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Mini-conference Poster: Thin current sheets and plasma bubbles
MIKHAIL SITNOV, PARVEZ GUZDAR, University of Maryland, MARC SWISDAK — The concept of underpopulated flux tubes or plasma bubbles has been introduced by Pontius and Wolf [1990] to resolve the convection crisis problem in the tail of Earth's magnetosphere. Plasma bubbles may convect much faster than the rest of the tail plasmas because of the buoyancy effect. The existence of bubbles and their relation to bursty bulk flows is confirmed by many observations. However, both formation and properties of bubbles remain insufficiently understood. We propose a simple self-consistent model, which describes properties of the tail current sheet after the formation of a small plasmoid on the closed field lines in the magnetotail and its quick tailward retreat. The model is based on the theory of forced magnetic reconnection, which is modified and re-interpreted, invoking stability properties of geomagnetotail plasmas. It is shown that the flux tube that contained a plasmoid becomes a plasma bubble, with the plasmoid being replaced by a thin current sheet embedded within the original thicker sheet. The model allows for an estimate of the decrease of the plasma entropy per unit magnetic flux within the bubble. It predicts that the bubble structure may also include bifurcated current sheets. The predictions are consistent with recent multi-probe observations of fast flows and atypical (embedded and bifurcated) current sheets from the Cluster mission.

Mikhail Sitnov
University of Maryland

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