

Abstract Submitted
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Ion Temperature Measurements in Ultracold Neutral Plasmas

JOSE CASTRO, HONG GAO, THOMAS KILLIAN, Rice University — Plasma ion temperatures are measured through fluorescence spectroscopy of Ultracold Neutral Plasmas. Ultracold Neutral Plasmas (UNP's) are created by photoionizing laser-cooled strontium atoms in a magneto-optical trap (MOT). Spatially-resolved fluorescence imaging of the strontium ions produces a spectrum that is Doppler-broadened due to the thermal ion velocity and shifted due to the ion expansion velocity. The fluorescence excitation beam is spatially narrowed into a sheet, allowing for localized analysis of ion temperatures within a volume of the plasma with small density variation. Using this technique, measurements of the ion temperature are shown to display characteristics of plasmas with strong coupling. Disordered induced heating is shown to match with theory in a wide range of experimental parameters; kinetic energy oscillations of the ions are demonstrated as well. Finally measurements of ion temperature are shown for very long expansion times ($\sim 70 \mu\text{s}$) after plasma formation displaying further heating of the ions and adiabatic cooling.

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