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The active Sun and its implication for the heliosphere
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Dynamic Current Sheet Formation and Dissipation with Application to Inter-(Super)granular Flow Lanes and Quasi-Homologous Jet Activity

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The solar magnetic field undergoes major geometric expansion passing from the photosphere, through the chromosphere, into the corona. No matter the specific details, a mixed polarity distribution at the lower boundary and the divergence-free condition, require invariant topological features such as an X-line and associated separatricies, and quasi-separatrix layers to exist between fields emanating from separate regions of the photosphere. We present the results of fully-3D numerical simulations of a simplified low-beta model of this field expansion. A symmetric injection of Maxwell stresses into this geometry inflates strongly line-tied fields, generating a region of large current densities and magnetic energy dissipation. Elsewhere the injected stresses accumulate along the existing separatricies. There is no evidence of reconnection dynamics until after the initial parity is broken. Once the symmetry breaks, the X-line deforms explosively into a Syrovatskii-type current sheet, leading to a succession of quasi-homologous jet dynamics, such that the system returns to nearly the same initial state with each jet de-stressing. The bursty-oscillations of these jets occur as the stresses within the low-lying arcades are alternately relived by reconnection. These results have applications to jet and spicule activity in the low-corona, and general lower-coronal boundary dynamics.