Reconnection exhausts: Earthward collapse of DFBs

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Abstract

Reconnection exhausts on the earthward side of a tail reconnection site are characterized by DFBs, "dipolarizing flux bundles," which consist of local enhancements of Bz, associated with strong earthward flows. A widely accepted view holds that they are entropy depleted magnetic flux tubes or "bubbles," presumably generated by plasmoid severance via tail reconnection. The entropy depletion is considered to be crucial in their earthward propagation via buoyancy/interchange motion and their final deposition closer to Earth in an environment of similar flux tube entropy.
However, fast earthward flows with local Bz enhancements have also been documented in 2-D models of tail reconnection, both in MHD and PIC simulations, where interchange instability is inhibited. Furthermore, earthward collapse has also been found in PIC, and even ideal MHD, simulations that start from near-equilibrium configurations that include a local Bz enhancement, a "Bz hump." We investigate the stability properties of such configurations, using both 2-D and 3-D ideal MHD simulations.

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