International Joint Observing Program JOP178, 2004
October 5-19: 11 solar instruments point the same filament, THEMIS maps the vector magnetic field
This international Joint Observing Program was devoted to the study of the solar filaments (solar activity tracers, as tracers of the "neutral lines" of the magnetic field). A filament was defined as the target common to the 11 instruments ground-based or flying (DOT-La Palma, DST-Sac Peak, THÉMIS, Meudon-Solar Tower, Pic-du-Midi-Spectro Tourelle, TRACE, SOHO-CDS, SOHO-MDI, SOHO-EIT, SOLIS, ISOON), including the French-Italian CNRS(INSU)-CNR THÉMIS telescope operating in a spectropolarimetric mode. The different wavelengths permit investigation of the solar atmosphere at different depths. As for the magnetic fields, the preliminary results are: 1) the observed parasitic polarities at the filament feet, theoretically predicted; 2) the stability of the magnetic field with respect to the apparent motions of the embedded matter.

The target filament is framed on the ISOON image. In the DOT and THÉMIS images at the upper left corner, it has been rotated to horizontal. In the other images, it has its primary orientation. These images are of 2004 October 6, except the ones from the Meudon Solar Tower that are of 2004 October 7, though pointed on the same filament. The filament is like a matter "wall" standing in the Solar Corona, anchored in the surface by "feet". When seen "on the disk" as here, it absorbs the disk radiation at certain wavelengths, in particular in the Ha hydrogen line where it then appears in dark (DOT-THÉMIS-Meudon-DST images). On the contrary, it does not absorb the continuum (DOT image), where only the granulation appears. It does not absorb also the H line of ionized calcium (DOT image), but this image shows clearly the neighbor activity plages that are poorly visible only in the Ha image. In the UV images (TRACE and SOHO-EIT), the filament location appears as a dark channel, broader than it. The THÉMIS image provides the magnetic field below and around the filament, and the MSDP images display the Ha line center and wings intensity, and the radial velocity field.

THEMIS map below and around another filament (October 16). The upper layer displays the longitudinal component using the same color scale as on the previous map. The lower layer is a 3D plot of the magnetic field vectors superimposed to the Ha map that shows the filament in dark.

These vector magnetic field maps are the exact superimposition of Ha maps showing the absorbing filament and of the parasitic polarities. They play a fundamental role in the formation and stability of a filament that may evolve in "Coronal Mass Ejection" where charged particles (electrons, ions) are ejected in the interplanetary space. The prevision of such events is a science still very much in limbo, the "space weather forecast".
vector magnetic field maps obtained at the photospheric level (below the filament) by using the photospheric line of neutral iron at 6302 Å. Such an exact superimposition, that enables to see the parasitic polarities at the filament feet, has been possible only because the two lines Hα and 6302 Å are simultaneously observed, a THÉMIS facility unique in the world still for a long time. This campaign has been initiated by Thierry Roudier (CNRS-UMR5572/LAT), who has organized and managed it, with the collaboration of Sylvain Rondi (CNRS-UMR5572/LAT) at DOT, Jean-Marie Malherbe and Christian Coutard (CNRS-UMR8109/LESIA) at Meudon, Véronique Bommier (CNRS-UMR8112/LERMA) at THÉMIS (October 5-11), Brigitte Schmieder (CNRS-UMR8109/LESIA) at THÉMIS (October 12-19), Arturo López Ariste (CNRS-UPS-THÉMIS) at THÉMIS, Guillaume Molodij (CNRS-UMR8109/LESIA) at Sac Peak, of all the THÉMIS S.L. staff, in particular Alberto Sainz Dalda, and of other international collaborations: Pit Sütterlin & R. Rutten (DOT, La Palma), Steve Keil (DST, Sac Peak), Carl Henney & Ruth Kneale (SOLIS, Kitt Peak), Tin Henry (ISOON, Sac Peak), Emily Stein (SOHO/SOC), S.E. Gregory (SOHO-MDI), Stein Vidar Hagfors Haugan & Joe Gurman (SOHO-EIT), Andrzej Fludra (SOHO-CDS), Karel Schrijver (TRACE), Sara Martin. The targets have been determined by using the full sun Hα observations of Meudon Observatory (France), Big Bear Observatory (USA), Kanzelhöhe Solar Observatory (Austria), Catania Astrophysical Observatory (Italy).