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Finite Length Effects on Collisional Damping of Plasma Waves in Single-Species Plasmas[1] M.W. ANDERSON, T.M. O'NEIL, F. ANDEREGG, C.F. DRISCOLL, UCSD — A recent paper[2] analyzed the collisional damping of a plasma wave propagating on a single-species plasma column of infinite length. For high-phase-velocity ω/k_z and weak collisions $\nu_{\perp\|}$, the predicted damping rate is $\gamma \cong -\nu_{\perp\|}(k_z \mathrm{v_{th}}/\omega)^2$, where $\mathrm{v_{th}} \equiv \sqrt{\mathrm{T/m}}$. Measurements of the $k_z = \pi/L_p$ mode on Mg^+ plasmas corroborate the temperature and density scaling implicit in this formula; however, the measured damping rates are about $40\times$ greater than predicted. Here we investigate finite-length effects as a possible source of this discrepancy. The ends of a plasma column couple higher k_z components to the fundamental mode;[3]; and these high-k_z components should enhance collisional damping. Motivated by this intuitive picture, we derive a generalized integral expression for the collisional damping rate that allows for arbitrary z-dependence in the waveform. We find that small amplitude high-k_z components can provide the dominant contribution to the mode damping, bringing theory and measurements into better accord.

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[2]M.W. Anderson and T.M. O'Neil, Phys. Plasmas **14**, 112110 (2007).
[3]S.A. Prasad and T.M. O'Neil, Phys. Fluids **26**, 665 (1983).

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