Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Diocotron Damping in Ion Plasmas in the Presence of a Few Electrons[1] F.A. ANDEREGG, D.R. CREVELING, C.F. DRISCOLL, UCSD —
Here, we present diocotron damping measurements of quiescent Mg^+ ion plasma columns including the effects of a small number of electrons. The ion plasma is contained in a 3 Tesla Penning-Malmberg trap with total number of particles $N \sim 10^8 - 10^9$. For the $m_\theta = 1$, $k_z = 0$ diocotron mode, γ/ω vs T was measured as the temperature was varied over the range $0.1 < T < 10$ eV with an ion column length $L_p = 12$cm. We find $4 \times 10^{-6} < \gamma/\omega < 10^{-4}$ decreasing with temperature for $0.1 < T < 1$ eV, increasing to 10^{-2} at $T \sim 10$ eV in the range of 1 eV $< T < 10$ eV. The low temperature damping may represent "rotational pumping," or trapped-particle-mediated asymmetry-induced damping; but the high temperature result is not understood. These new measurements of ion diocotron mode damping will be compared to previous work on diocotron mode damping in pure electron plasmas. Rapid loss of Mg^+ plasmas has been observed from overlapping nested electrons, but no instability is observed with a weak transiting electron beam, possibly due to concurrent damping. Ion plasma results will be compared to the analogous case of an electron column with transiting ions.

[1]Supported by NSF PHY-0354979.

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Date submitted: 25 Jul 2005 Electronic form version 1.4