Spacecrafts witness a new facet of Earth's magnetic behaviour

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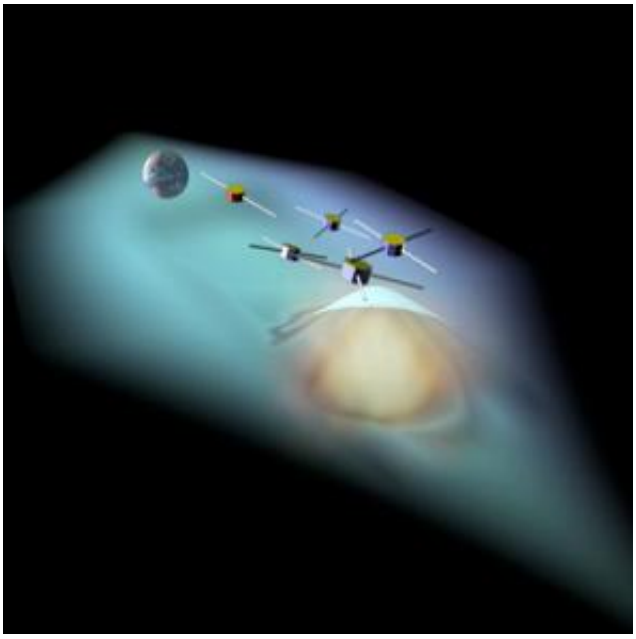

Artist impression of the electrical and magnetic energy event of August 2004

Five spacecraft from two ESA missions unexpectedly found themselves engulfed by waves of electrical and magnetic energy as they travelled through Earth’s night-time shadow on 5 August 2004. The data collected by the spacecraft are giving scientists an important clue to the effects of 'space weather' on Earth’s magnetic field.

Shortly after 15:34 CEST, something set the tail of Earth’s natural cloak of magnetism oscillating. "It was like the waves created by a boat

travelling across a lake," says Dr Tielong Zhang of the Austrian Academy of Sciences, Graz.

Only in this case, the identity of the 'boat' is unknown. It might be the fast flow of particles often observed in the central part of the magnetotail. Whatever it was produced waves that travelled from the centre of the tail to its outer edges.

The five spacecraft caught in this event were the four units of ESA's Cluster mission and the first unit of the joint CNSA/ESA mission Double Star. The Cluster quartet fly in formation, passing through Earth's magnetotail at distances of between 16 and 19 times Earth's radius.

One of the two spacecraft of Double Star, the TC-1 spacecraft, orbits at between 10 and 13 Earth radii. All five spacecraft are designed to collect data on the magnetic bubble surrounding our planet, called the 'magnetosphere'.

Earth's magnetic field is generated deep inside the planet and rises into space where it constantly interacts with the solar wind, a perpetual stream of electrically charged particles released by the Sun.

The stream pulls Earth's magnetic field into a tail that stretches behind the planet for tens of thousands of kilometres. Gusts and storms in the solar wind are known as 'space weather' and can make Earth's magnetic field quake.

On 5 August 2004, Cluster and Double Star satellites found themselves in the right place at the right time. The readings showed that the oscillations took place simultaneously across an area over 30 000 km in length. This is the first time that the true extent of the oscillations has been revealed.

Previous Cluster measurements, before the launch of Double Star, could only reveal the movement across a restricted location surrounded by the four satellites.

Understanding the way Earth's magnetic field interacts with the solar wind is the space-age equivalent of a meteorologist investigating the way a mountain range disturbs airflow, creating weather systems.

In the case of space weather, storms consist of fluctuating magnetic and electrical fields that can damage satellites and pose health risks to astronauts. If we are to fully exploit the potential of space, we have to understand the effects of space weather and be able to predict them. That's where missions like Cluster and Double Star come in.

"By studying the August oscillations, we may be able to develop a unifying theory for all the various motions of the magnetotail," says Zhang, who is heading the investigation into what happened that day.

Source: ESA