SS1: Summer School Lecture 1 - Ultrashort pulse and high power lasers - Prof. Morgner

Time: Sunday 14:00–16:00
Location: Oscar Klein - Lecture Hall

Summer School Lecture 1 - Ultrashort pulse and high power lasers - Prof. Morgner

Break

Summer School Lecture 1 - Ultrashort pulse and high power lasers - Prof. Morgner

Discussion

2: Coffee Break

Time: Sunday 16:00–16:30
Location: Main Hall Area

Coffee Break

SS2: Summer school lecture 2 - High harmonics, Attosecond generation - Prof. L’Huillier

Time: Sunday 16:30–18:30
Location: Oscar Klein - Lecture Hall

Summer school lecture 2 - High harmonics, Attosecond generation - Prof. L’Huillier

Break

Summer school lecture 2 - High harmonics, Attosecond generation - Prof. L’Huillier

Discussion

4: Welcome by chairs

Time: Monday 8:00–8:15
Location: Oscar Klein - Lecture Hall

Welcome

MoA: Novel trends in photonics

Time: Monday 8:15–10:00
Location: Oscar Klein - Lecture Hall

Invited talk

MoA.1 (233) Mon 8:15

Nonlinear optical phononics: harnessing sound and light in nonlinear nanoscale circuits — Benjamin Eggleton — University of Sydney, CUDOS, Australia

The convergence of optics and phononics, enabled by new nonlinear materials in which acoustic phenomena can be excited on small scales and nanoscale structures that enhance the interaction between sound and light, is unlocking innovations for chip-based information processing. This paper will review recent breakthroughs that harness this optical phononic interaction for a new paradigm in information processing, including tunable slow light, frequency comb sources and microwave photonic signal processing.

MoA.2 (107) Mon 8:45

1 mJ, 15 kHz Q-switched laser at 946 nm in Nd:YAG single-crystal fiber — Loïc Deyra1, François Balembois3, Xavier Delen5, Igor Martial2, Nicolas Aubry2, and Patrick Georges1 — Laboratoire Charles Fabry, Institut d’Optique, CNRS, Univ Paris-Sud, 91127 Palaiseau, France — Fibercry SAS, La DouaBatiment l’Atrium, Boulevard Latarjet, F 69616 Villeurbanne Cedex, France

We present the dual-frequency emission of a diode-pumped vertical external-cavity semiconductor laser at 852 nm dedicated to coherent population trapping experiments. With power solid-state 946nm lasers, 1mJ energy at 946nm have been reached in actively Q-switched operation at 15kHz, improving by 3.5 times the state-of-the-art level of output average power and by 2.4 times the output energy at 946nm.

MoA.3 (144) Mon 9:00

Dual frequency emission in a compact semiconductor laser for coherent population trapping cesium atomic clocks — Fabiola de Almeida Camargo1, Gaëlle Lucas-Leclin1, Patrick Georges1, Ghaya Baili2, Loïc Morvan2, Daniel Dolfi2, David Holleville3, Stéphane Guérandel3, and Isabelle Sagnes4 — Laboratoire Charles Fabry, Institut d’Optique, CNRS, Univ Paris-Sud XI, 2 Av. A. Fresnel, 91127, Palaiseau, France — Thales Research & Technology, 1 Av. A. Fresnel, 91767, Palaiseau, France — LNE-SYRTE, Systèmes de Référence Temps-Espace, Observatoire de Paris, CNRS, UPMC, 61 Av. de l’Observatoire, 75014, Paris, France — Laboratoire de Photonique et de Nanostructures, CNRS, Route de Nozay, 91460, Marcoussis, France

We present the dual-frequency emission of a diode-pumped vertical external-cavity semiconductor laser at 852 nm dedicated to coherent population trapping experiments.
Selective excitation of Laguerre-Gaussian (LG0n) doughnut modes in a diode-laser end-pumped solid-state laser — Ji Won Kim1 and William Andrew Clarkson2 1Department of Applied Physics, Hanyang University, Ansan, Gyeonggi-do 426-791, Republic of Korea 2Optoelectronics Research Centre, University of Southampton, Southampton, SO17 1BJ, UK

A simple method for direct excitation of Laguerre-Gaussian (LG0n) doughnut modes in a diode-laser end-pumped solid-state laser is described. Using this scheme, lasing on the LG01, LG02 and LG03 modes has been realised in a diode-pumped Nd:YAG laser. Experimental results for laser performance are presented and compared with theoretical predictions.

Graphene Saturable Absorber Mode-Locked Yb:KLuW Laser at 1047 nm — Elena Ugolotti1,2, Andreas Schmidt1, Valentin Petrov1, Jun Wan Kim3, Fabian Rotermund3, Sukang Bae4, Byung Hee Hong4, Antonio Agnesi2, Christian Fiebig5, Götz Erbert5, Xavier Mateos6, Magdalena Aguilo6, Christopher Richard Phillips1, Uwe Grießner1 1Max Born Institute, Berlin, Germany 2University of Pavia, Pavia, Italy 3Ajou University, Suwon, Korea 4Seoul National University, Seoul, Korea 5Ferdinand-Braun-Institut, Berlin, Germany 6Universitat Rovira i Virgili, Tarragona, Spain

We present a simple approach for the pulse duration reduction of passively Q-switched microchip lasers. With this technique a reduction from 138 ps to 24 ps has been realized and amplified to pulse energies of 20 μJ, subsequently.

Coffee Break

MoB: Nonlinear optics

Invited talk MoB.1 (234) Mon 10:30
Saturation of the all-Optical Kerr Effect in Solids and Gases — Günter Steinmeyer — Max-Born-Institut, 12489 Berlin, Germany

The saturation of nonlinear optical index changes in dielectric materials is theoretically modeled by a Kramers-Kronig transform and compared to recent experimental results in solids and gases. This investigation indicates a previously underestimated role of the Kerr saturation for various experimentally relevant scenarios, including supercontinuum generation in fibers and filamentation.

Mid-infrared pulses with 115 MW peak power from an OPCPA based on apodized APPLN — Benedikt Walfried Mayer1, Clemens Heese1, Christopher Richard Phillips2, Lukas Gallmann1, Martin Marty Feijer2, and Ursula Keller1 1Department of Physics, Institute of Quantum Electronics, ETH Zurich, 8093 Zurich, Switzerland 2Edward L. Ginzton Laboratory, Stanford University, Stanford, California 94305, USA

We present an ultra-broadband optical parametric chirped-pulse amplifier producing femtosecond pulses in the mid-infrared with 115-MW peak power. A record-high average power of 700 mW is achieved. The use of apodized aperiodically poled LiNbO3 amplifiers yields clean 75-fs pulses at 100 kHz and 110-fs pulses at 50 kHz repetition rate.

Multi-millijoule few-cycle pulses in mid-IR: generation and applications — Audrius Pugzlys1, Skirmantas Alisauskas1, Giedrius Andriukaitis1, Tadas Balciunas1, Danil Kartashov1, Ming-Chang Chen2, Tenio Popmintchev2, Audrius Zaukevičius3, Gintaras Vaičiulis3, and Andrius Baltuska1 1Photonics Institute, Vienna University of Technology, Gusshausstraße 27/387, 1040 Vienna, Austria 2JILA, University of Colorado at Boulder, Boulder, CO 80309-0440 USA 3Dep. of Quantum Electronics, Vilnius University, Sauletekio ave. 9, Vilnius, Lithuania

We present and characterize a compact 20-Hz-repetition-rate mid-IR OPCPA system delivering 12 mJ, 83 fs pulses at 3.9 μm. With the system we demonstrate generation of bright coherent X-ray supercontinua extending to 1.6 keV, studies on generation of lower-order harmonics and filamentation as well as efficient lasing from a filament.

Coffee Break
Two-color pumped OPCPA emitting 450 THz broadband spectra with 1 µJ of pulse energy at 200 kHz repetition rate — • Anne Harth\textsuperscript{1,2}, Marcel Schultze\textsuperscript{1}, Tino Lang\textsuperscript{1,2}, Thomas Binhammer\textsuperscript{3}, Stefan Rausch\textsuperscript{1,2}, and Uwe Morgner\textsuperscript{1,2} — \textsuperscript{1}Leibniz Universität Hannover, Hannover, Germany — \textsuperscript{2}Centre for Quantum Engineering and Space-Time Research (QUEST), Hannover, Germany — \textsuperscript{3}VENTEON Laser Technologies GmbH, Garbsen, Germany

We present a double-stage non-collinear parametric amplifier pumped with two different wavelengths. The system operates at 200 kHz and delivers µJ pulse energies with a 1.5-octaves spanning spectrum, supporting a Fourier limited pulse duration of 2.5 fs. Compression of the inner part leads to sub-5 fs pulse duration.

MoB.5 (166) Mon 11:45
Measurement and control of OPA-induced phase in ultra-broadband parametric amplifiers — Towards energetic single-cycle optical pulses — • Jan Rothhardt\textsuperscript{1,2}, Stefan Demmler\textsuperscript{1}, Steffen Hädrich\textsuperscript{1,2}, Jake Bromage\textsuperscript{3}, Jens Limpert\textsuperscript{1,2}, and Andreas Tünnermann\textsuperscript{1,2} — \textsuperscript{1}Friedrich Schiller University Jena, Abbe Center of Photonics, Institute of Applied Physics, Albert-Einstein-Straße 15, 07745 Jena, Germany — \textsuperscript{2}Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — \textsuperscript{3}University of Rochester, Laboratory for Laser Energetics, 250 East River Road, Rochester, NY 14623 USA

We present measurements of the spectral phase which is induced by the amplification process in an ultra-broadband OPCPA system. The measurements agree well with theory. Compensation of this phase leads to Fourier-limited pulses with less than two-optical cycles duration and potentially allows reaching single-cycle pulse durations in the future.

MoB.6 (196) Mon 12:00
Second harmonic generation in a CW diamond Raman laser for tunable visible emission — Daniele Parrotta, Alan Kemp, Martin Dawson, and • Jennifer Hastie — Institute of Photonics, University of Strathclyde, 106 Rottenrow, Glasgow G4 0NW, UK

Tunable, visible emission from a frequency-doubled CW diamond Raman laser intracavity pumped by an InGaAs-based semiconductor disk laser is reported. Maximum output power of 1.5W at 614nm was achieved, with good beam quality (M2\sim 1.3) and emission linewidth of \sim 0.1nm. The visible emission was tuned from 604.5-619.5nm.

8: Lunch Break

SS3: Summer school lecture 3 - Understanding fiber amplifiers - Dr Paschotta

Time: Monday 12:15–13:30
Location: Lunch
Lunch Break

Summer school lecture 3 - Understanding fiber amplifiers - Dr Paschotta

Break

Summer school lecture 3 - Understanding fiber amplifiers - Dr Paschotta

Discussion

10: Coffee Break

SS4: Summer school lecture - Ultrashort-pulse lasers for bioimaging applications - Prof. French

Time: Monday 16:45–18:30
Location: Main Hall Area
Coffee Break

Summer school lecture - Ultrashort-pulse lasers for bioimaging applications - Prof. French

Break

Summer school lecture - Ultrashort-pulse lasers for bioimaging applications - Prof. French

Discussion

SS5: Summer school lecture 5 - Mid-infrared fiber lasers - Prof. Jackson

Time: Tuesday 8:00–10:00
Location: Oscar Klein - Lecture Hall
Summer school lecture 5 - Mid-infrared fiber lasers - Prof. Jackson

Break

Summer school lecture 5 - Mid-infrared fiber lasers - Prof. Jackson

Discussion

13: Coffee Break

Time: Tuesday 10:00–10:30
Location: Main Hall Area

Coffee Break

SS6: Summer school lecture 6 - On chip nonlinear optics, Si photonics - Prof. Lipson

Time: Tuesday 10:30–12:30
Location: Oscar Klein - Lecture Hall

Break

Summer school lecture 6 - On chip nonlinear optics, Si photonics - Prof. Lipson

Discussion

15: Lunch Break

Time: Tuesday 12:30–13:30
Location: Lunch

Lunch Break

TuP: Poster Session I

Time: Tuesday 13:30–14:30
Location: Main Hall Area

TuP.1 (25) Tue 13:30

CW VECSEL Raman laser with tunable lime-yellow-orange output — JIPENG LIN1, HELEN M. PASK1, DAVID J. SPENCE1, CRAIG J. HAMILTON2, and GRAEME P. A. MALCOLM2 — 1Department of Physics and Astronomy, Macquarie University, Sydney, New South Wales 2109, Australia — 2M-Squared Lasers Ltd, 1 Technology Terrace, Todd Campus, Maryhill Road, Glasgow, G20 0XA

A compact CW VECSEL-pumped KGW Raman laser with intracavity sum-frequency-mixing was demonstrated. Two separate tunable emissions bands (548.5-566nm and 577.5-596nm) were obtained. The maximum output powers for SFG and SHG were 0.8W at 560 nm and 0.52W at 592.5 nm.

TuP.2 (225) Tue 13:30

4 - 5 um wavelength radiation generated by mid-IR lasers — HELENA JELINKOVA1, MAXIM DOROSENKO2, JAN SULC1, MICHAL JELINEK1, MICHAL NEMEC1, TASOLTAN BASHEV2, VITALY KOMAR3, ALEXANDER GERASIMENKO3, VYACHESLAV PUIZIKOV4, VALERII BADIKOV4, and DMITRI BADIKOV4 — 1Czech Technical University in Prague, Faculty of Nuclear Sciences and Physical Engineering — 2A. M. Prokhorov General Physics Institute, Russian Academy of Sciences, Materials and Technology Research Center, — 3Institute for Single Crystals, NAS of Ukraine, 60 Lenin Ave., Kharkiv, 61001 Ukraine — 4Kuban State University, May 9th Street 46a, 350040 Krasnodar, Russian Federation

Dy:PhGa2S4 and Fe:ZnSe lasers generated in 4-5 um region at room temperature were investigated. The generated energy, pulse-length, and the slope efficiency with respect to the absorbed energy were 7 mJ, 120 ns, 8%, respectively for Dy:PhGa2S4 laser, and 1.3 mJ, 120 ns, 30 %, respectively for Fe:ZnSe system.

TuP.3 (27) Tue 13:30

1064 nm pumped CdSiP2 optical parametric oscillator generating ~400 ps pulses near 6150 nm at 1-10 kHz repetition rates — GEORGI MARCHEV1, PAOLO DALLOCCHIO2, FEDERICO PIRZIO2, ANTONIO AGNESI2, GIANCARLO REALI2, VALENTIN PETROV4, ALEKSEY TYAZHEV1, PETER SCHUNEMANN3, and KEVIN ZAWILSKI3 — 1Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy, 2A Max-Born-Str., D-12489 Berlin, Germany — 2INFN and Dipartimento di Elettronica dell’Università di Pavia, Via Ferrata 1 - 27100 Pavia, Italy — 3BAE Systems, Inc., MER15-1813, P.O. Box 868, Nashua, NH 03061-0868, USA

A short cavity optical parametric oscillator based on CdSiP2 generates ~400ps idler pulses near 6150nm under 1064nm pumping at a variable repetition rate of 1-10kHz. Quantum conversion efficiency of 9.5% is achieved although the sig-
We report for the first time the applicability of graphene flakes as saturable absorber for bulk solid-state laser mode-locking. The graphene flakes-based saturable absorber mode-locked Cr:forsrerite laser delivers 131 fs long pulses at 75 MHz with an output power of 78 mW.

TuP.4 (173) Tue 13:30
Applicability of Graphene Flakes as Saturable Absorber for Bulk Solid-State Lasers — JUN WAN KIM, YOUNG CHOI, HOO JUNG, DONG-IL YEOM, KI-HONG KIM, and FABIAN ROTERMUND — Department of Physics and Division of Energy Systems Research, Ajou University, Suwon 443-749, Korea

We report for the first time the applicability of graphene flakes as saturable absorber for bulk solid-state laser mode-locking. The graphene flakes-based saturable absorber mode-locked Cr:forsrerite laser delivers 131 fs long pulses at 75 MHz with an output power of 78 mW.

TuP.5 (10) Tue 13:30
Experiments and modeling of energetic and spectral properties of triple photons third-order downconversion in KTiOPo4 — ADRIEN BORNE, AUDEY DOT, BENOT BOULANGER, PATRICIA SEGONDS, CORINNE FELIX, KAMEL BENCHEIKH, and JUAN ARIEL LEVENSON — Institut Niel, Grenoble, France — Laboratoire de Photonique et Nanostructures, Marcoussis, France

We performed the study of the spectral and energetic properties of triple photons generated by a down-conversion parametric process in KTP. Our model takes into account the beams spectral linewidths and a parasitic Kerr effect.

TuP.6 (28) Tue 13:30
Passively Q-switched Tm:LiLuF4 laser with 1.26 mJ output energy — HAOHAI YU, VALENTIN PETROV, UWE GRIEBNER, DANIELA PARISI, STEFANO VERONESI, and MAURO TONELLI — Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, 2A Max-Born-Str., D-12489 Berlin, Germany — State Key Laboratory of Crystal Materials and Institute of Crystal Materials, Shandong University, 250100 Jinan, China — NEST Istituto Nanoscienze-CNR and Dipartimento di Fisica dell’Universita di Pisa, Largo B. Pontecorvo 3, 56127 Pisa, Italy

We demonstrate passively Q-switched diode-pumped Tm3+:LiLuF4 laser operation near 1900 nm. Stable passive Q-switching with Cr2+:ZnS saturable absorbers resulted in minimum pulse duration of 7.6 ns and maximum pulse energy and peak power of 1.26 mJ and 166 kW, respectively, at a repetition rate of 161 Hz.

TuP.7 (49) Tue 13:30
Generation of ultrashort optical-vortex pulses in few-cycle regime — KEISAKU YAMANE, YASUNORI TODA, and RYOJI MORITA — Department of Applied Physics, Hokkaido University, and JST, CREST, Kita-13, Nishi-8, Kita-ku, Sapporo, 060-8628 Japan

We succeeded in generating 2.3-cycle, 5.9-fs, 56-$\mu$J ultrashort optical-vortex pulses by optical parametric amplification. A fork-like interferogram showed that the topological charge was conserved during the amplification process. To the best of our knowledge, it is the first generation of optical vortex pulses in the few-cycle regime.

TuP.8 (39) Tue 13:30
14 W High-Efficient cw Yb:KGd(WO4)2 Laser with Low Thermo-Optic Aberrations — PAVEL LOKHO, VIKTOR KISEL, KONSTANTIN YUMASHEV, NIKOLAI KULESHOV, and ANATOLY PAVLYUK — Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus — Nikolaev Institute for Inorganic Chemistry, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia

Thermal lensing was characterized in Ng-cut monoclinic Yb:KGd laser crystal under diode pumping. Thermal lens was found to be positive for rays lying in all meridional planes and slightly astigmatic. This athermal crystal was utilized to produce 14W cw Yb:KGd laser with slope efficiency of 76% and low thermo-optic aberrations.

TuP.9 (87) Tue 13:30
Ultrafast Composite-Thin-Disk Cryogenic Yb:YAG Laser Driver — LUIS E. ZAPATA, EDUARDO GRANADOS, KYUNG-HAN HONG, and FRANZ X. KAERTNER — MIT-RLE, Cambridge, MA, USA — DESY and University of Hamburg, Hamburg, Germany

We propose and analyze a composite-thin-disk technology based on cryogenic Yb:YAG for constructing high energy picosecond lasers for pumping of optical parametric chirped pulse amplifiers. The storage amplifiers thermo-mechanics/thermo-optics coupled with an image relayed multi-pass architecture predicts high beam-quality at high average power.

TuP.10 (101) Tue 13:30
Mode-locked Yb3+-doped Lu3Al5O12 ceramic laser — HIROYUKI NAKAO, AKIRA SHIRAKAWA, KEN-ICHI UEDA, HIDEKI YAGI, and TAKAGIMI YANAGITANI — Institute for Laser Science, University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, Tokyo 182-8585, Japan — Takuma Works, Konoshima Chemical Co., Ltd., 80 Kouda, Takuma, Mitoyo-gun, Kagawa 769-1103, Japan

Yb3+:Lu3Al5O12 ceramic is promising material for thin-disk laser due to its higher emission cross section and thermal conductivity than that of Yb3+:Y3Al5O12 at CT > 2-3%. The optical property and first mode-locked laser operation of Yb3+:Lu3Al5O12 ceramic with 200 mW average output power and 699 fs pulse duration is reported.

TuP.11 (5) Tue 13:30
Efficient, simultaneous dual-wavelength emission at 1.06 and 1.34 $\mu$m in Nd:GdVO4 laser crystal — NICOLAE PAVEL, GABRIELA SALAMU, OANA SANDU, ALINA IONESCU, CATALINA BRANDUS, FLAVIUS VOICU, and TRAIAN DASCALU — National Institute for Lasers, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Bucharest R-077125, Romania

A diode-pumped Nd:GdVO4 laser that generates up to 6.8 W powers simultaneously at 1.06 and 1.34 $\mu$m, having the 1.06-$\mu$m transition power ratio adjustable, is demonstrated. Furthermore, a Nd:GdVO4 laser that yields simultaneous emission at the two fundamental wavelengths and that generates concomitant green light at 0.53 $\mu$m is realized.
Spectral and Temperature Dependencies of Refractive Indices for Uniaxial M\(^{1+}\)T\(^{3+}\)(W/MoO\(_4\))\(_2\) Laser Host Crystals — Pavel A. Lohko\(^1\), Xiumei Han\(^2\), Konstantin V. Yumashev\(^1\), María Dolores Serrano\(^2\), Nikolay V. Kuleshov\(^1\), Concepción Cascales\(^2\), and Carlos Zaldu\(^2\) — Center for Optical Materials and Technologies, Belarusian National Technical University, 220013 Minsk, Belarus; 65/17 Nezavisimostyi Ave. — Instituto de Ciencia de Materiales de Madrid, Consejo Superior de Investigaciones Científicas, c/ Sor Juana Inés de la Cruz 3, 28049 Madrid, Spain

The anisotropy and dispersion of refractive indices and thermo-optic coefficients are investigated for uniaxial M\(^{1+}\)T\(^{3+}\)(W/MoO\(_4\))\(_2\) laser host crystals. They are characterized by low birefringence \(\Delta n \approx 10^{-3}\) and negative dn/dT due to large volumetric thermal expansion. The dependence of the refractive indices and group velocity dispersion on the crystal composition is investigated.

TuP.13 (67) Tue 13:30
Dependence of the Raman gain coefficient in diamond on pump wavelength — Vasili Savitski, Sean Reilly, and Alan Kemp — Institute of Photonics, University of Strathclyde, SUPA, 106 Rottenrow, Glasgow, G4 0NW, UK

Pump-probe and stimulated Raman scattering threshold experiments are used to give absolute and relative measurements of the SRS gain coefficient in CVD-grown single-crystal diamond. Both approaches indicate that the SRS gain coefficient is inversely proportional to the pump wavelength between 450 and 1450 nm.

TuP.14 (17) Tue 13:30
Thermal Lensing in CW Intracavity Raman Lasers — Gerald M Bonner\(^1,2\), Takasige Omatsu\(^3\), Andrew J Lee\(^1\), Alan J Kemp\(^2\), Jiayang Wang\(^4\), Hualin Zhang\(^4\), and Helen M Pask\(^1\) — MQ Photonics, Macquarie University, Sydney, Australia — Institute of Photonics, University of Strathclyde, Glasgow, UK — Graduate School of Advanced Integration Science, Chiba University, Chiba, Japan — State Key Laboratory of Crystal Materials, Shandong University, Jinan, China

Thermal problems often limit the performance of crystalline Raman lasers. Interferometric measurements of the thermal lenses in CW intracavity Raman lasers will be presented. The effect of these lenses on the behaviour of Raman laser cavities will be analysed and the implications for future Raman laser design will be discussed.

TuP.15 (50) Tue 13:30
Spectral Broadening in CW Intracavity Raman Lasers — Gerald M Bonner\(^1,2\), Andrew J Lee\(^1\), Jiayang Wang\(^3\), Hualin Zhang\(^4\), Helen M Pask\(^1\), and David J Spence\(^1\) — MQ Photonics, Macquarie University, Sydney, Australia — Institute of Photonics, University of Strathclyde, Glasgow, UK — State Key Laboratory of Crystal Materials, Shandong University, Jinan, China

Significant spectral broadening of the fundamental field occurs in intracavity Raman lasers as the Raman process presents a loss to the centre of the fundamental line. Theoretical and experimental investigations of this phenomenon will be presented and possible approaches to controlling it will be discussed.

TuP.16 (84) Tue 13:30
Spectral analysis of multi-beam pumped Non-Collinear Optical Parametric Amplifiers — Benoît Trophême, Gabriel Mennerat, and Benoît Boulangé — CEA DAM CESTA Le Barp France — CEASACLAY DSM Gif-sur-Yvette France

From spectral analysis of multi-beam pumped OPA experiments, we demonstrated the need of single-mode pumps to avoid cascading effects and that these pumps can be mutually incoherent without any degradation of the signal spectral quality.

TuP.17 (89) Tue 13:30
Enhancement of Cavity-Length Detuning Tolerance in Diffraction-Grating Narrowed Synchronously Pumped Optical Parametric Oscillators — Cédric Laporte, Antoine Godard, Jean-Baptiste Dherbecourt, Jean-Michel Melkonian, and Myriam Raybaud — ONERA - the French Aerospace Lab, F-91123 Palaiseau cedex, France

Line-narrowing of a synchronously-pumped OPO using an intracavity diffraction grating leads to an increase of the resonator-length detuning tolerance. We show that this effect, studied at 1.5 \(\mu\)m and 2.0 \(\mu\)m signal wavelengths, is due to resonant beam geometric adaptation within the cavity.

TuP.18 (69) Tue 13:30
Diode pumped Tm:BaYLuF\(_8\) 2 micron cw laser: first evidence with a novel host — Stefano Veronesi, Daniela Parisi, Azzurra Volpi, and Mauro Tonelli — Istituto Nanoscienze-CNR and Dipartimento di Fisica dell’Università di Pisa, I-56127 Pisa, Italy

We demonstrate, for the first time, diode-pumped Tm\(^{3+}\):BaYLuF\(_8\) laser operation near 1.9 micron in cw. The slope efficiency with respect to the absorbed power was about 28% and the emitted power 110 mW with a threshold of 87 mW. Power scaling experiments are in progress.

TuP.19 (188) Tue 13:30
Experiment and simulation of optical parametric amplified pulses inherently including parasitic, cascaded, and spatial effects — Tino Lang\(^1,2\), Anne Harth\(^1,2\), Marcel Schultze\(^1\), and Uwe Morgner\(^1,2\) — Institute of Quantum Optics, Leibniz Universität Hannover, Welfengarten 1, 30167 Hannover, Germany — Centre for Quantum Engineering and Space-Time Research (QUEST), Welfengarten 1, 30167 Hannover, Germany

We compare measured spectra of different stages and geometries of home-build OPCPA-systems to novel simulation results. The prominent characteristic features are reproduced and understood by the dispersive compression of the negatively chirped idler, the wavelength dependent spatial or temporal separation or cascaded effects.
**TuP.21** (221) Tue 13:30

Thermal management for high power VECSEL emission in the near- and the mid-IR — **Mathieu Devautour**, Adrien Michon, Gregoire Beaudoin, Isabelle Sagnes, Laurent Cherutti, and Arnaud Garnache — 1Institut d’Electronique du Sud, CNRS UMR5214, Université Montpellier 2, France — 2Laboratoire de Photonique et Nanostructures, CNRS UPR20, 91460 Marcoussis, France

Technological process for thermal management of VECSEL is reported. Substrate is removed through wet selective etching and an electrolytic gold layer is added on the wafer. 1.2 W and 11.6 mW maximum power and 7 K/W and 90 K/W thermal resistance are measured for GaAs- and GaSb-based chips.

**TuP.22** (123) Tue 13:30

Towards complete monolithic integration of microjoule-level femtosecond ytterbium fiber lasers — **Alma Fernandez**, Thomas Andersen, Tobias Flöry, Lingxiao Zhu, Almantas Galvanauskas, Andrius Baltuska, and Aart Verhoef — 1Institut für Photonik, Technische Universität Wien, Gussmanstrasse 27/387, Vienna, Austria — 2NKT Photonics A/S, Blokken 84, 3460 Birkeroed, Denmark — 3Center for Ultrafast Optical Science, University of Michigan, Ann Arbor, MI 48109-2009, USA

We present first pulse compression results from an all Ytterbium-fiber chirped pulse amplifier. The use of a dispersion engineered fiber stretcher and a 25 meter long hollow-core photonic bandgap fiber allowed to obtain 250 nJ, 220 fs pulses, opening the door to direct fiber delivery of microjoule-energy femtosecond laser pulses.

**TuP.23** (53) Tue 13:30

Simulations and Experiments of a Lateral Pumped Fiber Combiner for Monolithic Fiber Laser and Amplifier Systems — **Thomas Theeg**, Hakan Sayinc, Jose M. Chavez Boggio, Roger Haynes, Martin M. Roth, Uwe Morgner, Jörg Neumann, and Dietmar Kracht — 1Laser Zentrum Hannover e. V., Holtherithalle 8, D-30419 Hannover, Germany — 2Centre for Quantum Engineering and Space-Time Research QUEST, Welfengarten 1, D-30167 Hannover, Germany — 3Institut für Quantenoptik, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany — 4InnoFSPEC-VKS, Leibniz-Institut für Astrophysik Potsdam, An der Sternwarte 16, D-14482 Potsdam, Germany

Broadband cascaded four-wave mixing optical frequency comb (CFWM) around 1um is presented. The cascade is generated from two-tone low power pulsed seed lasers. The comb spans between 806nm and 1400nm. To the best of our knowledge it is the first demonstration of a fibre based CFWM frequency comb at 1um.

**TuP.25** (151) Tue 13:30

Er:LiLuF4 upconversion waveguide laser fabricated by femtosecond-laser writing — **Francesca Moglia**, Sebastian Müllner, Thomas Calmano, and Günter Huber — Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

The first crystalline erbium-doped fluoride upconversion waveguide laser is presented. Waveguides were written in an Er:LiLuF4 crystal via direct femtosecond-laser-writing technique. By Ti:Sapphire pumping at 974 nm, laser oscillation at 540.6, 551.5 and 850 nm was achieved.

**TuP.26** (19) Tue 13:30

Optically Controllable All-fiber based Phase Shifter — **P. C. Peng**, V. K. S. Hsiang, T. L. Chang, and H. Y. Chen — 1Department of Electro-Optical Engineering, National Taipei University of Technology, Taipei, Taiwan, R.O.C. — 2Department of Applied Materials and Optoelectronic Engineering, National Chi Nan University, Nanton, Taiwan, R.O.C.

This investigation demonstrates an optically controllable side-polished fiber phase shifter operating in the telecommunication wavelength of 1.55 μm. Experimental results indicate that the proposed phase shifter can be used in microwave photonic systems.

**TuP.27** (138) Tue 13:30

TEM00 mode content measurements on a large core passive CCC fiber — **Malte Karow**, Jörg Neumann, Dietmar Kracht, and Peter Wessels — 1Laser Zentrum Hannover e.V., Holtherithalle 8, 30419 Hannover, Germany — 2Centre for Quantum Engineering and Space-Time Research - QUEST, Welfengarten 1, 30167 Hannover, Germany

The overlap of a single-frequency signal, transmitted through a passive chirally coupled core fiber (42 micrometer mode field diameter) with the TEM00 mode of a non-confocal ring cavity is measured. For different fiber bending diameters and power levels, the obtained fractional fundamental mode content was always >96%.

**TuP.28** (217) Tue 13:30

Gain-switched laser-diode seeded Ytterbium fiber
amplifier delivering 11ps laser pulses at >1MW peak power — ●MANUEL RYSER1, SOENKE PILZ2, ANDREAS BURN3, and VALERIO ROMANO1,2 — 1Institute of Applied Physics, University of Bern, Sidlerstrasse 5, CH-3012 Bern, Switzerland — 2Bern University of Applied Sciences, ALPS, Pestalozzistrasse 20, CH-3400 Burgdorf, Switzerland

A gain-switched laser-diode was used as seed for a multi-stage fiber-amplifier. The final amplification was done with a cladding pumped Yb-doped large-mode-area fiber with a subsequent rod-type fiber and yielded pulse energies of >10µJ at pulse peak-powers of >1MW. The pulse duration was 11ps at a repetition rate of 1MHz.

**TuP.29 (212)** Tue 13:30

Experimental investigation of light propagation in tapered fiber with very large core size — JUHO KERTTULA1, VALERY FILIPPOV1, YURI CHAMOROVSKI2, VASILII USTIMCHIK2, KONSTANTIN GOLANT2, and OLEG OKHOTNIKOV1 — 1Optoelectronics Research Centre, Tampere University of Technology, P.O. Box 692, 33101 Tampere, Finland — 2Institute of Radio and Electronics of the Russian Academy of Sciences, Mokhovaya 11, bld.7, 125009 Moscow, Russia

In this paper we have experimentally studied the evolution of the parameters of radiation propagating in a long (up to 20m) adiabatic taper with an 117µm core diameter at the wide part (NA 0.11). The longitudinal distribution of the divergence, M2, mode content and polarization properties have been investigated in details.

**TuP.30 (68)** Tue 13:30

All-fiber erbium laser system for producing tunable optical pulses in the range of 1.7-2.5 µm with GeO2-doped fibers — ●ELENA ANASHKINA, ALEXEY ANDRIANOV, SERGEY MURAVIEV, MAXIM KOPTEV, and ARKADY KIM — Institute of Applied Physics, Russian Academy of Sciences,46 Ulyanov st., 603950 Nizhny Novgorod, Russia

We present an all-fiber system consisting of an Er: fiber laser source, GeO2-doped fibers for producing 50-150 fs optical pulses in the range of 1.7-2.5 µm, which can be used as a seed for Tm: fiber as well as for Cr:ZnSe amplifiers.

**TuP.31 (143)** Tue 13:30

Measurement of effective refractive-index differences in a few-mode fiber by axial fiber stretching — ●JUHA-MATTI SAVOLAINE and PETER BALLING — Department of Physics and Astronomy, University of Aarhus, Ny Munkegade 120, 8000 Aarhus C, Denmark

A method for measuring effective refractive-index differences in a few-mode fiber by applying axial fiber stretching is described. Interference between LP01 and LP11 and in some cases also between LP11 and LP21 are observed. The results agree well with theoretical predictions.

**TuP.32 (181)** Tue 13:30

Similariton-Induced Temporal Lens for Ultrafast Photonics — ●LEVON Mouradian1, ARAM ZEYTUNYAN2, GAREGIN YESAYAN2, FREDÉRIC LOURADOUR2, and ALAIN BARTHÉLÉMY2 — 1Ultrafast Optics Laboratory, Faculty of Physics, Yerevan State University, 1, Alex Manoogian Street, Yerevan 0005, Armenia — 2XLIM-UMR 6172 Université de Limoges/CNRS, 123 Avenue Albert Thomas, 87060 Limoges Cedex, France

The concept of similariton-induced parabolic temporal lens in view of its applications to ultrafast photonics based on our femtosecond scale experiments is presented. The temporal and spectral focusing, time-to-frequency conversion, and specificity of ”spectral domain Newton rings” in a fiber aberration-free spectrottemporal lens are the subjects of our report.

**TuP.33 (114)** Tue 13:30

Dispersion Measurement of Photonic Crystal Fibers up to Fifth Order Using Spectral Interferometry — ●TIIMEA GRÓSZ, MIKLÓS KISS, AND ATTILA P. KOVÁCS — Department of Optics and Quantum Electronics, University of Szeged, Szeged, Hungary

Spectral interferograms of a photonic crystal fiber were evaluated by various methods. We found that the Fourier-transform method provides the higher order dispersion coefficients with the best precision. We present a simplified Fourier-transform method which gives the spatial-temporal shape of the pulse after the fiber quickly and with high precision.

**TuP.34 (209)** Tue 13:30

Investigation of nonlinear spectral broadening in a ring resonator — ●JOSE CHAVEZ BOGGIO1, ANDRES RIEZNICK2, MATEUSZ WYSMOLEK3,4, HAKAN SAYINC3,4, JORG NEUMANN3,4, DIETMAR KRACHT3,4, ROGER HAYNES1, and MARTIN ROTH1 — 1inoFSPEC-VKS, Leibniz-Institut für Astrophysik Potsdam, An der Sternwarte 16, D-14482 Potsdam, Germany — 2Instituto Tecnologico de Buenos Aires and CONICET, Buenos Aires, Argentina — 3Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover, Germany — 4Centre for Quantum Engineering and Space-Time Research- QUEST, Welfengarten 1, D-30167 Hannover, Germany

We numerically investigated the generation of a broadband optical frequency comb with 80GHz spacing by placing the nonlinear medium in a ring configuration. It is shown that the comb bandwidth can be improved by one order of magnitude by appropriate adjustment of the dispersive and nonlinear parameters.
We present a next generation of large-aperture periodically poled Mg-doped LiNbO3 (PPLMgLN) device with 10-mm thickness. Half-joule class, efficient optical parametric oscillation using the 10-mm-thick PPLMgLN device in nanoseconds region could be realized with total conversion efficiency > 75%.

TuA.3 (127) Tue 15:30
Progress in Fabrication of sub-µm QPM Devices in Bulk Rb-doped KTP — •Andrius Zukauskas, Charlotte Liljestrand, Valdas Pasiskevicius, Fredrik Laurell, and Carlota Canalias — Department of Applied Physics, Royal Institute of Technology, Roslagstullsbacken 21, 10691 Stockholm, Sweden

We report on the progress in fabrication of sub-micrometer ferroelectric domain gratings in bulk Rb-doped KTiOPO4. Periodicities as short as 530 nm have been achieved in a 1 mm thick crystal. The different techniques used for sub-µm periodic poling are presented and discussed.

TuA.4 (124) Tue 15:45
ZnGeP2 RISTRA OPO in the mid-IR Region Pumped by a Periodically Poled KTiOPO4 Master-Oscillator Power Amplifier — •Nicky Thilmann1, Georg Stoeppler2, Marc Eichhorn3, Valdas Pasiskevicius1, Andrius Zukauskas1, and Carlota Canalias1 — 1Department of Applied Physics, Royal Institute of Technology, Roslagstullsbacken 21, 10691 Stockholm, Sweden — 2French-German Research Institute of Saint Louis ISL, 5 rue du Général Cassagnon, 68301 Saint-Louis, France

A ZGP RISTRA OPO is pumped by a PPKTP OPO and OPA system. Collinear and noncollinear phase matching is achieved and angle tuning is demonstrated. The maximum output energy at 6.45 µm was 0.9 mJ at 100 Hz repetition rate.

TuA.5 (194) Tue 16:00
Tunable, High-Power, All-Periodically-Poled, Continuous-Wave, Intracavity-Frequency-Doubled Optical Parametric Oscillator — •Kavita Devi1, Suddapalli Chaitanya Kumar1, and Majid Ebrahim-Zadeh1,2 — 1ICFO-Institut de Ciencies Fotoniques, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain — 2Instituto Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, Barcelona 08010, Spain

We report a high-power, single-frequency, near-infrared source tunable across 775-807 nm based on an all-periodically-poled, intracavity-frequency-doubled, continuous-wave OPO, generating up to 3.2 W of SHG power together with 4.1 W of mid-IR idler. The SHG output exhibits passive power-stability better than 3.5% rms (72 sec.) and a linewidth of 8.5 MHz in high-beam-quality (M2<1.4).

TuA.6 (175) Tue 16:15
Widely and continuously tunable Optical Parametric Oscillator up to 4.8 microns based on 5%MgO:PPLN crystal cut as a cylinder — •Vincent Keilmann1, David Jegouso1, Jérôme Debray1, Bertrand Menaert1, Patricia Segonds1, Benoit Boulangere1, Hideki Ishizuki2, and Takunori Taira2 — 1Institut Néel Centre National de la Recherche Scientifique Université Joseph Fourier 25 rue des Martyrs, BP 166, F38402 Grenoble Cedex 9 France — 2Laser Research Center for Molecular Science, Institute for Molecular Science, 38 Nishigonaka, Myodaiji, Okazaki 444-8585, Japan

An Optical Parametric Oscillator based on a 38 mm long 5%MgO:PPLN crystal engineered as a cylinder is reported. Continuous tuning is achieved from 1.37 microns up to 4.8 microns. First energetic characteristics are presented.

TuA.7 (136) Tue 16:30
1 W, 2 mJ-Kilohertz, Sub-nanosecond, 3 - 3.5 µm Tunable, PPSLT OPO Pumped at 1064 nm — •Danail Chuchumishiev, Alexander Gaydarzhiev, and Ivan Buchvarov — Department of Physics, Sofia University, 5 James Bourchier Blvd., BG-1164 Sofia, Bulgaria

We report 2.1 mJ at 0.5 kHz, temperature tunable (3-3.5 microns) radiation from a sub-nanosecond, singly resonant PPSLT OPO, pumped at 1064 nm. Idler conversion efficiency is 18.3%, while the overall quantum conversion efficiency (both idler and resonating signal) is nearly 52% and output pulse duration is 700 ps.

TuA.8 (134) Tue 16:45
Enhanced Backward Stimulated Raman Scattering in Periodically-Poled KTiOPO4 — •Hoong Jang, Gustav Strömquist, Andrius Zukauskas, Carlota Canalias, and Valdas Pasiskevicius — KTH, Stockholm, Sweden

We report the experimental demonstration of significantly enhanced backward Stimulated Raman Scattering (SRS) by suppressing forward SRS in periodically-poled KTP (PPKTP) crystals. We investigated thresholds of backward SRS in PPKTP crystals with different poling periods to explain the physical mechanism of the enhancement. This can be employed in BSRS-based devices.

Welcome reception at Stockholm City Hall

WeA: Special Symposium ” From Femto-Science to Atto Science: Sources and Applications”
Chaired by Jens Limpert, University of Jena, Germany

Invited talk
WeA.1 (231) Wed 8:00
Ultra-fast dynamics in atoms and molecules - Pump-probe experiments — •Markus Drescher — University of Hamburg, Department of Physics, Luruper Chaussee 149, 22761 Hamburg, Germany

Ultrashort synchronized XUV, laser- and terahertz pulses open up new opportunities for dynamics studies on the time-scale of electronic an nuclear motion. Coherent laser- and accelerator-based light sources, corresponding specialized pump-probe techniques and their application in time-
resolved experiments on atoms and molecules will be discussed.

Visible-OPA-driven tunable coherent EUV source for free electron laser seeding — Giovanni Cirri, Chien-Jen Lai, Eduardo Granados, Shu-Wei Huang, Alexander Sell, Kyung-Han Hong, Jeffrey Moses, Phillip Keathley, and Franz Kärtner — Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA 02139, USA — Center for Free-Electron Laser Science, DESY and University of Hamburg, Notkestraße 85, D-22607 Hamburg, Germany — IKERBASQUE, Basque Foundation for Science, 48011, Bilbao, Spain

We developed a prototype seed source for free electron lasers, based on high harmonic generation from a visible optical parametric amplifier, fully tunable in the 25-100 eV range. We studied the efficiency and cutover scaling laws.

Keynote

Time-delays in ionization: real, imaginary, and imagined — Misha Ivanov — Max Born Institute and Humboldt University, Berlin, Germany — Imperial College London, London UK

I will present our recent work on trying to understand how much time it takes to liberate an electron from an atom or a molecule, via either one-photon ionization or via optical tunnelling.

Isolated Attosecond Pulse Generation in Transition Metal Ablation Plumes — Tobias Witting, Rashid Ganeev, Felix Frank, Maria Tudorovskaya, Amelle Zahr, William Okell, Christopher Hutchingson, Manfred Lein, Jon Marangoz, and John Tisch — Blackett Laboratory, Imperial College London, Prince Consort Road, London SW7 2AZ, UK — Institute of Electronics, 33, Dormon Yoli Street, Tashkent 100125, Uzbekistan — Institut für Theoretische Physik und Centre for Quantum Engineering and Space-Time Research (QUEST), Leibniz Universität Hannover, Appelstraße 2, 30167 Hannover, Germany

We report experimental and theoretical studies of carrier-envelope phase (CEP) stabilised few-cycle pulses driven isolated attosecond pulse generation in Mn ablation plumes. First experimental results using 3.6fs high intensity laser pulses confirm the numerical simulations.

19: Coffee Break

Location: Main Hall Area

WeB: Special Symposium "From Femto-Science to Atto Science: Sources and Applications"

Chaired by Jens Limpert, University of Jena, Germany

Time: Wednesday 10:00–12:15

Invited talk


We show how to use spatio-temporally coupled light fields to generate isolated attosecond pulses. This general *attosecond lighthouse* effect provides a very convenient scheme for attosecond pump-probe experiments, and constitutes a powerful new tool for ultrafast metrology. We present the first experimental evidence of this effect.

Isolated Attosecond Pulse Generation at High Repetition Rate — Manuel Krebs, Steffen Hadrich, Stefan Demmler, Jan Rothhardt, Jens Limpert, and Andreas Tünnermann — Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745 Jena, Germany — Helmholtz Institute Jena, Fröbelstr 3, 07743 Jena, Germany — Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

We present first measurements of supercontinua supporting isolated attosecond pulses at substantially increased repetition rate of 150 kHz, which is easily scalable to 1 MHz. This will enable significant improvements of experiments studying the dynamics of electronic processes by reducing measurement times and increasing signal to noise ratio.

Efficient and Power Scalable Collinear XUV Output Coupling of Intracavity Generated High-Order Harmonics — Simon Holzberger, Ioachim Pupeza, Tino Eidam, Dominik Esser, Johannes Wettenberg, Henning Carstens, Peter Russhüldt, Jens Limpert, Thomas Udem, Andreas Tünnermann, Theodor W. Hänsch, Ferenc Krausz, and Ernst Fill — Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — Ludwig-Maximilians-Universität München, Fakultät für Physik, Am Coulombwall 1, 85748 Garching, Germany — Friedrich-Schiller-Universität Jena, Institut für Angewandte Physik, Albert-Einstein-Str. 15,
07745 Jena, Germany — Fraunhofer-Institut für Lasertechnik ILT, Steinbachstr. 15, 52074 Aachen, Germany — Lehrstuhl für Lasertechnik LLT, RWTH Aachen University, Steinbachstr. 15, 52074 Aachen, Germany

We generate harmonic radiation down to 23 nm in a 78-MHz femtosecond enhancement cavity and couple it out through an on-axis opening in a mirror. This concept offers an unparalleled flexibility for the driving pulse regarding power, bandwidth and polarization, together with a boost of XUV photon energy and flux.

We report on a new Bessel-Gauss enhancement cavity that can overcome the restrictions of conventional bow-tie cavities. Our novel resonator renders additional out coupling elements redundant, and allows for higher intensity ratios between the focus and the mirror surface. This increases damage threshold and permits higher circulating powers.

Sculpted Light Waveforms from a Phase-Locked Three-color OPA for attosecond control of strong-field dynamics — Stefan Haessler1, Tadas Balčiunas1, Guangyu Fan1, Giedrius Andriukaitis1, Audrius Pugzlys1, Audrius Baltuska1, Amelie Zair2, Richard Squibe2, Luke Chipperfield2, Leszek Frasinski2, John Tisch1, and Jon Marangos3 — Photonics Institute, Vienne University of Technology, Guss hausstrasse 27/387, 1040 Vienna, Austria — Imperial College London, London SW7 2BW, UK

We synthesize millijoule femtosecond pulses with sculpted optical cycles based on the combination of three phase-locked pulses of different color, together spanning two octaves, and demonstrate control of efficient HHG via shaping the waveform. The system is based on a collinear white-light-seeded OPA driven by a high-energy CEP-locked Yb CPA.

Towards Zeptosecond X-ray Pulses — Tenio Popmintchev — JILA and University of Colorado at Boulder

We demonstrate bright coherent X-ray supercontinuum generated through fully phase-matched upconversion of mid-IR laser light into the keV spectral region. The ultrabroad bandwidths can support pulse durations of few attoseconds, scalable to zeptosecond time scales.

We report on a cw singly-resonant optical parametric oscillator, emitting more than 1 W between 2.7 and 4.2 micron, which has been phase-locked to a self-referenced frequency comb. As a test, we performed saturation spectroscopy of CH3I rovibrational transitions around 3 micron, resolving resolution spectroscopy around 3 micron — Iolanda Ricciardi1, Edoardo De Tommasi1, Pasquale Maddalon1, Simona Mosca1, Alessandra Rocco1, Jean-Jacques Zondy2, Maurizio De Rosa1, and Paolo De Natale1 — 1INO-CNR, Istituto Nazionale di Ottica, Sezione di Napoli, and LENS, European Laboratory for Nonlinear Spectroscopy, Via Campi Flegrei 34, I-80078 Pozzuoli (NA), Italy — 2Laboratoire Commun de Métrologie LNE-CNAM, 61 rue du Landy, 93210 La Plaine Saint-Denis, France

We report a spectroscopic investigation and the first laser emission of a fluoride crystal grown by micro-PD technique. The Ho:LLF laser, in-band pumped at 1938 nm, yielded a maximum output power of 7.1W with a slope efficiency of 41%, at lasing wavelength of 2054.2 nm.

We present a high brightness XUV frequency comb, capable of delivering >200 µW of average power per harmonic in the 50-100 nm wavelength range. We present the first direct frequency comb spectroscopy in the extreme ultraviolet (XUV) palso discuss ongoing XUV comb coherence studies via heterodyne beat of two such combs.

We present a frequency-comb-referenced OPO for high-

21: Lunch Break

WeP: Poster Session II

High Brightness XUV Frequency Combs via Intracavity High Order Harmonic Generation — T.K. Allison1, A. Cingöz1, C. Benko1, D.C. Yost1, A. Ruehl2, M.E. Fermann2, S. Hartl2, and J Yeh1 — 1JILA, NIST and the University of Colorado, Boulder, CO 80309-0440, USA — 2IMA America Inc., 1044 Woodbridge Ave., Ann Arbor, MI 48105, USA

WeB.4 (223) Wed 11:00

WeB.5 (94) Wed 11:15

Time: Wednesday 12:15–13:30
Lunch Break

WeB.6 (190) Wed 11:30

Towards Zeptosecond X-ray Pulses — Tenio Popmintchev — JILA and University of Colorado at Boulder

We demonstrate bright coherent X-ray supercontinuum generated through fully phase-matched upconversion of mid-IR laser light into the keV spectral region. The ultrabroad bandwidths can support pulse durations of few attoseconds, scalable to zeptosecond time scales.

We report on a cw singly-resonant optical parametric oscillator, emitting more than 1 W between 2.7 and 4.2 micron, which has been phase-locked to a self-referenced frequency comb. As a test, we performed saturation spectroscopy of CH3I rovibrational transitions around 3.4 micron, resolving resolution spectroscopy around 3 micron — Iolanda Ricciardi1, Edoardo De Tommasi1, Pasquale Maddalon1, Simona Mosca1, Alessandra Rocco1, Jean-Jacques Zondy2, Maurizio De Rosa1, and Paolo De Natale1 — 1INO-CNR, Istituto Nazionale di Ottica, Sezione di Napoli, and LENS, European Laboratory for Nonlinear Spectroscopy, Via Campi Flegrei 34, I-80078 Pozzuoli (NA), Italy — 2Laboratoire Commun de Métrologie LNE-CNAM, 61 rue du Landy, 93210 La Plaine Saint-Denis, France

WeB.7 (241) Wed 11:45

WeP.1 (148) Wed 13:30

WeP.2 (163) Wed 13:30

Ho:LLF grown by micro-PD: spectroscopy and efficient laser emission — Stefano Veronesi1, Yongzhuan Zhang1, Mauro Tonelli1, and Martin Schellhorn2 — 1Research Laboratory of Electronics, Massachusetts Institute of Technology, 77 Mass Ave Cambridge MA 02139, USA — 2Center for Free-Electron Laser Science, DESY and University of Hamburg, Notkestraße 85, D-22607 Hamburg, Germany

A frequency-comb-referenced OPO for high-
their electronic hyperfine structure.

WeP.3 (169) Wed 13:30
Soft aperture Kerr-lens mode-locked laser with Yb:CaF$_2$ — •Guillaume Machinet, Florent Guichard$^1$, Pierre Sevillano$^1$, Romain Dubrasquet$^{1,2}$, Patrice Camy$^3$, Jean-Louis Doualan$^3$, Richard Moncorge$^3$, Sandrine Ricaud$^{3,4,5}$, Patrick Georges$^4$, Frédéric Druon$^4$, Dominique Descamps$^1$, and Eric Cormier$^3$ — •Université Bordeaux-CNRS-CEA-UMR 5107, Centre Lasers Intenses et Applications, 351 Cours de la Libération, F-33405 Talence, France — •Azur light System, Cité de la Photonique-Meropa, 33600 Pessac, France — •Centre de recherche sur les ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA CNRS-ENSICAEN, Université de Caen, 14050 Caen, France — •Laboratoire Charles Fabry, Institut d’Optique, CNRS, Université Paris Sud, 91127 Palaiseau, France — •Amplitude Systèmes, 11 avenue de Canteranne, Cité de la Photonique, 33600 Pessac, France

We demonstrate a soft-aperture Kerr-lens modelocking (KLM) operation in a long Yb:CaF$_2$ crystal optically pumped by a high brightness fiber laser operating at 976 nm. Stable 117 fs pulses at around 1048 nm are produced with an average power of 560 mW and a repetition rate of 82 MHz.

WeP.4 (186) Wed 13:30
Holmium-doped KLu(WO$_4$)$_2$ Laser with 67% Slope Efficiency — Venkatesan Jambunathan$^1$, •Xavier Mateos$^1$, Maria Cinta Pujo$^1$, Joan Josep Carvajal$^1$, Francesc Díaz$^1$, Magda Elena Aguilo$^1$, Uwe Grieben$^2$, and Valentín Petrov$^2$ — •FICMA-FicNA group, Universitat Rovira i Virgili (URV), Tarragona, Spain — •Max-Born Institut, Berlin, Germany

Resonantly pumped Ho:KLu(WO$_4$)$_2$ lasers of different Ho concentrations are studied. The optimized laser configuration operating at a wavelength of 2080 nm provides a slope efficiency approaching 70% with a maximum output power of 0.5 W.

WeP.5 (205) Wed 13:30
Diode-side-pumped channel waveguide laser — •Dimitri Geskus$^1$, Christos Grivas$^2$, Sanmugam Aravazhi$^1$, Uwe Grieben$^3$, Sonia García Blanco$^1$, and Markus Pollnau$^1$ — •Integrated Optical Microsystems Group, MESA+ Institute for Nanotechnology, University of Twente, Enschede, The Netherlands — •Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — •Max-Born-Institut, Forschungsverbund Berlin e.V., Berlin, Germany

Here we demonstrate laser emission from a highly Yb$^{3+}$-doped, Microstructured, tapered channel waveguide in KGd$_{x}$Lu$_{1-x}$(WO$_4$)$_2$ by diode side pumping with a high-power, multi-mode diode bar via a passive planar waveguide, offering the potential for significantly increased output powers.

WeP.6 (14) Wed 13:30
"Fiber laser pumped, microsecond, single frequency, nested cavity OPO for spectroscopy applications in the 3.0 - 3.5 micrometer range" — •Jessica Bar-
Pulsed polarization sequences from a twisted-mode Nd:YAG laser passively mode-locked by a SESAM — Jérémie Thévenin, Marc Vallet, and Marc Brunel

Institut de Physique de Rennes, Université de Rennes I - CNRS UMR 6251, Campus de Beaulieu, F-35042 Rennes Cedex, France

A mode-locked Nd:YAG laser containing two quarter-wave plates is shown to emit synchronously two frequency combs associated to the polarization eigenstates of the cavity. Experiments are in perfect agreement with a modal analysis predicting the polarization sequences of the pulse train. We demonstrate locking between the two combs.

Frequency Noise and Linewidth Properties of a Mid-IR Quantum Cascade Laser from Cryogenic to Room Temperature — Lionel Tombez, Stéphane Schilt, Joab Di Francesco, Pierre Thomann, and Daniel Hofstetter

Laboratoire Temps-Fréquence, Université de Neuchâtel, Neuchâtel, Switzerland

We present the temperature dependence of the frequency noise and linewidth of a mid-IR quantum cascade laser measured with the same device from 128K to 303K. While a sub-MHz linewidth is achieved at room-temperature, it rises exponentially below 200 K and broadens up to 10 MHz at low temperature.


QUEST Centre for Quantum Engineering and Space-Time Research (QUEST), Welfengarten 1, D-30167 Hannover, Germany — Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover, Germany

We demonstrate a novel SPIDER setup to measure ultrashort laser pulses with spectral bandwidths of only a few nanometers and pulse durations up to the picosecond range. The setup is free of drifts due to a monolithic glass stretcher and an etalon.

Tunable diode pumped 2.7 μm laser based on Er:CaF 2 hot-pressed ceramics — Jan Sulc, Michal Nemec, Maxim E. Doroshenko, Helena Jelinkova, Tasoltan T. Basiiev, Vasili A. Konvuskin, and Vyacheslav V. Osiko

IMST Prague, Prague, Czech Republic — GPI, Russian Academy of Sciences, Moscow, Russian Federation

Erbium doped hot-pressed fluoride ceramics CaF 2 was investigated as an active medium in diode pumped laser, tunable using birefringent filter. The laser tuning range extended from 2692 nm up to 2761 nm. The output energy of 0.2 mJ at 2705 nm was obtained for the absorbed energy 20 mJ.

Passively Q-switched microchip Er,Yb:YAB diode pumped laser — Victor Kisel, Konstantin Gorbachenya, Anatol Yasurevich, Alexey Ivashko, Nikolay Kuleshov, Victor Malteev, and Nikolay Leonvyk

Center for Optical Materials and Technologies, Belarusian National Technical University, 65 Nezavisimosti Avenue, Building 17, Minsk 220013, Belarus, e-mail: nkuleshov@bntu.by — 2 Institute of Geophysical and Geochemical Research, Moscow State University, Moscow 119992/GSP-2, Russia

Diode-pumped CW and Q-switched microchip Er,Yb:YAB laser operation is demonstrated. An output power of 800 mW at 1602 nm in CW regime was obtained. By using a Co2+:MALO saturable absorber Q-switched laser pulses with 5.25 microjoules energy, 5 ns duration, and 60 kHz repetition rate were demonstrated at 1522 nm.

GaN mirrorless optical parametric oscillator — Carlos Montes, Pierre Aschieri, and Marc de Micheli

LPM-CNRS, Université de Nice-Sophia Antipolis, Parc Valrose, F-06108 Nice, France

Quasi-phase-matching of counterpropagating three-wave parametric interaction requires sub-micrometric structuration of cm long waveguides which can hardly be realized without stitching errors. We numerically study a periodically poled GaN mirrorless OPO and show that it is very tolerant to these fabrication errors.
Diode-pumped Nd:YAG slab laser with self-adaptive, closed-loop resonator — •JAN JARZYNSKI, WALDEMAR ZENZIAŁ, MATEUSZ KASKOW, ŁUKASZ GORAJEK, JACEK KWIATKOWSKI, and KRZYSZTOF KOPECZYSKI — Military University of Technology, Institute of Optoelectronics, ul Gen S. Kaliskiego 2, 00-908 Warsaw, Poland

Four wave mixing process inside Nd:YAG slab side pumped by 4kW diode pump radiation was exploited to achieve near diffraction limited output beam with 1 mrad divergence. The output energy of 250 mJ with slope efficiency of 30% was demonstrated.

Microchip Tm:KY(WO4)2 Laser — •MAXIM GAPONENKO, PAVEL LOKO, NATALIYA GUSAKOVA, VIKTOR KISEL, KONSTANTIN YUMASHEV, ANOTOLY PAVLYUK, and NIKOLAI KULESHOV — 1 Center for Optical Materials and Technologies, Belarusian National Technical University, Bldg. 17, Nezavisimosti Ave 65, Minsk, 220013 — 2 Institute of Inorganic Chemistry, Siberian Branch of Russian Academy of Sciences, 3 Lavrentyev Ave., Novosibirsk, 630090, Russia

Thermal lensing effect is characterized in the diode-pumped monolithic Nã-cut Tm:KYW crystal under laser operation conditions at the wavelength of 1.94 µm. Passively-cooled cw microchip Tm:KYW laser with 0.65 W output power and 44% slope efficiency is presented.

Diode pumped tunable Tm:BaF2-SrF2 laser — JAN SULC, •MICHAL NEMEC, MAXIM E. DOROSHENKO, HELENA JELINKOVA, TASOLTANT BYASIEV, VASILI A. KONYUSKHIN, and VYACHESLAV V. OSIKO — 1 FNSPE, Czech Technical University in Prague, Prague, Czech Republic — 2 GPI, Russian Academy of Sciences, Moscow, Russian Federation

Tunability of diode pumped laser based on Tm:BaF2-SrF2 crystal was investigated. Smooth and broad tuning in range from 1840 up to 1990 nm was achieved using birefringent filter as a tuning element. The energy of 2.6 mJ @ 1943 nm was obtained for the absorbed pumping energy 61 mJ.

Slowly Polarization Evolving Vector Solitons in Erbium Doped Fibre Laser Mode Locked with Carbon Nanotubes — •SERGEY SERGEYEV, CHENGBO MOU, ALEKSEY ROZHIN, and SERGEI TURITSYN — Aston Institute of Photonic Technologies, Aston University, Aston Triangle, Birmingham, B4 7ET, UK

We demonstrate experimentally and study theoretically new type of stable pulse structures in erbium-doped fibre lasers - slowly polarization evolving vector solitons. Demonstrated vector solitons precess with characteristic times of 100-1000 round trips and their trajectories form a double semi-circle on the Poincaré sphere.

High-Power, Fiber-Based, Picosecond Green Source Based on BiB3O6 — •CHAITANYA KUMAR SUDDAPALLI and MAJID Ebrahim-Zadeh — 1 ICFO-The Institute of Photonic Sciences, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain — 2 Instituto Catalana de Recerca i Estudis Avançats (ICREA), Passeig Lluis Companys 23, Barcelona 08010, Spain

We present a stable, high-power, picosecond, green source at 532 nm based on single-pass second-harmonic-generation of Yb-fiber laser in 10-mm-long BiB3O6 crystal, generating >5 W of green power at a single-pass conversion efficiency of 38%. The green beam exhibits excellent power-stability of 0.2% rms (15 hours) and has TEM00 spatial profile (M2 < 1.93).

All-optical manipulation of light with an optical event horizon — •AVYAN DEMIRCAN, SHALVA AMIRANASHVILI, CARSTEN BREEGE, JENS BETHGE, and GÜNTHER STEINMEYER — 1 Invalidenstr. 114, 10115 Berlin, Germany — 2 Weierstrass Institute for Applied Analysis and Stochastics (WIAS), Mohrenstr. 39, 10117 Berlin, Germany — 3 Max-Born-Institut (MBI), Max-Born-Str. 2a, 12489 Berlin, Germany

We demonstrate numerically and experimentally that temporal locking of pulses in an optical event horizon enables effective modification of the central wavelength, energy, and duration of both pulses. The interaction scheme fulfills all necessary criteria for a practical all-optical transistor.

Efficient Coherent Addition of High Power Photonic Crystal Fiber Lasers — •BORIS SHULGA and AMIEL ISHAYA — Dept. of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel

We experimentally demonstrate efficient intracavity coherent combining of two high power rod-type photonic crystal fiber lasers. We further investigate coherent combining configurations for high peak and average power Q-switched pulsed operation.

Supercontinuum Generation in a Tapered Tellurite Air-clad Fiber — MEISONG LIAO, WEIQING GAO, TONGLING CHENG, ZHONGCHAO DUAN, TAKENOBU SUZUKI, and YASUTAKE OHISHI — Research Center for Advanced Photon Technology, Toyota Technological Institute, 2-12-1, Hisakata, Tempaku, Nagoya 468-8511, Japan

We adopt a tapered tellurite air-clad microstructured fiber with an extremely high nonlinearity as well as tailored dispersion to generate supercontinuum (SC) in the picosecond regime. The SC covers 350-2000 nm. The pump power is much lower than those of the conventional picosecond-pulse pumped SC sources with a similar bandwidth.

Wavelength conversion of nanosecond pulses to the mid-IR using four wave mixing in photonic crystal fibers — HERZOG AMIR, AVISHAY SHAMIR, and AMIEL ISHAYA — 1 Dept. of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel — 2 Electrooptics Unit, Ben-Gurion University of the Negev, Beer Sheva, Israel
We investigate degenerate four wave mixing with Nd:YAG nanosecond pulses in fused silica photonic crystal fibers. Experiments show more than an octave spanning conversion to idler and signal wavelengths at 3.105 and 0.642 μm, respectively, representing a new stretch towards the limit of the silica transmission window in the mid-infrared.

WeP.27 (113) Wed 13:30
Fabrication of High-aspect Ratio Microchannels in Fused Silica Hollow Fibers Using a Tesla coil — ZHANGWEI YU, MARTEN STEINSTRÖM, ANDRIUS ZUKAUSKAS, and FREDRIK LAURELL — Department of Applied Physics, Royal Institute of Technology (KTH), Roslagstullbacken 21, 10691 Stockholm, Sweden

Microchannels are fabricated into fused silica capillaries and hollow fibers by high-voltage high-frequency corona discharge induced by Tesla coil. Channels as narrow as 2.2 μm are successfully made in 2-μm-capillaries. This simple, low-cost and HF-free technique can be employed in developing fiber-based optofluidic systems for fiber dye lasers.

WeP.28 (83) Wed 13:30
Self-induced laser line sweeping in tunable erbium-doped fiber laser — PAVEL HONZÁTKO, PETR VOJTIŠEK, PETR NAVRÁTH, and PAVEL PETERKA — 1Institute of Photonics and Electronics Academy of Science of the Czech Republic, v.v.i., 18251 Prague, Czech Republic — 2Czech Technical University, Faculty of Nuclear Sciences and Physical Engineering, 115 19 Prague, Czech Republic

Periodic drift of laser wavelength is reported in core pumped erbium doped fiber laser tunable from 1557 to 1567 nm. The sweeping rate depends on the settings of the tunable filter, polarization controller and pump power and it was found in the range 0.8-12.5 nm/s.

WeP.29 (90) Wed 13:30
Erbium doped fibre laser passively harmonically mode locked using carbon nanotubes — CHENGBO MOU, RAZ ARIF, ALEKSEY ROZHIN, and SERGEI TURITSYN — Aston Institute of Photonic Technologies, Aston University, Birmingham, UK, B4 7ET

We have investigated passively harmonic mode locked erbium doped fibre laser using carbon nanotubes polymer films. Two types of carbon nanotubes have been studied including filtrated and centrifugated carbon nanotubes. The proposed laser can support up to 10 harmonic orders with 1 ps pulse duration and 12 mW output power.

WeP.30 (91) Wed 13:30
Yb3+ and Er3+ fiber lasers based on Pure Silica Sol-Gel core Photonic Crystal Fibers — IHHAN FSAIFES, ASSAAD BAZ, GUILLAUME LE COQ, BRUNO CAPOEN, GÉRARD BOUWMANS, LAURENT BIGOT, and MOHAMED BOUAZAOUI — PhLM/IRCICA - UMR8523/USR3380, CNRS - Université Lille1, Parc de la Haute Borne, 50 avenue Halley, 59658 Villeneuve d’Ascq cedex, France

In this paper, we present for the first time to our knowledge, the realization of Yb3+ and Er3+ fiber lasers based on Pure Silica Sol-Gel core Photonic Crystal Fibers

WeP.31 (161) Wed 13:30
Doping Management in High Power Fiber Amplifiers: Optimization of Heat Generation and Nonlinear Phase Shift — PARVIZ ELAHI, SINEM YILMAZ, ÖNDER AKÇAALAN, HAMIT KALAYCIOGLU, BÜLENT ÖKTEM, CAGHI SENEL, FATIH ÖMER ILDAY, and KORAY EKEN — 1Department of Physics, Bilkent University, 06800 Ankara, Turkey — 2Institute of Materials Science and Nanotechnology, Bilkent University, 06800 Ankara, Turkey — 3TÜBİTAK Ulaşal Metroloji Enstitüsü (UME), Gebze, 41470 Kocaeli, Turkey — 4FiberLAST Inc., 06531 Ankara, Turkey

We propose the use of varying doping levels along the gain fiber to optimize the trade-off between heat generation and nonlinear phase shift in high-power fiber amplifiers. We demonstrate a hybrid low- and high-doped Yb fiber laser-amplifier system, which generates 100-W at 100-MHz with pulse duration of 4.5 ps.

WeP.32 (192) Wed 13:30
Modal content study of an active multifilament-core fiber amplifier for long range coherent LIDAR — JULIEN LE GOUËT, LAURENT LOMBARD, and GUILLAUME CANAT — Office National des Etudes et Recherches Aerospatiales, F-91761 Palaiseau, France

The guiding properties of an Er:Yb doped multi-filament core fiber are extensively studied using spatially resolved spectral S2 imaging. Quantifying the effect of bending and pumping the fiber, and measuring its birefringence properties, we conclude on the interest of this fiber for sources in long range coherent LIDAR systems.

WeP.33 (63) Wed 13:30
Tellurite glass hollow-core photonic bandgap fiber — TONGLIE CHENG, MEISONG LIAO, WEIQING GAO, ZHONGCHAO DUAN, TAKENOBU SUZUKI, and YASUTAKE OHISHI — Research Center for Advanced Photon Technology, Toyota Technological Institute, 2-12-1 Hisakata, Tempaku, Nagoya 468-8511, Japan

This paper presents the design of a tellurite (TZLB) HC-PBGF with wide bandgap which can guide light in the mid-infrared region. The bandgaps are simulated by the plan-wave method, and because the tellurite glasses have low fiber drawing temperature, it is easier to draw than the silica bandgap fiber.

WeP.34 (198) Wed 13:30
Picosecond fiber laser system for synchronization of the pump and seed pulses of the OPCPA system — NERLIUS RUSTEIRA, VYTAUTAS VOSYLIUS, MARATAS SAINO, and ANDREJUS MICHALIOVAS — 1Center for Physical Sciences and Technology, Vilnius, Lithuania — 2Center for Physical Sciences and Technology, Vilnius, Lithuania — 3Ekspla, Vilnius, Lithuania

We developed fiber laser system for the synchronization of Yb/Nd:YAG OPCPA system. Picosecond pulses generated from a fiber oscillator were amplified and spectrally expanded in standard optical fiber to generate radiation in 1030-1064nm range. The pulses were spectrally filtered to match the amplification spectrum of the power laser system.
WeC: Ultrafast Fiber and Waveguide Oscillators

Time: Wednesday 14:30–16:15
Location: Oscar Klein - Lecture Hall

Keynote
WeC.1 (235) Wed 14:30
History and Prospects of Mode-locked Fiber and Waveguide Lasers — Eric P. Ippen — Massachusetts Institute of Technology, Cambridge, MA 02139 USA

The technology of ultrashort pulse generation with fiber lasers has advanced dramatically toward higher pulse energies, higher repetition rates, varied wavelengths and more compact formats. This talk will review the principles and techniques that have enabled these advances, describe recent progress in our laboratory and discuss possible future directions.

WeC.2 (156) Wed 15:15
500 MHz, 58fs highly coherent Tm fiber soliton laser — J. Jiang1, C.C. Lee2, J. Bethge1, A. Mills1, W. Mefford1, S. Suzuki2,3, T.R. Schibli2,1, H. Hartl1, and M.E. Fermann — 1IMRA America, Inc., 1044 Woodridge Ave., Ann Arbor, MI 48105, USA — 2Department of Physics, University of Colorado at Boulder, 2000 Colorado Avenue, Boulder, CO 80309, USA — 3Graduate School of Engineering, Toyota Technological Institute, 2-12-1 Hisakata, Tempaku, Nagoya 468-8511, Japan

We demonstrate a 500 MHz ultra-low noise 58fs Tm fiber soliton laser based on carrier phase noise reduction with an electro-optic grapheme modulator. We achieved record carrier phase stability of 400 mrad integrated f(CEO) phase noise (0.3 Hz to 3.5 MHz).

WeC.3 (46) Wed 15:30
2.46-GHz, fundamentally mode-locked, femtosecond Yb-fiber oscillator — Guoqing Chang1, Hung-Wen Chen1, Shanhui Xu1, Zhongmin Yang2, and Franz Kärtner1 — 1Research Laboratory of Electronics, Massachusetts Institute of Technology, 77 Mass Ave Cambridge MA 02139 — 2State Key Laboratory of Luminescent Materials and Devices and Institute of Optical Communication Materials, South China University of Technology, Guangzhou 510640, China — 3Center for Free-Electron Laser Science, DESY and University of Hamburg, Notkestraße 85, D-22607 Hamburg, Germany

We demonstrate a 2.46-GHz repetition-rate, fundamentally mode-locked, femtosecond Yb-fiber oscillator that incorporates two enabling technologies: a 1-cm heavily Yb-doped phosphate glass fiber as the gain medium and a high-dispersion (-1300 fs2) output coupler to manage cavity dispersion. The oscillator self-starts and generates 35-nW ultrashort pulses of 250-fs duration.

WeC.4 (178) Wed 15:45
Repetition-Rate Locked, Wavelength Tunable 1 GHz Erbium-doped Fiber Laser — Michelle Y. Sander1, David Chao1, Gale S. Petrich1, Leslie A. Kolodziejski1, Franz X. Kaertner1,2, and Eric P. Ippen1 — 1Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, 02139-4307, USA — 2Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron and Universität Hamburg, Notkestraße 85, D-22607 Hamburg, Germany

We demonstrate a 2.46-GHz repetition-rate, fundamentally mode-locked, femtosecond Yb-fiber oscillator that incorporates two enabling technologies: a 1-cm heavily Yb-doped phosphate glass fiber as the gain medium and a high-dispersion (-1300 fs2) output coupler to manage cavity dispersion. The oscillator self-starts and generates 35-nW ultrashort pulses of 250-fs duration.

WeC.5 (189) Wed 16:00
High Fidelity 62-fs, 7-nJ Pulses at 1035 nm from an Integrated Yb-Fiber Oscillator — Aart Verhoeof, Lingxiao Zhu, Dusan Lorenc, and Erich P. Ippen — 1Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, 02139-4307, USA — 2Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron and Universität Hamburg, Notkestraße 85, D-22607 Hamburg, Germany

We present a mode-locked Ytterbium-doped fiber oscillator operating in the net normal-dispersion regime, delivering 7.2 nJ pulses that can be dechirped down to 62 fs. A higher-order mode fiber is used for intracavity dispersion compensation.

24: Coffee Break
Location: Main Hall Area

WeD: Ultrafast Optics
Location: Oscar Klein - Lecture Hall

Invited talk
WeD.1 (243) Wed 16:30
High-power femtosecond Kerr-lens oscillators — Alexander Apolonskiy — Max-Planck Institut für Quantenoptik, Garching, Germany — Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching, Germany

High-energy femtosecond oscillators have chances to become key elements in nonlinear experiments with low yield where high photon flux is needed. I will present our recent experimental results showing progress in development of high-power Ti:Sa and Yb:YAG disk Kerr-lens oscillators together with numerical simulations showing the perspectives and limitations.

WeD.2 (128) Wed 17:00
25 W, 185 fs pulses from an Yb:Lu2O3 mode-locked thin disk laser — Clara Saracenò, Cinia
Schriber1, Oliver Heckl1, Cyrill Baer1, Matthias Golling1, Kolja Beil2, Christian Kraenkel2, Thomas Suedmeyer1,3, Günter Huber2, and Ursula Keller1 — 1Department of Physics, Institute for Quantum Electronics, ETH Zürich, Switzerland — 2Institute of Laser-Physics, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — 3Department of Physics, University of Neuchâtel, Neuchâtel, Switzerland

We demonstrate power scaling of a sub-200 fs Yb:Lu2O3 thin disk laser. We achieved 25 W of average power and 185 fs at a repetition rate of 66.5 MHz. The key element to achieve this result was the use of a high damage threshold SESAM with optimized parameters.

WeD3 (61) Wed 17:15

CW and femtosecond Yb:CALGO thin disk oscillator — Sandrine Ricaud1,5, Anael Jaffres2, Akiko Suganuma2, Bruno Viana2, Pascal Lioseau2, Hirgit Weichelt3, Katrin Wentsch3, Marwan Abdou-Ahmed3, Andreas Voss3, Thomas Graf3, Daniel Ritzi, Clemens Honninger5, Eric Mottay3, Patrick Georges1, and Frédéric Bruon4 — 1Laboratoire Charles Fabry, Institut d’Optique, Palaiseau, France — 2Laboratoire de Chimie de la Matière Condensée de Paris, Chimie-Paristech, Paris, France — 3Institut für Strahlwerkzeuge (IFSW), Stuttgart, Germany — 4FEE GmbH, Idar-Oberstein, Germany — 5Amplitude Systèmes, Pessac, France

In this contribution, we present the first femtosecond thin-disk oscillator using an Yb3+:CaGdAlO4 crystal. Pulses as short as 135 fs are obtained with an average power of 1.3 W and at higher average power operation 10.5 W and 390 fs pulse width are generated.

WeD4 (111) Wed 17:30

250 MHz Modeocked VECSEL: Towards Low Repetition Rates Using an Extendable Multi-Pass Approach — Christian A. Zaug1, Martin Hoffmann1, Wolfgang P. Palla2, Valentin J. Wittwer1, Matthias Golling1, Kurt J. Weingarten2, Thomas Suedmeyer1, and Ursula Keller1 — 1ETH Zurich, Department of Physics, Institute for Quantum Electronics, Zurich, Switzerland — 2Time-Bandwidth-Products, Zurich, Switzerland

With a multi-pass cavity we avoid modelocking instabilities of low-repetition rate modeocked VECSELS due to short gain lifetime. We achieve record-low 250-MHz repetition rates with 400 mW average output power in 11.2 ps pulses. Using modular Herriott-type cells will result in extremely compact high peak power ultrafast pulse sources.

WeD5 (41) Wed 17:45

Femtosecond pulse generation from a Tm:Lu2O3 ceramic laser at 2070 nm — Alexander A. Lagatsky1, Olek L. Antipov2, and Wilson Sibbett1 — 1SUPA, School of Physics and Astronomy, University of St Andrews, North Haugh, St Andrews, KY16 9SS, UK — 2Institute of Applied Physics of the Russian Academy of Sciences, 46 Ulyanov Street,603950, Nizhny Novgorod, Russia

Passive mode-locking of a Tm:Lu2O3 ceramic laser at around 2070 nm is reported. Nearly transform-limited 180 fs pulses are generated with an average power of 400 mW and a pulse repetition frequency of 121 MHz. A maximum output power of 750 mW is reached during ultrashort pulse generation.

WeD6 (52) Wed 18:00

Broadband Nonlinear Optical Characteristics of Graphene Saturable Absorber Applicable for Bulk Lasers — In Hyung Baek1, Hwang Woon Lee1, Jun Wan Kim1, Sukang Bae2, Byung Hee Hong2, Dong-Il Yeom1, and Fabian Rotermund1 — 1Department of Physics & Division of Energy Systems Research, Ajou University, Suwon 443-749, Korea — 2Department of Chemistry, Seoul National University, Seoul 151-747, Korea

Nonlinear optical characteristics of graphene saturable absorbers, such as nonlinear transmission and nonlinear responses, are investigated in a broad spectral range between 800 and 1500 nm. The results show excellent properties applicable for bulk solid-state laser mode-locking.

WeD7 (62) Wed 18:15

148-fs passively mode-locked Tm:LuScO3 laser at 2100 nm — Alexander A. Lagatsky1, Philipp Koopmann2,3, Peter Fuhrberg3, Günter Huber2, Christian Tom A. Brown1, and Wilson Sibbett1 — 1SUPA, School of Physics and Astronomy, University of St Andrews, North Haugh, St Andrews, KY16 9SS, UK — 2Institute of Laser-Physics, University of Hamburg, Luruper Chaussee 149, D-22761 Hamburg, Germany — 3LISA laser products, Max-Planck-Str. 1, D-27191 Katlenburg-Lindau, Germany

Femtosecond pulse generation from a SESAM mode-locked Tm:LuScO3 laser is reported. Near transform-limited pulses as short as 148 fs with a corresponding spectral bandwidth of 31.8 nm at a center wavelength of 2100 nm are generated at a maximum output power of 110 mW.

26: Conference Dinner

Time: Wednesday 20:00–23:00
Conference Dinner

Location: Moderna Museet
ThA: Coherent combining and high power fiber lasers

Time: Thursday 8:00–10:00

Invited talk

ThA.1 (238) Thu 8:00

High Power Fiber Lasers by Structured Fibers — •AKIRA SHIRAKAWA — Institute for Laser Science, University of Electro-Communications 1-5-1 Chofugaoka, Chofu-shi, Tokyo 182-8585, Japan

Fiber laser is now widely recognized as the most reliable high average power source with a diffraction-limit beam quality. However, the huge gain and nonlinearities due to the rather small mode area and long interaction length make generations of specific wavelength radiation and high peak-power/high energy radiation so difficult that applications have been limited. Our research focuses on new fiber lasers to overcome these problems.

ThA.2 (155) Thu 8:30

Large-pitch fibers: Pushing very large mode areas to highest powers — •FABIAN STUTZKI1, FLO-RIAN JANSEN1, CESAR JAUREGUI1, JENS LIMPERT1,2,3, and ANDREAS TÜNNERMANN1,2,3 — 1Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany — 2Helmholtz Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — 3Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

Large-pitch fibers demonstrated effective single-mode high power operation in fiber lasers with mode-field diameters exceeding 100μm. This superior performance is enabled by the fundamental concept of higher-order mode delocalization. We will propose novel fiber designs with improved delocalization to further increase the stable performance level of fiber based laser systems.

ThA.3 (139) Thu 8:45

Physical origin of the dynamic behavior of mode instabilities in active fibers — •CESAR JAUREGUI1, HANS-JÜRGEN OTTO1, FABIAN STUTZKI1, FLO-RIAN JANSEN1, TINO EIDAM1,2, JENS LIMPERT1,2, and ANDREAS TÜNNERMANN1,2,3 — 1Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany — 2Helmholtz Institute Jena, Fröbelstieg 3, 07743 Jena, Germany — 3Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

The physical origin of mode instabilities is explained in detail. Our simulations reveal the presence of two competing effects as the output power of a fiber laser system is increased. We believe that the interplay between these effects determines the complex temporal dynamics of mode instabilities.

ThA.4 (179) Thu 9:00

Influencing mode instabilities by dynamic excitation of fiber modes using an acousto optical deflector — •HANS-JÜRGEN OTTO1, FABIAN STUTZKI1, FLO-RIAN JANSEN1, TINO EIDAM1,2, CESAR JAUREGUI1, JENS LIMPERT1,2, and ANDREAS TÜNNERMANN1,2,3 — 1Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745 Jena, Germany — 2Helmholtz-Institute Jena, Helmholtzweg 4, 07743 Jena, Germany — 3Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany

We investigate how the dynamic excitation of fiber modes influences mode instabilities (MI). Hereby, the seed coupling to the main amplifier under study was varied on the characteristic time scale for MI. We show a clear increase of beam quality at power levels, where typically chaotic MI occurs.

ThA.5 (44) Thu 9:15

Passive coherent combining of two high energy fiber chirped pulse amplifiers — •YOANN ZAOUTER1, LOUIS DANIault2, MARC HANNA1, DIMITRIS PAPADOPoulos3, FRANCK MORIN1, CLEMENS HÖNNINGER2, FREDERIC DRUON2, ERIC MOTTAY3, and PATRICK GEORGES2 — 1Amplitude Systemes, 11 avenue de Canteranne, Cité de la Photonique, 33600, Pessac, France — 2Laboratoire Charles Fabry, Institut d’Optique, CNRS, Université Paris-Sud, 2 av. Augustin Fresnel, 91127 Palaiseau Cedex, France — 3Institut de la Lumière Extreme, CNRS, Ecole Polytechnique, ENSTA Paristech, Institut d’Optique, Université Paris Sud, Palaiseau Cedex, France

Using passive coherent beam combining of two ultrafast fiber amplifiers, we demonstrate the generation of high temporal quality 300fs 650µJ pulses at 92kHz repetition rate, corresponding to 60 W average power. Furthermore, at 2MHz up to 135W and 105W are generated, respectively, before and after compression.

ThA.6 (167) Thu 9:30

Coherent Combination of Femtosecond Fiber Amplifiers at High Average Power — •ARNO KLENK1,2, STEFAN DEMMLER1, THOMAS GOTTSCHALL1, TINO EIDAM1,2, STEFFEN HÄDRICH1,3, JAN ROTHARDY1,3, JENS LIMPERT1,2,3, and ANDREAS TÜNNERMANN1,2,3 — 1Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität, Albert-Einstein-Str. 15, 07745 Jena, Germany — 2Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany — 3Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany

We present the coherent combining technique as a scaling concept for the average power of femtosecond fiber amplifiers. Two fiber amplifiers were combined in a Mach-Zehnder type interferometer in a state-of-the-art CPA system. With this setup, we could achieve 560fs pulses at a compressed average power of 215W.

ThA.7 (73) Thu 9:45

Passive spatio-temporal coherent combining of stretcher-free femtosecond fiber systems — •LOUIS DANIault1, MARC HANNA1, DIMITRIS N. PAPADOPoulos1,2, YOANN ZAOUTER3, ERIC MOTTAY3, FREDÉRIC DRUON1, and PATRICK GEORGES1 — 1Laboratoire Charles Fabry, Institut d’Optique, CNRS, Univ Paris-Sud, 91127 Palaiseau, France — 2Laboratoire d’Utilisation des Lasers Intenses, CNRS, Ecole Polytech-
We demonstrate the passive coherent combining of 8 femtosecond pulses, generated from a common seed in both the spatial and the temporal domains and amplified by a single stretcher-free fiber amplifier. Sub-100 fs 52 MW peak-power pulses are obtained and the scalability is discussed.

28: Coffee Break

Time: Thursday 10:00–10:15
Coffee Break

ThuB: Novel fiber lasers and applications

Invited talk

ThuB.1 (237) Thu 10:15
Cladding-Pumped Raman Fibre Lasers and Amplifiers: Review and Progress — •CHRISTOPHE CODEMARD1,2, JUNHUA HU2, and JOHAN NILSSON2 — 1SPI Lasers, SO30 2QU, Hedge End, Southampton, United Kingdom — 2Optoelectronics Research Centre, Southampton University, SO17 1BJ, Southampton, United Kingdom

We review the state-of-the-art of cladding-pumped Raman fibre technology and its limits and present advances in output power and energy. We discuss the potential to scale to higher power than that of conventional rare-earth doped-fibre which suffers from deleterious effects and technical challenges at extreme power.

ThuB.2 (132) Thu 10:45
20 W average power picosecond Tm-doped all-fiber MOPA system — •JIANG LIU, QIAN WANG, and PU WANG — Beijing University of Technology, Beijing 100124, P. R. China

We report high average-power picosecond Tm-doped all-fiber MOPA system. The oscillator was mode-locked by a SESAM to generate average power 10 mW at repetition rate of 103 MHz. Two-stage Tm-doped all-fiber amplifiers were used directly to boost average power to 20.7 W, which corresponds to pulse width was 18 ps.

ThuB.3 (203) Thu 11:00
Power-scalable wavelength-agile fibre laser source at two-microns — •JAE DANIEL, MASAKI TUKURAKAWA, and ANDY CLARKSON — Optoelectronics Research Centre, University of Southampton, Highfield, SO17 1BJ, UK

A simple wavelength-agile Tm-doped fibre laser source employing an acousto-optic tunable-filter to achieve narrowband operation (~0.12 nm) with wide and rapid wavelength tunability in the two-micron spectral region at watt-level power is described. The prospects for extended wavelength coverage using spectral beam-combination and scaling to much higher powers are considered.

ThuB.4 (219) Thu 11:15
Frequency doubling in Rb:PPKTP of a high-power, continuous-wave, VBG-locked fiber laser — •PETER ZEIL, ANDRIUS ZUKAUSKAS, CARLOTTA CANALAS, VALDAS PASISKEVICIUS, and FREDRIK LAURELL — Laser physics, KTH Royal Institute of Technology, 106 91 Stockholm, Sweden

In this work, we demonstrate efficient single-pass second harmonic generation at 532 nm by frequency doubling of a high-power VBG-locked Yb-fiber laser. The narrow-band (<16 GHz) infrared power of 30 W generated 4.7 W green light in a periodically poled Rb:KTP crystal.

ThuB.5 (152) Thu 11:30
Simple scheme for active mode selection in a multimode fibre oscillator — •JAE DANIEL and ANDY CLARKSON — Optoelectronics Research Centre, University of Southampton, Highfield, SO17 1BJ, UK

A novel technique for electronically-controllable selection of different transverse modes in a multi-mode fiber laser oscillator is presented. Preliminary results demonstrate individual transverse mode lasing and fast switching between modes with watt-level output powers.

ThuB.6 (119) Thu 11:45
High Power Ytterbium LMA Rod-Type Fiber Laser Oscillator With Pulse Duration Flexibility — •PIERRE DESLANDES1,2, DAMIEN SANGLA1, JULIEN SABY1, MATHIAS PERRIN2, FRANCOIS SALIN3, and ERIC FREYSSZ4 — 1Eolite Systems, 11 Avenue Cauveranie, 33600 Pessac, France — 2Université de Bordeaux, CNRS, LOMA, UMR 5798, 351, Cours de la libération, 33405 Talence, France

We present a pulsewidth flexible, selfstarting and powerfull ytterbium doped ring LMA fiber laser. It makes it possible to generate subpicosecond or few tens of picosecond pulses almost Fourier Transfom limited with an average power up to 10 W at 104 MHz.

ThuB.7 (70) Thu 12:00
All-fiber laser source for CARS-Microscopy — •THOMAS GOTTSCHELL1, JAVIER ABREU-APONSO2, MARTIN BAUMGARTL1, TOBIAS MEYER2, BENJAMIN DIETZEL3, JÜRGEN POPP4, JENS LIMPERT1, and ANDREAS TÜNNERMANN1,4 — 1Friedrich-Schiller-Universität Jena, Institute of Applied Physics, Abbe Center of Photonics, Albert-Einstein-Str. 15, 07745 Jena, Germany — 2Universidad de Valencia, Instituto de Ciencias de los Materiales, La Coma S/N, 46100 Valencia, Spain — 3Institut für Photonische Technologien e.V., Albert-Einstein-Str. 9, 07745 Jena, Germany — 4Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany
We present a parametric all-fiber laser source for CARS microscopy. The pump and Stokes wavelengths are generated by four-wave-mixing and are delivered from a single fiber end with intrinsic synchronization. The generated wave-length pair was used to obtain high quality pictures of blood cells probing vibrational resonances around 2850 cm\(^{-1}\).

30: Lunch Break

Time: Thursday 12:15–13:30  
Location: Lunch

Lunch Break

ThP: Poster Session III

Time: Thursday 13:30–14:30  
Location: Main Hall Area

ThP.1 (47) Thu 13:30  
Experimental Validation of a Simple Relation between Laser Frequency Noise and Linewidth —  
Nikola Bucalovic, Vladimir Dolgovskiy, Christian Schori, Pierre Thomann, Gianni Di Domenico, and Stephihe Schilt — Laboratoire Temps-Fréquence, Université de Neuchâtel, Avenue de Bellevaux 51, 2000 Neuchâtel, Switzerland

We present an experimental validation of a simple formula that we recently proposed to calculate the linewidth of a laser from its frequency noise spectrum. Using state-of-the-art lasers, agreement within the experimental uncertainty is obtained between the linewidth approximated from the frequency noise spectrum and the actual value separately measured.

ThP.2 (4) Thu 13:30  
Measurement of transverse pseudo-nonlinear effects in solid-state laser materials using a highly sensitive technique — Thomas Godin, Michael Fromager, Emmanuel Cagniot, Tomaz Catunda, Richard Moncorgé, and Kamil Ait-Amour — CMAP, Caen, France — IFSC, São Carlos, Brasil

We present a detailed study of the Baryscan technique, a new efficient alternative to the widespread Z-scan technique for measuring pump-induced refractive index changes. This method, based upon the use of a Position Sensitive Detector, reaches among the highest sensitivity levels to date.

ThP.3 (66) Thu 13:30  
Laser Operation and Spectroscopy of Pr\(^{3+}:\)LaMgAl\(_{11}\)O\(_{19}\) — Daniel-Timo Marzahn, Fabian Reichert, Matthias Fechner, Nils-Owe Hansen, Klaus Petermann, and Günter Huber — Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

In this contribution we present spectroscopic investigations and demonstrate laser action of Pr\(^{3+}:\)LaMgAl\(_{11}\)O\(_{19}\). For central emission wavelengths of 729.1 nm, 648.1 nm, and 620.4 nm we obtained maximum output powers of 63.7 mW, 10.1 mW, and 2.9 mW with slope efficiencies of 12%

ThP.4 (176) Thu 13:30  
Generation of 1.6 ps by \(\chi(2)\)-lens Mode Locking of an In-band Pumped Nd:LuVO\(_4\) Laser — Hristo Iliev, Veselin Alexandrov, Ivan Buchvarov, Hualin Zhang, Jiayang Wang, and Valentin Petrov — Physics Department, Sofia University, 5 James Bourchier Blvd., BG-1164 Sofia, Bulgaria — National Laboratory of Crystal Materials, Shandong University, Jinan 250100, China — Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy, 2A Max-Born-Street, D-12489 Berlin, Germany

Mode-locking of an In-band pumped Nd:LuVO\(_4\) laser by \(\chi(2)\)-lens formation in periodically-poled KTP nonlinear crystal has been studied. The shortest pulse duration of 1.6 ps is obtained at 0.7 W, while the maximum output power reaches 4.6 W at 7.5 ps.
Efficient continuous-wave Pr:YAlO3 laser generation at 747nm in power-scaled resonator configuration is reported. As a pumping source, two GaN-laser-diodes with output power of 1W each were used. The maximum output power of 290mW with the slope efficiency of 28% related to absorbed power was reached.

**ThP.8 (145) Thu 13:30**

**Development of a Deformable Mirror for Compensation of Aspherical Components of the OPD in High Power Thin-Disk Lasers** — Elke Schmid, Jochen Speiser, and Adolf Giessen — Institute of Technical Physics, German Aerospace Center, Pfaﬀenwaldring 38-40, D-70569 Stuttgart

For compensating non-spherical parts of the intra-cavity OPD in high power lasers, the aberrations was measured and a deformable mirror based on locally thermal heating is introduced. According to simulations a deformable a mirror was produced. First measurements demonstrate the capability of the concept.

**ThP.9 (85) Thu 13:30**

**Pulsed Laser Deposition of Nd:Lu3Al5O12: Elimination of Particulates Using a Vane Velocity Filter** — Sebastian Heinrich, Jonathan Thielmann, Friedjof Tellkamp, Sven H. Wæselmann, Christian Kränkel, and Günther Huber — Institut für Laserphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

A vane velocity filter was used to reduce the number of undesired particulates on the surface of Nd:Lu3Al5O12 films grown with the pulsed laser deposition method. The elimination of particulates on the surface of the films results in a decrease of the waveguiding losses by a factor of 5.

**ThP.10 (38) Thu 13:30**

**The potential of Yb:Sc2SiO5 for high-power continuous-wave and passively mode-locked laser operation** — Katrin Sarah Wentsch, Lihe Zheng, Su Lianghbi, Xu Xiaodong, Jun Xu, Marwan Abdou Ahmed, and Thomas Graf — 1Graduate School of Excellence advanced Manufacturing Engineering, Universität Stuttgart, Nobelstrasse 12, D-70569 Stuttgart — 2Shanghai Institute of Ceramics, Chinese Academy of Sciences, 215 Chengbei Road, Cn-201800 Shanghai — 3Institut für Strahlwerkzeuge, Universität Stuttgart, Pfaﬀenwaldring 43, D-70569 Stuttgart

Ytterbium doped scandium silicon oxide (Yb:Sc2SiO5) is a rather novel laser material which is promising for high-power ultra-short pulse generation due to its excellent thermo-mechanical properties and its broad emission bandwidth. We present first characterizations and investigations on passively mode-locked thin-disk laser oscillators.

**ThP.11 (185) Thu 13:30**

**38-mJ, single frequency, sub-nanosecond, kilohertz, Nd based laser system** — Danail Chuclumishev, Bozhidar Oreshkov, Alexander Gaydarzhiev, Dimitar Draganov, and Ivan Buchvarov — Department of Physics, Sofia University, 5 James Bourchier Blvd., BG-1164 Sofia, Bulgaria

We report the amplification of pulses from a near diffraction limited, single frequency, passively Q-switched Nd:YAG laser (0.24 mJ, 830 ps at 0.5 kHz) up to 38-mJ in a one Nd:YVO4 preamplifier and two diode pumped boost YAG-amplifiers, whilst preserving pulse duration, beam quality and linear polarization.

**ThP.12 (201) Thu 13:30**

**Yb3+:YAl3(BO3)4 thin-disk laser** — Birgit Weichel, Katrin Sarah Wentsch, Andreas Voss, Andreas Gross, Volker Wesemann, Daniel Rytz, Marwan Abdou Ahmed, and Thomas Graf — 1Institut für Strahlwerkzeuge, Stuttgart, Germany — 2Graduate School of Excellence advanced Manufacturing Engineering, Stuttgart, Germany — Forschungsinstitut für mineralische und metallische Werkstoffe — Edesteine/Edelmetalle GmbH, Idar Oberstein, Germany

We present the first operation of Yb:YAl3(BO3)4, being of special interest due to its self-frequency doubling ability and its potential for sub-100 fs pulse generation, in thin-disk laser configuration. In continuous wave operation, an output power of 7.9 W with an optical efficiency of 37% at 1040 nm was obtained.

**ThP.13 (26) Thu 13:30**

**Singly-resonant LiGaS2 mid-IR optical parametric oscillator** — Aleksey Tyazhev, Vitaly Venedyapin, Georgii Marchev, Alexander Yelisseyev, Ludmila Isaenko, Dmitri Kolker, Marina Starkova, Sergei Lobanov, Valentin Petrov, and Jean-Jacques Zondy — Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy, 2A Max-Born-Str., D-12489, Berlin, Germany — 3Institute of Geology and Mineralogy, SB RAS, 43 Russkaya Str., 630058 Novosibirsk, Russia — 4Novosibirsk State Technical University, 20 K. Marx Ave., 630028 Novosibirsk, Russia — 5Laboratoire Commun de Métrologie LNE-CNAM, 61 rue du Landy, 93210 La Plaine Saint Denis, France

We demonstrate singly resonant optical parametric oscillator based on the wide band-gap (3.76eV) LiGaS2, pumped by a 100Hz, 8ns Nd:YAG laser. Due to the high optical damage resistivity this is possible notwithstanding the modest nonlinearity. The 5.4ns long idler pulses near 5500nm have a maximum energy of 134µJ.

**ThP.14 (76) Thu 13:30**

**Tunable Laser Operation of Pr3+:LaF3** — Fabian Reichert, Francesca Moglia, Daniel-Timo Marzahl, Philip Metz, Matthias Fechner, Nils-Owe Hansen, and Günther Huber — Institute of Laser-Physics, Hamburg, Germany

In this contribution we present diode-pumped tunable laser operation of Pr3+:LaF3. Tuning between 609.2 nm and 622.7 nm with two small gaps was achieved after inserting a birefringent filter into a linear cavity.

**ThP.15 (45) Thu 13:30**

**High-power qcw-side-pumped Nd:YLiF4 laser with over 50% efficiency using mode-controlling** —
Alessandro M. Deana\(^1\) and Niklaus U. Wetter\(^2\) — University of Nove de Julho, 109 Dr. Adolpho Pinto, São Paulo - SP, Brazil — Institute for Nuclear and Energetic Research, CNEN-IPEN/SP, 2242 Av. Prof. Lineu Prestes, São Paulo - SP, Brazil

A very compact and robust cavity design is demonstrated that allows record optical-to-optical efficiency of over 50% in a side-pumped Nd:YLF laser emitting at 1053 nm. This efficiency is even higher than in longitudinal pumped cavity designs and based on a novel two-beam mode-controlling scheme.

ThuP.16 (48) Thu 13:30

Over 2 mJ, 2 \(\mu\)m optical vortex pulse generation from an optical vortex pumped optical parametric oscillator — Yu Tokizane\(^1\), Takeshi Mochizuki\(^1\), Yusufu Tsuchiya\(^1\), Masaki Yamada\(^1\), Katsuhiko Miyamoto\(^1\), and Takashige Omatsu\(^1\) — Chiba University, 109 Dr. Adolpho Pinto, São Paulo - SP, Brazil

We demonstrate 2\(\mu\)m optical vortex generation from a semi-concentric KTP optical parametric oscillator pumped by a 1\(\mu\)m optical vortex. The maximum energy of the vortex 2\(\mu\)m output with a topological charge of 1 was measured to be 2.1 mJ with a slope efficiency of 15%.

ThuP.17 (140) Thu 13:30

Compact 2 \(\mu\)m Single-frequency, Q-switched Tm:YAG Laser Injection-seeded by Fiber Coupled Monolithic Nonplanar Ring Oscillator Laser — Lei Wang\(^1\), Chunqing Gao\(^1\), Mingwei Gao\(^1\), Yan Zheng\(^1\), and Zhifeng Lin\(^2\) — School of Opto-Electronics, Beijing institute of technology, 5 South Zhongguancun Street, Beijing 100081, P. R. China — 2CREST, Tokyo, Japan

A Single-frequency injection-seeded Q-switched Tm:YAG laser was demonstrated. The seed laser was a fiber-coupled Tm:YAG monolithic nonplanar ring oscillator with the maximum output power of 480 mW. The output energy of the single-frequency Q-switched pulse was 2.5 mJ, with pulse width of 250 ns and repetition rate of 100 Hz.

ThuP.18 (208) Thu 13:30

Sub-150-fs pulses from an Yb:KYW regenerative amplifier — Martin Delaigue, Clemens Hönninger, and Eric Mottay — Amplitude Systèmes, 11 avenue de Canteranne, Cité de la Photonique, Bâtiment MEROPA, F-33600 Pessac, France

We report an amplification scheme using femtosecond fiber oscillator and Yb:KYW regenerative amplifier, delivering 50\(\mu\)microJ-range pulses around 50kHz, in order to produce sub-150fs pulse duration exploiting non linear effects to compensate gain narrowing without degrading beam profile and temporal quality.

ThuP.19 (81) Thu 13:30

Multi-Wavelength Operation of Pr3+-doped Solid-State Lasers Q-switched by an Acousto-Optic Modulator or Novel Saturable Absorbers — Ryo Abe, Junichiro Kojou, and Fumihiko Kannari — Department of Electronics and Electrical Engineering, Keio University, 3-14-1, Hiyoshi, Kohoku-ku, Yokohama 223-8522, JAPAN

Q-switching of wavelength tunable Pr3+-doped fluoride-glass fiber laser pumped by high-power GaN diode lasers is demonstrated. We also experimentally prove that a Cr:YAG crystal exhibits saturable absorption in the visible region. We demonstrate passively Q-switched Pr:YLF and Pr:fluoride-glass lasers and their multi-color operation.

ThuP.20 (195) Thu 13:30

First complete phase-matching characterization of the Langatate LGT — Patricia Segonds, Bessot Boulanger, Bertrand Menaert, Jerome Debry, and Rajeev Raman — Institut Néel CNRS Université Joseph Fourier, 25 rue des Martyrs, 38042 Grenoble cedex 9, France

We identified the piezoelectric crystal La3Ga5.5Ta0.5O14 (LGT) as a new material for nonlinear optics from 0.5 microns to 6.5 microns. We performed the first characterization of sum- and difference-frequency generations by measuring the phase-matching properties using a LGT crystal cut as a sphere.

ThuP.21 (102) Thu 13:30

5 GHz passive harmonic mode-locking in a single-clad fiber laser via pulse energy engineering — Chang Su Jun, Sun Young Choi, Fabian Rotermund, Byeong Yoon Kim, and Dong-il Yeom — 1Division of Energy Systems Research, Ajou University, Suwon, 443-749, Republic of Korea — 2Department of Physics, KAIST, Daejeon, 305-701, Republic of Korea

We report the highest pumping efficiency of 13.8 MHz/mW in increasing the repetition rate of passive harmonic mode-locking through pulse energy engineering. Stable pulses with 5GHz repetition rate and 40dB super-mode suppression is demonstrated with only 395mW pump power in a single-clad fiber laser incorporating the carbon-nanotube saturable absorber.

ThuP.22 (16) Thu 13:30

Continuum Generation in Mid-IR from Tm-doped Germanate Fiber Using Femtosecond Cr:ZnS Laser — Nikolai Tolstik, Dmitriy Klimentov, Vladislav Dvoynik, Irina Sorokina, Vladimir Kalashnikov, and Evgeni Sorokin — 1Department of Physics, Norwegian University of Science and Technology, Hogskoleringen 5, N-7491 Trondheim, Norway — 2Photonics Institute, Vienna University of Technology, Gusshausstrasse 27/387, A-1040 Vienna, Austria

We report on continuum generation at 2.4 \(\mu\)m using a step-index germanate-doped silica fiber. Femtosecond Cr:ZnS laser was used as a pulse source. The supercontinuum spectral bandwidth reaches 600 nm at -20dB level for 0.65 nJ launched pulse energy.

ThuP.23 (227) Thu 13:30

Efficient frequency conversion by gain-induced four-wave mixing in optical fibers — Guillaume Tison, Eric Freysz, and Eric Freysz — 1Université de Bordeaux, CNRS, LOMA, UMR 5798, 351, Cours de la libération, 33405 Talence, France — 2NEXEYA SYSTEMS, Route des Lasers,
The effects of thermally-induced refractive index change on the single-mode regime of active distributed modal filtering photonic crystal fibers are numerically investigated. A blue-shift of the single-mode range and a decrease of the fundamental mode effective area, both proportional to the coupled pump power, are reported.

**ThP.27 (100)** Thu 13:30

**Radiofrequency Spectroscopy Method of Temperature Measurements in Silica Active Fiber Polymer Jacket** — Renat Shaidullin1,2, and Oleg Ryabushkin1,2,3 — 1NTU "IRE-Polus", Vvedensky Sq. 1, Fryazino, Moscow Region, Russia — 2Moscow Institute of Physics and Technology, Institutskiy per. 9, Dolgoprudny, Moscow Region, Russia. — 3Kotelnikov Institute of Radio-Engineering and Electronics of RAS, Vvedensky Sq. 1, Fryazino, Moscow Region, Russia.

In this paper a new method of temperature measurements in the protective polymer jacket of active fiber lasers is proposed. This method based on impedance spectroscopy allows to determine heating of the polymer jacket by measuring radio-frequency dielectric constant change.

**ThP.28 (95)** Thu 13:30

**High-average-power nanosecond pulse generation in polarization-maintained Yb-doped PCF fiber laser systems** — Hidetsugu Yoshida1, Koji Tsubakimoto1, Hisanori Fujita1, Noriaki Miyanaga1, Yamamura Takeshi2,3, Ishikawa Masahiro2,3, Sakagawa Tomokazu2,3, and Tsukamoto Masahiro4 — 1Institute of Laser Engineering, Osaka University, Osaka, Japan — 2Kataoka Corp., Kyoto, Japan — 3Advanced Laser and Process Technology Research Association (ALPROT), Tokyo, Japan — 4Joining and Welding Research Institute, Osaka University, Osaka, Japan

We have developed a high-peak and high-average power Yb-doped fiber laser system generates the polarization-maintained pulsed in PCF rod fibers. The output power has been achieved to 132-180 W by a 100-µm PCF rod type fiber.

**ThP.29 (147)** Thu 13:30

**Beam quality degradation of a strongly pumped Yb-doped photonic crystal fiber amplifier** — Malte Karow1,2, Henrik Tünnermann1,2, Jörg Neumann1,2, Dietmar Kracht1,2, and Peter Wessels1,2 — 1Laser Zentrum Hannover e.V., Hollerithallee 8, 30419 Hannover, Germany — 2Centre for Quantum Engineering and Space-Time Research - QUEST, Welten Garten 1, 30167 Hannover, Germany

The beam quality degradation of a strongly pumped Yb-doped photonic crystal fiber amplifier is investigated by measuring the frequency resolved intensity noise spectra. A sudden increase of the relative intensity noise at the onset of beam profile fluctuations and further changes in the dynamics beyond this threshold were observed.

**ThP.30 (199)** Thu 13:30

**Towards integrated channel waveguide lasers in monoclinic double tungstates** — Koop van Dalen1, Henk A. G. M. van Wolferen2, Mein...
Several photonic crystal fibers with core dimensions of 25-57 µm were fabricated and investigated. The structure was formed by 4, 3, 2 and 1 hole rings around the silica core. It is shown that, in contrary to the literature data, pure single-mode regime is not available in the 1-ring structure.

**Spectral Narrowing in a System of Coherently Combined Fiber Lasers**

**Is It Possible to Create Pure Single-Mode PCF with 100µm Core Diameter?**

**Nanohole Arrays in Borates by Femtosecond Laser Ablation toward Realizing Two-Dimensional Photonic Crystals**

**Ultrafast Nonlinear Optics in Hollow-Core Photonic Crystal Fibres**

**Pulse compression of a modelocked thin disk laser to 10 MW, sub-50 fs in a gas filled Kagome-type hollow-core PCF**

Several other laser amplification and coherent beam combining papers were also presented, covering topics such as high-power amplification and ultrafast nonlinear effects in fiber optics.

**ThP.31 (55) Thu 13:30**

**ThP.32 (131) Thu 13:30**

**ThP.33 (92) Thu 13:30**

**ThP.34 (11) Thu 13:30**

**ThC.1 (236) Thu 14:30**

**ThC.2 (142) Thu 15:15**

**ThC.3 (97) Thu 15:30**

**ThC: Applications of Engineered Fibers**

**Time: Thursday 14:30–16:30**

**Location: Oscar Klein - Lecture Hall**
served loss peaks are in good agreement with the predicted numerical simulations.

Th.C.4 (202) Thu 15:45

Single frequency amplification by ytterbium doped photonic bandgap fiber at 1178 nm —

• Mingchen Chen1, Akira Shirakawa1, Ken-ichi Ueda1, Christina Olausson2, Jens Lyngsø2, and Jes Broeng2 — 1Institute for Laser Science, University of Electro-Communications, 1-5-1 Chofugakou, Chofu, Tokyo 182-8585, Japan — 2NKT Photonics A/S, Blokken 84, DK-3460 Birkerød, Denmark

1178 nm single-frequency amplification by Yb-doped photonic bandgap fiber has been demonstrated. 24.6 W output was obtained without stimulated Brillouin scattering. 1.8 dB suppression of Brillouin gain by an acoustic antiguiding effect has been found in the low-index core antiresonant reflecting optical waveguide.

Th.C.5 (37) Thu 16:00

High normal Group Velocity Dispersion Photonic Crystal Fiber for wavelength tunable pulse stretching around 2 μm — • Pureur Vincent1, Guillemet Sébastien1, Bouwmans Géraud2, Bigot Laurent2, Hernandez Yves1, and Giannone Domenico1 — 1Applied Photonics Department, Multitool, 2 av Pierre et Marie Curie, Parc Initialis, 7000, Mons, Belgium — 2Laboratoire de Physique des Lasers, Atomes et Molécules UMR 8523, IRCICA USR 3380, 50 av Halley, 59658, Vile Nullune d’Asq, France

We present a polarization-maintaining solid-core photonic crystal fiber with very high normal group velocity dispersion around 2 μm for optical pulse stretching. With relatively low propagation losses, the total dispersion of the fiber is measured to be -530 and -400 ps/nm/km at 1979 nm depending on the polarization axis.

Th.C.6 (59) Thu 16:15

Nanosecond electrical switch using monolithic fiber interferometer — • Patrik Rugeland1,2, Walter Margulis1, and Oleksandr Tarasenko2 — 1Applied Physics, Royal Institute of Technology, Roslagstullbacken 21, 10691 Stockholm, Sweden — 2Fiber Photonics, Acreo, Electrum 296, 16440 Kista, Sweden

We demonstrate a monolithic fiber Mach-Zehnder interferometer that can be electrically switched with ~10 ns response time. The device is broadband and temperature stable, and could be used for low-loss all-spliced Q-switching of fiber lasers at tens of kilohertz.

33: Coffee Break

Time: Thursday 16:30–16:45

Coffee Break

ThD: Ultrafast optics and frequency combs

Time: Thursday 16:45–18:30

Invited talk — • Diddams —

Th.D.1 (232) Thu 16:45

Mid-IR frequency ruler based on a doubly resonant non-degenerate OPO — • Hartl1, J. Jiang1, C. Mohr1, J. Bethge1, M.E. Fermann1, N. Lien decker2, K.L. Vodopyanov2, and P.G. Schunemann2 — 1IMRA America, Inc., 1044 Woodridge Ave., Ann Arbor, MI 4810, USA — 2E.L. Ginzt on Laboratory, Stanford University, Stanford, CA, 94305, USA — 3BAE Systems, PO Box 868 Nashua NH, 30636, USA

We demonstrate a Tm-femtosecond fiber frequency comb pumped non-degenerate doubly resonant OP-GaAs-based broadband OPO, emitting idler and signal waves centered at 5283nm and 3350nm respectively. We demonstrate that the OPO produces a ruler of well defined signal and idler frequencies by cavity length stabilization with a comb-tooth linewidth of <300kHz, limited by the reference laser.

Th.D.2 (164) Thu 17:15

3D Precision Imaging with a Terahertz-bandwidth, Comb-calibrated Swept Laser — • Esther Baumann, Fabrizio R. Giorgetta, Ian Coddington, Kevin Knabe, Laura Sinclair, William C. Swann, and Nathan R. Newbury — Quantum Electronics and Photonics Division, National Institute of Standards and Technology, 325 Broadway, Boulder, CO, 80305, USA

We report the first comparison of microwaves generated from an ultra-stable laser using a SESAM mode- locked Er:Yb:glass laser oscillator (ERGO) and an Er:fiber fre-
We report on 2.85 micron laser performance of Er:Lu$_2$O$_3$. Highly efficient Er:Lu$_2$O$_3$ laser with 5.9 W of output power at 2.85 \( \mu \)m has been achieved. Under diode pumping, 5.9 W of output power with a slope efficiency of \(~36\%\) was obtained. Under diode pumping, 5.9 W of output power with 27\% of slope efficiency was achieved with an M2 of 1.2 to 1.4.

High Power Diode-Pumped Alexandrite Slab Laser — •MICHAEL DAMZEN and ARA MINASSIAN — Midaz Lasers Ltd, London, UK

Record powers are demonstrated from a diode-pumped Alexandrite slab laser producing pulse energy 23.4 mJ at 100 Hz (in quasi-CW mode) with \(~42\%\) slope efficiency, and 6.4 W in CW mode, showing exciting prospects as a high efficiency tunable wavelength source for remote sensing and ultrafast applications.

Record powers are demonstrated from a diode-pumped Alexandrite slab laser producing pulse energy 23.4 mJ at 100 Hz (in quasi-CW mode) with \(~42\%\) slope efficiency, and 6.4 W in CW mode, showing exciting prospects as a high efficiency tunable wavelength source for remote sensing and ultrafast applications.

Highly efficient Pr:LiYF$_4$-lasers — •PHILIP METZ, FABIAN REICHERT, SEBASTIAN MÜLLER, DANIEL-TIMO MARZHAL, NILS-OWE HANSEN, MATTHIAS FECHNER, CHRISTIAN KRÄNEL, and GÜNTER HUBER — Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, D-22761 Hamburg, Germany

We report on highly efficient Pr:LiYF$_4$-lasers pumped with a frequency doubled OPS laser at 480 nm. Slope efficiencies for the first time.
High energy and broadband Yb:CaF2 multipass amplifier — Dimitrios Papadopoulos1,2, Sandrine Ricaud1,2, Louis Daianault1, Florence Friebel1, Alain Pelegrina2, Marc Hannq1, Patrice Camy3, Jean Louis Doualan4, Richard Moncorge4, Patrick Georges1, and Frederic Druon1 — 1Laboratoire Charles Fabry, Institut d’Optique, CNRS, Univ Paris-Sud, 2 Av. A. Fresnel, 91127 Palaiseau, France — 2Laboratoire d’Utilisation des Lasers Intenses, CNRS, Ecole Polytechnique, CEA, Univ. Pierre et Marie Curie, Palaiseau, France — 3Amplitude Systèmes, 11 avenue de Canteranne, Cité de la Photonics, 33600 Pessac, France — 4Centre de recherché sur les Ions, les Matériaux et la Photonique, CEA, CNRS, ENSICAen, Université de Caen, 14050, Caen, France

A novel multipass amplifier design based on Yb:CaF2 that permits high gain and high energy operation is presented. Up to 105 mJ pulses at 30 Hz are obtained for 1.3 mJ at the input. The passive coherent combination technique is also examined to increase the output energy to >200 mJ.

Friday

38: Coffee Break

Location: Main Hall Area

Coffee Break

FrB: Waveguide photonics

Location: Oscar Klein - Lecture Hall

Femtosecond-laser Written Diode-pumped Visible Pr:LiYF4 Waveguide Laser — Sebastian Müller, Thomas Calmano, Philip Metz, Christian Kränkel, and Günter Huber — Institut für Laser-Physik, Universität Hamburg, Germany

In this contribution we present a femtosecond-laser inscribed Pr:YLF waveguide laser. Emission in the orange and red spectral region with output powers of 26 mW (604 nm) and 12 mW (720 nm) have been achieved under InGaN diode laser pumping.

Dual Wavelength and Switchable Laser Operation of Visible Pr: SrAl2O19 Waveguide Lasers — Thomas Calmano, Sebastian Müller, Fabian Reichert, Matthias Fechner, Niels-Owe Hansen, and Günter Huber — Institut für Laser-Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

Channel waveguides were fabricated in Pr: SrAl2O19 by femtosecond-laser writing. Dual wavelength and switchable laser operation in the visible spectral range could be demonstrated by using an output coupling mirror with variable transmission. Furthermore, output powers of 91 mW at 643.8 nm and 62 mW at 622.8 nm were obtained.
**Prizes, Closing Session**

Time: Friday 12:30–12:45  
Location: Oscar Klein - Lecture Hall

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**Ti:Sapphire Channel Waveguide Lasers Produced by Femtosecond and Picosecond Laser Writing**  
- Christos Grivas¹, Costantino Corbari², Gilberto Brambilla², and Pavlos Lagoudakis¹ — ¹School of Physics and Astronomy, University of Southampton, Southampton SO17 1BJ, United Kingdom — ²Optoelectronics Research Centre (ORC), University of Southampton, Southampton SO17 1BJ, United Kingdom

Fabrication and continuous-wave lasing near 798 nm is reported for femtosecond and picosecond laser-written channel waveguides in Ti:sapphire crystals. Channels inscribed by femtosecond (picosecond) pulses lase above a threshold of 84 mW (189 mW) with maximum output power and slope efficiency of 143 mW (45 mW) and 23.5% (7.1%), respectively.

**FrB.4 (118) Fri 11:30**

Single-mode, Tuneable Laser Operation of Hybrid Microcavities based on CdSe/CdS Core/Shell Colloidal Nanorods on Silica Microspheres — Christos Grivas¹, Peri Andreakou¹, Pengfei Wang², Ming Ding², Gilberto Brambilla², Liberato Manna³, and Pavlos Lagoudakis¹ — ¹School of Physics and Astronomy, University of Southampton, Southampton SO17 1BJ, United Kingdom — ²Optoelectronics Research Centre (ORC), University of Southampton, Southampton SO17 1BJ, United Kingdom — ³Istituto Italiano di Tecnologia (IIT), I-16163 Genoa, Italy

Fiber-coupled hybrid lasers based on colloidal CdSe/CdS core/shell semiconducting nanorods on silica microspheres produced single-mode emission near 628 nm above a 67.5-microwatts threshold. The lasing wavelength was tuned over a 2.1-nm range by laser-heating at 3.5 micrometers while the emission modality was dependent on the coupling conditions and microsphere size.

**FrB.5 (174) Fri 11:45**

Ytterbium-doped fiber laser mode-locked with electrooptical fiber — Mikael Malmström¹, Oleksandr Tarasenko², Walter Margulis², and Fredrik Laurell¹ — ¹Laser Physics, Applied Physics, Royal Institute of Technology, Roslagstullsbacken 21, 10691 Stockholm, Sweden — ²Fiber Photonics, Acreo, Electrum 236, 16440 Kista, Sweden

An actively mode-locked Yb-doped fiber laser is demonstrated, incorporating an electrooptical fiber phase modulator, driven with 40 Vpp. The all-spliced linear cavity generates subnanosecond pulses at 1065 nm wavelength with a fundamental repetition rate of 15.6 MHz. It produces comparable output pulses up to the 7th harmonic at 109 MHz.

**FrB.6 (9) Fri 12:00**

Temperature Induced Dynamic Refractive Changes in Fiber Amplifiers — Henrik Tünnermann¹,², Jörg Neumann¹,², Dietmar Kracht¹,², and Peter Wessels¹,² — ¹Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover — ²Centre for Quantum Engineering and Space-Time Research - QUEST, Welfengarten 1, 30167 Hannover, Germany

Thermally induced refractive index changes are important in high power fiber amplifiers. We present measurements of the time dependent optical phase shift and show it can be explained by radial heat diffusion through the fiber.

**FrB.7 (36) Fri 12:15**

Asymmetric single-mode fused fiber coupler for core pumping thulium-doped fiber at 795 nm — Gabriel Pelegrina-Bonilla¹, Katharina Hausmann¹,², Kai Liu¹, Hakan Sayinc¹,², Uwe Morgner¹,²,³, Jörg Neumann¹,², and Dietmar Kracht¹,² — ¹Laser Zentrum Hannover e.V., Hollerithalle 8, D-30419 Hannover, Germany — ²Centre for Quantum Engineering and Space-Time Research - QUEST, Welfengarten 1, 30167 Hannover, Germany — ³Institut für Quantenoptik, Leibniz Universität Hannover, Welfengarten 1, D-30167 Hannover, Germany

We present a fused fiber coupler capable of multiplexing wavelengths in the range of 795nm and 1980nm. Different single-mode fibers with single-mode guidance for the respective wavelength were employed. We achieved a transmission of 90% in the signal fiber for both wavelengths and demonstrated the application in a fiber amplifier.