Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

A method for minimizing secondary flows in Taylor-Couette experiments E.M. EDLUND, A. ROACH, E. SPENCE, H. JI, Princeton Plasma Physics Laboratory — The Princeton MRI Experiment is a Taylor-Couette device with differentially rotatable endcaps which enable significant reduction of secondary (poloidal) flows. The experimental goal of this project is the observation of the magnetorotational instability (MRI) in a rotating liquid metal with an applied axial field. It is expected that the MRI will be most clearly observed in cases where the the secondary flow is minimized. When the system is optimally tuned, hydrodynamic experiments show remarkable agreement between the azimuthal rotation profile and the ideal Couette profile, a state where the rotation profile is determined solely by the viscous force. This presentation examines how the boundary conditions modify the bulk flow. We present a model of secondary flow generation due to small axial pressure gradients; minimization of large scale secondary flow (Ekman circulation) occurs when the fluid pressure from the ideal Couette rotation balances the fluid pressure near the axial boundaries. Model predictions generally agree with experiments and will be compared with calculations from the finite element engineering code ANSYS and the compressible MHD code MINERVA. We will present design parameters of a new experiment for the study of purely hydrodynamic turbulence with an optimized geometry based on these principles.

Eric Edlund
PPPL

Date submitted: 16 Jul 2010 Electronic form version 1.4