



### 3D-Images of Solar Activity

#### Potsdam Sun researchers of the Astrophysical Institute Potsdam participate in NASA's STEREO mission

*Finally it happens. After several postponements NASA's STEREO mission starts in the evening of 25th October in Cape Canaveral in Florida. STEREO, that is Solar TERrestrial Relations Observatory, will for the first time deliver 3D-images of the Sun's atmosphere. Thus it will be possible to determine the correct position and speed of the coronal mass eruptions. The Astrophysical Institute Potsdam (AIP) participates with the instrument STEREO-Waves for which they analyze data and provide data analysis tools.*



Image 1: The two STEREO observatories observe coronal mass ejections at the sun, artistic image [Image: NASA/Walt Feimer]



Image 2: STEREO observatories observe a coronal mass ejection, artistic image [Image: NASA/Walt Feimer]

Solar eruptions are powerful energy bursts which can hurl up to 10 billion tons matter from the solar atmosphere into interplanetary space at speeds up to 2000 kilometers per second. They can cause great disturbances in interplanetary space and great magnetic storms on Earth. Moreover, during these solar eruptions energetic particles, i.e. protons are hurled into space. These may damage or destroy satellites and may be dangerous or even lethal to astronauts who are outside their space ship, e.g. for repairs. In the past geomagnetic storms have caused electric hazards, e.g. in 1989 in the whole province of Québec, in Canada where the whole power network went off and thus caused a havoc by leaving the inhabitants, traffic systems, the airport as well as schools and enterprises without power and heating. STEREO will contribute to a better understanding of the so called space weather. In the long run it will be possible to make accurate predictions and to take corresponding measures in order to prevent events such as the one in Canada in 1989. STEREO's task is to find out the origin, evolution and the interplanetary consequences of the solar activity. The focus is on Earth, i.e. on the coronal mass ejections which are directed towards Earth.

STEREO consists of two identical observatories which will circle the Sun with Earth. Thereby, one of them moves ahead of Earth, the other behind. Although there are already solar observatories in space, these are single stations which send direct sun images. The new STEREO observatories deliver STEREO images, i.e. they are able to observe three-dimensional just like our two eyes. Thus STEREO for the first time obtains 3D images and particle measurements of the Sun. The STEREO mission will run for two years and is the third mission in the Sun-Earth-sample-program of

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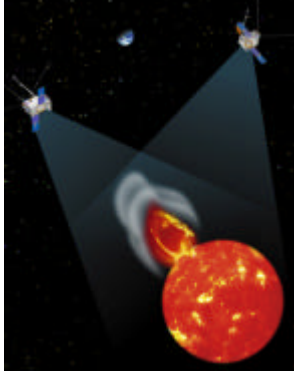


Image 3: The 2 STEREO observatories at their positions ahead and behind Earth observing a coronal mass ejections at the sun, artistic image [Image: NASA/JHU]

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NASA. STEREO carries many instruments and is thus a huge collaboration of astronomical institutes all over the world. The scientists of the Astrophysical Institute Potsdam (AIP) contribute to the instrument STEREO-Waves, a radio receiver which measures interplanetary shock waves and energetic electrons. Professor Gottfried Mann, head of the STEREO-group at the AIP sums up the goal of his group: “We concentrate on data analysis. Thus we have produced certain data analysis tools. They allow us to track the radio waves caused by the interferences of the Sun and measure their exact position and speed.“

But first the twin observatories which are shot into space by a rocket must reach their positions. Here the moon helps. Due to his gravity he pulls them along for a while. Otherwise too much fuel would be necessary. The observatories are directed to their positions from Earth., first the observatory trailing Earth and then the second observatory ahead of Earth. In three months Professor Mann expects the first results and then the data analysis can start. Professor Mann has been working at several radio stations on Earth for years. “Special about radio stations in space is their ability to observe short waves. They do not reach Earth bound stations because they are reflected by the ionosphere. And due to the three-dimensional look at coronal mass ejections we can very precisely predict the consequences solar eruptions. Up to one day ahead we can tell if they are directed at Earth or it they are passing by.“