Angle-resolved high-order above-threshold ionization spectra of inert gases in the low-frequency approximation

D. B. Milošević[*,1], **A. Čerkić**[*], **B. Fetić**[†], **E. Hasović**[*], **and W. Becker**[‡]

[*]Faculty of Science, University of Sarajevo, Department of Physics,
Zmaja od Bosne 35, 71000 Sarajevo, Bosnia and Herzegovina
[†]First High School, Gimnazijska 3, 71000 Sarajevo, Bosnia and Herzegovina
[‡]Max-Born-Institut, Max-Born-Strasse 2a, 12489 Berlin, Germany

Synopsis We compare angle-resolved high-order above-threshold ionization spectra of inert gases obtained using the improved strong-field approximation with the spectra obtained using the low-frequency approximation.

In the improved strong-field approximation (ISFA), which describes high-order above-threshold ionization (HATI), rescattering of the ionized electron off its parent ion is usually described within the first-order Born approximation (1BA). Coulomb effects in the rescattering process can be taken into account by replacing the final Volkov wave by the Coulomb-Volkov wave [1]. One can go beyond the 1BA by replacing in the rescattering amplitude the atomic scattering potential according to $V \to T(E) = V + VG_V(E)V$, where $G_V(E)$ is the stationary Green's operator at the energy $E(\tau)$ of the recolliding electron at the recollision time τ. This is similar to the low-frequency approximation for laser-assisted scattering ([2] and references therein). We have recently derived the low-frequency approximation (LFA) for HATI [3].

In the present contribution we will show our numerical results for the angle-resolved HATI energy spectra of inert gases; see Fig. 1. We show that the difference between the ISFA and the LFA is significant for scattering away from the laser polarization axis. In the context of quantum-orbit theory and the uniform approximation, we also show that on the back-rescattering ridge, the rescattering T-matrix element can be factorized into the product of the incoming flux and the elastic scattering cross section. Hence, the differential cross section of laser-free elastic electron-ion scattering can be extracted from the angle and energy resolved HATI spectra as proposed recently [4].

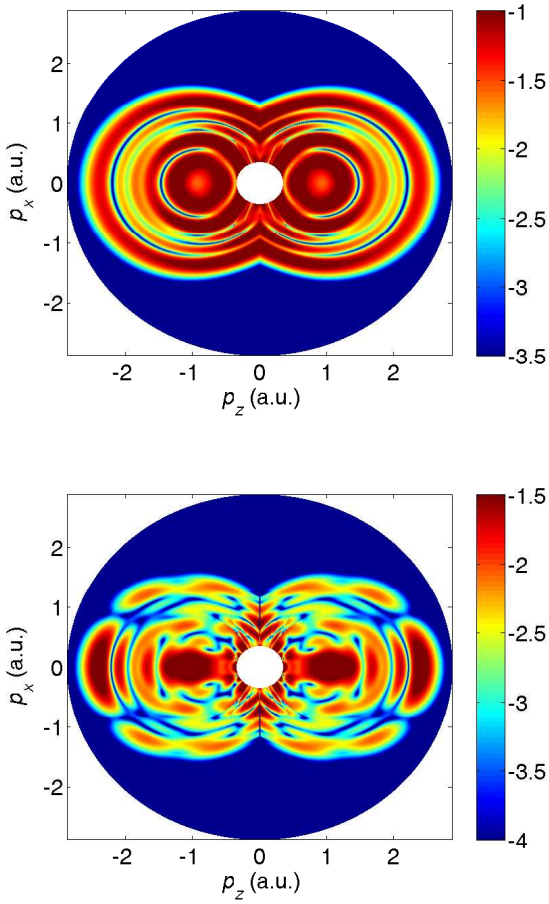

Fig. 1. 2D momentum distributions for Xe at 1.5×10^{14} W/cm^2 and 760 nm. The upper (lower) panel: the results obtained using the ISFA (LFA).

References

[1] D. B. Milošević and F. Ehlotzky, Phys. Rev. A **58**, 3124 (1998).

[2] D. B. Milošević, J. Phys. B **28**, 1869 (1995).

[3] A. Čerkić, E. Hasović, D. B. Milošević, and W. Becker, Phys. Rev. A **79**, 033413 (2009).

[4] X. X. Zhou, Z. J. Chen, T. Morishita, A. T. Le, and C. D. Lin, Phys. Rev. A **77**, 053410 (2008).

[1]E-mail: milo@bih.net.ba