Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Thermalization and Cooling of Cold, Highly-Magnetized, One-Component Plasmas ALEX POVILUS, STEVE CHAPMAN, MARCELO BAQUERO-RUIZ, CRYSTAL BRAY, JOEL FAJANS, University of California, Berkeley — Thermalization of strongly-magnetized plasmas relies on the dynamics of particle collisions and interaction with the background electromagnetic field. The nature of these interactions changes greatly as a plasma is cooled to lower temperatures. In particular, these effects can have a large effect on techniques requiring sympathetic cooling through cyclotron radiation of a cloud of electrons. With the intention of cooling dense ($\sim 10^9$/cc) non-neutral plasmas to 4K, we model the various mechanisms that are important in this regime. As a one-component plasma cools, the transverse and longitudinal degrees of motion become decoupled in collisions, inhibiting thermalization. Electromagnetic cavity modes from electrodes can couple to the plasma, inducing heating. The plasma can also become optically opaque to its own cyclotron radiation, reducing the efficiency of cyclotron cooling. Here, we present a model for these mechanisms and a proposed experiment for characterizing their behavior.

Alex Povilus
University of California, Berkeley

Date submitted: 22 Feb 2010 Electronic form version 1.4