

GRAPES-3 indicates a crack in Earth's magnetic shield

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The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield Credit: TIFR

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the [solar corona](#), and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio

signal blackouts in many high latitude countries.

Earth's magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and [galactic cosmic rays](#), thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in *Physical Review Letters*

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

More information: P. K. Mohanty et al, Transient Weakening of Earth's Magnetic Shield Probed by a Cosmic Ray Burst, *Physical Review Letters* (2016). [DOI: 10.1103/PhysRevLett.117.171101](https://doi.org/10.1103/PhysRevLett.117.171101)

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