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Digest and Copyright Information

The papers included in this digest comprise the short summaries of the 7th EPS-QEOD Europhoton Conference held in Vienna, Austria from 21 to 26 August 2016. The extended version of the papers (1-page summaries in pdf format) will be made available online during a time period of 2 months beginning from 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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Europhoton 2016 is organized by

European Physical Society
Quantum Electronics and Optics Divisior

http://qeod.epsdivisions.org

www.tuwien.ac.at/en/

List of Exhibitors

CRYSTALLINE MIRROR SOLUTIONS	**CRYTALLINE MIRROR SOLUTION** represent a ground-breaking optics technology, enabling radically new applications and products for the laser-based precision-metrology market. Without requiring modifications to existing measurement systems, our products provide an immediate 10- to **100-fold improvement** in the limiting performance of optically-enabled time and frequency measurement schemes. In addition, the crystalline coating process also enables unprecedented optical performance of mid-IR mirrors and thermal performance for high power/ultrafast laser systems. **http://www.crystallinemirrors.com/**
EKSMA OPTICS	**EKSMA Optics** is a manufacturer of precision components for high power laser applications.Product range includes laser optics, opto-mechanics and nonlinear crystals for 193-20.000nm range, Pockels cells, HV drivers and ultrafast pulse picking systems.Company owns IBS coating facility, optics and crystals polishing facilities, spherical and aspherical lenses production facilities. **www.eksmaoptics.com**
EKSPLA	**EKSPLA -** Innovative manufacturer of lasers, systems and components from custom system for basic research to small OEM series. In-house R&D team enables 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. **www.ekspla.com**
Laser QUANTUM	**Laser Quantum** is a world-class manufacturer of revolutionary solid-state and ultrafast lasers. Our products lead the industry in performance specifications, reliability, compactness and operational lifetime. You will find Laser Quantum lasers used in laboratories and integrated in systems and machines worldwide. Our lasers are helping scientists to break new ground in many applications ranging from attosecond physics to forensics and genomics. **http://www.laserquantum.com/**
LIGHT CONVERSION	**Light Conversion** is the world-leader for tunable ultrafast OPA systems with the worldwide recognized TOPAS series products. Light conversion is also an established manufacturer of Yb-based laser PHAROS (180 fs, up to 20w, 2mJ, 1MHz), harmonics generators, parametric amplifier "ORPHEUS" and time-resolved spectrometers. Together the portfolio forms a 'best-in-class' set of devices for femtosecond applications in industry, medicine, and fundamental research. **www.lightcon.com**

NUFERN	**NUFERN** is a leading U.S. manufacturer of specialty optical fibers, precision wound optical fiber coils, fiber lasers and amplifiers. Nufern's integrated team has the experience, resources, and facilities required to design, manufacture, test and qualify highly engineered optical fibers and fiber-based products for diverse applications and industries. **http://www.nufern.com**
MenloSystems	*Excitement is not measureable. Light* **Menlo Systems**, a leading developer and global sup instrumentation for high-precision metrology, was fou 2001 as a spin-off of the Max Planck Institute for Q Optics, with the foremost aim to commercialize measurement technologies and make it available to emerging application fields. Menlo Systems maint strong bond to co-founder Theodor W. Hänsch pioneered precision laser techniques. Known for the Prize-winning optical frequency comb technology, the M based company offers complete solutions based on u lasers and synchronization electronics. Applications products and solutions span from research laborato truly industrial tasks. The patented technology is rec by global laser manufacturers to whom we delive solutions for integration into cutting-edge pr **http://www.menlosystems.com/**
PicoQuant	**PICOQUANT -** Instrumentation for time-resolved fluorescence and single photon counting: picosecond/nanosecond pulsed and modulated diode lasers, PC modules for Time-Correlated Single Photon Counting, detectors, fluorescence lifetime systems (confocal microscopes, spectrometers), FLIM and FCS upgrade kits for laser scanning microscopes. **http://www.picoquant.com**
TOPTICA PHOTONICS	**TOPTICA** is a privately held technology driven company, which develops, produces and sells diode and ultrafast fiber lasers for scientific and industrial applications.The company sets its own challenge to regularly present exciting product innovations and world firsts. **www.toptica.com**

Spectra-Physics A Newport Company	As the first laser company, **Spectra-Physics** is singularly focused on helping customers use precision laser technologies to advance science and propel industries forward. The company does so by offering groundbreaking technologies, deep applications expertise, disruptive cost-performance, and a commitment to world-class customer experience. Our product portfolio spans CW to nanoseconds to femtosecond, UV to mid-infrared, and fiber to DPSS lasers. We enable applications in industrial and microelectronics manufacturing, medical and life sciences, and scientific research. **http://www.newport.com/**
standa	Standa Ltd. was founded in Vilnius, Lithuania in 1987 and now has more than 150 employees working at the company. Standa has it's own industrial base that includes CNC turning, milling, grinding machines. Standa's design department, while developing standard products presented in Standa's catalogue (such as motorized and manual translation and rotation stages, motion controllers, optical tables, vibration isolation systems, optical mounts and holders, optics, dpss lasers and etc.) also develops the equipment for OEM customers. Some examples of it, after the agreement with OEM customers, are shown on this website. Standa currently has several laser product development laboratories. **http://www.standa.lt/**
TRUMPF	**TRUMPF Scientific Lasers GmbH + Co. KG** TRUMPF Scientific Lasers is a Joint Venture between TRUMPF and Professor Dr. Ferenc Krausz, Director Max-Planck-Institute for Quantum Optics Garching, Munich. We are a high-tech company focusing on high-power femtosecond laser technology especially on optic parametric amplifiers and high energy picosecond lasers. Base technology is the TRUMPF disk laser technology. **www.trumpf-scientific-lasers.com**

Introduction

The **Europhoton** conference features the latest breakthroughs in the field of Solid-State, Fibre, and Waveguided Light Sources. The conference will be held in the **TU Vienna, Austria** (Campus Gusshaus - Gusshausstrasse 27) close to the city centre with many attractions easily accessible by foot or by excellent public transportation. World-renowned researchers discuss the latest developments in the scientific community accompanied by Summer School sessions at the PhD student and postdoctoral level, and by informal breakout sessions for discussion and company display. This conference will also feature a half-day special Symposium on "**Novel Laser-matter Interaction regimes**" where prominent Keynote and Invited Speakers will discuss state of the art and future visions for this fascinating field. The seventh 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** and the **TU Vienna** in cooperation with the **Quantum Electronics and Optics Division** (QEOD) of EPS.

The Conference Programme includes:

The **Summer School on Frontiers of Solid State Light Sources**
from Sunday 21 August (afternoon) to Monday 22 August 2016 (all day)

The main **Conference on Solid-State, Fibre, and Coherent Light Sources**
from Tuesday 22 August (morning) to Friday 26 August 2016 (evening)

A half-day **special Symposium on "Novel Laser-matter Interaction Regimes"** on Tuesday 23rd and Wednesday 24th August 2016 (morning).

The 7th EPS-QEOD Europhoton Conference 2016 technical programme includes keynote, invited and selected contributed papers completely encompassing the field of lasers and photonics. All aspects of the technologies will be covered, including fundamentals, device development, systems, and applications.

Short abstracts of the papers to be presented at the EPS-QEOD Europhoton Conference 2016 appear in this programme. 240 presentations (6 Summer School lectures, 2 keynotes, 12 invited speakers including 2 speakers for the Special Symposium, 89 orals, and 131 poster presentations from Europe and overseas) have been selected for presentation at the Conference.

Tabletop Exhibit
A tabletop exhibit will be organised from Tuesday 23 August (morning) to Thursday, 25 August (afternoon). It will take place on the ground floor near the Lecture Hall. 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.

Summer School
The Europhoton Conference includes a Summer School on "**Frontiers of Solid-State Light Sources**". The Summer School will be held **from Sunday 21 August (afternoon) to Monday 22 August (all day), 2016**. 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
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. To allow participants to see as many posters as possible, **3 sessions are organised from Tuesday 23 to Thursday 25 August 2016 in the afternoon.** All posters will be displayed in the rooms located next to the main lecture hall. There will be no oral presentations during this time.

Each author is provided with one bulletin board. Poster size should be portrait format A0 (120 cm high x 80 cm wide). The boards will be marked with the paper session code (ex. **PO-1.x; PO-2.xy; PO-3.yy**)

All authors are requested to display posters on their allocated boards in the morning of the day of their presentation. Fixing material (tape) 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.

Speakers' Information
Speakers are asked to check-in with the session presider in the conference room ten minutes before the session begins. Speakers will have also the opportunity to check their presentation at the registration counter.

Total length of the talks:
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.

A laptop with Windows 7 or Windows 10, PowerPoint (for ppt and pptx format files) and Adobe Reader (for pdf format file) will be available. Authors will transfer their oral presentation files by USB memory stick.

All oral sessions take place in the main auditorium so called **Lecture Hall EI7 of Campus Gusshaus.**

Abbreviations for the sessions:

SSL: Solid-State Lasers
FWG: Fibre and Waveguide Devices
SS: Special Symposium on Novel Laser-Matter Interaction Regimes

Conference Language
English will be the official conference language.

Technical Digest
The registration fee includes an online technical digest including the one-page summaries.

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

Welcome Reception: Monday 22 August 2016, 18:45 – 21:00.

The welcome reception will take place in the **Kuppelsaal** of the main building of TU Vienna. (Karlsplatz 13, 1040 Wien).

Conference Dinner: Wednesday 24 August 2016, 19:30 – 22:00.

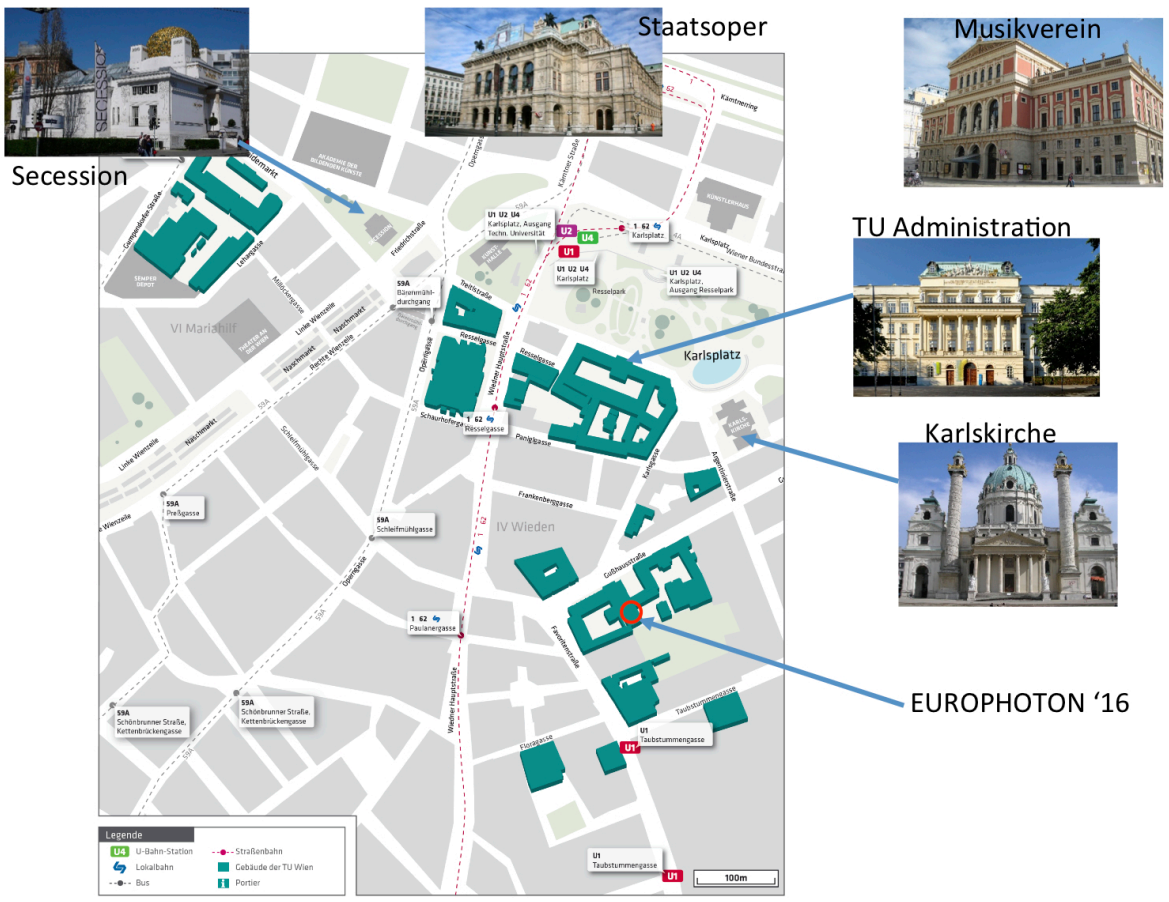
The conference dinner will take place at the **Wiener Rathauskeller**, Rathausplatz 1, 1010 Wien in the basement of the Viennese City Hall. The location is easy to reach by underground U2 (station Karlsplatz – station Rathaus) or by tram No 1 from the conference site (stop Paulanergasse – stop Rathhausplatz/Burgteater). Tradition and culinary delights meet in the traditional halls and parlours of the Wiener Rathauskeller have been known as the "centre of good taste" since their opening in 1899. An extra fee of 10€ has been asked during the registration on-line. Accompanying guests will pay an extra fee of 30€. No reservation can be done on site.

Conference & Social Programme Locations

The conference will take place at the **TU Vienna, Campus Gusshaus.**

Address: Gusshausstrasse 27-29, 1040 Vienna, Austria.
Phone: +43 1 58801-0

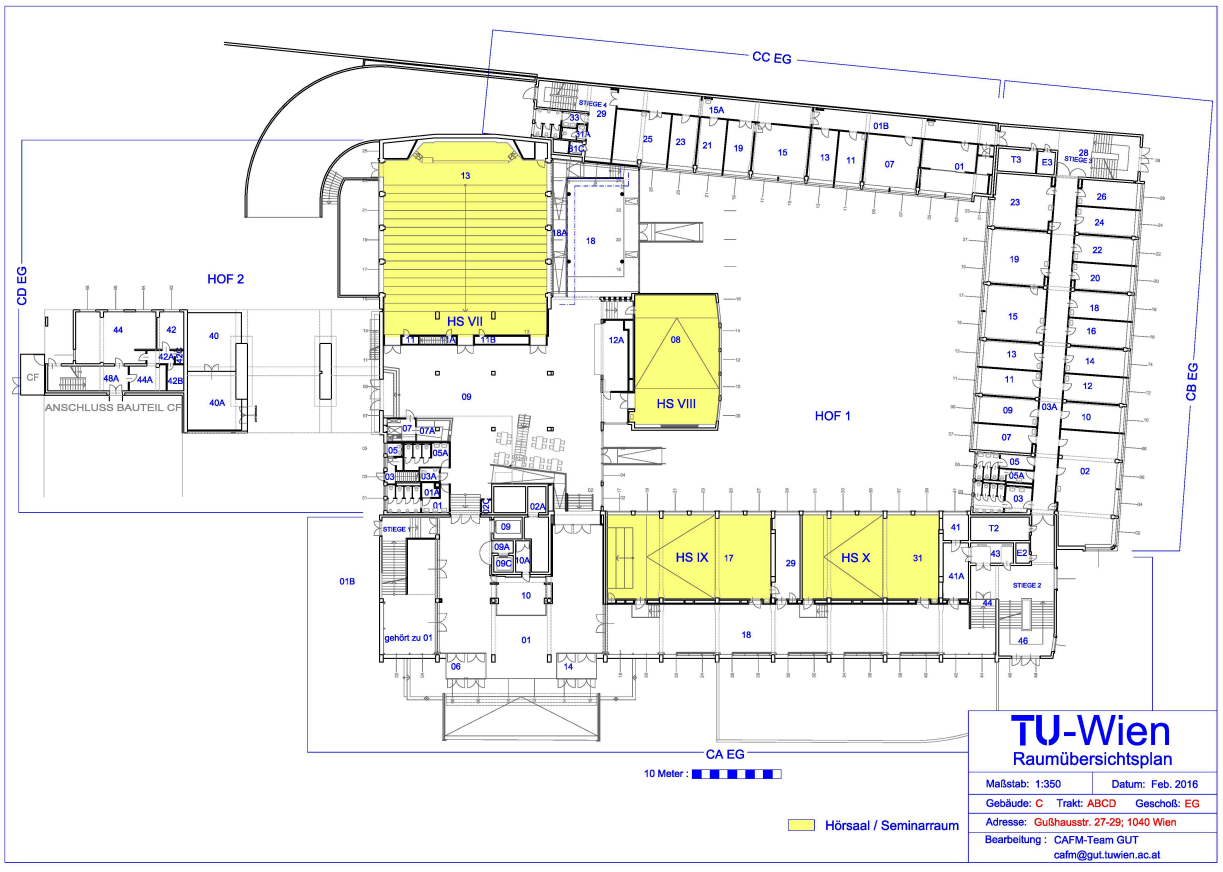
Campus Gusshaus



All oral sessions take place in the **Lecture Hall EI7**.

All poster sessions take place in rooms located next to the main lecture.

Exhibition and coffee breaks also take place in rooms next to the lecture hall.



On-Site Facilities
Wireless Internet is available inside the building of the conference centre with free access.
A message board around the registration area will be installed.

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.

Coffee Breaks
Coffee breaks take place directly next to the lecture room. The exhibition will take place at the same time.

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 to the **Special Symposium on** "**Novel Laser-Matter Interaction Regimes**" which will take place on Tuesday, 23rd and Wednesday morning 24th August 2016.
- 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.
- **Online digest** including the one-page summaries.
- **Welcome Reception** as mentioned in the Social Programme (**Conference Dinner** is only included provided an additional extra cost of 10€ per participant was paid)
- **Entrance to the exhibition**.
- **Coffee breaks** as mentioned in the programme.

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

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. Also, no guest tickets can be obtained on site.

Conference Registration Hours:

	Morning	Afternoon
Sunday 21 August 2016		12:00 – 17:00
Monday 22 August 2016	07:30 – 12:00	13:00 – 17:00
Tuesday 23 August 2016	07:30 – 12:00	13:15 – 16:30
Wednesday 24 August 2016	07:45 – 11:45	13:00 – 16:30
Thursday 25 August 2016	07:45 – 11:45	13:00 – 16:30
Friday 26 August 2016	07:45 – 12:00	13:30 – 16:00

Conference Hours:

	Morning	Afternoon
Sunday 21 August 2016		13:45 – 18:15 (*)
Monday 22 August 2016	08:00 – 12:30 (*)	13:45 – 18:15 (*)
Tuesday 23 August 2016	08:00 – 12:30	13:45 – 21:00 (**)
Wednesday 24 August 2016	08:00 – 12:30	13:45 – 19:00
Thursday 25 August 2016	08:00 – 12:30	13:45 – 19:15 (***)
Friday 26 August 2016	08:00 – 12:30	13:45 – 18:30

(*) Summer School
(**) including Special Student Training Session
(***) including Post deadline session

Coffee Breaks:

	Morning	Afternoon
Sunday 21 August 2016		15:45 – 16:15
Monday 22 August 2016	10:00 – 10:30	15:45 – 16:15
Tuesday 23 August 2016	10:00 – 10:30	15:45 – 17:00 (**)
Wednesday 24 August 2016	10:00 – 10:30	15:45 – 17:00 (**)
Thursday 25 August 2016	10:00 – 10:30	15:45 – 17:00 (**)
		18:00 – 18:30
Friday 26 August 2016	10:00 – 10:30	16:00 – 16:30

(**) held in conjunction with the poster session

Lunch Breaks:

Monday 22 August 2016	12:30 – 13:45
Tuesday 23 August 2016	12:30 – 13:45
Wednesday 24 August 2016	12:30 – 13:45
Thursday 25 August 2016	12:30 – 13:45
Friday 26 August 2016	12:30 – 13:45

Social Programme:

		Time	Location
Monday 21 August 2016	Welcome Reception	18:45 – 21:00	Kuppelsaal of TU Vienna
Wednesday 24 August 2016	Conference Dinner and Dinner Speech	19:30 – 22:00	Wiener Rathauskeller

Special Event:

		Time	Location
Thursday 25 August 2016	EPS QEOD Prize for Research in Laser Science and Applications Ceremony	17:00 – 18:00	Lecture Hall EI7

Conference Committees

General Chair: Andrius Baltuska, *TU Vienna, Austria*

Programme Chair: F. Ömer Ilday, *Bilkent University, Ankara, Turkey*

Local Chairs: Audrius Pugzlys and Markus Kitzler, *TU Vienna, Austria*

Programme Sub-Committee "Solid-State Lasers"

Chair: Majid Ebrahim-Zadeh, *The Institute of Photonic Sciences (ICFO), Barcelona, Spain*

Antonioangelo Agnesi, *Università di Pavia, Pavia, Italy*
Eric Cormier, *University of Bordeaux, Bordeaux, France*
Shekhar Guha, *Air Force Research Laboratory, Materials and Manufacturing Directorate, Wright Patterson Air Force Base, Ohio, USA*
Christian Kränkel, *University of Hamburg, Hamburg, Germany*
Vaslav Kubecek, *Czech Technical University, Prague, Czech Republic*
Marco Marangoni, *Politecnico di Milano, Milan, Italy*
Uwe Morgner, *University of Hannover, Laser Zentrum Hannover, Hannover, Germany*
Fabian Rotermund, *Ajou University, Suwon, South Korea*
Alphan Sennaroğlu, *Koç University, Istanbul, Turkey*

Programme Sub-Committee "Fibre and Waveguide Devices"

Chair: Johan Nilsson, *University of Southampton, ORC, Southampton, United Kingdom*

Rodrigo Amezcua Correa, *CREOL, Orlando, USA*
Mark Dubrinskii, US Army Research Laboratory, Adelphi, USA
Phillipe Grelu, *Université de Bourgogne, Dijon, France*
Xavier Mateos, *Max Born Institute, Berlin, Germany*
Markus Pollnau, *Kungliga Tekniska Högskolan, Kista, Sweden*
Thomas Schreiber, *Fraunhofer Institute for Applied Optics, Jena, Germany*
John Travers, *Max Planck Institute for the Science of Light, Erlangen, Germany*
Yoann Zaouter, *Amplitude Systèmes, Evry, France*

Steering Committee

Chair: Valdas Pasiskevicius, *Royal Institute of Technology, KTH, Stockholm, Sweden*

Andrius Baltuska, *Technical University of Vienna, Austria (ex officio)*
Andrew Clarkson, *University of Southampton, ORC, Southampton, United Kingdom (QEOD representative)*
Patrick Georges, *Institut d'Optique, Palaiseau, France*
Ingmar Hartl, *DESY, Hamburg, Hamburg, Germany*
Ömer Ilday, *Bilkent University, Ankara, Turkey (ex officio)*
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.

Vienna

Vienna is the capital and the largest city of Austria with a population of about 1.8 million (2.6 million within the metropolitan area) and it is the second-largest German-speaking city. Vienna is host to many major international organizations, including the **United Nations and OPEC**. In 2001, the city centre was designated a **UNESCO World Heritage Site.** The city is quite rich in culture.

Many sights are located in or around the present city center, as this was the entire city for many centuries, strictly confined by a fortification. Only few romanesque and gothic buildings remain, which are typically churches. The most famous one is certainly St. Stephen's Cathedral, which marks the very center of Vienna and features both medieval architectural styles. The imperial *Hofburg*. Palace also has a medieval core, but was extended and modified many times in various kinds of styles, such that the original look is well concealed today.

The baroque style is much more prominent in Vienna (and Austria). Many churches were built in that period, among them St. Charles's Church, which is located in close proximity to the conference venue. But there are also important secular buildings from the baroque era, most prominently *Schönbrunn* and *Belvedere* palaces.

The predominant historic style, however, dates back to the latter half of the 19th century, and is generally known as historicism. It means that previous styles were copied and often combined. As in many other cities, the fortification was eventually torn down, making room for a circular boulevard around the city center with many important buildings, such as the City Hall, the State Opera, the Parliament and several others. The architectural style was often chosen according to the function of the building.

Around 1900, the *Jugendstil* (Art noveau) emerged, and there are still several remnants of that era, most notably the Vienna Secession building, which is not far from the conference venue. The first metropolitan railways, built by Otto Wagner, also date back to that era, and you can still see the historic *Karlsplatz* station building close to the venue. Soon thereafter, modernism emerged, which was widely applied in an unparalleled municipal tenement building program. One of the most prominent architectural evidence of that era is the *Karl-Marx-Hof* with more than 1300 apartments. It is more than a kilometer long and remains the longest residential building in the world to date.

Museums

Vienna has a long tradition of arts, and consequently a large number of museums. The collections on display range from traditional paintings to very specialized topics such as globes, schnapps or undertakers.

During their long reign, the Habsburg dynasty collected numerous works by artists such as Raphael, Caravaggio, Tizian, Rubens, Bruegel, Arcimboldo and many others. Those paintings, as well as artefacts from ancient civilizations, are on display in the *Kunsthistorisches Museum*. Speaking of Habsburg: The crown jewels of the Holy Roman Empire and the Austrian Empire as well as many other valuables can be seen in the Secular and Ecclesiastical Treasury.

Paintings of the 19th and early 20th centuries, most notably Klimt, Schiele and Kokoschka, are hosted in the Upper *Belvedere*. Similarly, the *Leopold Museum* is focused on paintings of the early 20th century. It is located in the so called *Museumsquartier*, a complex which houses several museums, but also bars and restaurants. An impressive collection of drawings (e.g. by Dürer) and prints can be found in the *Albertina*.

The history of Vienna is well represented in the *Wien Museum*, next to St. Charles's Church not far from the conference venue. *MAK*, the museum of applied arts, has a large collection of handicrafts from medieval to contemporary periods. The *Sigmund Freud Museum* is located in the former place where the inventor of psychoanalysis lived and worked. The rich Jewish history of Vienna is revealed in the Jewish Museum Vienna.

This is only a short list of the most prominent museums.

Music

What would Vienna be without music? The *Wiener Klassik* (First Viennese School) features the most famous composers of the late 18th century: Haydn, Mozart and Beethoven. None of them was born in Vienna, but they all moved to the city, worked and died here. Needless to say that there are many opportunities to listen to their works.

But also in the 19th century, especially the second half, several famous musicians emerged in Vienna, e.g. Brahms, Mahler or the Strauss family. The *An der schönen blauen Donau* (Blue Danube) waltz by Johann Strauss the younger is probably the best known musical score of the time and has been used in many movies such as Kubrick's 2001.

Based on that long tradition, there are many places in Vienna where one can listen to classical music (in a wider sense, including the 19th and early 20th centuries as well). First of all, the well-known Vienna State Opera is certainly worth a visit, but be aware that it is not always easy to obtain tickets. There are two more opera houses in the city: one is the so called *Theater an der Wien*, quite close to the conference venue and the other one is the *Volksoper* (People's Opera), which also features operettas and musicals.

Get Around

Public transportation in Vienna is very good. Luckily, all means of public transportation within the city limits can be used with the same ticket (one exception is the yellow trams circulating around the city center). Tickets are sold at tobacconists, at vending machines in underground and S-Bahn stations.

From Vienna airport to the conference venue

Railjet and IC

Railjets (RJ) and intercity trains (IC) depart from the airport at **03** and **33 min** past the hour and bring you to the main railway station (Wien Haupfbahnhof) within 15 minutes. The cost of a one-way ticket is **8.60€.** From Wien Hauptbahnhof take subway **U1**: one stop to *Taubstummengasse* or two stops to *Karlsplatz.*

Currency

The official currency in Vienna is the **Euro.**

Weather

The climate in Austria is typically temperate. The temperatures are mild in summer. End of August may be nice but occasional showers may happen.

Sunday 21 August 2016 (Summer School)

13:45 - 15:45	**Summer School Lecture 1** **Giulio Cerullo,** *Politecnico di Milano, Italy* **"Micro/nanostructuring with Ultrashort Laser Pulses »**
15:45 - 16:15	Coffee Break
16:15 - 18:15	**Summer School Lecture 2** **See Lang Chin,** *Center for Optics, Photonics and Laser (COPL) Laval University,Quebec City, Canada* **"Femtosecond Laser Filamentation and Some Applications »**

Monday 22 August 2016 (Summer School)

08:00 - 10:00	**Summer School Lecture 3** **Ursula Keller,** *Department of Physics, Institute for Quantum Electronics ETH Z rich, Z rich, Switzerland* **"Semiconductor Saturable Absorber Mirror (SESAM) »**
10:00 - 10:30	Coffee Break
10:30 - 12:30	**Summer School Lecture 4** **Almantas Galvanauskas**, *Electrical Engineering and Computer Science Department University of Michigan, Ann Arbor, Michigan, USA* **"High Brightness Fiber Laser Technologies"**
12:30 - 13:45	Lunch Break
13:45 - 15:45	**Summer School Lecture 5** **Paul B. Corkum,** *Joint Attosecond Science Laboratory University of Ottawa, Ottawa, Canada* **"From Femtosecond to Attoseconds"**
15:45 - 16:15	Coffee Break
16:15 - 18:15	**Summer School Lecture 6** **Christopher Barty,** *Lawrence Livermore National Laboratory, Livermore, USA* **Megajoule-class Lasers for Fusion and Beyond**
18:45 – 21:00	**Welcome Reception and Welcome Speech**

Tuesday 23 August 2016 (Conference)

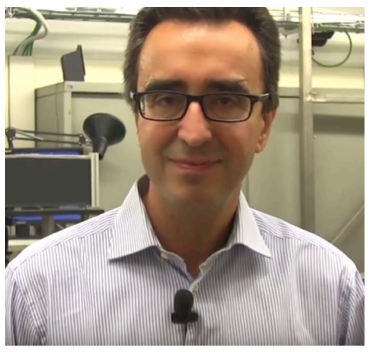
	08:00 - 08:15	Welcome presented by **Andrius Baltuska** and **Ömer Ilday**
SS-1	**08:15 - 10:00**	**Special Symposium – Novel Laser-matter Interaction Regimes (I)** (oral session and Special Symposium)
	10:00 - 10:30	Coffee Break
SSL-1	**10:30 - 12:30**	**Frequency Combs and CEP-Stabilised Sources** (oral session)
	12:30 -13:45	Lunch Break
FWG-1	**13:45 - 15:45**	**Beam Combination** (oral session)
PO.1	**15:45 - 17:00**	**Poster Session 1** with Coffee Break
FWG-2	**17:00 - 19:00**	**Fiber Lasers and Amplifiers** (oral session)

	Wednesday 24 August 2016 (Conference)	
SS-2	**08:00 - 10:00**	**Special Symposium – Novel Laser-matter Interaction Regimes (II)** (oral session - Special symposium)
	10:00 - 10:30	Coffee Break
SSL-2	**10:30 - 12:30**	**Frequency Conversion and OPOs** (oral session)
	12:30 - 13:45	Lunch Break
FWG-3	**13:45 - 15:45**	**New Sources and Concepts for Imaging and Spectroscopy** (oral session)
PO.2	**15:45 - 17:00**	**Poster Session 2** with Coffee Break
SSL-3	**17:00 - 19:00**	**OPAs/OPCPAs** (oral session)
	19:30 – 22:00	Conference Dinner
	Thursday 25 August 2016 (Conference)	
FWG-4	**08:00 - 10:00**	**Materials and Waveguide Lasers** (oral session)
	10:00 - 10:30	Coffee Break
SSL-4	**10:30 - 12:30**	**Crystalline Lasers** (oral session)
	12:30 - 13:45	Lunch Break
SSL-5	**13:45 - 15:45**	**High-Power Lasers** (oral session)
PO.3	**15:45 - 17:00**	**Poster Session 3** with Coffee Break
	17:00 - 18:00	**EPS Prize for Research in Laser Science and Applications**
	18:00 - 18:30	Refreshments
	18:30 - 19:15	**Post deadline Session**
	Friday 26 August 2016 (Conference)	
SSL-6	**08:00 - 10:00**	**Mode-Locked Lasers** (oral session)
	10:00 - 10:30	Coffee Break
SSL-7	**10:30 - 12:30**	**Lasers and Applications (I)** (oral session)
	12:30 - 13:45	Lunch Break
FWG-5	**13:45 - 16:00**	**Hollow-Core, Ultrashort, and High-Energy Fiber Sources** (oral session)
	16:00 - 16:30	Coffee Break
SSL-8	**16:30 - 18:15**	**Lasers and Applications (II)** (oral session)
	18:15 - 18:30	Closing Remarks

Sunday 21 August 2016

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



Giulio Cerullo
Politecnico di Milano, Milano, Italy

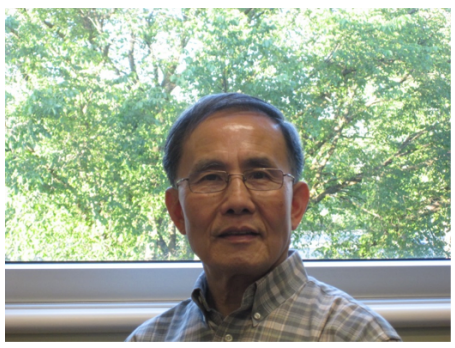
Topic: Micro/nanostructuring with ultrashort laser pulses

Due to their unique nonlinear light matter interaction regime, femtosecond lasers have recently emerged as a powerful micro/nanostructuring tool for transparent dielectrics. On the one hand, they enable to induce a permanent refractive index increase in a (sub-) micrometer-sized volume in the bulk of the material, allowing single-step, mask-free writing of optical waveguides and photonic circuits. On the other hand, glass irradiation followed by selective chemical etching enables the manufacturing of directly buried microfluidic channels. Finally, two photon polymerization of photosensitized resists results in cross linking of the monomers/oligomers and true three dimensional nanofabrication with subdiffraction limited lateral and axial resolution. This lecture will review the physical foundations of laser microstructuring techniques and present examples of their applications to manipulation and sensing of biomolecules as well as stem cell growth.

15:45 - 16:15 Coffee Break (Foyer)

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



See Leang Chin
Center for Optics, Photonics and Laser (COPL),
Laval University, Quebec City, Canada

Topic: **Femtosecond laser filamentation and some applications**.

After a quick historical review of the impact of laser technology on high laser field physics, the physics of femtosecond laser filamentation will be discussed in detail. Intensity clamping leads to the so-called filamentation nonlinear optics inside the filament zone where homogeneous high field interactions are possible. A few examples of application will be given, such as high field chemical reaction, remote sensing and lasing in air. The talk will end with the observation of filament induced snow/rain inside a cloud chamber

Monday 22 August 2016

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

Ursula Keller
Department of Physics, Institute for Quantum Electronics ETH Zürich, Switzerland

Topic: **Semiconductor saturable absorber mirror (SESAM)**

Ultrafast lasers have become the key enabling technology for many new applications. This tutorial reviews the design and characterization of SESAMs, SESAM-mode locked diode-pumped solid-state and semiconductor thin disk lasers, frequency comb generation and noise characterization.

10:00 - 10:30 Coffee Break (Foyer)

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 4

Almantas Galvanauskas
Electrical Engineering and Computer Science Department, University of Michigan, Ann Arbor USA

Topic: **High Brightness Fiber Laser Technologies**

This tutorial will survey scientific and technological foundations, state of the art, and emerging new applications of high peak power and high energy pulsed fiber lasers, with a strong emphasis on ultrashort pulse systems. Due to their suitability for high average power and high wall plug efficiency fiber lasers are very attractive as pulsed sources for multitude of applications, but limitations inherent in fiber geometry make it very challenging to achieve high short-pulse energies. It will be discussed how numerous innovations ranging from large core fiber design, to novel system architectures, such as coherent spatial-domain and time-domain combining, are pushing this technology towards significantly higher energies, and entirely new applications.

12:30 - 13:45 Lunch Break

Summer School Lecture 5 - 13:45 - 15:45

13:45-14:30 Summer School Lecture 5
14:30-14:45 Break
14:45-15:30 Summer School Lecture 5, continued
15:30-15:45 Discussion 5

Paul B. Corkum
Joint Attosecond Science Laboratory, University of Ottawa, Ottawa, Canada

Topic: **From Femtoseconds to Attoseconds**

Summer School

The tutorial will cover short pulse generation and characterization in both the femtosecond and attosecond domain. Similarities and differences will be emphasized as well as the unique experiments opened by attosecond science.

15:45 - 16:15 Coffee Break (Foyer)

Summer School Lecture 6 - 16:15 - 18:15

16:15-17:00 Summer School Lecture 6
17:00-17:15 Break
17:15-18:00 Summer School Lecture 6, continued
18:00-18:15 Discussion 6

Christopher Barty
Lawrence Livermore National Lab, Livermore, USA

Topic: **Megajoule-class Lasers for Fusion and Beyond**

This tutorial will review megajoule-class laser technology, the pursuit of inertial confinement fusion and the implications and extensions of these technologies for clean energy and extreme field science.

Tuesday 23 August 2016

SS-1: Special Symposium - Novel Laser-matter Interaction Regimes (I)
08:15 – 10:15

08:15 – 08:45 (Invited Speaker Special Symposium)
THz Linear Acceleration and Compact X-ray Sources,
Franz X. Kärtner, *Center for Free-Electron Laser Science, DESY, Hamburg, and The Hamburg Center for Ultrafast Imaging Hamburg, Germany*
A compact attosecond X-ray source based on novel laser-matter interactions is discussed. It includes a THz based electron gun and accelerator with a nanostructured photocathode and optical undulator to froma Free-Electron Laser like coherent X-ray source. The source is driven by a 1J, 1kHz repetition rate picosecond Yb:YAG laser.

09:00 – 09:30 (Invited Speaker Special Symposium)
Energy partition and dynamics of absorption and ablation in burstmode (>100 MHz) ultra-fast pulsed laser ablation in biotissues
Robin Marjoribanks, *Zuoming Qian.Z.[1], Andrés Covarrubias[1], Margarete Akens Lothar Lilge[2]— [1]Department of Physics, University of Toronto, Canada—[2]Princess Margaret Cancer Centre, and Department of Medical Biophysics, University of Toronto, Toronto, Canada*
100+ MHz burst-mode ultrafast-laser ablation of biological tissues depends on how each pulse interacts with the sample, thus ultimately on the state left over from the previous pulse. Measured dynamics of absorption show the impact of persistence of ionization, dissipation of plasma plume, and the driven oscillation of cavitation features.

SSL-1: Frequency Combs and CEP-Stabilised Sources
10:30 – 12:30

10:30 (Keynote) **- Advances in optical frequency combs and their applications**
Scott Diddams — *NIST, Gaithersburg, USA*
Recent advances in the development of optical freuquency combs based on both mode-locked lasers and micro-resonator devices will be reviewed. Precision frequency synthesis with these laser-based tools is enabling a range of applications in mid-infrared spectroscopy and trace gas sensing, optical clocks, waveform synthesis and astronomy.

FWG-1: Beam Combination
13:45 – 15:45

13:45 (Invited) - **Beam combining of fiber amplifiers**
Tso Yee Fan, *MIT Lincoln Laboratory, Lexington, MA, USA*
Beam combining of arrays of lasers is becoming an increasing attractive approach to generate high-power and high-brightness sources. Coherent beam combining can scale the brightness by large amounts, in principle by as much as the number of elements.

14:15 (Invited) **- Multi-kW-level near-diffraction-limited coherent polarization beam combining of fiber laser sources**
Pu Zhou[1,2], *Pengfei Ma[1,2], Jiangming Xu[1,2], Rumao Tao[1,2], Hailong Yu[1,2], Xiaolin Wang[1,2] - [1]College of Optoelectronic Science and Engineering, National University of Defense Technology, Changsha, 410073, China — [2]Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, Changsha 410073, China*
We will show the recent progress in developing the coherently combinable high power linearly-polarized fiber amplifiers and their combining. Four linearlypolarized fiber amplifiers are coherently polarized beam combined (CPBC) into a 3-kW single aperture beam with near-diffraction-limited beam quality. CPBC of two high-average-power femtosecond fiber amplifiers will also be presented

FWG-2 : Fiber lasers and Amplifiers
17 :00 – 19 :00

17 :00 **(Invited) Active and passive solid-core microstructured fibers for laser applications**
Olivier Vanvincq[1], *Jean-Paul Yehouessi*[1], *Pierre Gouriou*[1,2], *Florent Scol*[1,2], *Andy Cassez*[1], *Hicham El Hanazaoui*[1], *Mohamed Bouazaoui*[1], *Emmanuel Hugonnot*[2], *Constance Valentin*[1], *Yves Quiquempois*[1], *Géraud Bouwmans*[1], *Laurent Bigot*[1], *[1]University of Lille, Lille, France - [2]Commissariat à l'Energie Atomique et aux Energies Alternatives, Centre d'Etudes Scientifiques et Techniques d'Aquitaine, Le Barp, France*
We will describe our strategies to achieve largemode area while keeping a singlemode behavior in solid-core photonic bandgap fibers by using cladding heterostructuration or pixelated Bragg fibers. Experimental and numerical results on microstructured single-mode fibers that deliver a flat top intensity profile will be also reported.

STS : Student Training Session
19 :00 – 21 :00

19 :00 **Physical Modeling in Passive and Active Fiber Optics**
R. Paschotta, *R.P. Photonics GmbH, Bad Dürrheim, Germany*
This course gives an overview on modeling in fiber optics, covering the calculation of fiber modes, numerical beam propagation, light absorption and amplification in active fibers, amplified spontaneous emission, self-consistent steady-state solutions for fiber amplifiers and lasers, and ultrashort pulse propagation in mode-locked fiber lasers and ultrafast amplifiers.

Wednesday 24 August 2016

SSL-2 Frequency Conversion and OPOs
10:30 – 12:30

10:30 (Invited) **Highly nonlinear crystals for ultrafast mid-IR frequency conversion**
Peter Schunemann - *BAE Systems, Inc., Nashua, NH, USA*
ZnGeP2 and CdSiP2, as well as the orientation-patterned semiconductors GaAs (OP-GaAs) and GaP (OP-GaP), exhibit the highest nonlinear optical coefficients among phase-matchable crystals with practical absorption losses and transparency ranges. Advances in growth and processing of these materials have extended ultrafast laser output deep into the mid-infrared.

FWG-3 : New Sources and Concepts for Imaging and Spectroscopy
13 :45 – 15 :45

13:45 (Invited) **- All-fiber optical parametric oscillator for bio-medical imaging**
Thomas Gottschaal[1], *Tobias Meyer*[2], *Michael Schmitt*[2], *Jürgen Popp*[2,3], *Jens Limpert*[1,4], *Andreas Tünnermann*[1,4], - *[1]Friedrich-Schiller-Universität Jena, Abbe Center of Photonics, Albert-Einstein-Str. 6, 07745 Jena, Germany —[2]Friedrich-Schiller-Universität Jena, Institute of Physical Chemistry, Abbe Center of Photonics, Helmholtzweg 4, 07743 Jena, Germany—[3]Leibniz-Institut für Photonische Technologien Jena (IPHT) e.V., Albert-Einstein-Str. 9, 07745 Jena, Germany — [4]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany*
The first broadly tunable all-.ber optical parametric oscillator system is presented. This laser concept could very well be the missing key to establish nonlinear imaging as a diagnostic tool in bio-medical domains.

14:45 (Keynote) **- Intermodal nonlinear fiber optics: a new pathway to power scalable sources**
Siddharth Ramachandran —*ECE Department & Photonics Center, Boston, University, Boston, MA, USA*
Fibers stably guiding a multitude of Bessel-beam-like spatial modes help decouple the dispersion-versus-mode-area trade-off that often restricts achievable power levels via nonlinear-optical interactions in single-moded fibers and waveguides. We will discuss this design space and potential applications in fields as disparate as quantum-optics, nanoscale and deep-tissue imaging, and highpower lasers.

Thursday 25 August 2016

FWG-4: Materials and Waveguide Lasers
08:00 – 10:00

08:30 (Invited) **- Rare-earth-doped active device on glass: from telecom to sensors**
Jean-Emmanuel Broquin[1,2], *Lionel Bastard*[1,2], *Elise Chibaudo*[1,2], *Davide Bucci*[1,2] - [1]*Univ. Grenoble Alpes, IMEP-LAHC, F-38000 Grenoble, France* — [2]*CNRS, IMEP-LAHC, F-38000 Grenoble, France*
This paper reviews the activities carried-out on rare-earth-doped active devices made by ion exchange on glass at the IMEP-LaHC over the last decade. First the technology is presented, then results on Erbium lasers for airborne Lidar, Neodymium pulsed lasers for supercontinuum generation and recent developments on hybrid devices are shown.

SSL-4 : Crystalline Lasers
10 :30 – 12 :30

10 :30 (Invited) - **High-power single-crystal fiber amplifiers**
Xavier Délen - *Institute of Optics, France*
We present a study of the specificity of the pump guiding in the single crystal fiber (SCF) and give an overview of the results obtained using SCF gain modules in laser amplifiers including high power experiments and the last results obtained with picosecond multi-stages Yb:YAG SCF amplifiers.

Friday 26 August 2016

SSL-6: Mode-Locked Lasers
08:00 – 10:00

08:00 (Invited) **- Progress in development of gain and saturable absorber mirrors for semiconductor disc lasers**
Guina Mircea - *Tampere University, Tampere, Finland*
Recent progress in the development of gain and saturable absorber mirrors used in semiconductor disc lasers is reviewed. Emphasis is put on linking technological advances to laser performance, in particular concerning power scaling and wavelength coverage. An overview of emerging applications in spectroscopy and medicine is provided.

SSL-7 : Lasers and Applications (I)
10 :30 – 12 :30

10:30 (Invited) **- High-power single-mode cw lasers for gravitational wave detection**
Dietmar Kracht - *Lazerzentrum Hannover, Germany*
The development of high-power solid-state lasers for gravitational wave detectors is presented, in particular with respect to the state-of-the-art lasers utilized in the current generation of these detectors. Furthermore, results on high-power fiber amplifiers regarding

SSL-8: Lasers and Applications (II)
16:30 – 18:15

16:30 (Invited) **- Structured laser beams and novel applications**
G.K. Samanta - *Photonic Sciences Lab., Physical Research Laboratory, Navarangpura, Ahmedabad 380009, Gujarat, India*
Structured laser beams are of great importance due to their wide range of scientific and technological applications. In this talk, we will discuss our recent results on generation of various structured laser beams including optical vortices, perfect vortices, Airy beam, and hollow Gaussian beam and some of their applications.

SS: Special Symposium "Novel Laser-matter interaction regimes"

The Europhoton Conference includes a half day Special Symposium entitled "Novel laser-matter interaction regimes". We are experiencing truly exciting times for laser-matter interactions, as two broad fields have accelerated in recent years simultaneously. On the scientific side, interaction of intense laser radiation with matter enabled by novel laser sources now provide convenient access to extreme parameter ranges, which were only recently unthinkable, with impact from high-field physics to generation of x-rays. On the applications side, ultrafast lasers are finally fulfilling their long-held promise of transforming laser-material and in particular laser-tissue interactions, from glass processing to recently developed femtosecond cataract surgeries, with significant impact already materializing in the multi-billion dollar industries associated with them. Ranging from large-scale facilities to portable laser boxes, the common driving force behind these developments is the capability to access extreme parameter ranges enabled by recent developments in laser technology. The goal of this Special Symposium is to bring together a diverse group of users and developers of applications of novel interaction regimes together with the community behind the development of the laser technology, such that common interests as well as laser needs, which are not addressed by existing technologies can be identified."

SSL : 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.

FWD : 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.

The **EPS-QEOD Prize for Research in Laser Science and Applications** is a major prize awarded on behalf of the European Physical Society through its Quantum Electronics & Optics Division (QEOD). **The prize is awarded every 2 years in recognition of recent work by one or more individuals (no more than three) for scientific excellence in the area of laser science and applications in its broadest sense. Relevant topics include laser source development, power-scaling concepts, pump source development, nonlinear optics, ultrafast sources, material science, spectroscopic and characterisation techniques, and applications both in optics and photonics as well as in other fields.**

The work for which the individual(s) is/are nominated must be such that a significant component of it was performed during the period 5 years prior to the award. In addition, the award will recognise research for which a significant portion of the work was carried out in Europe or in cooperation with European researchers, and may be given for either pure or applied research. The award is accompanied by an engraved glass medal, a certificate, and a monetary sum of 2000 euros.

EPS QEOD Prize

Welcome Reception

Time: Monday, 18:45–21:00 Location: Kuppelsaal

Chair's Welcome

Chair: Andrius Baltuska, Technical University of Vienna, Austria and Ömer Ilday, Bilkent University, Turkey

Time: Tuesday, 8:00–8:15 Location: Lecture Hall EI7

SS-1: Special Symposium - Novel Laser-Matter Interaction Regimes (I)

Chair: Giulio Cerullo, Politecnico di Milano, Milano, Italy

Time: Tuesday, 8:15–10:00 Location: Lecture Hall EI7

Invited SS-1.1 Tue, 8:15

THz Linear Acceleration and Compact X-ray Sources — •Franz X. Kärtner — Center for Free-Electron Laser Science, DESY, Hamburg, and The Hamburg Center for Ultrafast Imaging Hamburg, Germany

A compact attosecond X-ray source based on novel laser-matter interactions is discussed. It includes a THz based electron gun and accelerator with a nanostructured photocathode and optical undulator to from a Free-Electron Laser like coherent X-ray source. The source is driven by a 1J, 1kHz repetition rate picosecond Yb:YAG laser.

SS-1.2 Tue, 8:45

Thulium-doped Fiber Lasers for Dielectric Laser Accelerators — •A. Ruehl[1], N. Schoenberger[2], F. Stutzki[3], M. Kozak[2], J. McNeur[2], C Gaida[3], M. Gebhard[3], J. Limpert[3], P. Hommelhoff[2], and I. Hartl[1] — [1]Deutsches Elektronen-Synchrotron (DESY), Notkestrasse 85, 22607 Hamburg, Germany — [2]Department of Physics, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstrasse 1, 91058 Erlangen, Germany — [3]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745 Jena, Germany

Dielectric laser acceleration has the potential to achieve GV/m accelerating gradients and to shrink the size of an electron accelerator to a microchip. We show that 2μm Tm:fiber drive laser in combination with silicon accelerating structures have an significant advance over previously used Ti:sapphire laser and fused silica gratings.

Invited SS-1.3 Tue, 9:00

Energy partition and dynamics of absorption and ablation in burst-mode (>100 MHz) ultra-fast pulsed laser ablation in biotissues — •Robin Marjoribanks[1], Zuoming Qian[1], Andrés Covarrubias[1], Margarete Akens[2], and Lothar Lilge[2] — [1]Department of Physics, University of Toronto, Toronto, Canada — [2]Princess Margaret Cancer Centre, and Department of Medical Biophysics, University of Toronto, Toronto, Canada

100+ MHz burst-mode ultrafast-laser ablation of biological tissues depends on how each pulse interacts with the sample, thus ultimately on the state left over from the previous pulse. Measured dynamics of absorption show the impact of persistence of ionization, dissipation of plasma plume, and the driven oscillation of cavitation features.

SS-1.4 Tue, 9:30

Ablation-cooled material removal at ultra-high repetition rates — Can Kerse[1], Hamit Kalaycioğlu[2], Perviz Elahi[2], Önder Akçaalan[1], Seydi Yavaş[3], Mehmet D. Aşik[4], Denizhan K. Kesim[1], Barbaros Çetin[5], and •F. Ömer İlday[1,2] — [1]Department of Electrical and Electronics Engineering, Bilkent University, Ankara, 06800, Turkey — [2]Department of Physics, Bilkent University, Ankara, 06800, Turkey — [3]FiberLAST, A.S., Ankara, 06800, Turkey — [4]Nanotechnology and Nanomedicine Department, Hacettepe University, Ankara, 06800, Turkey — [5]Department of Mechanical Engineering, Bilkent University, Ankara, 06800, Turkey

Here, we report material processing results which exploits ablation cooling, a concept very well-known in rocket design. We show the improvement in efficiency and thermal free ablation including metals, silicon, hard and soft tissue even with sub-microjoule pulses with efficiencies of 100-μJ pulses at ultra-high repetition rates.

SS-1.5 Tue, 9:45

Ultrafast four-wave-mixing to the deep-UV in gas-filled kagomé-PCF — •Federico Belli, Amir Abdolvand, John C. Travers, and Philip St.J. Russell — Max Planck Institute for the Science of Light, Erlangen, Germany

We report the generation of highly efficient deep-ultraviolet light pulses through four-wave mixing in a 26 μm diameter Ar-filled kagomé-PCF. We demonstrate a 30% conversion efficiency from 400 nm to obtain an energy of 490 nJ at 266 nm, when seeding at the idler wavelength of 800 nm.

Tuesday

10:00–10:30 Coffee Break

SSL-1: Frequency Combs and CEP-Stabilised Sources

Chair: Majid Ebrahim-Zadeh, The Institute of Photonic Sciences, Barcelona, Spain

Time: Tuesday, 10:30–12:30 Location: Lecture Hall EI7

Keynote SSL-1.1 Tue, 10:30

Advances in optical frequency combs and their applications — •Scott Diddams — NIST, Gaithersburg, USA

Recent advances in the development of optical freuquency combs based on both mode-locked lasers and micro-resonator devices will be reviewed. Precision frequency synthesis with these laser-based

tools is enabling a range of applications in mid-infrared spectroscopy and trace gas sensing, optical clocks, waveform synthesis and astronomy.

SSL-1.2 Tue, 11:15

Gigahertz Offset-Free Mid-Infrared Frequency Comb — •Aline S. Mayer[1], Chris R. Phillips[1], Carsten Langrock[2], Alexander Klenner[3], Adrea R. Johnson[3], Kevin Luke[4], Yoshitomo Okawachi[3], Michal Lipson[5], Alexander L. Gaeta[3], Martin M. Fejer[2], and Ursula Keller[1] — [1]Department of Physics, Institute of Quantum Electronics, ETH Zurich, 8093 Zurich, Switzerland — [2]Edward L. Ginzton Laboratory, Stanford University, Stanford, California 94305, USA — [3]Applied Physics and Applied Mathematics, Columbia University, New York, NY 10027, USA — [4]School of Electrical and Computer Engineering, Cornell University, Ithaca, NY 14853, USA — [5]Department of Electrical Engineering, Columbia University, New York, NY 10027, USA

We generate offset-free gigahertz frequency combs tunable from 2.5 to 4.2 μm with up to 4 μW per comb line by using PPLN waveguides for 35-dB-amplification of a supercontinuum generated in a silicon nitride waveguide by the same non-amplified Yb:CALGO-laser that pumps the OPA process.

SSL-1.3 Tue, 11:30

Energy-scalable, CEP-stable, 110-fs, 5.3-micron ZGP Parametric Amplifier Driven by a ps Ho:YAG Chirped Pulse Amplifier and its application to high harmonic generation — •Tsuneto Kanai[1], Pavel Malevich[1], Sarayoo Kangaparambil[1], Kakuta Ishida [2], Makoto Mizui [2], Kaoru Yamanouchi[2], Heinar Hoogland [3,4], Ronald Holzwarth[3], Audrius Pugzlys[1,5], and Andrius Baltuska[1,5] — [1]Photonics Institute, Vienna University of Technology, Gusshausstrasse 27-387, A-1040 Vienna, Austria — [2]Department of Chemistry, School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan — [3]Menlo Systems GmbH, Am Klopferspitz 19a, 82152 Martinsried, Germany — [4]Department of Physics, University of Erlangen-Nuremberg, Staudtstr. 1, 91058 Erlangen, Germany — [5]Center for Physical Sciences & Technology, Savanoriu Ave. 231 LT-02300 Vilnius, Lithuania

We present two alternative approaches for the compression of few-cycle MIR pulses and application of such pulses for HHG in bulk solids.

SSL-1.4 Tue, 11:45

Multi-mJ CEP-Stable Mid-IR OPA pumped by a femtosecond 120 mJ Yb:CaF2 amplifier — •Tadas Balciunas, Guangyu Fan, Tsuneto Kanai, Giedrius Andriukaitis, Edgar Kaksis, and Andrius Baltuska — Institute of Photonics, TU Wien, Gusshausstrasse 27/387, Vienna, Austria

We present a passively CEP-stabilized parametric source tunable in the 3 to 4 μm spectral range producing 6 mJ 82 fs pulses at 3.2 μm. A diode-pumped Yb:CaF2 120 mJ 200 fs multi-pass amplifier is used as a pump source

SSL-1.5 Tue, 12:00

First Detection and Stabilization of the Carrier Envelope Offset of a Diode-Pumped Mode-Locked Ti:Sapphire Laser — •Kutan Gürel, Valentin J. Wittwer, Sargis Hakobyan, Stéphane Schilt, and Thomas Südmeyer — Laboratoire Temps-Fréquence, Université de Neuchâtel, Avenue de Bellevaux 51, CH-2000 Neuchâtel, Switzerland

So far, femtosecond Ti:Sapphire-based frequency combs required complex and expensive green frequency-doubled DPSSL pump sources. Here we demonstrate the first detection and stabilization of the CEO frequency of a diode-pumped ultrafast Ti:Sapphire laser. No external power modulator is required; instead we use direct current modulation of the pump laser diode.

SSL-1.6 Tue, 12:15

VUV frequency comb from a non-planar femtosecond enhancement cavity — •Georg Winkler, Jakob Fellinger, Jozsef Seres, Enikoe Seres, and Thorsten Schumm — Vienna Center for Quantum Science and Technology, Atominstitut, Technische Universität Wien, Stadionallee 2, 1020 Vienna, Austria

A VUV frequency comb at 160 nm is demonstrated by generating the 5th harmonic of a femtosecond Ti:sapphire oscillator via cavity-enhanced HHG. Unique 3D resonator configuration is implemented to minimize dispersion and aberration effects. The source will be used for high-precision nuclear spectroscopy of the low-energy isomer state of Th-229.

12:30–13:45 Lunch Break

FWG-1: Beam Combination

Chair: Mark Dubinskiy, US Army Research Laboratory, Adelphi, USA

Time: Tuesday, 13:45–15:45 Location: Lecture Hall EI7

Invited FWG-1.1 Tue, 13:45

Beam combining of fiber amplifiers — •Tso Yee Fan — MIT Lincoln Laboratory, USA

Beam combining of arrays of lasers is becoming an increasing attractive approach to generate high-power and high-brightness sources. Coherent beam combining can scale the brightness by large amounts, in principle by as much as the number of elements.

Invited FWG-1.2 Tue, 14:15

Multi-kW-level near-diffraction-limited coherent polarization beam combining of fiber laser sources — •Pu Zhou[1,2], Pengfei Ma[1,2], Jiangming Xu[1,2], Rumao Tao[1,2], Hailong Yu[1,2], and Xiaolin Wang[1,2] — [1]College of Optoelectronic Science and Engineering, National University of Defense Technology, Changsha 410073, China — [2]Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, Changsha 410073, China

We will show the recent progress in developing the coherently combinable high power linearly-polarized fiber amplifiers and their combining. Four linearly-polarized fiber amplifiers are coherently polarized beam combined (CPBC) into a 3-kW single aperture beam with near-diffraction-limited beam quality. CPBC of two high-average-power femtosecond fiber amplifiers will also be presented.

FWG-1.3 Tue, 14:45

Coherent beam combining of 19 fibers in the femtosecond regime — Jeremy Le Dortz[1], Anke Heilmann[2], Marie Antier[3], Jerome Bourderionnet[1], Christian Larat[1], Eric Lallier[1], •Louis Daniault[2], Ihsan Fsaifes[2], Severine Bellanger[2], Christophe Simon-Boisson[3], Jean-Christophe Chanteloup[2], and Arnaud Brignon[1] — [1]Thales Research & Technology, Palaiseau, France — [2]LULI, Ecole Polytechnique, CNRS, CEA, UPMC, Palaiseau, France — [3]Thales Optronique SAS, Elancourt, France

Tuesday

We report on the coherent beam combining of a record number of 19 fibers in the femtosecond regime, actively phase-locked with an interferometric measurement method. The residual phase-shift error is measured below l/60 rms and the combined pulses are transform-limited with 305 fs duration.

FWG-1.4 Tue, 15:00

11.7 mJ pulse energy kW-class average power 8-channel ultrafast fibre laser — •Michael Müller[1], Marco Kienel[1,2], Arno Klenke[1,2], Thomas Gottschall[1], Evgeny Shestaev[1], Jens Limpert[1,2,3], and Andreas Tünnermann[1,2,3] — [1]Friedrich-Schiller-University Jena, Institute of Applied Physics, Albert-Einstein-Straße 15, 07745 Jena, Germany — [2]Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Straße 7, 07745 Jena, Germany

We demonstrate an ultrafast fibre laser featuring 8 amplifier channels delivering 1 kW average power at 1 mJ pulse energy and a pulse duration of ~260 fs. Using divided-pulse amplification, 11.7mJ of pulse energy are extracted using 4 pulses at 690 W average power.

FWG-1.5 Tue, 15:15

Extraction of enhanced, ultrashort laser pulses from a passive 10-MHz stack-and-dump cavity — •Sven Breitkopf[1], Stefano Wunderlich[1], Tino Eidam[2], Evgeny Shestaev[1], Thomas Gottschall[1], Henning Carstens[3,4], Simon Holzberger[3,4], Andreas Tünnermann[1,5,6], Ioachim Pupeza[3], and Jens Limpert[1,2,5,6] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität, Jena, Germany — [2]Active Fiber Systems GmbH, Jena, Germany — [3]Max-Planck-Institute of Quantum Optics, Garching, Germany — [4]Ludwig-Maximilians-Universität München, Garching, Germany — [5]Helmholtz-Institute Jena, Germany — [6]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

Periodic dumping of ultrashort laser-pulses from a passive enhancement-cavity, is a promising route towards multi-kHz-repetition-rate pulses with Joule-level energies at unparalleled average powers. We extract 0.16-mJ pulses (65 stacked pulses) at 30 kHz repetition-rate from a 10-MHz cavity, representing an energy improvement of three orders of magnitude over previous results.

FWG-1.6 Tue, 15:30

Manifold coherent combining in hollow-fiber compressors — Hermance Jacqmin[1,2], Brigitte Mercier[1], •Stefan Haessler[1], Aurélie Jullien[1], and Rodrigo Lopez-Martens[1,3] — [1]Laboratoire d'Optique Appliquée, ENSTA Paristech, Ecole Polytechnique, CNRS, Université Paris-Saclay, 828 bd des Maréchaux, 91762 Palaiseau cedex, France — [2]Thales Optronique SA, Laser Solutions Unit, 2 Avenue Gay-Lussac, 78995 Elancourt, France — [3]ELI Attosecond Light Pulse Source, ELI-Hu Non-Profit Ltd, Dugonics ter 13, Szeged, H-6720, Hungary

We demonstrate passive fourfold coherent combining of 10-fs pulses from a hollow-fiber compressor with 92% efficiency using birefringent plates for pulse division and combination and show how dispersion and nonlinear cross-talk between replicas must be carefully managed in order to preserve the high temporal fidelity of the compressed recombined pulses.

PO-1: Poster Session 1 with Coffee Break

Time: Tuesday, 15:45–17:00 Location: Foyer

PO-1.1 Tue, 15:45

Amplification of a radially-polarised beam in an Yb:YAG thin slab — •Callum Smith, Stephen Beecher, Jacob Mackenzie, and Andy Clarkson — Optoelectronics Research Centre, University of Southampton, Southampton, UK

Amplification of an axially-symmetric, doughnut-shaped radially-polarised beam at 1030nm in a diode-bar-pumped double-pass thin Yb:YAG slab amplifier architecture without degradation in polarisation purity is demonstrated. Preliminary experiments yielded a small-signal gain of 9dB for 50W of incident pump power while maintaining the polarisation purity of the seed beam.

PO-1.2 Tue, 15:45

Energy scaling of pre-chirp managed nonlinear amplification using circular polarization — •Yizhou Liu[1,2], Wei Liu[1,2], Damian Schimpf[1,3], Tino Eidam[4,5], Jens Limpert[4,5], Andreas Tünnermann[4,5], Franz Kärtner[1,2,3], and Guoqing Chang[1,3] — [1]Center for Free-Electron Laser Science — [2]Physics Department, University of Hamburg — [3]The Hamburg Centre for Ultrafast Imaging — [4]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena — [5]Helmholtz Institut Jena

We investigated energy scaling of pre-chirp managed amplification (PCMA) using circularly polarized seeding pulses. Using circularly polarized seed can scale up the pulse energy by 1.5 times than linearly polarized seed without changing the spectral bandwidth of the amplified pulse. We finally obtained 24-MHz, 55 fs, 1.4 μJ amplified pulses.

PO-1.3 Tue, 15:45

Simulation and experimental investigation of higher order beam distortions in end-pumped bulk laser amplifiers — •Philipp Albrodt[1], Xavier Délen[1], Mondher Besbes[1], Julien Pouysegur[2], Frédéric Druon[1], and Patrick Georges[1] — [1]Laboratoire Charles Fabry, Institut d'Optique Graduate School, CNRS, Université Paris-Saclay, 91127 Palaiseau Cedex, France — [2]Amplitude Systemes, 11 avenue de Canteranne, Cité de la Photonique, 33600, Pessac, France

We present a MATLAB-based FEA and BPM simulation and experimental investigation of beam distortions in end-pumped bulk crystals for a non-amplified probe signal. The results show higher order distortions, which are usually observed for end-pumped laser amplifiers and are a first step towards an implemented distortion compensation.

PO-1.4 Tue, 15:45

Diode-pumped Er,Yb:GdAl3(BO3)4 laser passively Q-switched with a SWCNT saturable absorber — •Konstantin Gorbachenya[1], Viktor Kisel[1], Anatol Yasukevich[1], Sergey Kurilchik[1,4], Viktor Maltsev[2], Nikolai Leonyuk[2], Sunyoung Choi[3], Fabian Rotermund[3], and Nikolai Kuleshov[1] — [1]Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — [2]Department of Crystallography and Crystal Chemistry, Moscow State University, Moscow, Russia — [3]Department of Energy Systems Research & Department of Physics, Ajou University, Suwon, Republic of Korea — [4]Kazan Federal University, Kazan, Russia.

Diode-pumped Er,Yb:GdAl3(BO3)4 laser emitting near 1.5 μm passively Q-switched by using single-walled carbon nanotube (SWCNT) based saturable absorber was demonstrated. Q-switched laser pulses with energy of 0.8 μJ and duration of 130 ns at a maximum repetition rate of 500 kHz were obtained at 1550 nm.

Tuesday

PO-1.5 Tue, 15:45

Fast-tunable femtosecond visible radiation via intracavity sum-frequency generation in a NIR NOPO — •Yuliya Khanukaeva[1], Tino Lang[2], Ayhan Tajalli[1], José R. C. Andrade[1], Thomas Binhammer[3], and Uwe Morgner[1,4] — [1]Institut für Quantenoptik, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany — [2]Deutsches Elektronen-Synchrotron DESY, Notkestrasse 85, D-22607 Hamburg, Germany — [3]VENTEON Laser Technologies GmbH, Hertzstr. 1B, D-30827 Garbsen, Germany — [4]Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover, Germany

We present an ultrabroadband femtosecond non-collinear OPO simultaneously delivering NIR pulses from 650-950 nm and VIS pulses from 412 to 500 nm generated via intracavity sum-frequency generation. Fast tunability over the whole range is demonstrated by varying the resonator length only.

PO-1.6 Tue, 15:45

Thermal lensing in cubic sesquioxides Tm:Lu2O3, Tm:Y2O3 and Tm:Sc2O3 — •Pavel Loiko[1,2], Josep Maria Serres[1], Xavier Mateos[1,3], Konstantin Yumashev[2], Valentin Petrov[3], Uwe Griebner[3], Magdalena Aguiló[1], Francesc Díaz[1], and Christian Kränkel[4,5] — [1]Física i Cristallografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV), Tarragona, Spain — [2]Center for Optical Materials and Technologies (COMT), Belarusian National Technical University, Minsk, Belarus — [3]Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — [4]Universität Hamburg, Institut für Laser-Physik, Hamburg, Germany — [5]Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Hamburg, Germany

Thermal lensing is studied for cubic sesquioxides, Tm:Lu2O3, Tm:Y2O3 and Tm:Sc2O3. For 1.8 at.%Tm:Lu2O3, sensitivity factor of the thermal lens is 3.7 m-1/W and the fractional heat load is 0.34±0.05. Tm:Lu2O3 microchip laser generated an output power of 3.3 W at 2063 nm with a slope efficiency of 50%.

PO-1.7 Tue, 15:45

Fabrication of a multicore coupler for phase locking of fiber lasers — •Ziv Alperovich[1,2], Gabriel Bialolenker[3], Zev Montz[1], and Amiel A. Ishaaya[1] — [1]Department of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva 84105, Israel — [2]Electro-Optics Unit, Ben-Gurion University of the Negev, Beer Sheva 84105, Israel — [3]Nuclear Research Center Negev, 84190 Beer-Sheva, Israel

We present a multicore fiber coupler design for passive phase locking six fiber lasers. The LMA core diameter is 20 μm and the pitch is 50 μm. Preliminary fabrication trials using tapered HF-etched LMA fibers and a Quartz tube are shown.

PO-1.8 Tue, 15:45

Generation and parametric amplification of broadband chirped pulses centered at 2 μm — •Agnė Marcinkevičiūtė and Rytis Butkus — Vilnius University, Faculty of Physics, Laser Research Center, Saulėtekio ave. 10, LT-10223 Vilnius, Lithuania

We demonstrate generation and parametric amplification of broadband chirped pulses at 2 μm. Two stages for parametric amplification were employed and 0.5 mJ pulses at 1 kHz have been achieved. Two-beam pumping was applied in the last stage for broadening and shaping of the amplified pulse spectrum.

PO-1.9 Tue, 15:45

Er:Ti:LiNbO3 ridge waveguides amplifiers by optical grade dicing and three-side Er/Ti in-diffusion — •Sergiy Suntsov, Christian Rüter, and Detlef Kip — Helmut Schmidt University, Hamburg, Germany

The fabrication of erbium-doped ridge waveguide optical amplifiers in lithium niobate by optical-grade diamond blade dicing is reported. The method of erbium/titanium in-diffusion from all three sides of the ridges allows for the better overlap of guided modes with the dopant concentration profiles thus leading to improved small-signal amplification.

PO-1.10 Tue, 15:45

Bending Loss Characterization in Nodeless Hollow-core Anti-Resonant Fiber — •Shoufei Gao[1], Yingying Wang[1], Xiaolu Liu[1], Wei Ding[2], and Pu Wang[1] — [1]Institute of Laser Engineering, Beijing University of Technology, Beijing, China — [2]Laboratory of Optical Physics, Institute of Physics, Chinese Academy of Sciences, Beijing, China

State-of-the-art nodeless hollow-core anti-resonant fibers are demonstrated with outstanding optical performance on the aspects of transmission bandwidth and bending loss. In-depth investigation show the flexibility of tailoring the transmission band in a tightly bent fiber, paving the way for plenty of interdisciplinary applications including pulse compression and laser-matter interaction.

PO-1.11 Tue, 15:45

New developments in high power, all-fiberized and polarization-maintained amplifiers with narrow linewidth and near-diffraction-limited beam quality — •Pengfei Ma[1,2,3], Pu Zhou[1,2,3], Jiangming Xu[1,2,3], Wei Liu[1,2,3], and Rumao Tao[1,2,3] — [1]College of Optoelectric Science and Engineering, National University of Defense Technology, Changsha, 410073, China — [2]Hunan Provincial Key Laboratory of High Energy Laser Technology, Changsha, 410073, China — [3]Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, Changsha, 410073, China

The brightness scaling potentials of all-fiberized, narrow linewidth and polarization-maintained amplifiers are investigated. The SBS effect is suppressed by two types of narrow linewidth seeds, respectively. The MI effect is suppressed by using selective mode loss mechanism. Near 2 kW output is achieved without SBS, SRS and MI effects.

PO-1.12 Tue, 15:45

Measurement of active fiber longitudinal temperature distribution using radiofrequency impedance spectroscopy — •Vadim Akhtyamov[1], Renat Shaidullin[1,2], and Oleg Ryabushkin[1,2] — [1]Moscow Institute of Physics and Technology, Institutskii per. 9, Dolgoprudny Moscow region, 141700, Russia — [2]Kotelnikov Institute of Radio-engineering and Electronics of RAS, Vvedensky Sq.1, Fryazino Moscow region, 141190, Russia

Method, based on radio-frequency impedance spectroscopy, for measuring longitudinal temperature distribution of protective polymer coating of active fiber in condition of generation and amplification of laser radiation is introduced. Temperature distribution measurement results for high-power optical amplifier, assembled using Yb3+/Er3+-doped silica fiber, are presented.

PO-1.13 Tue, 15:45

Periodic laminar structured quartz for intense-laser pumped wavelength conversion — •Hideki Ishizuki and Takunori Taira — Institute for Molecular Science, Okazaki, Japan

Crystal quartz was used in the first wavelength conversion, and has excellent optical properties as short absorption edge and high laser-damage threshold, which is suitable for intense pulse-laser pumped wavelength convesion. We present on initial evaluation of quasi-phase matched wavelength conversion using periodic laminar structured quartz.

PO-1.14 Tue, 15:45

A comparative study on cryogenically cooled Yb:YGAG ceramic diode laser pumped at 940 nm and Zero-phonon-line — •Venkatesan Jambunathan, Petr Navratil, Taisuke Miura, Akira Endo, Antonio Lucianetti, and Tomas Mocek — HiLASE Centre, Institute of Physics CAS, Dolní Břežany, Czech Republic

We present continuous-wave laser operation of cryogenically cooled Yb:YGAG ceramic diode laser pumped using two different pump

sources, one at 940 nm and other at 969 nm under identical experimental conditions. At 80K maximum output of 6.5 W with a slope efficiency of 52% is obtained for 969 nm.

PO-1.15 Tue, 15:45

Generation of ultra-broadband dissipative solitons from a simple Tm-doped all-fiber laser — •Grzegorz Sobon, Jaroslaw Sotor, and Krzysztof Abramski — Laser & Fiber Electronics Group, Wroclaw University of Technology, Wroclaw, Poland

We demonstrate the generation of ultra-broadband dissipative solitons from a simple, fully fiberized mode-locked Tm-doped fiber laser. The oscillator is mode-locked via nonlinear polarization evolution in the net normal dispersion regime. Depending on the net dispersion, the laser was capable of generating 60 nm or 100 nm broad dissipative solitons.

PO-1.16 Tue, 15:45

Building block of picosecond pump laser for large femtosecond OPCPA infrastructure projects — Jonas Adamonis[1], Aidas Aleknavicius[1], •Kirilas Michailovas[1], Stanislovas Balickas[1], and Andrejus Michailovas[1,2] — [1]Ekspla, Vilnius, Lithuania — [2]Institute of Physics, Center for Physical Sciences and Technology, Vilnius, Lithuania

We present an amplifier layout, which could be used as a building block of an efficient pump source for a TW class high repetition rate OPCPA system, providing output power of ~150W at 1 kHz repetition rate with pulse duration of ~100 ps.

PO-1.17 Tue, 15:45

High-power, room temperature, continuous-wave optical parametric oscillator across 0.7- 2.1 um based on fan-out grating MgO:sPPLT — •Kavita Devi[1] and Majid Ebrahim-Zadeh[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — [2]Institucio Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, Barcelona 08010, Spain

We report a high-power single-frequency continuous-wave optical parametric oscillator at room temperature, tunable across 0.7-2.1um, using fan-out grating MgO:sPPLT. The watt-level idler output exhibits passive power-stability better than 1%rms (30mins.), and the signal output exhibits a frequency stability of 518 MHz (2mins.) and a linewidth of 6.9MHz in good beam-quality.

PO-1.18 Tue, 15:45

Modelling the Influence of the Third Energy Level in the Gain Dynamics of Fiber Amplifiers — •Omar de Varona[1], Michael Steinke[1,2], Dietmar Kracht[1,2], Jörg Neumann[1,2], and Peter Wessels[1,2] — [1]Laser Zentrum Hannover, Hannover, Germany — [2]Centre for Quantum-Engineering and Space-Time research, Hannover, Germany

We report an analytical model to describe the gain dynamics of 3-level system fiber amplifiers and its experimental validation by fitting it to the pump-power-to-output-power transfer functions and studying the induced phase-shift in an EDFA. The results show good agreement with the common values in literature.

PO-1.19 Tue, 15:45

Polarization-controlled wavelength switching in fiber ring laser using inline switching filter based on polarization-diversity loop — •kyoungsoo Park[1], sungwook Choi[1], songhyun Jo[1], jihoon Kim[2], seullee Lee[1], junhyeog Jung[1], seonjae Jung[1], and yong wook Lee[1,2] — [1]Interdisciplinary Program of Biomedical Mechanical & Electrical Engineering, Pukyong National University, 45 Yongso-ro, Nam-gu, Busan 48513, Korea — [2]School of Electrical Engineering, Pukyong National University, 45 Yongso-ro, Nam-gu, Busan 48513, Korea

By composing a polarization-diversity loop, we have demonstrated the inline switching optical fiber ring laser of reflection spectra of one of two short-period grating with different resonance wavelengths, which is dependent of input polarization. The output lasing is generated at 1554.92 nm and 1549.98 nm.

PO-1.20 Tue, 15:45

Characterization of optical pulses generated by fiber pulse generators based on self-phase modulation and alternating spectral filtering — Julijanas Želudevičius, Marijus Mickus, and •Kęstutis Regelskis — Center for Physical Sciences & Technology, Vilnius, Lithuania

In this work we investigate fiber pulse generator based on self-phase modulation and alternating spectral filtering in the case when material dispersion effect is negligible. Influence of generator setup configuration for pulse characteristics is estimated by numerical calculations and experimental trials.

PO-1.21 Tue, 15:45

Bragg fibers for delivery of 1.9 μm- laser radiation — •Milan Frank[1], Michal Jelínek[1], Václav Kubeček[1], Ondřej Podrazký[2], Ivan Kašík[2], and Vlastimil Matějec[2] — [1]Czech Technical University in Prague, Faculty of Nuclear Sciences and Physical Engineering, Břehová 7, 115 19 Prague 1, Czech Republic — [2]Institute of Photonics and Electronics, ASCR v.v.i., Chaberská 57, 182 51 Prague 8, Czech Republic

In this paper we deal with the 1.94um laser-radiation delivery using several Bragg fibers with the air core diameters in a range of 5-73um. The lowest attenuation coefficient of 1.278dB/m was determined for the Bragg fiber with a core diameter of 56um. In addition, fundamental optical characteristics will be presented.

PO-1.22 Tue, 15:45

OPCPA Pump Source Based on Chirped Second Harmonic Pulse Compression — •Laurynas Veselis[1], Rokas Danilevičius[1,2], Audrius Zaukevičius[1], Andrejus Michailovas[1,2], and Nerijus Rusteika[1,2] — [1]Ekspla Ltd, Savanoriu ave. 237, LT-02300, Vilnius, Lithuania — [2]Center for Physical Sciences and Technology, Savanoriu ave. 231, LT-02300, Vilnius, Lithuania

In this work a novel variation of a CPA technique was demonstrated. Second harmonic generation was performed and corresponding pulses were compressed in Treacy pulse compressor yielding shorter pulse durations compared to first harmonic.

PO-1.23 Tue, 15:45

The characteristics of PW-level OPCPA near 800nm with different injected signal energies — •Lianghong Yu, Xiaoyan Liang, Wenqi Li, Yuxin Leng, Ruxin Li, and Zhizhan Xu — State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China

In this letter, we investigate the main output characteristics of PW-level Optical parametric chirped-pulse amplification (OPCPA) near 800 nm with different injected signal energies. After optimization, the peak power of amplified laser pulse reached 1.02 PW with a compressed duration of 32 fs.

PO-1.24 Tue, 15:45

Tunable diode pumped 2.1 μm Tm,Ho:GGAG laser — •Jan Šulc[1], Pavel Boháček[2], Michal Němec[1], Martin Fibrich[1], Helena Jelínková[1], Bohumil Trunda[2], Lubomír Havlák[2], Karel Jurek[3], Martin Nikl[3], and Karel Nejezchleb[4] — [1]Czech Technical University in Prague, Prague, Czech Republic — [2]Institute of Physics of the ASCR, Division of Condensed Matter, Prague, Czech Republic — [3]Institute of Physics of the ASCR, Division of Solid State Physics, Prague, Czech Republic — [4]Crytur, Ltd. Turnov, Turnov, Czech Republic

Non-stoichiometric tertiary garnet Tm,Ho:GGAG was investigated as an active medium in diode pumped laser, tunable using birefringent filter. The laser tuning range extended from 2006 nm up to 2122 nm. The output energy of 3.2 mJ at 2089 nm was obtained for the absorbed energy 50 mJ.

PO-1.25 Tue, 15:45

Passive harmonic mode-locking in all-polarization maintaining fiber laser based on antimony telluride saturable absorber — •Jakub Boguslawski[1], Grzegorz Sobon[1], Maciej Kowalczyk[1], Rafal Zybala[2], Jan Tarka[1], Krzysztof Abramski[1], and Jaroslaw Sotor[1] — [1]Wroclaw University of Technology, Wroclaw, Poland — [2]Warsaw University of Technology, Warsaw, Poland

We report 3 GHz passive harmonic mode-locking in all-polarization-maintaining Er-doped fiber laser. The laser was mode-locked by antimony telluride (Sb2Te3) thin film saturable absorber, deposited directly on the fiber connector, which provides 2% modulation depth at low saturation fluence. Picosecond, scalar soliton pulses were generated with 19 mW average power.

PO-1.26 Tue, 15:45

192.3J output energy using Ti:Sapphire CPA laser system — •Zebiao Gan, Yuxi Chu, Xiaoyan Liang, Lianghong Yu, Yuxin Leng, Ruxin Li, and Zhizhan Xu — Shanghai Institute of Optics and Fine Mechanics, Shanghai, China

We compare the output ability of the lightly doped and heavily doped large aperture Ti:Sapphire. Our research results indicated that lightly doped Ti:S is more favorable to overcome the PL and TASE, near 200J pulse energy can be achieved using a 150mm diameter lightly doped Ti:S with PL supression technology.

PO-1.27 Tue, 15:45

Laser performance of non-aqueous tape casting fabricated composite YAG/Yb:YAG ceramics — •Chao Wang[1], Wenxue Li[1], Chao Yang[1], Dongbi Bai[1], Jiang Li[2], Lin Ge[2], Yubai Pan[2], and Heping Zeng[2] — [1]East China Normal University, Shanghai, China — [2]Chinese Academy of Sciences, Shanghai, China

Two and three layers of different compositions (YAG/Yb:YAG and YAG/Yb:YAG/YAG) were designed to reduce the thermal effects and thermally induced mechanical stress, constructing better continuous-wave and mode-locked lasers.

PO-1.28 Tue, 15:45

Generation of laser beam in variable sized "perfect" vortex spatial structure and its interaction with nonlinear crystal — •M.V. Jabir[1], N. Apurv Chaitanya[1,2], A. Aadhi[1], and G. K. Samanta[1] — [1]Physical Research Laboratory, Ahmedabad, India — [2]Indian Institute of Technology-Gandhinagar, India

We report a novel scheme to generate a new class of laser beams in vortex structure having beam radius and vortex order as mutually independent parameters. Interaction of such beams with nonlinear crystal through spontaneous-parametric-down-conversion (SPDC) shows that the angular-spectrum of SPDC photons are independent of orbital-angular-momentum of pump laser.

PO-1.29 Tue, 15:45

10 W multipass Ti:S amplifier for 80 MHz repetition rate — •Attila Andrásik[1], Péter Jójárt[1,2], Szabolcs Toth[1,2], Roland Sándor Nagymihály[1,2], Ádám Börzsönyi[1,2], and Károly Osvay[1,2] — [1]Department of Optics and Quantum Electronics, University of Szeged, P.O. Box 406, H-6701 Szeged, Hungary — [2]ELI-HU Nonprofit Kft, Dugonics tér 13., Szeged, Hungary

We present a design of a novel multipass Ti:S amplifier for the amplification of few cycle laser pulses at 80MHz repetition rate. Ray-tracing modeling of the geometry, and beam size measurements based on knife-edge method are included.

PO-1.30 Tue, 15:45

Towards continuous wave operation of ring cavity quantum cascade lasers — •Martin Holzbauer[1], Rolf Szedlak[1], Benedikt Schwarz[1], Donald MacFarland[1], Tobias Zederbauer[1], Hermann Detz[2], Aaron M. Andrews[1], Werner Schrenk[1], Mykhaylo P. Semtsiv[3], Ted W. Masselink[3], and Gottfried Strasser[1] — [1]Institute of Solid State Electronics and Center for Micro- and Nanostructures TU Wien, Vienna, Austria — [2]Austrian Academy of Sciences, Vienna, Austria — [3]Physics Department Humboldt University Berlin, Berlin, Germany

We present strategies to achieve continuous wave operation of mid-IR ring cavity quantum cascade lasers. In FEM simulations the heat dissipation and thermal bottlenecks are investigated and compared to experimental results from fabricated lasers. Device configurations optimized for surface and substrate emission are discussed.

PO-1.31 Tue, 15:45

Characterization of ultranarrow-linewidth distributed-feedback resonators below laser threshold — •Cristine Calil Kores[1], Dimitri Geskus[1], Nur Ismail[1], Meindert Dijkstra[2], Edward Bernhardi[1], and Markus Pollnau[1] — [1]Department of Materials and Nano Physics, School of Information and Communication Technology, KTH – Royal Institute of Technology, Electrum 229, Isafjordsgatan 22–24, 16440 Kista, Sweden — [2]Optical Sciences, MESA+ Institute, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands

The resonance linewidth near 1029 nm of distributed-feedback resonators in Yb-doped aluminium oxide channel waveguides versus pump power below laser threshold is measured by a narrow-linewidth laser and calculated from gain measurements, providing good agreement between measurement and theory. The gain elongates the photon decay time and narrows the linewidth.

PO-1.32 Tue, 15:45

Simulation on thermal load gradient mitigation with auxiliary multi-seeds amplification in fiber amplifier — •Yutong Feng, Harish Achar Vasant, Yujun Feng, Nan Zhao, and Johan Nilsson — Optoelectronics Research Centre, University of Southampton, Southampton, UK

A technique that employs auxiliary multi-seeds for mitigating the inhomogeneous of thermal load in Yb-doped double cladding amplifier is presented and verified in simulation. The results shows this technique can reduce the thermal load gradient by a significant ratio, thus has potential application in high power amplifiers.

PO-1.33 Tue, 15:45

Picosecond high-average power parametric mid-IR source — Ondřej Novák[1], •Michal Vyvlečka[1,2], Martin Smrž[1], Taisuke Miura[1], Akira Endo[1], and Tomáš Mocek[1] — [1]HiLASE Centre, Institute of Physics AS CR, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic — [2]Faculty of Mathematics and Physics, Charles University in Prague, Ke Karlovu 3, 121 16 Praha 2, Czech Republic

The 100-kHz, 100-W, Yb:YAG thin-disk regenerative amplifier of 1030 nm wavelength pumps the parametric mid-IR source. The OPG stage with PPLN crystal is continuous-wave seeded at 1.94 μm. Signal is amplified in KTP crystals. The generated mid-IR idler wave of 2.2 μm wavelength is taken from the final amplifier.

PO-1.34 Tue, 15:45

Compact, high power, continuous-wave, single frequency, 10 um core Yb-doped fiber amplifier and single-pass, frequency doubling to 532 nm — •Enkeleda Balliu[1], Magnus Engholm[1], Peter Jänes[2], Gunnar Elgcrona[2], and Håkan Karlsson[2] — [1]Mid Sweden University, Sundsvall, Sweden — [2]Cobolt AB, (A HÜBNER group company), Solna, Sweden

We report on a high power, single frequency, continuous wave, polarization maintaining, single stage fiber amplifier operating at 1064nm by using a custom made, ultra low noise seed laser and an overall fiber core/cladding diameter of 10/125μm. A custom made, highly Yb-doped active fiber is used to suppress non-linear effects.

PO-1.35 Tue, 15:45

Single shot laser writing with sub-nanosecond bursts of femtosecond pulses — •Andrey Okhrimchuk, Ivan Glebov, Vladimir Sigaev, and Peter Kazansky — D. Mendeleyev University of Chemical Technology of Russia

A method of efficient laser micromachining of fused silica and sapphire with a burst of femtosecond pulses separated by 10 – 100 ps is proposed and demonstrated. It exploits strongly localized absorption by transient electronic excitations prepared by the first pulse in the burst.

PO-1.36 Tue, 15:45

Molecular pathway control in sequential double ionization of CO_2 using two-pulse sequences — •Sonia Erattupuzha, Seyedreza Larimian, Andrius Baltuška, Xinhua Xie, and Markus Kitzler — Photonics Institute, Vienna University of Technology, Vienna, Austria

We visualize and control molecular dynamics taking place on intermediately populated states during different sequential double ionization pathways of CO_2 using a sequence of two pulses with different peak intensities. Exchanging the pulse-sequence can almost completely switch the pathway, pointing towards opportunities for strong-field fragmentation control on extended time scales.

PO-1.37 Tue, 15:45

ultra-narrow linewidth 1.6 μm continuous-wave singly resonant optical parametric oscillator — •Aliou LY, Christophe Siour, and Fabien Bretenaker — Laboratoire Aimé Cotton, CNRS-Université Paris Sud 11-ENS Cachan, 91405 Orsay Cedex, France

We present a 1-Watt, low noise single frequency continuous-wave singly resonant optical parametric oscillator. When locked on a Fabry-Perot cavity by a recently demonstrated technique, the 1.65 μm non-resonant OPO idler is narrowed down to a sub-kHz linewidth over 2s.

PO-1.38 Tue, 15:45

Ultrafast All-in-fiber Soliton Oscillator Optimized for Fiber Chirped Pulse Amplification System — •Tadas Bartulevičius[1,2,3], Rokas Danilevičius[1,2], and Nerijus Rusteika[1,2] — [1]Ekspla, Ltd., Vilnius, Lithuania — [2]Center for Physical Sciences and Technology, Vilnius, Lithuania — [3]Department of Quantum Electronics, Vilnius University, Vilnius, Lithuania

In this work the generation of ultrashort pulses from all-in-fiber oscillator using low anomalous group delay dispersion chirped fiber Bragg gratings were investigated. Femtosecond pulses directly from average soliton pulse oscillator were achieved. Spectral filtering technique was demonstrated in all-in-fiber resonator for pulse spectrum quality management both numerically and experimentally.

PO-1.39 has been withdrawn.

PO-1.40 Tue, 15:45

Use of mismatched grating pairs with a cylindrical Öffner Stretcher working at the Littrow condition — •Shuai Li[1,2], Cheng Wang[1], Yanqi Liu[1], Zhengzheng Liu[1], Yuxin Leng[1], and Ruxin Li[1] — [1] State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China — [2]University of Chinese Academy of Science, Beijing 100049, China

A stretcher-compressor system based on the cylindrical stretcher and a standard Treacy compressor with mismatched grating pairs is presented. Experiment shows that the output beam of the stretcher has little chromatic aberration. With this type design, the production of high-contrast pulses with pulse widths less than 30fs becomes possible.

PO-1.41 Tue, 15:45

Multioctave, odd-harmonics-enhanced supercontinuum from plasma-dominated filamentation in solid state medium — •Nail Garejev[1], Vytautas Jukna[2], Gintaras Tamošauskas[1], Milda Veličkė[1], Rosvaldas Šuminas[1], Arnaud Couairon[3], and Audrius Dubietis[1] — [1]Department of Quantum Electronics, Vilnius University, Vilnius, Lithuania — [2]Laboratoire d'Optique Appliquée, ENSTA ParisTech, Ecole Polytechnique, Université Paris Saclay, Palaiseau, France — [3]Centre de Physique Théorique, CNRS, Ecole Polytechnique, Palaiseau, France

We demonstrate that plasma-dominated filamentation regime in a solid state medium (CaF_2 crystal), which is accessed for millimetre-range propagation lengths and few TW/cm^2 input pulse intensities, produces ultraviolet-to-mid-infrared supercontinuum, whose short wavelength side is strongly enhanced by cascaded generation and spectral broadening of third, fifth and seventh harmonics.

PO-1.42 Tue, 15:45

Influence of cooperative upconversion on optical gain in Yb3+-doped waveguide amplifiers — •Pavel Loiko[1], Laura Agazzi[1,2], Cristine Calil Kores[1], Meindert Dijkstra[3], Dimitri Geskus[1], and Markus Pollnau[1] — [1]Department of Materials and Nano Physics, School of Information and Communication Technology, KTH – Royal Institute of Technology, Kista, Sweden — [2]Visiting scientist — [3]Optical Sciences, MESA+ Institute, University of Twente, Enschede, The Netherlands

We show that the process responsible for fast quenching of Yb ions in amorphous aluminum oxide waveguide amplifiers is cooperative upconversion (CU). The macroscopic CU parameter is derived from pump-transmission and green/infrared-luminescence versus pump-power dependencies. The effect of CU on the optical gain is quantified by considering distinct ion classes.

PO-1.43 Tue, 15:45

Application of Ablation Cooling Technique to Cataract Surgery Using All-Fibre Burst-Mode Laser — •Denizhan Koray Kesim[1], Hamit Kalaycioğlu[2], M. Can Kerse[1], Nurullah Çağıl[3], Mehmet D. Aşık[4], and F. Ömer Ilday[1,2] — [1]Department of Electrical and Electronics Engineering, Bilkent University, Ankara, Turkey — [2]Department of Physics, Bilkent University, Ankara, Turkey — [3]School of Medicine, Yıldırım Beyazıt University, Ankara, Turkey — [4]Department of Nanotechnology and Nanomedicine, Hacettepe University, Ankara, Turkey

We present an all-fibre femtosecond laser system integrated with OCT that can operate in burst-mode. Ablation cooled regime is exploited via closely spaced pulses inside bursts. This enables us to reduce pulse energies for surgery which would decrease the thermal loading on tissue. Several preliminary experiments were conducted and presented.

PO-1.44 Tue, 15:45

Elastooptic effects on quasi-phase-matching wavelengths of a periodically-inverted AlGaAs waveguide — Atsushi Otsuka[1], Koji Amazutsumi[1], Tomonori Matsushita[1,2], and •Takashi Kondo[1,2] — [1]Department of Materials Engineering, The University of Tokyo, Tokyo, Japan — [2]Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, Japan

We have succeeded in determining elastooptic coefficients of $Al_{0.5}Ga_{0.5}As$ films at two wavelengths by utilizing phase-matching wavelengths of second harmonic generation in periodically-inverted AlGaAs waveguide grown on an intentionally-misoriented GaAs substrate. The obtained $p_{11}-p_{12}$ are −0.03 and −0.07 at 0.775 μm and 1.55 μm, respectively.

Tuesday

FWG-2: Fiber Lasers and Amplifiers

Chair: Markus Pollnau, Kungliga Tekniska Högskolan, Kista, Sweden

Time: Tuesday, 17:00–19:00 Location: Lecture Hall EI7

Invited FWG-2.1 Tue, 17:00

Active and passive solid-core microstructured fibers for laser applications — •Olivier Vanvincq[1], Jean-Paul Yehouessi[1], Pierre Gouriou[1,2], Florent Scol[1,2], Andy Cassez[1], Hicham El Hamzaoui[1], Mohamed Bouazaoui[1], Emmanuel Hugonnot[2], Constance Valentin[1], Yves Quiquempois[1], Géraud Bouwmans[1], and Laurent Bigot[1] — [1]University of Lille 1, CNRS, UMR8523, PhLAM, Lille, France — [2]Commissariat à l'Energie Atomique et aux Energies Alternatives, Centre d'Etudes Scientifiques et Techniques d'Aquitaine, Le Barp, France

We will describe our strategies to achieve large mode area while keeping a single-mode behavior in solid-core photonic bandgap fibers by using cladding hetero-structuration or pixelated Bragg fibers. Experimental and numerical results on microstructured single-mode fibers that deliver a flat top intensity profile will be also reported.

FWG-2.2 Tue, 17:30

Single-mode 4.3 kW average power fiber amplifer — •Franz Beier[1,2], Christian Hupel[2], Stefan Kuhn[2], Sigrun Hein[2], Nicoletta Haarlammert[2], Thomas Schreiber[2], Ramona Eberhardt[2], and Andreas Tünnermann[1,2] — [1]Friedrich Schiller University Jena, Institute of Applied Physics, Albert-Einstein-Str. 15, 07745 Jena, Germany — [2]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

We report on a ytterbium-doped high power fiber-amplifier-system based on 'in-house' designed and fabricated large mode area fibers with ultra-low NA. A maximum output power of 4.3kW was demonstrated with excellent beam quality and a high slope efficiency of 90%. No indications for mode instabilities or nonlinear effects were observed.

FWG-2.3 Tue, 17:45

High power all-fiber thulium oscillator with > 550 W output power — •Till Walbaum[1], Matthias Heinzig[1], Thomas Schreiber[1], Ramona Eberhardt[1], and Andreas Tünnermann[1,2,3] — [1]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany — [2]Institute of Applied Physics, Friedrich-Schiller-University Jena, Jena, Germany — [3]Abbe Center of Photonics, Friedrich-Schiller-University Jena, Jena, Germany

We present an all-fiber thulium oscillator at 1970 nm wavelength with more than 550 W output power, over three times the previous record below 2 micron. Splice characterization and optimization is shown to be crucial. Dual mode operation could be identified from fiber analysis and spectral measurement.

FWG-2.4 Tue, 18:00

Tunable Yb-doped fiber laser based on a fiber Bragg grating array and a modified resonator design enabling a constant repetition rate — •Tobias Tiess[1], Philipp Kellner[1], Martin Becker[1], Manfred Rothhardt[1], Hartmut Bartelt[1,2], and Matthias Jäger[1] — [1]Leibniz Institute of Photonic Technology, Jena, Germany — [2]Abbe Center of Photonics, Friedrich Schiller University Jena, Jena, Germany

This work presents an enhanced tuning method for pulsed fiber-integrated lasers using FBG arrays as tailored spectral filters. Based on a novel resonator design, the distributed feedback of the filter is compensated ensuring a constant repetition rate for each wavelength. The concept is experimentally investigated based on an Ytterbium-doped laser.

FWG-2.5 Tue, 18:15

Direct control of mode-locking states of a fiber laser — Roman Iegorov[1] and •F. Ömer Ilday[1,2] — [1]Department of Physics, Bilkent University, 06800 Ankara, Turkey — [2]Department of Electrical and Electronics Engineering, Bilkent University, Ankara, 06800, Turkey

Mode-locked lasers have diverse applications, in addition to being of fundamental interest for investigating nonlinear dynamics of non-equilibrium steady states. We show that we can halt/restart mode-locking, suppress instabilities, reversibly steer mode-locking from one state to another and shape the spectrum using a spatial light modulator placed inside the cavity.

FWG-2.6 Tue, 18:30

11-18 GHz continuously tunable repetition rate picosecond laser source at 1030 nm — •Adrien Aubourg[1], Jérôme Lhermite[1], Steve Hocquet[2], Giorgio Santarelli[3], and Eric Cormier[1] — [1]Centre Lasers Intenses et Applications, Université Bordeaux-CNRS-CEA-UMR 5107, 33405 Talence, France — [2]Greenfield Technology, 1 bis rue Marcel Paul, 91300 Massy, France — [3]Laboratoire Photonique Numérique et Nanosciences (LP2N), UMR 5298, CNRS-IOGS-Université Bordeaux, 33400 Talence, France

We report on a laser system generating 1 picosecond pulses using electro-optical modulation of a 1030 nm single frequency laser diode, with watt range average power and 11-18 GHz continuously tunable repetition rate.

FWG-2.7 Tue, 18:45

2.1 nJ an all-fiber Ho-doped mode-locked laser based on graphene saturable absorber — •Maria Pawliszewska[1], Grzegorz Sobon[1], Aleksandra Przewolka[2], Iwona Pasternak[2], Pavel Peterka[3], Pavel Honzatko[3], Ivan Kasik[3], Wlodek Strupinski[2], Krzysztof Abramski[1], and Jaroslaw Sotor[1] — [1]Laser & Fiber Electronics Group, Wroclaw Univ. of Technology, Wroclaw, Poland — [2]Institute of Electronic Materials Technology, Warsaw, Poland — [3]Institute of Photonics and Electronics, The Czech Academy of Sciences, Prague, Czech Republic

We report an all-fiber Ho-doped mode-locked fiber oscillator based on saturable absorber consisting of 5 layer of graphene. The laser was capable of generating soliton pulses at 2080 nm with duration of ~900 fs. The output power and pulse energy were scaled up to 107 mW and 2.1 nJ, respectively.

Wednesday

SS-2: Special Symposium - Novel Laser-Matter Interaction Regimes (II)

Chair: Ingmar Hartl, DESY, Hamburg, Germany

Time: Wednesday, 8:00–10:00 Location: Lecture Hall EI7

SS-2.1 Wed, 8:00

Laser-sub-cycle fragmentation dynamics of Argon dimers — •Sonia Erattupuzha[1], Vimal Kunnummel[1], Seyedreza Larimian[1], Vaclav Hanus[1], Markus Koch[2], Markus Schöffler[3], Xinhua Xie[1], Andrius Baltuška[1], Gerhard G. Paulus[4,5], Christoph Lemell[6], Joachim Burgdörfer[6], and Markus Kitzler[1] — [1]Photonics Institute, Vienna University of Technology, Vienna, Austria — [2] Institute of Experimental Physics,

Graz University of Technology, Austria — [3]Institut für Kernphysik, Goethe-Universität Frankfurt, Germany — [4]Friedrich-Schiller-Universität Jena, Germany — [5]Helmholtz Institute Jena, Germany — [6] Institute for Theoretical Physics, Vienna University of Technology, Austria

Single and double electron recapture processes into Rydberg states driven by few-cycle laser pulses are studied for argon dimers as a function of the pulses' carrier-envelope phase (CEP). The CEP-dependence of the dimers' center-of-mass momenta shows that the recaptured electrons are born around the maxima of the laser field oscillations.

SS-2.2 Wed, 8:15

Laser-sub-cycle control of sequential double ionization dynamics of Helium — Markus S. Schöffler[1], Xinhua Xie[1], Philipp Wustelt[2,3], Max Möller[2,3], Stefan Roither[1], Ondrej Hort[1], Daniil Kartashov[1], Andrius Baltuška[1], Gerhard G. Paulus[2,3], and •Markus Kitzler[1] — [1]Photonics Institute, Vienna University of Technology, Vienna, Austria — [2] Institute of Optics and Quantum Electronics, Friedrich-Schiller-University Jena, Germany — [3]Helmholtz Institute Jena, Germany

The dynamics of sequential double ionization from helium in near-circularly polarized laser pulses with a known carrier-envelope phase is extracted from measured ion momentum distributions. Two-electron emission in between the field-maxima and on sub-laser-cycle times is identified. Corresponding structures in the distributions cannot be reproduced by an established semi-classical model.

SS-2.3 Wed, 8:30

High photon flux 70 eV high harmonic source for coherent nanoscale imaging — •Getnet K. Tadesse[1,2], Robert Klas[1,2], Stefan Demmler[1,2], Steffen Hädrich[1,2], Imam Wahyutama[1,2], Michael Zürch[1,3,4], Michael Steinert[2], Christian Spielmann[1,3], Andreas Tünnermann[1,2,5], Jens Limpert[1,2,5], and Jan Rothhardt[1,2] — [1]Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — [2]Institute of Applied Physics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Straße 15, 07745 Jena, Germany — [3]Institute of Optics and Quantum Electronics, Friedrich-Schiller-University Jena, Max-Wien-Platz 1, 07743 Jena, Germany — [4]University of California, Department of Chemistry, CA 94720, Berkeley, USA — [5]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

We present an XUV source with record-high photon flux at 68.6eV ideally suited for coherent diffraction imaging experiments that achieved a record 13nm resolution. Pulses from a two channel fiber CPA are post-compressed and focused at a gas jet to generate XUV beam with flux of 6X10^(10) photons/sec.

SS-2.4 Wed, 8:45

Interferometric spatial characterization of high harmonic generation from two successive sources — •Kevin O'Keeffe[1], Matthias Mang[2], David Lloyd[2], Simon Hooker[2], and Ian Walmsley[2] — [1]Department of Physics, College of Science, Swansea University, Singleton Park, Swansea, SA2 8PP, UK — [2]Department of Physics, University of Oxford, Clarendon Laboratory, Parks Road, Oxford, OX2 8NP, UK

High harmonic generation from two longitudinally separated gas cells is observed to yield strong modulations in the intensity of both the long and short trajectories as the separation between cells is varied. Transverse spatial interferometry is preformed to characterize the evolution of the harmonic wavefronts.

SS-2.5 Wed, 9:00

Mid-IR filaments: higher order Kerr nonlinearities vs. plasma formation — •Skirmantas Alisauskas[1], Valentina Shumakova[1], Daniil Kartashov[2], Audrius Pugzlys[1,3], and Andrius Baltuska[1,3] — [1]TU Wien, Vienna, Austria — [2]Friedrich-Schiller University Jena, Jena, Germany — [3]Center for Physical Sciences & Technology, Vilnius, Lithuania

We examine the role of plasma and higher-order Kerr nonlinearities in filamentation of sub-100 fs multi-mJ mid-IR pulses. Two different regimes of filamentation are discovered in the case of moderate and loose focusing. Clear features of filamentation at negligibly low plasma densities point towards dominance of higher-order Kerr nonlinearities.

SS-2.6 Wed, 9:15

Control of mid-IR two color filamentaion in solid with stabilized carrier-envelope phase — •Tsuneto Kanai[1], Pavel Malevich[1], Sarayoo Kangaparambil[1], Kakuta Ishida [2], Makoto Mizui [2], Kaoru Yamanouchi[2], Heinar Hoogland[3], Ronald Holzwarth[3], Audrius Pugzlys[1,4], and Andrius Baltuska[1,4] — [1]Photonics Institute, Vienna University of Technology, Gusshausstrasse 27-387, A-1040 Vienna, Austria — [2]Department of Chemistry, School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyoku, Tokyo 113-0033, Japan — [3]Menlo Systems GmbH, Am Klopferspitz 19a, 82152 Martinsried, Germany — [4]Center for Physical Sciences & Technology, Savanoriu Ave. 231 LT-02300 Vilnius, Lithuania

We generated mid-IR two color filamentation in YAG, whose spectra depend on the carrier envelop phase of the input beam.

SS-2.7 Wed, 9:30

High-energy picosecond Yb:YAG amplifier for the European XFEL laser heater — •Francesca Moglia[1], Peter Kroetz[2,3], Sebastian Koehler[1], Lutz Winkelmann[1], and Ingmar Hartl[1] — [1]Deutsches Elektronen-Synchrotron, Hamburg, Germany — [2]Center for Free-Electron Laser Science, Hamburg, Germany — [3]Max-Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany

A compact single-pass, single-sided end-pumped Yb:YAG amplifier for the laser electron heater of the European X-ray-free-electron-laser was developed, which amplifies 600μs bursts of 222ns-spaced 9uJ ps-pulses and delivers up to 200 μJ per pulse. Energy improvements by 38% and 70% for double-pass and double-sided pump configuration, respectively, were obtained.

SS-2.8 Wed, 9:45

Extreme Ultraviolet High Harmonic Generation in Dielectrics: Waveform Control and Spectroscopy — •Stanislav Kruchinin, Tran Trung Luu, Manish Garg, and Eleftherios Goulielmakis — Max Planck Institute of Quantum Optics, Hans-Kopfermann-Str. 1, D-85748 Garching, Germany

We present the first observation of extreme ultraviolet high harmonic generation from thin films of polycrystalline quartz exposed to few-cycle and sub-cycle pulses. Carrier-envelope phase control of radiation spectrum was demonstrated. Theoretical analysis has shown that high harmonics can be used for characterization of band structure and lattice potential.

Wednesday

10:00–10:30 Coffee Break

SSL-2: Frequency Conversion and OPOs

Chair: Vaclav Kubecek, Czech Technical University, Prague, Czech Republic

Time: Wednesday, 10:30–12:30 Location: Lecture Hall EI7

Invited SSL-2.1 Wed, 10:30

Highly nonlinear crystals for ultrafast mid-IR frequency conversion — •Peter Schunemann — BAE Systems, Inc., Nashua, NH, USA

ZnGeP2 and CdSiP2, as well as the orientation-patterned semiconductors GaAs (OP-GaAs) and GaP (OP-GaP), exhibit the highest nonlinear optical coefficients among phase-matchable crystals with practical absorption losses and transparency ranges. Advances in growth and processing of these materials have extended ultrafast laser output deep into the mid-infrared.

SSL-2.2 Wed, 11:00

High-average-power, high-repetition-rate, Yb-fiber-laser-based picosecond parametric source at 2.1 μm — •Chaitanya Kumar Suddapalli[1] and Majid Ebrahim-Zadeh[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — [2]Institucio Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, Barcelona 08010, Spain

We report an Yb-fiber-pumped, high-power, linearly-polarized, picosecond source at 2.1 μm, providing >7 W of average power at 39.4% conversion efficiency in 20 ps pulses at ~79 MHz repetition-rate, with excellent power stability of <1% rms over 15 h and beam-pointing stability <40 μrad over 1 h, in good beam-quality.

SSL-2.3 Wed, 11:15

First Ultrafast Optical Parametric Oscillator (OPO) Pumped by a Vertical External Cavity Surface Emitting Laser (VECSEL) — •Nayara Jornod[1], Valentin J. Wittwer[1], Maxim Gaponenko[1], Martin Hoffmann[1], Nils Hempler[2], Graeme P. Malcolm[2], Gareth T. Maker[2], and Thomas Südmeyer[1] — [1]Laboratoire Temps-Fréquence, Université de Neuchâtel, Neuchâtel, Switzerland — [2]M Squared Lasers Ltd, Glasgow, Scotland

We present the first OPO synchronously pumped by an ultrafast VECSEL. The generated signal and idler waves cover the 1.35-1.80 μm and 2.10-3.57 μm range. The signal pulses have 2-4 ps duration and an output power up to 80 mW.

SSL-2.4 Wed, 11:30

Ultrafast Wavelength Tuning and Scaling Properties of a Non-collinear Optical Parametric Oscillator (NOPO) — Alexander Pape[1], •Thomas Binhammer[1], Yuliya Khanukaeva[2], Andreas Wienke[1], Tino Lang[3], Jan Ahrens[1], Oliver Prochnow[1], and Uwe Morgner[2] — [1]Laser Quantum, Hannover, Germany — [2]Institut für Quantenoptik, Hannover, Germany — [3]DESY, Hamburg, Germany

We present an ultrafast tunable non-collinear parametric oscillator (NOPO) which covers almost one optical octave from 650-1100 nm. The absence of intrinsic inversion life time allows a switching speed of more than 500 nm/ms. The scalability of the system and tuning behavior for two different non-collinear geometries will be investigated.

SSL-2.5 Wed, 11:45

Broadly tunable, femtosecond deep-infrared optical parametric oscillator based on CdSiP2 — •Chaitanya Kumar Suddapalli[1], A. Esteban-Martin[2], A. Santana[2], K. T. Zawilski[3], P. G. Schunemann[3], and M. Ebrahim-Zadeh[1,4] — [1]ICFO-Institut de Ciencies Fotoniques, Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — [2]Radiantis, Polígon Camí Ral, 08850 Gavà, Barcelona, Spain — [3]BAE Systems, Incorporated, MER15-1813, P.O. Box 868, Nashua, New Hampshire 03061-0868, USA — [4]Institucio Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, Barcelona 08010, Spain

We report the first pump-tuned cascaded deep-IR femtosecond OPO based on CdSiP2, providing rapid and hands-free tuning in 6-7 μm wavelength range, with up to 32 mW (6808 nm) of average idler power at 80 MHz and near-transform-limited signal pulse duration of ~100 fs with a time-bandwidth product of $\Delta\tau\Delta\nu$~0.36.

SSL-2.6 Wed, 12:00

Broad tuning of a picosecond OPO based on aperiodically poled lithium niobate using an intracavity chirped volume Bragg grating — Delphine Descloux[1], Guillaume Walter[1], Jean-Baptiste Dherbecourt[1], Guillaume Gorju[1], Jean-Michel Melkonian[1], Myriam Raybaut[1], Cyril Drag[2], and •Antoine Godard[1] — [1]ONERA–The French Aerospace Lab, F-91123 Palaiseau cedex, France — [2]Laboratoire Aimé-Cotton, CNRS, Univ. Paris Sud, ENS Cachan, Université Paris-Saclay, F-91405 Orsay cedex, France

We report on a narrow-linewidth synchronously-pumped picosecond OPO combining an aperiodically poled nonlinear crystal and an axially chirped volume Bragg grating. Translation of the grating along the beam axis enables wavelength tuning over 215 nm around 3.82 μm. Fast tuning over 170 nm in 100 ms is demonstrated.

SSL-2.7 Wed, 12:15

CEO Phase Noise Suppression in Synchronously Pumped Degenerate OPOs — •Chenchen Wan[1,2], Peng Li[1,3], Axel Ruehl[1], and Ingmar Hartl[1] — [1]Deutsches Elektronen-Synchrotron (DESY), Notkestraße 85, 22607 Hamburg, Germany — [2]Electro-optics Program, University of Dayton, 300 College Park, Dayton, OH, 45469-0245, USA — [3]Current affiliation: IMRA America Inc., 1044 Woodridge Ave., Ann Arbor, MI 48105, USA

The CEO frequency phase noise transfer from pump to a degenerate femtosecond doubly resonant OPO is measured. We observe, that the self-locked OPO has 6dB CEO phase noise suppression compared to pump indicating that it acts as an ideal frequency divider without any excess noise.

12:30–13:45 Lunch Break

Wednesday

FWG-3: New Sources and Concepts for Imaging and Spectroscopy

Chair: Tso Yee Fan, MIT Lincoln Laboratory, Lexington, MA, USA

Time: Wednesday, 13:45–15:45 Location: Lecture Hall EI7

Invited FWG-3.1 Wed, 13:45

All-fiber optical parametric oscillator for bio-medical imaging — •Thomas Gottschall[1], Tobias Meyer[2], Michael Schmitt[2], Jürgen Popp[2,3], Jens Limpert[1,4], and Andreas Tünnermann[1,4] — [1]Friedrich-Schiller-Universität Jena, Abbe Center of Photonics, Albert-Einstein-Str. 6, 07745 Jena, Germany — [2]Friedrich-Schiller-

Universität Jena, Institute of Physical Chemistry, Abbe Center of Photonics, Helmholtzweg 4, 07743 Jena, Germany — [3]Leibniz-Institut für Photonische Technologien Jena (IPHT) e.V., Albert-Einstein-Str. 9, 07745 Jena, Germany — [4]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

The first broadly tunable all-fiber optical parametric oscillator system is presented. This laser concept could very well be the missing key to establish non-linear imaging as a diagnostic tool in bio-medical domains.

FWG-3.2 Wed, 14:15

Ultrafast fiber laser source tunable in 825-1210 nm for multiphoton microscopy — •Wei Liu[1,2], Chen Li[3], Hsiang-Yu Chung[1,2], Shih-Hsuan Chia[1,2], Zhigang Zhang[3], Franz X. Kärtner[1,2,4], and Guoqing Chang[1,4] — [1]Center for Free-Electron Laser Science, DESY, Notkestraße 85, 22607 Hamburg, Germany — [2]Physics Department, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [3]State Key Laboratory of Advanced Optical Communication System and Networks School of Electronics Engineering and Computer Science, Peking University, Beijing 100871, China — [4]The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany

We propose and demonstrate a new approach to generate a wavelength-tunable ultrafast fiber laser source suitable for multiphoton microscopy. We employ fiber-optic nonlinearities to broaden a narrowband optical spectrum generated by an Yb-fiber laser system and then select the leftmost or rightmost spectral lobes from the broadened spectrum.

FWG-3.3 Wed, 14:30

In-vivo nonlinear optical microscopy with a novel all-polarization maintaining femtosecond Yb-fiber laser — •Aart Verhoef[1,2], Lingxiao Zhu[2,3], Marco Andreana[1], Martin Distel[4], Stine Møller Israelsen[5], Karsten Rottwitt[5], Wolfgang Kautek[3], Andrius Baltuska[2], Angelika Unterhuber[1], Wolfgang Drexler[1], and Alma Fernández[1,2] — [1]Center for Medical Physics and Biomedical Engineering, Medical University of Vienna, Vienna, Austria — [2]Institut für Photonik, Technische Universität Wien, Vienna, Austria — [3]Universität Wien, Institut für Physikalische Chemie, Vienna, Austria — [4]St. Anna Kinderkrebsforschung e.V., Children's cancer research institute, Vienna, Austria — [5]Technical University of Denmark, Department of Photonics Engineering, Kgs. Lyngby, Denmark

We present a novel all-polarization maintaining femtosecond Yb-fiber laser and its application to nonlinear optical microscopy. All-polarization maintaining Yb-fiber systems offer robust environmental stable turn-key operation, with a very compact footprint.

Keynote FWG-3.4 Wed, 14:45

Intermodal nonlinear fiber optics: a new pathway to power scalable sources — •Siddharth Ramachandran — ECE Department & Photonics Center, Boston University, Boston, MA, USA

Fibers stably guiding a multitude of Bessel-beam-like spatial modes help decouple the dispersion-versus-mode-area trade-off that often restricts achievable power levels via nonlinear-optical interactions in single-moded fibers and waveguides. We will discuss this design space and potential applications in fields as disparate as quantum-optics, nanoscale and deep-tissue imaging, and high-power lasers.

FWG-3.5 Wed, 15:30

Direct Frequency Comb Spectroscopy of Fundamental CO Band at 4.6 μm — •Vinicius Silva de Oliveira[1], Piotr Masłowski[2], Axel Ruehl[1], and Ingmar Hartl[1] — [1]Deutsches Elektronen-Synchrotron, Notkestrasse 85, Hamburg, Germany — [2]Institute of Physiscs, Nicolaus Copernicus University, Grudziadzka 5,Toruń, Poland

Direct frequency comb spectroscopy was accomplished on the fundamental absorption band of CO at 4.6μm. By optically controlling and scanning the comb frequency, the final spectrum was recorded on a custom Fourier transform spectrometer with 30 MHz interleaved frequency steps, five times lower than the comb spacing.

PO-2: Poster Session 2 with Coffee Break

Time: Wednesday, 15:45–17:00 Location: Foyer

PO-2.1 Wed, 15:45

Edge-pumped Nd:YAG/YAG lens-shaped composite laser — Oana Valeria Grigore[1], Gabriela Croitoru[1], Traian Dascalu[1], Mihai Dinca[2], and •Nicolaie Pavel[1] — [1]National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Bucharest, Romania — [2]University of Bucharest, Faculty of Physics, Bucharest, Romania

We describe a laser configuration that consists of a Nd:YAG core surrounded by a circular-undoped YAG, this composite structure having a lens-like shape. Under diode-laser edge-pumping in a three-fold scheme, the device yielded 1.06-microns laser pulses with 31.8-mJ energy at overall optical-to-optical efficiency of ~0.28; the slope efficiency was 0.31.

PO-2.2 Wed, 15:45

Blue-light induced infrared absorption in $KTiOPO_4$ isomorphs — •Staffan Tjörnhammar[1], Valerio Maestroni[1,2], Andrius Zukauskas[1], Carlota Canalias[1], Fredrik Laurell[1], and Valdas Pasiskevicius[1] — [1]KTH - Royal Institute of Technology, Stockholm, Sweden — [2]Politecnico di Milano, Milano, Italy

We compared the dynamics of blue-light induced infrared absorption in periodically poled $KTiOPO_4$, $Rb:KTiOPO_4$ and $KTiOAsO_4$. The results led us to attribute the largest portion of the induced absorption to photo-generated electrons and holes self-trapped in the proximity to Ti^{4+} and O^{2-} ions, respectively, forming polaron color centers.

PO-2.3 Wed, 15:45

Optimal pumping of an OPO with a pulsewidth-tunable MOPA source — Guillaume Aoust[1], Caroline Couvin[1,2], Xavier Délen[2], Myriam Raybaut[1], Jean-Baptiste Dherbecourt[1], Jean-Michel Melkonian[1], Guillaume Gorju[1], François Balembois[2], Patrick Georges[2], and •Antoine Godard[1] — [1]ONERA–The French Aerospace Lab, F-91123 Palaiseau cedex, France — [2]Laboratoire Charles Fabry, Institut d'Optique Graduate School, CNRS, Université Paris-Saclay, F-91127 Palaiseau cedex, France

A singly resonant OPO is pumped by a hybrid MOPA whose pulse duration is varied from 4 ns to 4 μs. For each pump energy, there is an optimal duration to maximize efficiency and avoid beam profile degradation. Numerical modelling enables to analyse the results and determine optimal pumping parameters.

PO-2.4 Wed, 15:45

Sub-nanosecond Yb:KLuW/Cr:YAG microchip laser — •Pavel Loiko[1,2], Josep Maria Serres[2], Xavier Mateos[2,3], Konstantin Yumashev[1], Anatoly Yasukevich[1], Valentin Petrov[3], Uwe Griebner[3], Magdalena Aguiló[2], and Francesc Díaz[2] — [1]Center for Optical Materials and Technologies (COMT), Belarusian National Technical University, Minsk, Belarus — [2]Física i Cristallografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV), Tarragona, Spain — [3]Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

Wednesday

A diode-pumped Yb:KLuW microchip laser passively Q-switched by a Cr4+:YAG saturable absorber generated a maximum average output power of 590 mW at 1031 nm with a slope efficiency of 55%. The pulse characteristics were 690 ps/47.6 uJ. The output beam had an excellent circular profile with M2 <1.05.

PO-2.5 Wed, 15:45

Compact terahertz-wave source based on silicon waveguides — •Qibing Sun, Zhaolu Wang, Hongjun Liu, and Nan Huang — Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Science, Xi'an, China

Compact terahertz-wave source based on four-wave mixing (FWM) in silicon waveguides is proposed and investigated. The pump wavelength located in the normal group-velocity dispersion regime is required to realize collinear phase matching for the THz-wave generation via FWM. Broadband THz-wave can be obtained with high conversion efficiency exceeding 1%.

PO-2.6 Wed, 15:45

2 mJ ring cavity diode-pumped Tm:YAP regenerative amplifier — •Pavel Malevich[1,2], Clement Livache[1,3], Yutaka Nomura[1], Andrius Baltuška[2], and Takao Fuji[1] — [1]Laser Research Center for Molecular Science, Institute for Molecular Science, 38 Nishigonaka, Myodaiji, Okazaki 444-8585, Japan — [2]Photonics Institute, Vienna University of Technology, Gusshausstrasse 27/387, 1040, Vienna, Austria — [3]École Nationale Superieure de Chimie de Paris (Chimie ParisTech), 11 rue Pierre et Marie Curie, 75005 Paris, France

In this contribution we demonstrate the first to our knowledge diode-pumped Tm:YAP chirp pulse amplification system delivering 2-mJ 250-kHz pulses.

PO-2.7 Wed, 15:45

Erbium-doped fiber laser with intracavity Mach-Zehnder interferometer for high-repetition short-pulse generation — Rachid Si Fodil[1,2], Foued Amrani[1], Abdelhamid Kellou[2], and •Philippe Grelu[1] — [1]Lab ICB UMR 6303 CNRS, Uni. Bourgogne Franche-Comté, BP 47870, Dijon F-21000, France — [2]Laboratoire d'Electronique Quantique, USTHB, BP32 El Alia, Bab Ezzouar, Algiers, Algeria

We experimentally investigate multipulse regimes obtained within a passively mode-locked fiber including a Mach-Zehnder interferometer. By adjusting the time delay imbalance, ultrashort pulse trains at multi-GHz repetition rates are generated, but display an inherent instability, which has been overlooked. By using a recirculation loop, we demonstrate a significant stability improvement.

PO-2.8 Wed, 15:45

An efficient single frequency Ho:YLF laser for IPDA lidar applications — •Jirong Yu[1], Yingxin Bai[2], Tehhwa Wong[2], Karl Reithmaier[2], Mulugeta Petros[1], and Upendra Singh[1] — [1]NASA Langley Research Center, Hampton, Virginia,23681, USA — [2]Science System & Applications, Inc. One Enterprise Parkway, Hmpton, Virginia, USA

An efficient, single frequency, high repletion rate, Q-switched Ho:YLF laser prototype has been developed for CO2 IPDA lidar applications. The output pulse energies are 42 mJ at 100 Hz and 30 mJ at 200 Hz. The characteristics of this laser meet the stringent requirements of CO2 IPDA lidar.

PO-2.9 Wed, 15:45

Rogue Waves Generated by Soliton Explosions in a Mode-Locked Laser — •Zhi-Chao Luo[1,2], Meng Liu[1], Ai-Ping Luo[1,2], and Wen-Cheng Xu[1,2] — [1]Guangdong Provincial Key Laboratory of Nanophotonic Functional Materials and Devices, School of Information and Optoelectronic Science and Engineering, South China Normal University, Guangzhou, Guangdong 510006, China — [2]Guangdong Provincial Engineering Technology Research Center for Microstructured Functional Fibers and Devices, South China Normal University, Guangzhou, Guangdong 510006, China

We reported on the observation of rogue waves (RWs) generated by the soliton explosions in an ultrafast fibre laser. The observed results provide the first experimental evidence for the connection between the soliton explosions and rogue wave generation.

PO-2.10 Wed, 15:45

Progress in Q-switched diode-pumped Alexandrite lasers — •Michael Damzen[1], Gabrielle Thomas[1], Ara Minassian[2], and Xin Sheng[1] — [1]Imperial College, London, UK — [2]Unilase Ltd, London, UK

We present latest results for Q-switched CW and QCW diode-pumped Alexandrite lasers with pulse energy as high as 3mJ (70ns) at 500Hz ; and high peak power pulses produced by cavity-dumped Q-switching (0.13mJ at 10kHz and 0.4mJ at 4kHz) with short 3ns pulse duration independent of pulse repetition rate.

PO-2.11 Wed, 15:45

GaN nonlinear waveguides — Maxim Gromovyi[1], Fabrice Semond[1], Julien Brault[1], Aimeric Courville[1], Pascal Baldi[2], Jean-Yves Duboz[1], and •Marc P. De Micheli[1] — [1]CNRS-CRHEA, 06560 Valbonne, France — [2]LPMC, University of Nice Sophia Antipolis, 06100 Nice France

Combining MBE and MOVPE we have been able to fabricate GaN epitaxial planar waveguides exhibiting ultra low loss in the visible (≤1dB/cm @540nm) and allowing efficient NIR to visible nonlinear conversion.

PO-2.12 Wed, 15:45

Accurate measurements of second-order nonlinear-optical coefficients of LaBGeO5 — •Yusuke Honda, Shinta Kawasaki, and Ichiro Shoji — Chuo University, Tokyo, Japan

We accurately measure the second-order nonlinear-optical coefficients d33 and d22 of LaBGeO5 at the fundamental wavelength of 1064 nm using the wedge technique. The values are determined to be d33 = 0.96 pm/V and d22 = 0.86 pm/V, which are 2.7 and 3.6 times larger than previously reported values, respectively.

PO-2.13 Wed, 15:45

Tunable dual-waveband 100 GHz high-repetition-rate ultrafast fiber laser — Xiao-Mei Tan[1], Guan-Kai Zhao[2], Yao-Kun Lv[3], •Ai-Ping Luo[4], Zhi-Chao Luo[5], and Wen-Cheng Xu[6] — [1]South China Normal University, Guangzhou, China — [2]South China Normal University, Guangzhou, China — [3]South China Normal University, Guangzhou, China — [4]South China Normal University, Guangzhou, China — [5]South China Normal University, Guangzhou, China — [6]South China Normal University, Guangzhou, China

We report a tunable dual-waveband 100 GHz high-repetition-rate (HRR) ultrafast fiber laser using a F-P filter and a piece of highly nonlinear fiber (HNLF). The spacing between these two wavebands could be tuned from 12.7 nm to 16.9 nm. This kind of fiber laser may provide some potential applications.

PO-2.14 Wed, 15:45

Attosecond transient XUV absorption spectroscopy of laser dressed krypton — Enikoe Seres[1], •Jozsef Seres[1], Carles Serrat[2], and Shinichi Namba[3] — [1]Atominstitut – E141, Technische Universität Wien, Stadionallee 2, 1020 Vienna, Austria — [2]Universitat Politècnica de Catalunya, Departament de Física, Colom 11, 08222 Terrassa, Spain — [3]Graduate School of Engineering, Hiroshima University, 1-4-1 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8527, Japan

Experimental results of time-resolved X-ray absorption spectroscopy in Krypton gas are presented. The laser dressed transition of 3d-5p with attosecond resolution and the quantum beat between 6p and 7p levels was measured using the high-order harmonics generated in Ne gas by a Ti:sapphire laser.

PO-2.15 Wed, 15:45

Powerful linearly-polarized high-order random fiber laser — •Jiangming Xu[1,2], Pu Zhou[1,2], Pengfei Ma[1,2], Jian Wu[1,2], and Hanwei Zhang[1,2] — [1]College of Optoelectronic Science and Engineering, National University of Defense Technology, Changsha 410073, China — [2]Hunan Provincial Collaborative Innovation Center of High Power Fiber Laser, Changsha 410073, PR China

We demonstrate a linearly-polarized narrowband high order random fiber laser operating at 1178 nm pumped by broadband amplified spontaneous emission (ASE) with maximal output power of 23.8 W. The dynamics of spectral-temporal evolutions is also investigated.

PO-2.16 Wed, 15:45

The generation of optical vortex beams using fused two-mode coupler based passively mode-locked fiber laser — •Feng Wang, Fan Shi, Yang He, and Xianglong Zeng — The Key Lab of Specialty Fiber Optics and Optical Access Network, Shanghai University, Shanghai, China

We demonstrate a new method for the generation of optical vortex beams using single mode fiber-two mode fiber (SMF-TMF) coupler acting as power splitting ratio and mode conversion. It is inserted into passively fiber laser cavity to obtain the mode-locked pulse based nonlinear polarization evolution.

PO-2.17 Wed, 15:45

Magnetic field sensor based on hollow optical fiber and magnetic fluid — •Fan Shi[1], Xuekun Bai[1], Feng Wang[1], Yang He[1], Shengli Pu[2], and Xianglong Zeng[1] — [1]The Key Lab of Specialty Fiber Optics and Optical Access Network, Shanghai University,200072 Shanghai, China — [2]College of science, University of Shanghai for Science and Technology, 200093 Shanghai, China

A compact all fiber magnetic field sensor is achieved using Mach-Zehnder interferometer (MZI) based on hollow optical fiber (HOF) and magnetic fluid (MF). The high sensing sensitivity of -170 pm/Oe is obtained when measuring the external magnetic field from 0 Oe to 79.4 Oe.

PO-2.18 Wed, 15:45

Spatial, temporal and spectral-resolved measurement of small signal gain coefficient in a cryogenically cooled Yb:YAG slab — •Paweł Sikociński[1,2], Akira Endo[1], Helena Jelínková[2], and Tomáš Mocek[1] — [1]HiLASE Centre, Institute of Physics AS CR, v.v.i., Dolní Břežany, Czech Republic — [2]Czech Technical University in Prague, Prague, Czech Republic

Temperature and pumping intensity dependence of small-signal gain coefficient and gain-bandwidth of cryogenically-cooled Yb:YAG slab crystal utilizing spectral and time-resolved probe beam technique is presented. This method provides precise 2D gain profiles, is insensitive against the mode mismatching and makes it possible to analyse temporal gain dynamics of laser medium.

PO-2.19 Wed, 15:45

Polarization-Multiplexed, Mode-Locked Fiber Laser — •Michael Kolano[1,2], Benedict Gräf[1,2], Daniel Molter[1], Frank Ellrich[1], and Georg von Freymann[1,2] — [1]Fraunhofer Institute for Physical Measurement Techniques IPM, Fraunhofer-Platz 1, 67663 Kaiserslautern, Germany — [2]Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, 67663 Kaiserslautern, Germany

Two orthogonal-polarized pulse trains are simultaneously emitted from a single, all-polarization-maintaining fiber laser using two saturable absorber mirrors and a fiber-coupled polarization beam splitter. To our opinion this design shows great potential to reduce the complexity of current time-resolved measurement systems without sacrificing performance.

PO-2.20 Wed, 15:45

CVD graphene/PMMA saturable absorber for power scaling of erbium doped fiber lasers — •Jan Tarka[1], Jakub Bogusławski[1], Grzegorz Soboń[1], Iwona Pasternak[2], Aleksandra Przewolka[2], Włodek Strupiński[2], and Jarosław Sotor[1] — [1]Laser & Fiber Electronics Group, Wroclaw University of Technology, Wybrzeze Wyspianskiego 27, 50-370 Wroclaw, Poland — [2]Institute of Electronic Materials Technology, Wolczynska 133, 01-919 Warsaw, Poland

We present the study on power scaling of an all-polarization maintaining (PM) fiber mode-locked laser using the multilayer CVD graphene/PMMA composite as a saturable absorber. Pulses with the duration of 148 fs were generated are the shortest pulses obtained from mode-locked erbium doped fiber laser working in anomalous dispersion regime.

PO-2.21 Wed, 15:45

A novel stochastic model for the energy transfer process in Er^{3+}:Yb^{3+} codoped phosphosilicate fibers — •Michael Steinke[1,2], Joerg Neumann[1,2], Dietmar Kracht[1,2], and Peter Wessels[1,2] — [1]Laser Zentrum Hannover e.V., Hollerithallee 8, D-30419 Hannover, Germany — [2]Centre for Quantum-Engineering and Space-Time Research – QUEST, Welfengarten 1, D-30167 Hannover, Germany

A novel stochastic model for the energy transfer process in Er^{3+}:Yb^{3+} codoped fibers is presented and corresponding results will be discussed. The stochastic model overcomes some inconsistencies of the common fixed rate modelling, in particular since it properly models the underlying dipole-dipole interaction with a $1/R^6$ characteristic.

PO-2.22 Wed, 15:45

Towards 20 nJ sub 10 fs UV pulses with MHz repetition rate — •Sven Kleinert[1], Ayhan Tajalli[1], Bernhard Kreipe[1], Yuliya Khanukaeva[1], Tamas Nagy[1,2], and Uwe Morgner[1,3,4] — [1]Institut für Quantenoptik, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany — [2]Laser-Laboratorium Göttingen e.V., Hans-Adolf-Krebs-Weg 1, D-37077 Göttingen, Germany — [3]Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover, Germany — [4]Hannoversches Zentrum für Optische Technologien, Leibniz Universität Hannover, NienburgerStraße 17, D-30167 Hannover, Germany

We present a compact optical parametric amplification system for the visible range pumped by a chirped pulse amplification system at 1 MHz repetition rate. Those pulses will be used for generation of UV radiation via second harmonic generation resulting in 20 nJ sub-10 fs pulses.

PO-2.23 Wed, 15:45

Rb-exchanged ridge waveguides in KTiOPO4 (KTP) — •Martin F. Volk[1], Christian E. Rüter[1], Christof Eigner[2], Harald Herrmann[2], Christine Silberhorn[2], and Detlef Kip[1] — [1]Faculty of Electrical Engineering, Helmut Schmidt University, 22043 Hamburg, Germany — [2]Department of Physics, University of Paderborn, 33098 Paderborn, Germany

We report on fabrication of KTP ridge waveguides by Rb-ion-exchange and optical-grade dicing, and their characterization. Waveguides were fabricated by ion-exchange through the top surface of z-cut substrates, followed by ridge definition. Additionally ridges were prepared in y-cut substrates and subsequently ion-exchanged through the side-walls.

PO-2.24 Wed, 15:45

Evaluation of True Temperature Tuning Curves of PPLN Crystal in Process of SHG — •Andrey Baranov[1,2], Oleg Ryabushkin[1,2], and Aleksey Konyashkin[1,2] — [1]Moscow Institute of Physics and Technology, Dolgoprudnyy, Russia — [2]. Kotelnikov Institute of Radioengineering and Electronics of RAS, Fryazino, Russia

Effect of temperature distribution of nonlinear-optical crystal on SHG process was investigated. Coupled equations of SHG and heat

conduction were solved. Evaluation of temperature tuning curves, measured for PPLN crystal using equivalent temperature concept, was specified in terms of longitudinal temperature gradient occurring inside crystal along laser beam propagation direction.

PO-2.25 Wed, 15:45

Tunable 2.03 – 2.12 um Ho:CaF2 laser pumped by Tm:fiber laser — •Michal Jelinek[1], Vaclav Kubecek[1], Weiwei Ma[2], Beibei Zhao[2], Dapeng Jiang[2], and Liangbi Su[2] — [1]Czech Technical University in Prague, FNSPE, Brehova 7, 115 19 Prague, Czech Republic — [2]Shanghai Institute of Ceramics, Chinese Academy of Sciences, 1295# Dingxi Road, Shanghai, 200050, China

Laser operation of modified-Bridgeman-grown Ho:CaF2 crystal at 83 up to 293 K pumped by a Tm:fiber laser is reported. The laser generated in the pulsed or continuous-wave regime with the maximum slope-efficiency of 54% at 83K. Continuous tuning range from 2030 to 2120 nm was achieved using a birefringent filter.

PO-2.26 Wed, 15:45

Description of Fabry-Pérot resonators with high outcoupling for fiber and waveguide lasers with high gain and high slope efficiencies — •Nur Ismail, Cristine Calil Kores, Dimitri Geskus, and Markus Pollnau — Department of Materials and Nano Physics, School of Information and Communication Technology, KTH – Royal Institute of Technology, Electrum 229, Isafjordsgatan 22–24, 16440 Kista, Sweden

We investigate laser resonators with high outcoupling losses, to which the approximations in the conventional Fabry-Pérot theory are not applicable. Use of the Lorentzian linewidth and definition of the Lorentzian finesse are necessary to determine the resonator losses. Our study is extended to laser resonators with distributed-Bragg-reflector (DBR) mirrors.

PO-2.27 Wed, 15:45

Czochralski growth and NLO properties of incongruent melting LaxGdyScz(BO3)4 (x +y + z = 4) crystal — •Lucian Gheorghe[1], Federico Khaled[2], Alexandru Achim[1], Flavius Voicu[1], Pascal Loiseau[2], and Gerard Aka[2] — [1]National Institute for Laser, Plasma and Radiation Physics, ECS Laboratory, PO Box MG-36, 077125 Magurele, Romania — [2]Chimie ParisTech, PSL Research University, Institut de Recherche de Chimie Paris, 11 rue Pierre et Marie Curie, 75005 Paris, France

Incongruent melting nonlinear optical crystals of LaxGdyScz(BO3)4 (x + y + z = 4) - LGSB were grown by the Czochralski method, for the first time to our knowledge. The main nonlinear properties of our LGSB crystal are compared with those of flux - grown LGSB and YAB crystals.

PO-2.28 Wed, 15:45

Highly efficient monoclinic double tungstate microchip lasers at ~1 and 2 μm — •Josep Maria Serres[1], Pavel Loiko[1,2], Xavier Mateos[1,3], Konstantin Yumashev[2], Valentin Petrov[3], Uwe Griebner[3], Magdalena Aguiló[1], and Francesc Díaz[1] — [1]Física i Cristal•lografia de Materials i Nanomaterials (FICMA-FICNA), Universitat Rovira i Virgili (URV), Tarragona, Spain — [2]Center for Optical Materials and Technologies (COMT), Belarusian National Technical University, Minsk, Belarus — [3]Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

The ultimate improvements of laser efficiency are reported in single doped monoclinic double tungstates with Tm3+, Yb3+, Nd3+ and Ho3+ ions and codoped with Tm3+/Ho3+ and Yb3+/Tm3+. With Yb:KLuW, we achieved 308mW at 1060nm and 91% slope. At 2μm, Tm:KLuW generated 785mW with a record slope of 77%.

PO-2.29 Wed, 15:45

Fe:ZnMnSe laser at room and cryogenic temperature generating in the 4.2 – 5 um region — •Helena Jelinkova[1], Maxim Doroshenko[2], Jan Sulc[1], Michal Jelinek[1], Michal Nemec[1], Martin Fibrich[1], David Vyhlidal[1], Miroslav Cech[1], V. Osiko[2], Y. Kovalenko[2], A. Gerasimenko[3], and V. Puzikov[3] — [1]Czech Technical University in Prague, Brehova 7, 11519 Prague 1, Czech Republic — [2]A.M. Prokhorov General Physics Institute RAS, Moscow, Russia — [3]Institute for single crystals, NAN Ukraine, Kharkov, Ukraine

Fe:Zn(1-x)Mn(x)Se solid solution (x=0.1 and 0.2) spectroscopic and laser properties were investigated in the temperature range 80-290K. Laser radiation generation was demonstrated at the central wavelength in the range 4.2 – 4.8 um at T~80 K and in the range 4.8 – 5 um at T~290 K.

PO-2.30 Wed, 15:45

160 fs pulses from a Kerr-lens mode-locked Yb^{3+}:Lu_2O_3 thin-disk oscillator — •Bernhard Kreipe[1], José Ricardo Cardoso de Andrade[1], Bastian Deppe[2,3], Christian Kränkel[2,3], and Uwe Morgner[1,4] — [1]Institute of Quantum Optics, Leibniz Universität Hannover, Welfengarten 1, 30167 Hannover, Germany — [2]Institut für Laserphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [3]The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — [4]Laser Zentrum Hannover e.V., Hollerithallee 8, 30419 Hannover, Germany

We demonstrate Kerr-lens mode-locking of a Yb^{3+}:Lu_2O_3 thin-disk oscillator. We achieved 160 fs with 0.1 μJ pulse energy at 60 MHz repetition rate in a stable and clean pulse operation. To investigate operation points for further energy scaling, the influence of different oscillator parameters on the mode-locking condition is also analysed numerically.

PO-2.31 Wed, 15:45

Power scaling of fs-laser oscillators in different operation modes using a modular 4-crystal resonator — •Jana Kampmann[1], Bernhard Kreipe[1], Moritz Emons[2], and Uwe Morgner[1,3] — [1]Institute of Quantum Optics, Leibniz Universität Hannover, Welfengarten 1, 30177 Hannover, Germany — [2]European XFEL GmbH, Notkestrasse 85, 22607 Hamburg, Germany — [3]Laser Zentrum Hannover, Hollerithallee 8, 30419 Hannover, Germany

Power scaling of ultrafast oscillators in a modular multi-crystal configuration is investigated with respect to the number of modules, pump splitting, output coupling ratio, gain materials, and different operation regimes, i.e. cw, modelocked, hybrid and cavity-dumped.

PO-2.32 Wed, 15:45

Nonlinear multilayer dielectric coatings for mode-locking applications — •Kilian Fritsch[1], Elena Fedulova[1,2], Michael Trubetskov[2], Tatiana Amotchkina[2], Volodymyr Pervak[1], and Oleg Pronin[2] — [1]Ludwig-Maximilians-Universität München, Am Coulombwall 1, D-85748 Garching, Germany — [2]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching, Germany

We present a nonlinear dielectric multilayer coating which shows increased reflectivity at increased intensity. The response is dominated by the Kerr-effect and is at least 1 ps short. This coating holds promise as a mode-locking device. Initial experiments on the mode-locking feasibility were performed.

PO-2.33 Wed, 15:45

Passive Q-switching of a Tm:YLF laser by graphene saturable absorbers — •Xavier Mateos[1], Pavel Loiko[3], Konstantin Yumashev[3], Sun Choi[4], Mi Kim[4], Fabian Rotermund[4], Mauro Tonelli[5], Uwe Griebner[2], and Valentin Petrov[2] — [1]Física i Cristal•lografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV), Campus Sescelades, c/ Marcel•lí Domingo, s/n., E-43007 Tarragona, Spain, — [2]Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, 2A Max-Born-Str., D-12489 Berlin, Germany — [3]Center for Optical Materials and Technologies (COMT), Belarusian National Technical University, 65/17 Nezavisimosti Ave., 220013 Minsk, Belarus — [4]Department of Physics & Department of Energy Systems Research, Ajou University,

San 5 Wonchun-dong, 443-749 Suwon, Republic of Korea — [5]NEST Istituto Nanoscienze-CNR and Dipartimento di Fisica dell'Università di Pisa, Largo B. Pontecorvo 3, 56127 Pisa, Italy

We report on diode-pumped, passively Q-switched Tm:YLF lasers with graphene as SA. We achieved 720 mW at 1884 nm with conversion efficiency as high as ~70%. The shortest pulse pulse duration was 130 ns. The bi-layer graphene with increased modulation depth was advantageous for the pulse characteristics.

PO-2.34 Wed, 15:45

Noise reduction in high power Yb-doped fiber laser systems — •Michael Müller[1], Cesar Jauregui[1], Marco Kienel[1], Florian Emaury[2], Clara Saraceno[2], Jens Limpert[1,3,4], and Andreas Tünnermann[1,3,4] — [1]Institute of Applied Physics, Friedrich-Schiller University Jena — [2]Institute for Quantum Electronics, ETH Zurich — [3]Helmholtz-Institute Jena — [4]Fraunhofer Institute for Applied Optics and Precision Engineering

The amplitude noise of a fiber laser system is tracked throughout the amplification chain. We observe a significant damping of the amplitude noise, reaching an rms value of ≈ 0.06% at the maximum output power. This noise damping is also theoretically studied and explained as a consequence of saturation effects.

PO-2.35 Wed, 15:45

Thermal behavior of composite Yb:YAG/YAG active element in high average power pulsed amplifier — •Ivan Kuznetsov, Ivan Mukhin, Mikhail Volkov, Olga Vadimova, Evgeniy Perevezentsev, and Oleg Palashov — Institute of Applied Physics of the Russian Academy of Science, Nizhny Novgorod, Russia

High energy and high average power multipass amplifier with the composite Yb:YAG/YAG active element is under development. It is shown that composite geometry helps not only to increase the gain but also to decrease thermal effects when optimal parameters are chosen. CW lasing with 440W average power is achieved.

PO-2.36 Wed, 15:45

Optimising Alexandrite laser performance – Experiment and Theory — •William R. Kerridge-Johns, Emma A. Arbabzadah, and Michael J. Damzen — Imperial College, London, UK

We demonstrate highest-ever laser slope efficiency (54%) and widest wavelength tuning range (713 – 817nm) from a diode-pumped Alexandrite laser. New analytical modelling, incorporating pump and laser excited and ground-state absorption in the end-pumping geometry, is developed and used to aid optimisation of diode-pumped Alexandrite laser performance.

PO-2.37 Wed, 15:45

Strong Laser Field Induced High-Lying Rydberg States — Seyedreza Larimian[1], Sonia Erattupuzha[1], Raffael Maurer[1], Christoph Lemell[2], Stefan Nagele[2], Shuhei Yoshida[2], Joachim Burgdörfer[2], Andrius Andrius Baltušk[1], Markus Kitzler[1], and •Xinhua Xie[1] — [1]Photonics Institute, Vienna University of Technology, A-1040 Vienna, Austria — [2]Institute for Theoretical Physics, Vienna University of Technology, A-1040 Vienna, Austria

We report on the measurement of electron emission from high-lying Rydberg states after the interaction of strong laser pulses with atoms and molecules. Simulations show that both tunneling ionization by a weak dc field and photoionization by the black-body radiation contribute to delayed electron emission.

PO-2.38 Wed, 15:45

Optical Parametric Generation in Orientation-Patterned Gallium Arsenide — •Brenda Donelan[1], Christian Kneis[1], Giuseppe Scurria[1], Benoît Cadier[2], Thierry Robin[2], Eric Lallier[3], Arnaud Grisard[3], Bruno Gérard[4], Marc Eichhorn[1], and Christelle Kieleck[1] — [1]French-German Research Institute of Saint-Louis, Saint Louis, France — [2]iXFiber, Lannion, France — [3]Thales Research and Technology France, Palaiseau, France — [4]Alcatel-Thales 3-5 Lab, Palaiseau, France

Optical parametric generation in OP-GaAs is demonstrated for the first time with single-source 2 μm pumping, reaching a record output energy of 2 μJ, 25 times more than previously reported.

PO-2.39 Wed, 15:45

Generation of tunable mid-infrared ultrashort pulses in suspended-core tellurite fibers — •Maksim Koptev[1], Elena Anashkina[1], Alexey Andrianov[1], Vitaly Dorofeev[2], Alexey Kosolapov[3], Sergey Muravyev[1], and Arkady Kim[1] — [1]Institute of Applied Physics of the Russian Academy of Science, 46 Ulyanov Street, Nizhny Novgorod, 603950, Russia — [2]Institute of High Purity Substances of the Russian Academy of Sciences, 49 Tropinin Street, Nizhny Novgorod, 603950, Russia — [3]Fiber Optics Research Center of the Russian Academy of Sciences, 28 Vavilov Street, Moscow, 119333, Russia

Widely tunable in 1.6-2.65 um range Raman solitons are demonstrated in microstructured tellurite fiber pumped by femtosecond Er/Tm fiber laser. We also demonstrate numerically the possibility to obtain solitons in the range beyond 4 um and red-shifted dispersive waves up to 5 um in such fibers with optimized parameters.

PO-2.40 Wed, 15:45

Dispersion managed mode-locked Holmium fibre oscillator operating beyond 2.1 um — •Ignac Bugar[1], Nikolai Tolstik[1,2], Evgeni Sorokin[1], and Irina T. Sorokina[2] — [1]Photonics Institute, TU Wien - Vienna University of Technology, Vienna, Austria — [2]Department of Physics, NTNU - Norwegian University of Science and Technology, Trondheim, Norway

We present a simple solution for mode-locked Ho-doped fibre linear oscillator composed of only commercially available components. Precise compensation of the intracavity anomalous dispersion resulted in stable operation supporting sub-ps pulse duration according to the registered spectrum. The system has the longest wavelength of all reported mode-locked holmium fibre lasers.

PO-2.41 Wed, 15:45

Towards an intrinsically stable all-fiber low-power broadband source at 1μm — •Philippe Raisin[1], Valerio Romano[1,2], Thomas Feurer[1], and Manuel Ryser[1] — [1]Institute of Applied Physics, University of Bern, Bern, Switzerland — [2]Bern University of Applied Sciences, Burgdorf, Switzerland

We present an intrinsically stable low power fiber-optic source in the 1μm wavelength range. It's based on the generation of strong population inversion in a few millimeter long piece of Yb-doped fiber by applying high pump power. Careful optimization of the setup leads to an ultra-stable broadband spontaneous emission source.

PO-2.42 Wed, 15:45

Absorption measurement effects in fibres with multimode cores — •Betty Meng Zhang[1,2], Yutong Feng[1], Jonathan H. V. Price[1], Rüdiger Paschotta[3], and Johan Nilsson[1] — [1]Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — [2]School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, Singapore — [3]RP Photonics Consulting, Bad Dürrheim, Germany

We use simulations to investigate measurement error effects in the absorption of Yb-doped fibers. We find that both re-emission into the investigated absorption band and modal cutoff effects can lead to unacceptable errors and discuss under what circumstances this may occur in practice.

PO-2.43 Wed, 15:45

Noise Induced Creation and Annihilation of Dispersion Managed Solitons in Fiber Oscillators — •Tesfay Teamir[1], Parviz Elahi[1], and F. Ömer Ilday[1,2] — [1]Department of Physics, Bilkent University, Ankara, 06800, Turkey — [2]Department of Electrical and Electronics Engineering, Bilkent University, Ankara, 06800, Turkey

Relative intensity noise of fiber oscillator is characterized in dispersion managed soliton regime. With scanning of pump power the sys-

tem undergoes irreversible transitions due to annihilation and creation of solitons resulting from their interaction with each other and with generated dispersive waves in the presence of noise.

PO-2.44 Wed, 15:45

Stochastic spatiotemporal dynamics of transition states of bound solitons in a fiber oscillator — •Tesfay Teamir[1], Parviz Elahi[1], Ghaith Makey[1], and F. Ömer Ilday[1,2] — [1]Department of Physics, Bilkent University, Ankara, 06800, Turkey — [2]Department of Electrical and Electronics Engineering, Bilkent University, Ankara, 06800, Turkey

Critical transition phenomena of a soliton bound state is experimentally observed as a pump power is scanned inside fiber oscillator. This far from thermodynamic equilibrium point is characterized by energy exchange between solitons, vibrating temporal separation and other effects associated with soliton perturbation.

SSL-3: OPAs/OPCPAs

Chair: Uwe Morgner, University of Hannover, Hannover, Germany

Time: Wednesday, 17:00–19:00 Location: Lecture Hall EI7

SSL-3.1 Wed, 17:00

Femtosecond-pumped mid-infrared few-cycle optical parametric chirped pulse amplifier source — •Philippe Rigaud[1], Aymeric Van de Walle[1], Marc Hanna[1], Alexandre Thai[2], Nicolas Forget[2], Florent Guichard[3], Yoann Zaouter[3], and Patrick Georges[1] — [1]Laboratoire Charles Fabry, Institut d'Optique Graduate School, CNRS, Université Paris-Saclay, 91127 Palaiseau Cedex, France — [2]Fastlite,1900 route des Crêtes 06560 Valbonne, Sophia Antipolis, France — [3]Amplitude Systemes, 11 avenue de Canteranne, Cité de la Photonique, 33600, Pessac, France

An OPCPA scheme based on a femtosecond pump is investigated to produce mid-infrared passively CEP stable few cycle pulses at high repetition rate. Femtosecond pumping advantages are highlighted in terms of optical synchronization, signal and idler generation, and stretching / compression solutions.

SSL-3.2 Wed, 17:15

Multipass OPCPA system at 100 kHz with sequential pump depletion — Jan Ahrens[1,2], Oliver Prochnow[1], •Alexander Pape[1], Thomas Binhammer[1], Stefan Rausch[1], Bastian Schulz[3], Maik Frede[3], and Uwe Morgner[2] — [1]Laser Quantum VENTEON, D-30419 Hannover, Germany — [2]Institute of Quantum Optics, Leibniz Universität Hannover, D-30167 Hannover, Germany — [3]neoLASE GmbH, D-30419 Hannover, Germany

We present a 100 kHz OPCPA system, seeded by an ultra-broadband Ti:sapphire oscillator and pumped by a frequency doubled CPA-free Nd:YVO4 based amplifier. Parametric amplification in two double-pass NOPA stages leads to 18 μJ of pulse energy at 8.7 fs pulse duration with low OPG background.

SSL-3.3 Wed, 17:30

High contrast few-cycle OPCPA system with adaptable repetition rate from 0.2 – 2 MHz — •Alexander Pape[1], Jan Ahrens[1], Oliver Prochnow[1], Hauke Bensch[1,2], Andreas Wienke[1], Stefan Rausch[1], Uwe Morgner[2], and Thomas Binhammer[1] — [1]Laser Quantum, Hollerithallee 17, 30419 Hannover, Germany — [2]Institute of Quantum Optics, Leibniz Universität Hannover, Welfengarten 1, 30167 Hannover, Germany

We present a compact high contrast few-cycle Ti:sapphire oscillator seeded OPCPA system with a push button adjustable repetition rate between 200 kHz and 2 MHz. Using a simple and efficient method the 80 MHz background can be suppressed by more than three orders of magnitude down to -70dBc.

SSL-3.4 Wed, 17:45

High-energy optical parametric amplifiers in the mid-infrared with large-aperture periodically poled Rb:KTiOPO4 — •Riaan Coetzee, Andrius Zukauskas Zukauskas, and Valdas Pasiskevicius — Royal Institute of Technology (KTH), Stockholm, Sweden

Parametric down-conversion and amplification schemes are often utilized to obtain high-energy, nanosecond pulses deep within the mid-infrared. We present a high-energy, 2 μm master oscillator power amplifier (MOPA) based on large-aperture periodically poled Rb:KTP. A maximum output energy of 52 mJ was obtained with a conversion efficiency of 40 %.

SSL-3.5 Wed, 18:00

Temporal Characterization of a Cascaded Optical Parametric Amplifier for Efficient THz Wave Generation — •Giovanni Cirmi[1,2], Koustuban Ravi[1,4], Fabian Reichert[3], Michael Hemmer[1], Huseyin Cankaya[1,2], Anne-Laure Calendron[1,2,3], Frederike Ahr[1,3], Nicholas Matlis[1], Luis Zapata[1], Oliver Muecke[1,2], and Franz Kaertner[1,2,3,4] — [1]Center for Free-Electron Laser Science, DESY, Hamburg, Germany — [2]The Hamburg Center for Ultrafast Imaging Hamburg, Germany — [3]Physics Department, University of Hamburg Hamburg, Germany — [4]Department of EECS and RLE, MIT Cambridge, USA

We perform spectro-temporal characterization of the optical output of a cascaded optical parametric amplifier, a novel source promising to generate multi-cycle THz radiation with several percent efficiency, necessary for table-top free electron lasers. FROG retrieval shows gradual modulation of the optical pulses into pulse trains spaced by the terahertz-wave period.

SSL-3.6 Wed, 18:15

Terahertz parametric generation from KTiOPO4 in comparison with LiNbO3 and LiTaO3 — Ming-Hsiung Wu[1], Yu-Chung Chiu[1], Tsong-Dong Wang[2], Gang Zhao[3], Andrius Zukauskas[4], Fredrik Laurell[4], and •Yen-Chieh Huang[1] — [1]National Tsing Hua University, Hsinchu, Taiwan — [2]Chung-San Institute of Science and Technology, Taoyuan, Taiwan — [3]Peking University, Beijing, China — [4]Royal Institute of Technology, Sweden

We show superior terahertz parametric generation from potassium titanyl phosphate over lithium niobate and lithium tantalate, and demonstrate seeded terahertz parametric amplification in KTP at 5.7 THz.

SSL-3.7 Wed, 18:30

Proof-of-principle experiment on a Thin Disk Ti:Sapphire amplifier with Extraction During Pumping (EDP-TD) — •Roland Sandor Nagymihaly[1], Huabao Cao[1], Mikhail Kalashnikov[1,2], Nikita Khodakovskiy[2], Lutz Ehrentraut[2], Karoly Osvay[1], and Vladimir Chvykov[1] — [1]ELI-HU Non-Profit Ltd, Szeged, Hungary — [2]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

Proof-of-principle experiment on a Thin-Disk (TD) Ti:Sapphire amplifier with Extraction During Pumping (EDP) method was performed with room temperature cooling. Highly efficient energy extraction was reached only with 3 passes of the seed and an output energy of 2.6 J. Temperature profile in the crystal was measured and numerically simulated.

SSL-3.8 Wed, 18:45

Few-cycle pulse characterization via XPW d-scan — •Ayhan

Tajalli[1], Bruno Chanteau[1], Martin Kretschmar[1], Heiko Kurz[1], David Zuber[1], Milutin Kovacev[1], Uwe Morgner[1,2], and Tamas Nagy[1,3,4] — [1]Institute of Quantum Optics, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany — [2]Laser Zentrum Hannover e.V., Hollerithallee 8, 30419 Hannover, Germany — [3]Laser-Laboratorium Göttingen e.V., Hans-Adolf-Krebs-Weg 1, 37077 Göttingen, Germany — [4]Current address: Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie, Max-Born-Straße 2a, 12489 Berlin, Germany

We demonstrate a dispersion scan (d-scan) pulse characterization scheme employing cross-polarized wave (XPW) generation as nonlinearity that has no phase-matching limitations. The scheme is an ideal choice for characterizing few-cycle pulses in various spectral regions. We characterize 5-10 fs near-IR pulses and compare them with the established SHG d-scan method.

19:30–21:30 Conference Dinner

FWG-4: Materials and Waveguide Lasers

Chair: Xavier Mateos, Max Born Institute, Berlin, Germany

Time: Thursday, 8:00–10:00 Location: Lecture Hall EI7

FWG-4.1 Thu, 8:00

Bi/Er co-doped silica-based fiber with gain bandwidth over 200 nm — Sergei V Firstov[1], •Sergey V Alyshev[1], Konstantin E Riumkin[1], Elena G Firstova[1], Mikhail A Melkumov[1], Vladimir F Khopin[2], Alexey N Gur'yanov[2], and Evgeny M Dianov[1] — [1]Fiber Optics Research Center of the Russian Academy of Sciences, Moscow, Russia — [2]Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia

In present paper we report the first demonstration of ~10-dB optical amplification in the spectral region from 1530 to 1750 nm (bandwidth ~200 nm) using a Bi/Er co-doped fiber pumped by a laser diode operating at the wavelength of 1460 nm

FWG-4.2 Thu, 8:15

'Crystalline-core/crystalline-clad' versus 'crystalline-core/glass-clad' fibers — •Mark Dubinskii[1], Jun Zhang[1], Youming Chen[1], George A. Newburgh[1], Tigran Sanamyan[1], Stuart Yin[2], and Claire Luo[2] — [1]US Army Research Laboratory, Adelphi, MD, USA — [2]General Opto Solutions, LLC, State College, PA, USA

Presented are comparison results of the 'crystalline-core/crystalline-clad' fiber (CCCCF = C4F) versus 'crystalline-core/glass-clad' fiber concepts for major further fiber laser power scaling out of single fiber aperture. Reported are C4F fabrication results based on liquid phase epitaxial growth of YAG clad around the 100 μm LHPG grown single-crystalline Yb:YAG core.

Invited FWG-4.3 Thu, 8:30

Rare-earth-doped active device on glass : from telecom to sensors — •Jean-Emmanuel Broquin[1,2], Lionel Bastard[1,2], Elise Chibaudo[1,2], and Davide Bucci[1,2] — [1]Univ. Grenoble Alpes, IMEP-LAHC, F-38000 Grenoble, France — [2]CNRS, IMEP-LAHC, F-38000 Grenoble, France

This paper reviews the activities carried-out on rare-earth-doped active devices made by ion exchange on glass at the IMEP-LaHC over the last decade. First the technology is presented, then results on Erbium lasers for airborne Lidar, Neodymium pulsed lasers for supercontinuum generation and recent developments on hybrid devices are shown.

FWG-4.4 Thu, 9:00

High-power operation in circular buried depressed-cladding waveguides inscribed in Nd:YAG and Nd:YVO4 by femtosecond-laser beam — •Gabriela Croitoru[1], Traian Dascalu[1], Florin Jipa[2], Marian Zamfirescu[2], and Nicolaie Pavel[1] — [1]National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Bucharest, Romania — [2]National Institute for Laser, Plasma and Radiation Physics, Laser Department, Bucharest, Romania

Power scaling is reported from circular (100-microns diameter) depressed-cladding waveguides realized in Nd-laser media by femtosecond-laser beam writing. Output powers of 3.1 W at 1.06 microns and 1.6 W at 1.3 microns were measured in Nd:YAG waveguides; for waveguides in Nd:YVO4 these powers reached 4.4 W and 1.7 W, respectively.

FWG-4.5 Thu, 9:15

Ultrafast laser inscribed single longitudinal mode Yb:YAG waveguide laser with high output power and high efficiency — •Thomas Calmano[1,2], Martin Ams[3], Peter Dekker[3], Michael J. Withford[3], and Christian Kränkel[1,2] — [1]Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [2]The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — [3]Centre for Ultra-high Bandwidth Devices for Optical Systems (CUDOS), MQ Photonics Research Centre, Department of Physics & Astronomy, Macquarie University, New South Wales 2109, Australia

We present highly efficient single longitudinal mode waveguide lasers with output powers of 1.59 W and optical-to-optical efficiencies of 65%. Single longitudinal mode operation was achieved by combining fs-laser written Yb:YAG waveguide lasers with external fs-laser written alumina-borosilicate glass waveguide Bragg-gratings.

FWG-4.6 Thu, 9:30

Optical gain of 13 dB/cm at 1.53 μm in $KGd_xLu_yEr_{1-x-y}(WO_4)_2$ channel waveguides and the influence of parasitic spectroscopic processes — •Sergio Andrés Vázquez Córdova[1], Shanmugam Aravazhi[2], Christos Grivas[3], Alexander M. Heuer[4], Christian Kränkel[4], Yean-Sheng Yong[1], Sonia M. García-Blanco[1], Jennifer L. Herek[1], and Markus Pollnau[5] — [1]Optical Sciences, MESA+ Institute, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands — [2]Integrated Optical Microsystems, MESA+ Institute, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands — [3]School of Physics and Astronomy, University of Southampton, Southampton SO17 1BJ, United Kingdom — [4]Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [5]Department of Materials and Nano Physics, KTH – Royal Institute of Technology, Isafjordsgatan 22-24, 16440 Kista, Sweden

We investigate optical gain around 1.53 μm in erbium-doped potassium double tungstate channel waveguides. A maximum gain per unit length of 13 dB/cm is measured. Parasitic excited-state absorption and energy-transfer upconversion are investigated spectroscopically, the corresponding parameters quantified, and their influence on gain is analyzed and compared with experimental results.

FWG-4.7 Thu, 9:45

Low-loss orientation-patterned GaAs buried waveguides for frequency conversion in the mid-infrared — •Sophie Roux[1], Axel Evirgen[2], Michel Lecomte[2], Gaëlle Lehoucq[1], Olivier Parillaud[2], Bruno Gérard[2], Arnaud Grisard[1], and Eric Lallier[1] — [1]Thales Research & Technology, 1 avenue Augustin Fresnel, 91767 Palaiseau Cedex, France — [2]III-V Lab, 1 avenue Augustin Fresnel, 91767 Palaiseau Cedex, France

We report the first realization of orientation-patterned GaAs buried waveguides for frequency conversion in the mid-infrared. Propagation losses down to 0.8 dB/cm at 3.9 μm have been measured in OP-waveguides, demonstrating the high quality of the regrowth on a corrugated template substrate. Nonlinear characterization will be reported at the conference.

10:00–10:30 Coffee Break

SSL-4: Crystalline Lasers

Chair: Eric Cormier, Université de Bordeaux, Bordeaux, France

Time: Thursday, 10:30–12:30 Location: Lecture Hall EI7

Invited SSL-4.1 Thu, 10:30

High-power single-crystal fiber amplifiers — •Xavier Délen — Institute of Optics, France

We present a study of the specificity of the pump guiding in the single crystal fiber (SCF) and give an overview of the results obtained using SCF gain modules in laser amplifiers including high power experiments and the last results obtained with picosecond multi-stages Yb:YAG SCF amplifiers.

SSL-4.2 Thu, 11:00

Nd:YVO4 laser LED-pumped with a luminescent concentrator — •Adrien Barbet[1], Amandine Paul[2], Thomas Gallinelli[3], François Balembois[1], Jean-Philippe Blanchot[2], Sébastien Forget[3], Sébastien Chénais[3], Frédéric Druon[1], and Patrick Georges[1] — [1]Laboratoire Charles Fabry, Institut d'Optique Graduate School, Palaiseau, France — [2]Effilux, Les Ulis, France — [3]Laboratoire de Physique des Lasers, Villetaneuse, France

We demonstrate that an LED-pumped Ce:YAG luminescent concentrator (LC) can increase the irradiance of blue LEDs by a factor of 10 with an optical efficiency of 25%. This LC was used to pump a Nd:YVO4 laser opening the way to new low cost LED pumped lasers.

SSL-4.3 Thu, 11:15

Development of an amplifier at 946 nm based on Nd:YAG single cristal fiber pumped at 885 nm — •Romain Baudoin[1], Jean-Thomas Gomes[1], Xavier Délen[1], Igor Martial[2], François Balembois[1], and Patrick Georges[1] — [1]Laboratoire Charles Fabry, Institut d'Optique Graduate School, CNRS, Université Paris-Saclay, 91127 Palaiseau Cedex, France — [2]Fibercryst SAS, Parc d'activité Wilson Bât A1, 31 Rue Wilson, F-69150 Decines Charpieu France

We present an amplifier at 946nm based on Nd:YAG single crystal fibers operating in continuous wave. Pumping is performed at 885nm in order to limit the thermal effects. As first result, single pass amplifier deliver 20 W at 946nm with a gain of 2 and a M2 better than 1.7.

SSL-4.4 Thu, 11:30

Efficient laser operation of Nd^{3+}:Lu_2O_3 at 8 different laser wavelengths between 917 nm and 1463 nm — •Patrick von Brunn[1,2], Alexander M. Heuer[1,2], and Christian Kränkel[1,2] — [1]Institut für Laser-Physik, Hamburg, Germany — [2]The Hamburg Centre of Ultrafast Imaging, Hamburg, Germany

We report on Ti:sapphire-pumped laser operation of a HEM-grown Nd^{3+}:Lu_2O_3 bulk crystal at different transitions. An excellent optical quality allowed for low laser thresholds and slope efficiencies as high as 70 %. 917 nm and 1463 nm represent the shortest and longest wavelength, respectively, ever realized in this material.

SSL-4.5 Thu, 11:45

Tunable green laser operation of Tb^{3+}:$LiLuF_4$ — Philip Metz[1], Günter Huber[1,2], and •Christian Kränkel[1,2] — [1]Institut für Laser-Physik, Universität Hamburg, Hamburg, Germany — [2]The Hamburg Centre for Ultrafast Imaging, Hamburg, Germany

We report on laser wavelength tuning in the green using a Tb^{3+}(28 at.%):$LiLuF_4$ crystal. At an absorbed 2ω-OPSL pump power of 0.57 W we obtained a total tuning range of more than 6 nm and more than 100 mW of output power at wavelengths between 542 nm and 551 nm.

SSL-4.6 Thu, 12:00

Passive Q-switching of Ho:KLuW lasers at ~2.1 μm by novel nanostructured saturable absorbers — •Josep Maria Serres[1], Ruijun Lan[2,3], Pavel Loiko[1,4], Xavier Mateos[1,2], Konstantin Yumashev[4], Sun Choi[5], Mi Kim[5], Fabian Rotermund[5], Haohai Yu[6], Huaijin Zhang[6], Yanxue Chen[7], Magdalena Aguiló[1], Francesc Díaz[1], Uwe Griebner[2], and Valentin Petrov[2] — [1]Física i Cristal•lografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV), Tarragona, Spain — [2]Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — [3]School of Opto-Electronic Information Science and Technology, Yantai University, Yantai, China — [4]Center for Optical Materials and Technologies (COMT), Belarusian National Technical University, Minsk, Belarus — [5]Department of Physics & Department of Energy Systems Research, Ajou University, Suwon, Republic of Korea — [6]State Key Laboratory of Crystal Materials and Institute of Crystal Materials, Shandong University, Jinan, China — [7]School of Physics, Shandong University, Jinan, China

A passively Q-switched Ho:KLuW laser pumped by a Tm-laser at ~1.95μm was demonstrate by novel nanostructured saturable absorbers. Stable pulses were achieved with SWCNTs, MoS2 and PbS Quantum-Dots with maximum average output power of 50mW, 125mW and 84mW and pulse characteristics of 100ns /0.31μJ, 150ns /0.46μJ and 55ns /1.2μJ, respectively.

SSL-4.7 Thu, 12:15

Mechanical Non Critical Phase Matching for SHG at 1064 nm in LBO at room temperature — •Romain Baudoin[1], Jean-Thomas Gomes[1], Xavier Délen[1], François Balembois[1], Sophie Coumar[1], Mondher Besbes[1], Philippe Villeval[2], and Patrick Georges[1] — [1]Laboratoire Charles Fabry, Institut d'Optique Graduate School, CNRS, Université Paris-Saclay, 91127 Palaiseau Cedex, France — [2]Cristal Laser, ZAC du Breuil – 32, rue Schumann 54850 Messein- France

By applying a mechanical pressure, a non-critical phase matching (NCPM) for SHG @ 1064 nm could be achieved at room temperature in LBO. The Mechanical Phase Matching allows the same SHG efficiency compared to the classical temperature phase matching.

Thursday

12:30–13:45 Lunch Break

SSL-5: High-Power Lasers

Chair: Chrisitan Krankel, University of Hamburg, Hamburg, Germany

Time: Thursday, 13:45–15:45 Location: Lecture Hall EI7

SSL-5.1 Thu, 13:45

SESAM modelocked Yb:CaF2 thin disk laser delivering 285 fs pulses with peak power of 5.5 MW — •Benjamin Dannecker, Marwan Abdou Ahmed, and Thomas Graf — Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Pfaffenwaldring 43, 70569 Stuttgart, Germany

We report on a SESAM-modelocked Yb:CaF2 thin-disk laser delivering an average output power of 17.8 W at 10 MHz repetition rate with 285 fs pulse duration i.e. pulse energy of 1.78 microJ and peak power of 5.5 MW. Furthermore, we show results on chirped pulse amplification using Single Crystal Fiber.

SSL-5.2 Thu, 14:00

10-MW sub-500 fs high power SESAM-modelocked Yb:Lu2O3 thin disk laser — •Ivan J. Graumann[1], Andreas Diebold[1], Florian Emaury[1], Bastian Deppe[2,3,4], Christian Kränkel[2,3], Clara J. Saraceno[1], and Ursula Keller[1] — [1]Institute for Quantum Electronics, ETH Zurich, 8093 Zurich, Switzerland — [2]Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [3]The Hamburg Center for Ultrafast Imaging, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [4]Center for Free-Electron Laser Science, DESY, Hamburg, Notkestraße 85, 22761 Hamburg, Germany

We present peak power scaling to 10 MW of a sub-500 fs modelocked Yb:Lu2O3 thin disk laser. Our laser resonator is operated in a pressure-controlled environment, allowing for high pulse energies of 6.5 uJ. Future pulse shortening will make this oscillator an excellent source for driving HHG experiments.

SSL-5.3 Thu, 14:15

Watt-class femtosecond mid-infrared sources in the wavelength range from 4.1 μm to 8.5 μm — •Marcus Seidel[1], Gunnar Arisholm[2], Xiao Xiao[1], Alexander Hartung[3], Vladimir Pervak[4], Oleg Pronin[1], and Ferenc Krausz[1,4] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching, Germany — [2]FFI (Norwegian Defence Research Establishment), P. O. Box 25, NO-2027 Kjeller, Norway — [3]Leibniz-Institute of Photonic Technology (IPHT), Albert-Einstein-Straße 9, D-07745 Jena, Germany — [4]Ludwig-Maximilians-Universität München, Am Coulombwall 1, D-85748 Garching, Germany

3.8 W average power at 4.1 μm wavelength and 1.3 W average power at 8.5 μm wavelength are generated through optical parametric amplification in periodically poled lithium niobate and $LiGaS_2$, resp. The crystals are directly pumped by a mode-locked thin-disk oscillator and seeded with continua from normal dispersion fibres.

SSL-5.4 Thu, 14:30

500 W - 10 mJ - Picosecond Thin Disk Regenerative Amplifier — •Marcel Schultze, Sandro Klingebiel, Christoph Wandt, Catherine Y. Teisset, Robert Bessing, Matthias Häfner, Stephan Prinz, Knut Michel, and Thomas Metzger — TRUMPF Scientific Lasers GmbH + Co. KG, Feringastr.10a, 85774 Unterföhring

We report on a thin-disk regenerative amplifier delivering more than 500 W of compressed output power and a pulse duration of less than 1.2 ps at a repetition rate of 50 kHz.

SSL-5.5 Thu, 14:45

Thin-disk multipass amplifier delivering fs pulses with up to 2.0 GW peak power — •Jan-Philipp Negel[1], André Loescher[1], Benjamin Dannecker[1], Paul Oldorf[2], Stefanie Reichel[2], Rigo Peters[2], Thomas Graf[1], and Marwan Abdou Ahmed[1] — [1]Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Pfaffenwaldring 43, 70569 Stuttgart, Germany — [2]Schweißtechnische Lehr- und Versuchsanstalt Mecklenburg-Vorpommern GmbH, Alter Hafen Süd, 18069 Rostock, Germany

We report on an Yb:YAG thin-disk multipass amplifier delivering linearly polarized laser pulses with 400 W average and 2.0 GW peak power (885 fs pulse duration, 200 kHz repetition rate). Furthermore, we show results on the amplification of radially polarized pulses with 235 W average and 1.2 GW peak power.

SSL-5.6 Thu, 15:00

Yb:CaF2 Regenerative Amplifier Producing 30-mJ 200-fs Pulses — •Edgar Kaksis[1], Giedrius Andriukaitis[1], Tobias Flöry[1], Audrius Pugžlys[1,2], and Andrius Baltuška[1,2] — [1]Photonics Institute Vienna University of Technology, Vienna, Austria — [2]Center for Physical Sciences & Technology, Vilnius, Lithuania

A dual Yb:CaF2 diode-pumped regenerative CPA system comprising room-temperature preamplifier and cryogenically cooled power amplifier is presented. The system delivers 220-fs, 23-mJ and 30-mJ pulses at 1 kHz at 500 Hz repetition rates respectively with the performance further scalable in terms of both pulse energy and average power.

SSL-5.7 Thu, 15:15

Generation of deep ultraviolet picosecond pulses by a 100 kHz thin-disk PERLA laser system — •Hana Turčičová, Ondřej Novák, Martin Smrž, Akira Endo, and Tomáš Mocek — HiLASE Centre, Institute of Physics of AS CR, Dolni Brezany, Czech Republic

Deep ultraviolet radiation (257.5 nm and 206 nm) in picosecond pulses is generated as harmonics of a diode pumped Yb:YAG thin-disk laser at 100 kHz repetition rate. The second (SH) is generated in LBO crystal, the fourth as SH doubling in BBO/CLBO crystal, and the fifth as 1omega+4omega in CLBO.

SSL-5.8 Thu, 15:30

Towards 10 TW infrared few-cycle pulses using FOPA — Bruno E. Schmidt[1], Guilmot Ernotte[2], Philippe Lassonde[2], Vincent Gruson[3], Mathieu Giguère[1], Nicolas Thiré[2], Antoine Laramée[2], Heide Ibrahim[2], and •François Légaré[2] — [1]few-cycle Inc., Montreal, Canada — [2]INRS-EMT, Varennes, Canada — [3]The Ohio State University, Columbus, USA

The universal dilemma of gain narrowing occurring in femtosecond amplifiers prevents high power lasers from delivering few-cycle pulses. This problem is overcome by Frequency-domain OPA. At 1.8 micron, few-cycle pulses with 14 mJ of energy per pulse have been generated, and we will present the route to reach >100 mJ.

PO-3: Poster Session 3 with Coffee Break

Time: Thursday, 15:45–17:00 Location: Foyer

PO-3.1 Thu, 15:45

Chirped pulse regenerative amplifier based on Yb:CaYAlO4 crystal: different orientation study — •Alexander Rudenkov[1], Viktor Kisel[1], Anatol Yasukevich[1], Karine Hovhannesyan[2], Ashot Petrosyan[2], and Nikolai Kuleshov[1] — [1]Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — [2]Institute for Physical Research, National Academy of Sciences, Ashtarak-2, Armenia

Chirped pulse amplification regime are reported for Yb:CaYAlO4 crystal with different polarization states in the gain media for the first time to our knowledge. Output power of 4.2W with 310fs pulses was obtained for s-polarization at 200kHz repetition rate. 190fs pulses with 2.3W output power were demonstrated for p-polarized light.

PO-3.2 Thu, 15:45

Cascaded supercontinuum in mid-infrared with periodically structured KTiOAsO4 and KTiOPO4 — •Anne-Lise Viotti and Valdas Pasiskevicius — Royal Institute of Technology, Stockholm, Sweden

Numerical modelling of mid-infrared octave-spanning supercontinuum generation in structured KTiOAsO4 and KTiOPO4 is presented. In periodically poled ferroelectrics, the effective cascaded Kerr nonlinearity can be tailored to maximize the width of generated supercontinuum. The broadest spectrum obtained in periodic KTiOAsO4 structures extends over one octave and beyond 3 μm.

PO-3.3 Thu, 15:45

A high power, tunable, dual wavelength and polarisation Yb-fiber laser — •Fredrik Laurell, Valdas Pasiskevicius, and Peter Zeil — KTH, Stockholm,Sweden

A high-power, dual polarization and dual wavelength Yb-fiber oscillator is demonstrated. The wavelength separation could be tuned from 0.03 to 2 THz, with output powers exceeding 78 W over the entire tuning range, maintaining a high beam-quality (M2<1.2) and a peak-to-peak power stability of <1 %.

PO-3.4 Thu, 15:45

Femtosecond fiber laser pumped parametric amplification of broadband phase stabilized few cycle pulses at 2.9 μm — Giedre Marija Archipovaite, •Stéphane Petit, Jean-Christophe Delagnes, and Eric Cormier — CELIA, Talence, France

Broadband and CEP stable few cycle pulses at 2.9 μm are generated through an optical parametric amplification in a three stage system pumped by femtosecond 100 kHz Yb fiber laser. 80 fs pulses with energy of 16 μJ are achieved.

PO-3.5 Thu, 15:45

Ultra-low power wavelength conversion in a silicon microring resonator — •Hongjun Liu, Zhaolu Wang, Qibing Sun, and Nan Huang — Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Science, Xi'an, China

We experimentally demonstrate ultra-low pump power all-optical wavelength conversion based on four-wave mixing in a silicon racetrack-shape microring resonator. When the input pump and signal are located at the resonance wavelengths of the microring, the maximum conversion efficiency of -21 dB is obtained for a relatively lower pump power.

PO-3.6 Thu, 15:45

Red Eu3+:KLu(WO4)2 laser at ~706 nm — •Pavel Loiko[1], Elena Vilejshikova[1], Vladimir Dashkevich[2], Valentin Orlovich[2], Anastasiya Rusak[2], Konstantin Yumashev[1], Nikolai Kuleshov[1], Sergei Bagaev[3], Sergei Vatnik[3], Xavier Mateos[4], and Anatoly Pavlyuk[5] — [1]Center for Optical Materials and Technologies (COMT), Belarusian National Technical University, Minsk, Belarus — [2]B.I. Stepanov Institute of Physics, National Academy of Sciences of Belarus, Minsk, Belarus — [3]Institute of Laser Physics, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia — [4]FiCMA-FiCNA group, Universitat Rovira i Virgili (URV), Tarragona, Spain — [5]A.V. Nikolaev Institute of Inorganic Chemistry, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia

We report on growth and spectroscopy of monoclinic Eu:KLuW crystals. The maximum stimulated-emission cross-section for the 5D0-7F4 transition is 1.78x10-20 cm2 and the lifetime of the 5D0 state is 0.45 ms. Quasi-CW Eu:KLuW laser operating at ~706 nm and pumped at 533.6 nm by a green Nd:KGdW/KTP laser is demonstrated.

PO-3.7 Thu, 15:45

High-energy single longitudinal mode MOPA laser systems at 1064 nm — Paolo Farinello[1], •Luigi Fregnani[1], Federico Pirzio[1], Stefano Dell'Acqua[2], Giuliano Piccinno[2], and Antonio Agnesi[1] — [1]University of Pavia – Laser Source Lab, Via Ferrata 5, 27100 Pavia - Italy — [2]Bright Solutions S.r.l., Via degli Artigiani 27, 27010 Cura Carpignano (PV) – Italy

We present compact and scalable single longitudinal mode MOPA laser systems providing Fourier-limited, 13-ns-long pulses at 1064 nm, with excellent spatial beam quality. Employing high-gain QCW Nd:YVO_4 amplifiers, we demonstrated 3.5 mJ pulse energy at 100 Hz. Average power exceeding 3 W was obtained at 10 kHz with cw-pumped amplifiers.

PO-3.8 Thu, 15:45

Spectroscopy and laser operation of Pr^{3+}:$Ba(Y_{0.8}Lu_{0.2})_2F_8$ single crystal — •Alberto Sottile[1], Stefano Veronesi[2], Eugenio Damiano[1], Daniela Parisi[2], and Mauro Tonelli[1,2] — [1]Dipartimento di Fisica, Università di Pisa, Largo B. Pontecorvo 3, IT-56127 Pisa, Italy — [2]NEST, Istituto Nanoscienze – CNR, Piazza S. Silvestro 12, IT-56127 Pisa, Italy

We report on the first growth, spectroscopy, and laser operation of monocrystalline Pr^{3+}:$Ba(Y_{0.8}Lu_{0.2})_2F_8$ (Pr:BYLF). BYLF is an isomorph of BaY_2F_8 (BYF) that has been introduced to improve thermomechanical properties of BYF, as shown in $LiYF_4$ and $LiLuF_4$. We obtained considerably improved continuous-wave laser performances with respect to Pr:BYF crystals.

PO-3.9 Thu, 15:45

Gain narrowing free operation of chirped pulse regenerative amplifier based on Yb:LuAlO3 crystal — •Viktor Kisel[1], Alexander Rudenkov[1], Anatol Yasukevich[1], Karine Hovhannesyan[2], Ashot Petrosyan[2], and Nikolay Kuleshov[1] — [1]Center for Optical Materials and Technologies, Belarusian National Technical University, 65/17 Nezavisimosti Ave., Minsk, 220013 Belarus. — [2]Institute for Physical Research, National Academy of Sciences, 0203, Ashtarak-2, Armenia.

In this Paper we report spectroscopic properties and results of chirped pulse RA performance for new Yb:LuAlO3 laser crystal. 14.9nm wide (FWHM) pulses were obtained for E//b-polarized light at the 4.5W output power with compressed pulse duration of 165fs. Gain properties of the crystal for E//b- and E//c-orientations were studied.

PO-3.10 Thu, 15:45

Synchronous generation of 466th harmonic soliton molecule and noise-like pulse at fundamental repetition rate in a fiber laser — •Ai-Ping Luo[1], Yu-Qi Huang[2], Zhi-Chao Luo[3], and Wen-Cheng Xu[4] — [1]South China Normal University, Guangzhou, China — [2]South China Normal University, Guangzhou, China — [3]South

China Normal University, Guangzhou, China — [4]South China Normal University, Guangzhou, China

We report on the synchronous generation of 466th harmonic soliton molecule and rectangular noise-like pulse (NLP) at the fundamental repetition rate in a figure-eight fiber laser based on nonlinear amplifying loop mirror (NALM). The experimental results are helpful to enrich the pulse operation regimes in fiber lasers.

PO-3.11 Thu, 15:45

Glass-Ceramics with Co2+:ZnO Nanocrystals: Novel Saturable Absorber for Erbium Lasers — •Nikolai Skoptsov[1], Olga Dymshits[2], Vladimir Vitkin[3], Pavel Loiko[1], Alexander Zhilin[2], Daria Shemchuk[2], Marina Tsenter[2], Kirill Bogdanov[3], Alexander Malyarevich[1], Ilya Glazunov[1], Xavier Mateos[4], and Konstantin Yumashev[1] — [1]Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — [2]NITIOM S.I. Vavilov State Optical Institute, St. Petersburg, Russia — [3]ITMO University, St. Petersburg, Russia — [4]Física i Cristallografia de Materials i Nanomaterials, Tarragona, Spain

Novel saturable absorbers based on transparent glass-ceramics with Co2+:ZnO nanocrystals are developed. They demonstrate broad 4A2(4F)→4T1(4F) absorption band of Co2+ ions, low saturation fluence (0.8 J/cm2) and fast recovery time of initial absorption (895 ns). Glass-ceramics can be used for passive Q-switching of crystalline erbium lasers at 1.6-1.7 μm.

PO-3.12 Thu, 15:45

Single-frequency Ho: YAG laser resonantly pumped by 1.9 μm laser diode — •Quanxin Na, Chunqing Gao, Yixuan Zhang, Qing Wang, and Yan Li — Beijing Institute Of Technology, Beijing, China

A single-frequency Ho: YAG laser resonantly pumped by a 1.9 μm laser diode is demonstrated. The single-frequency output energy is 15.15 mJ at a pulse repetetion rate of 200 Hz, with a pulse width of 109 ns and M2<1.22.

PO-3.13 Thu, 15:45

Sellmeier equations for CaGdAlO4 and CaYAlO4 laser host crystals — Petra Becker[1], Ladislav Bohatý[1], Christoph Liebald[2], Mark Peltz[2], Sophie Vernay[2], Daniel Rytz[2], •Pavel Loiko[3,4], Josep Maria Serres[4], Xavier Mateos[4,5], Konstantin Yumashev[3], Yicheng Wang[5], Valentin Petrov[5], and Uwe Griebner[5] — [1]Institute of Geology and Mineralogy, Section Crystallography, University of Cologne, Köln, Germany — [2]FEE GmbH, Idar-Oberstein, Germany — [3]Center for Optical Materials and Technologies (COMT), Belarusian National Technical University, Minsk, Belarus — [4]Física i Cristallografia de Materials i Nanomaterials (FiCMA-FiCNA), Universitat Rovira i Virgili (URV),Tarragona, Spain — [5]Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

Dispersion of the principal refractive indices, no and ne, is studied for the uniaxial CaGdAlO4 and CaYAlO4 laser host crystals, and Sellmeier equations are derived for the broad spectral range of 0.37-2.1 μm. Group velocity dispersion (GVD) is calculated. For CALGO at 2 μm, GVD is negative: –40 fs2/mm.

PO-3.14 Thu, 15:45

Cross relaxation and laser quantum efficiency in amorphous Al2O3:Tm3+ waveguides on silicon — •Pavel Loiko, Dimitri Geskus, and Markus Pollnau — Department of Materials and Nano Physics, School of Information and Communication Technology, KTH – Royal Institute of Technology, Kista, Sweden

Cross relaxation is studied for Tm-doped amorphous aluminum oxide waveguides on silicon. The impact of spectroscopically distinct ion classes, namely single ions and ions with neighbors, for the accurate description of cross relaxation is demonstrated. For the highest doping concentration investigated, the laser quantum efficiency of 2-μm emission reaches 1.73.

PO-3.15 Thu, 15:45

High Power THz Quantum Cascade Lasers — •Martin Brandstetter[1], Christoph Deutsch[1], Michael Krall[1], Sebastian Schönhuber[1], Martin A. Kainz[1], Hermann Detz[3], Donald C. MacFarland[2], Aaron M. Andrews[2], Werner Schrenk[2], Gottfried Strasser[2], and Karl Unterrainer[1] — [1]Photonics Institute, TU Wien, Austria — [2]Institute of Solid State Electronics, TU Wien, Austria — [3]Austrian Academy of Sciences, Austria

We present high power emission from terahertz (THz) quantum cascade lasers (QCLs) by making use of a direct wafer bonding technique to increase the active region thickness. In this way, optical output powers of almost 1 W have been achieved at an emission frequency of about 3.9 THz.

PO-3.16 Thu, 15:45

Rogue waves from spectral dynamics of phase-evolving bound solitons in a fibre laser — •Junsong Peng[1], Srikanth Sugavanam[1], Nikita Tarasov[1], and Dmitry Churkin[1,2,3] — [1]Aston University, Birmingham, United Kingdom — [2]Novosibirsk State University, Novosibirsk, Russia — [3]Institute of Computational Technologies SB RAS, Novosibirsk, Russia

By utilizing dispersive Fourier transform technique and spatio-temporal measurements, the real-time spectral dynamics of bound solitons were measured in a passively mode-locked fibre laser. It was found that though the phase-evolving bound solitons were static in time domain, their optical spectrum evolves and exhibits rogue waves.

PO-3.17 Thu, 15:45

Synchronized pulsed fiber laser source for single-photon frequency upconversion detection — •Jianhui Ma, Huiqin Hu, Haifeng Pan, E Wu, and Heping Zeng — State Key Laboratory of Precision Spectroscopy, East China Normal University, Shanghai 200062, P. R. China

We experimentally demonstrate a compact synchronized fiber laser system that enables fast and efficient coincidence infared single-photon frequency upconversion detection.

PO-3.18 Thu, 15:45

Sub-60 fs Yb:KGW oscillator pumped by single-mode laser diode — •Maciej Kowalczyk, Krzysztof M. Abramski, and Jarosław Sotor — Laser & Fiber Electronics Group, Wroclaw University of Technology, Wybrzeze Wyspiańskiego 27, 50-370 Wroclaw, Poland

We present a passively mode-locked Yb:KGW laser pumped by a low power single-mode laser diode. The laser operating in hybrid SESAM-assisted Kerr-lens mode-locked regime emits 59 fs pulses approaching the limit of the crystal performance.

PO-3.19 Thu, 15:45

Enhanced tissue ablation by manipulated pressure transients — Amir Herzog[1], •Ziv Alperovich[1], Idan Steinberg[2], and Amiel Ishaaya[1] — [1]Department of Electrical and Computer Engineering, Ben-Gurion University, Beer-Sheva 84105, Israel — [2]2. Department of Biomedical Engineering, Tel-Aviv University, Ramat Aviv, Tel-Aviv, 6997801, Israel

We manipulate the pressure transients initiated during tissue ablation with fiber-delivered 355 nm nanosecond pulses, by effectively enlarging the fiber's cladding diameter. We conducted numerical simulations, ultrasonic pressure measurements, high-speed photography and ex vivo studies, and show improvement of the ablation efficiency for given laser parameters.

PO-3.20 Thu, 15:45

Combining and temporal multiplexing of four pulsed beams in LBO crystal by means of non-collinear frequency conversion — •Julijanas Želudevičius, Marijus Mickus, and Kęstutis Regelskis — Center for Physical Sciences & Technology, Vilnius, Lithuania

We report experimental results of combining and temporal multiplexing of four pulsed beams in LBO crystal by means of non-

collinear frequency conversion. Pulses with 400 ps duration amplified in four separate fiber amplifiers up to 100 μJ energy were successfully combined achieving maximum conversion efficiency of 56%.

PO-3.21 Thu, 15:45

Multi-pulse behavior of a high-power sub-100-fs SESAM-modelocked VECSEL — •Dominik Waldburger, Sandro M. Link, Cesare G. E. Alfieri, Matthias Golling, and Ursula Keller — Department of Physics, Institute for Quantum Electronics, ETH Zurich, Auguste-Piccard-Hof 1, CH-8093 Zurich, Switzerland

We fully characterized an ultrafast optically pumped vertical external-cavity surface-emitting laser (VECSEL) generating sub-100-fs pulse durations and a 1.63-GHz pulse repetition rate at 100-mW average output power. We will discuss four distinct stable modelocking operation regimes which are separated by discontinuities in the output power and different pulsing behavior.

PO-3.22 Thu, 15:45

Spectroscopy of Er^{3+}-, Dy^{3+}-, Pr^{3+}-, and Ho^{3+}-doped Sesquioxides in the Mid-Infrared Spectral Region — •Alexander M. Heuer[1,2], Patrick von Brunn[1,2], and Christian Kränkel[1,2] — [1]Institut für Laser-Physik, Universität Hamburg, Hamburg, Germany — [2]The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Hamburg, Germany

Spectroscopic data are crucial in understanding and developing laser systems but challenging to acquire for wavelengths exceeding 3 μm. We report on our research activities concerning the precise determination of absorption, emission, and excited state absorption cross-sections of Dy^{3+}-, Pr^{3+}-, Er^{3+}-, and Ho^{3+}-doped sesquioxide crystals in the mid-infrared spectral range.

PO-3.23 Thu, 15:45

Modelling and Development of an 80 MHz Repetition Rate tuneable OPCPA system for In-Vivo Deep Brain Imaging Microscopy — •Szabolcs Tóth[1,2], Roland Flender[1], Roland S. Nagymihály[1,2], Péter Jójárt[1,2], Attila Andrásik[1], Ádám Börzsönyi[1,2], and Károly Osvay[1,2] — [1]Department of Optics and Quantum Electronics, Szeged, Hungary — [2]2ELI-HU Nkft., Szeged, Hungary

A pilot experiment is presented which demonstrate the viability of our high repetition rate OPCPA design. The parameters were obtained from a 1+1D simulation. The amplifier was pump with 2 μJ pulses at 532 nm and the 800 nm part of a continuum was amplified by a factor of five.

PO-3.24 Thu, 15:45

Chalcogenide glass fibers for luminescence and laser applications — •Radwan Chahal[1,2], Florent Starecki[2], Catherine Boussard-Plédel[2], Bruno Bureau[2], Virginie Nazabal[2], Jean-Louis Doualan[3], Alain Braud[3], Patrice Camy[3], Nikolai Tolstik[1], and Irina Sorokina[1] — [1]NTNU, Norwegian University of Science and Technology, Høgskoleringen 5, 7034, Trondheim, Norway — [2]Equipe Verres et Céramiques - Institut des Sciences Chimiques de Rennes (ISCR), UMR 6226 Université de Rennes 1-CNRS, Campus de Beaulieu, 35042 Rennes Cedex, France — [3]Centre de recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252CEA-CNRS-ENSI Caen, Université de Caen, 14050 Caen, France

This presentation will talk about the production of new doped chalcogenide glass fibers with rare earth or transition metal ions for luminescence and laser applications. Fabrication and optical characterization will be presented. Applications for these new chalcogenide glass fibers will be shown, as sensing or laser application.

PO-3.25 Thu, 15:45

All-in-fiber Yb Doped Femtosecond Fiber Oscillator Based On Low Dispersion Chirped Fiber Bragg Grating — •Saulius Frankinas[1,2], Rokas Danilevičius[1,2], and Nerijus Rusteika[1,2] — [1]Ekspla Ltd., Savanoriu ave. 237, LT-02300 Vilnius, Lithuania — [2]Center for Physical Sciences and Technology, Savanoriu ave. 231 LT-02300, Vilnius, Lithuania

In this work the femtosecond passively mode-locked all-in-fiber oscillator generating pulses with duration of 390 fs is presented. Short pulse duration was obtained using low dispersion chirped fiber Bragg grating as dispersion compensator in the cavity

PO-3.26 Thu, 15:45

Passive Q-switching of a Tm:YLF laser with a cobalt doped silver halide saturable absorber — •Harel Hecht — Ben-Gurion University of the Negev, Beer Sheva, Israel

We have managed to successfully Q-switch a Tm:YLF laser operating at 1.9 μm with a Co:AgClBr saturable absorber. To the best of our knowledge, this is the first time that a doped silver halide crystal was operated as a saturable absorber Q-switch.

PO-3.27 Thu, 15:45

Dual-frequency VECSEL source at 1.5μm for the generation of optically-carried RF signals — •Léa Chaccour[1,2], Guy Aubin[2], Kamel Merghem[2], Jean-louis Oudar[2], and Sophie Bouchoule[2] — [1]IFSTTAR, Marne-la-vallée, France — [2]LPN-CNRS, Marcoussis, France

We demonstrate a dual-frequency VECSEL source emitting two cross-polarized laser beams at 1550nm with a frequency difference close to 10GHz, for fiber optic sensors. We report on the VECSEL performances and we discuss the influence of the intra cavity elements on the laser output power and beat note stability.

PO-3.28 Thu, 15:45

MOPA laser for a compact, cost-effective underwater range-gated imaging system — •Stefano Dell'Acqua[1], Edoardo Cametti[1], Giuliano Piccinno[1], Giancarlo Reali[1], Paolo Farinello[2], and Antoniangelo Agnesi[1,2] — [1]Bright Solutions, srl, Via degli Artigiani 27, 27010 Cura Carpignano (PV), Italy — [2]Laser Source Laboratory, Università di Pavia, Via Ferrata 3. 27100 Pavia, Italy

A MOPA laser, generating pulses of >2mJ @532nm, <2ns, and reprate from single-shot to up 1kHz, was custom-designed to serve as illuminator for an underwater imaging system for turbid environments. It is tightly packaged within 1750 cm3 and operates with low power consumption under a wide range of environmental conditions.

PO-3.29 Thu, 15:45

Strong-Field Resonant Light-Induced Currents in Semiconductors — •Michael S. Wismer[1], Stanislav Yu. Kruchinin[1], Marcelo F. Ciappina[1], Mark I. Stockman[2], and Vladislav S. Yakovlev[2] — [1]Max Planck Institut für Quantenoptik, 85748 Garching, Germany — [2]Center for Nano-Optics and Department for Physics and Astronomy, Georgia State University, Atlanta, GA 30303, USA

We theoretically predict that a semiconductor (GaAs) resonantly excited by a ultrashort resonant laser pulse exhibits a novel phenomenon: kicked anharmonic Rabi oscillations (KARO). In this case, interband transitions are strongly coupled to intraband motion and mainly occur during short times when electron-hole pairs pass near the Brillouin zone center.

PO-3.30 Thu, 15:45

Passively mode locked Ho:YAG oscillator at 2.1 μm — •Ka Fai Mak[1], Sebastian Gröbmeyer[2], Vladimir Pervak[2], Ferenc Krausz[1,2], and Oleg Pronin[1] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — [2]Ludwig-Maximilians-Universität München, Fakultät für Physik, Am Coulombwall 1, 85748 Garching, Germany

We present a passively mode-locked Ho:YAG oscillator lasing at 2.1 μm at an average output power of up to 320 mW. Using SESAMs with different modulation depths, spectral widths ranging from 2.4 nm to 1 nm (~2-5 ps) have been measured. Further experiments towards SESAM-assisted Kerr-lens mode-locking are in progress.

PO-3.31 Thu, 15:45

High average power ultra-short pulse Yb-doped fiber amplifier: experimental realization and accurate theoretical modeling — •Robert Lindberg and Valdas Pasiskevicius — Royal Institute of Technology, Stockholm, Sweden

A high repetition rate high average power ultra-short pulse Yb-fiber amplifier was experimentally characterized and extensively theoretically modeled by including commonly neglected effects. It was found that among other effects, the dependence of the index dispersion on the population inversion is key for accurate modeling of the output spectrum.

PO-3.32 Thu, 15:45

Modelling the excited state absorption effects in Alexandrite lasers — •William R. Kerridge-Johns and Michael J Damzen — Imperial College, London, UK

The effects of pump excited state absorption are explored, both experimentally and theoretically, using a quasi-three level theory with end-pumped geometry. An experimental Alexandrite laser is shown to be well described by the modelling, the theory is then used to aid in optimising cavity parameters for laser performance.

PO-3.33 Thu, 15:45

Single-mode 1.1 kW monolithic Yb-doped fiber oscillator at 1030 nm — •Andreas Liem, Nicoletta Haarlammert, Thomas Schreiber, Ramona Eberhardt, and Andreas Tünnermann — Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

In this paper we demonstrate a Yb-doped, monolithic fiber oscillator with an output power of 1.1 kW, an emission wavelength of 1030 nm, diffraction limited beam quality and a slope efficiency of 75%. This laser can be used as high brightness pump source for tandem pumping.

PO-3.34 Thu, 15:45

Performance and new developments of the seed laser system of the FERMI FEL — •Miltcho B. Danailov — Elettra-Sincrotrone Trieste, SS 14, km.163.5, Trieste 34149, Italy

The work describes the performance and new developments of the ultrafast laser system generating tunable UV pulses for external seeding of the FERMI Free Electron Laser. A new feature of the system is the tunable third harmonic generation option allowing to cover the range 260-270 nm without use of OPA.

PO-3.35 Thu, 15:45

Mid-IR filament guided conductivity and high-voltage discharge in air — Denis Mongin[1], Valentina Shumakova[2], Skirmantas Alisauskas[2], Audrius Pugžlys[2,3], Elise Schubert[1], •Jérôme Kasparian[1], Jean-Pierre Wolf[1], and Andrius Baltuška[2,3] — [1]GAP, University of Geneva, Switzerland — [2]Photonics Institute, TU Wien, Austria — [3]Center for Physical Sciences & Technology, Vilnius, Lithuania

Filaments at 3.9 μm produce lower electron densities and lower pressure depression than in the mid-IR. Mid-IR filaments therefore require significantly higher energy/power levels for applications related to lightning control and for fully taking advantage of their unique propagation properties (single, large diameter filaments over long distances).

PO-3.36 Thu, 15:45

Scaling supercontinuum generation in gas-filled hollow-core fibers — •Andreas Hoffmann[1], Michael Zürch[1,2,3], Rudrakant Sollapur[1], Daniil Kartashov[1], Teodora Grigorova[1], Gregor Sauer[1], Alexander Hartung[4], Markus Schmidt[4], and Christian Spielmann[1,3] — [1]Institute of Optics and Quantum Electronics, Abbe Center of Photonics, Friedrich Schiller University, Max Wien Platz 1, 07743 Jena, Germany — [2]University of California, Chemistry Department, D39 Hildebrand Hall, CA 94720, Berkeley, USA — [3]Helmholtz Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — [4]Leibniz Institute of Photonic Technology, P.O. Box 100239, 07702 Jena, Germany

We report on two novel approaches for improved scaling supercontinuum generation in gas-filled hollow-core fibers. Switching either from atomic to molecular gases or from capillaries to novel anti-resonant hollow-core fibers allows increase of the parameter range and substantial performance, resulting in efficient UV generation or enhanced pulse shaping capabilities.

PO-3.37 Thu, 15:45

A selective transverse mode method for generating high-order Bessel-Gauss beams — Seyed Mehdi Mousavi[1], •Mohammad Sabaeian[2], Hamid Nadgaran[1], and Azadeh Ebrahimzadeh[2] — [1]Physics Department, College of Science, University of Shiraz, Shiraz, Iran — [2]Physics Department, Faculty of Science, Shahid Chamran University of Ahvaz, Iran

The zero-, first-, and second-order Bessel-Gauss beams were generated through the use of an axicon external to a plane-plane resonator supporting three lowest modes of Hermit-Gauss. Hermit-Gauss beams were extracted using a circular aperture in the cavity and after laser crystal with a predetermined aperture using the theory of diffraction.

PO-3.38 Thu, 15:45

High repetition rate Airy beam pulses in higher-harmonic fractional cavity — •Aadhi A, Varun Sharma, Apurv Chaitanya N, and Goutam Samanta — Photonic Sciences Lab., Physical Research Laboratory, Ahmedabad, Gujarat, India

We report a multi-GHz ultrafast source of optical radiation in 2D Airy intensity distribution. Based on intracavity cubic phase-modulation of an OPO we generate femtosecond Airy beam at repetition rate of 2.5GHz with output power of 680mW at 1525nm. The source also provides 570mW of broadband mid-IR radiation at 3545nm

PO-3.39 Thu, 15:45

107 W femtosecond all-fiber chirped pulse amplification system with a chirped-volume Bragg grating compressor — •Ruoyu Sun, Dongchen Jin, Fangzhou Tan, Shouyu Wei, and Pu Wang — Beijing University of Technology, Beijing, China

A femtosecond 1064nm Yb-doped all-fiber chirped pulse amplification system was report with an average output power of 107W. The seed was based on an Er-doped mode-locked fiber laser which gets frequency shifted to the 1μm. The pulse width is 566fs with 10.9MW peak power compressed by a chirped-volume Bragg grating.

PO-3.40 Thu, 15:45

Wavelength and temperature dependence of the refractive index of GaP — Jean Wei[1], Joel Murray[1], Jacob Barnes[1], Douglas Krein[1], Peter Schunemann[2], and •Shekhar Guha[1] — [1]Air Force Research Laboratory, WPAFB, Ohio, USA — [2]BAE Systems, Nashua, New Hampshire, USA

Refractive indices of gallium phosphide in the wavelength range of 0.6 to 12.5 micrometer at temperatures from 78 K to 473 K were determined from fringes in FTIR transmission spectra and from temperature dependent phase matching curves of second harmonic generation of a CO2 laser beam.

PO-3.41 Thu, 15:45

Enhanced pump absorption in double-clad fibres using localised laser-machined mode scramblers — •Antonin Billaud[1], Peter Shardlow[1], Keiron Boyd[2], Nikita Simakov[1,2], Alexander Hemming[2], and W. Andrew Clarkson[1] — [1]Optoelectronics Research Centre, University of Southampton, SO171BJ, UK — [2]Laser Technologies Group, Defence Science and Technology Group, Edinburgh, Australia 5111

A novel method for improving pump absorption efficiency in circular double-clad fibres by laser machining localised pump scramblers at strategic positions along the fibre is reported. Preliminary results for

Thursday

a thulium-doped double-clad fibre indicate that the pump absorption coefficient attainable via this approach is comparable to an equivalent octagonal fibre.

PO-3.42 Thu, 15:45

Self-starting all-fiber, all-polarization maintaining Tm-Ho-codoped fiber oscillator — •Andras Cserteg[1], Jerome Lhermite[2], and Eric Cormier[2] — [1]ELI-ALPS, Szeged, Hungary — [2]Centre Lasers Intenses et Applications, Université de Bordeaux-CNRS-CEA, Talence, France

We report a SESAM mode-locked all-fiber, all-polarization maintaining Tm-Ho-codoped fiber oscillator intra-cavity dispersion compensated with a chirped FBG. The laser operates in the dispersion managed soliton regime and delivers 0.46 nJ pulses with 2 nm spectral bandwidth centered at 2050 nm. The radiofrequency spectrum shows stable single pulse operation.

PO-3.43 Thu, 15:45

New 1.3-1.7 microns wideband fluorescent tin containing glasses. Synthesis, optical fibre fabrication and investigations. — •Boris Denker[1], Roman Ermakov[2], Boris Galagan[1], Liudmila Iskhakova[2], Sergei Sverchkov[1], Vladimir Velmiskin[2], and Evgenii Dianov[2] — [1]A.M.Prokhorov General Physics Institute of RAS, Moscow, Russia — [2]Fiber Optics Research Center of RAS, Moscow, Russia

Divalent tin containing silicate and germanate glasses have demonstrated wide photoluminescence peaking at 1.5 - 1.6 microns. The glasses are characterized by long emission lifetimes reaching 450 microseconds. The possibility of germanosilicate optical fiber fabrication by tin oxalate and germanium dioxide powder in silica tube method was demonstrated.

EPS Prize

Time: Thursday, 17:00–18:00 Location: Lecture Hall EI7

18:00–18:30 Refreshments

PD-1: Postdeadline Session

Time: Thursday, 18:30–19:15 Location: Foyer

Post-deadline PD-1.1 Thu, 18:30

Stabilized dual-comb modelocked semiconductor disk laser — •Sandro M. Link, Dominik Waldburger, Cesare G. E. Alfieri, Matthias Golling, and Ursula Keller — ETH Zürich, Zurich, Switzerland

We present a stabilized dual-comb semiconductor disk laser generating simultaneously two gigahertz modelocked beams from a single cavity. The resulting down-converted microwave frequency comb is fully stabilized by applying two feedback-loops directly to the microwave spectrum. A first proof-of-principle spectroscopy demonstration is shown and the absolute optical stability is measured.

Post-deadline PD-1.2 Thu, 18:45

Efficient High-Power Pulse Compression in Self-Defocusing Bulk Media — •Marcus Seidel[1,2], Jonathan Brons[1,2], Gunnar Arisholm[3], Kilian Fritsch[2,4], Vladimir Pervak[4], and Oleg Pronin[1,2] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching, Germany — [2]UltraFast Innovations GmbH, Am Coulombwall 1, D-85748 Garching, Germany — [3]FFI (Norwegian Defence Research Establishment), P. O. Box 25, NO-2027 Kjeller, Norway — [4]Ludwig-Maximilians-Universität München, Am Coulombwall 1, D-85748 Garching, Germany

The compression of 90-W average power, 190-fs pulses to 70-W, 30-fs is realized by three sequential pulse compression stages utilizing cascaded $\chi^{(2)}$-nonlinearities in BBO. Balancing self-defocusing and Gaussian beam convergence results in an efficient, power-scalable spectral broadening mechanism. An increase in peak power from 18 to 60-MW is achieved.

Post-deadline PD-1.3 Thu, 19:00

Single frequency Yb:YAG DFB waveguide laser with 2 W output power — •Thomas Calmano[1,2], Martin Ams[3], Benjamin F. Johnston[3], Peter Dekker[3], Michael J. Withford[3], and Christian Kränkel[1,2] — [1]Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [2]The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — [3]Centre for Ultrahigh Bandwidth Devices for Optical Systems (CUDOS), MQ Photonics Research Centre, Department of Physics & Astronomy, Macquarie University, New South Wales 2109, Australia

The first monolithic DFB Yb:YAG waveguide laser is presented. An output power of 2 W and a slope efficiency of 61% were achieved in single longitudinal mode operation. The DFB structures were inscribed as waveguide Bragg gratings by ultrafast laser writing into the Yb:YAG crystal.

SSL-6: Mode-Locked Lasers

Chair: Antoniangleo Agnesi, Università di Pavia, Pavia, Italy

Time: Friday, 8:00–10:00 Location: Lecture Hall EI7

Invited SSL-6.1 Fri, 8:00

Progress in development of gain and saturable absorber mirrors for semiconductor disc lasers — •Guina Mircea — Tampere University, Tampere, Finland

Recent progress in the development of gain and saturable absorber mirrors used in semiconductor disc lasers is reviewed. Emphasis is put on linking technological advances to laser performance, in particular concerning power scaling and wavelength coverage. An overview of emerging applications in spectroscopy and medicine is provided.

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SSL-6.2 Fri, 8:30

Record-short pulses from semiconductor disk lasers — •Sandro M. Link[1], Dominik Waldburger[1], Cesare G. E. Alfieri[1], Matthias Golling[1], Emilio Gini[2], and Ursula Keller[1] — [1]Institute for Quantum Electronics ETH Zürich, Zurich, Switzerland — [2]FIRST Center for Micro- and Nanoscience ETH Zürich, Zurich, Switzerland

We present the shortest pulses ever achieved from any fundamentally modelocked optically pumped semiconductor disk laser demonstrated with both a SESAM-modelocked VECSEL generating pulses as short as 96 fs and a high peak power of 0.56 kW, and a MIXSEL with 184 fs and 130 W.

SSL-6.3 Fri, 8:45

SESAMs for short-pulse, high-power thin-disk lasers — Cesare G. E. Alfieri[1], •Andreas Diebold[1], Michael Kopp[1], Florian Emaury[1], Clara J. Saraceno[1], Emilio Gini[2], and Ursula Keller[1] — [1]Department of Physics, Institute for Quantum Electronics, ETH Zurich, Switzerland — [2]FIRST Center for Micro- and Nanoscience, ETH Zurich, Switzerland

We present novel high-power MOVPE grown SESAM designs based on multiple strain compensated quantum wells. The structures show significant improvements in terms of recovery dynamics, damage threshold, and non-saturable losses compared to standard MBE grown samples. These ideal parameters will enable thin-disk lasers combining short pulses and high power.

SSL-6.4 Fri, 9:00

90-fs Yb:LuLiF$_4$ Single-Mode Diode-Pumped SESAM Mode-Locked Laser — •Hifeng Lin[1,2], Federico Pirzio[2], Azzurra Volpi[3], Alberto Di Lieto[3], Mauro Tonelli[3], and Antonio Agnesi[2] — [1]Fujian Institute of Research on the Structure of Matter, 155 Yangqiao Road West, Fujian 350002 China — [2]University of Pavia – Laser Source Lab, Via Ferrata 5, 27100 Pavia, Italy — [3]NEST Istituto Nanoscienze-CNR and Dipartimento di Fisica, Universita' di Pisa, Largo B. Pontecorvo 3, IT-56127 Pisa, Italy

We present, for the first time to the best of our knowledge, a SESAM mode-locked Yb:LuLiF$_4$ laser. Pumping with low-power single-mode fiber-coupled laser diodes at 976 nm (350 mW maximum absorbed pump power), we obtained almost Fourier transform limited, 90-fs pulses at 1054 nm, with 32 mW average power.

SSL-6.5 Fri, 9:15

Diode-pumped Tm:KYW laser passively mode-locked with a GaSb-SESAM — •Maxim Gaponenko[1], Antti Härkönen[2], Soile Suomalainen[2], Nikolay Kuleshov[3], Mircea Guina[2,4], and Thomas Südmeyer[1] — [1]Laboratoire Temps-Fréquence, Université de Neuchâtel, Ave. de Bellevaux 51, 2000 Neuchâtel, Switzerland — [2]Optoelectronics Research Centre, Tampere University of Technology, Korkeakoulunkatu 3, 33720 Tampere, Finland — [3]Center for Optical Materials and Technologies, BNTU, Nezavisimosti Ave 65, 220013 Minsk, Belarus — [4]RefleKron Ltd., Muotialankuja 5 C5, 33800 Tampere, Finland

We report on a GaSb-SESAM mode-locked diode-pumped thulium laser. The laser operates at a wavelength of 2030 nm and produces 6.5-ps pulses at rep. rate of 139 MHz with an average output power of 250 mW.

SSL-6.6 Fri, 9:30

Sub-100 fs Kerr-lens mode-locked Yb3+-doped Lu3Al5O12 ceramic laser — •Shotaro Kitajima[1], Hiroaki Nakao[1], Akira Shirakawa[1], Hideki Yagi[2], and Takagimi Yanagitani[2] — [1]Institute for Laser Science, University of Electro-Communications, Chofu, Tokyo, Japan — [2]Takuma Works, Konoshima Chemical Co., Ltd. Mitoyo, Kagawa, Japan

We have achieved Kerr-lens mode-locked operation of Yb:LuAG ceramic with a pulse duration of 91 fs, an average output power of 1.64 W, a pulse energy of 20 nJ, and a peak power of 220 kW. These are first sub-100-fs pulse demonstration of the mode-locked oscillator based on Yb:LuAG.

SSL-6.7 Fri, 9:45

Radially polarized mode–locked femtosecond Yb:YAG thin–disk oscillator — •Michael Eckerle[1,2], Tom Dietrich[1], Christof Pruss[3], Frederik Schaal[3], Wolfgang Osten[3], Wolfgang Pallmann[4], Bojan Resan[4], Marwan Abdou Ahmed[1], and Thomas Graf[1] — [1]Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Pfaffenwaldring 43, 70569 Stuttgart, Germany — [2]Graduate School of Excellence advanced Manufacturing Engineering (GSaME), University of Stuttgart, Nobelstraße 12, 70569 Stuttgart,Germany — [3] Institut für Technische Optik (ITO), University of Stuttgart, Pfaffenwaldring 9, 70569 Stuttgart, Germany — [4] Lumentum Switzerland AG, Ruetistrasse 12, CH-8952 Schlieren/Zurich, Switzerland

We report on the first radially polarized mode-locked Yb:YAG thin-disk oscillator. The system delivered 907 fs pulses at a repetition rate of 42.1 MHz and an average output power of 13.3 W. The degree of radial polarization was measured to be larger than 96 %.

10:00–10:30 Coffee Break

SSL-7: Lasers and Applications (I)

Chair: Marco Marangoni, Politecnico di Milano, Milano, Italy

Time: Friday, 10:30–12:30 Location: Lecture Hall EI7

Invited SSL-7.1 Fri, 10:30

High-power single-mode cw lasers for gravitational wave detection — •Dietmar Kracht — Lazerzentrum Hannover, Germany

The development of high-power solid-state lasers for gravitational wave detectors is presented, in particular with respect to the state-of-the-art lasers utilized in the current generation of these detectors. Furthermore, results on high-power fiber amplifiers regarding the next generation of gravitational wave detectors are presented and discussed.

SSL-7.2 Fri, 11:00

Mid-infrared ring lasers for sensing applications — •Rolf Szedlak, Andreas Harrer, Martin Holzbauer, Benedikt Schwarz, Donald MacFarland, Tobias Zederbauer, Hermann Detz, Aaron Maxwell Andrews, Werner Schrenk, and Gottfried Strasser — Institute of Solid State Electronics & Center for Micro- and Nanostructures, Floragasse 7, 1040 Vienna, Austria

We present a remote sensor concept based on bi-functional quantum cascade heterostructures and two concentric vertically emitting and detecting ring waveguides on the same chip. Both rings can be used as laser and detector at the same wavelength. Our concept could enable compact hand-held sensing devices.

Friday

SSL-7.3 Fri, 11:15

Chirped-pulse Stimulated Raman Scattering for atmospheric sensing — •Valentina Shumakova[1], Raffael Maurer[1], Pavel Malevich[1], Andrius Baltuska[1,2], and Audrius Pugzlys[1,2] — [1]TU Wien, Vienna, Austria — [2]Center for Physical Sciences & Technology, Vilnius, Lithuania

We present a concept of remote atmospheric sensing based on stimulated Raman scattering in the presence of backward reflecting/scattering objects. The concept is based on chirping and precise timing tunable-wavelength femtosecond high-energy pulses where an interplay between the scattering efficiency and spectral resolution of the detection plays an important role.

SSL-7.4 Fri, 11:30

~1400-nm continuous-wave diamond Raman laser intracavity-pumped by an InGaAs semiconductor disk laser — •Riccardo Casula[1], Daniele C. Parrotta[1], Alan J. Kemp[1], Jussi-Pekka Penttinen[2], Tomi Leinonen[2], Mircea Guina[2], and Jennifer E. Hastie[1] — [1]Institute of Photonics, Department of Physics, University of Strathclyde, Technology and Innovation Centre, 99 George Street, Glasgow, G1 1RD, United Kingdom. — [2]Optoelectronics Research Centre, Tampere University of Technology, Korkeakoulunkatu 3, FIN-33101 Tampere, Finalnd.

We present a ~1400nm-emitting diamond Raman laser intracavity-pumped by an ~1180nm semiconductor disk laser. We measured a maximum output power of 2.3 W at ~1400nm with an output coupling of 3.5%. The Raman laser was tunable from 1373 to 1415nm using a 4-mm-thick birefringent filter.

SSL-7.5 Fri, 11:45

High-power continuous wave Yb:GGG thin-disk laser — •Andreas Diebold[1], Zhitai Jia[2], Ivan J. Graumann[1], Yanru Yin[2], Florian Emaury[1], Clara J. Saraceno[1], Xutang Tao[2], and Ursula Keller[1] — [1]Institute for Quantum Electronics, ETH Zurich, 8093 Zurich, Switzerland — [2]State Key Laboratory of Crystal Materials, Shandong University, 250100 Ji'nan, China

We present, for the first time, a high-power continuous-wave Yb:GGG thin disk laser. We demonstrate more than 50 W of output power in multimode operation at 67% slope efficiency. Furthermore, we compare the performance of this material with Yb:YAG, showing the potential of this crystal for future power-scaling.

SSL-7.6 Fri, 12:00

High energy regenerative amplifier based on room temperature Yb :CaF2 — •Jean-Gabriel Brisset[1,2], Benoit Tropheme[3], Laurianne Caillon[3], Pierre Sevillano[3], Damien Sangla[3], and Antoine Courjaud[3] — [1]Max Born Institut, Max-Born-Straße 2A, 12489 Berlin, Germany — [2]Université de Genève, GAP-Biophotonics, Chemin de Pinchat 22, CH-1211 Geneva 4, Switzerland — [3]Amplitude Systèmes, 11 avenue de Canteranne, Cité de la photonique, 33600 PESSAC, France

We report an ultrafast amplifier based on Yb:CaF2 delivering 30mJ at a repetition rate of 100Hz, with a central wavelength of 1030nm. The 5.5nm bandwidth pulses have been compressed to 400fs. This laser constitutes a source for pumping an OPA or for seeding high energy amplifiers based on Yb:YAG crystals.

SSL-7.7 Fri, 12:15

Semiconductor heterostructure based amplifier of THz waves — •Juraj Darmo[1], Dominic Bachmann[1], Karl Unterrainer[1], Markus Roesch[2], Giacomo Scalari[2], Mattias Beck[2], and Jerome Faist[2] — [1]Technische Universität Wien, Vienna, Austria — [2]ETH, Zurich, Switzerland

Semiconductor amplifier of THz waves is presented. The amplifier boost the power by 100 in 1 THz broad frequency range centred at 2.6 THz.

12:30–13:45 Lunch Break

FWG-5: Hollow-core, Ultrashort, and High-energy Fiber Sources

Chair: Philippe Grelu, Université de Bourgogne, Dijon, France

Time: Friday, 13:45–16:00 Location: Lecture Hall EI7

FWG-5.1 Fri, 13:45

Wavelength-tunable high harmonic generation by blue-shifting solitons — •Francesco Tani[1], Michael H. Frosz[1], John C. Travers[1], and Philip St.J. Russell[1,2] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]Department of Physics, University of Erlangen-Nuremberg, Erlangen, Germany

We report generation of high harmonics in a gas-jet pumped by pulses compressed in a He-filled hollow-core photonic crystal fibre. Through the ionization-driven soliton self-frequency blue-shift, the harmonic wavelengths could be continuously tuned over the range 25 to 60 nm.

FWG-5.2 Fri, 14:00

Milliwatt Class Narrowband High Harmonic Source Based on Cascaded Frequency Conversion — •Robert Klas[1,2], Stefan Demmler[1,2], Maxim Tschernajew[1,2], Steffen Hädrich[1,2], Jan Rothhardt[1,2], Jens Limpert[1,2,3], and Andreas Tünnermann[1,2,3] — [1]Friedrich-Schiller-Universität Jena, Abbe Center of Photonics, Institute of Applied Physics, Albert-Einstein-Straße 15, 07745 Jena, Germany — [2]Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Straße 7, 07745 Jena, Germany

We present a table-top narrowband XUV source based on high-harmonic-generation of a high average power femtosecond fiber laser, which has a record-high average power of 832 μW at 21.7 eV. Furthermore, a resonantly-enhanced harmonic at 26.6 eV with an relative energy bandwidth of 3*10-3 has been generated in argon.

FWG-5.3 Fri, 14:15

Multi-shot TG-XFROG for the characterisation of deep-UV ultrashort pulses from dispersive-wave generation in gas-filled HC-PCF — •Alexey Ermolov[1], Heli Valtna-Lukner[2,1], John C. Travers[1], and Philip St.J. Russell[1] — [1]Max Planck Institute for the Science of Light, Günther-Scharowsky-str. 1, 91058 Erlangen, Germany — [2]Institute of Physics, University of Tartu, Ravila 14c, 50411 Tartu, Estonia

A multi-shot transient-grating cross-correlation FROG is implemented for characterization of nanojoule-scale, broadband, deep-UV pulses generated in a gas-filled kagomé-PCF through dispersive-wave emission. It is shown that the 210 THz broad dispersive-wave has a temporal duration of 5 fs. Modelling agrees with the experimental results.

FWG-5.4 Fri, 14:30

Nonlinear pulse compression and high-harmonic generation driven by a high repetition rate Tm-based fiber CPA system — •Fabian Stutzki[1], Christian Gaida[1], Martin Gebhardt[1,2], Robert Klas[1,2], Stefan Demmler[1], Steffen Hädrich[1], Jan Rothhardt[1,2], Cesar Jauregui[1], Jens Limpert[1,2,3], and Andreas Tünnermann[1,2,3] — [1]Institute of Applied Physics, Abbe Center of Photonics, Jena, Germany — [2]Helmholtz-Institute Jena, Jena, Germany — [3]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We present a Tm-based fiber CPA system delivering a peak power of 2GW and an average power of 28.5W. These pulses are nonlinerarily compressed in a hollow capillary fiber to less than 50fs pulse duration. Finally, first experimental results on high-harmonic generation driven by this system are discussed.

FWG-5.5 Fri, 14:45

Generation of Mid-IR Radiation by Four-Wave Mixing in Gas-filled Metal Coated Waveguides — •T. Flöry[1], P. Malevich[1], A. Pugzlys[1], A. Voronin[2], A. M. Zheltikov[2,3], and A. Baltuska[1] — [1]Photonics Institute Vienna University of Technology, Gusshausstrasse 27-387, A-1040 Vienna, Austria — [2]Physics Department, International Laser Center, M.V. Lomonosov Moscow State University, 119992 Moscow, Russia — [3]Department of Physics and Astronomy, Texas A&M University, College Station TX, 77843–4242, USA

Four-wave-mixing based optical parametric amplification of ultrashort pulses in gas-filled metal coated hollow waveguides enables the generation of tuneable mid-IR radiation. We present experimental data and numerical simulation that reveal the influence of self- and cross-phase modulation and show the limitations of this approach.

FWG-5.6 Fri, 15:00

Hollow-Core-Waveguide Compression of Multi-mJ CEP-Stable 3.2-μm Pulses — •Guangyu Fan[1], Tadas Balciunas[1], Tsuneto Kanai[1], Giedrius Andriukaitis[1], Bruno Schmidt[2,3], Francois Légaré[2], and Andrius Baltuska[2] — [1]Institute of Photonics, TU Wien, Gusshausstrasse 27/387, Vienna, Austria — [2]Centre Énergie Matériaux et Télécommunications, Institut National de la Recherche Scientifique, 1650 Boulevard Lionel-Boulet, Varennes, Quebec J3X1S2, Canada — [3]few-cycle, Inc., 2890 Rue de Beaurivage, Montreal, Quebec H1L 5W5, Canada

CEP stable, 6mJ, 80fs, 3.2 μm pulse via spectral broadening in 3 m long, 1mm diameter hollow core capillary with ~50% transmission, were compressed in 2mm CaF2 plate down to 23 fs and FT duration is below sub-two cycle pulse. The work is underway to improve towards single cycle regime.

FWG-5.7 Fri, 15:15

Development of chirped-pulse amplifier based on Thulium-doped ZBLAN fibers — Yutaka Nomura and •Takao Fuji — Institute for Molecular Science, Okazaki, Japan

A chirped-pulse amplifier system based on thulium-doped ZBLAN fibers has been demonstrated. The gain medium is a 3.8-m long, large-mode-area double-clad ZBLAN fiber. The maximum output power is 4.5 W, and the output pulse is compressed down to 150 fs.

FWG-5.8 Fri, 15:30

Generation of 36 fs 23 MW peak power pulses from a third order dispersion managed fiber amplifier — •Yang Liu, Wenxue Li, Daping Luo, Chao Wang, Dongbi Bai, and Heping Zeng — State Key Laboratory of Precision Spectroscopy, East China Normal University, Shanghai, China

We report on the generation of 36-fs, 23-MW pulses from a third order dispersion managed fiber amplifier operating at 110 MHz. Detail experiments show that tuning the grisms results in the production of ultrashort pulses with minimal temporal pedestal.

FWG-5.9 Fri, 15:45

Utilizing fiber lasers to obtain 220W average power energetic sub-2 cycle pulses — •Steffen Hädrich[1,2], Marco Kienel[1,2], Michael Müller[1], Arno Klenke[1,2], Jan Rothhardt[1,2], Robert Klas[1,2], Thomas Gottschall[1], Tino Eidam[3], András Drozdy[4], Péter Jójárt[4], Zoltan Várallyay[4], Eric Cormier[4,5], Károly Osvay[4], Andreas Tünnermann[1,2,6], and Jens Limpert[1,2] — [1]Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [2]Helmholtz Institute Jena, Jena, Germany — [3]Active Fiber Systems, Jena, Germany — [4]ELI-ALPS, ELI-HU Non-Profit Ltd., Szeged, Hungary — [5]Université Bordeaux-CNRS-CEA-UMR 5107, Talence, France — [6]Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

A state-of-the-art fiber-chirped-pulse-amplifier system based on coherent combination delivers 680W of average power 300fs pulses. Two-stage nonlinear compression in gas-filled capillaries yields 400W, 30fs, >300μJ pulses and 220W, sub-7fs, 170μJ pulses, respectively. In high energy operation 100W, 1mJ, sub-10 fs are demonstrated.

16:00–16:30 Coffee Break

SSL-8: Lasers and Applications (II)

Chair: P. G. Schunemann, BAE Systems, USA

Time: Friday, 16:30–18:15 Location: Lecture Hall EI7

Invited SSL-8.1 Fri, 16:30

Structured laser beams and novel applications — •G.K. Samanta — Photonic Sciences Lab., Physical Research Laboratory, Navarangpura, Ahmedabad 380009, Gujarat, India

Structured laser beams are of great importance due to their wide range of scientific and technological applications. In this talk, we will discuss our recent results on generation of various structured laser beams including optical vortices, perfect vortices, Airy beam, and hollow Gaussian beam and some of their applications.

SSL-8.2 Fri, 17:00

Ultrafast rotation of ring-shaped optical lattice in picosecond regime — •Keisaku Yamane, Kohei Kakizawa, Kazuhiko Oka, Yasunori Toda, and Ryuji Morita — Department of Applied Physics, Hokkaido University,Kita-13, Nishi-8, Kita-ku, Sapporo, 060-8628 Japan

A new method for ultrafast rotation of ring-shaped optical lattice based on frequency-chirp control was demonstrated in the picosecond regime. The time-resolved measurements successfully confirmed that the rotation period was ~2 ps, which is three orders of magnitude shorter than those by the conventional methods.

Friday

SSL-8.3 Fri, 17:15

Nonlinear generation of perfect vortex laser beams — •Apurv Chaitanya Nellikka[1,2], Jabir M. V.[1], and Goutam Kumar Samanta[1] — [1]Physical Research Laboratory, Ahmedabad, India — [2]Indian Institute of Technology, Gandhinagar, India

We demonstrate efficient nonlinear generation of high power, ultrafast "perfect" vortices (PV) in green. By single-pass three wave mixing in chirped MgO:ppCLN we generated PV at 530 nm with output power of 1.2W and vortex order up to 12 at a single-pass conversion efficiency of 27%, independent of the order.

SSL-8.4 Fri, 17:30

Coherent pulse stacking of solid-state laser pulses — •Ignas Astrauskas[1], Edgar Kaksis[1], Tobias Flöry[1], Giedrius Andriukaitis[1], Audrius Pugžlys[1], Andrius Baltuška[1], John Ruppe[2], Siyun Chen[2], Almantas Galvanauskas[2], and Tadas Balčiūnas[1] — [1]Photonics Institute, TU Wien, Vienna, Austria — [2]Center for Ultrafast Optical Science, University of Michigan, Ann Arbor, USA

We present a coherent pulse stacking approach for up-scaling energy of a solid-state femtosecond chirped pulse amplifier. We demonstrate pulse splitting into four replicas, amplification of non-overlapping pulse train in a specially designed regenerative amplifier cavity, and phase-locked stacking into one dominant pulse.

SSL-8.5 Fri, 17:45

Avalanche effect and gain saturation in high harmonic generation — Carles Serrat[1], David Roca[1], Josep M. Budesca[1], •Jozsef Seres[2], Enikoe Seres[2], Bastian Aurand[3], Andreas Hoffmann[4], Shinichi Namba[5], Thomas Kuehl[6,7], and Christian Spielmann[4,7] — [1]Universitat Politècnica de Catalunya, Departament de Física, Colom 11, 08222 Terrassa, Spain — [2]Institute of Atomic and Subatomic Physics, Vienna University of Technology, Stadionalle 2, 1020 Vienna, Austria — [3]Institut für Laser- und Plasmaphysik, Universität Düsseldorf, Universitätsstr. 1, 40225 Düsseldorf, Germany — [4]Institute of Optics and Quantum Electronics, Friedrich Schiller University, Max Wien Platz 1, 07743 Jena, Germany — [5]Graduate School of Engineering, Hiroshima University, 1-4-1 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8527, Japan — [6]GSI Helmholtz Centre for Heavy Ion Research, Planckstrasse 1, 64291 Darmstadt, Germany — [7]Helmholtz Institute Jena, Fröbelstieg 3, 07743 Jena, Germany

We show that the strong-field theory of high-harmonic generation fully describes the avalanche-like behavior of the amplification of XUV attosecond pulse trains in strong-field driven gas media. Furthermore, it excludes pressure induced phase matching as a possible explanation. The results of the simulations fully agree with the measurements.

SSL-8.6 Fri, 18:00

Self-pulsing by Excited-state Absorption in Visible Sm^{3+} Lasers — •Daniel-Timo Marzahl[1], Markus Pollnau[2], and Christian Kränkel[1,3] — [1]Institut für Laser-Physik, Universität Hamburg, Hamburg, Germany — [2]Department of Materials and Nano Physics, School of Information and Communication Technology, KTH – Royal Institute of Technology, Kista, Sweden — [3]The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Hamburg, Germany

We present numerical simulations of visible Sm^{3+} lasers considering excited-state absorption (ESA) at the laser wavelength. Assuming an ESA starting level populated by fluorescence and located above the lower laser level, at realistic ESA cross sections the simulations yield stable pulsed operation being in good agreement with the experimental data.

Closing Remarks

Time: Friday, 18:15–18:30 Location: Lecture Hall EI7

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