K 2: Light and Radiation Sources, EUV and X-Ray Sources

Zeit: Dienstag 11:00–12:40 Raum: HS 3

K 2.1 Di 11:00 HS 3

Robust difference frequency generation scheme tunable from 6 to 16 μm circumventing spatial beam offset from angular phase-matching — •Florian Mörz[1], Tobias Steinle[2], Heiko Linnenbank[1], Andy Steinmann[1], and Harald Giessen[1] — [1]4th Physics Institute, University of Stuttgart, Research Center SCoPE, Pfaffenwaldring 57, 70569 Stuttgart — [2]ICFO - The Barcelona Institute of Science and Technology, 08860 Castelldefels, Barcelona, Spain

As many molecular vibrations are located in the fingerprint region, laser sources covering this wavelength range are of high interest for spectroscopy, due to their high brilliance, beam quality, and low noise. Especially parametric frequency conversion schemes are beneficial, due to their broad tuning range and high conversion efficiencies. Many mid-IR setups are based on difference frequency generation (DFG) between signal and idler beams of optical parametric oscillators (OPOs) or amplifiers (OPAs). However, as the signal and idler wavelengths depend on each other, wavelength tuning requires crystal rotation to satisfy phase-matching. This causes a spatial beam offset, which needs to be compensated accurately. Here, we present a robust DFG scheme, which prevents crystal rotation. The crystal angle is fixed and phase-matching is satisfied by matching the input wavelengths, which can be tuned independently. Thus, a DFG tuning range spanning from 6 to 16 μm with several mW output power, excellent long-term stability and low noise is achieved. Furthermore, we compare the performance of this setup to a signal- and idler-seeded DFG, as well as the performance of $AgGaSe_2$ and GaSe crystals.

K 2.2 Di 11:20 HS 3

Surface-emitting semiconductor light sources with in-plane micro-mirrors — •Bruno Jentzsch[1,2], Alvaro Gomez-Iglesias[2], Alexander Tonkikh[2], and Bernd Witzigmann[1] — [1]Universität Kassel, Kassel, Germany — [2]OSRAM Opto Semiconductors, Regensburg, Germany

A novel concept of surface-emitting semiconductor light source based on in-plane amplified stimulated emission is presented. The concept is beneficial for applications where high output power and highly directional emission characteristic are required. The proposed concept is completely based on wafer-level processing and offers a substantial technology simplification over conventional LDs and SLEDs.

We apply monolithically integrated micro-mirrors to deflect in-plane gain-guided optical modes normal to the chip surface. The surface above the out-coupling structures is covered with an optical coating. Depending on the waveguide, chip, and optical coating geometry the concept can be used to either fabricate a surface-emitting LD or a surface-emitting SLED. The samples were grown by metal-organic vapor phase epitaxy with several InGaAs/GaAs QWs emitting at a peak wavelength of 950 nm. Promising performance characteristics of investigated IR surface-emitting light sources are achieved. For instance, the spectral FWHM is $>$ 10 nm in the superluminescence regime and $<$ 1 nm in the lasing regime. The output power in pulsed operation at room temperature higher than 3.4 W is recorded at an operating current density of 6 kA/cm2. The highest measured WPE is larger than 44 % and the smallest fast-axis FWHM is 30 °.

K 2.3 Di 11:40 HS 3

Spatial Characterization of Intense Synthesized Sub-Cycle Pulses — •Fabian Scheiba[1], Giulio Maria Rossi[1], Roland E. Mainz[1], Yudong Yang[1,2], Miguel Silva[1], Giovanni Cirmi[1,2], and Franz X. Kärtner[1,2] — [1]Center for Free-Electron Laser Science CFEL and Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany and Physics Department, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [2]The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany

We present the spatial characterization of coherent light synthesis. To extend the bandwidth beyond the limitation of already broadband sources such as OPAs, the coherent synthesis is a scalable approach in terms of energy and pulse duration. This has great potential as driving source for the direct generation of isolated attosecond pulses without gating techniques, which is of great advantage for attosecond science. The control over the electric field obtained by waveform synthesis promises to enhance the cutoff and efficiency of HHG. The current status of our implementation describes a 0.5 mJ pulse with at λ_c=1.8 μm and a temporal duration of only 4.1 fs (TL: 4.0 fs) FWHM corresponding to 0.63 cycles. A synthesis of pulses from individual OPA-sources requires precise synchronization in time e.g. via feedback on the CEP and relative phase, as well as matching the pulse modes spatially. We measure the spatial coherence between the outputs of two few-cycle OPAs in the NIR and IR and proof of principle HHG is demonstrated in gas.

K 2.4 Di 12:00 HS 3

Relative timing jitter measurement at MHz Free Electron Lasers — •Michael Diez[1,2], Andreas Galler[1], Sebastian Schulz[3], Wojciech Gawelda[1,4], and Christian Bressler[1,2] — [1]European XFEL GmbH, Holzkoppel 4, 22869 Schenefeld, Germany — [2]he Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg,Germany — [3]Deutsches Elektronen-Synchrotron DESY, Notkestrasse 85, 22607 Hamburg, Germany — [4]Faculty of Physics, Adam Mickiewicz University, Umultowska 85, 61-614 Poznań, Poland

Free Electron Lasers (FELs) are capable of producing intense and ultrashort X-ray pulses, which enable various kinds of femtosecond time - resolved experiments. Achieving highest time resolution in optical pump / X-ray probe experiments, so called 'Timing Tools' are necessary to measure the relative arrival jitter between optical and X-ray pulse pairs [1]. We report on a novel approach which enables us to measure the relative arrival time with superior signal quality. Consequently we can now use samples such as diamond which could not be used so far, but is one of the few materials to withstand the full power of the new MHz high repetition rate XFEL facilities such as European XFEL and LCLS II. We show proof of principle measurements from LCLS and SACLA experiments and first MHz timing measurements from European XFEL. [1] Bionta, M. R. et al. Spectral encoding method for measuring the relative arrival time between x-ray/optical pulses. Review of Scientific Instruments 85, 083116 (11) (2014).

K 2.5 Di 12:20 HS 3

Imaging of ultrafst demagnetization using high-harmonic radiation — •Sergey Zayko[1], Ofer Kfir[1], Michael Heigl[2], Michael Lohmann[1], Murat Sivis[1], Manfred Albrecht[2], and Claus Ropers[1] — [1]IV. Physical Institute - Solids and Nanostructures , University of Göttingen — [2]Experimental Physics IV, Institute of Physics, University of Augsburg

Laser-driven sources of extreme-UV radiation based on high-harmonic generation (HHG) provide unique access to femtosecond-to-attosecond pulses, and thus, become an indispencible tool for ultrafast dynamics studies. However, the combination of these temporal properties with real-space imaging [1] remained challenging. Here, we report on the first demonstration of nanoscale imaging of ultrafast dynamics using HHG source. Using a synergy of holography and coherent diffractive imaging we quantitatively map the magnetization state of worm-like domains as they undergo femtosecond demagnetization. This versatile element-specific dynamical microscope allows for comprehensive studies of ultrafast magnetism [2] in space and time, compatible with a wide-range in-situ control, e.g., with external magnetic and electric fields, currents, light and temperature.

[1] O. Kfir, S. Zayko et al., Science Advances 3, no. 12, eaao4641(2017). [2] J. Walowski and M. Münzenberg, Journal of Applied Physics 120, 140901 (2016).