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Ultrafast/Attosecond Transient Absorption with High Order Harmonics[1]

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Laser-produced high order harmonics are used to probe the chemical dynamics of atoms and molecules on femtosecond and attosecond timescales. The high order harmonics are produced with an 800 nm Ti:sapphire laser by focusing into a rare gas, and these pulses are used as the soft X-ray probe in wavelength-dispersed transient absorption. Inner shell core-level spectroscopic transitions are thus used to analyze the chemical and electronic environment of specific atomic states as a function of time following ionization and dissociation. High field ionization processes, using 800 nm pulses, result in spin-orbit electronic state populations, alignment, wave packet superposition states, and dissociative ionization events, which are investigated with the spectrally-resolved X-ray probe. By using isolated attosecond pulses as the probe, high field ionization events on a subfemtosecond timescale are probed. The generality of the transient absorption method for attosecond dyamics is described, as well as the complications during the pump-probe pulse overlap time period. The results are compared to theoretical calculations by collaborators.

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