



## **Property of the cross-tail current sheet variation during substorms observed by Cluster**

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The dynamical structure of the current sheet in the magnetotail is examined using magnetic field and plasma data obtained by the Cluster multi-satellites. From recent observations it is known that the current sheet is frequently far from the steady-state Harris-type structure and rather exhibits a highly variable current sheet thickness. While bifurcated current sheets and structures with concentrated current in the center are observed during relatively quiet (non-flapping) intervals, during active intervals they are associated with the temporal sausage-mode-like variations of the current sheet thickness. The sausage-mode-like oscillation is mostly concentrated within the neutral sheet region, and frequently coexists with large amplitude kink-mode-like waves or flapping motion.

This type of the variation exhibits two time-scales. One is observed associated with the occurrence of fast flows or after substorm onset with a time scale of 30 to 60 seconds, which is mostly consistent with the previous results reported as compressional waves in the neutral sheet. The other type of the variation is observed before substorm onset, with a time scale of several minutes.