Abstract Submitted
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Damping Measurements of Plasma Modes[1] F. ANDEREGG, M. AFFOLTER, C.F. DRISCOLL, UCSD — For azimuthally symmetric plasma modes in a magnesium ion plasma, confined in a 3 Tesla Penning-Malmberg trap with a density of $n \sim 10^7 \mathrm{cm}^{-3}$, we measure a damping rate of $2\mathrm{s}^{-1} < \gamma < 10^4\mathrm{s}^{-1}$ over a wide range in temperature ($5 \times 10^{-6}\mathrm{eV} < \mathrm{T} < 5\mathrm{eV}$) and aspect ratio ($0.25 < \alpha < 25$), with a wave amplitude of $\delta n/n \simeq 5\%$. Changing the aspect ratio, $\alpha = L_p/2r_p$, of the plasma column, alters the frequency of the mode from 16 KHz to 192 KHz. The oscillatory fluid displacement is small compared to the wavelength of the mode; in contrast, the fluid velocity, $\delta \mathrm{v_f}$, can be large compared to $\overline{\mathrm{v}}$. The real part of the frequency satisfies a linear dispersion relation. In long thin plasmas ($\alpha > 10$) these modes are Trivelpiece-Gould (TG) modes, and for smaller values of α they are Dubin spheroidal modes. However the damping appears to be non-linear; initially large waves have weaker exponential damping, which is not yet understood. Recent theory[2] calculates the damping of TG modes expected from viscosity due to ion-ion collisions; but the measured damping, while having a similar temperature and density dependence, is about 40 times larger than calculated. This discrepancy might be due to an external damping mechanism.

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[2]M.W. Anderson and T.M. O'Neil, Phys. Plasmas **14**, 112110 (2007).

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