Intracycle diffraction in atomic ionization by short-laser pulses: The time grating

Diego G. Arbó[1], Kenichi L. Ishikawa[2], Xinhua Xie[3], Markus Kitzler[3], Stefanie Gräfe[4], and Joachim Burgdörfer[4]

[1] *Institute for Astronomy and Space Physics, IAFE, Buenos Aires, Argentina*
[2] *Photon Science Center, Graduate School of Engineering, University of Tokyo, Japan*
[3] *Photonics Institute, Vienna University of Technology, Vienna, Austria*
[4] *Institute for Theoretical Physics, Vienna University of Technology, Vienna, Austria*
diego@iafe.uba.ar

Interference effects observed in the electron yield of atomic ionization due to the interaction with linearly polarized laser pulses are studied [1]. The interplay between *intra*- and *intercycle* interferences of electron trajectories leads to modulations in the photoelectron doubly-differential momentum distributions. *Intracycle* interference comes from the coherent superposition of electron wave packets released within the same optical cycle, whereas *Intercycle* interference corresponds to the well-known ATI peaks of the photoelectron spectrum arising from the superposition of wave packets of different optical cycles. The former corresponds to a diffraction grating in the time domain [1,2]. In Fig. 1 we display the doubly differential momentum distribution obtained by using a semiclassical calculation based on the Simple Man's Model (upper figure), and computing the time-dependent Schrödinger equation (lower figure). The *intercycle* interference pattern can be seen as concentric rings, which are modulated by the *intracycle* interference observed as oblique stripes. The *intracycle* interference modulation is independent of the number of optical cycles involved in the laser pulse and is affected by the long-range nature of the atomic potential.

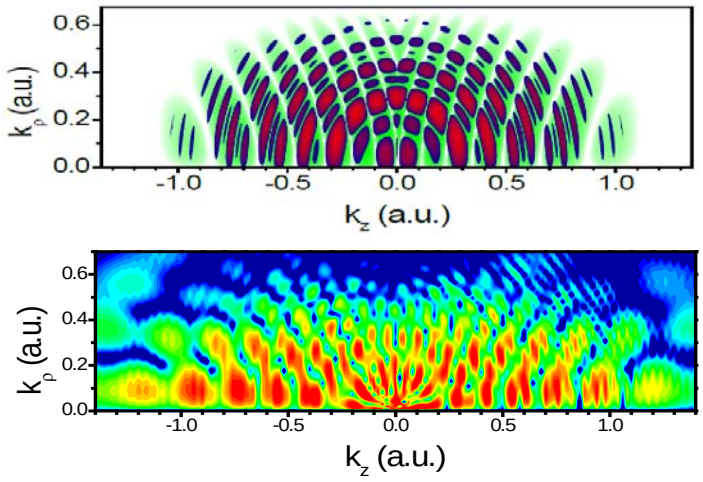

Fig.1. 2D electron momentum distribution ($2x10^{14}$ W/cm^2 and 800 nm). Upper: Semiclassical *intracycle* pattern in green and complete (*intra*- and *intercycle*) pattern in blue and red. Lower: TDSE calculations.

Extension to atomic ionization by two-color laser pulses will be shown [3].

Work supported by Conicet, UBACyT (Argentina), the MINCyT-BMWF Argentine-Austrian collaboration, and by the APSA project (JAPAN).

References:
[1] D. G. Arbó *et al*, Phys. Rev. A **81**, 021403 (2010); *ibid* **82**, 043426 (2010).
[2] S. Bivona *et al*, Phys. Rev. A **77**, 051404 (2008).
[3] X. Xie *et al*, Phys. Rev. Lett. 108, 193004 (2012).