PROPOSAL FOR OBSERVING PROGRAM 2006 for the Dutch Open Telescope (DOT) supporting SOHO JOP 171[1]

Title of the program:	Photospheric drivers of physical mechanisms responsible for the energy transport and dynamics in/above chromospheric network
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Type of the program: DOT imaging tomography

Targets: chromospheric network near the disk center

Cooperating instruments: Coronal Diagnostic Spectrometer (CDS), Michelson Doppler Imager (MDI), Extreme-Ultraviolet Imaging Telescope (EIT) and the TRACE satellite

Scientific objective: Photospheric and chromospheric layers are planned to be investigated in order to identify the most probable physical mechanisms responsible for the energy transfer and dynamics of the solar corona above chromospheric network. Our previous results derived from data of the SOHO JOP 78[2] indicate presence of the downward propagating waves in/above chromospheric network and lead to the assumption that reconnection of the magnetic field lines should be dominant mechanism to heat the solar corona above the particular chromospheric network (Gömöry at al., A&A, in press[3]). In contrast, findings of other authors (e.g. Marsh et al., A&A 404, L37 (2003)) show evidence of propagating intensity oscillations spreading out from the photosphere to the corona and therefore prefer alternative heating mechanism of the corona, i.e. dissipation of magneto-hydrodynamic waves which originate from the solar convective zone. To clarify these findings a new joint observing program (JOP 171) of the SOHO instruments (CDS, EIT, MDI) and the TRACE satellite was proposed. First runs of the JOP 171 were already performed but only with very limited support of the photospheric measurements. As the drivers of all proposed heating mechanisms are localized in the photosphere, additional information are necessary to data of the JOP 171 for better identification of the heating mechanism. We expect that time series of the speckle-reconstructed DOT filtergrams taken simultaneously with the CDS spectra will provide an excellent material for analysis of properties of the mentioned drivers and will help us to reach our goals.

[1] Details at: `http://sohowww.nascom.nasa.gov/soc/JOPs/jop171`

[2] Details at: `http://sohowww.nascom.nasa.gov/soc/JOPs/jop078/jop078.html`

[3] Preprint available at: `http://www.astro.sk/~gomory/articles/2005_AA/gomory_aa.pdf`

Planned analysis: The CDS spectroscopy, although of the low spectral resolution, provides a perfect temperature coverage of the line emission from chromosphere up to corona. Therefore, the CDS data are planned to be used for study of waves in the upper solar atmosphere and for determination of direction of the wave propagation. To do that we will apply cross-correlation technique (Gömöry at al., ESA SP-575, 400 (2004)) and wavelet analysis on the intensities and the Doppler shifts of the selected CDS spectral lines.

The main argument to try to acquire DOT data is that the filtergrams taken in G-band and red and blue continuum should enable us to analyze footpoints of the magnetic field concentrations. (Complementary SOHO/MDI magnetograms will be also used for study of evolution of the photospheric magnetic fields.) These magnetic elements, visible as the photospheric bright points concentrated in the network, are considered to be the prime candidate for drivers of the coronal heating mechanisms (Muller at al., A&A 283, 232). Moreover, time series of the DOT filtergrams taken in the Ba II 4554 Å, Hα and Ca II H spectral lines will provide additional information about behaviour of waves in the upper solar photosphere and chromosphere and therefore they will allow better identification of the coronal heating mechanism.

TRACE measurements will be used mainly for searching for the transition region and coronal responses of the propagating/standing waves.

The spatial co-alignment of the data taken by different instruments will be primarily performed in the following way:

- CDS $\rightarrow$ EIT: using CDS rasters taken in the He I 584 Å line and EIT filtergrams taken in the He II 304 Å line
- EIT $\rightarrow$ TRACE: using EIT and TRACE data taken in 171 Å channel
- TRACE $\rightarrow$ DOT: using TRACE data taken in 1600 Å channel and the DOT filtergrams taken in the Ca II H line (or using white light images if some significant pores will be available in the field-of-view of both instruments)

Time allocation request:

Number of days needed: 7 – 10 days
Preferred time: no preferred time
Impossible time: none

Observing procedures and requirements:

DOT:

As the main goal we plan to observe in all available spectral channels of the DOT telescope (i.e. G-band, red and blue continuum, Hα, Ca II H and Ba II 4554 Å spectral lines). In case of the Hα channel we would like to acquire cycle of the following measurements: five-wavelength profile sampling of the Hα line (providing dopplergrams for the chromospheric layers) followed by the Hα measurements taken in the standard DOT mode.

We apply for the external usage of the DOT in a service mode in which the DOT team operates the telescope. The support of cooperating instruments (i.e. CDS, EIT, MDI and TRACE) will be requested only when our DOT observing period will be scheduled.

CDS, EIT, MDI:

All important informations about the observing sequences of the CDS, EIT and MDI (instruments onboard SOHO) can be found in the proposal of the JOP 171 observing program which is available at `http://sohowww.nascom.nasa.gov/soc/JOPs/jop171`.

TRACE:

We are interested to acquire cycle of the high resolution images (spatial resolution 0.5") taken in the white light, UV 1600 Å continuum as well as in the C IV 1550 Å and Fe IX 171 Å spectral channels. Exposure times in different spectral channels should be controlled by automatic exposure control of the TRACE satellite.

Additional information:

No personal assistance of proposers is planed on La Palma. We suppose to run the SOHO JOP 171 program from our home institute.