Abstract Submitted
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Laser Cooling of Ions in a Neutral Plasma[1] GRANT GORMAN, THOMAS LANGIN, THOMAS KILLIAN, Rice University — Ultracold neutral plasmas (UNPs), created by photoionization of an ultracold atomic gas, are an excellent tool for studying strongly coupled plasmas. The ion Coulomb coupling parameter, Γ_i, which is the ratio of the nearest neighbor Coulomb energy to the average thermal energy, has been limited to $\Gamma_i \sim 3$ due to disorder-induced heating. We overcome this limitation by laser cooling the ions after photoionization, observing a factor of four reduction in temperature after 135 μs of cooling, achieving coupling as high as Γ_i=11. This regime is beyond the range of validity of current theoretical models, thus, the application of established techniques to measure collision rates, transport properties, and dispersion relations will allow for experimental tests of new models that seek to extend into the strong coupling regime. We also demonstrate that the optical forces can slow this expansion, opening new possibilities for confinement and manipulation of UNPs. This poster will discuss the challenges associated with laser cooling of ions in an expanding neutral plasma along with the exciting new possibilities stronger coupling brings.

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Grant Gorman
Rice University

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