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Self-Generation of Turbulence in Collisionless Magnetic Reconnection WILLIAM DAUGHTON, LANL, VADIM ROYTERSHTEYN, HOMA KARIMABADI, UCSD — Magnetic reconnection releases energy explosively in space, laboratory and astrophysical plasmas. In large 2D collisionless kinetic simulations, the nonlinear development features both ion and electron kinetic-scale features, with highly extended electron current layers which can trigger the formation of secondary magnetic islands. However, the influence of realistic 3D dynamics remains poorly understood. Using petascale kinetic simulations for guide field geometries, we show that the 3D evolution is dominated by the formation and interaction of magnetic flux ropes. In contrast to previous theories, the majority of flux ropes are produced by secondary instabilities within the electron current layers. New flux ropes spontaneously appear within these electron layers, leading to a turbulent evolution.[1] The turbulence is highly inhomogeneous and features anisotropic structures across multiple scales, including electron-scale current sheets that continually reform and breakup into filaments, along with flux ropes generated at these scales and quickly growing well above ion scales. To better understand the parametric dependencies, a range of guide fields are considered as well as asymmetric current layers of relevance to the magnetopause.

[1]Daughton et al, Nature Physics **7**, 539, 2011

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