



Contribution ID: 205 Contribution code: MOBI01

Type: **Invited Oral Presentation**

Impact of space charge in externally seeded FEL

Monday 19 August 2024 14:30 (35 minutes)

In high-gain harmonic generation (HG) FEL, the amplification process is triggered by an external seed laser that creates periodic energy modulation in the electron phase-space, which is then converted into a density modulation in a dispersive section. This density modulation presents strong current spikes at the seed laser wavelength that leads to the harmonic bunching in the forthcoming radiator. However, these spikes can also induce non-negligible space charge effect to the beam that under certain conditions can have a strong impact on the evolution of the FEL process in the long FEL radiator line tuned at a harmonic of the seed laser wavelength.

We present a detailed comparison of experimental data observed at FERMI FEL with numerical simulations highlighting how critical the influence of the space charge can be on the amplification process.

Footnotes

Funding Agency

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Session Classification: FEL theory

Track Classification: FEL theory