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Electron vortices

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Recently, the emergence of vortex structures in the momentum distribution of free electron wave packets from photoionization of atoms with sequences of two time-delayed counterrotating circularly polarized (CRCP) ultrashort laser pulses was predicted [1] and demonstrated experimentally [2]. Electron vortices arise from the superposition of two time-delayed free electron wave packets with different magnetic quantum numbers. In our experiment three-dimensional electron vortices are generated by multiphoton ionization of potassium atoms using CRCP femtosecond laser pulses from a polarization-shaped supercontinuum source [3] and reconstructed tomographically from velocity map imaging (VMI) measurements [4]. Absorption of another photon in the continuum changes the c6 azimuthal symmetry of the threshold vortex into c8 for above threshold ionization (ATI) [5]. Electron vortices from non-perturbative excitation show c4 azimuthal symmetry and a pi-phase jump in the polar direction. Currently, we study electron vortices generated by bichromatic polarization-shaped CEP-stable supercontinua [3].

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[4] S. Kerbstadt et al., New J. Phys. 19, 103017 (2017).
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