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Jankunas Doctoral Dissertation Award: Attosecond science with recolliding electrons

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Measuring the motion of valenceshell electrons in molecules is one of the main research thrusts in modern ultrafast science. The process of highharmonic generation (HHG), the conversion of many infrared photons into one XUV photon, relies on the laserdriven ionization, acceleration and precisely timed recombination in a strong laser field. The frequencies emitted upon recollision can be uniquely mapped to a transit time of the electron in the continuum thus providing attosecond temporal and Angstrom spatial resolution encoded in the HHG spectrum. In this talk we present experiments that utilize these capacities of HHG for following a coherent valenceshell electron current in nitric oxide on the femtosecond time scale in a classical pumpprobe experiment. Furthermore, we use the intrinsic time resolution of the HHG process to measure attosecond timescale electron dynamics: The motion of an electron hole across a molecular chain after ionization in spatially oriented iodoacetylene molecules.