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Title:Generating periodic terahertz structures in a relativistic electron beam through frequency down-conversion of optical lasers
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Abstract:We report generation of density modulation at terahertz (THz) frequencies in a relativistic electron beam through laser modulation of the beam longitudinal phase space. We show that by modulating the energy distribution of the beam with two lasers, density modulation at the difference frequency of the two lasers can be generated after the beam passes through a chicane. In this experiment, density modulation around 10 THz was generated by down-converting the frequencies of an 800 nm laser and a 1550 nm laser. The central frequency of the density modulation can be tuned by varying the laser wavelengths, beam energy chirp, or momentum compaction of the chicane. This technique can be applied to accelerator-based light sources for generation of coherent THz radiation and marks a significant advance toward tunable narrow band THz sources. © 2012 American Physical Society.
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