Attosecond Pulse Trains: Measurement, Control and Applications

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This presentation will review the physics of attosecond pulse generation and some of its applications.

When atoms are exposed to intense laser radiation, electrons in the ground state may tunnel ionize, acquire energy from the field, and recombine, leading to the generation of attosecond pulses with broad bandwidth. When this process is repeated many times, the emitted radiation takes the form of a frequency comb, with peaks at odd harmonics of the laser field. The first part of this presentation will describe some of the attosecond tools that are being developed ranging from single attosecond pulses to pulse trains with one or two pulses per laser cycle and the techniques used to characterize them.

One of the most interesting properties of attosecond pulses is that their short pulse duration allows us to measure both phase and amplitude of an unknown wave function or wave packet by pump-probe interferometric methods, giving us access to the temporal dynamics of the process that led to this wave-packet. In this presentation, we will describe some of the techniques that have been developed to have access to phase information, using both single attosecond pulses and pulse trains.