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Analysis of Helicities and Hall and MHD Dynamo Effects in Two-Fluid Reversed-Field Pinch Simulations[1] JOSHUA SAUPPE, CARL SOVINEC, University of Wisconsin-Madison — Relaxation in the RFP is studied numerically with extended-MHD modeling that includes the Hall term and ion gyroviscous stress. Previous results show significant coupling between magnetic relaxation and parallel flow evolution [King PoP 19, 055905]. Computations presented here display quasi-periodic relaxation events with current relaxation through MHD and Hall dynamo drives. The MHD dynamo always relaxes currents while the Hall dynamo may add or subtract from it, but the total dynamo drive is similar to single-fluid MHD computations. Changes in plasma momentum are due to viscous coupling to the wall and fluctuation-induced Maxwell stresses transport momentum radially inward when two-fluid effects are included. The magnetic helicity and hybrid helicity, a two-fluid extension of magnetic helicity that includes cross and kinetic helicity [Turner, 1986], are well-conserved relative to magnetic energy at each event. The cross helicity is well-conserved in single-fluid MHD but is significantly affected by both two-fluid effects and ion gyroviscosity. The plasma parallel current evolves towards the predicted flat profile; however, the plasma flow does not.

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