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Studies of the Two-Fluid RFP Dynamo and Mode Coupling J.R. KING, C.R. SOVINEC, V.V. MIRNOV, University of Wisconsin - Madison — The nonlinear evolution of finite beta, two-fluid tearing modes in a cylindrical, force-free pinch is investigated with the NIMROD code. A multihelicity case with $R/a \simeq 3$ simulates the two-fluid reversed field pinch (RFP) fluctuation driven dynamo electric fields. The model includes warm ions and ion gyroviscosity with an ion sound gyroradius, $\rho_s = 0.05$, and $\beta = 0.1$ which are realistic for the Madison Symmetric Torus (MST). During a relaxation event, we find that the Hall dynamo plays an important role reinforcing the MHD dynamo, driving poloidal current, and reversing the toroidal magnetic field at the wall. We compare this model to single-fluid MHD computations with zero and finite β. The coupling of the core mode fluctuations nonlinearly drive the $m = 0$ edge mode, resonant ($\mathbf{k}\cdot\mathbf{B_0} = \mathbf{0}$) near the wall, through significant fluctuation induced MHD and Hall contributions to the $m = 0$ parallel electric field. Single helicity profiles are compared to the analogous core modes in the multihelicity simulation in order to understand how the nonlinear effects modify the profiles and produce flows near the wall. Comparison of laboratory measurements with simulation results investigate the role of the Hall effect in the nonlinear mode coupling.

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