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Spectrotemporal shaping of attosecond x-ray pulses with a fresh-slice free-electron laser

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We propose a scheme for coherently shaping attosecond x-ray pulses at free-electron lasers. We show that by seeding an FEL with a short coherent seed that overfills the amplification bandwidth, one can shape the wigner function of the pulse by controlling the undulator taper profile. The examples of controllable coherent pulse pairs and trains, as well as isolated spectrotemporally shaped pulses with very broad coherent bandwidths are examined in detail. Existing attosecond XFELs can achieve these experimental conditions in a two-stage cascade, in which the coherent seed is generated by a short current spike in an electron bunch and shaped in an unspoiled region within the same bunch. We experimentally demonstrate the production of pulse pairs using this method at the Linac Coherent Light Source.

Footnotes

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