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Thermalization Rate Measurements in Strongly and Weakly Coupled Plasmas[1] TREVOR STRICKLER, PATRICK MCQUILLEN, JOSE CASTRO, THOMAS LANGIN, Rice University, GEORG BANNASCH, Max Planck Institute for the Physics of Complex Systems, THOMAS KILLIAN, Rice University, THOMAS POHL, Max Planck Institute for the Physics of Complex Systems
— Building on previous work, we present results of further experiments to directly measure thermalization rates in strongly coupled ultracold neutral plasmas (UNPs) created by photoionizing laser-cooled strontium atoms. Spin-selective excitation of the $^2S_{1/2}$-$^2P_{1/2}$ transition at 422 nm in Sr+ ions allows us to 'tag' and probe velocity subgroups in the ion velocity distribution to directly measure their rate of collisional equilibration. Previously, velocity relaxation rates were measured with time resolution on the order of 100 ns. Currently, efforts are focused on measurements at shorter time resolutions approaching 10 ns taken at times within 10s of nanoseconds after plasma creation. These short time scale measurements may more clearly demonstrate any deviations from the weakly coupled collision theory of Landau and Spitzer. Also, we discuss efforts to use laser heating to produce plasmas with lower coupling parameters to compare our results to theory in the weakly coupled regime.

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Trevor Strickler
Rice University

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