A 29: Photoionization II

Zeit: Donnerstag 14:00–15:30 Raum: VMP 8 R208

Hauptvortrag A 29.1 Do 14:00 VMP 8 R208

Radiometry and the nature of light — •Mathias Richter[1], Andrei A. Sorokin[1], and Kai Tiedtke[2] — [1]Physikalisch-Technische Bundesanstalt, Abbestraße 2-12, 10587 Berlin, Germany — [2]Deutsches Elektronen-Synchrotron, Notkestraße 85, 22603 Hamburg, Germany

At the Free-electron LASer in Hamburg FLASH, the non-linear photoionization of rare gases in the vacuum and extreme ultra-violet (VUV, EUV) was investigated by ion spectroscopy [1, 2]. Our quantitative experiments relied on different radiometric methods and tools of X-ray laser diagnostics to measure pulse energy and duration and focus size in absolute terms [3-6]. Thus, the behaviour of the different targets could be compared under equivalent conditions at irradiances from 10^{12} to 10^{16} W/cm^2. It came out that, in contrast to optical radiation, the degree of atomic perturbation and the nature of the VUV and EUV light on the interaction strongly depends on the respective target and the excitation of inner-shell resonances.

[1] A. A. Sorokin et al., Phys. Rev. A 75, 051402(R) (2007).
[2] A. A. Sorokin et al., Phys. Rev. Lett. 99, 213002 (2007).
[3] M. Richter et al., Appl. Phys. Lett. 83, 2970 (2003).
[4] A. Sorokin et al., Appl. Phys. Lett. 89, 221114 (2006).
[5] K. Tiedtke et al., J. Appl. Phys. 103, 094511 (2008).

Hauptvortrag A 29.2 Do 14:30 VMP 8 R208

Threshold Fragmentation of Simple Atoms by Electron Impact and FLASH VUV Light — •Alexander Dorn — Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany

Double ionization (DI) of an atom by electron impact (e,3e) or by absorption of one photon (γ,2e) is a process purely mediated by electron correlation and, therefore, is a very fundamental and intriguing problem in physics. Using many-particle imaging spectrometers (reaction microscopes) we have measured the momentum vectors of all final state continuum particles close to the DI threshold. Here, due to the vanishing kinetic energy the Coulomb-interaction among all particles should lead to highly symmetric electron emission patterns. For the three-electron final continuum state resulting from the (e,3e) reaction on helium at 5 eV excess energy the symmetric emission of the ejected electrons with 120° relative angles was observed settling a long standing issue between various theories and rising new questions on whether the emission configuration depends on the target structure.

In order to enable kinematically complete (γ,3e) studies on the fundamental three-electron atom lithium we have implemented a magneto-optical trap into a reaction microscope. Due to the small cross section in the order of 1 barn this process can be studied only at high flux photon sources as the Free Electron Laser at Hamburg (FLASH). In a recent pilot experiment at FLASH we studied DI of optically pumped Li(2p). It turns out that the dynamic correlation between a photoionized 1s-electron and the ejected 2p-electron strongly depends on the spatial alignment of the 2p-orbital.

Hauptvortrag A 29.3 Do 15:00 VMP 8 R208

Ring molecules as tunable light sources — •Andrey Moskalenko and Jamal Berakdar — Institut für Physik, Martin-Luther-Universität Halle-Wittenberg, Germany

We analyze the emission properties of molecular and nanostructured rings [1] excited by ultrafast light pulses. Application of an appropriate sequence of light pulses allows for the control of the charge polarization dynamics in such driven quantum rings. As a consequence, the spectral and polarization properties of the emitted radiation can be controlled on ultrafast time scales. This we conclude from the theory of the time-dependent spectrum and its generalization to the time-dependent detection of Stokes parameters and the polarization degrees of polychromatic radiations, valid for time scales comparable to the reciprocal of characteristic emission frequencies [2].

[1] A. S. Moskalenko, A. Matos-Abiague, J. Berakdar, Phys. Rev. B 74, 161303(R) (2006); EPL 78, 57001 (2007).
[2] A. S. Moskalenko and J. Berakdar, Phys. Rev. A 78, 051804(R) (2008).