Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Double Ionization of He by an Intense Elliptically-Polarized, Few-Cycle Attosecond Pulse

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— By solving the six-dimensional two-electron, time-dependent Schrödinger equation for He interacting with an arbitrarily-polarized intense attosecond XUV pulse, we demonstrate numerically the control of He double ionization by means of the pulse polarization and its carrier-envelope phase (CEP).

Using perturbation theory (PT), we predict a new type of CEP-sensitive polarization asymmetry that is normally absent in single photon double ionization of He, but does occur for an elliptically-polarized, few-cycle attosecond XUV pulse. We call this new effect nonlinear dichroism, which is sensitive not only to the ellipticity, peak intensity $I$, and temporal duration of the pulse, but also to the energy-sharing. This dichroic effect (i.e., the difference of the two-electron angular distributions for opposite helicities of the ionizing XUV pulse) originates from interference of first- and second-order PT amplitudes, allowing one to investigate and control S- and D-wave channels of the two-electron continuum. Nonlinear dichroism probes electron correlation on its natural timescale since it vanishes for long pulses.

Research supported in part by DOE, BES, Chem. Sciences, Geosciences, and Biosciences Div., Grant No. DEFG03-96ER14646.


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Date submitted: 27 Jan 2015

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