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Session FM1 - Mini-Conference on Singularities in Fluids and Plasmas: Geometry and Dynamics III.

ORAL session, Tuesday morning, November 12

Salon 5-6, Rosen Centre Hotel

[FM1.004] 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, for a system periodic in the transverse directions. 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 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. Based on simulation results, possible topologies of such current sheets will be presented. It is shown that such topologies do not violate existing theorems that prohibit the formation of current sheets with a simple topology.

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