A 42: Poster: Attosecond physics

Time: Thursday 16:00–18:30 Location: Empore Lichthof

A 42.1 Thu 16:00 Empore Lichthof

Correlated Few-Electron Dynamics on the Attosecond Timescale — •Thomas Ding, Christian Ott, Andreas Kaldun, Alexander Blättermann, Difa Ye, and Thomas Pfeifer — Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany

The concerted motion of two or more electrons is the fundamental cause of virtually any chemical reaction. With attosecond laser pulses, a time-resolved investigation of the correlated electron dynamics on their natural timescales is possible. In a recent experiment we induced a coherent wavepacket beating of several doubly-excited states (DES) in helium with weak broadband attosecond-pulsed light in the extreme ultraviolet (XUV) energy range. We studied the behavior of the DES under the influence of a strong few-cycle near-infrared (NIR) dressing field allowing the coherent coupling of the DES with the N = 2 threshold. The time-delay of the XUV pulse with respect to the NIR dressing field as well as the laser intensity of the latter are varied and serve as control parameters in this setup. In more recent experiments other rare gas species such as neon are investigated, which will be presented here. In addition, for a better understanding of the role of electron correlation, we reproduce our experimental conditions theoretically in a one-dimensional two-electron model system that interacts with the corresponding laser pulses. By numerically solving the time-dependent Schrödinger equation we calculate the XUV absorption cross section and obtain results that are qualitatively consistent with our experiments. The simulations allow a direct visualization of the induced and controlled correlated two-electron wavefunction dynamics.

A 42.2 Thu 16:00 Empore Lichthof

Spatial contribution of electron trajectories to HHG in a semi-infinite gas cell — •Martin Kretschmar[1,2], Carlos-Hernandes Garcia[3], Daniel S. Steingrube[1,2], Luis Plaja[3], Uwe Morgner[1,2], and Milutin Kovacev[1,2] — [1]Leibniz Universität Hannover, Institut für Quantenoptik, Welfengarten 1, D-30167 Hannover, Germany — [2]QUEST, Centre for Quantum Engineering and Space-Time Research, Welfengarten 1, D-30167 Hannover, Germany — [3]Grupo de Investigacion en Optica Extrema, Universidad de Salamanca, E-37008 Salamanca, Spain

We present an analysis of the spatial beam profile of high-order harmonic radiation generated in xenon in a semi-infinite gas cell (SIGC). The observed spatial profiles consist of a central, less divergent part surrounded by a conical structure. We were able to assign contributions of two electron trajectories to different regions of the beam by experimental observations as well as simulations. Furthermore we examine the influence of phase-matching parameters, such as the focusing position inside the SIGC and the pressure of the generating medium on the different electron trajectory contributions and their spatial separation. Simulations, based on the discrete dipole approximation, confirm the experimental observations and give further insight on the generation process.

A 42.3 Thu 16:00 Empore Lichthof

Yield-Control of High-Order Harmonic Generation from Water Droplets — Heiko G. Kurz[1,2], •Melanie Barth[1], Martin Kretschmar[1,2], Tamas Nagy[1], Daniel S. Steingrube[1,2], Detlev Ristau[3], Manfred Lein[2,4], Uwe Morgner[1,2,3], and Milutin Kovacev[1,2] — [1]Leibniz Universität Hannover, Institut für Quantenoptik, Welfengarten 1, Hannover — [2]QUEST, Centre for Quantum Engineering and Space-Time Research, Welfengarten 1, Hannover — [3]Laser Zentrum Hannover e.V., Hollerithallee 8, Hannover — [4]Leibniz Universität Hannover, Institut für theoretische Physik, Appelstrasse 2, Hannover

We use a pump-probe setup in order to investigate the properties of high-order harmonic radiation generated from liquid water droplets. Using a commercial CPA-laser system, the influence of the time delay onto the emission of harmonic radiation is systematically studied and optimum parameters for the conversion process are determined. We control the spatiotemporal dynamics of the droplet, such as the expansion of the droplet and plasma formation during interaction with intense laser pulses by variation of the intensity of the pump pulse and observe its influence onto high-order harmonic generation (HHG). Moreover, the coherent build-up of the generated radiation field (Phase-matching) is studied by controlling the focal position and the intensity of the probe pulse. We find transient phase-matching conditions and the spatio-temporal dynamics of the target to be of major influence on the harmonic yield. The experiments represent a fundamental analysis of phase matching during HHG from liquid droplets.

A 42.4 Thu 16:00 Empore Lichthof

Generation of few-femtosecond monochromatized XUV-pulses for ultrafast pump-probe studies in gas and liquid phase — •Markus Kubin[1], Martin Eckstein[1], Fabio Frassetto[2], Johan Hummert[1], Kathrin Lange[1], Luca Poletto[2], Chung-Hsin Yang[1], Julius Zielinski[1], Marc Vrakking[1], and Oleg Kornilov[1] — [1]Max-Born-Institut, Berlin — [2]LUXOR, Padova, Italy

High harmonic generation (HHG) driven by femtosecond (fs) lasers provides ultrashort XUV pulses with a comb-like spectrum with photon energies reaching several keV. In combination with pump-probe VIS/XUV photoelectron and photoion spectroscopy it helps to follow chemical reactions in real time on fs- to attosecond-scales. However, the broad spectrum of HHG often launches dynamics on many potential energy surfaces and poses challenges for retrieving useful information from the spectra. In grating-based monochromators - used to narrow the spectrum of HHG sources - dispersion stretches the XUV pulses in time. Here we report on the implementation of a two-stage time-compensating monochromator to deliver XUV pulses with photon energies up to 50 eV and pulse durations around 10 fs. The setup allows for VIS/XUV pump-probe photoelectron and photoion spectroscopy in gas phase and condensed phase (employing the liquid micro-jet technique). The spectral and temporal performance of the system will be discussed in the context of IR-assisted ionization of rare gas atomic samples.