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Nonlinear Delta-f Particle Simulations of Energy-Anisotropy Instabilities in High-Intensity Bunched Beams[1] HONG QIN, RONALD DAVIDSON, EDWARD STARTSEV, Princeton Plasma Physics Lab — The self-consistent Vlasov-Maxwell equations and a generalized delta-f particle simulation algorithm are applied to high- intensity finite-length charge bunches. For bunched beams with anisotropic energy, there exists no exact kinetic equilibrium because the particle dynamics do not conserve transverse energy and longitudinal energy separately. A reference state in approximate dynamic equilibrium has been constructed theoretically. The electrostatic Harris instability driven by strong energy anisotropy relative to the reference state have been simulated using the generalized delta-f algorithm for bunched beams. The observed growth rates are larger than those obtained for infinitely-long coasting beams. The growth rate decreases for increasing bunch length to a value similar to the case of a long coasting beam. For long bunches, the instability is axially localized symmetrically relative to the beam center, and the characteristic wavelength in the longitudinal direction is comparable to the transverse dimension of the charge bunch. A smooth, automatic-switching scheme between the delta-f and total-f methods is being used to simulate the nonlinear phase of the instability.

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