Observing the onset of a magnetic substorm

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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.

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