Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Damping of Plasma Waves in Multi-species Ion Plasmas[1] FRANCOIS ANDEREGG, MATTHEW AFFOLTER, C. FRED DRISCOLL, University of California San Diego — The damping of Langmuir waves in multi-species pure ion plasmas is measured over four decades in temperature covering regimes of Landau, bounce harmonics, and interspecies drag damping. Thermal cyclotron spectroscopy determines the plasma composition. The plasma is predominantly Mg^+ resulting from a Mg electrode arc, with roughly 5-30% other ions, typically H_3O^+ and O_2^+, arising from ionization and chemical reactions with the residual background gas. The plasma temperature is controlled with laser cooling of the Mg24 ions over the range $10^{-4} \leq T \leq 1$ eV. For $T \geq 0.1$ eV, the damping rates agree closely with Landau theory for θ-symmetric standing waves, with discrete wavenumber $k_1 = \pi/L_p$. At lower temperature $10^{-2} \leq T \leq 0.1$ eV the damping is not fully understood, but is most likely a result of Landau damping on higher k_z bounce harmonics produced by the rounded plasma ends. For $T \leq 10^{-2}$eV, damping rates $10 \leq \gamma \leq 10^3$ s^{-1} are proportional to the ion-ion collisionality $\nu_{ii} \propto T^{-3/2}$, consistent with a theory prediction that includes interspecies drag. A decrease in γ is observed at $T \leq 10^{-3}$eV, presumably due to strong magnetization, centrifugal separation of the species, and the collisionality approaching the mode frequency $f_1 \approx 20$ kHz.

[1]Supported by DOE grant DE-SC0002451

Francois Anderegg
University of California San Diego

Date submitted: 21 Jul 2015 Electronic form version 1.4