Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Using AC conductivity to probe electron-ion collision rates in extremely magnetized ultracold neutral plasmas[1] JACOB ROBERTS, Colorado State University, JOHN GUTHRIE, Coloradso State University, PUCHANG JIANG, Colorado State University — Collisions often play a significant or even dominant role in transport phenomena, including collisions between the electron and ion components of a plasma. The near-absolute-zero electron temperatures and low densities of ultracold neutral plasmas make it possible to produce extreme electron magnetization with only moderate laboratory magnetic fields. We have developed a technique to measure electron-ion collision rates in such magnetized plasmas through determining the electron heating rate caused by applying radiofrequency (RF) fields. We have measured unexpectedly low rates and unexpected variation as a function of magnetic field as compared to theory predictions. These prior measurements were limited in RF frequency range and electron temperature, though. A new extension to our technique allows measurements to be conducted with time-varying RF amplitudes that enable measurements over a greater span of electron temperature and RF frequency range, enabling studies where perturbation theory is more applicable to other studies that are sensitive to effects from strong coupling. Through scaling relations, these experimental measurements can be related to comparable systems in high-energy density plasmas and astrophysical plasmas with GigaGauss or greater magnetic fields.

[1]Supported by the AFOSR

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Date submitted: 29 Jun 2020 Electronic form version 1.4