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Complex Dynamics of Line-tied Flux Ropes and Screw Pinches[1]
MATTHEW BROOKHART, AARON STEMO, AMANDA ZUBERBIER, CARY FOREST, University of Wisconsin - Madison — It has been suggested that flux ropes – self-contained plasma structures with axial current and magnetic field – may be the basic building blocks of many astrophysical plasmas. Many of these plasmas – including coronal loops, the solar wind, and astrophysical jets – also show "line-tying" where the ends of flux ropes are magnetically fixed. The Line-tied Reconnection Experiment is a basic plasma research facility designed to study the behavior, instability, and self-organization of multiple line-tied flux ropes in a variety of geometries and plasma conditions. The recent construction of a 300 coil magnetic probe array has allowed for direct, time and space resolved observations of flux rope dynamics in a wide range of conditions. Complex dynamics of 2 and 3 flux ropes are observed both with and without background plasma. These plasmas exhibit complex instabilities and interactions. Observations show that larger numbers of flux ropes merge into azimuthally-symmetric screw pinch equilibria. High safety factor kink-like instabilities are seen in both hollow and reversed current profile plasmas, akin to tokamak current holes and certain models of solar flares. The equilibria, instability criteria, and dynamics of these plasmas are explored.

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