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Experimental Studies of the Hall Effect and Fluctuations in MRX
Y. REN, M. YAMADA, S.P. GERHARDT, H. JI, R. KULSRUD, A. KURITSYN, M. INOMOTO, PPPL, Princeton University, Princeton, NJ 08540 — Magnetic reconnection is being studied in the Magnetic Reconnection Experiment (MRX) in a well-controlled manner. The key question we wish to answer is: why the observed reconnection rate can be much larger than what the classical Sweet-Parker model predicts. In recent literature two mechanisms have often been cited for fast reconnection: anomalous resistivity generated by plasma turbulence and the Hall effect of two-fluid MHD theory. The first mechanism has been investigated in MRX and a positive correlation between resistivity enhancement and magnetic fluctuations has been found. An out-of-plane quadrupole magnetic field, the hallmark of the second mechanism, has also been observed during magnetic reconnection in MRX [1]. Recent reconnection experiments in MRX are focusing on both the Hall effect and fluctuations. Serval arrays of magnetic pickup coils (with resolution up to 1.25mm) are used to study the quadrupole magnetic field in more detail. Both electrostatic and magnetic fluctuations have been observed along with quadrupole field in the same low-collisionality discharges in MRX. The relationship between them is studied. In this paper, the recent data from MRX will be presented and a comparison between theory and experiment will be attempted. This work is supported by DOE, NASA and NSF. [1] Y. Ren et al., Phys. Rev. Lett., accepted (2005)

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