



Contribution ID: 32 Contribution code: TUBO4

Type: **Contributed Oral**

First Observation of Laser-Beam Interaction in a Dipole Magnet

Tuesday, 23 August 2022 12:20 (25 minutes)

Recently, a self-modulation scheme was proposed and experimentally demonstrated for enhancing energy modulation in seeded FELs [1], thereby significantly reducing the requirement of an external laser system. Driven by this scheme, an electron beam with a laser-induced energy modulation as small as 1.8 times the slice energy spread is used for lasing at the 7th harmonic of a 266-nm seed laser in a single-stage high-gain harmonic generation (HG) setup and the 30th harmonic of the seed laser in a two-stage HG setup. Moreover, using this scheme, we report the first observation of the laser-beam interaction in a pure dipole magnet [2] in which the electron beam energy modulation with a 40-keV amplitude and a 266-nm period is measured. We demonstrate that such an energy modulation can be used to launch a seeded FEL, that is, lasing at the sixth harmonic of the seed laser in a high-gain harmonic generation scheme. The results reveal the most basic process of the FEL lasing and open up a new direction for the study and exploitation of laser-beam interactions.

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Session Classification: Seeded FELs

Track Classification: Seeded FEL