

Physics and Applications of High Brightness Beams



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First Light at the Israeli THz Superradiant Free Electron Laser

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We report first observation of terahertz super radiant emission from the Israeli Free Electron Laser. This is first demonstration of a THz FEL source based on the scheme of coherent spontaneous superradiant (SR) emission by an ultra-short e-beam bunch. The first measured radiation signal corresponds to a 3.5THz beam output of 180 nanoJ.

The Israeli superradiant FEL operates in the FEL center of Ariel and Tel-Aviv universities. It is based upon the ORGAD RF-LINAC at the Schlesinger Accelerator Center in Ariel. The accelerator is a compact RF gun of accelerating energies 3.5 to 8.5 MeV. The gun is 64 cm long. It produces an electron bunch of about 100 femtoseconds. Since the frequency of the emitted radiation is 3.5 Tera Hertz, the bunch duration is shorter than half a period of the radiation (290 fs), satisfying the condition for SR emission. In this case all electrons in the bunch emit in phase with each other, and the total emitted radiation energy is proportional to the square of the number of the electrons N^2 and not to the number of electrons N as in conventional spontaneous emission. Based on a modal excitation theory we will estimate the short wavelength limits of SR.

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