A 22: Attosecond Physics II

Zeit: Mittwoch 16:30–17:30 Raum: VMP 8 R208

Fachvortrag A 22.1 Mi 16:30 VMP 8 R208

Attosecond pump-probe electron interferometry — •Kathrin Klünder[1], Thomas Remetter[1], Marko Swoboda[1], Johan Mauritsson[1], Anne L'Huillier[1], Kenneth J. Schafer[2], Freek Kelkenberg[3], Wing-Kiu Siu[3], Per Johnsson[2,3], Marc Vrakking[3], Franck Lépine[4], Matthias F. Kling[5], Irina Znakovskaya[5], Thorsten Uphues[5], Enrico Benedetti[6], Federico Ferrari[6], Giuseppe Sansone[6], and Mauro Nisoli[6] — [1]Department of Physics, Lund University, Lund, Sweden — [2]Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana, USA — [3]FOM Institute for Atomic and Molecular Physics, Amsterdam, The Netherlands — [4]Université Lyon 1, CNRS,Villeurbanne, France — [5]Max-Planck-Institut für Quantenoptik, Garching, Germany — [6]CUSBO, ULTRAS-INFM, Department of Physics, Politecnico, Milano, Italy

We present an interferometric pump-probe experiment to characterize ultrafast bound electron dynamics using isolated attosecond pulses generated from an ultrashort, carrier-envelope-phase stabilized infrared laser with a time-dependent polarization. These attosecond pulses have sufficient photon energy and are broad enough to excite coherently all the p-states in Helium and a fraction of the continuum. The wave packets created in Helium, partly trapped in the atomic potential, are further probed by a 7 fs infrared laser field. From the observed interference between the different ionization pathways we show that it is possible to extract the amplitudes and phase evolutions of the bound, excited states.

A 22.2 Mi 17:00 VMP 8 R208

Laser-Assisted Photoemission from surface/adsorbate systems — •Guido Saathoff[1], Luis Miaja-Avila[2], Stefan Mathias[3], Jing Yin[2], Chan La-o-vorakiat[2], Michael Bauer[4], Martin Aeschlimann[3], Margaret Murnane[2], and Henry Kapteyn[2] — [1]MPI für Quantenoptik, Garching — [2]Jila and University of Colorado, Boulder, CO — [3]TU Kaiserslautern — [4]Universität Kiel

Laser-assisted photoemission (LAPE) and Auger decay (LAAD) have evolved into a powerful tool for time-resolved studies of the femtosecond-to-attosecond dynamics of highly-excited states in atoms. Recently we have extended LAPE to clean solid surfaces [1] and a detailed study has allowed the discrimination of surface-LAPE against adverse above-threshold photoemission (ATP) caused by the high laser intensities required for dressing [2]. This has led to the first direct time-resolved observation of the lifetime of a core-excited state of an atom adsorbed onto a surface. By combining LAPE with LAAD, we measured the $4d^{-1}$ core level lifetime of Xenon on Pt(111) to be 7±1 fs [3]. We also show that using longer laser wavelengths enhances LAPE and LAAD while ATP is strongly suppressed. This will allow for time-resolved measurements on low-energy Auger electrons, which are usually buried by ATP. Our results open up time domain measurements of electronic processes in surface/adsorbate systems, which are fundamental to the understanding of surface chemistry.

[1] L. Miaja-Avila et al.,Phys Rev. Lett. 97, 113604 (2006)
[2] G. Saathoff et al., Phys. Rev. A, 77, 022903 (2008)
[3] L. Miaja-Avila et al., Phys.Rev. Lett., 101, 046101 (2008)

A 22.3 Mi 17:15 VMP 8 R208

Attosecond Pump-Probe Experiments with a Reaction Microscope — •Helga Rietz, Konstantinos Simeonidis, Ram Gopal, and Joachim Ullrich — Max-Planck-Insitut für Kernphysik, Heidelberg

An experiment combining an attosecond light source based on high harmonic generation (HHG) in Argon with an electron and recoil ion spectrometer, a so called reaction microscope, is presented. The experiment aims at performing pump-probe-measurements with attosecond time resolution on atoms and small molecules. One future goal is to take previous work from our insitute, where the vibrational motion of the nuclear wave packet in H_2^+ and D_2^+ was observed with femtosecond resolution, to the next level.

The harmonics are generated with a commercially available Ti:Sapphire amplifier delivering laser pulses with 25 fs duration at a wavelength of 800 nm and approximately 1 mJ pulse energy. The repetition rate can be varied between 3 and 10 kHz. Further compression of the pulses is achieved via spectral broadening through self phase modulation (SPM). The HHG-source yields photon fluxes of typically 10^9 photons per second and harmonic order for the plateau region of the VUV-spectrum, where the cutoff is observed at approximately 40 eV for Argon. The whole setup including pump-probe optics and the HHG-target is housed in a novel vacuum chamber to meet the challenging demands for stability set by the goal to achieve attosecond time resolution.