

Abstract Submitted
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Experimental Study of Two-fluid Effects on Magnetic Reconnection¹ M. YAMADA, Y. REN, H. JI, S. GERHARDT, M. INOMOTO, R. KULSRUD, S. DORFMAN, Y. WANG, Center for Magnetic Self-organization, PPPL, Princeton U, Princeton NJ 08543 — This paper describes the recent findings on two-fluid effects on magnetic reconnection in plasmas with variable collisionality in the MRX (Magnetic Reconnection Experiment)[1]. After the recent upgrade, our experimental operation regime has moved from the collisional to the collision-free, two-fluid effects have become more evident. It is observed that the 2-D profile of the neutral sheet is changed significantly from the rectangular shape of the familiar Sweet-Parker type to a double wedge shape as the collisionality is reduced and the reconnection rate increases. Two-fluid analysis is presented to illuminate the physics of Hall MHD in a collision-free reconnection layer for a variety of modes of operation. It is important to note that the Hall effect, which occurs due to 2-D laminar flows of electrons in the reconnection plane, is observed together with the presence of low and high frequency magnetic turbulence, which often has 3-D structures. In particular, the relationship of magnetic fluctuations[2] with the observed Hall field has been intensively studied in the MRX neutral sheet, where the sheet width is comparable to the ion skin depth. 1) M. Yamada et al, Phys. Plasmas 13, 052119 (2006) 2) H. Ji et al, Phys. Rev. Letts. 92, 115001 (2004)

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Masaaki Yamada
Center for Magnetic Self-organization, PPPL, Princeton U, Princeton NJ 08543

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