Coulomb Effects in the Nondipole Sub-Barrier Dynamics in Strong-Field Ionization

P-L He[1], M Klaiber[1], K Z Hatsagortsyan[1], and C H Keitel[1]

[1] *Theoretical Quantum Dynamics and Quantum Electrodynamics, Max Planck Institute for Nuclear Physics, Saupfercheckweg, Heidelberg, Germany. Contact Phone: +00491757053642*
Contact Email: peilun@mpi-hd.mpg.de

The nondipole under-the-barrier dynamics of the electron during strong-field tunneling ionization is investigated, examining the role of the Coulomb field of the atomic core. The analysis is based on the nondipole light-front Coulomb-corrected strong field approximation and demonstrates the counter-intuitive impact of the sub-barrier Coulomb field. Despite its attraction nature, the sub-barrier Coulomb field increases the photoelectron nondipole momentum shift along the laser propagation direction, inducing a strong dependence on the laser field. The scaling of the effect with respect to the principal quantum number and angular momentum of the bound state is found. With the developed light-front classical Monte Carlo model, we disentangle the sub-barrier and the continuum Coulomb effects in the nondipole regime. We demonstrate that the signature of the sub-barrier effect is distinguishable in the asymptotic photoelectron momentum distribution with the state-of-the-art experimental technique of mid-infrared lasers.