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Abstract Submitted
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Measurement of Correlation-Enhanced Collision Rates in the Mildly Correlated Regime ($\Gamma \sim 1$)¹ F. ANDEREGG, D.H.E. DUBIN, M. AFFOLTER, C.F. DRISCOLL, UCSD — We have recently measured correlation-enhanced perpendicular-to-parallel collision rates $\nu_{\perp//}$ in cryogenic, strongly magnetized ion plasmas in the mildly correlated regime. The enhancement of $\nu_{\perp//}$ is directly analogous [1] to the correlation-enhancement of fusion collisions in hot dense stellar plasma, as first analyzed by Salpeter [2]. The enhancement occurs because plasma screening reduces the repulsive Coulomb potential between charges, allowing closer collisions for a given relative energy. The correlations are parameterized by $\Gamma = e^2/aT$ which is the ratio of the nearest neighbor potential energy to the ion thermal energy. Our prior measurements [3] over the range $0 < \Gamma < 15$ observed enhancement up to 10^7 x, in broad agreement with Salpeter “equilibrium screening” theory. However recent “dynamical screening” theories [4] predict negligible enhancement for $\Gamma \sim 1$. In our magnesium ion plasmas, we obtain $\Gamma \sim 1$ at densities $n = 2 \times 10^7 \text{cm}^{-3}$ and temperatures $T \cong 5 \times 10^{-5} \text{eV}$. Recent improvements in our cooling and diagnostic lasers provide better long-term stability in T , enabling more accurate measurements of the enhancements. Our new results rule out the dynamical screening theories. [1] D.H.E. Dubin, Phys. Plasmas **15**, 055705, (2008) [2] E.E. Salpeter, Austr. J. Phys., 7, 373, (1954) [3] F. Anderegg et.al., Phys. Rev. Lett. **102**, 185001, (2009) [4] W. Däppen and K. Mussack Contrib. Plasma Phys. 52, 149, (2012).

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