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Demonstration of tunable, phase-locked X-ray FEL pulses

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The availability of coherent copies of free-electron laser (FEL) X-ray pulses with tunable delay will facilitate a realm of techniques, such as the X-ray analogue of Fourier transform infrared (FTIR) spectroscopy, and accelerate the development X-ray quantum optics. Here we report steps toward phase-locked, tunable X-ray FEL pulses by combining the self-seeding mechanism, the slotted foil technique and transverse beam shaping, following our proposal in PNAS 11, e2117906119 (2022). Experiments have been conducted at the PAL-XFEL facility in Pohang, South Korea, and reveal coherent interference of few-femtosecond hard X-ray pulses and achieved a tunable time delay between them of 7 to 12 fs. Our future efforts will include improving the performance and tunability of the scheme, and applying it to time-domain hard X-ray interferometry experiments.

Footnotes

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