Atomic ionization by short laser pulses: Coulomb-Volkov method with distortion in the initial and final channel

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Among the theoretical methods developed to describe the electronic transitions produced by ultra-short pulses, we can mention the Coulomb-Volkov (CV) approximation [1], which considers the combined action of the laser and atomic fields on the active electron, but only in the final channel of the interaction. Currently, the CV approximation has become a broadly extended method to investigate the physical mechanisms involved in the photoionization processes. However, the theory fails when the perturbative conditions are not fulfilled, i.e., when the ionization due to an intense laser field occurs at a time much shorter than the pulse duration, or as well, when the ionization involves multiphoton transitions.

In this work we propose a doubly distorted CV method (DDCV) [2,3], which extends the CV approximation through the incorporation of the laser field effects on both initial and final channel, equivalently. This improvement makes possible the description of the dynamic Stark effects, which play a relevant role when the electron describes orbits far away from the nucleus as a consequence of the action of the laser field. In Fig. 1 we show the photoelectron spectra of a hydrogen atom subject to an electric field with a sin^2 envelope.

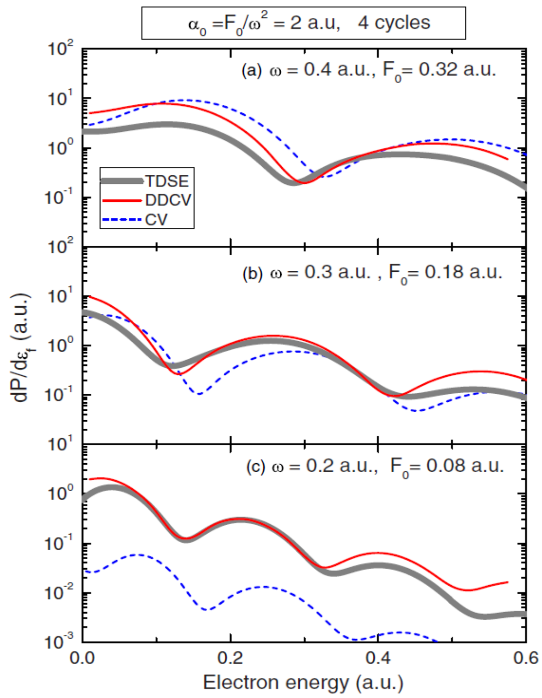

Fig. 1. Electronic emission spectrum for atomic hydrogen photoionization as a function of the energy of the emitted electron.

References:
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