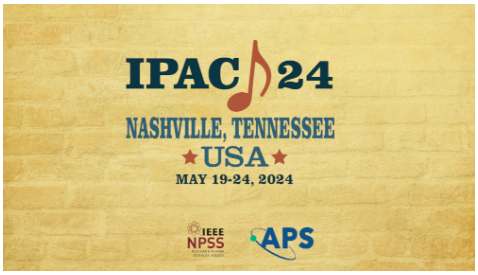

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Advanced laser-driven betatron X-ray generation

Tuesday, 21 May 2024 16:00 (2 hours)

Ultrafast high-brightness X-ray pulses have proven invaluable for a broad range of research. Such pulses are typically generated via synchrotron emission from relativistic electron bunches. Recently, compact X-ray sources based on laser-wakefield accelerated (LWFA) electron beams have been demonstrated, where the radiation is generated by transverse betatron oscillations of electrons within the plasma accelerator structure. Here, we present a novel method for enhancement of and control over the parameters of LWFA-driven betatron X-ray emission. We realize this through specific manipulation of the electron bunch phase-space using our novel Transverse Oscillating Bubble Enhanced Betatron Radiation (TOBER) scheme. The phase space is controlled through the orchestrated evolution of the temporal laser pulse shape and the accelerating plasma structure, which leads to off-axis electron injection and large-amplitude transverse betatron oscillation, resulting in enhanced X-ray emission. TOBER holds the promise of compact sources that can generate X-rays with optimized parameters for specific applications using the same setup beams with even higher peak and average brilliance.

Footnotes

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