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Study of the energy inventory during asymmetric magnetic reconnection in a laboratory plasma[1] JONGSOO YOO, MASAAKI YAMADA, BEN NA, JONATHAN JARA-ALMONTE, HANTAO JI, WILL FOX, ABE CHIEN, Princeton Plasma Phys Lab — The energy inventory of a magnetic reconnection layer is studied in a laboratory plasma with a significant density asymmetry across the current sheet. The upstream density ratio of about 7 is generated by the in-plane inductive electric field during the plasma formation in MRX. Compared to the symmetric case where the ion energy gain is about twice more than that of electrons, the ion energy gain becomes smaller and the electron energy gain is larger. The reduction in the ion energy gain is mainly caused by the asymmetric profile of the in-plane electrostatic potential, which is generated to balance the Lorentz force in the electron momentum equation. Since the out-of-plane electron fluid velocity on the high-density side is small due to the high density, the potential drop on the high-density side becomes also small. The potential drop on the low-density side is also smaller than expected from the general scaling ($\sim B^2/n$), since it is suppressed by a large density gradient across the low-density side separatrices. As a result, the ion energy gain from the in-plane electrostatic field is smaller than the symmetric case, thereby decreasing the total ion energy gain. Discussion on the electron energization process during asymmetric reconnection is also presented.

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