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Experiments on the effects of global force balance and local reconnection physics on magnetic reconnection with a guide field W. FOX, Princeton Plasma Physics Laboratory, F. SCIORTINO, Blackett Laboratory, Imperial College, J. YOO, J. JARA-ALMONTE, B. NA, H. JI, M. YAMADA, Princeton Plasma Physics Laboratory — In many plasma environments ranging from astrophysics to fusion, magnetic reconnection occurs with a finite guide field ranging from a fraction to many times the upstream reconnecting component. Theory and simulation yields a range of predictions of scaling of the rate of reconnection with guide field. Recent experiments on the Magnetic Reconnection Experiment observed a systematic decrease in reconnection rates with increasing guide field [1]. Here we present a new set of experimental results on MRX with a controlled applied guide magnetic field ranging from 0 to approximately 3 times the upstream reconnection field, where we observe both global and local processes which affect the reconnection rate in the guide field regime. First, we observe and quantify the effects of global force balance, in particular global back pressure due to pileup of magnetic field in the downstream, which decreases the outflow of plasma from the current sheet and hence the reconnection rate. Second, we study the role of electron pressure in the generalized Ohm's law in the guide field regime and its role in setting the reconnection rate.

[1] T.D. Tharp, M. Yamada, H. Ji, et al, Phys. Rev. Lett. 109, 165002 (2012)

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