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Exploration of Enhanced X-ray Scattering by Transient Atomic Resonances[1] PHAY HO, Argonne Natl Lab, STEPHAN KUSCHEL, SLAC, CHRISTOPHER KNIGHT, LINDA YOUNG, Argonne Natl Lab, TAIS GORKHOVER, SLAC — Intense x-ray free-electron laser (XFEL) pulses hold great promise for imaging function in nanoscale and biological systems with atomic resolution. However, the achieved spatial resolution obtained from the scattering signals of single shot experiments is currently limited by the induced electronic and structural damage in intense XFEL pulses. Our calculations show that, by exploring resonant scattering in the vicinity of atomic resonances of transient electronic states, enhanced scattering cross section and signal can be achieved without the need of extreme pulse intensity, where ultrafast structural damage can take place. Our results predict that scattering hotspots exist over a range of pulse parameters and show that attosecond XFEL pulses will enable the exploration of this resonant scattering scheme in both the soft and hard x-ray regimes.

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