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Driven reconnection in a quadrupole cusp field*

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Using acFm, a computational framework under development to facilitate easy and efficient solution of initial/boundary value problems, we are studying driven reconnection in a cusp field. The geometry is a linear version of the Versatile Toroidal Facility (VTF) experiment at MIT[1]. Reconnection is driven by an inductively applied external electric field in a quadrupole cusp field, augmented by a strong (toroidal) guide field. For these initial studies, reconnection physics is assumed to be described by a reduced two-fluid model extensively used elsewhere[2]. Our results differ significantly from both the experimental observations and the results of a previous study which assumed an infinite-sized system[3]. We see steady-state reconnection proceed essentially at a rate determined by the external electric field, but always accompanied by currents localized around the X-point, both in collisional and collisionless regimes. Remarkably, in the experiment these currents seem to asymptotically decay and disappear in time, which apparently cannot be reconciled with our simple model. Currently, we are cataloging the predictions of our model in different collisionality and parameter regimes. In a future collaborative effort with MIT, we will examine if the experimental results can be explained in terms of a more sophisticated extended-MHD model[4].

[1] J. Egedal, A. Fasoli, D. Tarkowski, and A. Scarabasio, Phys. Plasmas **8**, 1935 (2001).

[2] See, for example, E.Cafaro, D. Grasso, F. Pegoraro, F. Porcelli, and A. Saluzzi, Phys. Rev. Lett. **80**, 4430 (1998).

[3] J. J. Ramos, F. Porcelli, and R. Verastegui, Phys. Rev. Lett. **89**, 055002 (2002).

[4] J. J. Ramos, MIT Report, December 2002.

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