A 25: Poster: Attosecond physics

Time: Wednesday 16:30–19:00 Location: Poster.V

A 25.1 Wed 16:30 Poster.V

CEP Spectral Interferometry measurements near the Cooper minimum in argon, using high-harmonic generation — •Matteo Ceci, Andreas Kaldun, Christian Ott, Philipp Raith, Kristina Meyer, Martin Laux, Yizhu Zhang, and Thomas Pfeifer — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg, Germany

High-order harmonic generation (HHG) from laser-atom or laser-molecule interaction carries information about the structure and dynamics of the bound electronic wave function interfering with the returning wave packet. HHG spectra allow to gain insight into the electronic configuration of atoms and molecules that could lead to time resolved observations and time-domain control of atomic and molecular-scale electron dynamics. In the present work we measured HHG spectra in argon in the energy range of the Cooper Minimum (CM). While a microscopic single-atom response effect (structure of the bound-state wavefunction) is the origin of the CM, its spectral position observed with HHG has previously been measured to depend on macroscopic (phase-matching) parameters [1]. In our work, a few cycle CEP-stabilised laser with a central wavelength around 730 nm has been used to study the dependence of the CM on macroscopic parameters such as pressure variation and transient dynamics within the fewcycle field of the pulse. The experimental observations are discussed in the framework of our recently developed CEP spectral interferometry (CEPSI) approach [2]. [1] J. P. Farrell et al. Phys. Rev. A 83, 023420 (2011). [2] C. Ott et al., submitted (2011).

A 25.2 Wed 16:30 Poster.V

Quantitative measurement of phase matching in high harmonic generation — Sudipta Mondal[1], •Frederic L. Condin[1,2], Philipp L. Klaus[1,3], Kristen Gould[4], Benjamin Wilson[4], Erwin D. Poliakoff[4], and Carlos A. Trallero-Herrero[1] — [1]Department of Physics, Kansas State University, Manhattan, Kansas 66506, USA — [2]Eberhard Karls Universität Tübingen, D-72074 Tübingen, Germany — [3]Institut für Kernphysik, Goethe-Universität Frankfurt am Main, D-60438 Frankfurt am Main, Germany — [4]Department of Chemistry, Louisiana State University, Baton Rouge, Louisiana 70803, USA

Phase matching in high harmonic generation (HHG) is crucial for the quality and intensity of the generated harmonics and has important applications in modern attosecond science. We present a quantitative measurement of phase matching in HHG. In our experiments we simultaneously detect the generated harmonics and the produced ions as a function of laser focus position relative to a thin gas jet, intensity, and pressure for two pulse durations. The ion signal, the HHG yield, and the HHG yield divided by the squared ion signal serve as a measure of phase matching [cf. *PRL* **103,** 073902 (2009) for a justification of the latter]. We find that the conditions for ideal phase matching drastically change when we switch from Gaussian to Bessel mode. The results have implications for our ongoing research efforts to use HHG as a spectroscopic method. Using the recently developed quantitative rescattering theory of HHG [*PRA* **80,** 013401 (2009)], we want to extract photoionization cross sections from HHG spectra.

A 25.3 Wed 16:30 Poster.V

Design of an in-situ XUV spectrometer for attosecond experiments — •Michael Schönwald, Alexander Sperl, Andreas Fischer, Philipp Coerlin, Arne Senftleben, Thomas Pfeifer, Robert Moshammer, and Joachim Ullrich — Max-Planck-Institut für Kernphysik, Heidelberg, Deutschland

We present the design of a new extended ultraviolet (XUV) spectrometer for our attosecond beam line. We are producing attosecond pulses (AP) via high harmonic generation (HHG) in a small gas cell filled with rare gases in order to do pump-probe experiments in a reaction microscope (ReMi). Currently, a self-phase modulation hollow fiber filled with Neon in combination with a chirped mirror compressor is implemented in our setup to broaden the spectrum and shorten the infrared (IR) laser pulses from 30 fs to less than 10 fs for experiments with single AP. To measure the HHG spectra during ReMi type experiments and to be able to estimate the pulse durations of the AP, we build a spectrometer which uses the light transmitted through the interaction region of the ReMi. Immediately after entering the XUV spectrometer, the IR radiation is filtered out by thin Al or Zr foils. A spherical mirror is then used to focus the high harmonics through a transmission grating onto a MCP detector. Using a grazing-incidence reflection off a mirror with a 30 nm thin Au or B4C surface coating, we avoid bandwidth limitations and we are expecting a reflectivity of up to 75%. We will show first experimental results [hopefully] using the few-cycle driving laser pulses for HHG and discuss follow-on experiments enabled by the in-line combination of ReMi and XUV spectrometer.

A 25.4 Wed 16:30 Poster.V

Measurement of sub-1.5-cycle pulses from a single filament — •Martin Kretschmar[1], Daniel S. Steingrube[1], Emilia Schulz[1], Uwe Morgner[1], Milutin Kovacev[1], Dominik Hoff[2], Peter Hansinger[2], and Gerhard G. Paulus[2] — [1]Leibniz Universität Hannover, Institut für Quantenoptik, Welfengarten 1, D-30167 Hannover, Germany; QUEST, Centre for Quantum Engineering and Space-Time Research, Hannover, Germany — [2]Friedrich-Schiller-Universität Jena , Institut für Optik und Quantenelektronik , Max-Wien-Platz 1, D-07743 Jena

Femtosecond laser filamentation is a prominent approach for few-cycle pulse generation. The precise characterization of the time-dependent electric field of such a pulse is challenging but necessary for the understanding of strong-field effects occuring during filamentary propagation. We present an experimental setup capable of measuring the pulse duration and CEO-phase contributions of pulses originating from a femtosecond filament. The experiment consists of a semi-infinite gas cell which truncates the filament at different positions and a Stereo-ATI-Phasemeter, enabling the measurement of the pulse duration of the resulting beam. We report on the dependence of the resulting pulses upon various experimental parameters resulting in the observation of pronounced pulse splitting signatures. We identify pulses with a sub-1.5-cycle temporal duration emerging from a single filament.