Coulomb-corrected quantum orbits in strong-field ionization

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In the semi-classical limit, the strong field approximation (SFA) possesses an appealing interpretation in terms of interfering quantum trajectories. However, the plain SFA is rather inaccurate for the case of long-range Coulomb potentials due to the neglect of the interaction between the photoelectron and the parent ion after the time of ionization. It is shown that a conceptually simple extension towards the inclusion of Coulomb effects yields very good agreement with exact time-dependent Schrödinger results in the semi-classical regime. Moreover, the Coulomb quantum orbits allow for a physically intuitive interpretation and detailed analysis of all features in photoelectron spectra in terms of interfering quantum trajectories, including the so-called „low energy structure" [1] and „holographic side-lobes" [2,3]. Recently, we have extended the method to also account for sub-barrier Coulomb effects [4]. We show that - besides the well-known modification of the tunneling ionization probability - there is also an influence on the interference pattern in the photoelectron spectra. In the long-wavelength limit, the shift of the intra-cycle interference fringes caused by sub-barrier Coulomb effects in the laser polarization direction is derived analytically.

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