Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Two-fluid Magnetic Relaxation in the MST Reversed Field Pinch[1] JOSEPH TRIANA, AF ALMAGRI, KJ MCCOLLAM, JS SARFF, CR SOVINEC, University of Wisconsin - Madison — Recent measurements and extended MHD simulations expose the importance of two-fluid physics in the relaxation and self-organization of the current and momentum profiles in RFP plasmas. A hallmark of relaxation is that the inductive electric field is not balanced by resistive dissipation, prompting the study of fluctuation-induced emfs in the generalized Ohm's law, E-ηJ=-<vxb>+<jxb>/ne, the two terms on the right known as the MHD and Hall dynamo terms, respectively. The Hall emf is measured in the outer half of the MST plasma minor radius using an armored deep-insertion probe. The emf matches previous measurements in the edge (r/a>0.8) but in the new region examined (0.8>r/a>0.6) it is much larger than E-ηJ, implying the MHD dynamo must also be large and oppositely directed. Recent nonlinear simulations that include two-fluid effects using the extended-MHD NIMROD code show complex radial structure for the emf terms, but the size of the measured Hall emf is much larger than predicted by the simulations. In the two-fluid model, the Hall dynamo couples to the parallel momentum as the mean-field Maxwell stress. The simulations predict relaxation of the parallel flow profiles that is also qualitatively consistent with measurements in MST plasmas.

[1]Work supported by US DoE and NSF

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Date submitted: 14 Jul 2016 Electronic form version 1.4