Contribution ID: **2684** Contribution code: **TUPL003** Type: **Poster Presentation**

First light at the Israeli superradiant THz free electron laser

Tuesday 9 May 2023 16:30 (2 hours)

We report a first observation of terahertz super radiant emission from the Israeli Free Electron Laser. This is the first demonstration of a THz source based on the scheme of coherent spontaneous superradiant emission by an ultra-short e-beam bunch [1].
The FEL is driven by a compact (64 cm long) Hybrid photo-cathode RF gun, emitting a beam of electron with kinetic energy of 3.5 to 8.5 MeV [2]. At 6 MeV, the Undulator emission has a frequency of app 3.5 THz. A chirp-based bunching scheme produces a 100 fs pulse in the center of the undulator, which is less than half a period of the emitted radiation (290 fs). This produces superradiance, a phenomenon where the electrons emit coherently in phase with each other. In this situation the radiation fields emitted by the electrons add up. Thus, the total energy of the radiation is proportional to the square of the electrons number (current) and not proportional to the current as in a conventional spontaneous emitter.
This principle provides a significant advantage over THz FEL schemes based on SASE [3], since the energy is proportional to the number of electrons squared, and thus comparable THz radiation energies (we measured at first attempt ˜30 nJ per pulse) can be obtained with a very compact accelerator and a short wiggler.
In the framework of our FEL user center of the Ministry of Science, we aim to apply our special THz source to provide high energy tunable radiation to users in a wide range of disciplines.

Funding Agency

Footnotes

1. A. Gover et al, Superradiant and stimulated-superradiant emission of bunched electron beams. Reviews of Modern Physics, 91(3), .035003
2. A. Nause et al "6 Mev Novel Hybrid (Standing Wave - Traveling Wave) Photo-Cathode Electron Gun for a THz Sperradiant FEL", Nuclear Inst. and Methods in Physics Research, A, Vol 1010, 165547 (2021).
3. M. Krasilnikov et al "First Lasing of the THz SASE FEL at PITZ"International FEL Conference, Trieste, August 22, 2022, MOA08

I have read and accept the Privacy Policy Statement

Yes

Authors: NAUSE, Ariel (Ariel University); FRIEDMAN, Aharon (Ariel University); HAJ YAHYA, Adnan (Ariel University Center of Samaria); WEINBERG, Amir (Ariel University); FEIGIN, Leon (Ariel University); MAGORI, Eyal (Ariel University)

Presenter: NAUSE, Ariel (Ariel University)

Session Classification: Tuesday Poster Session

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