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Asymmetric Magnetic Reconnection: General Theory and Collisional Simulations PAUL CASSAK, MICHAEL SHAY, University of Delaware — Theories of magnetic reconnection usually assume that the plasmas on either side of the dissipation region have identical densities and magnetic field strengths. However, this canonical description is rarely realized in nature. There has been wide interest in the shock structure of fast reconnection, particularly at the dayside magnetopause, but a general theory of the structure of the dissipation region and the rate of reconnection during asymmetric reconnection has not been addressed. We derive analytical expressions from first principles using a Sweet-Parker type scaling analysis. Most of the scaling results are independent of the dissipation mechanism and, therefore, apply to asymmetric reconnection in general. Furthermore, we show that a generic feature of asymmetric reconnection is that the X-line and stagnation point are not colocated. This implies that there is a bulk flow of plasma across the X-line, as has been seen in many numerical studies and observations at the dayside. The theory is verified using two dimensional collisional magnetohydrodynamic simulations. Applications to the magnetosphere are discussed.

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