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Doubly-differential intracycle interference in above threshold photoionization

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Synopsis We analyze the doubly-differential momentum distributions of electrons ejected at the interaction of strong IR laser pulses with atoms. With the help of a semiclassical model we clarify the interplay between *intracycle* and *intercycle* interferences. The model results are compared with numerical solutions of the time-dependent Schrödinger equation for atoms with long-range potentials. Similarities and differences will be discussed.

Tunneling ionization by intense laser pulses (~ 10^{14} W/cm^2) occurs within each optical cycle predominantly around the maxima of the absolute value of the electric field. The interference of consecutive bursts of ejected electrons reaching the same final momentum gives rise to features in momentum distributions distinct from typical above-threshold ionization (ATI) spectra. Diffraction fringes have been experimentally observed in photoionization of He and F^- [1,2].

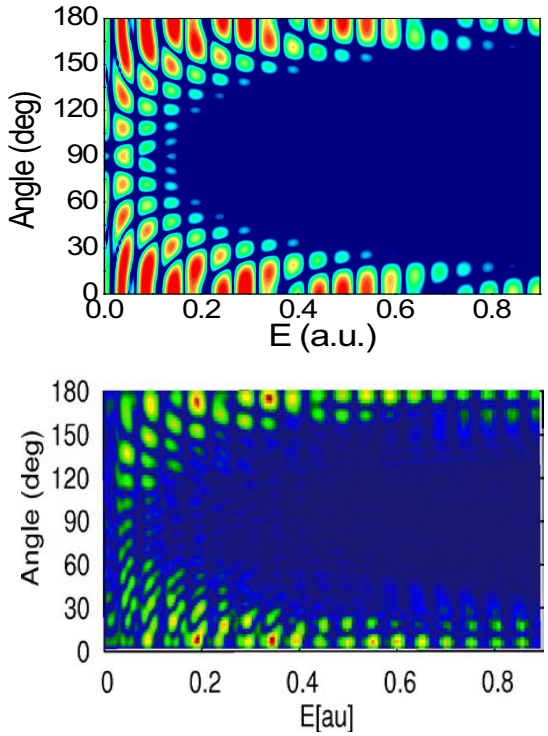

Fig. 1. Doubly-differential electron momentum distributions for a two-cycle field. Upper panel: SMM results. Lower panel: TDSE results for hydrogen.

In the present work we extend our previous analysis of the characteristic of *intra-* and *intercycle* interferences [3,4] to the full doubly-differential momentum distributions. Results from the Coulomb-Volkov approximation (CVA), the simple mans model (SMM) and the Schrödinger equation (TDSE) are compared.

In Fig. 1 (upper panel) we show the SMM momentum distribution as a function of the angle of emission and kinetic energy for a two cycle field. The curved nodal lines result from *intracycle* interference, also present when using a single-cycle field. These intracycle interferences are modulated by the equispaced vertical nodal pattern due to *intercycle* (ATI) interferences. In the lower panel of Fig. 1 we show TDSE results for the same laser field. A grid of nodal lines due to inter- and intracycle interferences can be seen. The intracycle structures display similarities to the SMM. Differences in the nodal structure and the appearance of additional structures give hints on non-trivial effects resulting from the presence of a long-range potential [5].

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References

[1] B. Bergues *et al*, Phys. Rev. A **75**, 063415 (2007).
[2] S. Bivona *et al*, Phys. Rev. A **77**, 051404 (2008).
[3] D. G. Arbó *et al*, Phys. Rev. A **81**, 021403 (2010).
[4] D. G. Arbó *et al*, Phys. Rev. A **82**, 043426 (2010).
[5] Huismans *et al*, Science **331**, 61 (2011).

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