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An Experimental Study of Waves in a Toroidal Electron Plasma[1]

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 cm, $B < 550$ G) for times ($\sim$1 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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