Ultrafast ionization and dissociation dynamics of molecules from femtosecond to attosecond

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Light-molecule interaction is an essential process in ultrafast science, which promotes our understanding of electron dynamics and nuclear evolution on unstable potential energy surfaces as well as improves the ability to control chemical reactions. The development of coincidence technology and light pulses allows us to tackle the ultrafast process in molecules from femtosecond to attosecond [1,2].

Molecular autoionization dynamics in strong laser fields have been tracked by performing 2e-2i coincidence measurements with the angular streaking method. The energy-dependent photoelectron angular distributions further reveal that the subcycle ac-Stark effect modulates the lifetime of the autoionizing state and controls the emission of electrons in the molecular frame [3]. With the femtosecond pump-probe method, the ultrafast fragmentation dynamics of molecules within a dimer have been studied. The influence of neighbors on the rotation, spin-exchange effect, and ion-molecule reaction on the fragmentation are captured in real-time [4]. Moreover, the attosecond beamline with high-resolution electron and XUV spectrometers based on high-harmonics generation is introduced. It shows the ability to generate the tunable photons from VUV to soft X-ray (20 - 180 eV) and can be stabilized to sub-30 as in hours. The attosecond pulse trains with around 300 *as* per pulse and 10 *fs* duration can be produced for investigating the ionization and dissociation dynamics of molecules in a broad energy range by measuring the electrons and photons with attosecond temporal resolution.

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