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**Current Sheet Formation and Parker Instability in Line-Tied Flux Tubes** A. BHATTACHARJEE, K. GERMASCHEWSKI, C.S. NG, University of New Hampshire, P. ZHU, University of Wisconsin-Madison — The dynamics of line-tied flux tubes is of great relevance to the Sun's convection zone and the corona, the Earth's magnetosphere, and the edge regions of tokamak plasmas. In this talk, we will focus on two aspects of line-tied flux tubes: the formation of current sheets and the stability of flux tubes with respect to the Parker instability (akin to the ballooning instability). In the first application, we demonstrate that for a fixed footpoint mapping between two perfectly conducting surfaces to which magnetic field lines are tied, there is at most one smooth equilibrium. This property implies that if the flux tube is driven by smooth footpoint motions to a smooth but unstable equilibrium, the tube must relax to an equilibrium with a current sheet (a tangential discontinuity). In the second application, we present direct numerical simulations of the line-tied Parker instability, based on the fully compressible ideal MHD equations. In the intermediate nonlinear phase, the instability continues to grow exponentially in time and the plasma tends to develop convection-induced discontinuities in the form of shock-like coherent structures. The system does not appear to "detonate," predicted by recent analytical theories. Implications of these results for heating, and eruptive/disruptive behavior of space and laboratory plasmas will be discussed.

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