Terahertz transition radiation generated in intense laser-foil interactions

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Recently Terahertz radiation from laser-produced plasmas has attracted much interest since plasmas can work at arbitrarily high laser intensity. However, only few experiments with relativistic laser pulses are reported. The THz generation is either not understood well. We have systematically studied strong THz radiation from solid targets driven by relativistic laser pulses and demonstrated three generation mechanisms. THz radiation with pulse energy of hundreds μJ/sr has been observed. In this talk, we will concentrate on the THz generation due to coherent transition radiation of relativistic laser-driven electron beams when they pass the solid-vacuum boundary. Targets including mass-limited foils and layered metal-plastic targets are used to verify the radiation mechanism and characterize the radiation properties. Observations of THz emissions as a function of target parameters agree well with the formation-zone and diffraction model of transition radiation. Particle-in-cell simulations also well reproduce the observed characteristics of THz emissions. The present THz transition radiation enables not only a potential tabletop brilliant THz source, but also a novel noninvasive diagnostic for fast electron generation and transport in laser-plasma interactions.

References

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