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High-power attosecond hard X-ray generation via enhanced SASE driven by cathode laser shaping

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In molecular systems, quantum-level electron motions occur on the sub-femtosecond timescale. In order to probe such dynamics, high energy attosecond pulses are required to provide the necessary spatial and temporal resolutions. At LCLS, the X-ray Laser-Enhanced Attosecond Pulses (XLEAP) collaboration develops operation modes for attosecond pulses in the soft and hard X-ray regimes for these studies. Here, we experimentally demonstrate the generation of high-power attosecond hard X-ray pulses via enhanced SASE driven by cathode laser shaping. Under this operation mode, we report pulses with tens of microjoules of energy and single-spike spectra with an average bandwidth of roughly 20 eV and an estimated pulse duration on the order of 100 as. Individual shots exhibit a bandwidth of up to 50 eV, paving the way to sub-100 as pulses with X-ray FELs.

Footnotes

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Author: GUO, Veronica (Stanford University)

Co-authors: MARINELLI, Agostino (SLAC National Accelerator Laboratory); CESAR, David (SLAC National Accelerator Laboratory); FRANZ, Paris (Stanford University); ROBLES, River (Stanford University); SONG, Sanghoon (SLAC National Accelerator Laboratory); ZHANG, Zhen (SLAC National Accelerator Laboratory)

Presenter: GUO, Veronica (Stanford University)

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