Abstract Submitted
for the DPP06 Meeting of
The American Physical Society

Evolution of Modes in Magnetically Insulated Crossed Field Diodes S. TAKEALL, A. GREENWOOD, K. CARTWRIGHT, T. FLEMING, P. MARDAHL, Air Force Research Lab, Y.Y. LAU, University of Michigan, N. RODERICK, University of New Mexico — The time-dependent behavior of electron sheaths in a magnetically insulated B>B_{Hull} anode-cathode gap with crossed electric and magnetic fields is studied. The crossed-field, space-charge limited diode is modeled for various magnetic fields by means of multidimensional (1d and 2d), self consistent, electromagnetic, particle-in-cell (PIC) simulations in both cylindrical and planar geometries. The transient behavior of the system is examined in detail and is divided into three separate stages: cycloidal flow, collapse of cycloidal flow and sheared (near-Brillouin) flow. Our 2d electromagnetic PIC simulations (both planar and cylindrical) show that cycloidal flow also collapses into a perturbed flow that is dominated by the E cross B drift, but is neither steady nor stable. This observed cycloidal flow instability is a kinetic mode, not a fluid mode such as the magnetron or diocotron instability. The growth of the kinetic mode is faster than that of either of the above mentioned fluid instabilities. After the kinetic mode saturates, the fastest growing fluid mode grows to dominate the system. The SWS is added by three different methods to separate the RF effects from the DC electric field effects created by the SWS. The first method is to add a circuit to the anode that does not effect the DC electric fields, the second is to add the SWS by placing a thin dielectric (with and unphysical large dielectric constant), and last is to add the geometric SWS.

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Date submitted: 23 Jul 2006 Electronic form version 1.4