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Attosecond x rays from x-ray-boosted high-order harmonic generation[1] CHRISTIAN BUTH, Argonne National Laboratory, MARKUS C. KOHLER, Max-Planck-Institut fur Kernphysik, FENG HE, Shanghai Jiao Tong University, KAREN Z. HATSAGORTSYAN, Max-Planck-Institut fur Kernphysik, JOACHIM ULLRICH, Max-Planck-Institut fur Kernphysik and Max Planck Advanced Study Group at CFEL, CHRISTOPH H. KEITEL, Max-Planck-Institut fur Kernphysik — We theoretically examine high-order harmonic generation (HHG) by an intense near-infrared (NIR) laser in combination with intense x rays from a free electron laser such as the Linac Coherent Light Source (LCLS) at SLAC. The x rays are tuned above an absorption edge thus causing one-photon ionization of a tightly bound core electron. The liberated core electron is driven by the NIR light through the continuum; when the electric NIR field reverses its direction, the electron may eventually return to the cation leading to its recombination with the core hole and the emission of a high-harmonic photon that is upshifted in energy by the x-ray photon energy. We develop a theory of this x-ray boosted HHG scenario and apply it to $1s$ electrons of neon atoms. HHG spectra are computed for LCLS pulses which are generated according to the self-amplification of spontaneous emission (SASE) principle. A time-frequency analysis of HHG emission reveals the imprinting of the varying LCLS pulse shapes on the boosted HHG spectrum which may open up prospects for pulse diagnostic. The boosted HHG light is used to generate a single attosecond pulse in the kiloelectronvolt regime by filtering out only the highest HHG photons close to the upshifted cutoff.

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