Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Ultracold Plasma Expansion Dynamics in High Magnetic Field
KEVIN TWEDT, XIANLI ZHANG, STEVEN ROLSTON, University of Maryland - Joint Quantum Institute — We study the expansion dynamics of an ultracold plasma in uniform magnetic fields up to 500 G. We use a time-of-flight projection imaging method to extract the ion distribution at varying times during the plasma evolution. Our previous study showed the transverse expansion velocity in a uniform longitudinal magnetic field scales as $B^{-1/2}$ for fields up to 70 G, explained by a non-linear ambipolar diffusion model that involves anisotropic diffusion in two directions. Preliminary results show above 100 G and up to 500 G, the expansion velocity does not continue to decrease, but levels off at $\sim$10m/s. This limit corresponds to the ion thermal velocity at an ion temperature of 1 K. We also observe a flat top in the ion images that we attribute to the formation of a shockwave at the edge of the ion cloud during the time of flight to the detector. This work is a preliminary step in pursuing 3D magnetic confinement of the ultracold plasma. This work is partially supported by the NSF.

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Date submitted: 24 Jan 2009 Electronic form version 1.4