Abstract Submitted
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Particle Energization via Tearing Instability with Global Self-Organization Constraints[1] M.D. NORNBERG, A.F. ALMAGRI, J.K. ANDERSON, A. DUBOIS, University of Wisconsin-Madison, D. CRAIG, Wheaton College (IL), D.J. DEN HARTOG, C.B. FOREST, K.J. MCCOLLAM, J.S. SARFF, P.W. TERRY, University of Wisconsin-Madison — Impulsive tearing magnetic reconnection leads to powerful ion energization in reversed field pinch (RFP) plasmas. Many characteristics of the process are measured, e.g., ion species dependence, anisotropy, and energetic tail formation. While ions are strongly energized, the bulk electrons cool, most likely from increased stochastic transport during the reconnection burst. However, new x-ray spectrum measurements reveal formation of an energetic electron tail. Global self-organization strongly impacts the energization behavior: multiple tearing interactions spanning the core to edge are required, dynamo-like magnetic flux generation drives runaway acceleration, dynamo feedback regulates correlations between electric and magnetic field fluctuations, and transport processes differ for ions and electrons. A mature MHD model for tearing instability has been developed that captures key nonlinear dynamics from the global to intermediate spatial scales, but a turbulent cascade is also present to at least the ion gyroradius scale. These features point to the need for a self-contained framework that spans the global-to-micro scales, including nonlinear self-organization feedback that influences the global structure and inhomogeneity on the system scale.

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