Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Perturbative Particle Simulations of Eigenmodes in High Intensity Charged Particle Beams[1] WEIHUA ZHOU, HONG QIN, RONALD C. DAVIDSON, Princeton Plasma Physics Laboratory, Princeton University, Princeton, NJ 08543 — Two-dimensional body modes in high intensity charged particle beams are studied using the Beam Equilibrium Stability and Transport (BEST) code, which numerically solves the Vlasov-Maxwell equations using a low noise perturbative particle simulation method. The beam equilibrium is inhomogeneous in the radial direction and spatially uniform in the beam propagation direction. The beam equilibrium is determined self-consistently from the steady-state Vlasov-Maxwell equations for arbitrary space charge intensity, subject to transverse confinement by the applied smooth-focusing field. The two-dimensional body modes have an (r,z) mode structure localized inside the beam, with finite wavelength in the beam propagation direction. Wave-particle interactions, such as a strong Landau damping when the wave velocity in the beam frame matches the beam thermal velocity in the longitudinal direction, are numerically investigated for this family of eigenmodes.

[1]Research supported by the U.S. Department of Energy.

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Date submitted: 21 Jul 2005 Electronic form version 1.4