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Boundary conditions in magnetic reconnection[1] J. EGEDAL, W. FOX, N. KATZ, A. LE, M. PORKOLAB, MIT, PSFC — Magnetic reconnection in the collisionless regime is studied on the Versatile Toroidal Facility (VTF) at MIT. The VTF device supports experiments with two distinct sets of boundary conditions: an "open" configuration for which the field lines intersect the vacuum vessel walls, and a "closed" configuration for which the magnetic field lines form closed loops inside the device. In the open configuration all electrons follow trapped trajectories. Our experimental and numerical studies reveal how these trapped electrons control the size of the reconnection region and mediate fast reconnection. This mechanism is found to be consistent observations by the WIND spacecraft in the deep magnetotail [1,2]. In the new closed configuration a parameter regime of special interest exists where the reconnection process appears in rapid bursts [3]. The vast differences in the experimental results for the two configurations emphasize the importance of boundary conditions. It suggests that there may not exist one unified theory for reconnection.

[1] M Oieroset, et al., (2002) Phys. Rev. Lett. 89, 195001.
[2] J Egedal, et al., (2005) Phys. Rev. Lett. 94, 025006.
[3] J Egedal, et al., (2007) Phys. Rev. Lett. 98, 015003.

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