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Electromagnetic energy transport in RFP magnetic relaxation

K.J. MCCOLLAM, D.J. THUECKS, D.R. STONE, J.K. ANDERSON, D.J. DEN HARTOG, J. DUFF, J. KO, S. KUMAR, E. PARKE, UW-Madison, L. LIN, D.L. BROWER, W.X. DING, UCLA — In an RFP driven by steady toroidal induction, tearing modes responsible for magnetic relaxation redistribute electromagnetic energy throughout the plasma, generating the net EMF that regulates the equilibrium profile. In MST experiments, insertable edge probes measure local fluctuations in electric and magnetic fields, from which flux-surface-average Poynting flux is derived. This outwardly directed flux is maximum during discrete "sawtooth" magnetic relaxation events and is a significant fraction (a few 10s of percent) of the total input inductive power when averaged over time. Spatially, the flux is maximum at the reversal surface and decreases outside, indicating that transported energy is deposited at the plasma edge. These results are similar to expectations from a simple model of an incompressible fluid plasma with a resistive boundary and consistent with estimates of global power balance from time-resolved equilibrium reconstructions. This work was supported by the US DOE and NSF.

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