

Title: Stereoscopic Observations of Coronal Structures

Author: Simon Plunkett, NRL

#### Points of Contact

JOP Lead: Simon Plunkett (NRL: STEREO/SECCHI)

SOHO/EIT: Jeffrey Newmark (NRL)

SOHO/LASCO: Guillermo Stenborg (CUA/NRL)

SOHO/CDS: Danielle Bewsher (RAL)

SOHO/MDI: TBD

TRACE: Jean-Pierre Wuelser (LMSAL, TBC)

Hinode/EIS: TBD

Hinode/SOT: TBD

#### Scientific Objectives

The aim of this joint observing program is to study the three-dimensional nature of coronal structures using observations from multiple vantage points in the ecliptic plane. Efforts at three-dimensional reconstructions to date have relied on solar rotation to provide multiple viewpoints of solar structures from a single observing location. These efforts are hampered by the fact that coronal structures are highly dynamic, and may evolve significantly over the timescales of several days that are necessary to obtain multiple lines of sight. The SECCHI instruments on the STEREO mission remove this restriction by providing simultaneous imaging of the corona from two spacecraft, one leading and the other lagging the Earth in heliocentric orbit. When combined with observations from SOHO, TRACE, and Hinode located along the Sun-Earth line, we have the capability for the first time to obtain near-simultaneous observations of coronal structures along three lines of sight. This will permit realistic three-dimensional reconstructions of coronal loops and other features, such as polar plumes.

Stereographic reconstruction techniques will be applied to EUV and visible-light imaging data from STEREO, SOHO and TRACE instruments. EUV spectroscopy from SOHO and Hinode will provide plasma diagnostics for selected target regions within the fields of view of the full-disk imaging instruments. Longitudinal and vector magnetograms from SOHO and Hinode will provide details of the photospheric and chromospheric magnetic fields underlying the coronal structures. Extrapolations of these data into the corona will provide sanity checks and constraints on the three-dimensional reconstructions of coronal features.

#### Proposed Dates

The period from May 4-17, 2007 has been designated as a SECCHI Campaign period by the STEREO mission. During this period, the daily volume of SECCHI data will be effectively double the normal amount. We propose that the first run of the JOP be scheduled for this two-week period. The separation of the two STEREO spacecraft will be approximately 7 degrees at this time, which is close to ideal for stereoscopic reconstruction of features on the solar disk. For this reason, the greatest emphasis will be

placed on observations with the SECCHI/EUVI telescope for this campaign. Future runs will focus more on observations of larger-scale structures at greater altitudes with the SECCHI coronagraphs and heliospheric imagers.

## Observations

STEREO/SECCHI: Full-disk EUV images will be obtained with a cadence of TBD minutes in 4 wavelengths: 304 Å, 171 Å, 195 Å and 284Å. Visible-light coronagraph images will be obtained with a cadence of TBD minutes in the range 1.4-4 Rs and 2.5-15 Rs.

SOHO/EIT: Full-disk images in wavelengths to match SECCHI, at synoptic cadence. If possible, these images should be in full-resolution (1024x1024 pixels), and should be synchronized with STEREO/SECCHI images.

SOHO/LASCO: Synoptic observations with C2 and C3. If possible, these images should be synchronized with STEREO/SECCHI images.

SOHO/CDS: Suggest using `eject_v3/v18` study. This is a 240"x240" raster with a good selection of lines over a wide temperature (10,000 K to  $2.5 \times 10^6$  K), and contains a density diagnostic. Target region should be coordinated with Hinode and TRACE.

SOHO/MDI: Full-disk magnetograms at TBD cadence. If target region used by SOHO/CDS and Hinode is within the high-resolution field of view, high-resolution magnetograms and visible-light filtergrams with a 1 minute cadence would be desirable.

TRACE: TBD, but should include EUV images of target region used by SOHO/CDS and Hinode.

Hinode/EIS: TBD, but should include lines over a broad range of temperatures to span the range covered by SECCHI/EUVI, and target region should be coordinated with SOHO/CDS.

Hinode/SOT: TBD, but should include photospheric and chromospheric vector magnetograms at a high cadence to permit reconstruction of coronal magnetic fields in target region.