

Abstract Submitted  
for the DAMOP11 Meeting of  
The American Physical Society

**Ion-ion thermalization rate in ultracold neutral plasmas** JOSE CASTRO, PATRICK MCQUILLEN, THOMAS KILLIAN, Rice University — We measured the ion-ion thermalization rate in strontium ultracold neutral plasmas (UNP) in a regime of strong ion coupling. Traditional plasma descriptions, based on the Landau-Spitzer collision time, fail to describe collisions in this regime of strong coupling where interaction energies between the ions become comparable to their kinetic energies. The thermalization rates were determined by measuring the relaxation time of an initially perturbed velocity distribution of  $\text{Sr}^+$  ions into a Maxwellian. The initial velocity distribution of one of the spin ground states of  $S_{1/2}$  level is perturbed by optically pumping the ions with circularly polarized light. The resulting, perturbed velocity distribution is then measured at a variable time until relaxation. Optical pumping and the subsequent relaxation of the velocity distribution are strongly affected by collisions between the ions. We modeled the measured spectra and their evolution with a system of coupled rate equations and a simple collisional term to determine the ion-ion thermalization rate and compare these to theory.

Jose Castro  
Rice University

Date submitted: 04 Feb 2011

Electronic form version 1.4