Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Numerical study of laboratory MRI experiment CHRISTOPHE GISSINGER, JEREMY GOODMAN, Princeton University, HANTAO JI, Princeton University, PPPL — Theoretical studies of the MagnetoRotational Instability (MRI) generally rely on a local description, or computations between axially infinite (or periodic) cylinders. Since laboratory MRI experiments involve finite geometries, it is important to understand the effect of boundaries on the MRI. We investigate numerically the flow of a conducting fluid in a Taylor-Couette flow when an axial magnetic field is applied. To minimize Ekman recirculation due to vertical no-slip boundaries, two rotating rings are used in the vertical endcaps, approximating setup used in the Princeton MRI experiment. Our 3D global simulations show that, in presence of boundaries, the nature of the bifurcation, the saturation and the structure of axisymmetric MRI modes are significantly affected by the resultant recirculation. In addition, large scale non-axisymmetric modes are obtained when the applied field is sufficiently strong. We show that these modes are related to destabilization of a free shear layer created by the conjugate action of the applied field and the rotating rings. Finally, we compare our calculations in cylindrical and spherical geometries to recent experimental results obtained in the Maryland experiment and the Princeton MRI experiment.

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Date submitted: 11 Aug 2011