Abstract Submitted
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Thermodynamic Bounds on Nonlinear Electrostatic Fluctuations in Intense Charged Particle Beams[1] NIKOLAS LOGAN, Princeton University, RONALD DAVIDSON, PPPL — This work calculates nonlinear thermodynamic bounds on electrostatic perturbations in anisotropic charged particle beams with a wide range of initial beam parameters. Anisotropies develop naturally in accelerators and can drive Harris-type electrostatic instabilities. These can cause a deterioration of beam quality and degraded focusing, resulting in limits on the luminosity and minimum spot size attainable in experiments. This presentation places an upper bound on the field fluctuation energy of these instabilities. A method previously used to bound field energy in unstable plasmas [Davidson and Tsai, 1973; Davidson, 1985] is generalized to the case of an intense non-neutral beam, fully encompassing intense self-field effects. A bound on the fluctuation field energy is given for an arbitrary initial distribution and the results are applied to space-charge-dominated, emittance-dominated, and general anisotropic bi-Maxwellian distributions.

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