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Control of parent-ion coherence in helium ionization[1] SAAD MEHMOOD, Dept. of Physics, University of Central Florida, EVA LINDROTH, Dept. of Physics, Stockholm University, LUCA ARGENTI, Dept. of Physics and CREOL, University of Central Florida — Attosecond extreme ultraviolet (XUV) pulses trigger the release of a photoelectron from an atom or molecule in a coherent ionization process. As soon as the electron is emitted, however, part of the coherence in the residual parent-ion is lost, and so is the chance of guiding any subsequent transformations of the target in a reproducible way. To influence the parent-ion coherence, the system can be perturbed with additional light pulses before the ionization process is over. Here we perform XUV-pump IR-probe ionization of Helium to create a controllable coherence of the ions in the $2s$ and $2p$ states of the He^+ ion. Within the electrostatic approximation, these states are degenerate, and hence their coherent superposition gives rise to a parent-ion with a permanent dipole moment whose polarization beats on a time scale of few femtosecond due to delay between ionizing pulses. The dipole moment fluctuates even in absence of external fields, due to spin-orbit interactions on a picosecond timescale. The determination of the amplitude and phase of such oscillation allows to reconstruct the net parent-ion dipole moment at the time of its inception.

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