

Transient Absorption X-Ray Probing in the Attosecond Limit

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Ultrashort pulses of soft x-rays are produced by the process of high harmonic generation with a Ti:sapphire laser and used to probe atomic and molecular dynamics by pump-probe core level x-ray transient absorption spectroscopy. High field ionization of Xe atoms initiates an electron ejection process that results in orbital alignment of the resulting ion. High field ionization of molecules, such as dibromomethane and methyl iodide, produces dissociative ionization fragmentation, where Coulomb explosion and wave packet dynamics are observed by core level transitions in the soft x-ray regime. In the limit of very short driver pulses used to produce the high harmonic generation process, isolated attosecond pulses are generated and used to study ionization events. Molecular dissociative ionization pathways initiated by isolated attosecond pulses are manipulated with the high field of the few cycle driver pulses. In a collaboration with F. Krausz and E. Goulielmakis in Munich, attosecond transient absorption is demonstrated with isolated attosecond pulses in a study of high field sequential ionization of Kr atoms.