Optica High-brightness Congress Session Guide

Disclaimer: This guide is limited to technical program with abstracts and author blocks as of 8 March. For updated and complete information with special events, reference the online schedule or mobile app.

Tuesday, 12 March

09:00 -- 10:00
Olympia Mancini 1
JTu1A • Joint Plenary Session I
Presider: Majid Ebrahim-Zadeh, ICFO -Institut de Ciencies Fotoniques , Spain

JTu1A.1 • 09:00 (Plenary)
Chip-Based Comb Spectroscopy, Alexander Gaeta[1]; [1]*Columbia Univ., USA.* Recent advances in integrated photonics will allow for a new class of spectroscopic sources, such as optical frequency combs, which will enable high-precision spectroscopic instruments in highly robust, compact and portable platforms.

10:30 -- 12:30
Olympia Mancini 3A
ETu2A • Compton Scattering Sources
Presider: Félicie Albert; Lawrence Livermore National Laboratory, United States

ETu2A.1 • 10:30 (Invited)
Compact Laser-Compton Light Sources and Applications, Christopher Barty[1]; [1]*Univ. of California Irvine, USA.* Design, optimization and initial medical and industrial uses of compact, laser-Compton, x-ray light sources based on x-band (11.424 GHz) accelerator technology and unique multi-bunch/multi-pulse interaction architectures are presented

ETu2A.2 • 11:00 (Invited)
Laser Systems and Diagnostics for the ASU Compact X-ray Source, Samuel T. Teitelbaum[1], Sean Tilton[1], Kevin Eckrosh[1], Rachel Larsen[1], Elena Ros[1], Hyung Seo Lee[1], Emmanuel Adamo[1], Dariannette Valentin[1], Thomas Metzger[2], Sandro Klingebiel[2], Arvinder Sandhu[4], Sudeep Banerjee[3], Robert Kaindl[1], Mark Holl[1], William Graves[1]; [1]*Arizona State Univ., USA;* [2]*TRMPF Scientific GmBH, Germany;* [3]*KLA Tencor, USA;* [4]*Physics, Univ. of Arizona, USA.* We present recent commissioning results from the ASU Compact x-ray source (CXLS)- an inverse Compton source producing sub-picosecond hard x-rays. We discuss the x-ray source performance, flux, diagnostics, and designs for a future ICS source.

ETu2A.3 • 11:30
X-Ray and Electron Beam Considerations for Laser-Compton Image-Guided Radiation Therapy, Haytham H. Effarah[1], Trevor Reutershan[1], Eric C. Nelson[1], Yoonwoo Hwang[2], Christopher Barty[1,2]; [1]*Univ. of California, Irvine, USA;* [2]*Lumitron Technologies, Inc., USA.* Electron beams used in laser-Compton X-ray sources can be utilized as ultra-high dose rate (UHDR) ionizing radiation sources if the architecture provides sufficient peak current and beam energy. Using a multi-step simulation workflow, we identify commensurate X-ray and electron beam profiles for image-guided UHDR (FLASH) radiotherapy experiments.

ETu2A.4 • 11:45
Scanning K-Edge Subtraction Imaging Using Laser-Compton Sources as a Method for High-Contrast and Low-Dose Mammography, Trevor Reutershan[1], Haytham H. Effarah[1], Christine Nguyen[1], Eric C. Nelson[1], Kyle D. Chesnut[1], Christopher Barty[1,2]; [1]*Univ. of California - Irvine, USA;* [2]*Lumitron Technologies, Inc., USA.* A single energy tuning, K-edge subtraction imaging method using laser-Compton sources (LCS) is presented. The narrow spectral

bandwidths that LCSs provide can improve clinical dual-energy mammography by 1000x in contrast enhancement or dose reduction.

ETu2A.5 • 12:00
Commissioning of the ICS hard X-ray light source, Alex Murokh[1]; [1]*RadiaBeam Technologies, LLC., USA.* The ICS source development program at RadiaBeam is discussed, including the recent progress on the commissioning of the novel C-band hybrid photoinjector, 100 MeV beam energy upgrade, and the initial results of the ICS source commissioning. We also provide a brief overview of the future experimental plans and source productization outlook.

ETu2A.6 • 12:15
Optimisation of K-edge Subtraction Imaging for Narrow-Band Inverse Compton X-ray Sources, Benedikt Günther[1,2], Ivan Kokhanovskyi[1,2], Klaus Achterhold[1,2], Martin Dierolf[1,2], Franz Pfeiffer[1,2]; [1]*School of Natural Sciences, Technische Universität Muenchen, Germany;* [2]*Munich Inst. of Biomedical Engineering, Technical Univ. of Munich, Germany.* K-edge subtraction (KES) imaging at inverse Compton X-ray sources is little explored. First, the K-edge-filter approach is introduced and reviewed. In particular, we present and experimentally demonstrate an optimisation of KES overcoming the filter-method's limitations.

Olympia Mancini 1
10:30 -- 12:30
HTu2B • Laser Technology I
Presider: Caterina Vozzi; Consiglio Nazionale delle Ricerche, Italy

HTu2B.1 • 10:30
High-average Power, Soft X-ray Generation Driver at 2.1 µm, Raman Maksimenka[1], Thomas Pinoteau[1], Nicolas Forget[2], Daniel Walke[3], Florian Gores[3], Iain Wilkinson[3]; [1]*Fastlite, France;* [2]*Institut de Physique de Nice (INPHYNI), France;* [3]*Helmholtz-Zentrum Berlin für Materialien und Energie, Germany.* We present a high-average power OPCPA system that produces CEP-stable, few-cycle pulses centered at 2.1 µm. The system was built at the Helmholtz-Zentrum Berlin and serves as a driver for a table-top, coherent, ultrashort-pulse soft X-ray source.

HTu2B.2 • 10:45
The Apollon laser facility upgrade to the multi-PW level, Dimitrios N. Papadopoulos[2], François Mathieu[1]; [2]*LULI, France.* The Apollon laser facility has recently increased its peak power capacity to the 3.7 PW level. In this presentation we discuss the commissioning of the laser system and provide feedback from the first experimental campaigns.

HTu2B.3 • 11:00
Amplification of high-energy single-cycle pulses, Eiji J. Takahashi[1]; [1]*RIKEN, Japan.* The advanced DC-OPA scheme has achieved carrier-to-envelope phase-stable mid-infrared laser pulses for a bandwidth of over one octave with an output pulse energy of 53 mJ, and a peak power of 6 TW.

HTu2B.4 • 11:15
Coherent combination of large-scale high-energy Nd:glass laser amplifiers, Pierre Lebegue[1,2], Dimitrios N. Papadopoulos[2], Frédéric Druon[1]; [1]*Laboratoire Charles Fabry,*

France; [2]Laboratoire pour l'utilisation des Lasers Intenses, France. We present, for the first time, coherent beam combination of 10 Joules nanosecond pulses in a Sagnac-interferometer configuration including large-diameter Nd:glass amplifiers. Efficiency over 90 % is demonstrated while maintaining good stability between shots.

HTu2B.5 • 11:30 (Invited)
Performance testing of the Faraday isolator for a 100J/10Hz pulsed laser, Ondrej Slezak[1], David Vojna[1], Jan Pilar[1], Martin Divoky[1], Ondrej Denk[1], Martin Hanus[1], Petr Navratil[1], Martin Smrz[1], Antonio Lucianetti[1], Tomas Mocek[1]; *[1]HiLASE Centre, Inst. of Physics, Czech Academy of Sciences, Czechia.* The Faraday isolator for a 100J/10Hz pulsed laser operated at HiLASE Centre has been demonstrated recently. The new measurements which were done with this device will be presented. Among the others the first tests with the TGG ceramics made magneto-active media will be shown. The other measurements are focused mainly to the thermal-stress induced birefringence suppression and the overall quality of the laser beam passing through the isolator.

HTu2B.6 • 12:00
Emerging Ultra-Fast Multi-Terawatt Long-Wave Infrared Lasers, Igor V. Pogorelsky[1], Mikhail Polyanskiy[1]; *[1]Brookhaven National Laboratory, USA.* We report on generating 9.2 mm sub-picosecond laser pulses of several joule energy and review the status of long-wave infrared laser technology that enables research spanning from particle acceleration to remote detection of ionizing sources.

HTu2B.7 • 12:15
Gas-Based Sono-Photonics Demonstrated via 20 GW-Scale Laser Pulse Deflection, Yannick Schrödel[2,1], Hanna Stawska[1], Jan Helge Dörsam[3], Claas Hartmann[3], Jiaan Zheng[1], Tino Lang[1], Max Steudel[4], Matthias Rutsch[3], Sarper H. Salman[1], Regina Schuster[4], Murat-Jakub Ilhan[4], Martin Kellert[5], Mikhail Pergament[5], Thomas Hahn-Jose[6], Sven Suppelt[3], Wim P. Leemans[1,7], Franz X. Kaertner[5,7], Ingmar Hartl[1], Anne Harth[4], Mario Kupnik[3], Christoph M. Heyl[2,1]; *[1]Deutsches Elektronen-Synchrotron DESY, Germany; [2]Helmholtz-Inst. Jena, Germany; [3]Measurement and Sensor Technology Group, Technical Univ. Darmstadt, Germany; [4]Center of Optical Technologies, Aalen Univ., Germany; [5]Center for Free-Electron Laser Science CFEL, Deutsches Elektronen-Synchrotron DESY, Germany; [6]inoson GmbH, Germany; [7]Department of Physics, Univ. of Hamburg, Germany.* We employ intense ultrasound fields in ambient air, enabling light control in extreme parameter ranges. We acousto-optically modulate 1030 nm ultrashort pulses with 20 GW peak power efficiently (> 50%), paving the way toward novel gas-based light control methods.

Olympia Mancini 3B
10:30 -- 12:30
MTu2C • Mid-IR and THz Coherent Sources I
Presider: Irina Sorokina; Norwegian Univ. of Science and Tech, Norway

MTu2C.1 • 10:30 (Invited)
Quantum cascade lasers/detectors and lab-on-chip mid-IR platforms, Benedikt Schwarz[1]; *[1]Technische Universität Wien, Austria.* The increasing interest in compact mid-infrared sensors demands a scalable technology. An overview of integrated multi-wavelength chips for liquid sensing as well as an outlook towards monolithic spectrometers using frequency

combs will be provided.

MTu2C.2 • 11:00
Optical Feedback Controlled Harmonic States in Mid-Infrared Quantum Cascade Laser Frequency Combs, Baichuan Huang[1], Nicholas Kosan[1], Gerard Wysocki[1]; *[1]Princeton Univ., USA.* An external cavity optical feedback is utilized to coherently control generation of high-order harmonic comb states in mid-infrared quantum cascade laser frequency combs with an improved coherence and up to two times broader spectral coverages.

MTu2C.3 • 11:15 (Invited)
Recent Progress in SESAM-modelocked Femtosecond Cr:ZnS Lasers at 2.4 µm, Ajanta Barh[1]; *[1]Technical Univ. of Denmark, Denmark.* The development of high-quality InGaSb-based SESAMs has enabled self-started low-noise and high-power femtosecond Cr:ZnS lasers at 2.4 µm. Their performance, recent progress, and suitability in dual-comb applications will be discussed in the talk.

MTu2C.4 • 11:45
Post-compression of 5 µm Pulses to 53 fs with millijoule Energy in ZnSe, Uwe Griebner[1], Martin Moerbeck-Bock[1], Lorenz von Grafenstein[1]; *[1]Max Born Inst., Germany.* Compact nonlinear compression of few-cycle multi-mJ pulses at 4.9-µm is presented. Using ZnSe as nonlinear medium for spectral broadening of 95-fs pulses, a duration of 53 fs with 1.9 mJ energy is achieved after compression.

MTu2C.5 • 12:00 (Invited)
High-brightness 7-octave spanning CEP-stable ultrafast source, Ugaitz Elu[1], Luke Maidment[1], Lenard Vamos[1], Julita Poborska[1], Igor Tyulnev[1], Francesco Tani[2], David Novoa[2], Michael H. Frosz[2], Valeriy Badikov[3], Dmitrii Badikov[3], Valentin Petrov[3], Philip St. J. Russell[2], Jens Biegert[1,4]; *[1]ICFO, Spain; [2]Max-Planck Inst. for Science of Light, Germany; [3]Max-Born-Inst. for Nonlinear Optics and Ultrafast Spectroscopy, Germany; [4]ICREA, Spain.* We present an ultra-broadband carrier-envelope-phase stable ultrafast source spanning from 340 nm to 40,000 nm with up to 5 orders of magnitude higher brightness than the brightest synchrotron. This source is ideal for multidimensional spectroscopy.

Olympia Mancini 3A
13:30 -- 15:30
ETu3A • Accelerator and Wakefield Based Sources
Presider: Alex Murokh; RadiaBeam Technologies, LLC., United States

ETu3A.1 • 13:30 (Invited)
X-ray Light Sources driven by laser-plasma acceleration for high energy density science applications, Félicie Albert[1]; *[1]Lawrence Livermore National Laboratory, USA.* We present recent experimental developments of x-ray sources based on laser-wakefield acceleration of electrons with high-intensity lasers. They are developed for applications including non-destructive imaging and high energy density science at mid- and large-scale laser facilities.

ETu3A.2 • 14:00
Withdrawn

ETu3A.3 • 14:15
Prospects for extreme light sources at the CERN accelerator complex, Eduardo Granados[1], Bruce Marsh[1], Valentin N. Fedosseev[1], Mieczyslaw Witold Krasny[1], Andrea Latina[1], Vlad Musat[1,2], Roberto Corsini[1], Aurelien Martens[3], Fabian Zomer[3], Kevin Cassou[3], Ronic Chiche[3], Kevin Dupraz[3], Daniele Nutarelli[3], Eric Cormier[4], Giorgio Santarelli[5], Yann Dutheil[1]; *[1]CERN, Switzerland; [2]Department of Physics, Univ. of Oxford, UK; [3]IJClab, Universite Paris-Saclay, France; [4]LP2N, Universite de Bordeaux, France; [5]ILE, France.* The unique parameter space of CERN's ultra-relativistic particle beams offers tremendous opportunities for extreme light production at photon energies ranging from the Soft X-rays to Gamma-rays when paired to state-of-the-art high-power lasers.

ETu3A.4 • 14:30 (Invited)
Using spatio-temporal couplings for controlling group velocity in seeded soft X-ray lasers, Stephane Sebban[1]; *[1]Laboratoire d'Optique Appliquée, France.* Plasma is a negative dispersion medium in which the propagation velocity of a wave depends on its wavelength. Controlling the group velocity of an ultrashort laser pulse by means of spatio-temporal couplings has been proposed to overcome the inherent limitations in laser–plasma interactions. Here we will present recent results showing how this method improves the performance of a SXRL (1), which intrinsically suffers from group velocity mismatch between the infrared pump beam.

ETu3A.5 • 15:00
A Compact Short-Wavelength Free-Electron Laser driven by a Two-Beam Acceleration Scheme, Philippe Piot[2,1]; *[1]Northern Illinois Univ., USA; [2]APS/ASD, Argonne National Laboratory, USA.* The paper discusses our progress toward a compact wavelength free-electron laser at soft X-ray wavelength based on a two-beam acceleration scheme. We especially discuss status of experiments dedicated to demonstrate key components and numerical simulation of the integrated accelerator.

ETu3A.6 • 15:15
Characterization and Optimization of 100 kHz Attosecond GHHG Beamlines at ELI ALPS Facility, Massimo De Marco[1], Tamás Csizmadia[1], Lénárd Gulyás Oldal[1], Zoltán Filus[1], Tímea Grósz[1], Chinmoy Biswas[1], Péter Jójárt[1], Imre Seres[1], Zsolt Bengery[1], Barnabás Gilicze[1], Subhendu Kahaly[1], Katalin Varjú[1], Balázs Major[1]; *[1]ELI ALPS, Hungary.* The stability of the HR HHG beamlines at the ELI ALPS laser facility (Hungary) was studied, and the XUV generation was simulated for the main physical parameters to improve the beamline efficiency.

Olympia Mancini 3B
13:30 -- 15:30
MTu3C • Mid-IR and THz Coherent Sources II

Presider: Helena Jelinkova; Czech Technical Univ. in Prague, Czechia

MTu3C.1 • 13:30 (Invited)
Novel Ultrafast 2 µm Sources for THz Generation, Clara J. Saraceno[1]; [1]*Ruhr Universität Bochum, Germany.* We will discuss latest advances in laser-driven high-power ultrafast Terahertz sources and future directions in this field, including the development of powerful ultrafast short-wave infrared lasers at 2.1µm that could help improve a variety of secondary sources.

MTu3C.2 • 14:00
In-Band Pumped Kerr-Lens Mode-Locked Tm,Ho-codoped Calcium Aluminate Laser, Huang-Jun Zeng[1,2], Wen-Ze Xue[1,2], Cui Chen[1,3], Li Wang[1,4], Zhongben Pan[5], Robert Murray[6], Pavel Loiko[7], Xavier Mateos[8], Ge Zhang[2], Uwe Griebner[1], Valentin Petrov[1], Weidong Chen[1,2]; [1]*Max Born Inst., Germany;* [2]*Fujian Inst. of Research on the Structure of Matter, CAS, China;* [3]*Xinjiang Technical Inst. of Physics and Chemistry, CAS, China;* [4]*Anhui Inst. of Optics and Fine Mechanics, CAS, China;* [5]*Shandong Univ., China;* [6]*Imperial College, UK;* [7]*Université de Caen Normandie, France;* [8]*Universitat Rovira i Virgili, Spain.* We report on a Kerr-lens mode-locked Tm,Ho,Lu:$CaGdAlO_4$ laser, in-band pumped by a fiber Raman laser at 1678 nm. 79-fs pulses were generated at 2073.6 nm with an average power of 91 mW at 85.7 MHz.

MTu3C.3 • 14:15
Planar Er:$LiYF_4$ Waveguide Laser at 2.8 µm, Ji Eun Bae[1], Pavel Loiko[1], Gurvan Brasse[1], Abdelmjid Benayad[1], Alain Braud[1], Patrice camy[1]; [1]*CIMAP, Université de Caen Normandie, France.* We report on mid-infrared laser operation of heavily Er^{3+}-doped $LiYF_4$ layers grown by Liquid-Phase Epitaxy. The planar waveguide laser generated 47 mW at ~2808 nm with a laser threshold of 67 mW and linear polarization.**MTu3C.4 • 14:30**
Monolithic Fiber Laser Emitting at 3920 nm Based on Ho3+:InF3, Tommy T. Boilard[1], Vincent Fortin[1], Maxime Lemieux-Tanguay[1], Paul Du Teilleul[2], Jean-Yves Carrée[2], Réal Vallée[1], Martin Bernier[1]; [1]*COPL, Université Laval, Canada;* [2]*Le Verre Fluoré, France.* An output of 1 W at 3920 nm is demonstrated from a monolithic all-fiber laser in a holmium-doped fluoroindate fiber, bonded by a pair of high reflectivity fiber Bragg gratings written in the active fiber.

MTu3C.5 • 14:45
Multi-Watt-Level Dual-Wavelength Pumped Heavily Erbium-Doped All-Fiber Laser at 3.8 µm, Maxime Lemieux-Tanguay[1], Tommy T. Boilard[1], Pascal Paradis[1], Réal Vallée[1], Martin Bernier[1]; [1]*Laval Univ., Canada.* A dual-wavelength pumped Er^{3+}:ZrF_4 all-fiber laser generating a maximum output power of 2 W at 3.79 µm is reported with a novel pumps absorption dependency for heavily erbium-doped fiber laser.

MTu3C.6 • 15:00 (Invited)
High-power Ultrashort Pulse LWIR Lasers and Applications, Sergei Tochitsky[1]; [1]*Univ. of California Los Angeles, USA.* Advent of high-power, picosecond CO_2 lasers opened new avenues in nonlinear optics and particle acceleration. Development of CO_2 amplifiers of 0.3-3 ps

pulses in the 4-16 mm range at a GW-TW power level is discussed.

Olympia Mancini 1
13:30 -- 15:30
HTu3B • Novel Schemes for Ultrashort Pulses
Presider: Giulia Mancini; Universita degli Studi di Pavia, Italy

HTu3B.1 • 13:30
Pulse compression in a multipass cell delivering 100 W, mJ-level, two-cycle pulses at 1.9 µm wavelength, Ziyao Wang[1], Tobias Heuermann[1,2], Yi Zhang[1,2], Philipp Gierschke[1,3], Mathias Lenski[1], Jan Rothhardt[1,2], Jens Limpert[1,2]; *[1]Inst. of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Univ. Jena, Germany; [2]Helmholtz-Inst. Jena, Germany; [3]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We report on the nonlinear pulse compression in a gas-filled multipass cell, delivering mJ-level, two-cycle pulses at 1.9 µm wavelength with 100 W average power at 100 kHz repetition rate.

HTu3B.2 • 14:00
Compact, folded multi-pass cells for post-compression of high-energy pulses, Arthur Schönberg[1], Supriya Rajhans[1], Nikita Khodakoskiy[1], Esmerando Escoto[1], Victor Hariton[1], Ingmar Hartl[1], Christoph M. Heyl[1,2]; *[1]Deutsches Elektronen-Synchrotron DESY, Germany; [2]Helmholtz-Inst. Jena, Germany.* We experimentally demonstrate the efficient post-compression of 8 mJ pulses from 1 picosecond to 51 femtoseconds using a novel, energy-scalable, folded MPC, providing a path towards compact, high-energy pulse post-compression.

HTu3B.3 • 14:15
Efficient Few-cycle Pulses Compression for 0.1-TW Sub-cycle Transient, Shaobo Fang[1,2], Yuzhe Liu[1,2], Zhidong Chen[1,2], Senchi Yang[1,2]; *[1]Inst. of Physics, Chinese Academy of Sciences, China; [2]Univ. of Chinese Academy of Sciences, China.* We provide a high-efficient, solid-based cascade compression technique from sub-200 fs to few-cycle regime with peak power increased over 10-fold. We foresee this scheme enables a high repetition rate pumping source for intense XUV generation.

HTu3B.4 • 14:30
A Single-stage Dispersion-Controlled Multi-Pass Cell Setup to Efficiently Drive Resonant Dispersive Wave Emission, Lorenzo Pratolli[2], Laura Silletti[2], Teodora Grigorova[3], Christian Brahms[3], Ammar B. Wahid[2], Esmerando Escoto[1], Supriya Rajhans[2], Katinka Horn[4,5], Lutz Winkelmann[1], Vincent Wanie[2], Andrea Trabattoni[2,6], Christoph M. Heyl[1], John C. Travers[3], Francesca Calegari[2]; *[1]DESY, Germany; [2]Center for Free-Electron Laser Science, Germany; [3]School of Engineering and Physical Sciences, Heriot-Watt Univ., UK; [4]ETH Zürich, Switzerland; [5]Center for Molecular and Water Science, Germany; [6]Inst. of Quantum Optics, Leibniz Univ., Germany.* An Ytterbium laser is compressed to sub-20fs by a single-stage multi-pass cell and used to produce tunable ultraviolet resonant dispersive wave (RDW) emission in a hollow-core fibre at 50kHz repetition rate and 12.5W average power.

HTu3B.5 • 14:45
High-brightness 100-kHz source of ultrashort pulses tunable in 200-1050 nm spectral range, Valentina Shumakova[1], Thomas Braatz[1], Luke Maidment[1], Alice Autuori[1], Bastian Manschwetus[1], Philipp Merkl[1], Hossein Goudarzi[1], Sebastian Starosielec[1], Mark Prandolini[1], Michael Schulz[1], Robert Riedel[1], Heye Buss[1]; *[1]Class 5 Photonics GmbH, Germany.* We present a multi-channel 100-kHz tunable table-top laser source of sub-50 fs pulses, based on an optical parametric chirped pulse amplification (OPCPA) and a multi-pass cell (MPC) post-compression technologies.

HTu3B.6 • 15:00
Spatially Chirped Pulses for Multipass Spectral Broadening, Aref Imani[1], Paolo Carpeggiani[1], Edgar Kaksis[1], Dimitar Popmintchev[1], Tenio Popmintchev[1,2], Audrius Pugzlys[1], Andrius Baltuška[1]; *[1]Photonics Inst., Technische Universität Wien, Austria; [2]Physics Department, Univ. of California San Diego, USA.* Gas-filled Multi-Pass Cells are commonly used for pulse spectral broadening via SPM, but pulse energy scaling requires larger setups. We propose and verify experimentally the use of spatially chirped pulses to reduce the setup footprint.

HTu3B.7 • 15:15
Dispersion engineering in nonlinear multipass cells to enhance pulse quality, Maximilian Karst[2,3], Maximilian Benner[2], Philipp Gierschke[1,4], Henning Stark[2,4], Jens Limpert[2,4]; *[1]Inst. of Applied Physics (Germany), Germany; [2]Inst. of Applied Physics, Friedrich Schiller Univ. Jena, Germany; [3]Helmholtz-Inst. Jena, Germany; [4]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We present a dispersion-engineered multipass cell operating in the enhanced frequency chirping regime. Reshaping of the nonlinear interaction allows 96% of the energy to be contained in the temporal main feature of the mJ-class pulses.

Olympia Mancini 2
15:30 -- 16:30
JTu4A • Joint Poster Session I

JTu4A.1
Raman time-delay in attosecond transient absorption of strong-field created krypton vacancy, Li Wang[1,2], Xiaowei Wang[1,2], Zengxiu Zhao[1,2], Jing Zhao[1,2]; *[1]National Univ. of Defense Technology, China; [2]National Univ. of Defense Technology, Hunan Key Laboratory of Extreme and Applications, China.* We observed the absorptions of two spin-orbit split states are modulated at different paces during krypton vacancy creation. Comparison between theory and experiments uncovers that coherent Raman coupling induces time-delay between the resonant absorptions.

JTu4A.2
Terawatt hard X-ray pulses using self-seeded FEL, Inhyuk Nam[1], Seongyeol Kim[1], Chang-kyu Sung[1], Kook-Jin Moon[1]; *[1]Pohang Accelerator Laboratory, Korea (the Republic of).* We report a terawatt-scale XFEL using an Enhanced Self-Amplified Spontaneous Emission scheme (E-SASE) and self-seeded FELs, manipulating electron beams with external laser, which will open new fields in nonlinear X-ray science and single molecular imaging.

JTu4A.3
Spectrally Selective Excitation of Electric Dipole and Magnetic Dipole Transitions in $Eu^{3+}Y_2O_3$ Nanostructures, Elizaveta Gangrskaia[1], Alessandra Bellissimo[1], Valentina Shumakova[1], Sarah Pulikottil Alex[1], Ignác Bugár[1], Lorenz Grünewald[2,3], Sebastian Mai[2], Thomas Schachinger[4], Dariusz Pysz[5], Ryszard Buczynski[5], Andrius Baltuška[1,6], Audrius Pugzlys[1,6]; *[1]Photonics Inst., Technische Universität Wien, Austria; [2]Inst. of Theoretical Chemistry, Faculty of Chemistry, Univ. of Vienna, Austria; [3]Vienna Doctoral School in Chemistry (DoSChem), Univ. of Vienna, Austria; [4]Univ. Service Centre for Transmission Electron Microscopy (USTEM), Technische Universität Wien, Austria; [5]Lukasiewicz Research Network - Inst. of Microelectronics and Photonics, Poland; [6]Center for Physical Sciences & Technology, Lithuania.* Implementing Stimulated Raman Scattering and spectral focusing in a long nonlinear crystal, we generate narrowband tunable ultrafast pulses for selective excitation of electric or magnetic dipole transitions in a FIB-fabricated $Eu^{3+}Y_2O_3$ nanostructure.

JTu4A.4
Aperiodic Ultrashort-Pulse Vernier Bursts, Vinzenz Stummer[1], Matthias Schneller[1], Edgar Kaksis[1], Tobias Floery[1], Markus Zeiler[1], Audrius Pugzlys[1,2], Andrius Baltuška[1,2]; *[1]Photonics Inst., TU Wien, Austria; [2]Center for Physical Sciences & Technology, Lithuania.* We demonstrate that the Vernier burst technique shows remarkable capabilities in generating aperiodic bursts of ultrashort pulses. Offering precise control through individual-pulse amplitude modulation, it enables unprecedented versatility in the shaping of ultrashort-pulse bursts.

JTu4A.5
Concept for TW-class Infrared Sub-Cycle Pulse Generation in Gas-filled Capillaries, Martin Gebhardt[1], Nikoleta Kotsina[1], Teodora Grigorova[1], Joleik Nordmann[1], Michael Heynck[1], Christian Brahms[1], John C. Travers[1]; *[1]School of Engineering and Physical Sciences, Heriot-Watt Univ., UK.* We present a design for the generation of TW-class infrared sub-cycle pulses. The concept is based on compressing state-of-the-art, multi-mJ pulses from parametric amplification in a set of hollow capillaries with individually controlled pressure points.

JTu4A.6
Extreme Soliton Sources for Driving Strong-Field Physics, Nikoleta Kotsina[1], Teodora Grigorova[1], Michael Heynck[1], Joleik Nordmann[1], Martin Gebhardt[1], Christian Brahms[1], John C. Travers[1]; *[1]Heriot-Watt Univ., UK.* We describe work towards generating terawatt-scale sub-femtosecond laser pulses in the visible and near-infrared, and sub-millijoule few-femtosecond pulses in the vacuum and deep ultraviolet. This source will be used to drive strong-field physics in new regimes.

JTu4A.7
Comparison of pulse duration measurement techniques in the few-cycle regime, Viktor Pajer[1], János Bohus[1], Levente Lehotai[1], Mikhail Kalashnikov[1], Imre Seres[1], Barnabás Gilicze[1], Bálint Kiss[1], Ádám Börzsönyi[1], Katalin Varjú[1], Gábor Szabó[1], Roland Nagymihály[1]; *[1]ELI-ALPS, Hungary.* We measured the duration of few-cycle pulses with different characterization techniques (d-scan, SRSI and TIPTOE) at four post-compression stages. We compared the retrieved temporal shapes, spectra and phases to see their reliability and limitations.

JTu4A.8
High Energy Picosecond laser for ICS X-ray source, Antoine Courjaud[1], Jean-Gabriel Brisset[1], Florent Pallas[1], Emilien Gontier[1], Pasquale Pagliusi[2], Raffaele Agostino[2]; *[1]Amplitude*

Laser, France; [2]Univ. of Calabria, Italy. We report a Yb laser delivering 500mJ at 100Hz repetition rate and 5ps pulse duration, fully synchronized to an accelerator in order to generate X-rays ranging from 17 to 350keV through Inverse Compton Scattering.

JTu4A.9
Semiconductor optical amplifier used as fibered arbitrary waveform generator for high energy applications, Raphaël Humblot[2,1], Loïc Meignien[2], Frédéric Druon[1], Joanna De Sousa[2], Cyril Rapenaud[2], Sophie Baton[2], Patrick Audebert[2]; *[1]Université Paris-Saclay, Institut d'Optique Graduate School, CNRS, Laboratoire Charles Fabry, France; [2]LULI-CNRS, CEA, Université Sorbonne, Ecole Polytechnique, Institut Polytechnique de Paris, France.* Generation of arbitrary-temporally-shaped optical pulses in an all-fiber MOPA seeder system integrating a Semiconductor Optical Amplifier is demonstrated. This system is successfully used as a seeder in a 200 J nanosecond laser chain.

JTu4A.10
The Apollon laser facility: operational aspects of the multi-PW beam line, Fabrice Gobert[1], François Mathieu[1], Dimitrios N. Papadopoulos[1]; *[1]LULI APOLLON, France.* The Apollon laser facility reached recently the 3.7 PW operational level. In this presentation we discuss the main development works of the 10 PW beamline such as the compressor qualification and the last stage amplifier.

JTu4A.11
Quantum computer-based first principles simulation of high harmonic generation, Hiroki Gi[1], Yuki Orimo[1], Kenichi Ishikawa[1], Yukio Kawashima[2], Tanvi Gujarati[2], Takeshi Sato[1]; *[1]The Univ. of Tokyo, Japan; [2]IBM Quantum, Japan.* We have successfully calculated the high harmonic generation from one-dimensional helium model irradiated by an intense laser pulse on an actual quantum computer using the time-dependent optimized unitary coupled cluster and the Natural-Expansion ansatz.

JTu4A.12
Withdrawn

JTu4A.13
Sub-2-cycle nonlinear compression of multi-mJ energy Ti:Sapphire laser pulses in a multipass cell, Jaismeen Kaur[1], Louis Daniault[1], Cédric Sire[2], François Sylla[2], Rodrigo Lopez-Martens[1]; *[1]Laboratoire d'Optique Appliquée (LOA), France; [2]SourceLAB, France.* We report on the nonlinear temporal compression of multi-mJ energy laser pulses from an ASTRELLA USP 1 kHz Ti:Sapphire laser amplifier in a gas-filled multipass cell. The > 5 mJ energy pulses are compressed in a single stage from 40 fs down to sub-5 fs with > 50% global efficiency and excellent spatio-temporal beam quality.

JTu4A.14
Spatially homogenized post-compression in a single thin plate, Levente Lehotai[1], Viktor Pajer[1], János Bohus[1], Balázs Tari[1], Bálint Kiss[1], Mikhail Kalashnikov[1], Károly Osvay[2], Ádám Börzsönyi[1], Roland Nagymihály[1]; *[1]ELI-ALPS, ELI-HU Non-Profit Ltd., Hungary; [2]National Laser-Initiated Transmutation Laboratory, Hungary.* Apodization was combined with thin plate post-compression of 30 fs laser pulses to achieve spatio-spectrally homogeneous broadened output. This method allows for simulating petawatt-class post-compression in small-scale experiments, while energy upscaling is in progress.

JTu4A.15
Post-compression of 2 mJ pulses via loose focusing in a gas cell, Fengling Zhang[1,2], Antonios Pelekanidis[1,2], Matthias Gouder[1,2], Augustas Karpavicius[1,2], Kjeld S. Eikema[1,2], Stefan Witte[1,2]; [1]*ARCNL, Netherlands;* [2]*Department of Physics and Astronomy, Vrije Universiteit, Netherlands.* We report on a novel double-pass-based scheme for nonlinear pulse compression, which operates at multi-mJ pulse energy while maintaining high beam quality, and features extreme simplicity, high compression efficiency, and average power scaling capabilities.

JTu4A.16
Flexible XUV source at high repetition rate with multiple output mode selection: photon energy, temporal resolution, spectral resolution, Aura I. Gonzalez[1], Franck Falcoz[1]; [1]*Amplitude Technologies, France.* We report the development of a flexible XUV source with two outputs: "*Low*" (20 – 36 eV) and "*High"* (30 – 200 eV). The *Low* output can be tuned between high temporal/spectral resolution mode (< 30fs /<50meV).

JTu4A.17
Withdrawn

JTu4A.18
Industrial Flexible Laser System for Ultrafast Pulses at Multi-10mJ or kW Level, Michael Scharun[1], Dominik Bauer[1], Benjamin Dannecker[1], Helge Hoeck[1], Klaus Albers[1], Alexander Killi[1]; [1]*Trumpf Laser GmbH, Germany.* We present an industrial flexible laser system utilizing fibre, rod, slab and thin-disk multipass amplifier stages to generate ultrafast pulses with 10mJ at 1ps or 40mJ at 120ps only depending on seed source.

JTu4A.19
Fast Phase Retrieval for Broadband Attosecond Pulses Characterization, Jiacan Wang[1,2], Xiaowei Wang[1,2], Zengxiu Zhao[1,2]; [1]*National Univ. of Defense Technology, China;* [2]*National Univ. of Defense Technology, Hunan Key Laboratory of Extreme Matter and Applications, China.* We propose a fast phase retrieval algorithm for broadband attosecond pulse characterization with omega oscillation filtering technique. A new error function is introduced and solved with steepest descent methods to improve the speed and accuracy.

JTu4A.20
Amplification of Supercontinuum Seed Pulses at 1.1–1.4 μm by Cascade Rotational SRS in Compressed Hydrogen, Paulius P. Mackonis[1], Augustinas Petrulenas[1], Auguste Černeckyte[1], Aleksej Rodin[1]; [1]*Ctr for Physical Sciences & Technology, Lithuania.* Multiple higher-order Stokes of stimulated rotational Raman scattering (SRRS) in compressed hydrogen covered the wavelength range from ~1078 nm to ~1355 nm using ~1.2 ps pump pulses from a Yb:YAG laser.

JTu4A.21
New Grating Compressor Designs for XCELS and SEL-100 PW Projects, Efim A. Khazanov[1]; [1]*Gaponov-Grekhov Inst. of Applied Physics of the Russian Academy of Sciences, Russian Federation.* Out-of-plane compressor parameters ensuring maximum power of the output pulse were found analytically. For 160-cm long gratings, an optimal design enables 111 PW for XCELS and 120 PW for SEL-100 PW.

JTu4A.22
Narrow-linewidth high-stability nanosecond laser source for dual-wavelength long-duration VISAR plasma analysis, Raphaël Humblot[2,1], Loïc Meignien[2], Frédéric Druon[1], Patrick Audebert[2]; [1]*Université Paris-Saclay, Institut d'Optique Graduate School, CNRS, Laboratoire Charles Fabry, France;* [2]*LULI-CNRS, CEA, Université Sorbonne, Ecole Polytechnique, Institut Polytechnique de Paris, France.* We demonstrate a laser source generating mJ-level temporally-flat-top pulses of arbitrary duration between 1 ns and 100 ns simultaneously at 1064 nm and 532 nm operating at 10 Hz with 0.3 % RMS energy stability.

JTu4A.23
Nonlinear Optics of Complex Spatio-Temporal Pulses, Michael H. Helle[1]; [1]*Naval Research Laboratory, USA.* We will discuss ongoing research examining nonlinear optics of complex spatio-temporal pulses. Numerical results as well as a method to adaptively generate such pulses using a fully programmable laser field shaping technique will be presented.

JTu4A.24
Withdrawn

JTu4A.25
Enhancement of Surface High-Harmonic Generation Efficiency through Soliton Dynamics, Michael Heynck[1], Teodora Grigorova[1], Nikoleta Kotsina[1], Martin Gebhardt[1], Joleik Nordmann[1], Christian Brahms[1], John C. Travers[1]; [1]*Heriot-Watt Univ., UK.* Using numerical simulations we show that the use of soliton dynamics in gas-filled hollow-core capillaries can alter the waveform of a laser pulse and enhance the efficiency of surface high harmonic generation.

JTu4A.26
Unsupervised Deep Learning for Ptychography, Carmelo Grova[1], Charles S. Bevis[1], Nicola Giani[1], Daniel Adams[2], Giulia F. Mancini[1], Giovanni Pellegrini[3]; [1]*Department of Physics, Univ. of Pavia, Laboratory for Ultrafast X-ray and Electron Microscopy (LUXEM), Italy;* [2]*Department of Physics, Colorado School of Mines, USA;* [3]*Department of Physics, Univ. of Pavia, Italy.* We couple an untrained neural network to a complete physical model that describes the image formation process in Ptychography. We demonstrate high fidelity, full-field image reconstruction with ×5 less diffraction patterns for real-time ultrafast microscopy.

JTu4A.27
Withdrawn

Olympia Mancini 3A
16:30 -- 17:30
ETu5A • Laser Plasma Sources
Presider: Manasa Medikonda; IBM TJ Watson Research Center, USA

ETu5A.1 • 16:30 (Invited)
Laser Driven Bright X-Ray Source from Cryogenic Xenon Target, Oleg Khodykin[1], Chao Chang[1]; *[1]KLA Corporation, USA.* We present experimental results of exploratory laser driven hard x-ray source from cryogenic solid target. High intensity short pulse laser is directed onto solid Xenon target. 30keV K-Alpha and 33keV K-beta lines are well resolved from Xe emission. Conversion efficiency agrees with empirical model and experimental data reported in literatures.

ETu5A.2 • 17:00
Developments in spectral and spatial characterisation of soft x-ray emitting laser-produced plasmas, Kevin Mongey[1], Emma Sokell[1], Fergal O'Reilly[1], Ben Delaney[1], Ruairi Brady[1], John Sheil[2]; *[1]School of Physics, Univ. College Dublin, Ireland; [2]ARCNL, Netherlands.* Soft x-ray emitting laser plasmas offer a compact, affordable method of x-ray production. We present progress in experimental characterisation as well as comprehensive modelling of micrometer scale x-ray emitting laser plasmas.

ETu5A.3 • 17:15
Highly Efficient 13.5 nm Light Generation Using 2 µm Laser Driven Tin Plasma, Yahia Mostafa[1,2], Lars Behnke[1,2], Dion Engels[1,2], Zoi Bouza[1,2], John Sheil[1,2], Wim Ubachs[1,2], Oscar Versolato[1,2]; *[1]Advanced Research Center for Nanolithography, Netherlands; [2]Department of Physics and Astronomy, and LaserLaB, Vrije Universiteit Amsterdam, Netherlands.* We demonstrate highly efficient 2 µm-wavelength laser-produced plasma light sources for nanolithographic applications, reaching efficiencies of up to 5%.

Olympia Mancini 1
16:30 -- 17:30
HTu5B • Laser Technology II
Presider: Riccardo Piccoli; Univ. of Venice, Italy

HTu5B.1 • 16:30
High-Efficiency BiBO-Based OPCPA with ~2.2 mJ Output Pulses at ~2.2 µm Compressed to 25 fs, Augustinas Petrulenas[1], Auguste Černeckyte[1], Paulius P. Mackonis[1], Aleksej Rodin[1]; *[1]State research Inst. Center for Phys, Lithuania.* 3-stage BiBO-based OPCPA pumped by ~1.2 ps, ~10 mJ pulses at 1030 nm from Yb:YAG laser provides ~2.2 mJ, 25 fs output pulses at ~2150 nm after compression with a pump-to-signal conversion efficiency of ~27%.

HTu5B.2 • 16:45
Design and Implementation of a >25 TW Dual-Channel OPCPA System, Ignas Balciunas[1], Tomas Juodgalvis[1], Vytenis Girdauskas[1], Rimantas Budriunas[1], Valdas Maslinskas[1], Tomas Stanislauskas[1]; *[1]Light Conversion, Lithuania.* Presenting a dual-output OPCPA system, operating simultaneously at 100 Hz and 10 Hz repetition rates, generating independent output channels of 6 TW and 26 TW, respectively. The system incorporates an effective CEP stabilization achieving 251 mrad CEP stability exceptional for a NIR, multi-TW system.

HTu5B.3 • 17:00
High repetition rate Joule class TiSa laser for laser plasma acceleration, Christophe A. Simon-Boisson[1]; *[1]Thales LAS France, France.* Particle flux is not enough for societal applications when using TW/PW class lasers to generate high energy electron. To overcome this, we have developed a 100 Hz Joule class TiSa laser and report initial results.

HTu5B.4 • 17:15
Withdrawn

Olympia Mancini 3B
16:30 -- 17:30
MTu5C • Materials for mid-IR and THz Sources
Presider: Sergey Mirov; Univ. of Alabama at Birmingham, USA

MTu5C.1 • 16:30
Withdrawn

MTu5C.2 • 16:45
Prospects of Ho^{3+}-Doped Sesquioxide Laser Ceramics for Laser Emission at 3 µm, Kirill Eremeev[1], Pavel Loiko[1], Stanislav Balabanov[2], Timofey Evstropov[2], Denis Kosyanov[2,3], Sergey Filofeev[2], Patrice camy[1], Alain Braud[1]; *[1]CIMAP, Université de Caen Normandie, France; [2]G. G. Devyatykh Inst. of Chemistry of High-Purity Substances of RAS, Russian Federation; [3]Far Eastern Federal Univ., Russian Federation.* Ho:R_2O_3 (R = Y, Lu, Sc) transparent sesquioxide ceramics were fabricated and their mid-infrared emission properties (the $^5I_6 \rightarrow {}^5I_7$ transition) were studied at room- and cryogenic-temperatures with the goal of developing novel materials for 3-µm lasers.

MTu5C.3 • 17:00
Watt-Level 2.3 µm Thulium Laser with Intracavity Upconversion Pumping, Hippolyte Dupont[1], Timothée Lenfant[1], Lauren Guillemot[2], Xavier Delen[1], Pavel Loiko[2], Alain Braud[2], Pascal Loiseau[3], Bruno Viana[3], Thierry Georges[4], Patrick Georges[1], Frédéric Druon[1]; *[1]CNRS - Institut d'Optique, France; [2]CIMAP, France; [3]Chimie Paris, France; [4]Oxxius, France.* A Tm:YLF laser operating on the $^3H_4 \rightarrow {}^3H_5$ transition is intracavity upconversion pumped at 1.05 µm by a diode-pumped Nd:ASL laser. The continuous-wave 2.3-µm Tm-laser delivers 1.59 W at 35 W of laser diode power.

MTu5C.4 • 17:15
Comparison of GST and Sb_2S_3 Phase Change Materials for Reconfigurable Integrated Mid-Infrared Supercontinuum Sources, Marko Perestjuk[1,2], Adam Bieganski[1,2], Anas Chalak[1], Remi Armand[1], Alberto Della Torre[1], Sebastien Cueff[1], Arnan Mitchell[2], Andreas Boes[3], Jean-Michel Hartmann[4], Jean-Marc Fedeli[4], Vincent Reboud[4], Pierre Brianceau[4], Christelle Monat[1], Christian Grillet[1]; *[1]Institut des Nanotechnologies de Lyon, France; [2]RMIT Univ., Australia; [3]Univ. of Adelaide, Australia; [4]CEA-Leti, France.* We characterize the properties of two phase change materials, $Ge_2Sb_2Te_5$ and Sb_2S_3, for integrated mid-infrared photonics. Further, we demonstrate that Sb_2S_3 is suitable for reconfigurable supercontinuum generation as a broadband, coherent and intense light source.

Olympia Mancini 3A
17:45 -- 18:45
ETu6A • Laser Driven x-ray/EUV Light Sources and Applications

Presider: Don McDaniel; Energetiq Technology Inc, United States

ETu6A.1 • 17:45 (Invited)
Nanoscale Imaging with High Average Power High-Harmonic EUV and Soft-X-ray Sources, Jan Rothhardt[1]; [1]*Friedrich-Schiller-Universität Jena, Germany*. I report about recent advances concerning high-power high harmonic sources and their application to nanoscale imaging. This includes nanoscale mapping of the chemical composition of semiconductor- and biological samples and a novel water window source.

ETu6A.2 • 18:15
Metrology-class EUV light source based on broadband emission from copper-target laser produced plasma, Seth L. Cousin[1], Feng Dong[1], Matt Hetterman[1], Dave Houser[1], Patrick Naulleau[1]; [1]*EUV Tech, USA*. The performance and characteristics of our broadband EUV source derived from copper-based laser produced plasma, currently in use in our EUV reflectometer and EUV Scatterometry tools are presented for the first time in this submission

ETu6A.3 • 18:30
Multi-GHz Photoinjector Lasers for High Brightness X-ray Sources, Michael Seggebruch[1], Alex Amador[2], Shawn Betts[2], Adan Garcia[2], Daniel Gitlin[2,3], Gennady Imeshev[2], Ricardo De Luna Lopez[2], Mauricio Quinonez[2], Ferenc Raksi[2], Kelly Zapata[2], Luis Zapata[2], Allen J. Zhang[2], Christopher P. Barty[1,2]; [1]*University of California Irvine, USA;* [2]*Lumitron Technologies, Inc., USA;* [3]*The Institute of Optics, University of Rochester, USA*. We present a photogun laser (PGL) architecture that generates 11.424 GHz repetition rate, 2.0 ps FWHM, 249 nm pulses for injecting electron bunches into sequential RF buckets of a pulsed X-band linac.

Wednesday, 13 March

Olympia Mancini 1
09:00 -- 10:00
JW1A • Joint Plenary Session II
Presider: Patrick Naulleau, Lawrence Berkeley National Laboratory, United States

JW1A.1 • 09:00 (Plenary)
Advancing Metrology for Microelectronics: CHIPS Metrology Program, Marla Dowell[1]; [1]*National Inst of Standards & Technology, USA.* Under the CHIPS and Science Act of 2022, NIST is expanding its support of the microelectronics technology and manufacturing ecosystem by developing, advancing and deploying measurement technologies that are accurate, precise and fit-for-purpose.

Olympia Mancini 3A
10:30 -- 12:30
EW2A • Metrology Applications I
Presider: Manasa Medikonda; IBM TJ Watson Research Center, USA

EW2A.1 • 10:30
Correlative Fluorescence and Soft X-Ray Microscopy in an Integrated Laboratory-based Setup, Julius Reinhard[1,2], Sophia Kaleta[1], Johann Jakob Abel[1], Felix Wiesner[1], Martin Wünsche[1,2], Eric Seemann[3], Martin Westermann[4], Thomas Weber[1], Jan Nathanael[1,2], Alexander Iliou[5], Henryk Fiedorowicz[6], Falk Hillmann[5,7], Christian Eggeling[8,9], Gerhard G. Paulus[1,2], Silvio Fuchs[2,10]; [1]*Inst. of Optics and Quantum Electronics, Univ. of Jena, Germany;* [2]*Helmholtz Inst. Jena, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Germany;* [3]*Inst. of Biochemistry I, Jena Univ. Hospital, Germany;* [4]*Electron Microscopy Center, Jena Univ. Hospital, Germany;* [5]*Leibniz Inst. for Natural Product Research and Infection Biology, Hans Knöll Inst. (Leibniz-HKI), Germany;* [6]*Inst. of Optoelectronics, Military Univ. of Technology, Poland;* [7]*Biochemistry/Biotechnology, Faculty of Engineering, Hochschule Wismar Univ. of Applied Sciences Technology, Business and Design, Germany;* [8]*Leibniz Inst. of Photonic Technology e.V., Germany;* [9]*Inst. of Applied Optics and Biophysics, Friedrich Schiller Univ. Jena, Germany;* [10]*Laserinstitut Hochschule Mittweida, Univ. of Applied Science Mittweida, Germany.* We present an integrated correlative fluorescence and soft X-ray microscope in the water-window spectral range employing a laser-produced plasma as a source. Demonstration experiments with fluorescent nanoparticles, bacteria and various cell lines are shown.

EW2A.2 • 11:00
Direct Signatures of Light-Driven Bands in Ultrafast Nonlinear Optical Excitations, Anna Galler[1,2], Angel Rubio[2,3], Ofer Neufeld[2]; [1]*Inst. of Theoretical and Computational Physics, Graz Univ. of Technology, Austria;* [2]*Theory Department, MPI for the Structure and Dynamics of Matter, Germany;* [3]*Center for Computational Quantum Physics, Flatiron Inst., USA.* We theoretically show that strong-field nonlinear optical transitions in solids, which are the basis for a plethora of physical phenomena, map the structure of the Floquet light-dressed electronic bands, opening new possibilities for ultrafast spectroscopy.

EW2A.3 • 11:15
Optical coherence tomography of encapsulated two-dimensional materials using extreme ultraviolet radiation from high-harmonic generation sources, Felix Wiesner[1,2], Julius

Reinhard[1,2], Johann Jakob Abel[1], Martin Wünsche[1,2], Gerhard G. Paulus[1,2], Silvio Fuchs[2,3]; *[1]Friedrich Schiller Univ. Jena, Germany; [2]Helmholtz Inst. Jena, Germany; [3]Univ. of Applied Sciences Mittweida, Germany.* We present the investigation of encapsulated two-dimensional materials with extreme ultraviolet (EUV) coherence tomography. This method is demonstrated on encapsulated graphene using EUV radiation produced by a high-harmonic generation source.

EW2A.4 • 11:30
Single-shot spatial coherence studies of plasma based X-ray laser, Martin Albrecht[1], Ondrej Hort[1], Michaela Kozlova[1,2], Miroslav Krus[2], Jaroslav Nejdl[1,3]; *[1]The Extreme Light Infrastructure ERIC, Czechia; [2]Inst. of Plasma Physics, Czechia; [3]Czech Technical Univ. in Prague, Czechia.* We present a single-shot method of spatial coherence measurement based on the evaluation of the far-field diffraction pattern from a specially designed 1D and 2D binary masks. The method was demonstrated using a plasma-based Zn X-ray laser.

EW2A.5 • 11:45
Laser-Compton Source-Driven Nuclear Functional Imaging Via Isotope-Specific Resonance Phenomena, Trevor Reutershan[1], Christopher Barty[1]; *[1]Univ. of California - Irvine, USA.* Nuclear resonance fluorescence is the process by which atomic nuclei absorb and emit radiation. We discuss the possibility of using laser-Compton sources to interrogate these transitions for isotope selective biological functional imaging.

EW2A.6 • 12:00
Frequency resolved cross correlation between XUV high harmonics and IR fundamental laser pulses by transient multiphoton absorption spectroscopy in gases, Juliette Dubois[2,1], Leonardo Rico[2], Julien Gautier[1], Fabien Tissandier[1], Boris Vodungbo[2], Camille Lévêque[2], Jérémie Caillat[2], Richard Taïeb[2], Guillaume Lambert[1]; *[1]Laboratoire d'Optique Appliquée, France; [2]Laboratoire de Chimie - Physique Matière et Rayonnement, France.* A new technique gives access to temporal and spectral characteristics of femtosecond duration XUV pulses. It is based on a frequency resolved cross-correlation between XUV and IR lasers, through a transient absorption in gases.

EW2A.7 • 12:15
Atomic/Ion Velocity Measurements Using Isotopic Resonant Transitions Stimulated by Laser-Compton Radiation, Trevor Reutershan[1], Jennifer Mettler[1], Eric C. Nelson[1], Christopher Barty[1]; *[1]Univ. of California - Irvine, USA.* The intensity of nuclear resonant transitions is largely dominated by atomic motion. Laser-Compton sources have the capability to measure these Doppler spectrum shifts and a method of atomic velocity measurements is presented.

Olympia Mancini 1
10:30 -- 12:30
HW2B • High-brightness Secondary Sources and Applications: THz, X-ray, Gamma Ray, Particle Beams
Presider: Thomas Metzger; TRUMPF Scientific Laser GmbH + Co KG, Germany

HW2B.1 • 10:30 (Invited)
Dynamic Ultrafast X-ray Imaging of Shocks in Water, Carolyn Kuranz[1], M.D. Balcazar, H-E Tsai, T Ostermayr, M Trantham, S Hakimi, R Jacob, P Campbellv, Y Ma, P King, R Simpson, E

Grace, Kettle, E Los, F Albert, J Van Tilborg, SPD Mangles, J Nees, E Esarey, CGR Geddes, AGR Thomas; *[1]Univ. of Michigan, USA.* Small-scale hydrodynamic structure in high-energy-density plasmas requires a diagnostic with sub-micron, picosecond resolution. We utilized a betatron x-ray source to dynamically observe the evolution of a shockwave in water with unprecedented spatio-temporal resolution.

HW2B.2 • 11:00
Significant Increase of Performances of a kHz Laser-Plasma Accelerator Using a H2 Plasma, Josephine Monzac[1], Slava Smartsev[1], Julius Huijts[3], Lucas Rovige[2], Igor A. Andriyash[1], Aline Vernier[1], Jaismeen Kaur[1], Antoine Cavagna[1], Zhao Cheng[1], Rodrigo Lopez-Martens[1], Jérôme Faure[1]; *[1]Laboratoire d'Optique Appliquée, France; [2]UCLA, USA; [3]Eindhoven Univ. of Technology, Netherlands.* By using a Hydrogen plasma, we significantly increased the performances of our kHz laser-plasma accelerator. We achieved excellent level of stability both on the spectrum and the spatial profile of the electron beam.

HW2B.3 • 11:15
Intense Few-Cycle Light Transients from the Terahertz to the Visible Domain Empowered by Hollow-Core Fibers, Riccardo Piccoli[1,2], Young-Gyun Jeong[2], Luca Zanotto[2], Roberto Morandotti[2], Bruno Schmidt[3], Luca Razzari[2]; *[1]Politecnico di Milano, Italy; [2]INRS-EMT, Canada; [3]few-cycle Inc, Canada.* Starting from ~50-cycle-long pulses at 1035 nm, we show how gas-filled hollow-core fibers facilitate the generation of intense few-cycle light transients from the terahertz to the visible domain.

HW2B.4 • 11:30 (Invited)
Scaling of the Fractional Angular Momenta of a Light Polarization Möbius Strip in Extreme Non Linear Optics, Thierry Ruchon[1]; *[1]CEA, France.* The spin and orbital angular momentum of light are respectively related to the rotational invariance of the polarization vector and of the spatial distribution of the light field. They may take values integer multiple of hbar per photon. But in some cases, a generalized angular momentum, taking fractional values, appears naturally. We have shown theoretically and experimentally that it is conserved during high harmonics generation, yielding beams with half integer units of hbar angular momenta.

HW2B.5 • 12:00
Laser Wakefield Acceleration with Optical Guiding on the High-Power Apollon Laser System, Ronan Lahaye[1], Kosta Oubrerie[2,1], Olena Kolonenko[1], Cédric Thaury[1]; *[1]Laboratoire d'Optique Appliquée, France; [2]LIDYL, CEA, France.* To limit diffraction in laser wakefield accelerator, a secondary laser pulse can be used to create a waveguide through optical field ionization. Here we present an optical guiding technique with density transition injection. This technique was used on the 1 PW Apollon laser system to achieve quasi-monoenergetic electron beams up to 2.15 GeV.

HW2B.6 • 12:15
Revisiting longitudinal electron acceleration with extreme focusing and ionization dynamics, Jeffrey Powell[2], Spencer W. Jolly[1], Simon Vallières[2,3], Stéphane Payeur[2], Sylvain Fourmaux[2], François Fillion-Gourdeau[2,4], Philippe Lassonde[2], Heide Ibrahim[2], Steve MacLean[2,4], François Légaré[2]; *[1]Universite Libre de Bruxelles, Belgium; [2]ALLS at INRS-EMT, Canada; [3]Inst. for Quantum Computing, Univ. of Waterloo, Canada; [4]Infinite Potential Laboratories, Canada.* We generate electrons exceeding 1 MeV by direct acceleration in a low-

density gas using longitudinal electric fields of a focused radially-polarized laser. Results depend strongly on the atomic species, explained by simulations that hint at even higher energies.

Olympia Mancini 3B
10:30 -- 12:30
MW2C • Nonlinear Frequency Conversion and Parametric Sources I
Presider: Uwe Griebner; Max Born Inst., Germany

MW2C.1 • 10:30 (Invited)
High Quantum Efficiency Mid-IR Parametric Amplification via Hybridized Nonlinear Optics, Jeffrey Moses[1]; [1]*Cornell Univ., USA.* Parametric amplifiers normally possess cyclic gain and poor conversion efficiency. When hybridized with second-harmonic generation, however, they possess laser-like saturating gain. This allows high quantum efficiency, potentially even exceeding 100%, for high-energy picosecond mid-infrared amplifiers.

MW2C.2 • 11:00
Multicolor-Pulse-Burst-Pumped Long-Wave Infrared NOPCPA, Rokas Jutas[1], Joris Roman[1], Ignas Astrauskas[1], Aref Imani[1], Paolo Carpeggiani[1], Pavel Polynkin[2], Edgar Kaksis[1], Tobias Floery[1], Jonas Kolenda[3], Tadas Bartulevicius[3], Kirilas Michailovas[3], Andrejus Michailovas[3,4], Andrius Baltuška[1,4], Audrius Pugzlys[1,4]; [1]*Technische Universität Wien, Austria;* [2]*Univ. of Arizona, USA;* [3]*EKSPLA, Lithuania;* [4]*FTMC, Lithuania.* LWIR pulses are amplified to 80 mJ energy in an angularly multi-beam non-collinearly seeded and non-collinearly pumped OPCPA, the first being pumped by a burst-mode Nd:YAG amplifier. LWIR pulse energies of >10 mJ are targeted.

MW2C.3 • 11:15
Intracavity-Pumped, Noncritical CdSe OPO at 100 Hz, Li Wang[1,2], Weidong Chen[1,3], Ivan Divliansky[4], Valdas Pasiskevicius[5], Oussama Mhibik[4], Kjell Moelster[5], Andrius Zukauskas[5], Leonid Glebov[4], Valentin Petrov[1]; [1]*Max Born Inst., Germany;* [2]*AIOFM, CAS, China;* [3]*FJIRSM, China;* [4]*CREOL, USA;* [5]*KTH, Sweden.* Spectral narrowing of the first stage signal wave in a cascade optical parametric oscillator using a Volume Bragg Grating produced narrowband 0.6-mJ idler pulses near 9.26 μm from the second stage.

MW2C.4 • 11:30
Power Scalable and Tunable Operation of a Narrow-Band PPLN Non-Resonant Optical Parametric Oscillator, Weidong Chen[1,2], Li Wang[1,3], Cui Chen[1,4], Ge Zhang[2], André Schirrmacher[5], Edlef Büttner[6], Valentin Petrov[1]; [1]*Max Born Inst., Germany;* [2]*Fujian Inst. of Research on the Structure of Matters, CAS, China;* [3]*Anhui Inst. of Optics and Fine Mechanics, Hefei Inst. of Physical Science, CAS, China;* [4]*Xinjiang Technical Inst. of Physics and Chemistry, CAS, China;* [5]*CANLAS GmbH, Germany;* [6]*APE Angewandte Physik & Elektronik GmbH, Germany.* The average power of a narrow-band PPLN non-resonant optical parametric oscillator is scaled up to the 10-W level with tuning across 40 nm (signal) and 66 nm (idler) achieved using transversely chirped volume Bragg gratings.

MW2C.5 • 11:45
Mid-infrared femtosecond pulse generation from a continuous-wave driven degenerate optical parametric oscillator, Alfredo Sanchez[1], Chaitanya Kumar Suddapalli[2], Majid Ebrahim-Zadeh[1,3]; [1]*ICFO -Institut de Ciencies Fotoniques, Spain;* [2]*Tata Inst. of Fundamental Research*

Hyderabad, India; [3]Instituciò Catalana de Recerca i Estudis Avancats (ICREA), Spain. We describe a novel configuration of bulk $\chi^{(2)}$ cw OPO based on MgO:PPLN generating near-transform-limited mid-infrared pulses of 96-fs duration with a broadband phase-locked spectrum by deploying an intracavity phase-modulator in combination with dispersion compensation.

MW2C.6 • 12:00 (Invited)
Wavelength-tunable few-cycle mid-IR laser pulses from frequency domain optical parametric amplification, Gilles Dalla-Barba[2,1], Gaëtan Jargot[1], Philippe Lassonde[1], Szabolcs Tóth[3], Elissa Haddad[1], Fabio Boschini[1], Jean-Christophe Delagnes[2], Adrien Leblanc[4], Heide Ibrahim[1], Eric Cormier[2], François Légaré[1]; *[1]INRS-Energie Mat & Tele Site Varennes, Canada; [2]Université de Bordeaux, France; [3]ELI-ALPS, Hungary; [4]École Polytechnique, France.* Using frequency domain optical parametric amplification and frequency resolved optical switching, we report on both generation and characterization of high-field mid-infrared few-cycle laser pulses tunable from 5 to 14 microns.

Olympia Mancini 3A
13:30 -- 15:30
EW3A • Metrology Applications II
Presider: Anna Galler; MPSD, Germany

EW3A.1 • 13:30 (Invited)
Gamma-Ray Tomography, Donald C Gautier[1]; *[1]Los Alamos National Laboratory, USA.* We demonstrate a high resolution, MeV x-ray source for micro-computed tomography driven a petawatt class, 0.5 Hz laser irradiating a mm thick high Z target. This has profound implications for nondestructive evaluation of dense materials.

EW3A.2 • 14:00
Compact realization of attosecond-pump attosecond-probe spectroscopy, Bernd Schuette[1], Martin Kretschmar[1], Evaldas Svirplys[1], Mikhail Volkov[1], Tobias Witting[1], Tamás Nagy[1], Marc J. J. Vrakking[1]; *[1]Max Born Inst., Germany.* Attosecond-pump attosecond-probe spectroscopy (APAPS) promises novel insights into extremely fast electronic dynamics. Here we present a compact realization of APAPS at kHz repetition rate, providing a high stability and good statistics.

EW3A.3 • 14:15
Femtosecond Imaging at Spatio-Temporal Limits, Sergey Zayko[1], Hung-Tzu Chang[1], Ofer Kfir[2], Murat Sivis[1], Claus Ropers[1]; *[1]Ultrafast Dynamics, Max-Planck-Inst. for Multidisciplinary Sciences, Germany; [2]School of Electrical Engineering, Faculty of Engineering, Tel Aviv Univ., Israel.* We demonstrate imaging capabilities at ultimate scales, reaching down to 12.5 nm spatial and 35 fs temporal resolution with element-specific and spin-sensitive contrasts. Our ultra-bright HHG microscope sets new performance benchmarks for photon-based imaging techniques.

EW3A.4 • 14:30
High-speed, high-resolution, and material-specific coherent EUV imaging using a high-order harmonic source, Wilhelm F. Eschen[1,2], Chang Liu[1,2], Daniel Santiago Penagos Molina[1,2], Robert Klas[1,2], Jens Limpert[1,2], Jan Rothhardt[1,2]; *[1]GSI GmbH, Germany; [2]Inst. of Applied Physics, Friedrich-Schiller Univ., Germany.* We present a tabletop coherent imaging

system at 13.5 nm driven by an ultrafast 75 W fiber laser, achieving a record imaging-speed of 5 Mpix/h, enabling detailed chemical composition mapping for samples from microbiology and the semiconductor industry.

EW3A.5 • 14:45
Enhancing Multi-Wavelength Extreme Ultraviolet Ptychography with Vortex Beams, Antonios Pelekanidis[1,2], Fengling Zhang[1], Matthias Gouder[1], Mengqi Du[1], Kjeld S. Eikema[1,2], Stefan Witte[1,2]; *[1]ARCNL, Netherlands; [2]Department of Physics and Astronomy, Vrije Universiteit, Netherlands.* We propose to improve multi-wavelength extreme ultraviolet imaging via high-efficiency structuring of high harmonic beams using a driving laser carrying orbital angular momentum. We demonstrate the improved reconstruction results in a multi-wavelength ptychography setup.

EW3A.6 • 15:00 (Invited)
Improving the Focal Spot Shape of a Focused, Laser-wakefield-acceleration Generated Betatron Source for XANES Studies of Warm Dense Matter, Meriame Berboucha[1,2], C. Colgan[2], M.R. Edwards[3], R. Hollinger[4], B. Kettle[4], P.M. King[3], S.X. Lee[5], N. Lemos[3], E. Los[2], J. Park[4], Z. Shpilman[4], S. Wang[4], S.A. Zahedpour[4], P. Zhang[5], F. Albert[3], G. Dyer[1], M. Fuchs[5], J. Rocca[4], C. Galtier[1], S.P.D. Mangles[2]; *[1]SLAC National Accelerator Laboratory, USA; [2]Imperial College London, UK; [3]Lawrence Livermore National Laboratory, USA; [4]Colorado State Univ., USA; [5]Univ. of Nebraska-Lincoln, USA.* Betatron radiation is an important source for x-ray absorption near-edge spectroscopy (XANES) measurements of warm dense matter thanks to its wide spectral bandwidth and short (fs) pulse durations. Femtosecond-resolved x-ray absorption spectroscopy can provide time-resolved information on the ultrafast dynamics of the non-equilibrium transition of a metal foil from solid to the warm dense matter state; an opportunity to provide information to better describe and understand astrophysical and fusion plasmas. This work portrays the focusing of laser-wakefield acceleration produced betatron radiation for sub-100 fs XANES snapshots of the L-edge (707 eV) of laser-heated iron. Focusing of the betatron was previously achieved with a gold toroidal mirror at the Matter in Extreme Conditions end-station at LCLS, SLAC. The focal spot size achieved was ~50 x 35 mm, however, the spot profile exhibited wings that spanned hundreds of microns. Consequently, the photons in these wings probe cold conditions within the sample inhibiting the use of XANES for warm-dense studies. At the ALEPH laser facility at Colorado State Univ., the betatron focal spot wings were suppressed by placing an aperture at the output of the focusing toroidal mirror to achieve a near-diffraction limited round spot size of ~51 x 52 mm with no wings. This improved betatron spot profile ensures photons at the focal plane pass through a homogeneous region in warm dense conditions, avoiding probing cold material. This minimizes temperature and density gradients for accurate XANES measurements. We present a ray-tracing model used to achieve this improved spot with the support of experimental data, as well as a preliminary XANES analysis of warm dense iron.

Olympia Mancini 1
13:30 -- 15:30
HW3B • High-order Harmonic Sources and Applications
Presider: Vincent Wanie; DESY, Germany

HW3B.1 • 13:30 (Invited)
Simulating Macroscopic High-order Harmonic Generation Driven by Structured Laser Beams Using Artificial Intelligence, Carlos Hernandez-Garcia[1]; [1]*Universidad de Salamanca, Spain.* Employing artificial intelligence, we integrate microscopic quantum computations based on the time dependent Schrödinger equation with macroscopic physics, to unveil hidden signatures in the ultrafast electronic dynamics of high-order harmonic generation by structured laser beams.

HW3B.2 • 14:00
Versatile Two-Color High Harmonic Generation Setup for XUV Yield Optimization, Ann-Kathrin Raab[1], Marvin Schmoll[2,1], Emma Simpson[1], Melvin Redon[1], Yuman Fang[1], Chen Guo[1], Anne-Lise Viotti[1], Cord Arnold[1], Anne L'Huillier[1], Johan Mauritsson[1]; [1]*Lunds Universitet, Sweden;* [2]*Physikalisches Institut, Albert-Ludwigs-Universität Freiburg, Germany.* We present a versatile two color high-harmonic generation setup employing spatial light modulators for precise waveform control. Independent power control for both colors allows a continuous two-color ratio and phase scan of the harmonic yield.

HW3B.3 • 14:15
A Compact Beamline for High-Throughput, Multiscale, Ultrafast Extreme Ultraviolet Ptychography, Carmelo Grova[1], Charles S. Bevis[1], Nicola Giani[1], Daniel Adams[3], Cristian Svetina[2], Giulia F. Mancini[1]; [1]*Univ. of Pavia, Laboratory for Ultrafast X-Ray and Electron Microscopy (LUXEM), Italy;* [2]*IMDEA Nanociencia, X-ray Wave-mixing Spectroscopies Group (X-WaveS), Spain;* [3]*Department of Physics, Colorado School of Mines, USA.* We report the design of a tabletop beamline for Ultrafast Ptychographic Imaging capable of supporting full-field quantitative reconstructions with near-wavelength spatial resolution and sub-50fs temporal resolution.

HW3B.4 • 14:30
Nonadiabatic Harmonic Generation in a Sub-mm Glass Chip, Agata Azzolin[1,2], Gaia Giovannetti[1], Guangyu Fan[3], Sabbir Ahsan[1], Sabine Rockenstein[1], Oliviero Cannelli[1], Lorenzo Colaizzi[4], Erik Maansson[1], Davide Faccialà[5], Fabio Frassetto[6], Dario W. Lodi[4], Cristian Manzoni[5], Rebeca Martínez Vázquez[5], Michele Devetta[5], Roberto Osellame[4], Luca Poletto[6], Salvatore Stagira[4], Caterina Vozzi[5], Vincent Wanie[1], Andrea Trabattoni[1], Francesca Calegari[1]; [1]*Deutsches Elektronen Synchrotron, Germany;* [2]*Univ. of Hamburg, Germany;* [3]*Univ. of Shangai for Science and Technology, China;* [4]*Politecnico di Milano, Italy;* [5]*Consiglio Nazionale delle Ricerche, Italy;* [6]*Consiglio Nazionale delle Ricerche, Italy.* This work presents experimental results on High-order Harmonic Generation in a sub-mm glass cell using long driving pulses. The results show a remarkable extension of the cutoff explicable in the framework of the nonadiabatic regime.

HW3B.5 • 15:00
Tuneable Vacuum Ultraviolet Generation from an Ytterbium-based Ultrafast Laser by Resonant Dispersive Wave Emission, Christian Brahms[1], Deepjyoti Satpathy[1], Teodora Grigorova[1], Joleik Nordmann[1], John C. Travers[1]; [1]*Heriot-Watt Univ., UK.* We frequency convert

ultrafast laser pulses from a commercial high-power ytterbium-based drive laser to the vacuum ultraviolet down to 145 nm through resonant dispersive wave emission in a gas-filled hollow-core fibre.

HW3B.6 • 15:15
Control of ion-photoelectron entanglement and coherence via Rabi oscillations, Kenichi Ishikawa[1], Kevin C. Prince[2], Kiyoshi Ueda[3]; *[1]Univ. of Tokyo, Japan; [2]Elettra-Sincrotrone Trieste S.C.p.A., Italy; [3]Tohoku Univ., Japan.* We theoretically show that photoelectron-ion entanglement created by bichromatic extreme-ultraviolet pulses can be converted into coherence through Rabi coupling between the two ionic states. Then, the photoelectron angular distribution can be coherently controlled.

Olympia Mancini 3B
13:30 -- 15:30
MW3C • Nonlinear Frequency Conversion and Parametric Sources II
Presider: Antoine Godard; ONERA, Université Paris-Saclay, France

MW3C.1 • 13:30 (Invited)
Mid infrared optical parametric oscillation and comb generation in whispering gallery resonators, Ingo Breunig[1,2]; *[1]Albert-Ludwigs-Universität Freiburg, Germany; [2]Fraunhofer Inst. for Physical Measurement Techniques IPM, Germany.* Pumping millimeter-sized $CdSiP_2$ microresonators with compact telecom lasers, we realize mid-infrared OPOs tunable between 2.3 and 5.1 µm wavelength with milliwatt output powers. Operating them at degeneracy, we generate frequency combs centered at 3.1 µm.

MW3C.2 • 14:00
Synchronously-Pumped OPO with Record-High 10.3 W Average Power at 3.1 µm, Vito F. Pecile[1,2], Michael Leskowschek[1], Norbert Modsching[3], Valentin J. Wittwer[3], Thomas Südmeyer[3], Oliver H. Heckl[1]; *[1]Faculty of Physics, Faculty Center for Nano Structure Research, Christian Doppler Laboratory for Mid-IR Spectroscopy, Univ. of Vienna, Austria; [2]Vienna Doctoral School in Physics, Univ. of Vienna, Austria; [3]Laboratoire Temps-Fréquence (LTF), Institut de Physique, Université de Neuchâtel, Switzerland.* We investigate power scaling with a signal singly-resonant OPO pumped by a 125 MHz Yb:fiber CPA. We achieve an average power of 10.3 W at 3.1 µm with a free-running power stability of 0.84%.

MW3C.3 • 14:15
Non-collinearily phase-matched high-power $CdSiP_2$ OPO pumped at 2.06 µm, Marcin Piotrowski[1], Achille Bogas-Droy[1], Gerhard Spindler[2], Anne Hildenbrand-Dhollande[1]; *[1]French-German Research Inst., France; [2]GS, Germany.* In a compact cavity, we use a CSP OPO driven by a Ho:LLF laser (2.06 µm) to achieve more than 3 W of mid-IR power with exceptional beam quality. The OPO waves are broadly tunable from 3.5 to 4.7 µm.

MW3C.4 • 14:30
Optical Parametric Generation in Non-Critically Cut $CdSiP_2$ with a Nanosecond 1.064 µm Nd:YAG Laser, Marius-Andrei Codescu[1], Joel Murray[2], Zawilski T. Kevin[3], Peter Schunemann[3], Robert Murray[1], Shekhar Guha[4]; *[1]Imperial College London, UK; [2]UES, Inc., USA; [3]BAE Systems, USA; [4]Wright-Patterson Air Force Base, Air Force Research Laboratory, USA.* We demonstrate nanosecond pulsed optical parametric generation in $CdSiP_2$ with a 1.064 µm

Nd:YAG pump laser, generating 200 mW of signal light at 1.286 μm with a conversion efficiency of 28%.

MW3C.5 • 14:45
Perspectives and Experimental Challenges of High Repetition Rate THz Generation via Optical Rectification in GaP Crystals Inside an Enhancement Resonator, Francesco Canella[1], Edoardo Suerra[2,3], Dario Giannotti[4,3], Simone Cialdi[2,3], Gianluca Galzerano[1,3]; *[1]Istituto di Fotonica e Nanotecnologie - CNR, Italy; [2]Physics Department, Università degli Studi di Milano, Italy; [3]INFN - Sezione di Milano, Italy; [4]Physics Department, Politecnico di Milano, Italy.* We report on GaP crystal characterization for the generation of milliwatt-level THz radiation inside an enhancement resonator pumped by near-infrared pulses, with the aim of overcoming high-average power and nonlinear absorption limits.

MW3C.6 • 15:00
Electron to photon noise transfer in mid-infrared lasers, Irene La Penna[1], Tecla Gabbrielli[1], Francesco Cappelli[1], Paolo De Natale[1], Georg Marschick[2], Robert Weih[3], Borislav Hinkov[2]; *[1]LENS, Italy; [2]TU Wien, Austria; [3]Nanoplus, Germany.* We investigate the noise transfer from injected electrons to emitted photons in coherent mid-infrared (MIR) sources with the aim of finding the best fitting conditions for detection of squeezed light in the MIR.

MW3C.7 • 15:15
A High-Flux Tunable Accelerator-Based Terahertz Source, Philippe Piot[2,1]; *[1]Northern Illinois Univ., USA; [2]APS/ASD, Argonne National Laboratory, USA.* This contribution discusses a concept for the generation of high-flux THz pulses by combining a compact accelerator with passive elements.

Olympia Mancini 2
15:30 -- 16:30
JW4A • Joint Poster Session II

JW4A.1
Withdrawn

JW4A.2
Temperature Dependence of Fe:ZnSe Laser Output Characteristics under ~4 μm Radiation Excitation, Adam Riha[1], Helena Jelinkova[1], Maxim E. Doroshenko[2], Michal Jelinek[1], Michal Nemec[1], Jan Sulc[1], Dmitry V. Badikov[3]; *[1]Department of Physical Electronics, FNSPE, Czech Technical Univ. in Prague, Czechia; [2]General Physics Inst., Russian Academy of Sciences, Russian Federation; [3]High Technologies Laboratory, Kuban State Univ., Russian Federation.* Temperature dependences of spectroscopic (absorption, fluorescence, lifetime) and laser output properties (energy, oscillation spectra) of the Fe^{2+}:ZnSe laser under ~4 μm radiation pumping are presented. Wide laser oscillation spectrum of up to ~4.9 μm is demonstrated.

JW4A.3
Resolving the tensor components for low-symmetry, polar class 3 nonlinear optical crystals: example of $BaGa_2GeS_6$, Kiyosi Kato[2,3], Nobuhiro Umemura[2], Kentaro Miyata[1], Valentin Petrov[4]; *[1]RIKEN, Japan; [2]Chitose Inst. of Science and Technology, Japan; [3]Okamoto*

Optics, Inc., Japan; [4]Max-Born-Inst. for Nonlinear Optics and Ultrafast Spectroscopy, Germany. The magnitude and sign of the nonlinear coefficients of the trigonal $BaGa_2GeS_6$ are determined by second-harmonic and sum-frequency generation, rendering it a viable alternative to $AgGaS_2$ for 1-μm pumped frequency down-conversion to the mid-IR.

JW4A.4
Depressed cladding buried waveguide lasers: single-crystal vs. polycrystalline Cr:ZnS, Maxim Demesh[1], Evgeni Sorokin[2], Eskil Einmo[1], Christos Grivas[1], Nikolai Tolstik[1], Vladimir L. Kalashnikov[1], Irina T. Sorokina[1], Marisa Sabatino[1], Christoph Brüne[1]; *[1]Inst. of Physics, NTNU, Norway; [2]Institut für Photonik, TU Wien, Austria.* We report a comparative study of depressed-cladding buried waveguide lasers manufactured by ultra-short-pulse-laser writing in single- and polycrystalline Cr:ZnS. Single-crystalline samples yield over 150 mW at 2272 nm with <0.62 dB/cm loss.

JW4A.5
Optimizing 2.3 μm emission with cascade laser of $^3H_4 \rightarrow {}^3H_5$ and $^3F_4 \rightarrow {}^3H_6$ sequent transitions in Tm:YLF, Hippolyte Dupont[1], Lauren Guillemot[2], Pavel Loiko[2], Alain Braud[2], Patrice camy[2], Patrick Georges[1], Frédéric Druon[1]; *[1]CNRS - Institut d'Optique, France; [2]CIMAP, France.* We study cascade laser configuration in Tm:YLF. We demonstrate that this effect can either double the laser power at 2.3 W or extinguish it depending on the Tm-doping.

JW4A.6
Backward wave optical parametric oscillator (BWOPO) numerical model based on finite differences for frequency transfer and conversion efficiency studies, Antoine G. Zheng[1], Jean-Baptiste Dherbecourt[1], Myriam Raybaut[1], Xavier Delen[3], Jean-Michel Melkonian[1], Valdas Pasiskevicius[2], Antoine Godard[1]; *[1]Onera, France; [2]KTH, Sweden; [3]Laboratoire Charles Fabry, France.* To study the BWOPO as an efficient and easily tunable parametric source for differential absorption LIDAR, we present a 1D and 3D cylindrical symmetry finite difference time domain numerical scheme for linewidth and conversion[ZA1] studies.

JW4A.7
Pr:Lu_2S_3 - New Low-phonon Energy Material for Mid-infrared Laser Sources, Jan Sulc[1], Martin Fibrich[1], Lubomír Havlák[2], Vítězslav Jarý[2], Robert Král[2], David Vyhlídal[1], Helena Jelinkova[1], Martin Nikl[2]; *[1]Czech Technical Univ. in Prague, Czechia; [2]Inst. of Physics of the Czech Academy of Sciences, Czechia.* New praseodymium-doped lutetium sesqui-sulfide single crystal Pr:Lu_2S_3 was grown by micro-pulling-down technique. The highest-energy peak in Raman spectrum corresponds to 312 cm^{-1}. The excitation and fluorescence spectra up to 6 μm are presented.

JW4A.8
5.5 W Diode-Pumped Tm:YVO_4 Laser at 2.29 μm, Xiaoxu Yu[2], Kirill Eremeev[1], Zhongben Pan[2], Pavel Loiko[1], Hongwei Chu[2], Han Pan[2], Alain Braud[1], Patrice camy[1], Dechun Li[2]; *[1]CIMAP, Université de Caen Normandie, France; [2]School of Information Science and Engineering, and Key Laboratory of Laser and Infrared System of Ministry of Education, Shandong Univ., China.* A diode-pumped continuous-wave Tm:YVO_4 laser operating on the $^3H_4 \rightarrow {}^3H_5$ transition generated 5.52 W at 2.29 μm with a slope efficiency up to 25.9% and linear polarization (π). The spectroscopic properties of this material are revised.

JW4A.9
Original Chaotic Dynamics in Passively Q-switched Cascade Mid-Infrared Thulium Laser, Hippolyte Dupont[1], Pavel Loiko[2], Patrice camy[2], Patrick Georges[1], Frédéric Druon[1]; *[1]CNRS - Institut d'Optique, France; [2]CIMAP, France.* We present an atypical chaotic dynamic behavior with type-I intermittency transition in a 2.3-µm Tm:YLF laser passively Q-switched by Cr^{2+}:ZnSe. A novel approach is shown, monitoring the metastable population via cascade laser at 1.9 µm.

JW4A.10
Graphene Q-switched Dy-fluoride Fiber Laser, Fedele Pisani[1], Francesco Canella[2], Dario Giannotti[1], Paolo Laporta[1,2], Gianluca Galzerano[2]; *[1]Politecnico di Milano, Italy; [2]Istituto di Fotonica e Nanotecnologie - CNR, Israel.* Stable graphene Q-switched operation of an in-band pumped Dy-doped fluorozirconate fiber laser emitting around 3.1 µm is demonstrated. A minimum pulse duration of 591 ns and a highest repetition frequency of 103 kHz are obtained.

JW4A.11
Direct Resonant Diode Pumping of Tm-fiber Laser, Jan Sulc[1], Michal Nemec[1], Jan Kratochvíl[1], Helena Jelinkova[1]; *[1]Czech Technical Univ. in Prague, Czechia.* CW laser diode emitting at 1.7 µm was used to pump thulium-doped fiber laser with free-space coupling and mirror. For absorbed power 11.5 W output power 5.2 W was reached at wavelength 1950 nm with slope efficiency 70%.

JW4A.12
Fabrication of Highly Nonlinear Waveguide Arrays for the Mid-infrared, Thuy Ha[1], Thomas Gretzinger[1], Alex Fuerbach[1]; *[1]Mathematical and Physical Sciences, Macquarie Univ., Australia.* Optical waveguides that preserve the high intrinsic nonlinearity of GLS glass are fabricated via femtosecond laser inscription. A design for mid-infrared ultrafast saturable absorbers based on nonlinear waveguide arrays is presented.

JW4A.13
Study of high-power effects in cavity-enhanced terahertz generation, Edoardo Suerra[2,1], Francesco Canella[3], Dario Giannotti[4,1], Simone Cialdi[2,1], Gianluca Galzerano[3,1]; *[1]Istituto Nazionale di Fisica Nucleare, Italy; [2]Università degli Studi di Milano, Italy; [3]Istituto di Fotonica e Nanotecnologie – CNR, Italy; [4]Politecnico di Milano, Italy.* In this work, we study the generation of THz radiation using a GaP crystal inside an enhancement cavity, simulating the effect of high power on the cavity modes, and calculating the expected THz performances.

JW4A.14
Withdrawn

JW4A.15
Fabrication of EUV Gratings via Ion Irradiation, Johannes M. Kaufmann[1], Thomas Siefke[1,2], Carsten Ronning[3], Uwe Zeitner[2,4]; *[1]Inst. of Applied Physics Friedrich Schiller Univ. Jena, Germany; [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany; [3]Inst. of Solid State Physics Friedrich Schiller Univ., Germany; [4]Department of Applied Sciences and Mechatronics Munich Univ. of Applied Sciences, Germany.* We fabricated shallow silicon gratings for EUV applications utilizing swelling upon irradiation with helium ions through polymer masks. Understanding the effects of fluence, flux and ion energy enables height control

between 1 to 20 nm.

JW4A.16
Laser-driven x-ray generation for industrial applications - A literature- and model-based approach to evaluate brilliance, flux and radiation safety, Jochen Vieker[1], Rolf Wester[1], Klaus Bergmann[1], Hans-Dieter Hoffmann[1], Sophia Schröder[2], Constantin L. Haefner[1,3]; *[1]Fraunhofer Inst. for Laser Technology ILT, Germany; [2]Chair for Technology of Optical Systems TOS, RWTH Aachen Univ., Germany; [3]Chair for Laser Technology, RWTH Aachen Univ., Germany.* A simplified model based on data from literature is presented, to determine the x-ray emission spectrum as function of laser pulse energy, wavelength and peak intensity, to assess applications and radiation safety requirements.

JW4A.17
Gamma/X-Ray Refractive Index of Materials Near Nuclear Resonances and Simulated Experiments Using Laser-Compton Sources, Trevor Reutershan[1], Christopher Barty[1]; *[1]Univ. of California - Irvine, USA.* Nuclear resonance fluorescence is the process by which atomic nuclei absorb and emit radiation. Around these resonances, the refractive index changes according to the Kramers-Kronig relations. We discuss how to measure such physics using laser-Compton sources.

JW4A.18
Thermal-deformation X-ray mirror development for advanced light sources, Fugui Yang[1], Xiaowei Zhang[1], Weifan Sheng[1], Ming Li[1]; *[1]Inst. of High Energy Physics, China.* An electric-heating-based X-ray deformable mirror was developed and tested. The feature of surface actuation has advantage of modulation with high spatial resolution and low drive power.

JW4A.19
Withdrawn

JW4A.20
User Experiments at the MAC End-station at ELI Beamlines Facility, Eva Klimešová[1], Andreas Hult Roos[1], Ziaul Hoque[1], Achary N. Smijesh[1], Ltaief Ben Ltaief[3], Lucie Jurkovičová[1,2], Martin Albrecht[1,2], Ondrej Hort[1], Jaroslav Nejdl[1,2], Marcel Mudrich[3], Jakob Andreasson[1], Maria Krikunova[1,4]; *[1]ELI Beamlines facility, ELI ERIC, Czechia; [2]Czech Technical Univ., Czechia; [3]Aarhus Univ., Denmark; [4]Technical Univ. of Applied Sciences, Germany.* The MAC end-station at ELI Beamlines facility is intended for studies of femtosecond dynamics in low-density matter and coherent diffractive imaging. We present recent results on ultrafast dynamics in atoms and helium nanodroplets.

JW4A.21
Attosecond X-ray absorption spectroscopy of ionic dynamics induced by strong field ionization, Jing Zhao[1]; *[1]National Univ. of Defense Technology, China.* We establish a theoretical approach to simulate the transient absorption of ions induced by strong-field ionization. By considering the coupled electronic-vibrational dynamics of the ions, we successfully reproduced the time-resolved X-ray absorption spectra of nitrogen ions observed in the experiment.

Olympia Mancini 1
17:15 -- 18:30
HW5A • Postdeadline Paper Presentations

Presider: Emily Sistrunk Link; Lawrence Livermore National Laboratory, United States

HW5A.1 • 17:15
High Energy Short Pulse Operation of Tm:YLF Amplifiers, Leily S. Kiani[1], Issa Tamer[1], Zbynek Hubka[1], Jason Owens[1], Andrew J. Church[1], Frantisek Batysta[1], Thomas Galvin[1], Drew Willard[1], Andrew Yandow[1], Justin Galbraith[1], David Alessi[1], Colin Harthcock[1], Brad Hickman[1], Candis Jackson[1], James Nissen[1], Sean R. Tardif[1], Hoang Nguyen[1], Emily Sistrunk Link[1], Thomas M. Spinka[1], Brendan A. Reagan[1]; *[1]Lawrence Livermore National Lab, USA*. We report high energy pulses from compact, diode-pumped Tm:YLF amplifiers. We demonstrated pulse energies of 21.7J for 20ns pulses and 108J for long pulses. CPA produced broadband 1.6J pulses that were subsequently compressed to 270fs.

HW5A.2 • 17:27
TW-level three-stage pulse compression for all-attosecond pump-probe spectroscopy, Eli Sobolev[1], Mikhail Volkov[1], John Thomas[1], Evaldas Svirplys[1], Tobias Witting[1], Marc J. J. Vrakking[1], Bernd Schuette[1]; *[1]Max Born Institute, Germany*. A three-stage post-compression scheme enabling the generation of sub-4-fs terawatt pulses is demonstrated. The high stability of the generated pulses makes them ideally suited for performing attosecond-pump attosecond-probe spectroscopy, as demonstrated in this work.

HW5A.3 • 17:39
2.8 W, 90 nJ, 114 fs Yb: YAG thin-disk pumped degenerate optical parametric oscillator at 2.06 µm, Anni Li[1,2], Mehran Bahri[1,2], Robert M. Gray[3], Seowon Choi[1,2], Sajjad Hoseinkhaniasl[1,2], Anchit Srivastava[1,2], Alireza Marandi[3], Hanieh Fattahi[1,2]; *[1]Max Planck Institute for the Science of, Germany; [2]Friedrich-Alexander-University Erlangen-Nuremberg, Germany; [3]California Institute of Technology, USA*. We present unprecedented 2.8 W, 90 nJ, 114 fs, 30.9 MHz pulses at 2.06 µm from a degenerate optical parametric oscillator pumped by a high-power Yb: YAG thin-disk oscillator.

HW5A.4 • 17:51
Compact Generation of Isolated Attosecond Pulses Driven by Self-compressed Sub-cycle Waveforms, Marina F. Galán[1], Javier Serrano[1], Enrique Conejero Jarque[1], Rocío Borrego-Varillas[2], Matteo Lucchini[3], Maurizio Reduzzi[3], Mauro Nisoli[3], Christian Brahms[4], John C. Travers[4], Carlos Hernandez-Garcia[1], Julio San Roman[1]; *[1]Universidad de Salamanca, Spain; [2]IFN-CNR, Italy; [3]Politecnico di Milano, Italy; [4]Heriot-Watt University, United Kingdom*. We theoretically demonstrate a compact and robust scheme for the direct generation of extreme-ultraviolet isolated attosecond pulses from high-order harmonics driven by self-compressed sub-cycle waveforms produced in a gas-filled hollow capillary fiber.

HW5A.5 • 18:03
Photoelectron Spectroscopy with Synthetically Chiral Laser Pulses, Zack Dube[2,1], Giorgios Katsoulis[3], Tian Wang[2,1], Yonghao Mi[2,1], Philippe G. Burden[2,1], Andrei Y. Naumov[1], David M. villeneuve[1], Paul B. corkum[1,2], Agapi Emmanouilidou[3], André Staudte[1,2]; *[1]National Research Council of Canada, Canada; [2]Physics, University of Ottawa, Canada; [3]Physics, Department of Physics and Astronomy, University College London, United Kingdom*. We report on experiments to detect molecular chirality using strong-field photoelectron spectroscopy. Gas-phase

propylene oxide molecules were subjected to intense, femtosecond laser pulses which were arranged to synthesize a locally chiral electric field.

HW5A.6 • 18:15
Generation of high-order harmonic spatiotemporal optical vortices, Rodrigo Martín Hernández[1,2], Guan Gui[3], Luis Plaja[1,2], Henry K. Kapteyn[3], Margaret M. Murnane[3], Miguel A. Porras[4], Chen-Ting Liao[3,5], Carlos Hernandez-Garcia[1,2]; *[1]Grupo de Investigación en Aplicaciones del Láser y Fotónica. Departamento de Física Aplicada, Universidad de Salamanca, Spain; [2]Unidad de Excelencia en Luz y Materia Estructuradas (LUMES), Univerisdad de Salamanca, Spain; [3]JILA and Department of Physics, University of Colorado and NIST, USA*; [4]Grupo de Sistemas Complejos, ETSIME, Universidad Politécnica de Madrid, Spain; [5]Department of Physics, Indiana University, USA. We theoretically and experimentally demonstrate the generation of high-topological charge, extreme-ultraviolet (EUV) spatiotemporal optical vortices (STOV) from high-order harmonic generation. EUV-STOVs are unique structured light tools for exploring ultrafast topological laser-matter interactions.

Thursday, 14 March

Olympia Mancini 1
09:00 -- 10:00
JTh1A • Joint Plenary Session III
Presider: Constantin Haefner; Fraunhofer-Institut für Lasertechnik, Germany

JTh1A.1 • 09:00 (Plenary)
Advancement of High Intensity Laser Driven Particle Accelerators to Application Readiness, Ulrich Schramm[1]; [1]*Ludwig-Maximillians-Universität Munchen, Germany.* Improved control of high intensity laser beam parameters on target recently enabled proton energies beyond 100 MeV, dose-controlled in-vivo radiobiology experiments and seeded FEL demonstration, which will be discussed jointly with the underlying physics.

Olympia Mancini 3A
10:30 -- 12:30
ETh2A • Industrializing EUV FELs
Presider: Patrick Naulleau; Lawrence Berkeley National Laboratory, United States

ETh2A.1 • 10:30 (Invited)
The Last Light Source, Erik Hosler[1]; [1] *xLight, Inc., USA.* Light drives innovation – the wavelength, the power, the intrinsic qualities. This is no more true than in semiconductor manufacturing. From the mask shop to the packaging fab, from lithography to metrology, each technology node has relied on light invention to enable scaling, process control, reliability, and even ensuring supply chain security. However, the increasing cost and complexity of new light sources to meet industry demands has become prohibitive, leading to stagnation in technology development and reliance on the status quo in terms of the light available and the applications it permits. Now, a leap is required to a new generation of light source that will serve the semiconductor industry indefinitely, providing low-cost EUV as well as any wavelength required for manufacturing and R&D applications. xLight is building an accelerator-based light source to drive the semiconductor industry into the next decade and beyond, providing high power, quality light to any application and delivering Light as a utility.

ETh2A.2 • 11:00 (Invited)
Enabling Technology for Compact XFELs, John Byrd[1]; [1]*Lawrence Berkeley National Laboratory, USA.* After almost 15 years of openation, XFELs are well-established light sources for addressing many problems in science. However, most FEL facilities are relatively large to reach the beam energies and geometric emittancs needed to lase at higher photon energy. Furthermore, the XFEL can only serve one or a few users at at time. At Argonne National Laboratory, we have initiated a research program to address some of these issues. We report on our program develop independent undulator arrays to allow more simultaneous users. We are developing a compact Adjustable Phase Undulator that have a compact transverse footprint and a superconducting undulator design with multiple undulators per cryostat. In addition, we report on a new concept for an ultrolow emittance electron gun which reaches fields several times higher than existing guns. This is achieved by generating <10 nsec RF pulses similar to other two-beam accelerator concepts.

ETh2A.3 • 11:30 (Invited)
Accelerator Development Plan in KEK Toward Realization of High-power EUV-FEL for Future Lithography, Hiroshi Kawata[1], Norio Nakamura[1], Ryukou Kato[1], Hiroshi Sakai[1], Kimichika Tsuchiya Tsuchiya[1], Yasunori Tanimoto Tanimoto[1], Yosuke Honda Honda[1], Miho Shimada Shimada[1], Takanori Tanikawa[1], Olga Tanaka[1], Takashi Obina[1], Shinichiro Michizono[1]; [1]*High Energy Accelerator Research Org, Japan.* The development of a high-power EUV light source is important to overcome the stochastic effects in future lithography. The EUV-FEL light source is one of the promising candidates. This paper proposes the accelerator development plan.

ETh2A.4 • 12:00 (Invited)
Laser-accelerator driven Ultrahigh Brightness EUV and SXR sources, Bjorn M. Hegelich[1,2], Stephen Milton[1]; [1]*Tau Systems, USA;* [2]*Physics, Univ. of Texas at Austin, USA.* TAU Systems is developing ultrabright table-top synchrotron x-ray sources and compact EUV Free-electron lasers driven by laser wakefield accelerators. We show advances in accelerator and undulator technology enabling synchrotron type brightness and >100W EUV output.

Olympia Mancini 1
10:30 -- 12:30
HTh2B • High-field Science, Methods, and Theory
Presider: Scott Feister; California State Univ. Channel Islands, United States

HTh2B.1 • 10:30 (Invited)
First-principles electron dynamics simulations for light-induced electron dynamics in solids, Shunsuke A. Sato[1]; [1]*Univ. of Tsukuba, Japan.* We have been developing the first-principles electron dynamics simulation based on the time-dependent density functional theory. In this talk, we present the recent applications of the simulations to ultrafast electron dynamics in solids.

HTh2B.2 • 11:00
Withdrawn

HTh2B.3 • 11:15
Two-photon polymerization 3D printed microstructures as a platform for high-energy laser-driven ion accelerators, Sergei Tochitsky[1], Nuno Lemos[2], Raspberry Simpson[2], Elizabeth Grace[2]; [1]*Univ. of California Los Angeles, USA;* [2]*Lawrence Livermore National Laboratory, USA.* We present the results on ion acceleration in 3D printed wire structures irradiated by PW laser pulses. Above 100 MeV proton and 500 MeV carbon beams are reported in 10-20 um thick microstructures.

HTh2B.4 • 11:30 (Invited)
Withdrawn

HTh2B.5 • 12:00 (Invited)
Single-Shot, Multi-Timestep Chirped Optical Probe Method for High Temporal Resolution Reconstruction of Plasma Evolution, Elizabeth Grace[1], Derek A. Mariscal[1], Ghassan

Zeraouli[2], Matt Hill[1], Raspberry Simpson[1], rick trebino[3], Tammy Ma[1]; *[1]Lawrence Livermore National Laboratory, USA; [2]Colorado State Univ., USA; [3]Georgia Inst. of Technology, USA.* This work discusses the simulation and development of a new single-frame technique for reconstruction of plasma electron density profiles at multiple (25+) timesteps within each shot using a single chirped probe pulse. This new method uses just two components, a diffractive optical element and an interference bandpass filter, to simultaneously take multiple time-resolved electron density measurements on a single camera frame.

Olympia Mancini 3B
10:30 -- 12:30
MTh2C • Applications of Mid-IR and THz Sources I
Presider: Majid Ebrahim-Zadeh; ICFO -Institut de Ciencies Fotoniques, Spain

MTh2C.1 • 10:30 (Invited)
Mid-infrared photothermal quantitative phase imaging with nanosecond lasers, Takuro Ideguchi[1]; *[1]The Univ. of Tokyo, Japan.* We have developed mid-infrared photothermal quantitative phase microscopes utilizing nanosecond lasers. This advancement has enabled us to demonstrate high-resolution mid-infrared imaging of living cells at video rate.

MTh2C.2 • 11:00
Fourier Transform Multi-pass Photothermal Spectroscopy Using a Quantum Cascade Laser Frequency Comb, Grzegorz E. Gomolka[1,2], Baichuan Huang[2], Tommi Mikkonen[3], Gerard Wysocki[2]; *[1]Department of Optics and Photonics, Wroclaw Univ. of Science and Technology, Poland; [2]Department of Electrical and Computer Engineering, Princeton Univ., USA; [3]Department of Chemistry, Univ. of Helsinki, Finland.* Fourier transform photothermal spectroscopy is demonstrated in a multi-pass configuration using a quantum cascade laser frequency comb operating between 7.7 and 8.2 µm. Broadband detection of nitrous oxide in the mid-infrared is performed as proof-of-concept.

MTh2C.3 • 11:15
Single-shot based background-free mid-infrared spectroscopy using upconversion of sub-cycle pulses, Neil Cabello[1], Shinta Ozawa[1], Yue Zhao[2], Takao Fuji[1]; *[1]Toyota Technological Inst., Japan; [2]Muroran Inst. of Technology, Japan.* We have successfully demonstrated highly sensitive broadband mid-infrared spectroscopy using sub-cycle pulses generated through filamentation. Single-shot based and background-free measurement of absorption spectra was achieved by upconversion of the sub-cycle mid-infrared pulses.

MTh2C.4 • 11:30
Control of nonlinearity enables 3D silicon processing, Maxim Demesh[1], Nikolai Tolstik[1], Vladimir L. Kalashnikov[1], Alexander Rudenkov[1], Evgeni Sorokin[2], Eskil Einmo[1], Marisa Sabatino[1], Irina T. Sorokina[1]; *[1]Institut of Physics, NTNU, Norway; [2]Institut für Photonik, TU Wien, Austria.* We demonstrate effective control of the shape and depth of sub-wavelength-sized structures in silicon through repeatable single pulse modifications at the optimum wavelength of 2.1 µm, which provides a balance of Kerr-effect and multi-photon absorption.

MTh2C.5 • 11:45
High-intensity mid-IR OPA at 250 kHz for time- and angle-resolved photoemission spectroscopy at ALLS, Adrien Longa[1], Jean-Michel Parent[1], Benson Frimpong[1], François Légaré[1], Gaëtan Jargot[1], Fabio Boschini[1]; *[1]Institut National de la Recherche Sci., Canada.* We have developed an OPA providing intense optical excitation in the infrared region (1.7 to 8 µm) that is used as a pump for time- and angle-resolved photoemission (TR-ARPES). Preliminary TR-ARPES results are presented.

MTh2C.6 • 12:00 (Invited)
"Differential absorption lidar for water vapour and HDO sensing based on 1.98µm parametric sources", Myriam Raybaut[1], Jean-Baptiste Dherbecourt[1], Jean-Michel Melkonian[1], Valdas Pasiskevicius[4], Michael Strotkamp[2], Antoine Godard[1], Cyrille Flamant[3]; *[1]Office Natl d'Etudes Rech Aerospatiales, France; [2]Fraunhofer ILT, Germany; [3]UMR 8190, CNRS–SU–UVSQ, LATMOS, France; [4]Laser Physics Group, KTH, Sweden.* Water vapor isotopologue sensing is a challenging topic with climate and meteorological studies applications. Differential absorption lidar is a promising solution, requiring 2µm tunable specific sources, for which parametric conversion can be implemented.

Olympia Mancini 3A
13:30 -- 15:30
ETh3A • High Harmonic Generation Sources
Presider: Frances Kraus; Princeton Plasma Physics Laboratory, United States

ETh3A.1 • 13:30 (Invited)
Unveiling the Atomic Dipole Phase: EUV Interferometry of High Harmonics Generated in Gases and Solids, Nataliia Kuzkova[1,2], Pieter J. van Essen[1], Brian de Keijzer[1], Peter M. Kraus[1,2]; *[1]Advanced Research Center for Nanolithography (ARCNL), Netherlands; [2]Department of Physics and Astronomy, and LaserLaB, Vrije Universiteit, Netherlands.* We present direct measurements of the atomic dipole phase in high-harmonic generation using EUV interferometry. By employing a common-path birefringent interferometer, the intensity-dependent dipole phase in both gases and solids was accessed, revealing underlying mechanisms.

ETh3A.2 • 14:00
Advances in HHG for User Operations: Novel Techniques for Monochromatization, Ondrej Hort[1], Lucie Jurkovičová[1,2], Jan Vábek[1], Martin Albrecht[1,2], Matyáš Staněk[1,2], Ondrej Finke[1,2], Ltaief Ben Ltaief[3], Andreas Hult Roos[1], Ziaul Hoque[1], Eva Klimešová[1], Akgash Sundaralingam[3], Roman Antipenkov[1], Annika Grenfell[1], Alexandr Špaček[1,2], Wojciech Jerzy Szuba[1], Maria Krikunova[1,4], Marcel Mudrich[3], Jakob Andreasson[1], Jaroslav Nejdl[1,2]; *[1]ELI Beamlines, The Extreme Light Infrastructure ERIC, Czechia; [2]FNSPE, Czech Technical Univ. in Prague, Czechia; [3]Inst. of Physics and Astronomy, Aarhus Univ., Denmark; [4]Technical Univ. of Applied Sciences, Germany.* In this work, we introduce two novel techniques for generating (quasi)monochromatic XUV radiation. One utilizes Bessel-Gauss beams and modulated gas media, while the other achieves continuous VUV tuning, enhancing versatility and efficiency for user applications.

ETh3A.3 • 14:15
High harmonic generation with femtosecond drivers: MPC vs OPCPA, Bastian Manschwetus[1], Valentina Shumakova[1], Alice Autuori[1], Thomas Braatz[1], Sebastian Starosielec[1], Hossein Goudarzi[1], Christoph M. Heyl[2,4], Mark Prandolini[1,3], Heye Buss[1], Michael Schulz[1], Robert Riedel[1]; *[1]Class 5 Photonics, Germany; [2]Deutsches Elektronen Synchrotron, Germany; [3]Institut für Experimentalphysik, Universität Hamburg, Germany; [4]Helmholtz-Institut Jena, Germany.* We compare the spectral flux of a high harmonic source for two driver systems using similar pulse parameters but different central wavelength: a multipass cell compressed Yb laser or an optical parametric amplifier system.

ETh3A.4 • 14:30
Table-top coherent XUV source with a brightness of 1kW/(mm^2)sr /1%BW at 130eV, Maxim Tschernajew[1], Vinzenz Hilbert[1], Robert Klas[4,2], Oliver Herrfurth[1], Sven Breitkopf[1], Jan Rothhardt[3,4], Tino Eidam[1], Jens Limpert[4,2]; *[1]Active Fiber Systems GmbH, Germany; [2]Inst. of Applied Physics, Germany; [3]Helmholtz-Inst. Jena, Germany; [4]Fraunhofer IOF, Germany.* We present a highly stable, easy-to-use, table-top coherent XUV source delivering a brightness of >1kW/(mm^2)/sr/1%BW at 130eV (9.5nm). IT is based on high-harmonic generation driven by an ultrastable Ytterbium-dope fiber laser and a multi-pass-cell based post-compression to 35fs.

ETh3A.5 • 14:45
Extreme-Ultraviolet Light Generated by Vector Beams in a Microfluidic Waveguide, Riccardo Piccoli[1], Marco Bardellini[1], Stavroula Vovla[1,2], Kamal Abedin[1], Anna Ciriolo[2], Rebeca Martínez Vázquez[2], Luca Poletto[3], Fabio Frassetto[3], Davide Faccialà[2], Michele Devetta[2], Caterina Vozzi[2], Salvatore Stagira[1]; *[1]Politecnico di Milano, Italy; [2]National Research Council, Italy; [3]National Research Council, Italy.* We demonstrated the generation of extreme-ultraviolet light via high-order harmonics generation in a microfluidic device by means of radially or azimuthally polarized laser beams.

ETh3A.6 • 15:00
Roadmap towards High-Brilliance EUV and SXR Sources Driven by Advanced Nonlinear Laser Technologies, Bastian Manschwetus[1], Philipp Merkl[1], Valentina Shumakova[1], Thomas Braatz[1], Alice Autuori[1], Sebastian Starosielec[1], Heye Buss[1], Robert Riedel[1]; *[1]Class 5 Photonics GmbH, Germany.* High-power femtosecond lasers based on optical-parametric chirped-pulse amplifiers and multi-pass cell spectral broadening are crucial technologies along the roadmap towards next generation high-brilliance extreme ultraviolet and soft-X-ray sources via higher-harmonic generation.

ETh3A.7 • 15:15
Design of time-delay-compensated grating monochromators for femtosecond pulses in the extreme-ultraviolet, Luca Poletto[1], Fabio Frassetto[1]; *[1]National Research Council, Italy.* It is presented the design of a compact time-delay-compensated monochromator to provide pulses with sub-10-fs temporal response. It has four optical elements: two gratings and two mirrors. The design has advantages in terms of costs, compactness and throughput.

Olympia Mancini 1
13:30 -- 15:30
HTh3B • Ultrafast Metrology - Methods, Technology and Applications
Presider: Nicolas Thiré; Fastlite, France

HTh3B.1 • 13:30 (Invited)
Bright Sub-cycle Pulses for Petahertz Fieldoscopy, Hanieh Fattahi[1]; [1]*Max-Planck-Inst Physik des Lichts, Germany.* Abstract not available.

HTh3B.2 • 14:00
Quasi-stationary hydrodynamics in high repetition rate filamentation, Robin Löscher[1], Victor Moreno[2], Dionysis Adamou[3], Denizhan K. Kesim[1], Malte C. Schroeder[1], Matteo Clerici[3,4], Jean-Pierre Wolf[2], Clara J. Saraceno[1]; [1]*Photonics and Ultrafast Laser Science, Ruhr-Universität Bochum, Germany;* [2]*Groupe de Physique Appliquée, Université de Genève, Switzerland;* [3]*James Watt School of Engineering, Univ. of Glasgow, UK;* [4]*Dipartimento di Scienza e Alta Tecnologia, Università dell'Insubria, Italy.* We present the first experiments and characterization of filamentation at high energy and high repetition rates (≥ 10 kHz), showing a quasi-stationary depletion offering improved electric discharge triggering and guidelines for future laser filamentation research.

HTh3B.3 • 14:15
Detection of dispersion-related pulse-duration changes with attosecond precision, Arno Klenke[1,2], Jonas Margraf[2], Mats Segbers[2,3], Tino Eidam[3], Jens Limpert[2,1]; [1]*Helmholtz-Inst. Jena, Germany;* [2]*FSU Jena, Germany;* [3]*Active Fiber Systems GmbH, Germany.* We present a setup to detect dispersion related pulse duration fluctuations in an ultrafast laser system. Applying pre-chirping of the pulses in combination with spectral-broadening allows to detect these changes with precision of 200 attoseconds.

HTh3B.4 • 14:30
Single-Shot, High-Repetition Rate Carrier-Envelope-Phase Detection of Ultrashort Laser Pulses, Chen Guo[1], Miguel Miranda[2,3], Ann-Kathrin Raab[1], Anne-Lise Viotti[1], Paulo Tiago Guerreiro[3], Rosa Romero[3], Helder Crespo[3,4], Anne L'Huillier[1], Cord Arnold[1]; [1]*Lund Univ., Sweden;* [2]*IFIMUP-IN and Departamento de Fisica e Astronomia, Universidade do Porto, Portugal;* [3]*Sphere Ultrafast Photonics, Portugal;* [4]*Blackett Laboratory, Imperial College, UK.* We present a novel detection scheme for single-shot Carrier-Envelope Phase measurement scheme, based on evaluating f-2f fringes by means of optical Fourier transform, which is suitable for high-repetition rates (> 200 kHz) lasers.

HTh3B.5 • 15:00
From Astronomy to Laser-Labs: Real-Time Wavefront Stabilization at Apollon, Jonas B. Ohland[1,2], Nathalie Lebas[1], Vincent Deo[3], Olivier Guyon[3,4], François Mathieu[1], Dimitris Papadopoulos[1]; [1]*Laboratoire d'Utilisation des Lasers Intenses, France;* [2]*GSI-Darmstadt, Germany;* [3]*SCExAO, Subaru Telescope, USA;* [4]*Astrobiology Center of NINS, Japan.* The Apollon Real Time Adaptive Optics (ARTAO) project aims to mitigate air turbulence-induced Strehl ratio fluctuations in Apollon, a 10 PW Ti:Sapphire laser system. This presentation discusses ARTAO's current state and initial results.

HTh3B.6 • 15:15
Diagnosing the temporal contrast degradation in amplifier stages of a petawatt laser, Viktor Pajer[1], Mikhail Kalashnikov[1], Levente Lehotai[1], János Bohus[1], Ádám Börzsönyi[1], Roland Nagymihály[1]; *[1]ELI-ALPS, ELI-HU Non-Profit Ltd., Hungary.* Artificially generated post-pulses at different positions in a petawatt laser were utilized to measure the nonlinear phase accumulation of individual amplifier stages by using a third order autocorrelator, providing a novel tool diagnosing contrast degradation.

Olympia Mancini 3B
13:30 -- 15:30
MTh3C • Applications of Mid-IR and THz Sources II
Presider: Takao Fuji; Toyota Technological Inst., Japan

MTh3C.1 • 13:30 (Invited)
Multimodal Imaging and Spectroscopy for Archaeology, Art History and Cultural Heritage Conservation, Haida Liang[1]; *[1]School of Science & Technology, Nottingham Trent Univ., UK.* Complementary non-invasive imaging and spectroscopy play an important role in investigating the microstructure and identifying the materials of cultural heritage assets. Multi-wavelength optical coherence tomography and spectral imaging applications including remote sensing will be explored.

MTh3C.2 • 13:30
Laser Ablation of Biological Tissue with a 2.94 µm Picosecond Optical Parametric Amplifier for Ambient Mass Spectrometry Imaging, Yu Wang[1], Ronan Battle[1], Daniel Simon[1,2], Yuchen Xiang[1], Samuel Azevedo Magalhaes[1], Kenneth Robinson[1,2], Timothy Runcorn[1], Zoltan Takats[1,2], Robert Murray[1]; *[1]Imperial College London, UK; [2]Rosalind Franklin Inst., UK.* We report a 2.94 µm OPA with ~100 ps pulse duration, 400 nJ pulse energy and a 500 kHz repetition rate, which enables high resolution (≤10 µm) laser desorption-based mass spectrometry imaging of biological tissue.

MTh3C.3 • 13:30
Withdrawn

MTh3C.4 • 13:30
Withdrawn

MTh3C.5 • 13:30
Mid-infrared Photothermal Lens Spectroscopy of Liquids Using an External Cavity Quantum Cascade Laser, Gustavo V. Lukasievicz[1,2], Elizandra Sehn[1,2], Alicja Dabrowska[1], Leopold Lindenbauer[1], Bernhard Lendl[1]; *[1]Inst. of Chemical Technologies and Analytics, Technische Universität Wien, Austria; [2]Departamento de Física, Universidade Tecnológica Federal do Paraná, Brazil.* The photothermal lens spectroscopy using a quantum cascade laser was applied to analyze liquid samples. The results show the great potential of this technique for the mid-IR spectroscopic analysis of different liquids and mixtures.

MTh3C.6 • 13:30
Advanced spectroscopic instruments based on high-brightness mid-infrared lasers, Ivan Zorin[1], Paul Gattinger[1], Markus Brandstetter[1]; *[1]Research Center for Non Destructive Testing*

GmbH, Austria. In the past decade, mid-infrared lasers emerged as cost-effective alternatives for routine infrared spectroscopy, notable for their brightness and coherence. We review advancements in IR spectroscopy techniques tailored for mid-IR supercontinuum sources.

MTh3C.7 • 13:30
Broadband MWIR laser interrogator for quick and nondestructive analysis of physical evidence at crime scenes, Yuri V. flores[1], Markus Schwarzenberg[2], Gino Groeneveld[3], Cristina Cano Trujillo[4], Gemma Montalvo García[4], André Merten[2], Marko Haertelt[1]; [1]*Fraunhofer Inst. for Applied Solid State Physics, Germany;* [2]*Fraunhofer Inst. for Photonic Microsystems, Germany;* [3]*Netherlands Forensic Inst., Netherlands;* [4]*Univ. of Alcalá, Spain.* We present a MWIR active sensor that combines two individual broadband MOEMS external-cavity quantum cascade lasers. The multiplexed beam is used to stand-off interrogate forensic-relevant samples. The diffuse-reflectance spectrum is collected and evaluated in real-time.

Olympia Mancini 3A
16:00 -- 17:00
ETh4A • Advanced Applications
Presider: Nataliia Kuzkova; ARCNL, Netherlands

ETh4A.1 • 16:00 (Invited)
Atom Probe Tomography Using an Extreme Ultraviolet Pulsed Light Source, Luis Miaja Avila[1]; [1]*NIST Boulder, USA.* We describe an atom probe microscope that is coupled with an ultrafast extreme ultraviolet high-harmonics source to successfully trigger field ion emission from semiconductor, insulating, and cryogenically cooled organic materials.

ETh4A.2 • 16:30 (Invited)
Hot-Dense Plasma Physics via X-ray Spectroscopy of Intensely Driven Solids, Frances Kraus[1]; [1]*Princeton Plasma Physics Laboratory, USA.* Ultraintense lasers with high temporal contrast can generate keV-temperature plasmas at solid density. We capture high-resolution x-ray spectra from volume-limited partitions of these plasmas, studying thermal equilibration and plasma transport with detailed x-ray line shapes.

Olympia Mancini 1
16:00 -- 17:00
HTh4B • High-order Harmonics and Attosecond Science
Presider: Shima Gholam Mirzaeimoghadar; National Research Council Canada, Canada

HTh4B.1 • 16:00 (Invited)
Isolated 64-attosecond pulses driven by a postcompressed Yb laser, Ming-Chang Chen[1], Yu-En Chien[1], Ming-Shian Tsai[1], An-Yuan Liang[1]; [1]*National Tsing Hua Univ., Taiwan.* For the first time, an isolated attosecond pulse is directly generated from the Yb- laser. Intense post-compressed 3.5-fs pulses at 1030 nm were focused into a gas cell filled with neon, resulting in the generation of isolated 64-as pulses, which were characterized by attosecond streaking.

HTh4B.2 • 16:30
Probing the Structural Dynamics of Tellurium with Time-Resolved High-order Harmonic Generation, Andrea Annunziata[1,2], Cristian Soncini[2], Matteo Scandella[1], Nicolas Tancogne-

Dejean[3], Umberto De Giovannini[3], Hannes Hübener[3], Michele Devetta[2], Angel Rubio[3], Salvatore Stagira[1,2], Alberto Crepaldi[1], Eugenio Cinquanta[2], Davide Faccialà[2], Caterina Vozzi[2]; *[1]Department of Physics, Politecnico di Milano, Italy; [2]Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy; [3]Center for Free Electron Laser Science, Max Planck Inst. for the Structure and Dynamics of Matter, Germany.* We developed a time-resolved high-order harmonic generation scheme for probing the ultrafast lattice and electron dynamics of Tellurium. The results show the high sensitivity of this technique.

HTh4B.3 • 16:45
Ultraviolet supercontinuum generation using a differentially-pumped integrated glass chip, Vincent Wanie[1], Pasquale Barbato[2], Josina Hahne[1], Sergey Ryabchuk[1], Ammar B. Wahid[1], David Amorim[1], Erik Maansson[1], Andrea Trabattoni[1], Roberto Osellame[2], Rebeca Martínez Vázquez[2], Francesca Calegari[1]; *[1]DESY, Germany; [2]CNR-IFN, Italy.* A microfluidic chip integrating a gas cell and two lateral differential pumping stages is used to generate ultraviolet supercontinua via third-harmonic generation in neon or argon. Spectra spanning from 200 to 325 nm are obtained with pulse energies up to ~0.8 µJ, corresponding to 0.2% conversion efficiency.

Olympia Mancini 3B
16:00 -- 17:00
MTh4C • Mid-IR and THz Sources III
Presider: Martin Bernier; Université Laval, Canada

MTh4C.1 • 16:00
Energy Scalability Limits of mid-IR Femtosecond Pulse Oscillators, Vladimir L. Kalashnikov[1]; *[1]Department of Physics, Norwegian Univ. of Science and Technology, Norway.* Using statistical mechanics analysis, we establish the two main limiting factors to the energy scaling of femtosecond pulses in a mid-IR chirped-pulsed oscillator: system entropy increases with energy, causing multiple pulsing, and a pulse phase inhomogeneity.

MTh4C.2 • 16:15
Intensity and Phase Noise Characterization of a Kerr-Lens Mode-Locked Cr:ZnSe Laser, Dario Giannotti[1], Antonio Caruso[1], Francesco Canella[2], Fedele Pisani[1], Paolo Laporta[1,2], Gianluca Galzerano[2]; *[1]Politecnico di Milano, Italy; [2]Istituto di Fotonica e Nanotecnologie - CNR, Italy.* We report on a detailed intensity and phase noise characterization of a Kerr-lens mode-locked Cr:ZnSe laser at 2.4 µm wavelength with 42 fs pulse duration and a stabilized repetition frequency of 215 MHz.

MTh4C.3 • 16:30
Polarized Spectroscopy of Ho:CALGO for Ultrafast Lasers, Pavel Loiko[1], Kirill Eremeev[1], Christoph Liebald[2], Volker Wesemann[2], Sebastian Schwung[2], Mark Peltz[2], Daniel Rytz[2], Weichao Yao[3], Yicheng Wang[3], Sergei Tomilov[3], Patrice camy[1], Clara J. Saraceno[3], Alain Braud[1]; *[1]CIMAP, Université de Caen Normandie, France; [2]EOT GmbH, Germany; [3]Photonics and Ultrafast Laser Science, Ruhr Universität Bochum, Germany.* We report on the polarized spectroscopy of Ho^{3+}-doped CALGO crystals in the spectral range of 2-3 µm, confirming observed trends in recent mode-locking experiments. The role of multiphonon-assisted processes is discussed.

MTh4C.4 • 16:45

Broadly Tunable Continuous Wave Tm^{3+}:BaF_2 Laser, Karel Veselsky[1,2], Pavel Loiko[2], Kirill Eremeev[2], Abdelmjid Benayad[2], Alain Braud[2], Patrice camy[2], Jan Sulc[1], Helena Jelinkova[1]; *[1]Czech Technical Univ. in Prague, Czechia; [2]Centre de Recherche sur les Ions, les Matériaux et la Photonique, France.* We report on the growth, spectroscopic and laser properties of a Tm^{3+}:BaF_2 crystal. A continuous-wave Tm^{3+}:BaF_2 laser generated 184 mW at 1.89 μm with 54.8% slope efficiency and wavelength tuning across 169 nm was demonstrated.