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Modifying X-ray Processes with Strong Optical Fields

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We are investigating how a high-field/ultrafast laser modifies the x-ray photoionization and vacancy decay of an isolated atom. Since many proposed experiments for the next generation x-ray sources, e.g. Linac Coherent Light Source, LCLS, involve laser/x-ray pump probe techniques on the 100 fs timescale, it is important to understand how the x-ray physics of an atom is perturbed due to the presence of a high-power laser. Two effects have been theoretically predicted: 1) a shift of the ionization threshold, and, 2) the appearance of sidebands in the photoelectron spectrum. The shifts can be sizable with oft-used laser intensities; at 10^{14} W/cm^2 (1mJ/100ps/10 μm^2) for 800 nm light, simple theories yield a threshold shift of 6 eV. These shifts have never been observed in the x-ray region. In addition, free-free transitions in the continuum will modify the photoelectron and Auger electron energy spectra, producing sidebands spaced by the laser photon energy. Technically, our goal is to provide temporal and spatial overlap of the Advanced Photon Sources x-ray beam with a focused laser beam to ca. 20 ps and 2 microns. We will present our progress to date.

☐ Prefer Oral Session
☒ Prefer Poster Session

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