Magnetc reconnection in the Earth's magnetosphere

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The Swedish Institute of Space Physics and Uppsala University

UPPSALA UNIVERSITET

Cluster

Cluster is a four-satellite ESA mission. Each satellite has a set of eleven instruments to study electric and magnetic fields, and charged paerticles. Our team has the main esponsibility for the Electric Field and Wave (EFW) instruments. The spacecraft separation has been varied from 10,000 to 20 km.

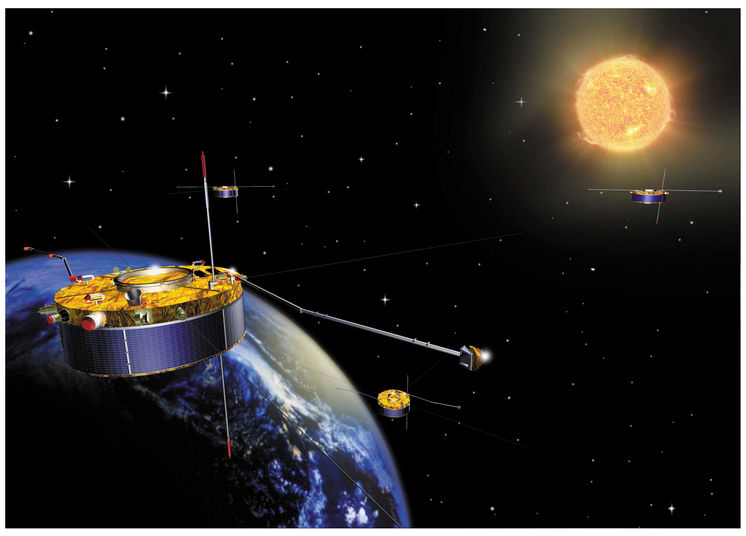

Figure 1: Artist picture of Cluster satellites.

The Earth's magnetosphere

The Earth's magnetosphere is the best plasma environment where fundamental plasma physics processes can be studied in detail.

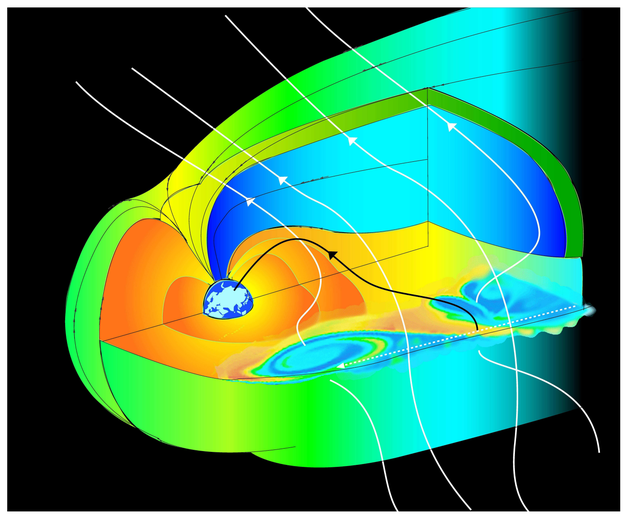

Figure 3: The Terrestrial magnetosphere (Sketch).

Magnetic reconnection

At the boundary between two colliding magnetized plasmas, magnetic field energy is converted to kinetic energy of charged particles[1]. Magnetic reconnection can occur in: laboratory and fusion devices, the solar wind, planetary magnetospheres, solar flares, supernovae and other astrophysical sources.

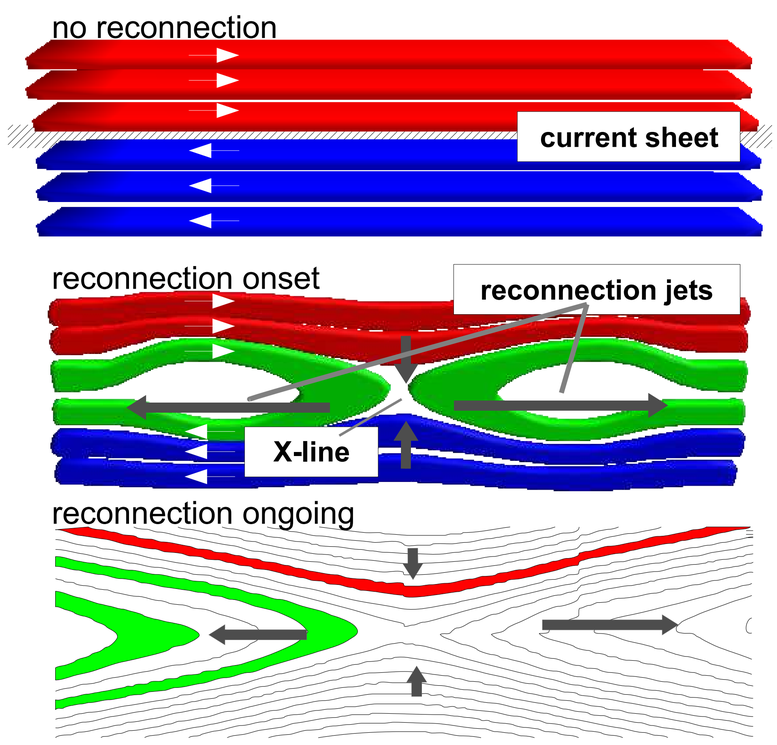

Figure 2: Schematic view of the reconnection process[1].

Top: initially a thin current sheet separates two magnetized plasmas. Middle: due to microphysica processes 'blue' and 'red' flux-tubes are interconnected, forming 'green' flux-tubes which are rapidly transported away (jets). Bottom: magnetic field lines from simulation (B. Rogers). Plasma fllows in from top and bottom to an X-line (extending out of page), and is accelerated to right and left (arrows). The 'red' field-line is close to a separatrix.

Magnetopause reconnection. Observations.

Cluster crossing of the magnetopause (front of the magnetosphere)[2]. The observations show that oxygen ions can be energized to high energies at the space plasma boundaries formed during the magnetic reconnection process.

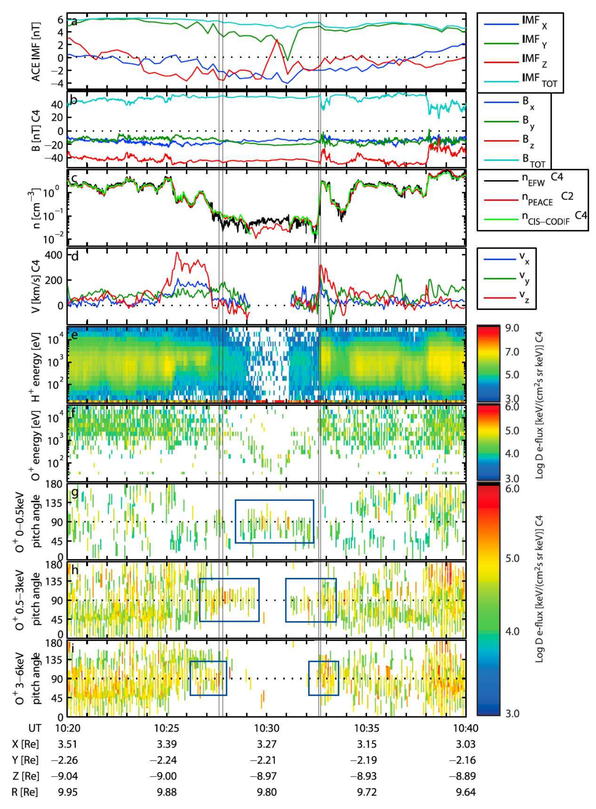

Figure 4: Observations from Cluster satellites [2].

PhD students

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NN being recruited. (Supervisor: M. André, A. Vaivads)

References

[1] A. Vaivads, A. Retinò, and M. André. Microphysics of magnetic reconnection. *Space Science Reviews*, 122:19–27, February 2006.

[2] T. Lindstedt, Y. V. Khotyaintsev, A. Vaivads, M. André, H. Nilsson, and M. Waara. Oxygen energization by localized perpendicular electric fields at the cusp boundary. *Geophys. Res. Lett.*, 37:9103–+, May 2010.