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## First Light at the Israeli THz Superradiant Free Electron Laser

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We present first light emission from the Israeli THz superradiant FEL based on the ORGAD accelerator. The source was designed to operate beyond 1 THz. However, we measured superradiant emission near 0.6 THz with radiative energy output of 1.5 uJ.

This FEL operates in the FEL center of Ariel and Tel-Aviv universities. Designed and constructed in collaboration with UCLA, it is a hybrid RF gun with accelerating energies of 3.5 to 8.5 MeV. It is 64 cm in length. With charge of up to 330 pC. The electron bunch is 150 fsec. The planar undulator is 80 cm long. At radiation frequency of 0.6 THz, the super-radiant emission condition was satisfied (bunch duration less than quarter period of the radiation). When this condition is met, all electrons in the bunch emit in phase with each other. Hence the total radiation energy is proportional to the square of the number of electrons, not to the number of electrons as in conventional spontaneous emission. The bunch duration is limited by space-charge beam effect in the undulator, limiting attainment of superradiance at higher frequencies. This will be improved by ongoing work, adjusting the beam transport parameters and undulator injection.

### Footnotes

### Funding Agency

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