

Superradiant THz Free Electron Laser Driven by Intense Ultrashort Electron Bunches

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Abstract

Intense ultrashort electron pulses have been generated from the NSRRC photoinjector which is a radio frequency linear accelerator (i.e. rf linac) system equipped with a 2998 MHz, laser-driven photo-cathode rf electron gun and a 5.2-m long S-band traveling-wave rf linac for beam acceleration. This system has been installed in the Accelerator Test Area (ATA) for novel accelerator-based light source development. A 25 MeV beam of bunch duration as short as 240 fs has been produced from this injector by the so-called velocity bunching technique. With the injector's energy-booster linac operating near zero-crossing rf phase, bunch compression with compression ratio as high as 12.5 can be achieved at 530 pC bunch charge. By injecting such ultrashort beam into a gap-tunable U100 planar undulator, superradiant THz radiation of pulse energy as high as 20 μ J can be generated at 1.24 THz. In this report, progress of photoinjector and intense THz source development at NSRRC and recent progress will be discussed.