Control of strongly driven electrons: the development and application of attosecond lasers

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In my talk I will discuss experiments on the behaviour of electrons that are controlled by electric fields that vary over a wide range of timescales (from DC electric fields to laser fields at optical frequencies).

Starting in DC fields, experiments will be described where direct and indirect photoionization events can be distinguished¹ and where a quantummechanical interference between several competing pathways that take the electron from the atom to the detector can be observed^{2,3}. In the RF domain results will be then be presented where photoionization is observed in real-time⁴, whereas recent experiments at an IR Free Electron Laser similarly show the promise of observing the electron motion on sub-cycle timescales. Finally, in the optical domain, high harmonic generation is shown to lead to the formation of attosecond laser pulses⁵ and results will be presented of a very recent experiment where the motion of a strongly driven continuum electron is initiated and controlled on attosecond timescales. is a probe of the dynamics of the strongly driven electron.

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