



THEMIS solar telescope: A new era begins!

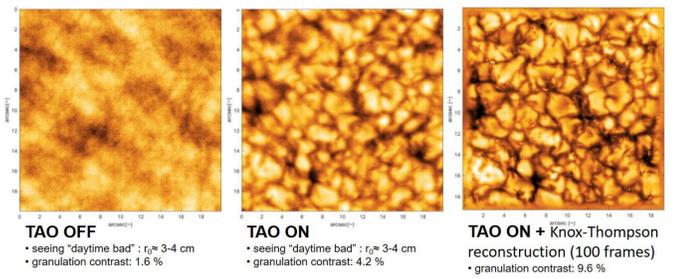
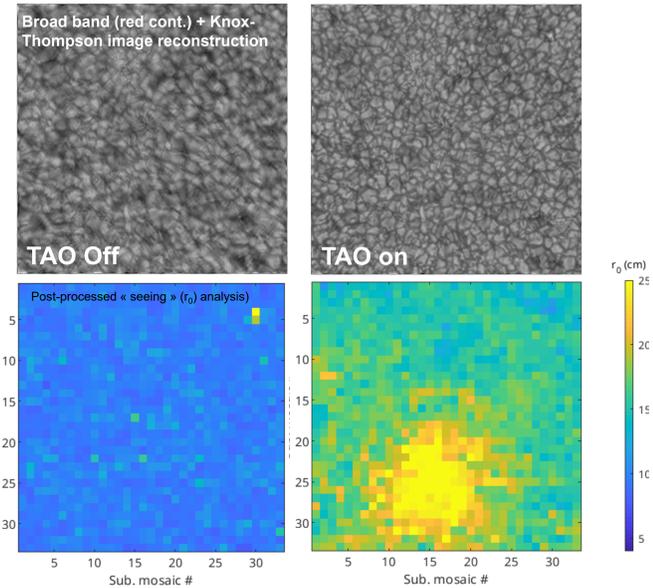
Étienne Pariat^{1,2}, Bernard Gelly¹, Richard Douet¹, Didier Laforgue¹

(1) French-Spanish Laboratory for Astrophysics in Canarias (FSLAC), CNRS-IRL2009, IAC, La Laguna, Spain
(2) LPP, Sorbonne Université, Ecole polytechnique, Institut Polytechnique de Paris, Observatoire de Paris-PSL, CNRS, Paris, France

THEMIS (Rayrole et al. 85), the French 1-m class solar telescope, has benefited from profound renovations and modification of its light path over the last 10 years (Gelly et al. 16). Thanks to a state-of-the-art solar adaptive optics, THEMIS observations can now reach the diffraction limit at 0.15", enabling to resolve details on the scale of 100 km on the Sun. THEMIS spectro-polarimetric mode has also been renewed, providing unprecedented observations by THEMIS

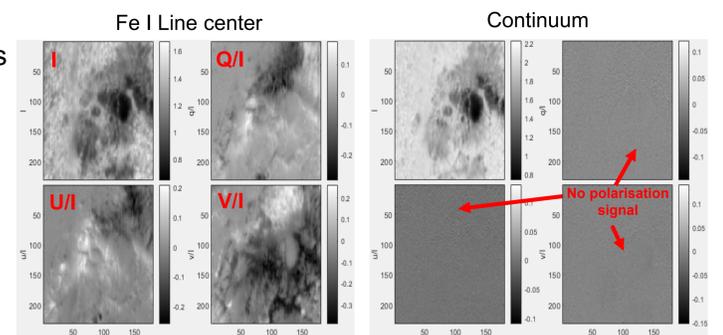
THEMIS Adaptive Optics:

- "Classical" single-deformable mirror (DM) AO
- **TAO uses innovative wavefront sensing and mirror commanding concepts (Tallon et al. 22, Thiebaut et al. 22)**
- Specifications
 - 76 sub-aperture Shack-Hartmann WFS
 - Optical-path-compatible 16mm DM
 - 97 actuators on DM
- TAO started from scratch in 2016
 - first light in December 2020
 - Closed AO loop on the Sun
 - Real time correction (RTC) running in CPU at 1250 Hz
- **With TAO, THEMIS is reaching its theoretical diffraction limit, of ~0.17" at $\lambda \sim 650$ nm!**
 - resolution on the Sun: ~125 km

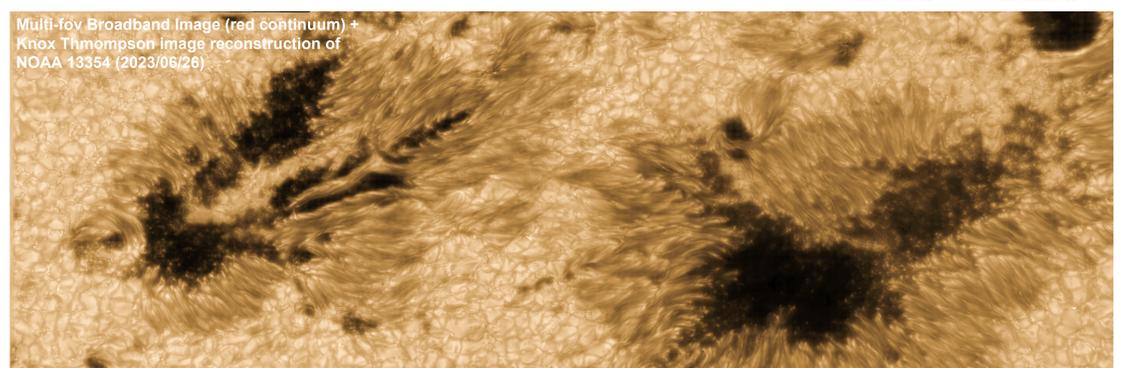
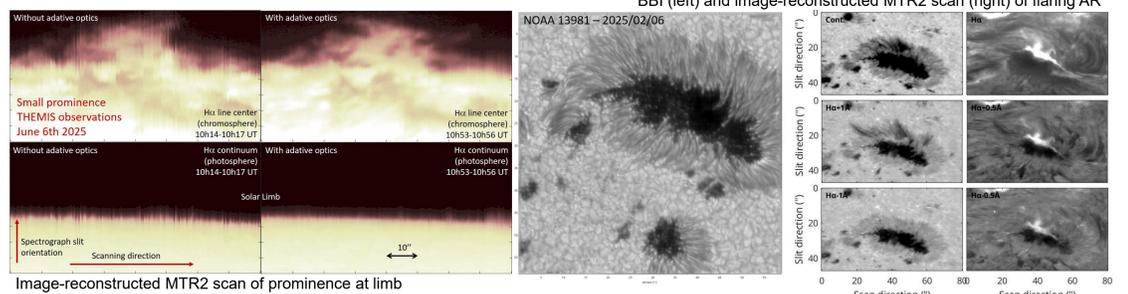


Updated polarimetry

- New AO-compatible optical path
 - new transfert optics and new derotator
- **Superimposed dual-beam with beam exchange**
 - F1 : Polarization analyzer + double Savart plates
 - Wollaston prisms ahead of spectral cameras
- **THEMIS remains strongly a polarization-calibration-free telescope**
- Routine production of Stokes map (x, y, λ , S).
 - **B maps with spatial resolution < 0.5"**



Recent highlights



Superimposed dual-beam polarimetric analyzer @ F1

New Transfer Optics & Derotator

Deformable Mirror

Field scanning mirror

to MTR2 spectrograph



<https://www.themis.iac.es>



THEMIS_SOLAR

In the spring of 2026, a new synergic instrument is going to be installed and commissioned at THEMIS, the upgraded Italian spectro-imager "Interferometric Bldimensional Spectrometer (IBIS 2.0, Ermolli et al. 24)



TERRE & UNIVERS



FSLAC International Research Lab.



ATST Action Thématique Soleil-Terre



ASHRA Action Spécifique Haute Résolution Angulaire