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A Femtosecond Time-Resolved Transient X-ray Absorption Study of Light-Induced Coupling and Transparency in Xenon MING-FU LIN, UXSL/CSD Lawrence Berkeley Lab and UC Berkeley, ADRIAN PFEIFFER, UC Berkeley, DANIEL NEUMARK, STEPHEN LEONE, UXSL/CSD Lawrence Berkeley Lab and UC Berkeley, OLIVER GESSNER, UXSL/CSD Lawrence Berkeley Lab. — We have performed a femtosecond time-resolved transient x-ray absorption spectroscopy study to monitor the light induced coupling between bright and dark states in xenon exposed to infrared (780 nm) laser pulses with intensities up to 5×10^{13} W/cm^2. Significant transient variations in the inner-shell absorption spectra between ∼63 eV and ∼69 eV photon energy are observed. Near time zero, the transmission at 67 eV increases from 6(1) % (field-free) to 14(3) % (laser dressed). Transient absorption and transient transparency effects are interpreted within a picture of strong-field induced coupling between core-excited $4d^{-1}(^2\mathrm{D}_{5/2})6p(^2\mathrm{P}_{3/2})$ and $4d^{-1}(^2\mathrm{D}_{3/2})6p(^2\mathrm{P}_{1/2})$ states at 65.1 and 67 eV, respectively, and nearby dark states with *ns* and *nd* characters. The major features of the transient absorption spectra can be well described within a three-level (Autler-Townes) coupling scheme. Employing this model, a dipole-moment for the $4d^{-1}(^2\mathrm{D}_{3/2})6p(^2\mathrm{P}_{1/2})$ to $4d^{-1}(^2\mathrm{D}_{3/2})6s(^2\mathrm{S}_{1/2})$ transition of 0.4(0.1) Debye is derived.

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