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Dynamics of Attosecond Electron Wave Packets[1]

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We present results from some of the first experimental studies of attosecond electron wave packets created via the absorption of ultrashort extreme ultraviolet (XUV) light pulses [1]. The pulses, made via high harmonic generation, form an attosecond pulse train (APT) whose properties we can manipulate by a combination of spatial and spectral filtering. For instance, we show that on-target attosecond pulses of 170 as duration, which is close to the single cycle limit, can be produced [2]. The electron wave packets created when such an APT is used to ionize an atom are different from the tunneling wave packets familiar from strong field ionization. We show how to measure the dynamics of these wave packets in a strong infrared (IR) field, where the absorption of energy above the ionization threshold is found to depend strongly on the APT-IR delay [3]. We also demonstrate that altering the properties of the initial electron wave packet by manipulating the APT changes the subsequent continuum electron dynamics. Finally, we show how the phase of a longer, femtosecond electron wave packet can be modulated by a moderately strong IR pulse with duration comparable to or shorter than that of the electron wave packet. This experiment reveals how the normal ponderomotive shift of an XUV ionization event is modified when the IR pulse is shorter than the XUV pulse.

[1] The experiments were done at Lund Institute of Technology, Sweden.
[2] R. Lpez-Martens, *et al.*, Phys. Rev. Lett. **94**, 033001 (2005)
[3] P. Johnsson, *et al.*, submitted to Phys. Rev. Lett.

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