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Ultracold Plasma Expansion in Magnetic Field XIANLI ZHANG, ROBERT FLETCHER, STEVEN ROLSTON, Joint Quantum Institute, Department of Physics, University of Maryland — We image the ion distribution of an ultracold neutral plasma by extracting the ions with a high voltage pulse onto a position-sensitive detector. Early in the lifetime of the plasma, the size of the image is dominated by the Coulomb explosion of the dense ion cloud. At about 20 microseconds the image size is at a minimum and then linearly increases, reflecting the true size of the plasma. The ion cloud maintains a Gaussian density profile throughout the lifetime of the plasma. By 2-D Gaussian fitting of the ion image, we obtain the transverse width, perpendicular to an applied magnetic field. The longitudinal width is obtained from the temporal width of the ion current. Without magnetic field, the plasma expansion velocity at different initial electron temperatures matches the result obtained by measuring the plasma oscillation frequency (Killian etc, PRL, 85, 2 (2000)). As we increase the magnetic field up to 70 Gauss, we find that the expansion velocity decreases, roughly scaling as $B^{-1/2}$. This field dependence is unlike expectations from ambipolar diffusion, which has a diffusion constant that scales as B^{-2}. Possible models for the expansion will be discussed.

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