erbium and Holmium double tungstate channel waveguide lasers — ESROM KIFLE¹, •PAVEL LOIKO², JAVIER RODRÍGUEZ VÁZQUEZ DE ALDANA³, AIRÁN RÓDENAS^{1,4}, VENKATESAN JAMBUNATHAN⁵, ANTONIO LUCIANETTI⁵, TOMAS MOCEK⁵, VIKTOR ZAKHAROV², ANDREY VENIAMINOV², UWE GRIEBNER⁶, VALENTIN PETROV⁶, MAGDALENA AGUILÓ¹, FRANCESC DÍAZ¹, and XAVIER MATEOS¹ — ¹Universitat Rovira i Virgili, Departament Química Física i Inorgànica, Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA)-EMaS, Campus Sescelades, E-43007, Tarragona, Spain — ²ITMO University, 49 Kronverkskiy pr., 197101 St. Petersburg, Russia — ³Aplicaciones del Láser y Fotónica, University of Salamanca, 37008 Salamanca, Spain — ⁴Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche (IFN-CNR), Piazza Leonardo da Vinci, 32, 20133 Milano, Italy — ⁵HiLASE Centre, Institute of Physics CAS, Za Radnicí 828, 25241 Dolní Brežany, Czech Republic — ⁶Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2a, D-12489 Berlin, Germany

Depressed-index buried channel waveguides are produced in monoclinic Er:KLu(WO₄)₂ and Ho:KGd(WO₄)₂ by femtosecond direct-laser-writing. The first erbium double tungstate waveguide laser operated at 1535.2 nm with a slope efficiency η of 20.9%. The in-band-pumped holmium waveguide laser was scaled to 212 mW at 2055 nm with $\eta = 67.2\%$.

Oral

ThM1.3 8:45

High resolution coherent diffractive imaging using a fibre laser driven high-order harmonic source — WILHELM ESCHEN^{1,2}, GETNET TADESS^{1,2}, •ROBERT KLAS^{1,2}, MAXIM TSCHERNAJEW^{1,2}, VINZENZ HILBERT², FREDERIK TUITJE^{1,3}, DETLEF SCHELLE², ANNE NATHANAE², MATTHIAS ZILK², MICHAEL STEINERT², FRANK SCHREMPPEL², THOMAS PERTSCH², CHRISTIAN SPIELMANN^{1,3}, ANDREAS TÜNNERMANN^{1,2,4}, JENS LIMPET^{1,2,4}, and JAN ROTHHARDT^{1,2} — ¹Helmholtz-Institut Jena, Fröbelstieg 3, 07743 Jena, Germany — ²Institute of Applied Physics, Friedrich-Schiller-University Jena, Albert-Einstein-Straße 15, 07745 Jena, Germany — ³Institute of Optics and Quantum Electronics, Friedrich-Schiller-University Jena, Max-Wien-Platz 1, 07743 Jena, Germany — ⁴Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

We present our latest results on coherent diffractive imaging with a fibre laser driven high-order harmonic source. We used Fourier Transform Holography and Ptychography to demonstrate record resolutions for a table top setup. In contrast to previous works we used the classical Rayleigh criterion to determine the achieved resolution.

Invited

ThM1.4 9:00

Digital Photonic Production as a key enabling technology for Industry 4.0 — •CHRISTIAN HINKE¹ and R. POPRAWÉ^{1,2} — ¹Chair for Laser Technology, Steinbachstr. 15, 52074 Aachen, Germany — ²Fraunhofer Institute for Laser Technology, Steinbachstr. 15, 52074 Aachen, Germany

The talk will discuss the economic potential of that approach and in parallel highlight new requirements to actual and future laser based manufacturing processes.

ThP: Poster Session 3 with Exhibition and coffee break

Time: Thursday, 9:30–11:00

Location: Foyer

Poster

ThP.1 9:30

Highly concentrated Erbium silicate glass fiber laser for efficient power scaling — •JUN ZHANG¹, MARK DUBINSKI¹, and SHIBIN JIANG² — ¹U.S. Army Research Laboratory, Adelphi, Maryland, USA — ²AdValue Photonics, Inc., Tucson, Arizona, USA

A triple-clad highly Er-doped fiber based on a silicate glass has been studied in a resonantly pumped laser configuration. Laser output of over 100 W at 1615.3 nm has been achieved with ~55% efficiency. To the best of our knowledge, it is the highest power demonstrated from silicate glass fiber.

Poster

ThP.2 9:30

Enhancement of optical gain at 1.7 μ m in bismuth-doped germanosilicate fibers by thermal treatment — •SERGEI FIRSTOV^{1,2}, ELENA FIRSTOVA¹, SERGEY ALYSHEV¹, ALEXANDER KHARAKHORDIN¹, MIKHAIL MELKUMOV¹, and EVGENY DIANOV¹ — ¹Fiber Optics Research Center of the Russian Academy of Sciences, Moscow, Russia — ²Institute of Physics and Chemistry, National Research Mordovia State University, Saransk, Russia

The effect of thermal treatment on gain enhancement in bismuth-doped germanosilicate fibers was investigated. It was shown that at optimal conditions the optical gain of this type of active fibers can be increased by several times. The possible underlying mechanisms of the observed effect are discussed.

Poster

ThP.3 9:30

Broadband ASE sources with flat output spectra without internal spectral flattening filter — •JAN AUBRECHT¹, PAVEL PETERKA¹, PAVEL HONZÁTKO¹, ONDŘEJ MORAVEC¹, MICHAL KAMRÁDEK^{1,2}, and IVAN KAŠÍK¹ — ¹Institute of Photonics and Electronics of the Czech Academy of Sciences, Chaberská 57, Prague, Czech Republic — ²Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Břehová 7, Prague, Czech Republic

We report on broadband sources at around 1.9 micrometer based on thulium-doped fibers fabricated in-house. The 3-dB bandwidth exceeds 160 nm and 10-dB and 20-dB bandwidths are 240 nm and 317 nm, respectively. To our knowledge, it is the broadest thulium-doped fiber ASE source with output power exceeding 100 mW.

Poster

ThP.4 9:30

Heavy-tailed statistic behavior in random distributed feedback fibre laser induced by stochastically stimulated Brillouin scattering — •JIANGMING XU^{1,2}, JUN YE¹, JIAXIN SONG¹, YIZHU CHEN¹, PU ZHOU^{1,2}, JIAN WU^{1,2}, and HANWEI ZHANG^{1,2} — ¹College of Optoelectronic Science and Engineering, National University of Defense Technology, Changsha 410073, China — ²Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, Changsha 410073, PR China

We present the first experimental observation of rogue wave behavior in random distributed feedback fiber laser (to the best of our knowledge), which may open up a new field of investigation of temporal statistic behavior in RFL. The dynamics and evolutions of rogue wave behavior are also investigated.

Poster

ThP.5 9:30

Watt-level single-frequency tunable Neodymium MOPA fiber laser operating at 915-937 nm — •SERGIO ROTA-RODRIGO¹, BENOIT GOUHIER¹, MATHIEU LAROCHE², JIAN ZHAO¹, BENJAMIN CANUEL¹, ANDREA BERTOLDI¹, PHILIPPE BOUYER¹, NICHOLAS TRAYNOR³, BENOIT CADIER⁴, THIERRY ROBIN⁴, and GIORGIO SANTARELLI¹ — ¹LP2N, IOGS, CNRS, Université de Bordeaux, 33400 Talence, France — ²CIMAP, ENSICAEN, CNRS, CEA/IRAMIS, Université de Caen, 14050 Caen cedex, France — ³Azur Light Systems, Pessac, France — ⁴IXBLUE Photonics, Rue Paul Sabatier, Lannion, France

We present a Watt-level single-frequency tunable fiber laser in the 915-937 nm spectral window, based on a neodymium-doped fiber MOPA architecture. The laser exhibit output power >2 W from 921 to 933 nm, with a signal to integrated ASE higher than 15 dB, instability <1.4% and low relative intensity noise.

Poster

ThP.6 9:30

Watt-level green random laser at 532 nm — •SERGIO ROTA-RODRIGO¹, BENOIT GOUHIER¹, CLÉMENT DIXNEUF², LAURA ANTONI-MICOLLIER¹, GERMAIN GUIRAUD², DANIEL LEANDRO³, MANUEL LOPEZ-AMO³, NICHOLAS TRAYNOR², and GIORGIO SANTARELLI¹ — ¹LP2N, IOGS, CNRS, Université de Bordeaux, 33400 Talence, France — ²Azur Light Systems, 11 avenue de Canteranne, 33600 Pessac, France — ³Public University of Navarra (UPNA) and Institute of Smart Cities (ISC), Navarra, Spain

We report a Watt-level green random laser at 532 nm with more than 1 W output power, instability <1%, OSNR>70dB, 0.1nm linewidth and excellent beam quality. The laser is based on a MOPA architecture seeded by a Yb-gain assisted random fiber laser. A 10mm PPLN is used for SHG.

Poster

ThP.7 9:30

Tunable fiber lasers using FBG arrays for dual wavelength emission and sub-ns-pulse generation — TOBIAS TIESS, MARTIN BECKER, MANFRED ROTHHARDT, HARTMUT BARTELT, and •MATTHIAS JÄGER — Leibniz Institute of Photonic Technology, Jena, Germany

We report on Ytterbium-doped wavelength tunable fiber lasers based on fiber Bragg grating arrays that are electronically tuned using a modulator. A dual wavelength emission was demonstrated tunable over 50 nm as well as a pulse length reduction to sub-ns-duration using two different modulation schemes.

Poster

ThP.8 9:30

Self-stabilisation mechanism in Fourier domain mode-locked (FDML) lasers — •MARK SCHMIDT¹, TOM PFEIFFER¹, ROBERT HUBER², and CHRISTIAN JIRAUSCHEK² — ¹Department of Electrical and Computer Engineering, Technical University of Munich, Munich, Germany — ²Institute for Biomedical Optics, University of Lübeck, Lübeck, Germany

Fourier-domain mode locked (FDML) lasers are high-speed optical frequency swept sources which have revolutionized optical imaging and sensing. We present a self-stabilisation effect in FDML lasers which enables ultra-stable operation. We show by numerical simulations that a finite amount of dispersion in the optical fiber cavity can be compensated.

Poster

ThP.9 9:30

Linearly polarized holmium-doped fiber amplifier at 2.11 μm — •LARS G. HOLMEN^{1,2} and GUNNAR RUSTAD¹ — ¹Norwegian Defence Research Establishment, Kjeller, Norway — ²Dept. of Technology Systems, University of Oslo, Kjeller, Norway

We present a simple polarization maintaining double-pass holmium-doped fiber amplifier optimized for operation in the long wavelength region of the Ho gain spectrum. The amplifier provides a small-signal gain of 35 dB at 2.11 μm , and careful spectral filtering is implemented to suppress the level of short-wavelength ASE below -55 dB.

Poster

ThP.10 9:30

Femtosecond writing of surface sensitive waveguide. — •DMITRII PEREVOZNIK¹, BIN WU¹, and UWE MORGNER^{1,2,3} — ¹Gottfried Wilhelm Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany — ²Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover, Germany — ³Hannoversches Zentrum für Optische Technologien, Leibniz Universität Hannover, Neinburger Straße 17, D-30167 Hannover, Germany

We present a new waveguides in PMMA material which are sensing the surface of the substrate. This waveguides possibly could be used for applications such as lab-on-a-chip devices.

Poster

ThP.11 9:30

Pulsed-laser-deposited Yb:YAG planar-waveguide amplifier — •SERGEY KURILCHIK, JAMES GRANT-JACOB, JAKE PRENTICE, PING HUA, ROBERT EASON, and JACOB MACKENZIE — Optoelectronics Research Centre, University of Southampton, Southampton, UK

Recent advances in the development of a PLD-grown Yb:YAG planar waveguide laser and amplifier will be presented. Laser output power of 21 W with 70% slope efficiencies was achieved. >20dB amplification in the small signal regime and >30W output power in the saturated amplifier regime were also demonstrated.

Poster

ThP.12 9:30

withdrawn

Poster

ThP.13 9:30

Ultrashort-pulse fiber lasers in advanced fabrication of nanostructures and nanomaterials — •ANDREY IONIN, SERGEY KUDRYASHOV, PAVEL DANILOV, IRINA SARAIEVA, ALENA NASTULYAVICHUS, NIKITA SMIRNOV, and ANDREY RUDENKO — P.N.Lebedev Physical Institute of Russian Academy of Sciences, Moscow, Russia

Experimental results on application of a high-repetition MHz rate tightly focused femtosecond fiber laser for high-throughput and ultra-rapid fabrication of nano- and micro-patterns on thin plasmonic films by using diffractive optical elements and for milligram-per-second production of selenium nanoparticles in water sols will be presented.

Poster

ThP.14 9:30

Femtosecond fiber Bragg grating inscription through the coating using a low-NA lens — •AVIRAN HALSTUCH, AVISHAY SHAMIR, and AMIEL A. ISHAAYA — Department of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel

We demonstrate inscription of fiber Bragg gratings (FBGs) through the fiber coating with a fs laser, a phase mask, and a low-NA lens. With a suitable fs photo-treatment to the coating, we obtain FBGs with different transmission dips up to -30dB. Some minor visible damage to the coating is observed.

Poster

ThP.15 9:30

Linear scaling of depth for laser processing of silicon in an ablation-cooled regime — •JAN SZCZEPANEK¹, PARVIZ ELAHI², HAMIT KALAYCIOĞLU², DENIZHAN K. KESIM³, ÖNDER AKÇAALAN², and F. ÖMER ILDAY^{2,3,4} — ¹Faculty of Physics, University of Warsaw, Pasteura 5, 02-093 Warsaw, Poland — ²Department of Physics, Bilkent University, Ankara 06800, Turkey — ³Department of Electrical and Electronics Engineering, Bilkent University, Ankara 06800, Turkey — ⁴UNAM - National Nanotechnology Research Center, Bilkent University, Ankara 06800, Turkey

The highly efficient ablation-cooled material removal is enabled via carefully designed laser systems generating bursts of GHz - repetition rate femtosecond pulses. Here, we present the linear scaling of single-shot ablation hole depth up to an extreme value of above 36 μm on silicon samples with ablation-cooled laser material removal.

Poster

ThP.16 9:30

Advances in ultrafast laser inscription in optical materials: from fundamentals to technological applications — •GUSTAVO TORCHIA^{1,2}, MATIAS TEJERINA³, DEMIAN BIASETTI¹, VALENTIN GUAREPI¹, DAMIAN PRESTI^{1,2}, ROBERTO PEYTON^{1,2}, FABIAN VIDELA¹, and ENRIQUE NEYRA¹ — ¹Centro de Investigaciones Ópticas, CONICET-CICBA-UNLP — ²Departamento de Ciencia y Tecnología, Universidad Nacional de Quilmes — ³Centro de Tecnología de Recursos Minerales y Cerámica (CONICET La Plata-CIC),

In this work, we would like to introduce some fundamental studies and technological developments on integrated photonics by ultrafast laser inscription (ULI). On one side, micro Raman and luminescence experiments have been used to characterize the written waveguides. On the other side, suitable technological devices were developed by using ULI.

Poster

ThP.17 9:30

Broadband 2-3.2 μm dispersive mirrors for Cr:ZnS/Cr:ZnSe laser — •VLADIMIR PERVAK¹, TATIANA AMOTCHKINA¹, QING WANG^{2,3}, OLEG PRONIN¹, KA FAI MAK², and MICHAEL TRUBETSKOV² — ¹Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching, Germany — ²Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — ³School of Optics and Photonics, Beijing Institute of Technology, 100081 Beijing, China

Dispersive mirrors based on Si/SiO₂ thin-film materials operating in spectral range from 2 to 3.2 μm are reported. The coating exhibit reflectance exceeding 99.6% and provide a group delay dispersion of -200 fs². The fabricated mirrors are critical elements in Cr:ZnS/Cr:ZnSe femtosecond oscillators and open a new avenue.

Poster

ThP.18 9:30

LED-pumped Ti-sapphire laser — •PIERRE PICHON^{1,2}, JEAN-PHILIPPE BLANCHOT², FRÉDÉRIC DRUON¹, FRANÇOIS BALEMBOIS¹, and PATRICK GEORGES¹ — ¹Laboratoire Charles Fabry, Institut d'Optique Graduate School CNRS, Université Paris-Saclay, 91127, Palaiseau Cedex, France — ²Efflux, 1 rue de Terre Neuve, 91940, les Ulis, France

We present the first demonstration of an LED-pumped Ti:sapphire laser. The free-running operation such as the tunability and gain measurements are investigated under this novel pumping scheme. It opens a new paradigm on pump sources for Ti:sapphire taking advantage of the LED ultra-low-cost, compactness and robustness.

Poster

ThP.19 9:30

Comparative spectroscopic and laser study of Tm3+, Na+(Li+)-codoped CNGG-type disordered garnet crystals for mode-locked lasers — ZHONGBEN PAN^{1,2}, •PAVEL LOIKO³, JOSEP MARIA SERRES⁴, ESROM KIFLE⁴, HUALEI YUAN¹, XIAOJUN DAI¹, HUAQIANG CAI¹, MAGDALENA AGUILÓ⁴, FRANCESC DÍAZ⁴, YICHENG WANG², YONGGUANG ZHAO^{2,5}, UWE GRIEBNER², VALENTIN PETROV², and XAVIER MATEOS⁴ — ¹Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang, 621900, China — ²Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2a, D-12489 Berlin, Germany — ³ITMO University, 49 Kronverkskiy Pr., 197101 Saint-Petersburg, Russia — ⁴Universitat Rovira i Virgili, Depart. Química Física i Inorgànica, FiCMA-FiCNA-EMaS, Campus Sescelades, E-43007, Tarragona, Spain — ⁵Jiangsu Key Laboratory of Advanced Laser Materials and Devices, Jiangsu Normal University, 221116 Xuzhou, China

Tm3+,Na+ and Tm3+,Li+-codoped Ca3Nb1.5Ga3.5O12-type disordered garnet crystals were grown. Their spectroscopy, CW and tunable laser operation were studied. The Tm3+,Li+-codoped crystal generated 1.32 W at 2002.1 nm with 45.8% slope efficiency; the tuning range reached 224 nm (1848-2072 nm). The studied crystals are promising for sub-100-fs mode-locked oscillators.

Poster

ThP.20 9:30

Tm and Ho-doped "mixed" sesquioxide ceramics (Lu,Sc)2O3 – promising materials for mode-locked 2-μm lasers — PAVEL LOIKO¹, JOSEP MARIA SERRES², WEI JING³, YICHENG WANG⁴, XAVIER MATEOS², MAGDALENA AGUILÓ², FRANCESC DÍAZ², UWE GRIEBNER⁴, HUI HUANG³, and VALENTIN PETROV⁴ — ¹ITMO University, 49 Kronverkskiy pr., 197101 St. Petersburg, Russia — ²Universitat Rovira i Virgili, Departament Química Física i Inorgànica, Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA)-EMaS, Campus Sescelades, E-43007, Tarragona, Spain — ³Institute of Chemical Materials, China Academy of Engineering Physics, 64 Mianshan Road, 621900 Mianyang, China — ⁴Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2a, D-12489 Berlin, Germany

We report on the synthesis, spectroscopic and laser studies of novel "mixed" (Lu,Sc)2O3 transparent ceramics doped with Tm3+ and Ho3+ ions. A CW Tm3+ ceramic laser generated 1.01 W at 2095-2102 nm. Under quasi CW pumping, the Ho3+ ceramic laser generated 187 mW at 2114-2135 nm.

Poster

ThP.21 9:30

Mode-locked femtosecond Tm,Ho:CNCG laser at 2078 nm using graphene — ZHONGBEN PAN^{1,2}, YICHENG WANG¹, YONGGUANG ZHAO¹, MACIEJ KOWALCZYK^{1,3}, JAROSLAW SOTOR^{1,3}, HUALEI YUAN², XIAOJUN DAI², HUAQIANG CAI², JOSEP MARIA SERRES⁴, XAVIER MATEOS⁴, PAVEL LOIKO⁵, YOUNG JUN CHO⁶, FABIAN ROTERMUND⁷, UWE GRIEBNER¹, and VALENTIN PETROV¹ — ¹Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2a, D-12489 Berlin, Germany — ²Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang, 621900, China — ³Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland — ⁴Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA)-EMaS, Dept. Química Física i Inorgànica, Universitat Rovira i Virgili (URV), Campus Sescelades, E-43007 Tarragona, Spain — ⁵ITMO University, 49 Kronverkskiy Pr., 197101 St. Petersburg, Russia — ⁶Department of Energy Systems Research, Ajou University, Worldcup-ro 206, 443-749 Suwon, South Korea — ⁷Department of Physics, Korea Advanced Institute of Science and Technology (KAIST), 34141 Daejeon, South Korea

A Tm,Ho co-doped CNCG disordered crystal was prepared and employed for the first time in a passively mode-locked laser. Pulses as short as 105 fs at 2078 nm was generated by using a graphene-based saturable absorber.

Poster

ThP.22 9:30

Growth and Mid-Infrared Continuous Wave Laser Action of Er³⁺:Sc₂O₃ — ALEXANDER MARC HEUER^{1,2}, PATRICK VON BRUNN^{1,2}, GÜNTER HUBER¹, and CHRISTIAN KRÄNKEL³ — ¹Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — ²The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — ³Zentrum für Laser-materialien, Leibniz-Institut für Kristallzüchtung, Max-Born-Straße 2, 12489 Berlin, Germany

We report on the growth, spectroscopic, and laser characterization of high quality Er³⁺:Sc₂O₃ crystals. Continuous wave laser action at 2855.8 nm with slope efficiencies reaching 30 % and output powers exceeding 0.5 W are obtained. This represents the first mid-infrared cw laser based on this material.

Poster

ThP.23 9:30

228 fs operation of a diode-pumped Nd,Gd:SrF₂ laser — VACLAV KUBECEK¹, MICHAL JELINEK¹, MIROSLAV CECHE¹, DAVID VYHLIDAL¹, FENGKAI MA², DAPENG JIANG², and LIANGBI SU² — ¹Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University, Břehova 7, 115 19 Prague 1, Czech Republic — ²Key Laboratory of Transparent and Opto-functional Inorganic Materials, Shanghai Institute of Ceramics, Chinese Academy of Sciences, No.588 Heshuo Road, Jiading, Shanghai 201899, China

Femtosecond passively mode-locked operation of a low power diode-pumped Nd,Gd:SrF₂ laser is reported. 228 fs long pulses at 1053.5 nm were obtained for absorbed pump power lower than 1.4 W with total output power of 100 mW. In the free running regime the 12 nm tuning range was achieved.

Poster

ThP.24 9:30

Unidirectional single-frequency operation of a wavelength-tunable red-diode-pumped Alexandrite ring laser — XIN SHENG¹, GORONWY TAWY¹, JUNA SATHIAN¹, ARA MINASSIAN², and MICHAEL J DAMZEN¹ — ¹Photonics Group, Blackett Laboratory Physics, Imperial College London SW7 2AZ, United Kingdom — ²Unilase Ltd, 1 Filament Walk, Unit G02, London, SW18 4GQ, United Kingdom

First unidirectional single-frequency operation of a wavelength-tunable red-diode-pumped Alexandrite ring laser demonstrating continuous-wave output power > 1W in TEM₀₀ mode with M₂ < 1.2 and wavelength tuning from 727 - 792 nm.

Poster

ThP.25 9:30

Tm3+ and Ho3+-doped monoclinic MgWO₄ – promising materials for efficient lasers at >2 μm — PAVEL LOIKO¹, LIZHEN ZHANG², JOSEP MARIA SERRES³, YICHENG WANG⁴, HAIFENG LIN², GE ZHANG², ESROM KIFLE³, MAGDALENA AGUILÓ³, FRANCESC DÍAZ³, UWE GRIEBNER⁴, VALENTIN PETROV⁴, ZHOUBIN LIN², WEIDONG CHEN^{2,4}, and XAVIER MATEOS³ — ¹ITMO University, 49 Kronverkskiy pr., 197101 St. Petersburg, Russia — ²Key Laboratory of Optoelectronic Materials Chemistry and Physics, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou, 350002 Fujian, China — ³Universitat Rovira i Virgili, Depart. Química Física i Inorgànica, FiCMA-FiCNA-EMaS, Campus Sescelades, E-43007, Tarragona, Spain — ⁴Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2a, D-12489 Berlin, Germany

Monoclinic magnesium tungstate (MgWO₄) crystals doped with Tm3+ and Ho3+ ions are promising for tunable and mode-locked lasers at >2 μm due to their large Stark splittings and strongly polarized stimulated-emission cross-sections. Tunable (1897-2062 nm) and vibronic (2093 nm) operation of Tm3+:MgWO₄ is demonstrated. The first Ho3+:MgWO₄ laser is presented.

Poster

ThP.26 9:30

Spectroscopy and diode-pumped laser operation of Er3+,Yb3+:Ca3RE2(BO3)4 (RE=Y, Gd) laser — KONSTANTIN GORBACHENYA¹, VIKTOR KISEL¹, ANATOL YASUKEVICH¹, ROMAN DEINEKA¹, ALEXEY SHEKHVOTSOV², MIRON KOSMYNA², and NIKOLAY KULESHOV¹ — ¹Center for Optical Materials and Technologies, Belarusian National Technical University, 65/17 Nezavisimosti Ave., Minsk, Belarus — ²Institute for Single Crystals, NAS of Ukraine, Lenin Ave. 60, Kharkov, Ukraine

Laser related spectroscopy and, for the first time to our knowledge, laser operation of Er,Yb:Ca₃RE₂(BO₃)₄ (RE=Y, Gd) crystals are presented. The absorption and emission cross-section spectra, luminescence kinetics and Yb→Er energy transfer efficiencies were investigated. The maximal peak output power of 0.5

W was obtained at 1534 nm.

Poster

ThP.27 9:30

Spectroscopic properties of Eu³⁺:LiYF₄ and lasing on the 5D₀ → 7F₄ transition — •MAXIM DEMESH¹, ELENA CASTELLANO-HERNÁNDEZ², ANATOL YASUKEVICH¹, VIKTOR KISEL¹, VLADIMIR DASHKEVICH³, VALENTIN ORLOVICH³, ELENA DUNINA⁴, ALEXEI KORNIENKO⁴, CHRISTIAN KRÄNKEL², and NIKOLAI KULESHOV¹ — ¹Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — ²Center for Laser Materials, Leibniz Institute for Crystal Growth, Berlin, Germany — ³Vitebsk State Technological University, Vitebsk, Belarus — ⁴B.I. Stepanov Institute of Physics, NAS of Belarus, Minsk, Belarus

We reexamined Eu:YLF as a gain medium for the visible lasers. Laser-related spectroscopic properties are determined and laser operation was demonstrated. Up to 15 mW of CW laser output at 702 nm is obtained using a Eu³⁺(7.6 at. %):LiYF₄ under pumping with a 2ω-Ti:sapphire laser at 393.5 nm.

Poster

ThP.28 9:30

Growth of novel QPM structures in orientation-patterned gallium phosphide — •PETER SCHUNEMANN, DANIEL MAGARELL, and LEONARD POMERANZ — BAE Systems, Nashua, NH, USA

We report the successful growth and fabrication of engineered quasi-phase-matched grating structures - parallel gratings, tandem gratings, linear- and curved fan gratings, and chirped gratings - in the new nonlinear optical semiconductor OP-GaP by means of hydride vapor phase epitaxy on MBE-grown templates.

Poster

ThP.29 9:30

Synthesis and horizontal gradient freeze growth of barium chalcogenide crystals for mid-IR frequency conversion — •PETER SCHUNEMANN and KEVIN ZAWILSKI — BAE Systems, Nashua, NH, USA

Horizontal gradient freeze growth in transparent furnaces yields extremely favorable crystallization of high-optical quality barium thiogallate and selenogallate: two new nonlinear optical crystals with wide band gaps, deep infrared transparency, and moderately high nonlinear coefficients.

Poster

ThP.30 9:30

CSP: an alternative to ZGP for power scaling mid-IR parametric sources — •PETER SCHUNEMANN, KEVIN ZAWILSKI, and LEONARD POMERANZ — BAE Systems, Nashua, NH, USA

Cadmium silicon phosphide, CdSiP₂ (CSP), was developed in recent years as a ZGP analog which could be pumped by 1- or 1.5-micron laser sources. Improved crystal quality and reduced losses now make CSP more favorable than ZGP even for 2-micron-pumped applications due to its higher nonlinearity and reduced thermal lensing.

Poster

ThP.31 9:30

Nanosecond Pulses from SESAM Q-switched Er:Y₂O₃ Laser at 2.7 μm — •RICHARD ŠVEJKAR, JAN ŠULC, MICHAL NĚMEC, and HELENA JELÍNKOVÁ — Czech Technical University in Prague, Faculty of Nuclear Sciences and Physical Engineering, Prague, Czech Republic

In this work we present results from passively Q-switched Er:Y₂O₃ ceramic. Using the short laser resonator with the saturable absorber mirror allow to generate laser pulses with a duration 21.6 ns, repetition rate 35.7 kHz, single Q-switched pulse energy 0.94 μJ, emission wavelength 2717 nm, and peak power 43.3 W.

Poster

ThP.32 9:30

Influence of dopant concentration in cryogenic Yb:KLu(WO₄)₂ lasers — •FANGXIN YUE¹, SAMUEL PAUL DAVID¹, VENKATESAN JAMBUNATHAN¹, PETR NAVRATIL¹, JOSEF MARIA SERRES², XAVIER MATEOS², MAGDALENA AGUILÓ², FRANCESC DÍAZ², UWE GRIEBNER³, VALENTIN PETROV³, ANTONIO LUCIANETTI¹, and TOMAS MOCEK¹ — ¹HiLASE Center, Institute of Physics ASCR, Za Radnici 828, 25241 Dolní Břežany, Czech Republic — ²Universitat Rovira i Virgili, Departament Química Física i Inorgànica, Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA)-EMaS, Campus Sescelades, E-43007, Tarragona, Spain — ³Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2a, D-12489 Berlin, Germany

The influence of the Yb³⁺ concentration in KLuW is studied at cryogenic temperatures. From the results, low doping levels are promising for power scaling of the laser as well as for high slope efficiency.

Poster

ThP.33 9:30

LED-pumped Alexandrite lasers — •PIERRE PICHON^{1,2}, JEAN-PHILIPPE BLANCHOT², FRÉDÉRIC DRUON¹, FRANÇOIS BALEMBOIS¹, and PATRICK GEORGES¹ — ¹Laboratoire Charles Fabry, Institut d'Optique Graduate School CNRS, Université Paris-Saclay, 91127, Palaiseau Cedex, France — ²Effilux, 1 rue de Terre Neuve, 91940, les Ulis, France

LED-pumped Alexandrite laser is studied including free-running operation and tunability at a repetition rate of 100 Hz. The particular properties of Alexandrite together with LED advantages open the way for robust, compact, simple, high-energy and low-cost laser systems emitting in the near infrared which is particularly appealing for medical applications.

Poster

ThP.34 9:30

Czochralski growth and optical properties of pure, Yb- and Nd-doped LaxGdySc₄-x-y(BO₃)₄ nonlinear optical and laser crystals — •LUCIAN GHEORGHE¹, MADALIN GRECELEA^{1,2}, FLAVIUS VOICU^{1,2}, FEDERICO KHALED³, PASCAL LOISEAU³, GERARD AKA³, STEFANIA HAU^{1,2}, CRISTINA GHEORGHE¹, GABRIELA CROITORU^{1,2}, and NICOLAIE PAVEL¹ — ¹National Institute for Laser, Plasma and Radiation Physics, Magurele, Romania — ²Doctoral School of Physics, University of Bucharest, Romania — ³Chimie ParisTech, CNRS, Institut de Recherche de Chimie Paris, France

Pure, Yb- and Nd-doped LaxGdySc₄-x-y(BO₃)₄ (LGSB, Yb:LGSB, Nd:LGSB) incongruent melting nonlinear optical (NLO) crystals were successfully grown by the Czochralski method, for the first time to our knowledge, and their optical properties and laser performances were evaluated. The obtained results confirm the high quality of the grown crystals.

Poster

ThP.35 9:30

Compact 999.6 nm actively Q-switched Yb:LuAP laser — •ALEXANDER RUDENKOV¹, VIKTOR KISEL¹, ANATOL YASUKEVICH¹, KARINE HOVHANNESYAN², ASHOT PETROSYAN², and NIKOLAY KULESHOV¹ — ¹Center for Optical Materials and Technologies, Belarusian National Technical University, 65/17 Nezavisimosti Ave., Minsk, 220013 Belarus — ²Institute for Physical Research, National Academy of Sciences, 0203, Ashtarak-2, Armenia

Compact 999.6nm diode-pumped actively Q-switched Yb:LuAP laser is demonstrated. Average output power of 4.9W with pulse repetition frequency up to 50kHz and pulse duration of (11.5–24)ns were obtained. Maximum pulse energy of 333uJ and 29kW peak power were achieved. 97uJ SH-pulses at 10kHz PRF were demonstrated at 499.8nm.

Poster

ThP.36 9:30

Fe:Zn_{0.6}Mn_{0.4}Se laser generating in the wavelength region 5.0 - 5.8 μ m in the temperature range 78 - 300 K — •HELENA JELINKOVÁ¹, MAXIM DOROSHENKO², MICHAL JELINEK¹, JAN ŠULC¹, DAVID VYHLIDAL¹, NAZAR KOVALENKO³, and ANDREY GERASIMENKO³ — ¹FNSPE, Czech Technical University in Prague, Brehova 7, 11519 Prague 1, Czech Republic — ²Prokhorov General Physics Institute, Russian Academy of Sciences, Vavilova 38, Moscow, Russian Federation — ³Institute for single crystals, NAN Ukraine, Kharkov, Ukraine

Temperature-dependent spectroscopic and laser properties of novel Fe:ZnMnSe crystal with high manganese concentration of 0.4 were investigated. Laser central wavelength varied from 5.0 μ m at 78 K up to 5.8 μ m at 300 K without any intracavity wavelength-selective element.

Poster

ThP.37 9:30

Passively Q-switched microchip Tm,Ho:KYW laser with a SWCNTs — •NATALI GUSAKOVA¹, VIKTOR KISEL¹, ANATOL YASUKEVICH¹, SUN YOUNG CHOI², FABIAN ROTHERMUND², ANATOLIY PAVLYUK³, and NIKOLAI KULESHOV¹ — ¹Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — ²Korea Advanced Institute of Science and Technology, Daejeon, South Korea — ³Institute of Inorganic Chemistry, Siberian Branch, Russian Academy of Sciences, Novosibirsk, Russia

We present a diode-pumped passively Q-switched Tm-Ho:KYW microchip laser using a single-walled carbon nanotubes (SWCNTs). The pulses with 89 ns duration, 0.22 μ J energy and 717 kHz were obtained at 2057 nm

Poster

ThP.38 9:30

Broadly-tunable diode pumped Tm:SBN laser — •JAN ŠULC¹, RICHARD ŠVEJKAR¹, KAREL VESELSKÝ¹, HELENA JELÍNKOVÁ¹, MAXIM E. DOROSHENKO², ALEXANDER G. PAPASHVILI², PAVEL A. LYKOV², and LIUDMILA I. IVLEVA² — ¹Czech Technical University in Prague, FNSPE, Prague, Czech Republic — ²General Physics Institute of Russian Academy of Sciences, Moscow, Russian Federation

Diode pumped laser based on Tm:SBN (Sr_{0.61}Ba_{0.39}Nb₂O₆, 2 wt.% of Tm₂O₃) crystal was investigated at 300 K. Smooth tuning from 1830 up to 2102 nm was reached using quartz plate as a tuning element. The energy of 0.4 mJ @ 2045 nm was obtained for the absorbed pumping energy 44 mJ.

Poster

ThP.39 9:30

Ti:Sapphire spectroscopic and laser characteristic investigation down to cryogenic temperatures — •MARTIN FIBRICH^{1,2}, JAN ŠULC¹, MICHAL JELÍNEK¹, HELENA JELÍNKOVÁ¹, and VÁCLAV KUBEČEK¹ — ¹Czech Technical University in Prague — ²Institute of Physics ASCR, ELI-Beamlines

We report on temperature influence on spectroscopic and laser properties of Ti:Sapphire crystal. Fluorescence lifetime,

polarization-resolved absorption and emission spectra, and laser characteristics at ~750nm are described in detail within 78-320K temperature range. Cooling of Ti:Sapphire crystal down to cryogenic temperatures resulted in a dramatic improvement of its laser properties.

Poster

ThP.40 9:30

Tunable Dy:PbGa₂S₄ laser pumped by 1.7 μ m radiation — •MICHAL NĚMEC¹, JAN ŠULC¹, MAXIM DOROSHENKO², HELENA JELÍNKOVÁ¹, VALERII BADIKOV³, and DMITRII BADIKOV³ — ¹Czech Technical University in Prague - FNSPE, Prague, Czech Republic — ²A. M. Prokhorov General Physics Institute, Moscow, Russia — ³Kuban State University, Krasnodar, Russia

The possibility of Dy:PbGa₂S₄ laser radiation wavelength selection by a birefringent plate at room temperature was investigated. As pump system, a fiber coupled laser diode generating at 1.7 μ m was utilized. The Dy:PbGa₂S₄ laser tuning range extended from 4320 nm up to 4680 nm.

Poster

ThP.41 9:30

Growth and characterization of Sm- and Dy-doped CNGG and CLNGG single crystals for laser emission in the yellow - orange spectral range — •MADALIN GRECCULEASA^{1,2}, LUCIAN GHEORGHE¹, FLAVIUS VOICU^{1,2}, CRISTINA GHEORGHE¹, STEFANIA HAU^{1,2}, and AUREL-MIHAI VLAICU³ — ¹National Institute for Laser, Plasma and Radiation Physics, Magurele, Romania — ²Doctoral School of Physics, University of Bucharest, Romania — ³National Institute of Materials Physics, Magurele, Romania

Single crystals of Sm- and Dy-doped CNGG and CLNGG crystals were successfully grown by the Czochralski method, for the first time to our knowledge, and their structural and optical properties were evaluated. For the doping of the grown crystals, five new stoichiometric garnets were synthesised and investigated by X-ray diffraction.

Poster

ThP.42 9:30

Spectroscopic properties of Tb³⁺:KY(WO₄)₂ — •MAXIM DEMESH¹, VIKTOR KISEL¹, NIKOLAI KULESHOV¹, ALEXANDER MUDRYI², ELENA CASTELLANO-HERNÁNDEZ³, CHRISTIAN KRÄNKEL³, and ANATOLIY PAVLYUK⁴ — ¹Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — ²Scientific-Practical Material Research Centre of the NAS of Belarus, Minsk, Belarus — ³Center for Laser Materials, Leibniz Institute for Crystal Growth, Berlin, Germany — ⁴Institute of Inorganic Chemistry, Siberian Branch, Russian Academy of Sciences, Novosibirsk, Russia

We present the spectroscopic properties of Tb³⁺:KY(WO₄)₂ with regard to its applicability as a laser gain medium for the visible spectral range. Cross sections are about one order of magnitude higher than the corresponding values for fluoride crystals. However, ESA and charge transfer suppressed the laser oscillation.

ThM2: Special Symposium 2

Time: Thursday, 11:00–12:30

Location: Auditorium

Invited

ThM2.1 11:00

Laser applications in the field of e-mobility — •BERTHOLD SCHMIDT — TRUMPF Lasertechnik GmbH, Johann-Maus-Street 2, 71254 Ditzingen, Germany

Advanced applications in the world of e-mobility are important drivers for optimization of TRUMPF's laser systems. Latter allow

defect-free and hermetic sealings, spatter-free welding of copper and of dissimilar materials. Combined with progressive sensors and I4.0 readiness these laser systems yield perfect solutions for the next generation of industrial manufacturing.

Invited

ThM2.2 11:30

Importance of laser parameter control in laser material processing — •STEWART WILLIAMS — Cranfield University, College Road, Cranfield, Bedfordshire, MK43 0AL, United Kingdom

Laser are a perfect energy source in material processing due to their capability for being controlled, both spatially and temporally. The usefulness of this controllability will be illustrated in new applications in both additive manufacture and welding. The importance of in stability of the laser parameters will be highlighted.

Oral

ThM2.3 12:00

Robust Picosecond 2.09- μ m Ho:YAG CPA for Material Processing — •IGNAS ASTRAUSKAS¹, TOBIAS FLÖRY¹, PAVEL MALEVICH¹, AUDRIUS PUGŽLYS^{1,2}, and ANDRIUS BALUŠKA^{1,2} — ¹Photonics Institute, TU Wien, Gusshausstrasse 27-387, A-1040, Vienna, Austria — ²Center for Physical Sciences and Technology, Savanoriu Ave. 231, LT-02300, Vilnius, Lithuania

We present a high-performance 3.5-ps; 1.4-mJ; 14-W Ho:YAG amplifier with a simple robust dispersion and bandwidth man-

agement and demonstrate advantages of long wavelength short pulse laser processing in several classes of materials in the single- and multi-photon ablation and optical damage regimes.

Oral

ThM2.4 12:15

Scaling ultrafast laser pulse induced glass modifications for cleaving applications — KLAUS BERGNER¹, •MALTE SIEMS¹, MICHEAL MÜLLER¹, ROBERT KLAS^{1,3}, JENS LIMPET^{1,2,3}, and STEFAN NOLTE^{1,2} — ¹Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, Albert-Einstein-Straße 15, 07745 Jena, Germany — ²Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Straße 7, 07745 Jena, Germany — ³Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany

Ultrashort laser pulses allow for in-volume processing of glass through non-linear absorption, which can be used e.g. for glass cutting applications. We report on the scaling of this approach to glasses thicker than 20 mm by using a novel femtosecond fiber laser system in combination with spatial beam shaping.

12:30–14:00: Lunch Break

ThA1: THz, and XUV Generation

Chaired by Jens Biegert, ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain

Time: Thursday, 14:00–16:00

Location: Auditorium

Oral

ThA1.1 14:00

50-fs thin-disk laser oscillator generating broadband THz pulses — •CLÉMENT PARADIS¹, NORBERT MODSCHING¹, OLGA RAZSKAZOVSKAYA¹, JAKUB DRS¹, FRANK MEYER², CHRISTIAN KRÄNKEL³, CLARA J. SARACENO², VALENTIN J. WITTE¹, and THOMAS SÜDMEYER¹ — ¹Laboratoire Temps-Fréquence, Université de Neuchâtel, Switzerland — ²Photonics and Ultrafast Laser Science, Ruhr Universität Bochum, Germany — ³Center for Laser Materials, Leibniz Institute for Crystal Growth, Berlin, Germany

We demonstrate MHz-repetition-rate broadband-THz-pulse generation and detection using directly the output of an ultrafast thin-disk laser oscillator without any external amplification or compression. Optical rectification of the 50-fs infrared pump pulses in GaP crystals led to the generation of THz pulses with a broad spectrum extending up to 6 THz.

Oral

ThA1.2 14:15

Extreme THz Fields from Mid-IR Two-Color Laser-Driven Plasma — ANASTASIOS D. KOULOULIDIS^{1,2}, •CLAUDIA GOLLNER³, VALENTINA SHUMAKOVA³, VLADIMIR FEDOROV^{1,4}, AUDRIUS PUGŽLYS^{3,5}, ANDRIUS BALUŠKA^{3,5}, and STELIOS TZORTZAKIS^{1,2,6} — ¹Science Program Texas A&M University at Qatar, Doha, Qatar — ²Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology, Heraklion, Greece — ³Photonics Institute TU Wien, Vienna, Austria — ⁴P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia — ⁵Center for Physical Sciences & Technology, Vilnius, Lithuania — ⁶Department of Materials Science and Technology, Heraklion, Greece

We demonstrate broadband strong THz emission from two-color mid-infrared (3.9 μ m) femtosecond laser filaments. The maximum achieved THz pulse energy is 49 μ J, wherein the conversion

efficiency approaches the percent level, which is at least one order of magnitude higher than the previously reported for plasma-based THz sources.

Oral

ThA1.3 14:30

THz Generation Driven by a 120W Average Power Ultrafast Thin-Disk Oscillator — •NEGAR HEKMAT, FRANK MEYER, SAMIRA MANSOURZADEH, MARTIN HOFFMANN, and CLARA JODY SARACENO — Photonics and Ultrafast Laser Science, Ruhr Universität Bochum, Bochum, Germany

We demonstrate THz generation via optical rectification in GaP, driven by a 120-W average power Yb:YAG modelocked Thin-Disk laser. To the best of our knowledge, this is the first time THz radiation is generated with a 100-W class driving laser. We measure THz power up to 78 μ W at 0.8 THz.

Oral

ThA1.4 14:45

Amplitude and Phase Shaping of High-Energy Femtosecond Pulses at THz Burst Frequencies — •TOBIAS FLÖRY¹, EDGAR KAKSIS¹, IGNAS ASTRAUSKAS¹, TADAS BALCIUNAS¹, AUDRIUS PUGŽLYS^{1,2}, ANDRIUS BALUŠKA^{1,2}, DANIIL KARTASHOV³, ALEXANDER MITROFANOV⁴, ANDREY FEDOTOV⁴, DMITRIY SIDOROV-BIRYUKOV⁴, and ALEXEY ZHELTIKOV^{4,5,6} — ¹Photonik Institut, Technische Universität Wien, Gusshausstrasse 27 / 387, 1040 Vienna, Austria — ²Center for Physical Sciences & Technology, Savanoriu Ave. 231 LT-02300 Vilnius, Lithuania — ³Friedrich-Schiller University Jena, Max-Wien Platz 1, 07743 Jena, Germany — ⁴Physics Department, M.V. Lomonosov Moscow State University, 119992 Moscow, Russia — ⁵Russian Quantum Center, ul. Novaya 100, Skolkovo, Moscow Region, 143025 Russia — ⁶Department of Physics and Astronomy, Texas A&M University, College Station TX, 77843–4242, USA

We demonstrate generation of fully controllable fs multimillijoule pulse bursts with the energy handling, throughput effi-

ciency and frequency resolution substantially exceeding spatial-light-modulator and interferometric techniques. A proof-of-concept experiment coherently controls nitrogen-ion emission via multiple-pulse excitation.

Oral ThA1.5 15:00

Phase-matched high-harmonic generation at 77 MHz repetition rate — •CHRISTOPH M HEYL^{1,2,3}, GIL PORAT¹, STEPHEN B SCHOON¹, CRAIG BENKO¹, NADINE DÖRRE^{1,4}, KRISTAN L CORWIN^{1,5}, and JUN YE¹ — ¹JILA, NIST and the University of Colorado, 440 UCB, Boulder, CO 80309-0440, USA — ²Department of Physics, Lund University, P. O. Box 118, SE-221 00 Lund, Sweden — ³Now at: Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena and Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany — ⁴University of Vienna, Faculty of Physics, VCQ & QuNaBioS, Boltzmannngasse 5, A-1090 Vienna, Austria — ⁵Department of Physics, Kansas State University, Manhattan, Kansas, USA

We discuss recent progress for power scaling of extreme ultraviolet frequency combs enabling phase-matched high harmonic generation at 77 MHz repetition rate. We demonstrate a generated average power of 2 mW at photon energy of 12.7 eV.

Oral ThA1.6 15:15

Separation of High Average Power Driving Lasers from Higher Order Harmonics Using an Annular Beam — •ALEXANDER KIRSCHKE^{1,2}, ROBERT KLAS^{1,2}, MAXIM TSCHERNAJEV^{1,2}, ANDREAS TÜNNERMANN^{1,2,3}, JAN ROTHARDT^{1,2}, and JENS LIMPET^{1,2,3} — ¹Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University Jena, Albert-Einstein-Straße 15, 07745 Jena, Germany — ²Helmholtz Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — ³Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Straße 7, 07745 Jena, Germany

An annular beam is used as an effective and power scalable beam

separation method for high average power laser driven high harmonic generation, showing a 27% lower conversion efficiency and similar phase matching conditions compared to its Gaussian beam counterpart.

Oral ThA1.7 15:30

Towards Chirp Control of XUV Free Electron Lasers — •MEHDI M. KAZEMI¹, ARMIN AZIMA², VANESSA GRATTONI¹, BASTIAN MANSCHWETUS¹, JÖRN BÖDEWADT¹, CHRISTOPH LECHNER¹, TIM PLATH⁴, ROSEN IVANOV¹, LESLIE LAMBERTO LAZZARINO², VELIZAR MILTCHEV², ANDREAS PRZYSTAWIK¹, SHAUKAT KHAN⁴, TIM LAARMANN^{1,3}, WOLFGANG HILLERT², RALPH ASSMANN¹, JÖRG ROSSBACH², MARKUS DRESCHER², WILFRIED WURTH², and INGMAR HARTL¹ — ¹Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — ²Universität Hamburg, Hamburg, Germany — ³The Hamburg Centre for Ultrafast Imaging, Hamburg, Germany — ⁴Technische Universität Dortmund, Dortmund, Germany

We use 267nm femtosecond laser pulses to modulate electrons of a XUV free electron laser. By changing the chirp of this laser pulses we can influence the chirp of the generated XUV FEL pulses, which are characterized by THz streaking. The measured effect is in agreement with simulations.

Oral ThA1.8 15:45

Flexible Pulse-Train Amplitude Shaping for the European XFEL Photoinjector Laser — LUTZ WINKELMANN, CHRISTIAN MOHR, HONGWEI CHU, SARPER SALMAN, and •INGMAR HARTL — DESY, Hamburg, Germany

A pulse-to-pulse energy control scheme for the new 266nm, 4.5 MHz burst-mode drive laser for the high-brightness photocathode gun of the European XFEL is presented. The system stabilizes against Nd:YVO4 amplifier gain dynamics and temperature slopes in burst operation. We achieved a long-time electron charge stability of better than 0.7%.

16:00–16:30: Exhibition and Coffee Break

ThA2: Novel Active Materials

Chaired by Andrejus Michailovas, UAB Ekspla, Vilnius, Lithuania

Time: Thursday, 16:30–18:30

Location: Auditorium

Invited ThA2.1 16:30

Highly efficient Mid-infrared laser operation of Ho³⁺, Er³⁺ and Tm³⁺ doped fluorite single crystals — •LIANGBI SU^{1,2}, ZHEN ZHANG¹, FENGKAI MA¹, XINSHENG GUO¹, JIE LIU³, and VACLAV KUBECEK⁴ — ¹Synthetic Single Crystal Research Center (SSCRC), CAS Key Laboratory of Transparent and Opto-functional Inorganic Materials, Shanghai Institute of Ceramics, Chinese Academy of Sciences, Shanghai 201899, China — ²State Key Laboratory of High Performance Ceramics and Superfine Microstructure, Shanghai Institute of Ceramics, Chinese Academy of Sciences, Shanghai 201899, China — ³Shandong provincial key laboratory of optics and photonic device, School of Physics and Electronics, Shandong Normal University, Jinan 250014, China — ⁴Faculty of Nuclear Sciences and Phys. Eng., Czech Technical University in Prague, Brehova 7, 115 19 Prague, Czech Republic

In this work, crystal growth, optical spectra properties, and highly-efficient laser performances of Ho, Er and Tm doped CaF₂ and SrF₂ single crystals were investigated, which were codoped with the local lattice structure regulators of Y, La or Gd ions.

Oral ThA2.2 17:00

Tb³⁺-doped materials for efficient lasing at 588 nm — •ELENA CASTELLANO-HERNÁNDEZ¹, ANASTASIA UVAROVA¹, MAXIM DEMESH², HIROKI TANAKA^{1,3}, and CHRISTIAN KRÄNKEL¹ — ¹Center for Laser Materials, Leibniz-Institute for Crystal Growth (IKZ), Berlin, Germany — ²Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — ³Department of Electronics and Electrical Engineering, Keio University, Yokohama, Japan

We present the most efficient and highest output power Tb³⁺:LiLuF₄ yellow solid-state lasers. Under 2.16 W absorbed 2ω-OPSL pump power at 486.2 nm we obtained 0.5 W of cw laser output at 587.5 nm with a slope efficiency of 25%. Our direct approach enables compact, efficient and cost-efficient yellow lasers.

Oral

ThA2.3 17:15

High power mode-locked Yb:LuAP bulk laser — •ALEXANDER RUDENKOV¹, VIKTOR KISEL¹, ANATOL YASUKEVICH¹, KARINE HOVHANNESYAN², ASHOT PETROSYAN², NATALIYA RUBTSOVA³, ALEXEY KOVALYOV³, VALERY PREOBRAZHENSKI³, and NIKOLAY KULESHOV¹ — ¹Center for Optical Materials and Technologies, Belarusian National Technical University, 65/17 Nezavisimosti Ave., Minsk, 220013 Belarus — ²Institute for Physical Research, National Academy of Sciences, 0203, Ashtarak-2, Armenia — ³Rzhanov Institute of Semiconductor Physics, Siberian Branch of Russian Academy of Sciences, Academician Lavrentyev Ave., 13, Novosibirsk 630090, Russia

High power mode-locked Yb:LuAP bulk laser is demonstrated in the wide wavelength range (999.3-1040.9nm). 90fs-pulses with 2.9W average power were obtained for E//b polarization. 840-fs pulses with maximum output power of 7.8W were obtained with 31% optical efficiency at 999.3nm central wavelength for E//c polarization.

Oral

ThA2.4 17:30

Broadband graphene and SESAM mode-locking of Yb:CNIGS lasers — •MACIEJ KOWALCZYK^{1,2}, XUZHANG ZHANG^{3,4}, XAVIER MATEOS³, ZHENGPING WANG⁴, XINGUANG XU⁴, PAVEL LOIKO⁵, YOUNG JUN CHO⁶, FABIAN ROTERMUND⁷, JAROSŁAW SOTOR¹, UWE GRIEBNER², and VALENTIN PETROV² — ¹Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland — ²Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2a, D-12489 Berlin, Germany — ³Universitat Rovira i Virgili, Depart. Química Física i Inorgànica, FICMA-FICNA-EMaS, Campus Sescelades, E-43007 Tarragona, Spain — ⁴State Key Laboratory of Crystal Materials and Institute of Crystal Materials, Shandong University, 250100 Jinan, China — ⁵ITMO University, 49 Kronverkskiy pr., 197101 St. Petersburg, Russia — ⁶Department of Energy Systems Research, Ajou University, Worldcup-ro 206, 443-749 Suwon, Republic of Korea — ⁷Department of Physics, KAIST, Daehak-ro 291, Yuseong-gu, 34141 Daejeon, Republic of Korea

We report on a first mode-locked Yb:CNIGS oscillator. The single-mode diode-pumped laser was mode-locked with a semiconductor saturable absorber mirror and a bi-layer graphene saturable absorber. In these two regimes it delivered 52 fs and 80 fs pulses, respectively.

Oral

ThA2.5 17:45

SWCNT-SA mode-locked Tm:(Lu,Sc)2O3 mixed ceramic laser at 2 μ m — •YICHENG WANG¹, WEI JING², PAVEL LOIKO³, YONGGUANG ZHAO¹, HUI HUANG², ZHONGBEN PAN^{1,2}, XAVIER MATEOS⁴, YONG JUN CHO⁵, FABIAN ROTERMUND⁶, UWE GRIEBNER¹, and VALENTIN PETROV¹ — ¹Max-Born-Institute, Berlin, Germany — ²Institute of Chemical Materials, Mi-nyang, China — ³ITMO University, Saint-Petersburg, Russia — ⁴Universitat Rovira i Virgili, Tarragona, Spain — ⁵Ajou University, Suwon, Republic of Korea — ⁶Korea Advanced Institute of Science and Technology, Daejeon, Republic of Korea

We demonstrate a SWCNT-SA mode-locked Tm:(Lu,Sc)2O3 mixed ceramic laser. Pulse duration of 125/117 fs was obtained for an average output power of 62/175 mW at 2000/2073 nm, respectively.

Oral

ThA2.6 18:00

Broadly tunable diode-pumped femtosecond Tm:LuScO3 laser — •NEIL K STEVENSON^{1,2}, C TOM A BROWN², JOHN-MARK HOPKINS¹, MARTIN D DAWSON^{1,3}, and ALEXANDER A LAGATSKY¹ — ¹Fraunhofer Centre for Applied Photonics, Fraunhofer UK, Technology and Innovation Centre, Glasgow, G1 1RD, UK — ²SUPA, School of Physics and Astronomy, University of St Andrews, St Andrews, KY16 9SS, UK — ³Institute of Photonics, University of Strathclyde, Technology and Innovation Centre, Glasgow, G1 1RD, UK

We report on a diode-pumped femtosecond Tm:LuScO3 laser broadly tunable over 87 nm around 2.06 μ m. The shortest recorded pulse duration of 225 fs corresponded to an average output power of 85 mW. Continuous wavelength tuning was achieved by using a dive cut quartz birefringent filter.

Oral

ThA2.7 18:15

60-W cryogenically-cooled Nd:YAG 946nm laser — •SILVIA CANTE, STEFANO VALLE, and JACOB I. MACKENZIE — Optoelectronics Research Centre, University of Southampton, Southampton SO17 1BJ, United Kingdom

Power-scaling the 946nm Nd:YAG laser via cryogenically-cooling the gain media is explored. Critical spectroscopic data are determined for 0.3at.% and 0.6at.% doping levels, providing a foundation for designing these lasers. As a result, the first 60W in-band end-pumped cryo-cooled 946nm laser with 52% efficiency (versus absorbed power) is reported.

FrM1: Fiber Lasers and Amplifiers - Novel Design, mid-IR

Chaired by David Lancaster, The Uni. of South Australia, Adelaide, Australia

Time: Friday, 8:15–10:00

Location: Auditorium

Invited

FrM1.1 8:15

Sub-cycle Quantum Physics with Ultrabroadband Fiber Laser — •DANIELE BRIDA — Department of Physics and Center for Applied Photonics, University of Konstanz, Konstanz, Germany — Physics and Materials Science Research Unit, University of Luxembourg, Luxembourg

Single cycle pulses produced by a femtosecond Er:fiber laser system display passive control of the carrier-envelope phase. The electric field of these pulses is exploited to drive fundamental physical phenomena at the sub-cycle timescale.

Oral

FrM1.2 8:45

100 μ J picosecond pulses from a single-stage fluoride fiber amplifier at 2.86 μ m — •YIGIT OZAN AYDIN¹, VINCENT FORTIN¹, DARREN KRAEMER², RÉAL VALLÉE¹, and MARTIN BERNIER¹ — ¹Centre d'Optique, Photonique et Laser (COPL), Université Laval, Québec City, Québec G1V 0A6, Canada — ²Light Matter Interaction Inc., 95 Advance Road, Toronto, Ontario M8Z 2S6, Canada

We report the demonstration of a 2.86 μ m Ho³⁺, Pr³⁺ co-doped fiber amplifier based on one-stage amplification delivering 113 μ J, 500 ps pulses at 1 kHz repetition rate with a peak power of 225 kW. The obtained pulse energy is a record from a single-stage fluoride fiber amplifier.

Oral

FrM1.3 9:00

200 mW-level, few-optical-cycle tunable femtosecond mid-infrared source based on a Cr:ZnS oscillator and step-index fluoride fibers — •NATHALIE NAGL¹, KA FAI MAK², VLADIMIR PERVAK¹, FERENC KRAUSZ^{1,2}, and OLEG PRONIN² — ¹Ludwig-Maximilians Universität München, Garching, Germany — ²Max-Planck Institute of Quantum Optics, Garching, Germany

We report generating a 1.5-octave-spanning spectrum and wavelength-tunable femtosecond pulses in the 2–5 μ m region at 200 mW-level by combining a Cr:ZnS oscillator with a nonlinear fiber broadening stage. Coupling the 46 fs pulses into ZBLAN fibers, clear soliton dynamics were demonstrated, including soliton self-compression and soliton self-frequency shift.

Oral

FrM1.4 9:15

high efficient dual-wavelength-pumped (1050 + 1220 nm) Tm³⁺-doped ZBLAN fiber MOPA at 813 nm — •EIJI KAJIKAWA¹, TAKASHI KUBO¹, TOMOHIRO ISHII¹, YU-ICHI TAKEUCHI¹, MITSURU MURASHI¹, and KAZUHIKO OGAWA² — ¹institute for laser science, university of electro-communications, tokyo, japan — ²fiberlabs inc., saitama, japan

We have developed the Tm³⁺-doped ZBLAN fiber MOPA at 813 nm for the trapping laser of Sr optical lattice clock. By using dual-wavelength-pumping scheme (1050 + 1220 nm), the slope efficiency has been improved to 25%, which is the highest slope efficiency to best of our knowledge.

Oral

FrM1.5 9:30

kW-level average power from an ultrafast Tm-doped fiber CPA — •CHRISTIAN GAIDA¹, MARTIN GEBHARDT^{1,2}, TOBIAS HEUERMANN^{1,2}, FABIAN STUTZKI³, CESAR JAUREGUI¹, and JENS LIMPERT^{1,2,3} — ¹Institute of Applied Physics, Jena, Germany — ²Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — ³Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

We present a thulium-doped fiber chirped pulse amplifier with 790 W average power, 250fs pulses and diffraction limited beam quality with high stability (RIN<1%). The average power scaling capabilities are further analyzed in the context of optical to optical efficiency, available pump brightness and transverse mode instabilities.

Oral

FrM1.6 9:45

Suppression of stimulated Brillouin scattering in a counter-pumped fiber Raman amplifier with intensity modulated pump — •HARISH ACHAR VASANT^{1,2} and JOHAN NILSSON¹ — ¹Optoelectronics Research Centre, University of Southampton, Southampton, UK - SO182NU — ²Department of Physics, Karnataka University, Dharwad, India - 580003

We improve the stimulated Brillouin scattering (SBS) threshold in a counter-pumped fiber Raman amplifier by intensity modulating the pump. The modulated pump broadens the Stokes linewidth through cross-phase modulation without broadening the signal. This inhibits the build-up of the Brillouin Stokes wave. We experimentally demonstrate 4.7 dB SBS threshold enhancement.

10:00–10:30: Coffee Break

FrM2: Thin Disk Oscillators

Chaired by Uwe Griebner, Max Born Institute, Berlin, Germany

Time: Friday, 10:30–12:30

Location: Auditorium

Invited

FrM2.1 10:30

Ultrafast thin-disk oscillators at 1 μm and 2 μm wavelengths — •OLEG PRONIN¹, MARKUS PÖTZELBERGER¹, KILIAN FRITSCH², SEBASTIAN GRÖBMEYER², DOMINIK BAUER³, DIRK SUTTER³, KAFAI MAK¹, JONATHAN BRONS², JINWEI ZHANG¹, and FERENC KRAUSZ^{1,2} — ¹Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — ²Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching, Germany — ³TRUMPF Laser GmbH, D-78713 Schramberg, Germany

Recent progress in the development of ultrafast thin-disk oscillators at 1 μm and 2 μm wavelengths will be reviewed. This will include an oscillator with the highest peak power operating in ambient air, novel CEP stabilization and all-bulk external spectral broadening techniques. Additionally, high-power ultra-broadband infrared frequency comb generation will be reported.

Oral

FrM2.2 11:00

100 W-level carrier-envelope-phase stable thin-disk oscillator — •SEBASTIAN GRÖBMEYER¹, JONATHAN BRONS¹, MARCUS SEIDEL², and OLEG PRONIN² — ¹Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching, Germany — ²Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany

We present carrier-envelope-phase (CEP) stabilization of a Kerr-lens mode-locked thin-disk oscillator by realizing Kerr-lensing in a quartz crystal simultaneously serving as an acousto-optic loss-modulator. With this original method 105 W average output power and intra-cavity peak-powers exceeding 200 MW were achieved, representing the highest average power CEP stable laser today.

Oral

FrM2.3 11:15

Kerr-lens mode-locked thin-disk oscillator with 50% output coupling rate — •MARKUS POETZLBERGER¹, JONATHAN BRONS², DOMINIK BAUER³, DIRK SUTTER³, JINWEI ZHANG¹, FERENC KRAUSZ^{1,2}, and OLEG PRONIN¹ — ¹Max-Planck-Institut für Quantenoptik, Garching, Germany — ²Ludwig-Maximilians-Universität München, Garching, Germany — ³TRUMPF Laser GmbH, Schramberg, Germany

Highest peak-power (43 MW) femtosecond thin-disk oscillator operating in ambient air is demonstrated. 50% output coupling rate is realized by means of 16 passes through the thin-disk. Hardly any spectral narrowing is observed, resulting in 290fs short pulses. This effect is attributed to the enhanced soft-aperture in the thin-disk.

Oral

FrM2.4 11:30

Discrete similariton and dissipative soliton modelocking of thin-disk lasers — •F. ÖMER ILDAY^{1,2,3}, DENIZHAN KORAY KESIM², MARTIN HOFFMANN⁴, and CLARA J. SARACENO⁴ — ¹Department, of Physics, Bilkent University, Ankara 06800, Turkey — ²Department of Electrical and Electronics Engineering, Bilkent University, Ankara 06800, Turkey — ³UNAM – National Nanotechnology Research Center and Institute of Materials Science and Nanotechnology, Bilkent University, Ankara 06800, Turkey — ⁴Photonics and Ultrafast Laser Science, Ruhr Universität Bochum, Germany

We explore numerically the similariton and dissipative soliton modelocking regimes for the next generation of high-energy modelocked thin-disk lasers, and suggest two viable practical implementations of these regimes. Our investigation indicates that both these nonlinearity resistant regimes are promising for mJ-class ultrafast oscillators.

Oral

FrM2.5 11:45

Depletion based thin-disk CEP stabilization concept and realization — •JOSÉ R. C. ANDRADE¹, FABIAN PLACZEK^{1,2}, BERNHARD KREIPE¹, and UWE MORGNER^{1,3,4} — ¹Institut für Quantenoptik, Leibniz Universität Hannover, Hannover, Germany — ²Center for Medical Physics And Biomedical Engineering, Medical University of Vienna, Vienna, — ³Laser Zentrum Hannover e.V., Hannover, Germany — ⁴Hannoversches Zentrum für Optische Technologien, Leibniz Universität Hannover, Hannover, Germany

We present, to the best of our knowledge, a novel CEP locking technique for ultrafast thin-disk lasers. Using the easily accessible large pump area, a secondary cavity is built around the thin-disk in order to modulate the inversion via an AOM. We present the implementation and drawbacks of such technique.

Oral

FrM2.6 12:00

CEO frequency stabilization of a thin disk laser with intra-cavity high harmonic generation — •MAXIM GAPONENKO¹, FRANÇOIS LABAYE¹, PIERRE BROCHARD¹, NORBERT MODSCHING¹, KUTAN GÜREL¹, VALENTIN WITTEW¹, CLEMENT PARADIS¹, CHRISTIAN KRÄNKEL^{2,3}, STEPHANE SCHILT¹, and THOMAS SÜDMEYER¹ — ¹Laboratoire Temps-Fréquence, Institut de Physique, Université de Neuchâtel, Switzerland — ²Institut für Laser-Physik, Universität Hamburg, Germany — ³Center for Laser Materials, Leibniz Institute for Crystal Growth, Germany

We demonstrate the detection and stabilization of the CEO frequency of a mode-locked thin-disk laser with intra-cavity high-harmonic generation at a repetition rate of 17.4 MHz. The laser operates with a high-pressure xenon gas jet at an intracavity peak intensity of $2.6 \times 10^{13} \text{ W/cm}^2$ and 300 W of intracavity average power.

Oral

FrM2.7 12:15

10W-200 μJ Thin-Disk Pumped Few-Cycle OPCPA System — •MARCEL SCHULTZE, STEPHAN PRINZ, SANDRO KLINGEBIEL, CHRISTOPH WANDT, CATHERINE Y. TEISSET, ROBERT BESSING, KNUT MICHEL, and THOMAS METZGER — TRUMPF Scientific Lasers GmbH, Unterföhring, Germany

We present a high-power few-cycle NIR-OPCPA system generating CEP-stabilized 10W-200 μJ -sub7fs pulses with an excellent power stability measured over a time period of more than 28 hours.

12:30–14:00: Lunch Break

FrA1: Few Cycle Mid IR Sources

Chaired by Vaclav Kubecek, Czech Technical University in Prague, Prague, Czech Republic

Time: Friday, 14:00–15:30

Location: Auditorium

Oral

FrA1.1 14:00

Single-cycle strong-field mid-infrared laser source — TOBIAS STEINLE¹, •UGAITZ ELU¹, MATTHIAS BAUDISCH¹, HUGO PIRES¹, FRANCESCO TANI², MICHAEL H. FROSZ², FELIX KOETTIG², ALEXEY ERMOLOV², PHILIP S. RUSSEL², and JENS BIEGERT^{1,3} — ¹ICFO - Institut de Ciències Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — ²Max-Planck Institute for Science of Light, Staudtstraße 2, 91058 Erlangen, Germany — ³ICREA Passeig Lluís Companys 23 08010 Barcelona, Spain

We present a unique single-cycle mid-infrared driving source for strong-field processes based on highly efficient nonlinear compression of a high repetition rate OPCPA. The system delivers CEP stable 1.35 optical cycle pulses (14.5 fs) with 3.9 GW peak power centered at 3.3 μm and 160 kHz repetition rate.

Oral

FrA1.2 14:15

High-energy 7 μm OPCPA pumped by 260 mJ Ho:YLF 2 μm CPA laser — •UGAITZ ELU¹, DANIEL SÁNCHEZ¹, TSUNETO KANAI¹, TOBIAS STEINLE¹, KEVIN ZAWILSKI², PETER G. SCHUNEMANN², OLIVIER CHALUS³, GUILLAUME MATRAS³, CHRISTOPHE SIMON-BOISSON³, and JENS BIEGERT^{1,4} — ¹ICFO - Institut de Ciències Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels, Barcelona, Spain — ²BAE Systems, MER15-1813, P.O. Box 868, Nashua, New Hampshire 03061, USA. — ³THALES Optronique S.A.S., Laser Solutions Unit, 2 avenue Gay-Lussac, 78995 Elancourt Cedex, France — ⁴ICREA, Pg. Lluís Companys 23, 08010 Barcelona, Spain

We present the development of a 2- μm Ho:YLF MOPA system with the record output pulse-energy of 260-mJ. The high-energy Ho:YLF laser is being a key-enabling tool for pumping a new millijoule-level optical parametric chirped pulse amplifiers in the mid-infrared regime.

Oral

FrA1.3 14:30

Picosecond Ho:YLF Chirped Pulse Amplifier System with 10 GW Peak Power at a 1 kHz Repetition Rate — LORENZ VON GRAFENSTEIN, MARTIN BOCK, •UWE GRIEBNER, and THOMAS ELSAESSER — Max Born Institute, Berlin, Germany

We report on a 2.05- μm Ho:YLF based laser source, containing a regenerative and two power amplifiers. The system delivers 40.5 mJ, 3 ps pulses with energy fluctuations of the 1 kHz pulse train <0.3% rms.

Oral

FrA1.4 14:45

Generation of Millijoule Few-Cycle Pulses at 5 μm by Indirect Spectral Shaping of the Idler in an OPCPA — MARTIN BOCK, LORENZ VON GRAFENSTEIN, •UWE GRIEBNER, and THOMAS ELSAESSER — Max Born Institute, Berlin, Germany

We demonstrate the successful application of a midwave-infrared spatial light modulator for the generation of 5- μm idler pulses with duration of 80 fs by shaping the 3.5- μm signal pulses in an OPCPA. The achieved pulse energy in the 1 kHz pulse train amounts to 1.0 mJ.

Oral

FrA1.5 15:00

High-power broadband mid-IR difference-frequency generation driven by a few-cycle 2 μm laser system — •TOBIAS HEUERMANN^{1,2}, CHRISTIAN GAIDA¹, MARTIN GEBHARDT^{1,2}, FABIAN STUTZKI³, CESAR JAUREGUI¹, JOSE ANOTNIO-LOPEZ⁴, AXEL SCHULZGEN⁴, RODRIGO AMEZCUA-CORREA⁴, IOACHIM PUPEZA⁵, ANDREAS TÜNNERMANN^{1,2,3}, and JENS LIMPET^{1,2,3} — ¹Institute of Applied Physics, Jena, Germany — ²Helmholtz Institute Jena, Jena, Germany — ³Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany — ⁴CREOL College of Optics and Photonics, Orlando, USA — ⁵Max-Planck-Institute of Quantum Optics, Garching, Germany

We present efficient intrapulse difference-frequency generation driven by a high-power Tm-doped fiber laser resulting in 450mW of average mid-infrared output power corresponding to 1.8% of conversion efficiency. The produced radiation covers more than an octave with a central wavelength of 12 μm spanning from 7.2 μm to 16.5 μm (10dB width).

Oral

FrA1.6 15:15

Four-octave simultaneous infrared spectral coverage (2–16.5 μm) based on a compact Cr:ZnS laser — •QING WANG^{1,2}, JIN-WEI ZHANG¹, NATHALIE NAGL³, VLADIMIR PERVAK³, FERENC KRAUSZ^{1,3}, OLEG PRONIN¹, and KA FAI MAK¹ — ¹Max-Planck Institute of Quantum Optics, Garching, Germany — ²School of Optics and Photonics, Beijing Institute of Technology, Beijing, China — ³Ludwig-Maximilians Universität München, Garching, Germany

We present a table-top Cr:ZnS-based source capable of simultaneously covering over four octaves (2–16.5 μm) in the mid-infrared ‘molecular finger-print’ region. The simple master-oscillator power-amplifier setup, together with the elegant single-beam intra-pulse difference frequency generation scheme, provide an average mid-infrared power of 1.7 mW—enough to saturate typical HgCdTe (MCT) detectors.

15:30–15:45: Closing Remarks

A

Aadhi, A. WeP.23
Achar Vasant, Harish....•FrM1.6
Ackermann, Alexander... WeP.37
Afkhamiardakani, Hanieh
TuM2.4
Agnesi, Antonio .. TuP.32, TuP.33
Aguiló, Magdalena WeP.18,
ThM1.1, ThM1.2, ThP.19,
ThP.20, ThP.25, ThP.32
Ahmad, Munadi •TuP.27
Aka, Gerard ThP.34
Akçaalan, Önder ThP.15
Alam, Sabir Ul TuP.34
Albrodt, Philipp •TuM1.4
Aleksiev, Dmitriy WeM1.4
Ališauskas, Skirmantas... TuP.21,
WeP.2, WeM2.6
Aloian, Georgii •TuP.23
Alves, Joana •WeP.33
Alyshev, Sergey ThP.2
Amezcu-Correa, RodrigoFrA1.5
Amotchkina, Tatiana ThP.17
Amrani, Foued MoA1.3
Anderson, Miles TuA1.4
Andrade, Jose WeP.26
Andrade, José R. C. WeP.29,
•FrM2.5
Andrade, José Ricardo ... WeP.25
Andrade , José Ricardo Cardoso
de WeP.21
Anotnio-Lopez, Jose..... FrA1.5
Antier, Marie TuM1.3
Antipov, Oleg WeM1.4
Antipov, S. TuP.31
Antoni-Micollier, Laura ... ThP.6
Anuszkiewicz, Alicja WeP.6
Aravazhi, Shanmugam ... WeP.17
Arissian, Ladan TuM2.4
Arshad, M. Assad. WeA1.2
Assmann, Ralph ThA1.7
Astrauskas, Ignas •ThM2.3,
ThA1.4
Aubrecht, Jan •ThP.3
Auguste, Jean-Louis..... WeM1.1
Aydin, Yigit Ozan •FrM1.2
Azima, Armin ThA1.7

B

Babushkin, Ihar WeP.21
Badikov, Dmitrii ThP.40
Badikov, Valerii ThP.40
Bae, Ji Eun ThM1.1
Baev, Valeri M. WeP.12
Bai, Z. TuP.31
Baker, Howard J. WeP.19
Balandin, Vladimir TuP.18
Balandyte, Sigita WeP.38
Balcunas, Tadas ThA1.4
Balcou, Philippe TuM2.2
Balembos, François ThP.18,
ThP.33
Baltuska, Andrius..... MoA2.5,
WeP.2, ThM2.3, ThA1.2,
ThA1.4
bang, Ole WeP.10, WeP.11
Bartelt, Hartmut. . WeA1.2, ThP.7
Barthélémy, Alain WeM1.1
Bartulevicius, Tadas •TuP.15,
TuP.16, TuP.22
Baudisch, Matthias FrA1.1
Bauer, Dominik . FrM2.1, FrM2.3
Becker, Martin ThP.7
Beichert, Luise . •WeP.25, WeP.26
Bellanger, Séverine TuM1.3
Belogolovskii, Dmitrii... TuP.24
Benko, Craig ThA1.5
Bergner, Klaus ThM2.4
Bernier, Martin FrM1.2
Bertoldi, Andrea ThP.5
Bessing, Robert FrM2.7
Biasetti, Demian ThP.16
Biegert, Jens..... FrA1.1, FrA1.2
Bigotta, Stefano TuP.12
Binhammer, Thomas ... •WeP.26
Binhammer, Yuliya WeP.25,
WeP.26
Birch, Rolf B WeP.19

Blanchot, Jean-Philippe... ThP.18,
ThP.33
Blume, Gunnar TuM1.4
Bock, Martin FrA1.3, FrA1.4
Bödewadt, Jörn ThA1.7
Bogusławski, Jakub TuP.8
Böhle, Frederik TuP.28
BOIVIN, Denis TuP.14
Bose, Surajit •WeP.4
Bouchy, François TuA1.4
Boullet, Johan WeP.36
Bourderionnet, Jérôme .. TuM1.3
BOURDON, Pierre TuP.14
Boutu, Willem WeP.22
Bouyer, Philippe ThP.5
Brandam, Jeremy TuM2.2
Brida, Daniele •FrM1.1
Brignon, Arnaud TuM1.3
Briles, Travis TuA1.5
Brinker, Frank TuP.18
Brochard, Pierre FrM2.6
Brons, Jonathan MoA2.3, FrM2.1,
FrM2.2, FrM2.3
Brown, C Tom A. ThA2.6
Bucksbaum, Philip H.... •TuM2.1
Buczynski, Ryszard WeP.5
Buldt, Joachim TuM1.2

C

CADIER, Benoit... TuP.14, ThP.5
Cai, Huaqiang... ThP.19, ThP.21
Canals Casals, Josep..... WeP.20,
•WeP.31
Cante, Silvia •ThA2.7
Cantelar, Eugenio WeP.18
Canuel, Benjamin ThP.5
Carlson, David TuA1.5
Casanova, Alexis MoA2.6
Castellano-Hernández, Elena
ThP.27, ThP.42, •ThA2.2
Cecconi, Massimo TuA1.4
Cech, Miroslav ThP.23
Chaitanya Kumar , Suddapalli
WeP.31
Chalus, Olivier FrA1.2
Chanteloup, Jean-Christophe
TuM1.3
Chazelas, Bruno TuA1.4
Chen, Hong-Jie TuP.3, TuP.5
Chen, Weidong ThP.25
Chen, Xiaowei WeP.22
Chen, Yizhu •TuM1.6, TuP.17,
ThP.4
Chiche , Ronic WeP.22
Cho, Yong Jun ThA2.5
Cho, Young Jun . ThP.21, ThA2.4
Choi, Sun Young ThP.37
Choi, Sun Yung ThM1.1
Chu, Hongwei ... TuP.18, ThA1.8
Chyla, Michal TuP.25
Ciążka, Piotr WeP.5
Ciappina, Marcelo WeP.35
Cimek, Jarosław WeP.5
Clarkson, Andy TuP.29
Clarkson, William A.... WeA1.3
Coetzee, Riaan WeM2.3
Coillet, Aurélien .. MoA1.5, TuP.2
Conejero, Enrique . WeP.7, WeP.8
Corwin, Kristan L ThA1.5
Couderc, Vincent WeM1.1
Courjaud, Antoine MoA2.6,
WeP.36
Crego , Aurora •WeP.8
Crespo, Helder TuP.28
Crespo López-Urrutia, José
Ramon WeP.37
Croitoru, Gabriela..... •WeP.16,
ThP.34
Crump, Paul..... TuM1.4
Csanaková, Bianka WeP.30,
•WeP.32
Csontos, Janos TuP.28

D

Dai, Xiaojun ThP.19, ThP.21
Dalloz, Nicolas TuP.12
Damzen, Michael J ThP.24

Daniault, Louis TuM1.3
Danilevicius, Rokas TuP.16
DANILOV, PAVEL ThP.13
Dashkevich, Vladimir ThP.27
Dawson, Martin TuP.30
Dawson, Martin D. ThA2.6
de Aldana, Javier Rodriguez
Vázquez ThM1.2
Deineka, Roman ThP.26
Délén, Xavier .. TuM1.7, •WeP.28
Delancourt, Etienne WeM1.1
Demesh, Maxim •ThP.27,
•ThP.42, ThA2.2
Demetriou, Giorgos TuP.30
Demircan, Ayhan WeP.4
Descamps, Dominique .. TuM2.2
Desfarges-Berthelemy, Agnes
WeM1.1
Devi, Kavita WeM2.2
Deyra, Loïc WeP.36
Dianov, Evgeny ThP.2
Díaz, Francesc ThM1.1, ThM1.2,
ThP.19, ThP.20, ThP.25, ThP.32
Díaz, Francisco WeP.18
Díaz, Roman WeP.36
Diddams, Scott TuA1.5
Diels, Jean-Claude •TuM2.4
Dietrich, Christian Markus
•WeP.21
Ding, Yihang TuP.4
Dixneuf, Clément ThP.6
Dobrakowski, Dominik... •WeP.6
Doroshenko, Maxim ThP.36,
ThP.40
Doroshenko, Maxim E. .. ThP.38
Dörre, Nadine ThA1.5
Drake, Tara •TuA1.5
Drescher, Markus ThA1.7
Drs, Jakub ThA1.1
Druon, Frédéric . WeP.28, ThP.18,
ThP.33
Dubietis, AudriusWeP.38, WeP.39
Dubinskii, Mark... •TuA1.3, ThP.1
Dunina, Elena ThP.27
Dupiol, Richard WeM1.1
Durand, Eric TuM1.3
Durand, Magali WeP.36

E

Eason, Robert ThP.11
Ebrahim-Zadeh, M. WeP.23,
WeP.24
Ebrahim-Zadeh, Majid .. WeP.20,
WeP.27, WeP.31, WeM2.1,
WeM2.2
Eichhorn, Marc TuP.12
Elahi, Parviz ThP.15
Elsaesser, Thomas FrA1.3, FrA1.4
Elu, Ugaitz •FrA1.1, •FrA1.2
Endo, Akira TuP.19, TuP.25,
WeP.30, WeP.32
Engelsholm, Rasmus Dybbro
•WeP.10
Ermolov, Alexey FrA1.1
Eschen, Wilhelm ThM1.3
Escoto, Esmerando TuP.28
Esser, Daniel M.J TuP.27
Esser, M J Daniel WeP.19

F

Fabert, Marc WeM1.1
Fedorov, Vladimir WeP.2, ThA1.2
Fedotov, Andrey ThA1.4
Fellinger, Jakob •MoA1.6
Feral, Christophe TuM2.2
Fibrich, Martin •ThP.39
Figueira, Gonçalves WeP.33
Firstov, Sergei •ThP.2
Firstova, Elena ThP.2
Fjodorov, Peter •WeP.12
Flöry, Tobias... •MoA2.5, ThM2.3,
•ThA1.4
Foltynowicz, Aleksandra .. WeP.9
Fortin, Vincent FrM1.2
Frank, Milan •TuP.38
Fregani, Luigi ••TuP.33, WeM2.3
Fritsch, Kilian . •MoA2.3, FrM2.1

Fromzel, Viktor TuA1.3
Frosz, Michael H. FrA1.1
Fsaifes, Ihsan TuM1.3

G

Gaida, Christian •FrM1.5, FrA1.5
Gaponenko, Maxim •FrM2.6
Garcia-Blanco, Sonia M. . WeP.17
Gebhardt, Martin FrM1.5, FrA1.5
Geiselmann, Michael TuA1.4
Georges, Patrick TuM1.4,
TuM1.7, WeP.22, WeP.28,
ThP.18, ThP.33
Gerasimenko, Andrey ThP.36
Geskus, Dimitri TuA1.2
Ghedina, Adriano TuA1.4
Gheorghe, Cristina ThP.34,
ThP.41
Gheorghe, Lucian •ThP.34,
ThP.41
Ghosh, Anirban .. TuP.34, TuP.35
Glebov, Leonid TuP.25
Gluszek, Aleksander WeA1.1
Gollner, Claudia •WeP.2, •ThA1.2
Gorbachenya, Konstantin •ThP.26
Gouhier, Benoît .. •TuP.10, ThP.5,
ThP.6
Grant-Jacob, James ThP.11
Grattoni, Vanessa ThA1.7
Greculeasa, Madalin ThP.34,
•ThP.41
Grelu, Philippe MoA1.3,
•MoA1.5, TuP.2
Grewal, Raghwinder Singh
•TuP.35
Griebner, Uwe ThM1.1, ThM1.2,
ThP.19, ThP.20, ThP.21,
ThP.25, ThP.32, ThA2.4,
ThA2.5, •FrA1.3, •FrA1.4
Gröbmeyer, Sebastian ... FrM2.1,
•FrM2.2
Gu, Erdan TuP.30
Guarepi, Valentin ThP.16
Guenard, Romain WeM1.1
Guichard, Florent TuM1.7,
WeP.22
Guiraud, Germain . TuP.10, ThP.6
Gulyashko, Alexander... WeP.34
Guo, Xincheng ThA2.1
Gurel, Kutun... •MoA1.2, FrM2.6
Gusakova, Natali •ThP.37
GUSTAVE, François TuP.14

H

H. Heckl, Oliver MoA1.6
Hakobyan, Sargis MoA1.2
Halstuch, Aviran •ThP.14
Hamdi, Said MoA1.5, •TuP.2
Hanna, Marc TuM1.7, WeP.22
Hansen, Anders Kragh ... TuM1.4
Hartl, Ingmar ... MoA2.2, TuP.18,
TuP.21, WeP.1, WeM2.6,
ThA1.7, •ThA1.8
Hartung, Alexander WeA1.2
Harutyunyan, Avet TuA1.4
Hau, Stefania ThP.34, ThP.41
Heilmann, Anke •TuM1.3
Heiner, Zsuzsanna WeM2.5
Hekmat, Negar •ThA1.3
Hendrie, James TuM2.4
Herek, Jennifer L. WeP.17
Hergott, Jean-François ... WeP.22
Herr, Tobias TuA1.4
Heuer, Alexander Marc... •ThP.22
Heuermann, Tobias FrM1.5,
•FrA1.5
Heyl, Christoph M. TuP.18,
•ThA1.5
Hickstein, Daniel TuA1.5
Hilbert, Vinzenz ThM1.3
Hildenbrand-Dhollande, Anne
TuP.12
Hillert, Wolfgang ThA1.7
Hinke, Christian •ThM1.4
Hochheim, Sven •WeA1.4
Hoffmann, Martin ThA1.3,
FrM2.4

Holmen, Lars G. •ThP.9
Honzátok, Pavel ThP.3
Hopkins, John-Mark ThA2.6
HOREZAN, Nicolas TuP.14
Horstman, Luke TuM2.4
Houssaini, Rachid WeA1.4
Hovhannesian, Karine... ThP.35,
ThA2.3
Hsu, Ning TuM2.4
Hua, Ping ThP.11
Huang, Hui ThP.20, ThA2.5
Huber, Günter ThP.22
Huber, Robert ThP.8
Hudzikowski, Arkadiusz. WeA1.1
Hülensbusch, Thomas... •TuP.21,
WeM2.6
Hupel, Christian TuM1.1,
WeM1.3
Huynh, Jaroslav WeP.32

I

Ilday, F. Ömer... ThP.15, •FrM2.4
IONIN, ANDREY •ThP.13
Isaenko, Ludmila TuP.40
Ishaaya, Amiel A. ThP.14
ishii, tomohiro FrM1.4
Ishizuki, Hideki •TuP.36
Ishmagetiev, Nikolay ... WeP.13
Ismagilova, Renata •TuP.13,
WeP.13
Ismail, Nur TuA1.2
Ivanov, Rosen ThA1.7
Ivleva, Liudmila I. ThP.38
Ivleva, Lyudmila I. TuP.38

J

Jäger, Matthias... •WeA1.2, •ThP.7
Jamal, Muhammad Tahir TuM1.4
Jambunathan, Venkatesan
ThM1.2, ThP.32
Jang, Hoon WeP.15
Jarutis, Vyngandas WeP.3
Jauregui, CesarWeM1.3, WeM1.5,
FrM1.5, FrA1.5
Jelínek, Michal .. TuP.25, TuP.38,
•TuP.40, •TuP.41, WeP.30,
ThP.23, ThP.36, ThP.39
Jelínková, Helena ThP.31,
•ThP.36, ThP.38, ThP.39,
ThP.40
Jensen, Ole Bjarlin..... TuM1.4
Jiang, Dapeng ThP.23
Jiang, Shibin ThP.1
Jing, Wei ThP.20, ThA2.5
Jirauschek, Christian ThP.8
João, Celso P. WeP.33
Jornod, Nayara MoA1.2
Jukna, Vytautas WeP.38

K

kajikawa, eiji •FrM1.4
Kakis, Edgar... MoA2.5, ThA1.4
Kalaycıoğlu, Hamit ThP.15
Kamrádek, Michal ThP.3
Kanai, Tsuneto... •WeM2.4, FrA1.2
Kardaś, Tomasz M. TuP.1
Kartashov, Daniil. WeP.2, ThA1.4
Kašik, Ivan ThP.3
Kästel, Jürgen TuP.20
Kasztelanic, Rafał... WeP.5, WeP.6
Kemp, Alan TuP.30
Kermene, Vincent WeM1.1
Kesim, Denizhan K. ThP.15
Khaled, Federico ThP.34
Khan, Shaikat ThA1.7
Kharakhordin, Alexander.. ThP.2
Khramov, Ivan .. TuP.13, •WeP.13
Kieleck, Christelle TuP.12
Kifle, Esrom... •ThM1.1, ThM1.2,
ThP.19, ThP.25
Kim, Dong Eon WeM2.4
Kip, Detlef WeP.18
Kippenberg, Tobias TuA1.4
Kirsche, Alexander •ThA1.6
Kisel, Viktor ThP.26, ThP.27,

ThP.35, ThP.37, ThP.42,
ThA2.3
Klas, Robert ... •ThM1.3, ThM2.4,
ThA1.6
Kleinert, Sven ... TuP.28, •WeP.29
Klenke, Arno ... TuM1.1, TuM1.2
Klimczak, Mariusz. WeP.5, WeP.6
Klingebiel, Sandro FrM2.7
Kniggendorf, Ann-Kathrin
WeP.25
Koettig, Felix FrA1.1
Konyashkin, A. V. TuP.26
Konyashkin, Aleksey TuP.23,
TuP.24
Koray Kesim, Denizhan .. FrM2.4
Kores, Cristine C. TuA1.2
Kornienko, Alexei ThP.27
Korolkov, Andrei •TuP.24
Kosmyna, Miron ThP.26
Kot, Yauhen TuP.18
Koulouklidis, Anastasios D.
ThA1.2
Kovalenko, Nazar ThP.36
Kovalenko, Nikita TuP.23
Kovalyov, Alexey ThA2.3
Kowalczyk, Maciej •TuP.39,
ThP.21, •ThA2.4
Kracht, DietmarMoA1.4, WeA1.4
Kraemer, Darren FrM1.2
Kränkel, Christian ThP.22,
ThP.27, ThP.42, ThA1.1,
ThA2.2, FrM2.6
Krausz, Ferenc .. FrM1.3, FrM2.1,
FrM2.3, FrA1.6
Kreipe, Bernhard WeP.29, FrM2.5
Krupa, Katarzyna MoA1.5,
•WeM1.1
Kubeček, Václav .. TuP.38, TuP.40,
TuP.41, •ThP.23, ThP.39,
ThA2.1
kubo, takashi FrM1.4
KUDRYASHOV, SERGEY. ThP.13
Kühn, Steffen WeP.37
Kuleshov, Nikolai ThP.27, ThP.37,
ThP.42
Kuleshov, Nikolay ThP.26,
ThP.35, ThA2.3
Kumar, S. Chaitanya WeP.23,
WeP.24
Kundermann, Stefan TuA1.4
Kurilchik, Sergey •ThP.11
Kurus, Aleksey TuP.40
Kuznetsov, Maxim WeM1.4
Kwarkye, Kyei •WeP.11

L

Laarmann, Tim ThA1.7
Labaye, François FrM2.6
Lagatsky, Alexander A. ... ThA2.6
Lallier, Eric TuM1.3
Lancaster, David •TuA1.1
Lang, Tino TuP.21, WeM2.6
Larat, Christian TuM1.3
Larionov, Igor WeP.34
Laroche, Mathieu ThP.5
Laurell, Fredrik .. MoA2.4, TuP.8,
WeP.15, WeM2.3
Lavenue, Loïc ... •TuM1.7, WeP.22
Lazzarino, Leslie Lamberto
ThA1.7
le Dortz, Jérémy TuM1.3
LE GOUËT, Julien •TuP.14
Leandro, Daniel ThP.6
Lechner, Christoph ThA1.7
Lecomte, Steve TuA1.4
Lee, Yeon WeM2.4
Leng, Jinyong... TuM1.5, TuM1.6
Lenzner, Matthias TuM2.4
Leroi, Florian •WeA1.3
Lhermite, Jerome TuM2.2
Li, Chen •MoA2.2
Li, Qing TuA1.5
Liao, Wen-Jing TuP.5
Lifante, Ginés •WeP.18
Limpert, Jens .. TuM1.1, TuM1.2,
WeM1.3, WeM1.5, ThM1.3,
ThM2.4, ThA1.6, FrM1.5,
FrA1.5

Lin, Haifeng ThP.25
Lin, Zhoubin ThP.25
Lindberg, Robert •TuP.8
Lisowska, Jolanta WeP.6
Liu, Hangyu TuP.30
Liu, Jie ThA2.1
Liu, Junqui TuA1.4
Liu, Qiyao •TuP.29
Loiko, Pavel .. ThM1.1, •ThM1.2,
•ThP.19, ThP.20, ThP.21,
•ThP.25, ThA2.4, ThA2.5
Loiseau, Pascal ThP.34
Lopez-Amo, Manuel ThP.6
Lopez-Martens, Rodrigo .. TuP.28
Lopez-Zubieta, Boris WeP.7
Louis de Canonville, Cyprien
WeP.28
Lucas-Leclin, Gaëlle TuM1.4
Lucianetti, Antonio ThM1.2,
ThP.32
Lukošiūnas, Julius WeP.39
Luo, Ai-Ping •TuP.3, •TuP.5
Luo, Zhi-Chao TuP.3, TuP.5
Lykov, Pavel A. ThP.38

M

M. Kazemi, Mehdi •ThA1.7
Ma, Fengkai ThP.23, ThA2.1
Ma, Pengfei •TuM1.5
Ma, Yanxing TuM1.5
Mackenzie, Jacob ThP.11
Mackenzie, Jacob I. ThA2.7
Mackonis, Paulius •TuM2.3
Madeikis, KarolisTuP.15, •TuP.16,
TuP.22
Magarell, Daniel ThP.28
Mak, Ka Fai ThP.17, FrM1.3,
FrA1.6
Mak, KaFai FrM2.1
Malevich, Pavel .. WeP.2, ThM2.3
Manek-Hönniger, Inka .. TuP.12
Manschewet, Bastian ... ThA1.7
Mansourzadeh, Samira... ThA1.3
Marcinkevičiūtė, Agnė... •WeP.38,
WeP.39
Marion, Denis TuM2.2
Martynkien, Tadeusz TuP.9,
TuP.39, WeP.9, WeA1.1
Masons, Jaume WeP.18
Mateos, Xavier ThM1.1, ThM1.2,
ThP.19, ThP.20, ThP.21,
ThP.25, ThP.32, ThA2.4,
ThA2.5
Matras, Guillaume FrA1.2
Medina, Marc WeP.18
Mélet, Alexandre TuM2.2
Melkumov, Mikhail ThP.2
Meng, Daren TuM1.5
Merdji, Hamed WeP.22
Mergo, Paweł TuP.39, WeP.9,
WeA1.1
Mero, Mark •WeM2.5
Metzger, Thomas FrM2.7
Meyer, Frank... ThA1.1, ThA1.3
Michailovas, Andrejus ... TuP.15,
TuP.16, TuP.22
Michel, Knut FrM2.7
Mickus, Marijus .. MoA2.1, TuP.7
Mildren, R.P. TuP.31
Mildren, Richard •TuP.31
Milla, Maria Jose •WeP.36
Miller, R.J. Dwayne •EPS.1
Millot, Guy WeM1.1
Miltchev, Velizar ThA1.7
Minassian, Ara ThP.24
Minoni, Umberto WeM1.1
Mitrofanov, Alexander... WeP.2,
ThA1.4
Mocek, Tomas ... TuP.19, TuP.25,
WeP.30, WeP.32, ThM1.2,
ThP.32
Modotto, Daniele WeM1.1
Modsching, Norbert... ThA1.1,
FrM2.6
Mohr, Christian ThA1.8
Molinari, Emilio TuA1.4
Moravec, Ondřej ThP.3
Morgner, Uwe TuP.28, WeP.4,

WeP.21, WeP.25, WeP.26,
WeP.29, ThP.10, FrM2.5
Mottay, Eric TuM1.7
Mudryi, Alexander ThP.42
Muga, J. G. •EPL.1
Müller, MichaelTuM1.1, •TuM1.2
Müller, Micheal ThM2.4
Musgrave, Ian TuP.27
musha, mitsuru FrM1.4
Muzik, Jiri TuP.19, TuP.25

N

Nadeau, Marie-Christine TuM2.2
Nagl, Nathalie .. •FrM1.3, FrA1.6
Nagy, Tamas TuP.28
Nandy, Biplob •WeP.20
NASTULYAVICHUS, ALENA
ThP.13
Nathanael, Anne ThM1.3
Natile, Michele. TuM1.7, •WeP.22
Nauta, Janko WeP.37
Navratil, Petr ThP.32
Negri, Jacopo Rubens... •TuP.32
Némec, Michal .. ThP.31, •ThP.40
Neumann, Jörg. MoA1.4, WeA1.4
Neyra, Enrique .. WeP.35, ThP.16
Nikitin, D. G. •TuP.26
Nikitin, Dmitrii .. TuP.23, TuP.24
Nilsson, Johan FrM1.6
Nithyanandan, K. MoA1.5
Nold, Johannes WeM1.3
Nolte, Stefan ThM2.4
Novak, Ondřej ... TuP.19, TuP.25,
WeP.30, WeP.32

O

Obrzud, Ewelina •TuA1.4
O'Donnell, Callum F.... WeP.20,
•WeP.27, •WeM2.1
Oelmann, Jan-Hendrik... •WeP.37
ogawa, kazuhiko FrM1.4
Orlovich, Valentin ThP.27
Ouillé, Marie TuP.28

P

Padhye, Anuja •WeM2.2
Pan, Zhongben . ThP.19, •ThP.21,
ThA2.5
Paoletta, Therese WeM2.1
Papadopoulos, Dimitrios. WeP.28
Papashvili, Alexander G. . ThP.38
Papp, Scott TuA1.5
Paradis, Clément •ThA1.1,
FrM2.6
Paschke, Katrin TuM1.4
Pasiskevicius, Valdas ... MoA2.4,
TuP.8, WeP.15, •WeM2.3
Paul David, Samuel ThP.32
Pavel, Nicolaie ... WeP.16, ThP.34
Pavlyuk, Anatoliy ThP.37, ThP.42
Pawliszewska, Maria •TuP.9
Pepe, Francesco TuA1.4
Perevoznik, Dmitrii •ThP.10
Pérez Hernández, Jose Antonio
WeP.35
Pertsch, Thomas ThM1.3
Pervak, Vladimir MoA2.3,
•ThP.17, FrM1.3, FrA1.6
Peterka, Pavel ThP.3
Petit, Stephane •TuM2.2
Petrosyan, Ashot ThP.35, ThA2.3
Petrov, Valentin WeM2.5,
ThM1.1, ThM1.2, ThP.19,
ThP.20, ThP.21, ThP.25,
ThP.32, ThA2.4, ThA2.5
Petrulenas, Augustinas .. TuM2.3
Peyton, Roberto ThP.16
Pfeifer, Thomas WeP.37
Pfeiffer, Tom ThP.8
Pichon, Pierre... •ThP.18, •ThP.33
Pigarev, A. V. TuP.26
Pires, Hugo WeP.33, FrA1.1
Pirzio, Federico... TuP.32, TuP.33
Placzek, Fabian FrM2.5
Plath, Tim ThA1.7

Poetzlberger, Markus ... MoA2.3, •FrM2.3
Pollnau, Markus •TuM2.5, •TuA1.2, •WeP.17
Pomeranz, Leonard ThP.28, ThP.30
Poprawe, R. ThM1.4
Porat, Gil ThA1.5
Pötzelberger, Markus FrM2.1
Prentice, Jake ThP.11
Preobrazhenskii, Valery.. ThA2.3
Presti, Damian ThP.16
Prinz, Stephan FrM2.7
Pronin, Oleg... MoA2.3, ThP.17, FrM1.3, •FrM2.1, FrM2.2, FrM2.3, FrA1.6
Przewłoka, Aleksandra TuP.8, TuP.9
Przystawik, Andreas ThA1.7
Pugzlys, Audrius MoA2.5, WeP.2, ThM2.3, ThA1.2, ThA1.4
Pujol, Maria Cinta WeP.18
Pumpe, Sebastian •TuP.18
Puncken, Oliver MoA1.4
Pupeza, Ioachim FrA1.5
Pysz, Dariusz WeP.6

Q

Qiu, Dong TuP.5
Qiu, Min WeP.15

R

Rainer, Monica TuA1.4
Ramachandran, Siddharth WeM1.2
Rampur, Anupamaa •WeP.5, WeP.6
Rao, A Srinivasa •TuP.34
Razskazovskaya, Olga ThA1.1
Regelskis, Kęstutis •MoA2.1, TuP.7
Reilly, Sean TuP.30
Rishøj, Lars •WeM1.2
ROBIN, Thierry ... TuP.14, ThP.5
Ródenas, Airán. WeP.18, ThM1.1, ThM1.2
Rodin, Aleksej M. TuM2.3
Romero, Rosa TuP.28
Rosenberg Petersen, Christian WeP.11
Roskot, Lukas TuP.19, TuP.25, •WeP.30
Roso, Luis WeP.35
Rossbach, Jörg ThA1.7
Rota-Rodrigo, Sergio TuP.10, •ThP.5, •ThP.6
Rotermund, Fabian ThM1.1, ThP.21, ThP.37, ThA2.4, ThA2.5
Rothhardt, Jan.. ThM1.3, ThA1.6
Rothhardt, Manfred ThP.7
Rubtsova, Nataliya ThA2.3
RUDESKO, ANDREY ThP.13
Rudnikov, Alexander ... •ThP.35, •ThA2.3
Russel, Philip S. FrA1.1
Rustad, Gunnar ThP.9
Rusteika, Nerijus. TuP.15, TuP.16, TuP.22
Rüter, Christian E. WeP.18
Ryabushkin, O. A. TuP.26
Ryabushkin, Oleg TuP.13, TuP.23, TuP.24, WeP.13

S

Salman, Haydar S. TuP.18
Salman, Sarper ThA1.8
Samanta, G K. TuP.34, WeP.23, WeP.24
Samanta, Goutam Kumar. TuP.35
San Roman, Julio.. •WeP.7, WeP.8
Sánchez, Daniel FrA1.2
Sangla, Damien WeP.36
Santarelli, Giorgio •MoA2.6,

TuP.10, ThP.5, ThP.6
Saraceno, Clara J.ThA1.1, FrM2.4
Saraceno, Clara Jody ThA1.3
SARAEVA, IRINA ThP.13
Sathian, Juna ThP.24
Sauder, Daniel TuP.20
Savitski, Vasili. •TuP.30
Schaarschmidt, Kay •WeP.1
Schelle, Detlef ThM1.3
Schilt, Stephane MoA1.2, FrM2.6
Schirmel, Nora. TuP.21, •WeM2.6
Schmidt, Berthold •ThM2.1
Schmidt, Mark. •ThP.8
Schmidt, Markus A. WeP.1
Schoun, Stephen B. ThA1.5
Schreiber, Thomas TuM1.1
Schrempel, Frank ThM1.3
Schultze, Marcel •FrM2.7
Schulz, Christof WeP.12
Schulzen, Axel FrA1.5
Schunemann, Peter WeA1.1, •ThP.28, •ThP.29, •ThP.30
Schunemann, Peter G. FrA1.2
Scurria, Giuseppe •TuP.12
Seidel, Marcus FrM2.2
Serres, Josep Maria ThP.19, •ThP.20, ThP.21, ThP.25, ThP.32
Sevillano, Pierre WeP.36
Shaidullin, Renat TuP.13, WeP.13
Shamir, Avishay ThP.14
Shardlow, Peter TuP.29
Shardlow, Peter C. WeA1.3
Sharma, Varun. •WeP.23, •WeP.24
Shebarshina, Irina TuP.23
Shekhovtsov, Alexey ThP.26
Sheng, Xin •ThP.24
Shi, Liping •WeP.14
Shirakawa, Akira TuP.11
Shumakova, Valentina WeP.2, ThA1.2
Sidorov-Biryukov, Dmitri. WeP.2
Sidorov-Biryukov, Dmitriy ThA1.4
Siems, Malte •ThM2.4
Simon-Boisson, Christophe TuM1.3, FrA1.2
Sirutkaitis, Valdas WeP.3
Smetanin, Sergei.. TuP.40, TuP.41
Smetanin, Sergei N. TuP.38
SMIRNOV, NIKITA ThP.13
Smirnov, Vadim TuP.25
Smrz, Martin TuP.19, TuP.25, WeP.30, WeP.32
Sobon, Grzegorz .. TuP.8, TuP.39, •WeP.9, WeA1.1
Sola, Iñigo WeP.7
Song, Jiaxin. TuP.17, ThP.4
Song, Yanrong •TuP.6
Sotor, Jaroslaw TuP.8, TuP.9, TuP.39, WeP.9, •WeA1.1, ThP.21, ThA2.4
Speiser, Jochen •TuP.20
Spence, D.J. TuP.31
Spencer, Daryl TuA1.5
Spielmann, Christian... ThM1.3
Srinivasan, Kartik TuA1.5
Stark, Henning •TuM1.1, TuM1.2
Stark, Julian WeP.37
Steinert, Michael ThM1.3
Steinke, Michael WeA1.4
Steinkopff, Albrecht.... •WeM1.3
Steinle, Tobias. ... FrA1.1, FrA1.2
Steinmeyer, Günter TuP.28
Stepanenko, Yuriy TuP.1
Štěpánková, Denisa •TuP.25
Stepniewski, Grzegorz.... WeP.6
Stevenson, Neil K. •ThA2.6
Stihler, Christoph •WeM1.5
Stirmanov, Yu. S. TuP.26
Stone, Jordan TuA1.5
Stutzki, Fabian TuM1.1, WeM1.3, FrM1.5, FrA1.5
Su, Liangbi ThP.23, •ThA2.1
Su, Rongtao TuM1.5
Suddapalli, Chaitanya Kumar WeP.20, WeP.27, WeM2.1

Südmeyer, Thomas MoA1.2, ThA1.1, FrM2.6
Sukeert, Sukeert WeM2.2
Šulc, Jan ThP.31, ThP.36, •ThP.38, ThP.39, ThP.40
Šuminas, Rosvaldas WeP.38, •WeP.39
Sutter, Dirk FrM2.1, FrM2.3
Švejkár, Richard. •ThP.31, ThP.38
Szczepanek, Jan.. •TuP.1, •ThP.15

T

Tadess, Getnet ThM1.3
Tai, Boyin WeM1.2
Taira, Takunori. MoA2.7, TuP.36
Tajalli, Ayhan .. •TuP.28, WeP.26, WeP.29
takeuchi, yu-ichi FrM1.4
Tamošauskas, Gintaras .. WeP.38, WeP.39
Tanaka, Hiroki. ThA2.2
Tani, Francesco FrA1.1
Tarnowski, Karol WeP.9
Tawy, Goronwy ThP.24
Tchofo-Dinda, Patrice . •MoA1.3, MoA1.5
Teisset, Catherine Y. FrM2.7
Tejerina, Matias ThP.16
Ter-Gabrielyan, Nikolay. . TuA1.3
Tereschenko, Dmitriy ... TuP.41
Tian, Jingyi •WeP.15
Tian, Jinrong TuP.6
Tiess, Tobias ThP.7
Tkalec, Kimberly E. •WeP.19
Tonello, Alessandro WeM1.1
Torchia, Gustavo •WeP.35, •ThP.16
Traynor, Nicholas. TuP.10, ThP.5, ThP.6
Trophème, Benoit MoA2.6
Trubetskov, Michael ThP.17
Tschernajew, Maxim ThM1.3, ThA1.6
Tuitje, Frederik ThM1.3
Tünnermann, Andreas .. TuM1.1, TuM1.2, WeM1.3, WeM1.5, ThM1.3, ThA1.6, FrA1.5
Tünnermann, Henrik •TuP.11
Turcicova, Hana •TuP.19
Tyrtyschny, Valentin .. •WeM1.4, •WeP.34
Tzortzakakis, Stelios WeP.2, ThA1.2

U

Uren, Robin TuP.29
Uvarova, Anastasia ThA2.2

V

Vaity, Pravin TuP.34
Valle, Stefano ThA2.7
Vallée, Réal FrM1.2
Vazquez-Cordova, Sergio A. WeP.17
Vázquez de Aldana, Javier Rodríguez ThM1.1
Vengelis, Julius •WeP.3
Veniaminov, Andrey ... ThM1.1, ThM1.2
Vernier, Aline TuP.28
Veselis, Laurynas. TuP.15, TuP.16, •TuP.22
Veselský, Karel ThP.38
Videla, Fabian ... WeP.35, ThP.16
Viotti, Anne-Lise •MoA2.4
Viskontas, Karolis TuP.16
Vlaicu, Aurel-Mihai ThP.41
Voicu, Flavius ThP.34, ThP.41
von Brunn, Patrick ThP.22
von Grafenstein, Lorenz . FrA1.3, FrA1.4
Voronin, Alexandr WeP.2
Vrakkid, Marc WeM2.5
Vyhliadal, David .. ThP.23, ThP.36
Vývlečka, Michal WeP.30, WeP.32

W

Wabnitz, Stefan WeM1.1
Wandt, Christoph FrM2.7
Wandt, Dieter MoA1.4
Wang, Pan TuP.4
Wang, Qing ThP.17, •FrA1.6
Wang, Yicheng .. ThP.19, ThP.20, ThP.21, ThP.25, •ThA2.5
Wang, Zhengping ThA2.4
Wang, Zhiqiang MoA1.5
Weichelt, Birgit TuP.20
Westly, Daron TuA1.5
Wienke, Andreas •MoA1.4
Wildi, François TuA1.4
Williams, R.J. TuP.31
Williams, Stewart •ThM2.2
Winkelmann, Lutz MoA2.2, TuP.18, TuP.21, ThA1.8
Winkler, Georg. MoA1.6
Wise, Frank •MoA1.1
Wittwer, Valentin FrM2.6
Wittwer, Valentin J. MoA1.2, ThA1.1
Wu, Bin ThP.10
Wu, Hanshuo TuP.17
Wu, Jian ThP.4
Wurth, Wilfried ThA1.7

X

Xiao, Hu TuM1.5, TuM1.6
Xiao, Xiaosheng TuP.4
Xu, Jiangming TuP.17, •ThP.4
Xu, Runqin TuP.6
Xu, Wen-Cheng TuP.3, TuP.5
Xu, Xinguang ThA2.4
Xuan, Hongwen.. MoA2.2, WeP.1

Y

Yahia, Vincent •MoA2.7
Yang, Changxi •TuP.4
Yao, Shunyu TuP.4
Yao, Tianfu TuM1.6
Yasukevich, Anatol ThP.26, ThP.27, ThP.35, ThP.37, ThA2.3
Ye, H. WeP.23
Ye, Jun ... •TuP.17, ThP.4, ThA1.5
Yong, Yean-Sheng WeP.17
Yuan, Hualei ThP.19, ThP.21
Yue, Fangxin •ThP.32

Z

Zakharov, Viktor ThM1.1, ThM1.2
Zaouter, Yoann.. TuM1.7, WeP.22
Zawilski, Kevin . ThP.29, ThP.30, FrA1.2
Želudevičius, Julijanas .. MoA2.1, •TuP.7
Zhang, Ge ThP.25
Zhang, Han TuP.9
Zhang, Hanwei TuP.17, ThP.4
Zhang, Jinwei... FrM2.1, FrM2.3, FrA1.6
Zhang, Jun •ThP.1
Zhang, Lizhen ThP.25
Zhang, Xuzhao ThA2.4
Zhang, Zhen ThA2.1
Zhao, Guan-Kai TuP.3
Zhao, Jian ThP.5
Zhao, Kangjun TuP.4
Zhao, Yongguang ThP.19, ThP.21, ThA2.5
Zheltikov, Alexey. WeP.2, ThA1.4
Zheng, Jiaan ... TuP.21, WeM2.6
Zheng, Xionghua WeM2.3
Zhou, Pu TuM1.5, TuM1.6, TuP.17, ThP.4
Zilk, Matthias ThM1.3
Zuber, David WeP.29
Zverev, Petr G. TuP.38



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