

Abstract Submitted
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High resolution ionization of ultracold neutral plasmas P. MC-QUILLEN, J.A. CASTRO, T.C. KILLIAN, Department of Physics and Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005, USA — Collective effects, such as waves and instabilities, are integral to our understanding of most plasma phenomenon. We have been able to study these in a new regime, ultracold neutral plasmas, by effectively shaping the initial density distribution through spatial modulation of the ionizing laser. This technique has allowed us to excite ion acoustic waves (IAW) and measure the dispersion relation in the long wavelength limit. We have produced streaming plasmas and measured the evolution of a possible instability. To overcome resolution limits imposed by diffraction of the modulated ionizing beam, we have developed and implemented a high resolution 1:1 optical relay with $\text{CTF}_{100} > 80$ cyc./mm. This unlocks a wide range of studies in both linear and nonlinear phenomenon at length scales comparable to Debye shielding lengths on both sides of the strongly coupled crossover. The latest results from these studies will be presented.

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