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Measurements of Nonlinear Hall-Driven Reconnection in the Reversed Field Pinch[1] T.D. THARP, A.F. ALMAGRI, M.C. MILLER, V.V. MIRNOV, S.C. PRAGER, J.S. SARFF, University of Wisconsin - Madison, C.C. KIM, University of Washington — Previous measurements have established that reversed field pinch (RFP) sawtooth relaxation is characterized by spontaneous reconnection occurring simultaneously at multiple sites. Here, we report measurements of the magnetic fields and terms in Ohm's law associated with reconnection in the edge region of MST plasmas. The magnetic field structure is measured by probes and compared with theoretical predictions computed in both toroidal and cylindrical geometry. The composite magnetic structure from modes with toroidal mode numbers n=1-4 resonant at the toroidal field reversal surface reveals a complex but still coherent edge structure. Key terms of Ohm's law for the dominant mode ($n = 1$) are accessible from magnetic field measurements and reveal the ordering ($\frac{1}{ne} J \times B >> E > \eta J$), clearly indicating that single fluid physics is not sufficient to explain this reconnection. In particular, nonlinear three-wave coupling through the Hall term acts as a driving mechanism for this linearly stable mode. The observed coherent structures and strong nonlinear interaction terms highlight the substantial role of collective mode phase matching during sawtooth events.

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