

THEMIS TELESCOPE: PROSPECTS IN HIGH RESOLUTION MAGNETIC FIELD OBSERVATIONS

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ABSTRACT The THEMIS telescope will provide high resolution observations of the solar vector magnetic field. We present some capabilities of this instrument, concerning the polarization analysis, the correlation tracker and the two spectrographs. THEMIS is expected to come into operation in 1995-1996.

INTRODUCTION

THEMIS (Télescope Héliographique pour l'Etude du Magnétisme et des Instabilités Solaires) is a french-italian project. The main goals are:

- Accurate polarization measurements (4 Stokes parameters)
- High spatial resolution
- Powerful spectral analysis (up to 10 lines) in several modes (1D or 2D)
- Imagery with birefringent filter and Pérot-Fabry (Arcetri Observatory)

We shall present briefly the capabilities of THEMIS concerning the three first points. More details can be found in a paper by Mein and Rayrole (1989).

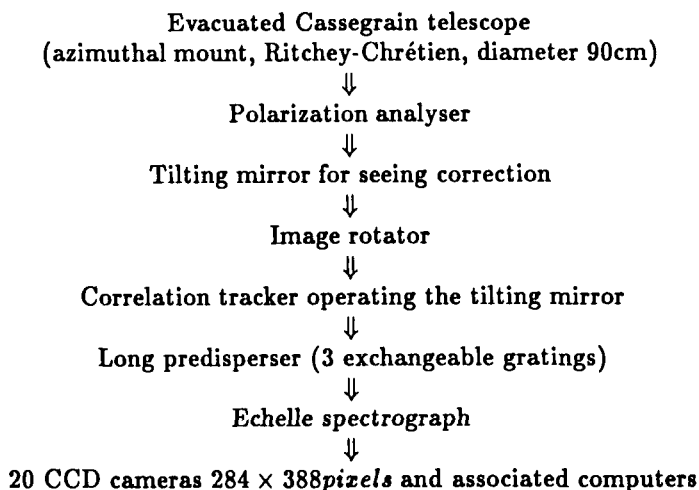
POLARIZATION ANALYSIS

Normal incidence optics are exclusively used before the polarization analysis. The entrance window is already built, and tests have shown that it is excellent from the point of view of the low birefringence. In the basic instrument, the analyser will consist of rotating plates providing 2 Stokes parameters simultaneously (successively I and V, I and U, I and Q). According to the observing modes, the two beams can be produced in the direction parallel or perpendicular to the dispersion of the spectrographs.

(1) presented by P. Mein.

OPTICAL SCHEME

The instrument consists of the following parts:



HIGH SPATIAL RESOLUTION

The site was carefully selected by the JOSO site testing campaigns. THEMIS will be erected in the vicinity of the german VTT and GCT telescopes at the Teide Observatory (Tenerife). The tower will be 22.5 meters high, and the cap-dome should be very efficient to reduce turbulence effects close to the instrument. The telescope is evacuated. The diameter 90cm with the correction of image motions is the best compromise to obtain a good image quality (0.2arcsec), taking into account

- the high values of the Fried parameter on the site (25cm expected 20% of the time)
- the need of a large useful wavelength range (1000Å)

MULTILINE AND IMAGING SPECTROSCOPY

The two long spectrographs allow many observing modes:

- high spectral resolution in 10 lines

The study of magnetic flux tubes smaller than 0.2 arcsec requires simultaneous observations in many lines, with different sensitivities to temperature. Moreover, the vertical structure of the tubes can be deduced from the analysis of several lines formed at different heights.

The first spectrograph is used as a predisperser to sort the orders of the second one. The 20 CCD cameras are arranged so that they record 2 Stokes parameters in each of the 10 lines.

- high spatial resolution in fast 2D spectroscopy (MSDP)

The first spectrograph is equipped with an echelle grating similar to the grating of the second one. The mode is subtractive, and the slit is replaced by a two-dimensional field stop. The spatial resolution is optimal (no slit-width). 2 lines are recorded simultaneously in 20 wavelengths (channels) and 2 Stokes parameters. The 2D character is very suitable for fast events analysis and coordinated campaigns with other instruments.

- fast maps of longitudinal magnetic field

This mode uses a slit in subtractive spectroscopy. The Sun is scanned by diurnal motion (typically 8 strips of 4'). The magnetic field and the doppler velocity are deduced from the method of profile-barycenter in 1 line. In the focus of the first spectrograph, the full line profiles are weighted by neutral densities increasing or decreasing linearly with the wavelength (in each point of the slit). The detectors are linear CCD arrays. The resolution is 0.5 arcsec.

This observing mode is very fast (20 mn for the full Sun), and should be suited to coordinated observations between ground and space (SOHO for example): choice of targets, flare prediction, extrapolation of magnetic field to corona,...

CONCLUSION

THEMIS should be operated in 1995-1996. It will provide accurate vector magnetic field measurements with high spatial resolution. Its flexibility allows optimizations for many scientific programs. We hope particularly that it will promote collaborations between observatories at different longitudes, for a full coverage of evolving solar phenomena.

REFERENCES

- Mein P., Rayrole, J. 1989, in Proceedings of the Tenth Sac Peak Summer Workshop, ed. O. von der Luhe, NSO, p 12.