

Observing the onset of a magnetic substorm

2 September 2014

Magnetic substorms, the disruptions in geomagnetic activity that cause brightening of aurora, may sometimes be driven by a different process than generally thought, a new study in the *Journal of Geophysical Research: Space Physics* shows.

Hwang *et al.* report observations using the Cluster spacecraft and ground-based magnetometers associated with the onset of a substorm. They saw two consecutive sudden jumps in the current sheet normal component of the magnetic field in the plasma sheet (the surface of [dense plasma](#) that lies approximately in Earth's equatorial plane), separated by about 5 minutes. The first magnetic field enhancement, along with a series of other magnetic structures and a region of rarefied plasma, propagated outward away from Earth; the second magnetic field enhancement (dipolarization front) rapidly propagated toward Earth.

They argue that the observed sequence of events suggests that a disruption in the current sheet originated near Earth and moved toward the magnetotail, where it facilitated [magnetic reconnection](#) (the breaking and reconnecting of [magnetic field](#) lines, which releases energy), creating conditions for substorm enhancement. This differs from the more commonly accepted scenario in which a substorm begins with magnetic reconnection in the magnetotail.

More information: Hwang K.-J., M. L. Goldstein, T. E. Moore, B. M. Walsh, D. G. Baishev, A. V. Moiseyev, B. M. Shevtsov, and K. Yumoto (2014), A tailward moving current sheet normal magnetic field front followed by an earthward moving dipolarization front, *J. Geophys. Res. Space Physics*, 119, 5316, [DOI: 10.1002/2013JA019657](https://doi.org/10.1002/2013JA019657)

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