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Rapid Change of Field Line Connectivity in Stochastic Magnetic Fields YI-MIN HUANG, A. BHATTACHARJEE, Department of Astrophysical Sciences, Princeton University, ALLEN H. BOOZER, Department of Applied Physics and Applied Mathematics, Columbia University — Magnetic fields depending on three spatial coordinates generally have the feature that neighboring field lines exponentiate away from each other and become stochastic. Under the condition of large exponentiation, magnetic field line connectivity becomes extremely sensitive to small perturbations. Consequently, small deviations from ideal Ohm's law will violate the ideal magnetohydrodynamic constraint and completely scramble the field line connectivity. This idea of breaking field line connectivity by stochasticity is tested with numerical simulations based on reduced magnetohydrodynamics equations. We employ a simple model starting from a uniform magnetic field in the z direction, and bounded by perfectly conducting planes in z. High order hyperresistivity is employed as the mechanism of breaking field lines. As magnetic field lines is gradually entangled by the spatially smooth applied force, neighboring field line exponentiation becomes large. Field line connectivity is observed to undergo rapid change on Alfven transit time scales, accompanied by sporadic magnetic energy release.

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