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Attosecond Electron Wave Packet Interferometry

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The well controlled generation and characterization of attosecond XUV light pulses provide an unprecedented tool to study electron wave packets (EWPs). Here a train of attosecond pulses is used to create and study the phase of an EWP in momentum space. There is a clear analogy between electronic wave functions and optical fields. In optics, methods like SPIDER or wave front shearing interferometry, allow to measure the spectral or spatial phase of a light wave. These two methods are based on the same principle: an interferogram is produced when recombining two sheared replica of a light pulse, spectrally (SPIDER) or spatially (wave front shearing interferometry). This enables the comparison of two neighbouring different spectral or spatial slices of the original wave packet.

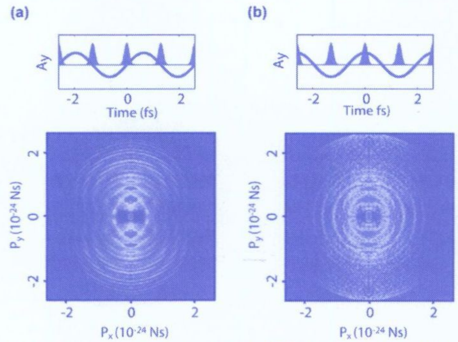

Fig. 1. Experimental interferogram obtained when the EWPs coincide with (a) the minimum (b) the maximum of the vector potential of the IR field.

In the experiment [1], a train of attosecond pulses is focused in an Argon atomic gas jet. EWPs are produced from the single XUV photon ionization of Argon atoms. If an IR beam is synchronized to the EWPs, it is possible to introduce a shear in momentum space between two consecutives wave packets. A Velocity Map Imaging Spectrometer (VMIS) enables us to detect the interference pattern. An analysis of the interferograms will be presented leading to a conclusion about the symmetry of the studied wave packet.

References

T. Remetter *et al.,Nature Physics.*, (May 2006)

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