Abstract Submitted
for the 4CF14 Meeting of
The American Physical Society

**Increasing the Coulomb coupling of an ultracold neutral plasma**[1]

MARY LYON, SCOTT BERGESON, Brigham Young University — Ultracold neutral plasmas are strongly coupled Coulomb systems that are generated by photoionizing laser-cooled atoms close to threshold. The strong coupling parameter Γ, defined as the ratio of the nearest-neighbor Coulomb potential energy to the average ion kinetic energy, is limited at times later than ∼100 ns by an ultrafast, nonequilibrium relaxation of the ions. This process is called "disorder-induced heating" and it limits Γ in our plasmas to order unity. A recent simulation predicted that higher values of Γ can be realized in an ultracld plasma if the plasma ions are excited to higher ionization states. The maximum value of Γ depends on the time at which the second ionization laser pulses arrive. I will present recent results from an experiment designed to increase the ion strong coupling of an ultracold neutral plasma by promoting the plasma ions to the second ionization state. Using laser-induced fluorescence we map out the ion velocity distribution of the $Ca^+$ ions in a partially doubly ionized plasma and show that the heating due to the second ionization depends on the timing of the second ionization laser pulses, as predicted by MD simulations.

[1]National Science Foundation (grant no. PHY-0969856), Air Force Office of Scientific Research (grant no. FA9950-12-1-0308), Rocky Mountain NASA Space Grant Consortium

Mary Lyon
Brigham Young University

Date submitted: 12 Sep 2014 Electronic form version 1.4