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## STEREO twin probes lift off on mission to explore the Sun

*26 October 2006*

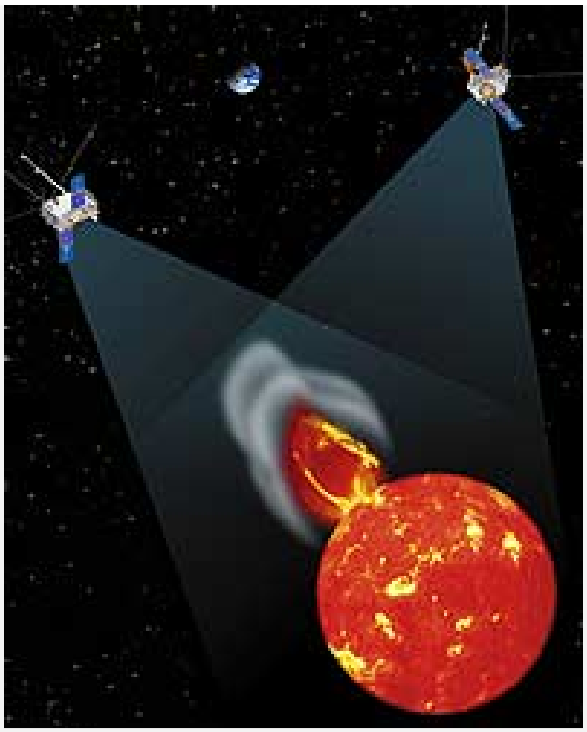
Launch of the STEREO mission

On the night of 25/26 October 2006, the twin STEREO probes were launched into space from Cape Canaveral by an American Delta launch vehicle. German research institutes are involved in three experiments onboard the mission, which is receiving €4.6 million in funding from the Space Agency of the German Aerospace Center (DLR). Solar researchers have been waiting since April 2006, due to technical problems with the launch vehicle.

The launch of the STEREO mission on Wednesday evening at 20:52 local time (02:52 CEST) signalled the start of a new era in solar research. This is the first time that a twin mission with two virtually identical probes has been deployed into space. The resulting 'stereo' view will enable researchers to observe the Sun in three dimensions, particularly phenomena originating from the Sun and their effects on Earth.

The STEREO project (Solar-TErrestrial RElations Observatory) is being run by the American space agency NASA with the involvement of scientists and research institutes from ten different countries. Germany's participation in the mission is represented by the Max Planck Institute for Solar System Research in Katlenburg-Lindau, the Max Planck Institute for Extraterrestrial Physics in Garching and the Universities of Kiel and Göttingen.

Throughout the mission, which is scheduled to last at least two years, the two STEREO probes will observe the Sun from different angles. They will be studying what are known as coronal mass ejections from the Sun and how they travel through interplanetary space as far as Earth orbit.



STEREO probe, artist's impression

Coronal mass ejections or CMEs are massive solar eruptions that expel millions of tonnes of hot material into interplanetary space. The huge bubbles of gas reach speeds of up to 2000 kilometres per second. If they reach Earth's magnetic field, they can trigger geomagnetic storms that not only result in the northern lights but also cause satellite malfunctions, telecommunication blackouts and power cuts. The high-energy protons accelerated by coronal mass ejections also pose a risk to astronauts, for example the crews on the International Space Station.

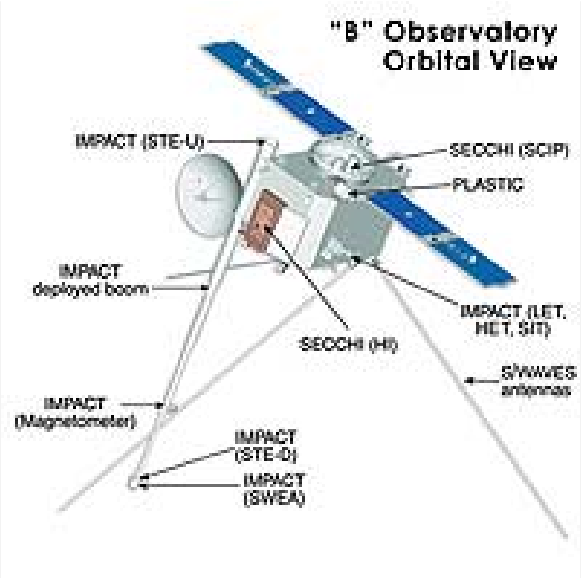
Although coronal mass ejections can have a significant impact on life and technical infrastructures on Earth, the mechanisms that govern how they are created and distributed are still poorly understood. The objective of the STEREO mission is to discover more about the physical processes associated with CMEs and, in the long term, to be able to predict the 'weather' in space.

Up until now, very little has been known about the origins of CMEs and how they travel through interplanetary space because we have only been able to observe these events from a single point. Ejections whose course takes them straight towards Earth are only identified quite late on.

To solve this problem, NASA has launched two almost identical probes, STEREO-A ('Ahead') and Stereo-B ('Behind'), simultaneously into space. The probes will spend several years observing the Sun and the interplanetary space between the Sun and Earth, one spacecraft preceding the Earth in its orbit while the other follows behind the Earth. Armed with the measurement data from the probes, scientists will be able to observe the origins, structure and travel of CMEs in detail and in three dimensions.

**The twin STEREO probes each carry four identical experiments and experimental packages:**

- SECCHI (Sun-Earth Connection Coronal and Heliospheric Investigation) is a telescope group consisting of two coronagraphs (COR 1 and 2), a UV camera (EUVI) and a camera for observing the heliosphere (Heliospheric Imager or HI).
- IMPACT (In-situ Measurements of PArticles and CME Transients) is a package of seven instruments for in-situ measurement of the 3-D distribution of electrons in the solar wind plasma, the properties of solar energetic particle (SEP) ions and electrons and the local vector of the magnetic field.
- PLASTIC (PLAsma and SupraThermal Ion Composition) is an experiment for in-situ measurement of the speed, density and temperature of the solar wind and also for measuring the charge composition of suprathermal ions.
- SWAVES (STEREO/WAVES), the final experimental component, will measure solar radio eruptions.




The STEREO-B probe and its instruments

DLR's Space Agency has been involved in the STEREO mission since the year 2000 through funding various experimental components.

A group from the Max Planck Institute for Solar System Research (MPS) collaborated with the University of Kiel to build the protective and opening mechanisms for the two coronagraphs and the EUV camera on the SECCHI instrument. These mechanisms will prevent the telescope from becoming contaminated and therefore unusable during the early phase of the mission.

Another group from the same institute was responsible for developing the SECCHI instrument's highly complex data evaluation system. The team developed software for stereoscopic image processing, data analysis of the 3-D observations of the Sun's corona and inner heliosphere and modelling the coronal magnetic field.

Lastly, MPS also had a role to play in the experimental package IMPACT. It was here that the flight time electronics for the IMPACT experiment SIT (Suprathermal Ion Telescope) were developed and built. SIT is a flight time spectrometer that measures the ion composition in the solar wind.

The Institute for Experimental and Applied Physics at the University of Kiel contributed another important component to IMPACT. Scientists there developed and built the Solar Electron and Proton Telescope or SEPT. During the mission, two identical particle telescopes on board the STEREO probes will measure and differentiate the type, energy and direction of incidence of electrons and protons in the solar wind.

The Institute in Kiel and the Max Planck Institute for Extraterrestrial Physics are also co-investigators for the PLASTIC instrument.

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