



Contribution ID: 1597 Contribution code: MOPB027

Type: **Poster Presentation**

Interference of harmonics observed in a free-electron laser oscillator

Monday 2 June 2025 16:00 (2 hours)

In an FEL oscillator with a planar undulator, odd harmonics appear as either spontaneous emission or as linear and nonlinear harmonics associated with the FEL pulse evolution. Additionally, misalignment of the electron beam or the resonator can lead to off-axis gain, generating even harmonics. We conducted an experiment at KU-FEL, operated at 5 μm , to measure the 6th- and 7th-harmonic spectra using a spectrometer equipped with an intensified CCD. Scanning the gate timing enabled us to capture the time evolution of the harmonic spectrum within the macro pulse. The results revealed that the harmonic spectra broaden as the macropulse intensity rises, with interference observed between the harmonics. Such interference between adjacent-order harmonics has also been observed in high-harmonic generation from solid-state targets and utilized to measure the carrier-envelope phase (CEP) of optical pulses. Based on the results of our FEL harmonic measurements and numerical simulations, we will discuss the potential for CEP measurement using FEL harmonics, highlighting the implications for further developments in FEL-based attosecond X-ray sources via high-harmonic generation.

Footnotes

Paper preparation format

Word

Region represented

Asia

Funding Agency

MEXT Q-LEAP (JPMXS0118070271), and JSPS KAKENHI (22H03881, 23K25135).

Author: HAJIMA, Ryoichi (National Institutes for Quantum Science and Technology)

Co-authors: ZEN, Heishun (Kyoto University); OHGAKI, Hideaki (Kyoto University); KAWASE, Keigo (Japan Atomic Energy Agency); KANAI, Tsuneto (Kyoto University)

Presenter: HAJIMA, Ryoichi (National Institutes for Quantum Science and Technology)

Session Classification: Monday Poster Session

Track Classification: MC2: Photon Sources and Electron Accelerators: MC2.A06 Free Electron Lasers (FELs)