Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Relaxed states and finite pressure effects in the reversed field pinch IVAN KHALZOV, FATIMA EBRAHIMI, DALTON SCHNACK , VLADIMIR MIRNOV, Center for Magnetic Self-Organization, University of Wisconsin, Madison, WI — Two-fluid relaxation and finite pressure effects in the reversed field pinch (RFP) are studied. First, we analytically find the relaxed states of a cylindrical plasma column in standard (single-fluid) and Hall (two-fluid) MHD minimizing the energy with constraints imposed by invariants inherent in corresponding models. The relaxed state in Hall MHD is the force-free magnetic field with uniform axial flow and/or rigid azimuthal rotation. The relaxed states in standard MHD are more complex due to the coupling between velocity and magnetic field. $F-\Theta$ diagrams (reversal parameter vs. pinch) are obtained for different values of cross helicity and total angular momentum. Analytical results are also compared with numerical simulations performed with the extended MHD code NIMROD (nimrodteam.org). Second, we examine the behavior of resistive interchange instability at high beta RFP plasma. Equilibrium profiles from MSTFIT for high beta plasma are loaded into the Grad-Shafranov solver NIMEQ. Two-fluid and MHD stability analysis of the high beta MST plasma is then performed using NIMROD. The growth rate of high-n localized interchange modes is found to be significantly reduced by finite Larmor radius effect. The work is supported by NSF and DOE.

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Date submitted: 21 Jul 2009 Electronic form version 1.4