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Session 8S - Space.

POSTER session, Thursday afternoon, November 14

Exhibit Hall - Concourse Level, Adam's Mark

[8S.10] On Non-Equilibrium and Current Sheet Formation in Line-Tied Magnetic Fields

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Parker's model of coronal heating is considered using the ideal reduced magnetohydrodynamic equations. It is shown that there can be at most one smooth magnetostatic equilibrium for each smooth footpoint mapping between two plates with line-tied boundary conditions. It follows that if such a static equilibrium is driven unstable by footpoint motions, then there is no other equilibrium for the plasma to relax to, leading to magnetic non-equilibrium and the formation of current sheets. It is shown that this process can occur as the system relaxes asymptotically to a state of minimum energy, possibly in infinite time. Numerical simulations for line-tied island coalescence and equilibria containing current layers are presented which suggest that as current layers become intense and cross a threshold for instability, the magnetic relaxation observed is consistent with the formation of non-equilibrium states with current sheets. A criterion is given to determine geometrically the sites of current sheet formation and magnetic reconnection in models without nulls or closed field lines. This criterion requires the rate of velocity amplification, which is analogous to the Lyapunov exponent in nonlinear dynamics, to become arbitrarily large.

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