K 2: Optical Methods - Light and Radiation Sources

Time: Monday 16:15–17:45 Location: MB HS

Invited Talk K 2.1 Mon 16:15 MB HS

Leistungsfähigkeit und Entwicklungsrichtungen moderner Bildsensoren und Kamerasysteme — •Gerhard Holst — PCO AG, Donaupark 11, 93309 Kelheim

Seit der Ankündigung der Firma Sony im Januar 2015, dass sie die Produktion von CCD (Charge Coupled Devices) Bildsensoren einstellen will hat sich der Fokus auf CMOS (Complementary Metal Oxide Semiconductors) Bildsensoren noch vergrössert. Seit dem letzten Überblick wurden einige neue Kamerasysteme mit mehr Empfindlichkeit oder besseren Leistungsdaten realisiert und auch im kommerziellen Bereich neue Konzepte vorgestellt, die möglicherweise auch in wissenschaftliche Kamerasysteme Einzug halten werden. Der Vortrag wird anhand von Beispielen einen Überblick hierzu geben und soweit möglich Resultate zeigen.

K 2.2 Mon 16:45 MB HS

Ptychographic reconstruction and characterization of optical vortices — •Frederik Tuitje[1,2], Michael Zürch[1,2], and Christian Spielmann[1,2] — [1]Institute for Optics and Quantum Electronics, Abbe Center of Photonics, Friedrich Schiller University Jena, Germany — [2]Helmholtz Institute Jena, Germany

Electromagnetic fields exhibiting helical phase profiles, so-called optical vortices (OV), are widely used in high-resolution imaging as structured light field, in spectroscopy to measure dipole-forbidden transitions and in particle manipulation. Recent research focusses on generating OV beams in the extreme ultraviolet regime via high harmonic generation [1]. In this spectral region, conventional beam characterization approaches for helical wavefronts are difficult to implement owing to the lack of efficient optical elements. Here, we present a method to fully characterize an optical vortex in amplitude and phase by employing ptychographic reconstructions following detection of a series of coherent diffraction patterns formed by a binary aperture. With this method, we can successfully reconstruct the helical phase of an OV yielding information about the topological charge, shape and size of the illuminating OV in unprecedented quality.

[1] Zürch, M.; Kern, C.; Hansinger, P.; Dreischuh, A.; Spielmann,C.: Strong-field physics with singular light beams. In: Nature Physics 8 (2012)

K 2.3 Mon 17:00 MB HS

Spatio-spectral analysis of ultrashort vortex pulses by radial meta-moments — •Max Liebmann[1], Alexander Treffer[1], Martin Bock[1], Thomas Seiler[2], Thomas Elsaesser[1], and Ruediger Grunwald[1] — [1]Max Born Institut for Nonlinear Optics and Short-Pulse Spectroscopy, Berlin — [2]FernUniversität Hagen, Optische Nachrichtentechnik, Hagen, Germany

The propagation-dependent spectral structure of ultrashort-pulsed wavepackets with orbital angular moment was characterized by high-resolution and high sensitivity spatially resolved spectroscopy and adapted statistical tools. In particular, a rotation of extremal spectral features around the singularity was observed which is explained by a Gouy phase shift (spectral Gouy rotation [1]). A more complex oscillatory behavior is revealed by advanced statistical tools on the basis of spectral meta-moments [2]. The analysis of radially and azimuthally dependent meta-moments enables to adequately describe fast variations in shape and size of spectral maps like symmetry break and spiral distortion. The propagation time interval for a complete switching between minimum and maximum spatial diameter of the spectral peaks was found to be < 34 fs.

References: 1. M. Liebmann et al., Spectral anomalies and Gouy rotation around the singularity of ultrashort vortex pulses, Opt. Express 25, 26076-26088 (2017). 2. M. Liebmann et al., Spectral anomaly of ultrashort vortex pulses with axially oscillating twist, Photonics West, Complex Light and Optical Forces XII, paper 10549-14, San Francisco, USA (to be submitted, 2018).

K 2.4 Mon 17:15 MB HS

PHz-wide spectral interference through coherent plasma-induced fission of higher-order solitons — •Felix Köttig[1], Francesco Tani[1], John C. Travers[1,2], and Philip St.J. Russell[1] — [1]Max Planck Institute for the Science of Light, Erlangen, Germany — [2]School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, UK

Gas-filled hollow-core photonic crystal fibers provide a unique platform for studying strong-field nonlinear fiber optics, in particular the interaction of optical solitons with self-induced plasmas. While this has practical applications, for example in the generation of spectra extending from the ultraviolet to the mid-infrared, soliton-plasma interactions can also lead to as-yet-unexplored soliton dynamics. We report a novel regime of soliton-plasma dynamics in which high-intensity ultrashort pulses of intermediate soliton order undergo coherent plasma-induced fission. Experimental results obtained in gas-filled hollow-core photonic crystal fiber are supported by rigorous numerical simulations. In the anomalous dispersion regime, the cumulative blueshift of higher-order input solitons with ionizing intensities results in pulse splitting before the point of maximum self-compression, leading to the generation of robust ultrashort pulse pairs with PHz bandwidths. The observed dynamics close the gap between plasma-induced adiabatic soliton compression and modulational instability.

K 2.5 Mon 17:30 MB HS

μTRLFS: Spatially- and time-resolved laser fluorescence spectroscopy of Eu(III) sorption on Eibenstock granite — •Konrad Molodtsov[1,2] and Moritz Schmidt[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Institute of Resource Ecology, Germany — [2]Technische Universität Dresden, Germany

Time-resolved laser fluorescence spectroscopy (TRLFS) is a widely used method to obtain information about the surrounding chemical environment of fluorophores with trace concentration sensitivity. This method allows determining the symmetry and grade of complexation of the fluorophore and provides information about the surrounding quenchers, mainly water as well. For highly heterogeneous systems however distinguishing and separating multiple binding species becomes an unsolvable problem. In this study a new method called μTRLFS is introduced, which will add a spatial dimension to TRLFS, giving the possibility to separate a multi-phase system into discrete single-phase systems. Because of its advantageous fluorescence properties we use europium as an analogue for Am(III) and Cm(III) to study the sorption behaviour of granite as a possible host rock for high-level nuclear waste repositories. Spatially resolved sorption experiments with Eu(III) on granite samples from Eibenstock in Erzgebirge, Germany are presented. These samples are excited by a focused and pulsed UV laser beam, and scanned with a resolution of 20 μm. Through this approach it becomes possible to characterize Eu(III) sorption on single grains of the complex material by mapping fluorescence intensity, band ratios, as well as lifetimes.