Julius-Maximilians-
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WÜRZBURG

Kolloquium der Physikalischen und Theoretischen Chemie

Dienstag, 25.06.2019 **Hörsaal D, Chemiezentralgebäude, 17:15 Uhr**

Sprecher: Matthias Wollenhaupt

(Universität Oldenburg)

Titel: Bichromatic coherent control of photoionization

Abstract:

Three-dimensional free electron wave packets with arbitrary rotational symmetry are generated by multiphoton ionization of atoms with polarization-tailored laser fields and manipulated with the optical phases including the CEP and relative phases. In the experiment we combine advanced supercontinuum pulse shaping with high-resolution photoelectron tomography. We use a 4f polarization pulse shaper to sculpture bichromatic fields from a CEP-stable over-octave spanning white light supercontinuum by spectral amplitude and phase modulation [1]. The experimental results show that multiphoton ionization of potassium atoms with a single-color sequence of counterrotating circularly polarized (CRCP) femtosecond laser pulses produces vortex-shaped photoelectron momentum distributions [2] with even-numbered rotational symmetry (c4, c6 and c8). In contrast, bichromatic CEP-stable polarization-tailored counter- and corotating (COCP) femtosecond laser pulses generate c7 rotationally symmetric and asymmetric momentum distributions [3]. To elucidate the physical mechanisms, we investigate the interplay between the symmetry properties of the driving field and the resulting electron wave packets by varying the optical field parameters.

[1] S. Kerbstadt, D. Timmer, L. Englert, T. Bayer, M. Wollenhaupt, Ultrashort polarization-tailored bichromatic fields from a CEP-stable white light supercontinuum, Opt. Express 25 (2017) 12518.

[2] D. Pengel, S. Kerbstadt, D. Johannmeyer, L. Englert, T. Bayer, M. Wollenhaupt, Electron Vortices in Femtosecond Multiphoton Ionization, Phys. Rev. Lett. 118 (2017) 053003.

[3] S. Kerbstadt, K. Eickhoff, T. Bayer, M. Wollenhaupt, Odd electron wave packets from cycloidal ultrashort laser fields, Nat. Comm. 10 (2019) 658.

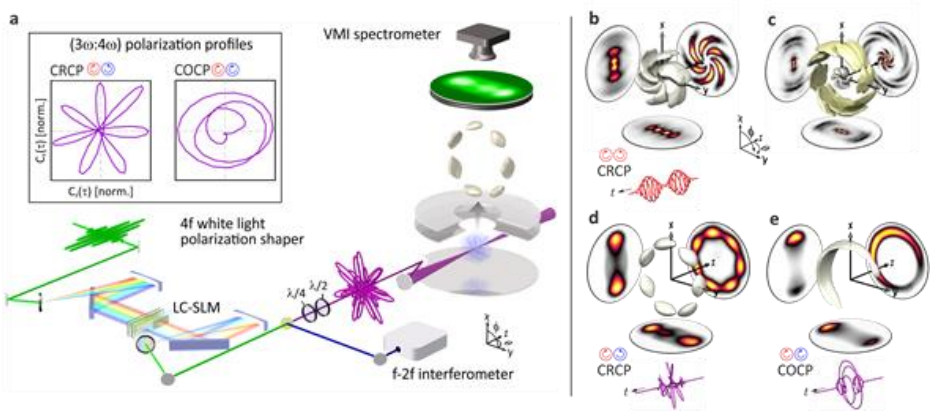

Figure 1 (a) Experimental setup: combination of shaper-based generation of bichromatic pulses and photoelectron tomography using a velocity map imaging spectrometer. Inset: measured polarization profile of CRCP and COCP pulses. (b)-(e) Experimental results: ionization of potassium atoms with a single-color sequence of CRCP femtosecond laser pulses creates free electron vortices with c6 rotational symmetry at the ionization threshold (b) and c8 rotational symmetry by ATI (c). Bichromatic ionization of sodium atoms with CRCP pulses creates electron wave packet with c7 rotational symmetry (d) whereas the electron wave packet from ionization with COCP pulses exhibit no rotational symmetry (e).

Organisation: V. Engel

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