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The RFP dynamo: MHD to kinetic regimes J.S. SARFF, A.F. ALMAGRI, D.J. DEN HARTOG, K.J. MCCOLLAM, M.D. NORNBERG, J.P. SAUPPE, C.R. SOVINEC, P.W. TERRY, J.C. TRIANA, Univ. Wisconsin-Madison and CMSO, D.L. BROWER, W.X. DING, E. PARKE, Univ. California-Los Angeles and CMSO — The hallmark of magnetic relaxation in an RFP plasma is profile flattening of $\mathbf{J_0} \cdot \mathbf{B_0}/B^2$ effected by a dynamo-like emf in Ohm's law. This is well-studied in single-fluid MHD, but recent MST results and extended MHD modeling show that both $< \mathbf{V_1} \times \mathbf{B_1} >$ and the Hall emf, $- < \mathbf{J_1} \times \mathbf{B_1} > /en_e$, are important, revealing decoupled electron and ion motion. Since dynamo is current-related, the electron fluid emf, $< \mathbf{V_{e,1}} \times \mathbf{B_1} >$, captures both effects. In MST, the electron flow is dominantly $\mathbf{V_{e,1}} \approx \mathbf{E_1} \times \mathbf{B_0}/B^2$, implying $< \mathbf{V_{e,1}} \times \mathbf{B_1} > \approx < \mathbf{E_1} \cdot \mathbf{B_1} > /B$. This and the Hall emf are measured in MST for comparison in Ohm's law. A finite-pressure response is also possible, e.g., "diamagnetic dynamo", $\nabla \cdot < p_{e,1}\mathbf{B_1} > /en_e$, associated with diamagnetic drift, and "kinetic dynamo" associated with collisionless streaming of electrons in a stochastic magnetic field. Correlation measurements $< n_{e,1}B_{r,1} >$ and $< T_{e,1}B_{r,1} >$ using FIR interferometry and Thomson scattering reveal these as small but finite in MST. A kinetic emf might be expected for any high-beta plasma with inhomogeneous pressure. Support by DOE/NSF

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