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Attosecond pulse shaping of X-ray free-electron lasers and applications to coherent control in quantum systems

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The development of high-power, attosecond methods at free-electron lasers has led to new possibilities in the probing and control of valence electron dynamics. Beyond simple observation of ultrafast processes, one of the longstanding goals of atomic physics is control of the electronic wavefunction on attosecond timescales. We present a scheme to generate sub-femtosecond pulse pairs from x-ray free-electron lasers with fs-scale separation, few eV energy separation, and a coherent phase relationship. This shaping method can be employed to coherently control ultrafast electronic wavepackets in quantum systems. We study in detail the Auger-Meitner decay process initiated by such a pulse pair and demonstrate that quantum beats of the decaying electronic wavepacket can be shaped by controlling the separation in energy and time of the pulse pair.

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Footnotes

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Yes

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