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Degenerate Mixing of Trivelpiece-Gould Waves on a Cold, Finite-Length Plasma Cylinder[1] M.W. ANDERSON, T.M. O'NEIL, UCSD, R.W. GOULD, CalTech — In the cold-fluid dispersion relation $\omega = \omega_p/[1 + (k_\perp/k_z)^2]^{1/2}$ for Trivelpiece-Gould waves on an infinitely-long magnetized plasma cylinder, the transverse and axial wavenumbers appear only in the combination $k_\perp/k_z$. As a result, for any frequency $\omega < \omega_p$, there are infinitely many degenerate waves, all having the same ratio $k_\perp/k_z$. On a cold finite-length plasma cylinder, each longitudinal normal mode is a mixed superposition of these degenerate waves. Here several such modes are calculated for a single-species plasma cylinder with rounded ends. A striking feature of these modes is that the short-wavelength waves add constructively along cones[2] given by $dz/dr = \pm(\omega_p^2/\omega^2 - 1)^{1/2}$. Thus, the mode structure of even a low order mode is substantially more complicated than the single sine wave approximation typically assumed. Also, the admixture of short wave lengths substantially enhances the viscous damping of the mode.

[1]Supported by NSF PHY-0903877 and DOE DE-SC0002451.
[2]R.K. Fisher and R.W. Gould, Phys. Rev. Lett. **22**, 1093 (1969).

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