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.