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Intense-laser-induced rescattering photoelectron spectroscopy of atomic and molecular systems

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Abstract
Photoelectron momentum distributions (PEMDs) resulting from the ionization of atoms and molecules by intense low frequency laser pulses contain valuable information about the electronic and nuclear structure of the target. The development of methods of extracting this information, potentially in a time-resolved manner, is one of the fundamental tasks of strong-field physics. The different parts of a strong-field PEMD reflect different aspects of the ionization dynamics and encode different target structure information. Here we focus on two features specific to PEMDs generated by linearly polarized pulses and related to rescattering. In the first one, we will discuss the high-momentum region of PEMDs associated with the backward rescattering, where one can extract the differential cross section (DCS) for elastic scattering of a photoelectron on the parent ion [1]. In the second one, we will discuss the low-energy regions of PEMDs associated with the forward rescattering, where one can extract the phase of the scattering amplitude for elastic scattering [2]. In this presentation, some illustrative calculations as well as experimental results will be presented after theoretical basics will be described.

References
[1] T. Morishita and O. I. Tolstikhin, Phys. Rev. A 96, 0534162017 (2017).
[2] Y. Zhou, O. I. Tolstikhin, and T. Morishita, Phys. Rev. Lett. 116, 173001 (2016).