Abstract Submitted
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Cyclotron Modes in a Multi-Species Nonneutral Plasma Column[1]

D. DUBIN, UCSD — A kinetic theory of electrostatic modes near the cyclotron frequency Ω_c of a given plasma species is developed for a multi-species nonneutral plasma column, keeping terms in the perturbed distribution up to order $1/\Omega_c^2$, and including the effects of finite-larmor radius r_c up to order r_c^2. The theory requires perturbatively solving for particle orbits to order $1/\Omega_c^4$, and for the equilibrium distribution to order $1/\Omega_c^3$. At this order this distribution is not Maxwellian if the plasma temperature or rotation frequency is not uniform.[2] For $r_c \to 0$ the theory reproduces cold-fluid theory, which predicts a single mode for each azimuthal mode number and each species.[3] The mode frequencies depend on species concentration, making them a useful diagnostic. However, at low temperature, centrifugal separation of the species causes frequency shifts that complicate the concentration diagnostic. In addition, the frequency spectrum is broadened by spatial Landau damping at radii where the transverse cold fluid dielectric vanishes. These singularities are regularized by finite r_c, giving a set of closely-spaced Bernstein modes.[2]

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[2]O'Neil, Driscoll, Phys Fl **22** 266 (1979)
[3]Gould, LaPointe, PRL **67** 3685 (1991)

D.H.E. Dubin
UCSD

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