EST: the European Solar Telescope

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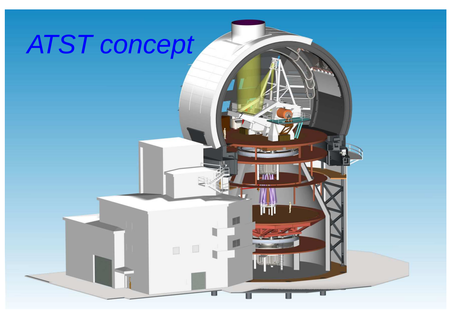
1. Background

In the **United States**, the National Research Council's decadal report "Astronomy and Astrophysics in the New Millenium", stated:

> *The first scientific goal for advancing the current understanding of solar magnetism is to measure the structure and dynamics of the magnetic field at the solar surface down to its fundamental length scale.*

The project to reach this goal is the **Advanced Technology Solar Telescope: ATST**. It is planned as a 4-m off-axis reflecting telescope in a ventilated enclosed dome. It is designed to do "everything": cover the whole wavelength range from UV to thermal IR, including coronal studies and high-precision polarimetry. The designated ATST site is on Haleakala, Hawaii.



The ATST project is waiting to be included in the federal budget (the price tag is 185 MUS$), which is expected to happen in 2009. External funding is needed and the project expects to get it from the US Air Force and Europe. An understanding of financing from international partners is then needed in October 2008. If construction starts in 2009, operations could start in 2015.

In **Europe**, the ASTRONET science vision group recommends in their draft report "A Science Vision for European Astronomy" that a principal facility for European solar astronomy is to be built:

> *A large-aperture (3–5 m) solar telescope with adaptive optics and integral-field spectropolarimeters to observe astrophysical processes at their intrinsic scales, and thereby observe the interaction of magnetic fields and plasma motions in the solar atmosphere.*

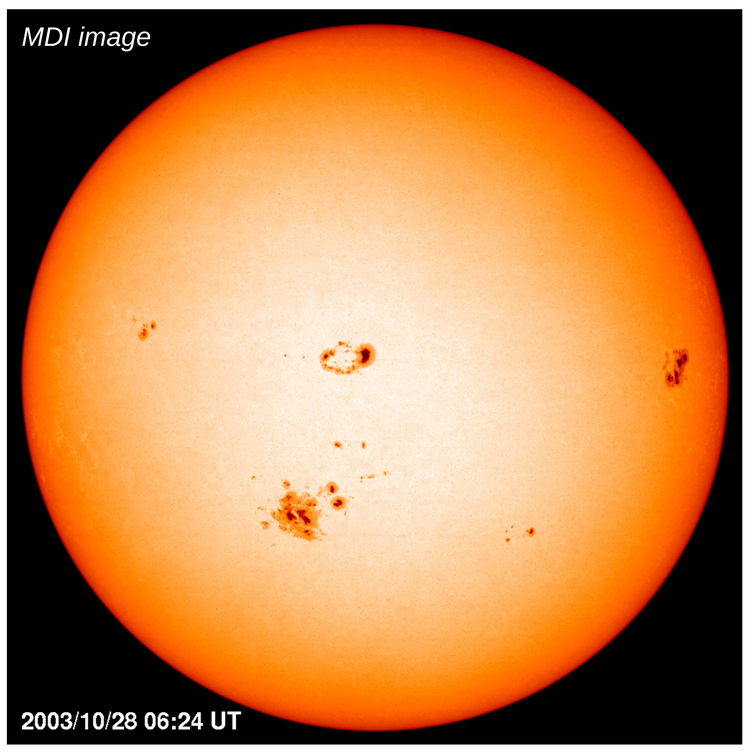
2. EAST

The **European Association of Solar Telescopes** was formed in the early 2007. Its main goal is to construct a new large-aperture solar telescope: the European Solar Telescope (EST).

3. EST design study

An application has been submitted to the FP7 infrastructure program for funding a **three-year design study** of the EST. It has received favourable grades and negotiations of a contract with the European Commission is now underway. The contribution from the commission is expected to be 3.2 MEUR.

The design study is lead by the **Instituto de Astrofísico de Canarias**. There are 28 participating institutes and industrial partners from 10 countries.



4. EST Properties

The EST is currently envisaged as a **3–5 m reflector**. It would have an **open and domeless** design, relying on wind to avoid heated air in the light path. Its instrumentation will be aimed at observations of solar features with many instruments simultaneously. This improves photon efficiency and diagnostic capabilities relative to other telescopes.

The EST will not be designed for coronography. Thus it can have on-axis optics which makes the crucial polarimetry calibration much easier.

For such a large aperture, **multi-conjugate adaptive optics (MCAO)** is most likely necessary and a systematic investigation of the high-altitude seeing properties is therefore included in the EST design study programme.

A **site-characterisation campaign** is also needed to compare the two candidate sites – the Roque de los Muchachos Observatory on La Palma and the Teide Observatory on Tenerife – as well as differential testing of specific locations on the two mountains.

5. Swedish participation

The Institute for Solar Physics of the Royal Swedish Academy of Sciences will lead the workpackage related to the construction and use of **wide-field wavefront sensors** that will measure differential seeing at the SST on La Palma and the German VTT on Tenerife. The data acquired from this will be used to design the multi-conjugate adaptive optics (MCAO) system. The institute will also participate in the work on the **optical design of the telescope**, the **wavefront reconstruction technique needed for the MCAO**, the **tunable filter spectro-imager**, the **grating spectropolarimeters**, and the **seeing measurements** using SHABARs for the site characterisation.