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Velocity Relaxation in Strongly and Weakly Coupled Ultracold Plasmas[1] TREVOR STRICKLER, Rice University, GEORG BANNASCH, Max Planck Institute for the Physics of Complex Systems, JOSE CASTRO, PATRICK MCQUILLEN, THOMAS LANGIN, Rice University, THOMAS POHL, Max Planck Institute for the Physics of Complex Systems, THOMAS KILLIAN, Rice University
— In this talk, we present direct measurements of thermalization rates in strongly coupled ultracold neutral plasmas, which are created by photoionizing strontium atoms in a magneto-optical trap. Because strong coupling can be achieved in ultracold plasmas at low densities, it is possible to probe collisional processes with time-resolved optical diagnostics. Spin-selective excitation of the $^2S_{1/2}-^2P_{1/2}$ transition at 422 nm in Sr+ ions allows us to perturb and probe the ion velocity distribution and directly measure collisional thermalization rates. We have measured relaxation rates with time resolution on the order of 100 ns. Currently, efforts are underway to achieve better time resolutions on the order of 10 ns, which may give us better insight into deviations from Landau-Spitzer collision theory. Also, we discuss efforts to use laser heating to produce plasmas with lower coupling parameters to connect our results to theory for the weakly coupled regime.

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