An Experimental Study of Waves in a Toroidal Electron Plasma

M.R. STONEKING, F. CHOUDHURY, J.W. DARRELL, S.A. EXARHOS, A.H. WRIGHT, Department of Physics, Lawrence University, Appleton, WI — Electron plasma is confined using a purely toroidal magnetic field \((R_o = 18 \text{ cm}, B < 550 \text{ G})\) for times \((\sim 1 \text{ s})\) that are much longer than any of the dynamical timescales of the system. Wave dynamics are compared for two experimental regimes: 1) a toroidal arc (or bent Penning-Malmberg trap) and 2) a fully toroidal trap in which the no electrostatic fields are used for confinement. Damping of the \(m=1 (k=0)\) diocotron mode is explored to assess the extent to which rotational and/or magnetic pumping transport mechanisms are operative. The frequency of the \(m=2 (k=0)\) diocotron mode is used to directly measure the transport rate and determine its scaling with control parameters. Resonant standing wave plasma modes \((m =0)\) are excited in order to determine the Trivelpiece-Gould dispersion relation and identify toroidal and thermal effects.

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