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Bifurcation Model for the Onset of Fast Magnetic Reconnection PAUL CASSAK, JAMES DRAKE, University of Maryland-College Park, MICHAEL SHAY, University of Delaware, BRUNO ECKHARDT, Phillipps-Universität Marburg — The mechanism triggering the onset of fast magnetic reconnection, the driver of solar eruptions and fusion device disruptions, has long been elusive. A catastrophe model for the explosive onset of fast magnetic reconnection has been proposed[1]. The crux of the model is that both the Sweet-Parker and Hall reconnection solutions are valid when the Sweet-Parker current sheet is thicker than the ion inertial length d_i, but the Sweet-Parker solution disappears catastrophically when the layer thins below d_i. Simulations confirm that the thinning of the current sheet occurs naturally during reconnection as convection increases the magnetic field just upstream of the dissipation region, eventually leading to explosive onset. We interpret the disappearance of the Sweet-Parker solution as a saddle-node bifurcation and confirm its signatures with simulations. Earlier numerical results have been extended to include a guide field. We explore the model's potential impact on the explosive onset of magnetic reconnection in solar eruptions and sawtooth crashes.

[1]P. A. Cassak, M. A. Shay, and J. F. Drake, Phys. Rev. Lett., 95, 235002 (2005).

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