

X-ray nonlinear processes in solid Fe with hard X-ray free-electron laser pulses (+ Discussion)

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Nonlinear interaction of solid Fe with intense femtosecond hard x-ray free-electron laser (XFEL) pulses will be reported. The experiment was performed at the CXI end-station of the Linac Coherent Light Source (LCLS) by means of high-resolution x-ray emission spectroscopy. Extreme fluences reaching $\sim 10^{15}$ photons/ \AA^2 allowed for x-ray nonlinear two-photon absorption. Double-K-hole formation via sequential two-photon absorption, and the direct two-photon absorption leading to single K-shell ionization was observed. The cross-sections for the nonlinear x-ray photon absorption processes were derived from the x-ray fluence dependence of the measured x-ray emission rates. I will present the obtained results as well as the different aspects of the experimental setup, the beam parameters and diagnostic in view of future needs.

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