OBSERVING TIME PROPOSAL FORM 2008
for the Vacuum Tower Telescope (VTT)
at the Observatorio del Teide, Tenerife, Spain

Please send the completed form by email to: `tac@kis.uni-freiburg.de`
Deadline: 19 January 2008!

For retrieving this form[1] and for information on the VTT consult our web page:
http://obs.kis.uni-freiburg.de/tfs-index.htm

1 Applicants

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[X] We/I want to apply for time under the OPTICON ACCESS program.

For allocation of observing time the VTT TAC has two requests:

Request 1:

[X] We will deliver a technical report on our observing campaign – if granted – within one week after the last day of observation. This report will contain information on: names of observers and assistants, title of project, used instruments, instrument changes, positive feedback, problem feedback, seeing conditions, and a wish list. The report will be sent via email to `vtt@kis.uni-freiburg.de`.

Request 2:

Please let us know about any publication that results from VTT data sets by sending the references to H. Wöhl (`hw@kis.uni-freiburg.de`).

[1] Critical comments on this form are appreciated by R. Schlichenmaier (`schliche@kis.uni-freiburg.de`).

2 Justification

Title of Project: Dynamic fibrils in the upper photosphere, chromosphere and above.

Scientific Objectives of Observing Time

(Please give a brief statement of the scientific objectives of the requested observing campaign. This information will be used to evaluate the scientific merit and the observatory's general capability to conduct the type of research you intend to do. Please make sure that all necessary information is provided.)

This campagn aim at investigation of coupling of chromospheric fine structures with global photospheric oscillations. In particular, we will focus at topology of acoustic power distribution in the photosphere and its relation to 'dynamic fibrils' (DFs) seen in the chromosphere.

(1) Photospheric oscillations as drivers of chromospheric dynamic fibrils (DFs):

1.1 *ECHELLE SPECTROGRAPH ONLY:*
It has recently been found that chromospheric "dynamic" fibrils display repetitive mass loading by acoustic shocks driven by the global oscillations in the underlying photosphere (De Pontieu et al. 2007, *High-Resolution Observations and Modeling of Dynamic Fibrils*, ApJ 655, p. 624-641). This scenario assumes that considerable power of photospheric 5-min oscillations is concentrated at the bases of inclined magnetic fluxtubes giving rise to the chromospheric DFs.

Using Hα filtergrams obtained by the Dutch Open Telescope we have shown that the DFs exhibit significant variations in orientation, which are faster for shorter DFs (Koza et al. 2007, *Temporal Variations in Fibril Orientation*, ASP.Conf.Series 368, p.115-120).

Aim: As an extension of the work mentioned above, in this proposal we aim at identification of quiet-sun network areas with increased acoustic power seen in the photosphere and its relation to occurrence of the DFs in the overlaying chromosphere and investigation of their mutual relations in time and space. This brings additional walue to the previous works in the sense that the photospheric velocities will be measured experimentaly instead of model. Thus, the spectral observations of both, the photosphere and chromosphere with the best, spatial and spectral resolution possible are needed.

To do this we will perform scanning of a small photospheric area by the slit of Echelle spectrograph using two different sets of lines:

a) fully Doppler photospheric lines Fe I 7090 Å (formation heigth ∼300 km) and Fe II 7224 Å (formation heigth ∼130 km) and Hα line with contextual slit-jaw imaging in Hα (and shortly in WL amd Ca II H).

b) fully Doppler photospheric lines Fe I 7090 Å (formation heigth ∼300 km) and Fe II 7224 Å (formation heigth 130 ∼km) and Ca II 8662 Å line and Hα line with contextual slit-jaw imaging in Hα (and shortly in WL amd Ca II H).

As a result of observations we expect 2D time series of spectra of the upper and lower photosphere and chromosphere, namely 2D space-time slices of intensities constructed from various positions in the spectral profiles, corressponging to different layers in the solar atmosphere. More, standard spectral characteristics (Ic, Ir, FWHM and bisectors - 'velocities') will be computed.

1.2 *ECHELLE SPECTROGRAPH WITH GÖTTINGEN FPI*

To extend the above described data to spatially larger 2D time series, we will try to use combination of the FPI imaging with Echelle scanning. We will perform observations of the Hα line with FPI - intensity mode combined with observations using Echelle scanning a small photospheric area by the spectrograph slit. Two different sets of lines from Echelle will be used:

a) fully Doppler photospheric lines Fe I 7090 Å (formation heigth ∼300 km) and Fe II 7224 Å (formation heigth ∼130 km) and Ca II 8662 Å line and contextual slit-jaw imaging in Hα line (and shortly in WL amd Ca II H).

b) fully Doppler photospheric line Fe I 5434 Å (formation heigth 500 km) and contextual slit-jaw imaging in Hα line (and shortly in WL amd CaII H).

We plan to perform reasonable long (1 hour) series for possibility to investigate location and role of the 5 and 3 minutes oscillations in the field. Careful inspection of 2D space-time slices in different positions in the Hα (Ca II 8662 Å) spectral profiles will allow us to localize ends of fibrils on the photosphere-chromosphere level and coalign them with the parameters of photospheric lines to interpret the dynamical characteristics of the DFs.

Additionally, for both modes (**1.1 and 1.2**) we will apply for supporting observations performed with TRACE (optionally also with MDI/SOHO) to gain information also for the layers above the chromosphere and about the magnetic situation in the photosphere.

(2) Magnetic reconnection as drivers of chromospheric fine structure:

As an extension of the task (1) we would like to perform also polarimetric observations with FPI. (*But this only* **optionally**, *if there will be possible to have overlap of a few days of our campaign with the team from Göttingen which will use the FPI, to get chance to learn more about polarimetry made with this modern instrument prepared for implementation on the GREGOR telescope.*)

Aim: Recently, downflows and upflows occurring at the base and tops of mottles, respectively were reported. (Tziotziou et al. 2003, *On the nature of the chromospheric fine structure. I. Dynamics of dark mottles and grains*, A&A, 402, p.361-372). To explain this dynamic structure their suggested magnetic reconnection as a potential driver of mottles. The same mechanism is likely to be at work also in the case of Type II spicules discovered by De Pontieu et al. 2007, (*A Tale Of Two Spicules: The Impact of Spicules on the Magnetic Chromosphere*, 2007arXiv0710.2934D) in Hinode CaII H images of solar limb.

With an aim to lend observational evidences on magnetic reconnection as a potential driver of these chromospheric fine structures we would like to study fast temporal variations in magnetic topology of quiet-sun network with simultaneous chromospheric imaging.

We wish to obtain reasonable long time-series of high-resolution Stokes V maps of solar network in the pair of lines Fe I 6301/02 with FPI together with imaging of the same area in Hα slit-jaw and with the Echelle spectra of selected spectral lines (Dichroic spliter will be used for this purpose). Thus, if the Echelle slit will be hold on fixed position 1D time series of spectra within 2D time series of Stokes V maps from FPI will be registered together. If there will be possible to make small scans with Echelle, then also time series of Echelle spectra will be in 2D.

As a result of these observations we expect:

- 2D Stokes V maps (from Fe I 6301/02 from FPI)
- 2D H-alpha image from slit-jaw (shortly also WL and Ca II H)
- 1D (or 2D) spectra (Hα, photospheric lines 7090 Å, 7224 Å, and Ca II 8662 Å) from Echelle, which will be inside the 2D field of view.

Such set of the data is possible to interpret with use of inversion methods (SIR).

Our results should clarify the following issue. If the mottles and Type II spicules originate from magnetic reconnections occurring at chromospheric layers, are the onsets or consequences of such events observable also in variations of field topology at photospheric layers and in variations of other spectral characteristics of the photospheric spectral lines?

Former projects

(If this proposal is a continuation of a former project, please provide a list of previous program titles and a brief progress report on a separate sheet. Please include references to publications which resulted from your earlier observing programs. Apropos: Please let us know about any publication that results from VTT data sets by sending the references to H. Wöhl: hw@kis)

No previous project on VTT were done on this topic but we have run several campaigns on VTT in the past using Echelle spectrograph as well as TESOS instrument.

3 Observing requests:

Amount of time requested: 10 days

Coordinated observation: (Please indicate if you are planning coordinated observations with other facilities.)

We intend to apply for the supporting observations two space-born instruments – TRACE satellite and MDI/SOHO. Application for the Hinode support is under considerations. We shall apply for observing time once the VTT time will be granted and scheduled.

TRACE: In particular we are interested in the high resolution images (0.5") taken by TRACE in the white light (WL) channel, UV 1600 Å continuum channel, and in the Lyman alpha channel. Expected exposure times are 0.2, 4, 2 sec, respectively. Therefore cadence of one set of these exposures per 20 seconds can be reached.

MDI/SOHO: high-resolution longitudinal magnetograms (0.6") of the 1-min cadence will be acquired with some intensitygrams (one per hour) for the co-alignment purposes.

The WL channels will be used for the post-facto co-alignment of the VTT, TRACE and MDI images. For this purpose the H-alpha slit-jaw imaging at VTT will be alternate with several short series of slit-jaw images in WL.

Impossible Dates: (In order to make most efficient use of observing time in view of personnel limitations, the number of reconfigurations of the telescope and its instrumentation will be limited. We therefore will group observing requests of similar technical nature into combined periods. An attempt will be made to accommodate a very limited amount of "impossible time" in the schedule. There is absolutely no guarantee for success of this attempt. Please keep this in mind when specifying your restrictions above these lines. Please keep also in mind the possibility of having your observations made by a colleague in cases of time conflicts. Thank you for your cooperation.)

NONE

3.1 Instruments

In the following please specify the needs for your observing run. Please give an overview and describe additional needs at the end of this form in Sect. **??**.

Some of the following instruments can be used simultaneously: (TIP or Echelle) and (POLIS or TESOS or Göttingen FPI). Additionally, fast cameras for speckle bursts are available.

3.1.1 POLIS [ ]

The neutral iron lines at 630 nm are observed in polarimetric mode. The second channel (Ca H) only records Stokes I.

Slit: [ ] 15 μm (0.18") [ ] 40 μm

Imaging channel: [ ]
The relict of the correlation tracker channel can now be used for imaging in the continuum. For a list of available CCDs, cf. Sect. **??**.

3.1.2 TIP (Tenerife IR Polarimeter) [ ]

Wavelength range:

[ ] 1040 - 1100 nm [ ] 1200 - 1260 nm [ ] 1530 - 1800 nm

3.1.3 TESOS [ ] (available: July until December 2008)

[ ] Intensity Mode [ ] VIP (Vector Imaging Polarimeter) (Stokes I, Q, U, & V)

Please contact Thomas Kentischer (tk@kis.uni-freiburg.de) or Luis Bellot Rubio (lbellot@iaa.es) if you want to use VIP.

Please specify the spectral lines you want to use in the prefilter list (cf. Sect. **??**).

3.1.4 Göttingen FPI [X]

[X] Intensity Mode [X-optionally only] Polarimetric Mode (Stokes I, Q, U, & V)

If you apply for observing time with the Göttingen FPI, please consult:
`http://www.astro.physik.uni-goettingen.de/~nazaret/FPI_Manual/`

Please specify the spectral lines you want to use in the prefilter list (cf. Sect. **??**).

3.1.5 Echelle Spectrograph [X]

Grating:

[X] 63° Standard [ ] 62° Chrom. [ ] 55° IR

(The number gives the blaze angle in degrees. Put a question mark if you don't know!)

Spectral lines that you want to observe simultaneously:

You can observe up to 3 lines simultaneously. List the combination(s) that you want to use.

Set	Wavelength [nm]	Order	Remarks
1a	709.0	32	
1b	722.4	31	
1c	656.3	34	
1d			
2a	709.0	32	
2b	722.4	31	
2c	866.2	26	
2d			
3a	543.4	42	
3b			
3c			
3d			

[ ] I already have a predisperser mask.
[X] I need a new prediserser mask.
[ ] Please help me calculating mask parameters.
[ ] I use the predisperser with mirror (no grating) and use filters (cf. Sect. **??**).

Slit width: The image scale on the entrance slit is 4.49 arcsec/mm.

[X] 40 μm [X] 60 μm [ ] 80 μm [ ] 100 μm (0.45") [ ] 150 μm
[ ] no slit (mirror)

Detectors in focal plane of spectrograph: cf. Sect. **??**.

3.1.6 Other instruments

In case you plan to use other instruments, please describe your needs in detail here.

3.2 Additional needs

3.2.1 Detectors: CCDs

[X] PCO 1 (4072x2720) [X] PCO 2 (4072x2720)
[X] Sensicam (1376x1040) [X] DALSA II (1024 x 1024, faster)

Video Cameras: [ ] COHU 2/3" (RS170) [ ] COHU 2/3" (CCIR)

3.2.2 Interference Prefilters:

#	Central wavelength [nm]	FWHM [pm]	remarks
1	656.3	???	
2			
3			
4			
5			

3.2.3 Beam Splitter Spectr/Lab:

[ ] CaK Beam splitter [X] IR/VIS Beam splitter[1]
[X] 50/50 % Beam splitter [ ] Mirror

([1]: to be used if you observe with TIP & POLIS or TIP & TESOS.)

3.2.4 Media (Portable data storage devices)

Please specify numbers in checkboxes! Note: Media are expensive! Please recycle old tapes.

[ ] Exabytes DAT-Tapes: [X] DDS-3 [ ] DDS-4

DLT-Tapes: [X] DLT-IV (black, for DLT4000 and DLT8000)
[ ] SDLT1-Tape (green, for SDLT320)

[X] LTO-Tapes (800GB uncompressed, 4 x faster than DLT)

[X] S-VHS Tapes [ ] VHS Tapes

3.2.5 Computational environment

[ ] I need a computer account for

Full Name	User name

If you need dedicated IP-numbers for your own devices, please contact Peter Caligari (cale@kis.uni-freiburg.de, Tel.: ++49-761-3198-220)

3.3 Overview and technical description

[X] We want to make simultaneous measurements with different devices/cameras.

Give an overview and describe your plans, technical remarks, and wishes below:

We plan to use:

1. Echelle spectrograph with 3 cameras in the focal plane of the Echele spectrograph simultaneously for registration of the spectra. For the slit-jaw system ve plan to use analog TV cameras + videorecorder (WL, Ca II H) and digital CCD camera for the Hα registration.
2. Göttingen FPI in intensity mode (optionally also in polarimetric mode)