Short Time-scale Physics and Applied Laser Physics Division
Fachverband Kurzzeit- und angewandte Laserphysik (K)

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Overview of Invited Talks and Sessions

(Lecture hall HS 20; Poster Philo 1. OG)

Invited Talks

K 1.1	Mon	11:30–12:00	HS 20	**Explaining changes in the crystallinity of a thin gold film upon irradiation with ultrafast laser radiation by ultrafast metrology and ex situ analysis** — Markus Olbrich, Petr Cejpek, Hariprasath Ganesan, Theo Pflug, Andy Engel, David Rafaja, Stefan Sandfeld, Andrés Fabián Lasagni, •Alexander Horn
K 5.1	Thu	11:00–11:30	HS 20	**Scientific imaging in experimental physics: from photon flux to detector requirements and challenges for scientific cameras** — •Simon Assmann

Invited Talks of the joint Symposium SAMOP Dissertation Prize 2026 (SYAD)

See SYAD for the full program of the symposium.

SYAD 1.1	Mon	14:30–15:00	RW 1	**What graphs can tell us about quantum information** — •Kiara Hansenne
SYAD 1.2	Mon	15:00–15:30	RW 1	**Realization of alkaline-earth circular Rydberg qubits in optical tweezer arrays** — •Christian Hölzl
SYAD 1.3	Mon	15:30–16:00	RW 1	**Pattern Formation and Supersolid-like Sound Modes in a Driven Superfluid** — •Nikolas Liebster
SYAD 1.4	Mon	16:00–16:30	RW 1	**Harnessing time-frequency qudits using integrated nonlinear processes** — •Laura Serino

Invited Talks of the joint Symposium New Trends in Laser Systems and their Applications for Photonic Quantum Systems and Emerging Technologies (SYLA)

See SYLA for the full program of the symposium.

SYLA 1.1	Tue	11:00–11:30	P 1	**3D printing of integrated optics on thin-film lithium niobate for quantum photonic applications** — •Moritz Hinkelmann, Alexandra Rittmeier, Elisavet Chatzizyrli, Philipp Gehrke, Muhamed A. Sewidan, Andreas Wienke, Dietmar Kracht, Michael Kues
SYLA 1.2	Tue	11:30–12:00	P 1	**Photonic Quantum Sensors and Their Fabrication Using Femtosecond Laser Micromachining** — •Tobias Menold
SYLA 1.3	Tue	12:00–12:30	P 1	**3D printed micro-optics: Novel fabrication enabling innovative designs** — •Michael Schmid, Simon Thiele, Nils Fahrbach
SYLA 2.1	Wed	14:30–15:00	HS 20	**Low-Noise Quantum Frequency Conversion for NV-Based Quantum Network Nodes** — •Bernd Jungbluth, Fabian Geus, Ludwig Hollstein, Hans Huber, Florian Elsen
SYLA 2.2	Wed	15:00–15:30	HS 20	**ZEISS Innovation: EUV lithography, a European Success story** — •Dirk Heinrich Ehm
SYLA 2.3	Wed	15:30–16:00	HS 20	**Advancements in Infrared Spectroscopy with Undetected Photons** — •Chiara Lindner, Frank Kühnemann

SYLA 2.4	Wed	16:00–16:30	HS 20	**Ultrafast 2μm fiber lasers for scientific and industrial applications** — Tobias Heuermann, Christian Kern, Ziyao Wang, Evgeny Shestaev, •Oliver Herrfurth, Christian Gaida, Tino Eidam

Invited Talks of the joint Symposium Laser Driven X-Rays: Generation and Application (SYLX)

See SYLX for the full program of the symposium.

SYLX 1.1	Fri	14:30–15:00	RW 1	**Laserstrahlquellen als Treiber für Sekundärstrahlquellen** — •Torsten Mans, Dominik Bauer, Thomas Metzger, Dominik Ertel, Claus Schnitzler, Tino Eidam
SYLX 1.2	Fri	15:00–15:30	RW 1	**Development and Integration of Novel LPP Radiation Sources for Enhanced Characterization and Industrial Application** — Lion Günster, Luka Petersen, Philip Mosel, Peer Biesterfeld, Sven Fröhlich, Jose Mapa, Greta Paruschke, Pia Koopmann, Bianca Iwan, Uwe Morgner, •Milutin Kovacev
SYLX 1.3	Fri	15:30–16:00	RW 1	**Near-relativistic ytterbium fiberlaser plasma source for high-flux hard X-ray generation from a liquid-metal jet** — •Robert Klas, Maximilian Benner, Mohammed Almassarani, Maximilian Karst, Lucas Eisenbach, Philipp Gierschke, Warunya Röder, Arno Klenke, Jan Rothhardt, Jens Limpert
SYLX 1.4	Fri	16:00–16:30	RW 1	**Laser-driven X-ray generation for industrial applications** — •Johannes Maximilian Ebert, Klaus Bergmann, Sarah Klein, Martin Traub, Jochen Vieker, Stephan Herman Wissenberg, Hans-Dieter Hoffmann

Sessions

K 1.1–1.6	Mon	11:30–13:15	HS 20	**Laser Systems and their Applications I**
K 2.1–2.3	Mon	17:00–17:45	HS 20	**Laser Systems and their Applications II**
K 3.1–3.4	Mon	17:45–18:45	HS 20	**THz, EUV and X-Ray Sources and their Application**
K 4.1–4.19	Tue	17:00–19:00	Philo 1. OG	**Poster (joint session K/Q)**
K 5.1–5.5	Thu	11:00–12:30	HS 20	**Optical Methods**
K 6	Thu	12:30–13:00	HS 20	**Members' Assembly**

Members' Assembly of the Short Time-scale Physics and Applied Laser Physics Division

Thursday 12:30–13:00 HS 20

- Bericht
- Verschiedenes

K 1: Laser Systems and their Applications I

Time: Monday 11:30–13:15 Location: HS 20

Invited Talk K 1.1 Mon 11:30 HS 20

Explaining changes in the crystallinity of a thin gold film upon irradiation with ultrafast laser radiation by ultrafast metrology and ex situ analysis — Markus Olbrich[1,2], Petr Cejpek[3,4], Hariprasath Ganesan[5], Theo Pflug[1,6], Andy Engel[1], David Rafaja[3], Stefan Sandfeld[5,7], Andrés Fabián Lasagni[2,8], and •Alexander Horn[1] for the DFG Microstructure-Collaboration — [1]Hochschule Mittweida — [2]Technische Universität Dresden — [3]TU Bergakademie Freiberg — [4]Institute of Physics FZU Prague — [5]Forschungszentrum Jülich — [6]Carl Zeiss SMT GmbH — [7]RWTH Aachen — [8]Fraunhofer-Institut IWS Dresden

Complementary investigations combining ultrafast interferometry and reflectometry with ex-situ SEM, EBSD, TEM, and EELS analysis of the microstructure, as well as two-temperature modeling in combination with hydrodynamics (TTM-HD) and molecular dynamics (TTM-MD), are performed to study irreversible changes in the material's microstructure upon irradiation with ultrafast laser radiation. The approach is exemplified by irradiating a 150 nm-thick gold layer, including a 20 nm-thick chromium adhesion layer on a glass substrate with ultrafast laser radiation (800 nm, 40 fs). The results of ultrafast metrology are correlated with the final size and orientation of the metallic grains, with the interdiffusion of chromium and gold, and complemented by the TTM-HD and TTM-MD simulations. Thereby, the generation of nanovoids in the ps-range and the delamination of the films in the μs-range are the dominant effects, inducing changes in the size and orientation of the metallic grains.

K 1.2 Mon 12:00 HS 20

Single-shot time resolved diffractive imaging of ultrafast plasma-dynamics in gold foils — •Tom Böttcher, Maura Münier, Stefan Lochbrunner, Christian Peltz, Thomas Fennel, and Franziska Fennel — University of Rostock, Germany

Resolving the excitation and relaxation dynamics of laser-induced solid-state plasmas is essential for understanding how condensed matter targets respond to intense laser radiation. Knowledge about the influence of laser parameters, such as spatial, temporal, and spectral pulse structure on the plasma dynamics is crucial for tailored laser machining applications.

Here, we present an experimental method to observe plasma dynamics in laser-excited, thin, semi-transparent targets using single-shot pump-probe coherent diffractive imaging. Our targets are 30 nm thin, free-standing gold foils which are excited by a focused femtosecond 800 nm pump pulse. To capture the resulting dynamics, a low-intensity femtosecond 400 nm probe pulse images the excited target, and the resulting diffraction image is captured using a CMOS camera.

Using a phase retrieval algorithm [1], we reconstruct the 2D spatially resolved complex transmission from the diffraction patterns for different time delays of up to 2 ns. This allows us to probe ultrafast excitation processes in the femtosecond-to-picosecond regime, as well as melting and ablation dynamics in the picosecond-to-nanosecond regime.

[1] R. Altenkirch et al, *New J. Phys.* 26 (2024), 113010

K 1.3 Mon 12:15 HS 20

Coherent control in V-type system: Simulation insights using intense two-dimensional coherent spectroscopy — •Rishabh Tripathi, Krishna Maurya, and Rohan Singh — Indian Institute of Science Education and Research (IISER) Bhopal, Bhopal, India

Our study investigates coherent control in V-type three-level systems using high-intensity, ultrafast laser pulses, explored through two-dimensional coherent spectroscopy (2DCS). Employing numerical solutions of the optical Bloch equations, we analyze the response of a V-type system to Gaussian pulses of 10 fs and 120 fs. The research reveals that shorter pulses induce uniform Rabi oscillations, whereas longer pulses result in complex quantum interference and state-specific population dynamics. This distinction underscores the pivotal role of pulse duration and spectral properties in modulating quantum interactions. Our 2DCS simulations, utilizing phase-cycling methods, provide insight into the system's spectral response in both perturbative and non-perturbative regimes. These simulations reveal the manipulation of spectral peak amplitudes and phases by adjusting the pulse areas, demonstrating control over the system.

This work contributes to the understanding of light-matter interactions in quantum systems and highlights the potential of tailored laser pulses for advanced coherent control, with implications for atomic vapors, semiconductor nanostructures, and photonics research.

K 1.4 Mon 12:30 HS 20

Laser-induced processes during and after the laser-matter interaction of single-crystalline silicon irradiated with ultrashort pulsed laser radiation — •Andy Engel, Markus Olbrich, Theo Pflug, and Alexander Horn — Laserinstitut Hochschule Mittweida, Technikumplatz 17, 09648 Mittweida, Germany

The irradiation of single-crystalline silicon with ultrashort pulsed laser radiation leads to irreversible material changes when a material-dependent threshold is exceeded, starting with changes in crystallinity and extending to ablation. This work examines these material transformations for the irradiation of single-crystalline, <111>-oriented silicon as a function of both the fluence of the applied ultrashort pulsed laser radiation (40 fs, 800 nm) and the number of individual pulses delivered to each processing spot. The irreversible changes arising from the interaction between laser radiation and matter were identified by measuring the spatially and spectrally resolved refractive index using ex-situ ellipsometry and SEM analyses. Comparative investigations of the surface topography of the irradiated regions were conducted via confocal laser scanning microscopy and atomic force microscopy. Additional insights into the depth of thermally induced material alterations were obtained through subsequent wet chemical etching. When combined with ultrafast metrology, pump-probe imaging reflectometry, and interferometry, these methods enable a more comprehensive and precise characterization of the physical processes triggered by ultrashort pulsed laser irradiation.

K 1.5 Mon 12:45 HS 20

Utilizing Transient Effects for Ablating Glass Using Combined Picosecond and Nanosecond Laser Pulses — •Lasse Bienkowski[1,2], Liseth Y. Martinez Aponte[1], Andreas A. Brand[1], and Jan Nekarda[1] — [1]Fraunhofer Institute for Solar Energy Systems, Freiburg, Germany — [2]Institut für Ionenphysik und Angewandte Physik Universität Innsbruck, Innsbruck, Austria

Ultrashort pulsed lasers are essential for various glass processing applications. Nanosecond (ns) laser pulses typically offer higher ablation rates, while picosecond (ps) pulses generally improve process quality. We explore a hybrid approach utilizing a double-pulse laser system capable of generating near-infrared pulse pairs with durations of 1 ps and 10 ns with a tunable delay. Our goal is to enhance ablation efficiency by using a leading ps-pulse to induce transient effects, enabling the absorption of subsequent ns-pulses.

We investigate the interaction by focusing the beam on fused silica and soda-lime glass and measuring the transmitted ns-pulse intensity. For leading ps-pulses, the transmission of the ns-pulses is reduced by up to 40 %. For leading ns-pulses, no reduction is observed, suggesting the presence of a transient effect triggered by the ps-pulse glass interaction.

In a single-shot ablation experiment, pulse pairs are focused on the glass samples. The resulting craters show an enhancement in ablation depth for leading ps-pulses, surpassing the single-pulse ablation depth. The effect persists for delays of > 200 ns, depending on the material and envelope energy. This approach provides a promising route to faster laser-glass machining processes.

K 1.6 Mon 13:00 HS 20

High resolution materials processing with temporally shaped femtosecond pulses — Cristian Sarpe[1], Florian Fiedler[1,2], Omar Elsheikh[1,2], Bastian Zielinski[1,2], and •Camilo Florian[1,2] — [1]University of Kassel, Institute of Physics and CINSaT, Heinrich-Plett-Str. 40, 34132 Kassel, Germany — [2]University of Kassel, Institute of Materials Engineering, Moenchebergstr. 7, 34125 Kassel,University of Kassel, Institute of Materials Engineering, Moenchebergstr. 7, 34125 Kassel, Germany

Femtosecond laser systems are becoming the mainstream processing tool for high lateral resolution materials processing. Traditional direct write laser systems employ nominal bandwidth limited pulses that typically display Gaussian temporal profiles, which most of the time produce crater shaped modifications at the surface level in dielectric, semiconductor, and metallic materials. Advancements in temporal pulse shaping techniques have demonstrated significant improvements in the final size and depth, increasing the overall ablation efficiency and the final lateral resolution. In this work, we present a survey that includes the formation of micro and nanometric size modifications induced by temporally shaped femtosecond laser pulses generated by an amplified Ti:Sa femtosecond laser system operating at 1 kHz, 790 nm nominal wavelength, and a pulse duration of 30 fs. Five types of femtosecond pulses were implemented. The results highlight the critical role of temporal pulse shaping in controlling laser material interactions and open new pathways for high precision material processing across many disciplines and fields of application.

K 2: Laser Systems and their Applications II

Time: Monday 17:00–17:45 Location: HS 20

K 2.1 Mon 17:00 HS 20

Diode-Pumped and Helium-Gas-Cooled Yb:YAG Multi-Slab Amplifier with > 10 J Pulse Energy and > 1 Hz Repetition Rate — •Katrin Schulz[1,2], Klaus Ertel[1], Markus Graf[1], Harald Rapp[1], Aleksander Budnicki[1], Klaus Albers[1], Thomas Dekorsy[2,3], and Bernd Metzger[1] — [1]Trumpf Laser SE, 78713 Schramberg, Germany — [2]University of Stuttgart, 70569 Stuttgart, Germany — [3]German Aerospace Center (DLR), 70569 Stuttgart, Germany

We report on a high-energy, diode-pumped solid-state laser employing a multi-slab multi-pass Yb:YAG amplifier operating with helium gas cooling at room temperature. So far, the highest measured parameters with this setup are 10.4 J pulse energy at 20 ns pulse duration, an optical-to-optical efficiency of 23 %, and a repetition rate of 10 Hz. Furthermore, an output energy stability of 0.17 % (std. dev.) was demonstrated over 20 minutes. The current results demonstrate the potential to increase the output energy and repetition rate to approximately 20 J and 100 Hz, respectively, within a reasonable timescale. This demonstration of room temperature operation brings industrial application of high-energy and high-average power laser systems closer to reality.

K 2.2 Mon 17:15 HS 20

Compact Shot-Noise Limited Multipass OPO providing Watt-Scale, Femtosecond Pulses — •Johann Thannheimer[1], Florent Kadriu[1,2], Philipp Flad[1], Tobias Steinle[1,2], and Harald Giessen[1] — [1]4th Physics Institute and Research Center SCoPE, University of Stuttgart, Stuttgart, Germany — [2]SI Stuttgart Instruments GmbH, Stuttgart, Germany

We present an efficient, high power, tunable, shot-noise limited, truly single-stage, ultrashort pulse source with an excellent spatial profile. High power ultrafast lasers are essential light sources for a many applications such as ultrafast spectroscopy, bioimaging and medical ablation. The limited number of laser gain media that simultaneously provide a large gain bandwidth and high gain limits ultrafast lasers to only a few central wavelengths. Optical parametric oscillators (OPO) are inherently broadly tunable, but limited to either a high gain or a broad bandwidth. The traditional solution to this are cascading amplification stages, increasing system footprint and cost. Our novel multipass parametric amplifier (MPA) [Nägele et al. Nature 647, 74 (2025)] combines multiple passes through a single nonlinear crystal with dispersion engineered coatings to reset the dispersion and drop the idler, simultaneously achieving a broad bandwidth and high gain. In this work the MPA is implemented in a fiber-feedback cavity as an oscillator (FFMOPO). This allows us to forgo a seed OPO, decreasing the system footprint and cost. Signal powers over one Watt at pulse durations around 100 fs are achieved with a system conversion efficiency of around 40 % and a tuning range of over 400 nm.

K 2.3 Mon 17:30 HS 20

Continuous-wave injection-seeded multipass OPA for direct 1 W, 76 MHz, sub-50 fs pulse generation at 1.5*1.7 *m — •Florent Kadriu, Johann Thannheimer, Philipp Flad, Tobias Steinle, and Harald Giessen — University of Stuttgart 4th Physics Institute

Generating sub-50 fs laser pulses in the near-infrared via nonlinear down-conversion is fundamentally limited by the trade-off between amplification bandwidth and achievable gain. Conventional approaches based on OPOs or OPO/OPA combinations often require several amplification stages, adding significant complexity. A cw-seeded OPA can eliminate the need for an additional OPO, but such setups typically remain elaborate multi-stage systems. Here, we present a cw-seeded, extremely compact, and low-noise OPA based on our recently introduced multipass-OPA technology (Nägele et al.,*Dispersion-engineered multipass optical parametric amplification,* Nature 647, 74*79 (2025)). The system delivers Watt-scale average power in sub-50 fs pulses and is continuously tunable from 1.5 to 1.7 *m, offering a simple and efficient alternative to conventional multi-stage near-IR ultrafast sources.

K 3: THz, EUV and X-Ray Sources and their Application

Time: Monday 17:45–18:45 Location: HS 20

K 3.1 Mon 17:45 HS 20

Overdriven High-Harmonic Generation in a Sub-mm Glass-Chip — •Linda Oberti for the HHG in glass-chip-Collaboration — Centre for Free-electron Laser Science, Deutsches Elektronen-Synchrotron, Notkestr. 85, 22607 Hamburg, Germany — Institute for Photonics and Nanotechnologies, Consiglio Nazionale delle Ricerche, piazza L. da Vinci 32, 20133 Milano, Italy — Physics Department, Politecnico di Milano, piazza L. da Vinci 32, 20133 Milano, Italy

Attosecond light sources based on high-harmonic generation provide a table-top route to coherent broadband radiation from the extreme ultraviolet to the soft X-ray region. One approach to extending the harmonic cutoff is to increase the driving wavelength, though this reduces conversion efficiency. Alternatively, the overdriven regime can be accessed at the same wavelength, requiring precise control of plasma formation over sub-millimeter distances. We address this challenge using a newly designed differentially pumped glass-chip target that ensures efficient gas confinement on sub-mm scales. Driven with multicycle near-infrared pulses at 800 nm and 1500 nm, it enables a cutoff extension up to a factor of two compared with conventional phase-matching geometries. Three-dimensional propagation simulations reproduce the experimental results and reveal that efficient phase matching of cutoff harmonics is achieved only in short media. They also show that plasma-induced reshaping of the driving field confines high-energy emission to the leading edge of the pulse and directs it off-axis in the near field. These results clarify key mechanisms governing overdriven HHG and demonstrate the importance of strong gas confinement.

K 3.2 Mon 18:00 HS 20

Coherent small-angle magnetic scattering from a high harmonic generation source — •Konstanze Korell[1], Sergey Zayko[1], Hung-Tzu Chang[1], Timo Schmidt[2], Murat Sivis[1,3], Manfred Albrecht[2], and Claus Ropers[1,3] — [1]Max Planck Institute for Multidisciplinary Sciences, Göttingen, Germany — [2]Experimental Physics IV, University of Augsburg, Germany — [3]4th Physical Institute - Solids and Nanostructures, University of Göttingen, Germany

Ultrafast demagnetization has been widely studied using time-resolved optical spectroscopy as well as soft X-Ray and EUV diffraction. Using a femtosecond high harmonic generation source, we conduct EUV scattering experiments on magnetic nanostructures in a laboratory-based setup. This yields general information about the transient evolution of statistical properties of domain walls. Ultrafast coherent diffractive imaging has recently provided real-space insights [1], limited, however, to reversible dynamics. Here, by carrying out coherent speckle diffraction, we combine the strengths of diffraction with the coherence of a source capable of coherent imaging. This approach provides insights to reversible and irreversible processes. In this contribution I present both the opportunities and limitations providing a basis for the interpretation of nanoscale magnetic dynamics in future ultrafast experiments.

[1] H.-T. Chang et. al, arXiv:2504.17917 (2025)

K 3.3 Mon 18:15 HS 20

Gepulste Plasmaquellen als brillante Emitter im Vakuum Ultraviolett — •Leonie Steigerwald[1], Klaus Bergmann[2] und Carlo Holly[1] — [1]Lehrstuhl für Technologie Optischer Systeme TOS, RWTH Aachen University, Germany — [2]Fraunhofer-Institut für Lasertechnik ILT, Aachen, Germany

Zukünftige Analyseverfahren in der Inspektion von Halbleitern erfordern neuartige, brillante Strahlungsquellen im Spektralbereich des Vakuum Ultraviolett (VUV), konkret im Bereich von ca. 100 nm - 200 nm. Heute eingesetzte kurwellige UV-Strahlungsquellen wie Deuterium Hochdrucklampen oder Laser geheizte kontinuierliche Plasmaquellen stoßen bzgl. Brillanz und der Skalierung zu kürzeren Wellenlängen an ihre Grenzen. Im Vortrag werden kurz die Anforderungen an die neuen VUV-Quellen aus der Messaufgabe in der Halbleiterinspektion abgeleitet und der Stand der Technik hinsichtlich der UV-Strahlungsquellen dargestellt. Mögliche Emitter und Konzepte für gepulste, hochbrillante Plasmaquellen werden diskutiert. Ferner werden ersten Ergebnisse zur Emission im VUV an einer hohlkathoden-getriggerten Pinchplasma-Entladung vorgestellt.

K 3.4 Mon 18:30 HS 20

Efficient Terahertz Generation via Two-color Field in Semiconductor — •Han Rao[1,2], Yiteng Zhang[3], Robin Mevert[1,2], Fridolin Jakob Geesmann[1], David Zuber[1,2], Arun Paudel[1,4], Ihar Babushkin[1,2,5], and Uwe Morgner[1,2] — [1]Leibniz University Hannover, Institute of Quantum Optics, Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany — [3]Leibniz University Hannover, Institute of Solid State Physics, Hannover, Germany — [4]Laser Zentrum Hannover, Hannover, Germany — [5]Max Born Institute, Berlin, Germany

Efficient and broadband terahertz (THz) sources operating at high repetition rates are essential for advanced spectroscopy and imaging applications. In this work, we demonstrate efficient two-color field-driven THz generation in Al0.4Ga0.6As using a femtosecond laser system operation at a 32.5MHz repetition rate. The 1 micrometer thick AlGaAs emitter achieves comparable THz strength to that of widely used GaP (200 micrometer) crystals under similar excitation conditions. The generated THz radiation exhibits a broad spectrum, with measurable frequency components extending up to 5THz. Moreover, the AlxGa1-xAs material system offers an additional degree of tunability: by varying the aluminum mole fraction x, the bandgap of the material and corresponding nonlinear response can be precisely engineered. This tunability provides a versatile platform for studying phase-controlled injection photocurrents and quantum path interference in solids, thereby enabling systematic exploration of ultrafast carrier dynamics in semiconductor systems.

K 4: Poster (joint session K/Q)

Time: Tuesday 17:00–19:00 Location: Philo 1. OG

K 4.1 Tue 17:00 Philo 1. OG

Theoretical prediction of vibrational effects in multi-photon spectroscopy — •herve tajouo tela, deshan li, and julien bloino — Scuola Normale Superiore Pisa, Italy

The numerical investigation of molecular optical properties is essential for advancing our understanding of light*matter interactions. In this work, we present computational approaches for modeling two- dimensional (2D) photon absorption processes, with a particular focus on benchmarking 2D electronic*electronic transitions. These benchmark studies establish a basis for extending the methodology to more general frameworks that incorporate electronic*vibrational coupling. By employing advanced numerical techniques and high-precision algorithms, we aim to achieve accurate simulations of nonlinear optical responses and to predict spectroscopic signatures in complex molecular systems. Ultimately, this work seeks to improve the reliability of numerical simulations in capturing the fundamental features of multiphoton absorption processes, with applications spanning spectroscopy, photophysics, and quantum dynamics.

K 4.2 Tue 17:00 Philo 1. OG

A Flexible Laser Micromachining Platform for Fabricating Integrated Photonic Systems in Transparent Materials — •Yassin Nasr, Patrick Hildebrand, Veronica Montoya, Thilo Danner, Andreas Michalowski, and Tobias Menold — University of Stuttgart - Institut für Strahlwerkzeuge (IFSW), Stuttgart, Germany

The increasing demand for compact, robust, and fully integrated photonic systems requires fabrication tools that can structure transparent materials with high precision and three-dimensional flexibility. Many established laser micromachining studies rely on highly specialized setups optimized for a single process, limiting systematic comparisons and slowing scientific progress. To overcome these constraints, we developed a laser micromachining platform that combines multiple ultrafast laser processes into one versatile system architecture.

The setup combines a high-NA microscope objective for generating micrometer-scale focal spots, a galvanometric scanner and a high-precision XYZ translation stage for dynamic 3D processing and a spatial light modulator (SLM) for dynamic correction of aberrations and controlled beam shape inside transparent materials.

This architecture enables scientific investigations of various laser-based micromachining processes like direct laser writing of waveguides, selective laser etching to create integrated microstructures like lenses and laser-assisted bonding for joining glass substrates. All these processes form the technological basis for the scalable fabrication of robust integrated photonic systems on one single manufacturing platform.

K 4.3 Tue 17:00 Philo 1. OG

Spatiotemporal analysis of non-collinear optical parametric oscillators — •Robin Mevert[1,2], Fridolin Jakob Geesmann[1], Oliver Melchert[1,2], Han Rao[1,2], Arun Paudel[1,2], and Uwe Morgner[1,2,3] — [1]Leibniz University Hannover, Institute of Quantum Optics, Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany — [3]Laser Zentrum Hannover e.V., Hannover, Germany

Femtosecond non-collinear optical parametric oscillators exhibit complex spatiotemporal dynamics, making it challenging to predict their steady-state under different input conditions. This study applies a GPU-accelerated 2D+1-dimensional split-step Fourier method to solve a generalized model of the coupled wave equations. It considers all potential second-order nonlinear mixing processes, including phase matching, diffraction, and walk-off, for all interacting pulses. Additionally, the model includes the impact of third-order nonlinear effects, such as self-phase modulation (SPM) and cross-phase modulation (XPM), on the resulting cavity mode. The cavity roundtrip is modelled using the Collins diffraction integral, with additional losses, dispersion, and spatial filtering due to the limited size of the mirrors.

K 4.4 Tue 17:00 Philo 1. OG

Dressed-state-enhanced harmonic generation at high intensities with a single driving field — •Oskar Ernst and Thomas Halfmann — TU Darmstadt, Institut für angewandte Physik, Darmstadt, Germany

We investigate 5th and 7th harmonic generation of ultrashort picosecond laser pulses in the vacuumultraviolet (VUV) regime, enhanced by laser-induced dressed states in xenon. The pump laser for harmonic generation simultaneously acts as a control field, preparing multiple dressed states with large Autler-Townes splittings in the terahertz range. We observe well-defined dressed states even at large intensities up to 30 TW/cm^2, corresponding to an already small Keldysh parameter around 2. The presence of dressed states compensates the Stark shift, enabling resonantly enhanced frequency conversion by up to one order of magnitude across a broad spectral window of approximately 40 nm, tunable via laser wavelength and intensity. Our results demonstrate that significant resonance enhancements of VUV generation via dressed states are possible and relevant even without an additional control field.

K 4.5 Tue 17:00 Philo 1. OG

Time-Trapping Towards Manipulation of Single-Photon Wavepackets — •Marvin Franzke[1], Fridolin Geesman[1], David Zuber[1,2], Ihar Babushkin[1,2,3], and Uwe Morgner[1,2] — [1]Leibniz University Hannover, Institute of Quantum Optics, Welfengarten 1, 30167 Hannover, Germany — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering-Innovation Across Disciplines), 30167 Hannover, Germany — [3]Max Born Institute, Max-Born-Straße 2a, 10117 Berlin, Germany

In this project we are going to demonstrate experimentally a recent, theoretically suggested way of trapping and manipulating femtosecond-long weak pulses. A soliton propagating in a gas-filled hollow-core fiber creates a refractive index potential capable of trapping a much weaker pulse or even single photons. A weak pulse, described by linear optics, would always undergo dispersion, but trapping inside a soliton, described by nonlinear optics, allows for a dispersion-free propagation. Furthermore, trapping allows manipulation of the weak pulse by manipulating the soliton trap, since the weak pulse follows adiabatically. Here, two components of the experimental setup are discussed: an optical parametric amplifier (OPA) delivering the pulses, and diffractive optical elements (DOEs) converting the Gaussian mode from the OPA to higher order modes. These higher order modes are a crucial feature because the soliton and the weak pulse are at different wavelengths. By choosing different higher order modes for them and tuning the gas pressure, group velocity matching can be achieved. Furthermore, theoretical considerations about time-trapping are presented.

K 4.6 Tue 17:00 Philo 1. OG

Towards All-Optical Attoclock Measurements in Noble Gases Using Short-Wave Infrared Laser Pulses — •Fridolin Geesmann[1], Morten Drees[2], David Zuber[1,3], Ihar Babushkin[1,3,4], and Uwe Morgner[1,3] — [1]Leibniz University Hannover, Institute of Quantum Optics, Hannover, Germany — [2]University of Ottawa, Ottawa, Canada — [3]Cluster of Excellence PhoenixD, Hannover, Germany — [4]Max Born Institute, Berlin, Germany

Laser driven ionization of noble gases gives rise to a plethora of interesting effects, such as the so-called Brunel radiation, which originates from the ionization and subsequent acceleration of electrons in the strong optical electric field. The study of this radiation, in particular of its polarization state, allows for detailed insights into the fundamental principles of light-matter interaction. Here, we report on the usage of elliptically polarized short-wave infrared femtosecond laser pulses generated by a home-built optical parametric amplifier to drive the generation of Brunel harmonics in Argon, which then encode information about the tunnel time of the electrons through the Coulomb barrier of the gas atoms in the rotation of their polarization ellipse. Our setup facilitates ultrashort laser pulses centered around 2 μm that exhibit pulse energies of up to 110 μJ and pulse durations below 40 fs. Furthermore, it allows for the simultaneous measurement of the intensity-dependent polarization state of the third and fifth harmonic from the Brunel field, thus enabling an all-optical characterization of the tunnelling time of the matter under test.

K 4.7 Tue 17:00 Philo 1. OG

Probing High-Order Susceptibilities of monolayer MoS_2 via High Harmonic Generation: TDDFT approach — •Yeganehsadat Alvankar[1,2], Elnaz Irani[2], Hamid Talkhabi[1,2], and Mohammad Monfared[3] — [1]3ICMM, Centro Superior de Investigaciones Cientficas, Sor Juana Ines de la Cruz, 3 Cantoblanco, 28049 Madrid, Spain — [2]Department of Physics, Faculty of Basic Sciences, Tarbiat Modares University, P.O. Box 14115-175, Tehran, Iran — [3]Institute of Theoretical Physics, Leibniz University Hannover, Appelstraße 2, 30167 Hannover, Germany

High-harmonic generation (HHG) is a powerful method for probing high-order nonlinear optical responses in solids, across both perturbative and non-perturbative regimes.

Here, we use time-dependent density functional theory (TDDFT) to compute the nonlinear susceptibilities ($\chi^{(5)}, \chi^{(7)}, \chi^{(9)}$) of monolayer MoS_2 via HHG. Simulations employ intense ultrafast laser pulses ($\lambda_0 = 600,\text{nm}$) with peak intensities from 0.2-1.2 TW/cm^2.

Our results exhibit power-law scaling $\text{Yield}_N = A_N I^N$ and interband polarization, enabling direct extraction of higher-order susceptibilities. We also observe strong crystal orientation dependence, with anisotropic behavior across harmonic orders, emphasizing the role of polarization control in 2D material characterization.

Unlike previous methods (e.g., attosecond streaking) that inferred lower-order susceptibilities indirectly, HHG directly reveals higher-orders responses without broad spectra or indirect analysis. Quantifying such nonlinearities is key to advancing ultrafast photonic.

K 4.8 Tue 17:00 Philo 1. OG

Neural network reconstruction of hamiltonians and transition dipole couplings from transient absorption spectra — •Ronald Cardenas, Ulf Saalmann, and Jan-Michael Rost — MPI-PKS, Dresden, Germany

Transient absorption spectroscopy (TAS) provides insight into ultrafast electronic dynamics, yet the resulting spectra are often challenging to interpret with conventional tools. In this work, we develop a Convolutional Neural Network (CNN) that reconstructs effective Hamiltonian matrices directly from TAS data. In addition to recovering effective energy levels, the model also predicts transition dipole couplings, which determine electronic coherences and state interactions under external fields. These couplings are essential to determine the optical response for linear and nonlinear optical processes. As they cannot be measured directly, they are typically obtained from ab initio calculations. Such calculations can become demanding for larger systems or situations involving many excited states. The CNN approach provides an alternative route to estimating these couplings using only spectroscopic input. The reconstructed Hamilton matrices enable the calculation of dynamical properties such as time-dependent dipole moment and polarization response. They can also be used for simulations of open-system Lindblad dynamics, coherent control schemes, nonlinear spectroscopy, and strong-field ionization models. Overall, our approach links experimental TAS data to the theoretical parameters needed to model ultrafast light*matter interactions, offering a flexible framework for complex molecular systems.

K 4.9 Tue 17:00 Philo 1. OG

Neural network reconstruction of hamiltonians and transition dipole couplings from transient absorption spectra — •Ronald Cardenas, Ulf Saalmann, and Jan-Michael Rost — MPI-PKS, Dresden, Germany

Transient absorption spectroscopy (TAS) provides insight into ultrafast electronic dynamics, yet the resulting spectra are often challenging to interpret with conventional tools. In this work, we develop a Convolutional Neural Network (CNN) that reconstructs effective Hamiltonian matrices directly from TAS data. In addition to recovering effective energy levels, the model also predicts transition dipole couplings, which determine electronic coherences and state interactions under external fields. These couplings are essential to determine the optical response for linear and nonlinear optical processes. As they cannot be measured directly, they are typically obtained from ab initio calculations. Such calculations can become demanding for larger systems or situations involving many excited states. The CNN approach provides an alternative route to estimating these couplings using only spectroscopic input. The reconstructed Hamilton matrices enable the calculation of dynamical properties such as time-dependent dipole moment and polarization response. They can also be used for simulations of open-system Lindblad dynamics, coherent control schemes, nonlinear spectroscopy, and strong-field ionization models. Overall, our approach links experimental TAS data to the theoretical parameters needed to model ultrafast light-matter interactions, offering a flexible framework for complex molecular systems.

K 4.10 Tue 17:00 Philo 1. OG

Open-shell electron dynamics with restricted open-shell configuration interaction singles — •ka hei lee[1,2], pascal krause[1], and annika bande[1,2] — [1]Inorganic Chemistry Institute, Leibniz University Hannover, Germany — [2]Theory of Electron Dynamics and Spectroscopy, Helmholtz-Zentrum Berlin, Germany

The description of correlated, ultrafast electron dynamics in polyatomic many-electron molecules is a challenging task. The time-dependent configuration interaction (TDCI) method has shown to correctly describe the light-induced excitation processes on the natural time scale of the electrons. By employing atom-centered basissets formed spin orbitals, monitoring the evolution of the electronic wave packet in TDCI framework becomes possible and analysis tools of the electron-hole-pair formation are available. [1, 2]

The study of dynamics of open-shell systems states an even bigger challenge as it requires a multi-configurational character for the spin-adapted wavefunction. In this poster, I present how the time-dependent restricted open-shell configuration interaction singles (TD-ROCIS) methods can be employed to monitor light-driven electron dynamics calculations for open-shell systems.

[1] F. Langkabel, P. A. Albrecht, A. Bande, P. Krause, Chem. Phys., 557, 111502 (2022)

[2] F. Langkabel, P. Krause, A. Bande, WIREs Comput Mol Sci., 14, e1696 (2024)

K 4.11 Tue 17:00 Philo 1. OG

Impact of vertical Lidar misalignment on turbulence characterization for wind energy applications — •Vidana Popkova[1], Florian Jäger[1,2], Lukas Pauscher[1,2,3], Fabian Spallek[1], and Stefan Yoshi Buhmann[1] — [1]University of Kassel, Germany — [2]Fraunhofer IEE, Kassel, Germany — [3]Vrije Universiteit Brussel, Belgium

To evaluate the quality of possible wind-park locations, accurate knowledge of the turbulence characteristics of the expected wind-velocity-field is essential. The turbulence properties are commonly described by the variance of the field and may be extracted from measurements or simulations. Multi-LiDAR (Light Detection And Ranging) setups offer precise measurements for determining turbulence properties, but some systematic measurement uncertainties remain hard to control for. In particular, vertical offsets between LiDAR beams can drastically bias derived variances due to the large impact of the beam configuration on the measured data. We use a modified Mann model [1] to calculate the turbulence properties based on the spectral tensor and simulate dual-LiDAR configurations to study the influence of vertical offsets on the resulting variances. To this end, we introduce offsets directly in the spectral domain and examine their impact for varying atmospheric parameters. Several significant beam configurations are analyzed and compared with data from long-term mast measurements. The resulting theoretical framework can subsequently be used to develop turbulence-correction methods for misaligned LiDAR setups.

[1] Mann, J., J. Fluid Mech., 273, 141-168 (1994).

K 4.12 Tue 17:00 Philo 1. OG

Methods and hurdles for a live shot to shot polarization diagnostic — •Moritz Mogilowski[1,2] and Markus Illchen[1,2] — [1]Universität Hamburg, Hamburg, Germany — [2]CFEL, Hamburg, Germany

With the recent advances of free electron lasers, pushing further into the attosecond time regime with ultra short pulses investigation of the chirality and and its time dependence on electronic movements is becoming feasible. The polarization of the FEL pulse is critical and its charactisation is not only important for analysing the data but also an important live metric for the machine operators. In this poster a robust and flexible approach to a shot based live polarization diagnostic based on almost intrusion free electron time of flight spectroscopy is shown. Common failures and their remedies are also discussed.

K 4.13 Tue 17:00 Philo 1. OG

A Lab-based High Brilliance Secondary Source for Hard X-ray Generation — •Lion Günster, Luka Petersen, Jose Mapa, Greta Paruschke, Philip Mosel, Sven Fröhlich, Andrea Trabattoni, Uwe Morgner, and Milutin Kovacev — Leibniz Universität Hannover - Institut für Quantenoptik, Hannoverm Deutschland

The development of high-brilliance X-ray sources is one of the key factors driving rapid progress in industrial and medical applications. Due to the limitations of conventional X-ray sources, this growing demand has stimulated research into laser-based secondary sources. Combined with very high-power-laser, very promising results have already been reported. Within the framework of the XProLas project we construct and test such a laser-produced plasma X-ray source for their usability in industrial applications.

Femtosecond pulses with a pulse energy of 10 mJ are focused on a copper wire target reaching laser intensities of $2 * 10^{18}\,\mathrm{W/cm^2}$. To enable continuous operation of the source multiple debris mitigation schemes have been implemented. With a repetition rate of 50 kHz we aim to achieve brilliance levels of over $5 * 10^{13}$ photons/s sr in Cu K_α, surpassing state-of-the-art conventional X-ray sources by one order of magnitude.

K 4.14 Tue 17:00 Philo 1. OG

New light in the lab for single-particle imaging experiments — •Jasper Boultwood[1], Indrani Dey[1], Frederic Ussling[1], José Gómez Torres[1], Yves Acremann[2], Alessandro Colombo[1], Linos Hecht[1], Isabelle Bollier[1], Ehsan Hassanpour Yesagi[1], Jannis Lehmann[2], Katharina Kolatzki[1], Mirjam Kunz[1], Mario Sauppe[1], Angela Vidoni[1], Simon Wächter[1], Björn Senfftleben[1], and Daniela Rupp[1] — [1]Nanostructures and Ultrafast Science, ETH Zürich — [2]D-PHYS, ETH Zürich

Lab-based coherent diffraction imaging (CDI) of free-flying isolated nanoparticles has only recently become feasible and opens up new research opportunities. Short-wavelength pulses focused to high intensities are required, which are connected to rather extreme conditions for the high-harmonic generation (HHG) process. We investigate the use of different focusing geometries and driving wavelengths to optimize XUV pulse generation from a high-power NIR laser amplifyer (800 nm, 20 mJ, 30 fs). Interestingly, XUV generation in a Xenon gas cell using a 400 nm driving wavelength from second harmonic generation (SHG) in a BBO crystal results in the production of a single harmonic instead of four harmonics typical for an 800 nm driver. This single-line output is of interest for CDI applications as monochromatic diffraction creates clearer interference structures.

K 4.15 Tue 17:00 Philo 1. OG

X-ray and Electron Emission from peeling Adhesive Tape — Jose L. Mapa[1], •Luka Petersen[1], David Theidel[3], Philip Mosel[1], Charlotte Fischer[1,2], Sven Froehlich[1], Kim-Alessandro Weber[1], Peter Oberta[4,5], Jan-Willem Vahlbruch[2], Hamed Merdji[3], Uwe Morgner[1], and Milutin Kovacev[1] — [1]Leibniz University Hannover, Institute of Quantum Optics, Welfengarten 1, 30167 Hannover, Germany — [2]Leibniz University Hannover, Institute of Radioecology and Radiation Protection, Herrenhäuser Str. 2, 30419 Hannover, Germany — [3]Laboratoire dOptique Appliquée, École nationale supérieure de techniques avancées (ENSTA) ParisTech, CNRS, École polytechnique, 828 Boulevard des Maréchaux, 91120 Palaiseau, France — [4]Rigaku Innovative Technologies Europe s.r.o., Dolní Brežany, 252 41, Czech Republic — [5]Institute of Physics of the Czech Academy of Sciences, Na Slovance 1999/2, Praha 8, 182 00, Czech Republic

In recent years, several scientific groups have investigated X-ray generation by peeling adhesive tape in vacuum. X-ray generation results from electron emission during the peeling and their interactions with surrounding materials. These studies mainly focused on the tape, system properties, and electron interactions near the detachment point. We examine electron interactions with solid materials along their travel path. We observe a non-homogeneous spatial distribution of electron energies, which we compare with numerical simulations. It shows peeling adhesive tape can serve as a simple, low-cost X-ray source for educational demonstrations and small lab experiments.

K 4.16 Tue 17:00 Philo 1. OG

Dispersive-Wave Generation in a Kagome-Type Hollow-Core Fibre by Few-Cycle-Pulses — •David Zuber[1,2], Fridolin Jakob Geesmann[1], Ihar Babushkin[1,2,3], and Uwe Morgner[1,2] — [1]Leibniz University Hannover, Institute of Quantum Optics, Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany — [3]Max Born Institute, Berlin, Germany

Tunable ultrashort pulses in the ultraviolet (UV) spectral range have attracted significant attention in a variety of applications, including pump-probe spectroscopy, lithography, and the control of chemical reactions. Conventional laser systems are often limited by the availability of suitable gain media, while their nonlinear counterparts such as optical parametric amplifiers or oscillators face constraints imposed by crystal absorption, phase-matching conditions, and the availability of sufficiently energetic pump photons. The presented UV source is based on dispersive-wave generation in a gas-filled Kagome-type hollow-core fibre. The fibre is pumped with a few-cycle OPCPA system, thereby generating a tunable UV radiation peak accompanied by a broadband background spanning more than 1 PHz. The experimental findings are supported by numerical simulations, which demonstrate the potential for producing few-cycle pulses directly in the UV. In addition, the paper discusses prospects for extending this concept toward the extreme-ultraviolet regime.

K 4.17 Tue 17:00 Philo 1. OG

Temperature-dependence of two-color laser-induced currents in graphene — •Celina Hüttner[1], Weizhe Li[1], Daniel Lesko[1,2], and Peter Hommelhoff[1,2] — [1]Department Physik, Friedrich-Alexander-Universität (FAU) — [2]Department Physik, Ludwig-Maximilians-Universität München (LMU)

Strong laser fields have previously been used to induce directional currents in solids via symmetry breaking, enabling electronic coherent control on the femtosecond timescale. In graphene, an inversion symmetric semi-metal with extraordinary electronic and optical properties, the photocurrent generation can be controlled by shaping the laser field, for instance through control of the carrier envelope phase or by combining harmonics of a laser pulse. As the latter requires a coherent interaction of both pulses and the electrons in graphene, it enables detailed exploration of decoherence- and dephasing-mechanisms. While the two-color photocurrents have been extensively studied before, the role of phonon-electron scattering remains unclear. In order to investigate this process, we cool graphene to temperatures below 25 K via a continuous flow cryostat setup and measure the two-color photocurrent, at both room and cryogenic temperature. We study the behavior of the photocurrent at different temperatures by varying field strength, polarization and the two-color-phase.

K 4.18 Tue 17:00 Philo 1. OG

Investigation of the Thermal Behaviour of Yb:YAG and Yb:LuAG in High-Power Bulk Amplifiers — •Julian Siller[1], Arun Paudel[1], Han Rao[1,2], David Zuber[1,2], and Uwe Morgner[1,2] — [1]Leibniz University Hannover, Institute of Quantum Optics, Hannover, Germany — [2]Cluster of Excellence PhoenixD, Hannover, Germany

Ytterbium-doped gain materials are widely used in modern high-power ultrafast laser systems, where thermally induced effects strongly influence beam quality, wavefront stability and hence achievable focusability. While Yb:YAG is a well-established workhorse for solid-state amplifiers, recent studies suggest that Yb:LuAG may exhibit significantly reduced thermo-optical distortions, potentially offering advantages for high power operation. Here, we report on the development of a home-built bulk laser amplifier designed to directly compare the thermal behavior of Yb:YAG and Yb:LuAG under identical pumping conditions. The setup enables controlled high-power pumping in the near-infrared regime and allows for simultaneous measurements of thermal lensing and temperature-dependent gain dynamics. Using beam profiling and M square analysis, we quantify the evolution of thermally induced distortions within each crystal and assess their impact on the amplified output. We expect that the observed differences in the thermo-optical response of the two materials will provide insights into the suitability of Yb:LuAG as a low-distortion alternative to Yb:YAG for next-generation high-power bulk amplifiers.

K 4.19 Tue 17:00 Philo 1. OG

Characterization of the Temporal Pulse Contrast for Laser-Produced Plasma Applications — •Pia Koopmann, Peer Biesterfeld, Sven Fröhlich, and Milutin Kovacev — Leibniz Universität Hannover - Institut für Quantenoptik, Welfengarten 1, 30167 Hannover, Germany

Ultrafast, high-intensity laser systems are increasingly used to generate secondary radiation sources, such as X-rays and particle beams, offering promising capabilities for scientific and industrial applications. At these intensities, even the comparatively low-intensity laser pedestals and pre-/post-pulses can exceed material ionization thresholds. In particular, the formation of pre-plasma significantly changes the interaction conditions. This can result in effects such as an increased emission of hazardous radiation. Therefore, understanding and controlling these effects is critical for optimizing secondary source performance.

We present the development of an in-house built third-order autocorrelator, designed to characterize the temporal contrast of ultrafast laser systems with high dynamic range. A third-order autocorrelator provides the sensitivity necessary to capture these features and enables systematic studies of how the temporal contrast influences plasma dynamics and the efficiency of Laser-produced plasma sources. The device is optimized to provide the high dynamic range required to resolve weak ns to ps temporal structures, such as pedestals and pre-/post-pulses, which play a decisive role in laser-matter interaction dynamics.

K 5: Optical Methods

Time: Thursday 11:00–12:30 Location: HS 20

Invited Talk K 5.1 Thu 11:00 HS 20

Scientific imaging in experimental physics: from photon flux to detector requirements and challenges for scientific cameras — •Simon Assmann — Excelitas PCO GmbH, Donaupark 11, 93309 Kelheim

Optical imaging is essential in experimental physics whenever spatially and/or temporally resolved measurements are required. The motivation for using a camera arises from the need to capture intensity distributions, structural features, and spatial or temporal dynamics of light emission, scattering, or transmission that cannot be adequately measured with point detectors. Depending on the application, the underlying light conditions, such as photon flux, spectral characteristics, contrast, and relevant timescales, impose distinct requirements on detector performance. This contribution provides an overview of how these conditions translate into concrete camera specifications and highlights the relevance of key parameters such as spectral quantum efficiency, photon-shot and readout noise, dynamic range, pixel size, temporal sampling capability, and data-interface bandwidth. The current state of scientific camera technology is examined, and it is assessed how closely modern detectors approach the properties expected from an ideal sensor. A brief overview of the main camera system classes in the PCO portfolio, as well as recent challenges and developments, is discussed with respect to different types of experimental measurement scenarios.

K 5.2 Thu 11:30 HS 20

Nonlinear absorption and lasing properties of Rhodamine-110 dye composites using a 532 nanosecond laser — •Abeer Salah, Elham M. Mostafa, Randa Saad Hassan, and Ahmed M. Saad for the Z Scan Abeer Salah-Collaboration — National Institute of Laser Enhanced Sciences, Cairo University, Egypt

Rhodamine 110 (Rh-110) is a xanthene-based fluorescent dye that has garnered significant attention in scientific and industrial communities. The linear and nonlinear optical properties of the laser dye Rhodamine 110 in an ethanol solvent at various concentrations, ranging from 2 mM to 0.001 mM, were studied. The maximum lasing was observed at 1 mM via 532 nm pumping; the absorption and emission wavelengths were found to be 501 nm and 522 nm, respectively. RH-110 was polymerized in methyl methacrylate MMA, Glycidyl Methacrylate GMA, and GMA-MMA polymer matrices. The absorption and emission are slightly shifted compared to the liquid samples. The absorptivity, oscillator strengths, and emission cross sections were calculated. Observations indicate apparent concentration-dependent variations in spectral features, which is correlated with nonlinear optical measurements. Nonlinear absorption was carried out via a Z-scan using 532 nm nanosecond pulses. The measurements reveal saturable absorption, which provides an explanation for the lasing behavior of the Rh-100 series. The GMA-MMA dyes exhibit enhanced nonlinearity compared to GMA or MMA alone. The composite RH110 can be utilized in photonic devices due to its nonlinear optical properties.

K 5.3 Thu 11:45 HS 20

Comparing clocks: from time interval counting to timetagging — •Tizian Schmidt and Ilja Gerhardt — Institute of Solid State Physics, light & matter group, Leibniz Universität Hannover

Precise timing plays a crucial role in many areas of physics. Comparing ultra stable clocks is particularly challenging when the composite noise of the compared clocks is lower than the noise of the measurement system such as a conventional time interval counter.

The Dual Mixer Time Difference (DMTD) method overcomes this limitation by enabling a measurement of the relative phase and frequency differences between two such clocks without relying on a superior measurement system. Here, we present a setup based on digital post-processing of the DMTD signals using a commercially available timetagging device, negating the need for custom built electronic hardware. The setup is suitable for laboratory experiments as well as undergraduate lab courses. The resulting Allan deviations for the measured atomic clocks are compared to other standard time measurement techniques to compare clocks.

K 5.4 Thu 12:00 HS 20

Real-time tracking of the intramolecular vibrational dynamics of liquid water — Gaia Giovannetti[1], Sergey Ryabchuk[1,2], Ammar Bin Wahid[1], Hui-Yuan Chen[3], Giovanni Batignani[4], Erik P. Månsson[1], •Oliviero Cannelli[1], Emanuele Mai[4], Andrea Trabattoni[1,5], Ofer Neufeld[6], Angel Rubio[1,7], Vincent Wanie[1], Hugo Marroux[8], Tullio Scopigno[4], Majed Chergui[3,9], and Francesca Calegari[1,2,10] — [1]CFEL, DESY, Hamburg, Germany — [2]CUI, Hamburg, Germany — [3]LACUS, EPFL, Lausanne, Switzerland — [4]Università di Roma La Sapienza, Roma, Italy — [5]Leibniz Universität Hannover, Germany — [6]Technion Israel Institute of Technology, Haifa, Israel — [7]MPSD, Hamburg, Germany — [8]CEA-Saclay, Gif-sur-Yvette, France — [9]Elettra, Trieste, Italy — [10]Universität Hamburg, Hamburg, Germany

Water's vibrational motions, occurring on a few-femtosecond timescale, govern ultrafast energy transfer within its hydrogen-bond network. However, direct real-time observation of these motions has remained elusive due to the extreme temporal resolution required. Here, we investigate the ground-state vibrational dynamics of liquid water initiated by a sub-5 fs near-infrared pump pulse via Impulsive Stimulated Raman Scattering. Using few-fs ultraviolet probe pulses transmitted through a 5 um-thick liquid jet, we monitor the coherent vibrational wave packet dominated by the OH stretch mode, exhibiting a 10 fs oscillation period and a 25 fs damping time. These results reveal the rapid dephasing of the OH stretch mode preceding its relaxation through coupling to the bending vibrations.

K 5.5 Thu 12:15 HS 20

Photocurrent control in a light-dressed Floquet topological insulator — •Weizhe Li[1], Daniel Lesko[1,2], Tobias Weitz[1,2], Simon Wittigschlager[1], Christian Heide[3,4], Ofer Neufeld[5], and Peter Hommelhoff[1,2] — [1]Department of Physics, Friedrich-Alexander Universität Erlangen-Nürnberg — [2]Department of Physics, Ludwig-Maximilians Universität München — [3]Department of Physics, University of Central Florida — [4]CREOL, The College of Optics and Photonics, University of Central Florida — [5]Schulich Faculty of Chemistry, Technion - Israel Institute of Technology

Light-dressed materials, based on Floquet engineering, offers unique opportunities to shape transient band structures. Most commonly, circularly-polarized dressing light can generate topologically non-trivial nonequilibrium states known as Floquet topological insulators (FTIs) which host a variety of topological phenomena. Floquet engineering with strong optical fields opens routes to optically tunable band structures and devices for petahertz electronics.

Here we demonstrate coherent control of photocurrents in light-dressed graphene. Circularly-polarized laser pulses dress the graphene into an FTI, and phase-locked second harmonic pulses drive electrons in the FTI, forming a stroboscopic detection scheme. The two-color phase dependent photocurrents reflect the laser-induced symmetry breaking. This approach allows us to measure all-optical anomalous Hall currents and photocurrent circular dichroism. Furthermore, we map out the sub-optical cycle Floquet phase by varying the two-color phase.

K 6: Members' Assembly

Time: Thursday 12:30–13:00 Location: HS 20

All members of the Short Time-scale Physics and Applied Laser Physics Division are invited to participate.