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German and Japanese Satellites Confirm Cosmic Plasma Process

Magnetic Reconnection is a process that converts magnetic energy into kinetic energy of plasma jets. It also provides access of one cosmic plasma to another one, e. g. at the interface of a stellar wind or accretion disk with the magnetic field of a neighbouring star. Such a situation exists between the solar wind and the Earth's magnetosphere. Reconnection of the respective magnetic fields does not only allow entry of solar wind plasma into the Earth's field, but by stretching it into the long magnetic tail it pumps energy into the Earth's system and is so responsible for magnetic storms, aurora, radiation belts and their variations, in short, for the *space weather.*

Originally proposed as the process causing solar flares, reconnection has been the object of intense research since the late 1950's. Many theories of dramatic energy release events in the universe are based on this process. Hence experimental proof of its existence has been a matter of great importance, both for laboratory and space experiments. Over the years indirect and direct evidence has been accumulated by satellite measurements in the Earth's environment, the clearest signatures being the jets of plasma found at the magnetopause, the boundary between solar wind and Earth's magnetic field, when the magnetic field configuration was favourable for reconnection to occur. But all of these measurements, being made with one spacecraft at a time, could only capture one of the two symmetric jets shooting out of the magnetic field configuration with the shape of a stretched letter X.

In February 1998, a very fortunate constellation existed for the German satellite *Equator-S*, built by the Max-Planck-Institut für extraterrestrische Physik at Garching near Munich, and the Japanese-US satellite *Geotail*. Being both at the morningside magnetopause, *Equator-S* above, *Geotail* below the equator, they could measure for the first time both jets, one directed northward, the other southward, for a period exceeding one hour. Not only do these measurements deliver the long desired final confirmation of the basic nature of reconnection, they also demonstrated its existence over a large part of the magnetopause, resulting in substantial solar wind entry into the magnetosphere at a rate of 10^{12} watts.

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