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Inverse magnetic energy transfer through magnetic reconnection<sup>1</sup> MUNI ZHOU, PALLAVI BHAT, NUNO LOUREIRO, Massachusetts Institute of Technology, DMITRI UZDENSKY, University of Colorado, Boulder — A wide range of space and astrophysical systems, such as the solar corona, heliosheath and Weibelproduced magnetic field in supernova shocks, of which the dynamics are governed by turbulence and reconnection, can be conceptualized as an ensemble of interacting flux ropes. We investigate magnetic field dynamics in a system of parallel flux ropes as well as more generic magnetically-dominated turbulent systems, focusing on the inverse magnetic energy transfer. An analytical model is introduced and shown to capture the evolution of the main quantities of interest, as borne out by our 2D and 3D reduced magnetohydrodynamics (RMHD) and 2D particle-in-cell simulations. Magnetic reconnection is identified as the key mechanism enabling the inverse transfer and setting its properties: magnetic energy decays as  $\tilde{t}^{-1}$ , where  $\tilde{t}$ is time normalized to the reconnection timescale; and the field correlation length grows as  $\tilde{t}^{1/2}$ . Critical balance is shown (by magnetic structure functions) to govern the aspect ratio of the flux ropes in 3D RMHD simulations. This quantitative description of inverse energy transfer could improve our understanding of longstanding problems such as coronal heating, galactic magnetogenesis, and high-energy emission in gamma-ray bursts.

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Muni Zhou Massachusetts Institute of Technology

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