Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Measurements of Correlation-Enhanced Collision Rates[1] F. ANDEREGG, D.H.E. DUBIN, T.M. O'NEIL, C.F. DRISCOLL, UCSD — We measure the perp-to-parallel collision rate $\nu_{\perp\|}$ in laser-cooled Magnesium ion plasmas in the strongly-magnetized and correlated regime; and obtain close agreement with the "Salpeter correlation enhancement" first studied for fusion in dense plasmas such as stars.[2] The cyclotron energy, like nuclear energy, is released only through rare close-range collisions. These close collisions are suppressed by strong magnetization, because collisional impact distances are rarely as small as a cyclotron radius r_c. However, theory[3] predicts that particle correlations reduce this suppression of collisionality, enhancing the rare close collisions by e^{Γ}, where $\Gamma \equiv e^2/aT$ is the correlation parameter. We control the plasma temperature over the range $4\times10^{-6} < T < 1$eV, giving correlation parameters up to $\Gamma \sim 20$, with measured collision rates $2 < \nu_{\perp\|} < 2\times10^4$ sec^{-1}. At low temperatures, the measured $\nu_{\perp\|}$ are enhanced by up to 10^9 compared to uncorrelated theory, consistent with the predicted correlation enhancement. When the plasma density is reduced from 2 to 0.12 $\times10^7$cm^{-3}, the correlations are eliminated and the measured $\nu_{\perp\|}$ agree with uncorrelated theory.

[1]Supported by NSF/DOE PHY-0613740 and NSF PHY-0354979.
[2]E.E. Salpeter and H.M. Van Horn, Astrophys. J. **155**, 183 (1969).
[3]D.H.E. Dubin, Phys. Rev. Lett. **94**, 025002 (2005).

Francois Anderegg

Date submitted: 19 Jul 2008 Electronic form version 1.4