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Generation of vortex electrons in high energy ionization[1]
KATARZYNA KRAJEWSKA, FELIPE CAJIAO VÉLEZ, JERZY KAMIŃSKI, University of Warsaw — Electron beams with a well-defined longitudinal orbital angular momentum (OAM), known as twisted or vortex electrons, are attracting considerable interest in both fundamental and applied physics. Their unique features (such as helical wavefronts, circulating probability density currents, etc.) make these beams ideal tools for studies in various fields of modern physics. For instance, scattering of twisted electrons on a solid target can provide detailed information about the magnetic properties of the target material. The same concerns helical properties of crystals or nanomolecules. Here, we investigate a possibility of generating vortex electrons in high-energy ionization. We show that photoelectrons of unprecedented large OAM can be emitted when a high-intensity laser pulse interacts with atomic targets. In order to analyze how OAM of photoelectrons may influence the ionization spectrum we use the quasi-relativistic strong-field approximation. This approach (with the binding potential neglected during the electron dynamics in a laser field) is particularly well suited for describing high-energy ionization. In addition, it accounts for relativistic effects, including the electron recoil due to the interaction with the laser field and the relativistic mass correction.

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