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Collisional Damping of Plasma Waves on a Pure Electron Plasma Column.[1] M.W. ANDERSON, T.M. O'NEIL, UCSD — Collisional damping of electron plasma waves (Trivelpiece-Gould waves) on a magnetized pure electron plasma column is discussed. Damping in a pure electron plasma differs from damping in a neutral plasma, since there are no ions to provide a collisional drag on the oscillating electrons. A dispersion relation for the complex frequency, ω, is derived from Poisson's equation and the drift-kinetic equation with the Dougherty collision operator. This approximate Fokker-Planck operator conserves particle number, momentum, and energy, and also is analytically tractable. For large phase velocity, where Landau damping is negligible, the dispersion relation yields the complex frequency $\omega = (k_z \omega_p / k)[1 + (3/2)(k\lambda_D)^2 (1 + i10\alpha/9)(1 + i2\alpha)^{-1}]$, where ω_p is the plasma frequency, k_z is the axial wave number, k is the total wave number, λ_D is the Debye length, ν is the collision frequency and $\alpha \equiv \nu k / \omega_p k_z$. This expression spans uniformly from the weakly collisional regime ($\alpha \ll 1$) to the strongly collisional regime ($\alpha > 1$), matching onto fluid results in the latter limit. For comparison, note that in the weakly collisional regime, the damping rate is given by $\mathrm{Im}(\omega) = -4\nu k^2 \lambda_D^2 / 3$, which is suppressed from the damping rate for the case of a neutral plasma [i.e., $\mathrm{Im}(\omega) \simeq -\nu$] by the small factor $(k\lambda_D)^2 \ll 1$.

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