Abstract Submitted for the DPP12 Meeting of The American Physical Society

Velocity Relaxation in a Strongly Coupled Neutral Plasma¹ TREVOR STRICKLER, Rice University, GEORG BANNASCH, Max Planck Institute for the Physics of Complex Systems, JOSE CASTRO, PATRICK MC-QUILLEN, Rice University, THOMAS POHL, Max Planck Institute for the Physics of Complex Systems, THOMAS C. KILLIAN, Rice University — The analytical expressions developed by Landau and Spitzer to describe Coulomb collisions are fundamental to plasma physics, applicable over wide range of plasma conditions. However, in the strongly-coupled plasma regime (Coulomb coupling parameter > 1), the theory underlying the Landau-Spitzer formula breaks down, yielding nonsensical values for collision rates. Efforts to extend theory into the strongly coupled regime have not yet led to an agreed upon solution to the problem. Also, because of the short time scales involved, experiments to measure ultra-fast relaxation times in a strongly coupled neutral plasma have also remained a challenge. In this work, we present the first direct measurement of velocity relaxation rates in strongly coupled neutral plasmas. Exploiting the very low temperatures in ultra-cold plasmas, we achieve strong coupling at low densities that permit time-resolved optical diagnostics of velocity relaxation. Already, we have measured relaxation rates with time resolution on the order of 100 ns. Currently, efforts are underway to achieve time resolutions on the order of 10 ns to study non-Markovian relaxation dynamics.

¹This work was supported by the United States National Science Foundation and Department of Energy Partnership in Basic Plasma Science and Engineering (PHY-1102516) and the Air Force Office of Scientific Research (FA9550-12-1-0267).

Trevor Strickler Rice University

Date submitted: 20 Jul 2012

Electronic form version 1.4