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Progress Towards Laser Cooling of an Ultracold Neutral Plasma[1]

THOMAS LANGIN, GRANT GORMAN, ZHITAO CHEN, KYLE CHOW, THOMAS KILLIAN, Rice University — We report on progress towards laser-cooling of the ion component of an ultracold neutral plasma (UNP) consisting of $^{88}Sr^{+}$. The goal of the experiment is to increase the value of the ion Coulomb Coupling Parameter, Γ_i, which is the ratio of the average nearest neighbor Coulomb interaction energy to the ion kinetic energy. Currently, Γ_i is limited to ~ 3 in most UNP systems. We have developed a new photoionization pathway for plasma creation that starts with atoms in a magnetic trap. This allows us to create much larger plasmas (upwards of 10^9 atoms with a width of 4 mm). This greatly reduces the plasma expansion rate, giving more time for laser cooling. We have also installed lasers for optically pumping atoms out of dark states that are populated during laser cooling. We will discuss these new systems, along with the results of our first attempts at laser-cooling.

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