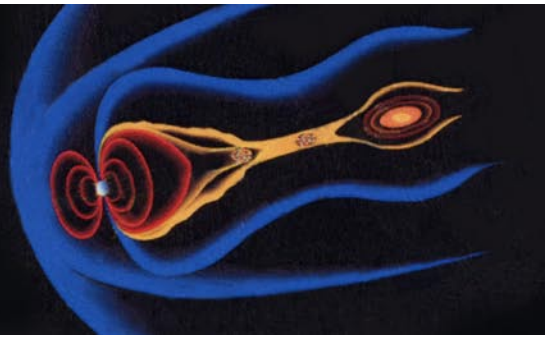
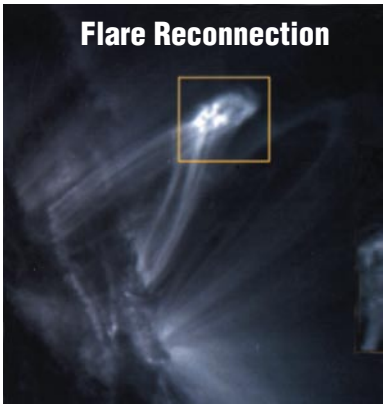
MMS:
The Magnetospheric Multiscale Mission



Reconnection around Earth



Reconnection in Solar Flares

"Combined results from missions that explore individual links in the Sun-heliosphere-Earth chain will result in true systems-level understanding. ...Solar B, STEREO, SDO, MMS, Radiation Belt Storm Probes and IT Storm Probes missions represent a combination that provides unprecedented detailed measurements extending from inside the Sun down to the ionosphere."

From: NASA Sun-Earth Connections Roadmap 2003-2028

Launch of the MMS mission is planned for 2013.

A Stubborn Mystery

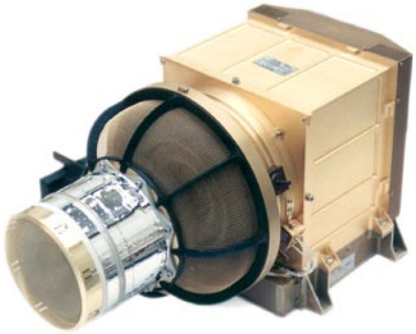
As the next Solar-Terrestrial Probe mission, MMS forms a cornerstone to the entire Solar-Terrestrial research enterprise by focusing on a single, but essential scientific problem. Throughout the universe, from galactic nuclei to solar flares to geomagnetic storms to earth-bound magnetic fusion reactors, nature finds a way to rapidly convert magnetic energy to heat. This process, called "reconnection," is not understood and, for a time, was thought to be impossible. Extensive space and ground research over forty years has led to the realization that a space mission of multiple satellites, flying in a formation more closely packed than ever before attempted, has the best chance of unlocking the mysteries of reconnection.

The Plan of Attack

The challenge of reconnection is that the process occurs over a small scale: a "diffusion region," which is about 10 km in size in space near the earth. (In a laboratory plasma research machine, it is so small, (a tenth of an inch), that probes interfere with the process.) MMS plans to fly a formation of four satellites, maintaining a separation of 10 km in orbits going halfway to the moon, and measure a comprehensive set of parameters to determine the processes in reconnection. They must all be closely coordinated, maintaining communication between themselves to precisely time the measurements and to keep from colliding with each other!

The UNH Contribution

After studies lasting seven years, NASA selected two teams to prepare a final proposal for implementing the 400 M$ MMS mission. Competition was intense, ending with the selection of the team led by SouthWest Research Institute. On this team, UNH will be responsible for all electromagnetic field measurements, providing the central electronics and a new type of instrument called the Electron Drift Instrument (EDI). EDI will measure both electric and magnetic fields with unprecedented accuracy and also the rapidly varying electrons that are a key component of reconnection.



EDI Instrument

Fields Central Electronic Controls

Education and Public Outreach

Along with undergraduate and graduate research projects, the mission will leverage the resources here in New Hampshire to involve high school students via NH Space Grant and Project SMART, and to work with the Leitzel Center for Math, Science, and Engineering Education.

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