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Radio and Plasma Wave Generation by an Electron Beam in a Laboratory Plasma[1] S DORFMAN, V ROYTERSHTEYN, Space Science Institute, C CATTELL, C COLPITTS, UMN, GL DELZANNO, Q MARKSTEINER, LANL — Interaction between relativistic electron beams and magnetized plasma is a fundamental and practical problem relevant to many challenging issues in space physics and astrophysics. We present results from a 20 keV beam experiment on the Large Plasma Device (LAPD) at UCLA motivated by the problem of how naturally occurring electron beams may produce type II/III solar radio emissions as well as recent proposals to place compact high-energy electron beam sources on future spacecraft. These spacecraft-borne beams may be used to map magnetic field lines in the Earth's magnetosphere or to generate waves for radiation belt remediation. In the LAPD experiments, electromagnetic emission between the plasma and upper hybrid frequencies is observed by both in-situ probes and by an antenna outside of the plasma. The parallel phase speed of the excited waves is measured to be consistent with generation via a resonance process, while estimates of the radiated power are consistent with incoherent Cherenkov emission. Kinetic modeling suggests that the apparent absence of strong instabilities is due to velocity dispersion imposed by the beam injection conditions. Signatures of nonlinear interactions between fluctuations above the plasma frequency and observed whistler modes are also observed.

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