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Toward ultra-bright x-ray pulses at PAL-XFEL

Friday, November 15, 2024 9:30 AM (30 minutes)

X-ray free electron lasers (XFELs) have the remarkable ability to generate X-ray beams with intense peak brightness, full transverse coherence, and femtosecond-scale pulse durations [1]. However, the current standard method of operation, Self-Amplified Spontaneous Emission (SASE), is affected by issues such as noisy spikes in both time and spectrum, primarily due to electron beam shot noise. To address these challenges and achieve brighter, fully coherent FEL sources, self-seeding has emerged as a promising solution. At PAL-XFEL, a forward Bragg-diffraction (FBD) monochromator is employed to produce nearly fully coherent hard X-ray self-seeded (HXRSS) free-electron laser (FEL) pulses. These HXRSS FEL pulses demonstrate exceptional peak brightness and a narrow spectral width, delivering outstanding performance across a wide photon energy range, from 3.5 keV to 14.6 keV. These results provide valuable insights for the development of next-generation X-ray sources and their diverse applications [2]. In addition, self-seeding plays a key role in the generation of terawatt (TW)-scale X-ray pulses with femtosecond pulse durations and enhanced peak current using the enhanced SASE (ESASE) method, which incorporates laser-electron modulation. We will also discuss our future plans to develop a TW-scale XFEL using ESASE and self-seeding technologies for the second hard X-ray undulator beamline project (HX2) at PAL-XFEL.

References
[1] H.S. Kang, et al., Nat. Photon., 11 (11), 708-713 (2017).
[2] Inhyuk Nam, et al., Nat. Photon., 15 (6), 435-441 (2021).

Contribution track

Paper submission Plan

Best Presentation

Presenter: Prof. NAM, Inhyuk (UNIST)

Session Classification: Plenary Talk