Abstract Submitted
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Measuring 10 fs dynamics via resonant x-ray pump/x-ray probe spectroscopy[1] RYAN COFFEE, MINA BIONTA, NICK HARTMANN, LCLS-SLAC, JAMES CRYAN, JAMES GLOWNIA, ADI NATAN, PULSE-Stanford, DOUG FRENCH, Penn. State, MARCO SIANO, Imperial College, LCLS - AMO42112 COLLABORATION — We used two x-ray pulses to investigate the femtosecond scale molecular response to K-shell resonant excitation in O_2. Our results give three perspectives on this dynamic response: 1) sub-10 fs transient bleaching of resonant absorption, 2) a corresponding sub-10 fs evolution of the resonant Auger electron spectrum, and 3) a 10–15 fs evolution of electronic molecular symmetry. The x-ray pulses are tuned to the 531 eV $1s \rightarrow 2p\pi^*$ resonance in O_2. Upon excitation by the first pulse, further absorption is suppressed until the dynamic molecular valence pulls a new valence state into resonance. The new resonance occurs only after about 5–10 fs and reveals opposite electronic symmetry to the π^*. After 15 fs, this newly resonant state has lost molecular symmetry and undergoes atomic-like resonant absorption. We have thus used x-ray pump-probe spectroscopy to build a time-domain picture of the $\sim$10 fs molecular response to x-ray absorption.

[1]This research was carried out at the Linac Coherent Light Source (LCLS).

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