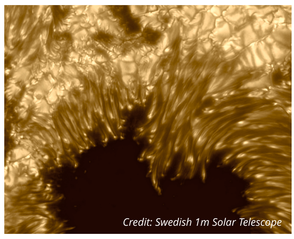
The European Solar Telescope

Observing the Sun like never before

EST will be the largest solar telescope ever built in Europe. With a 4-metre primary mirror and state-of-the-art technology, it will furnish astronomers with a unique tool to understand the Sun and how it determines space weather conditions

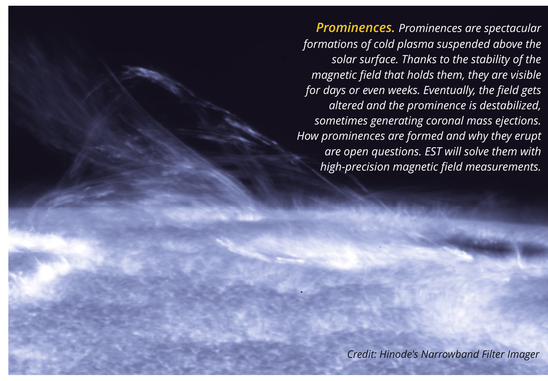
EST science. Understanding our active Sun

The main goal of EST is to investigate the structure, dynamics, and energetics of the lower solar atmosphere, where magnetic fields continually interact with plasma, and magnetic energy is sometimes relased in powerful explosions.
This requires observing fundamental processes at their intrinsic scales - less than 30 kilometres on the solar surface. To that end, EST is equipped with a 4-metre mirror, advanced adaptive optics, and a suite of innovative instruments for high-sensitivity, multi-wavelength spectropolarimetric observations.
EST will be used to peer into the workings of the solar atmosphere with unprecedented detail and solve long-standing questions such as: the structure and evolution of solar magnetic fields, including sunspots; the emergence of magnetic fields through the solar surface; the dynamics and heating of the chromosphere; the trigger mechanism of flares; the magnetic coupling of the solar atmosphere.



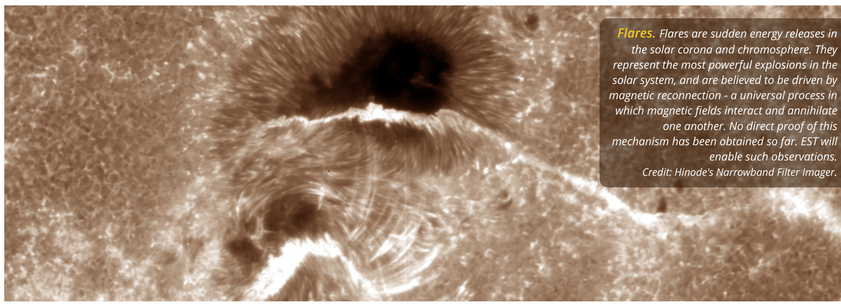
Credit: Swedish 1m Solar Telescope

Sunspots. *Despite having been observed for centuries, sunspots are still enigmatic; we do not know why their penumbrae have a filamentary appearance or how they form and decay. The structure of sunspots is dictated by the interaction between their strong magnetic fields and the plasma, but the details are poorly understood due to the small spatial scales involved. EST will resolve those scales, shedding new light on the nature of these fascinating objects.*



Prominences. *Prominences are spectacular formations of cold plasma suspended above the solar surface. Thanks to the stability of the magnetic field that holds them, they are visible for days or even weeks. Eventually, the field gets altered and the prominence is destabilized, sometimes generating coronal mass ejections. How prominences are formed and why they erupt are open questions. EST will solve them with high-precision magnetic field measurements.*

Credit: Hinode's Narrowband Filter Imager



Flares. *Flares are sudden energy releases in the solar corona and chromosphere. They represent the most powerful explosions in the solar system, and are believed to be driven by magnetic reconnection - a universal process in which magnetic fields interact and annihilate one another. No direct proof of this mechanism has been obtained so far. EST will enable such observations.*
Credit: Hinode's Narrowband Filter Imager.

EST. A technological challenge

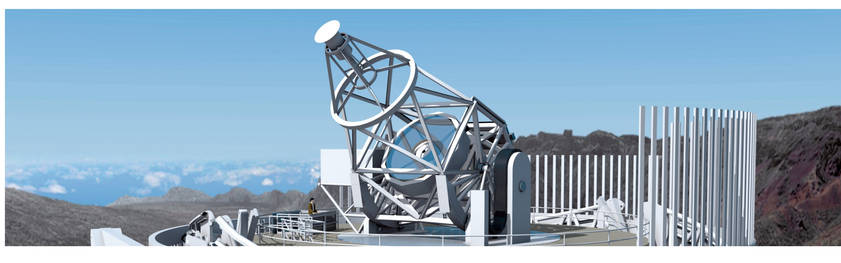
EST represents a formidable technological challenge in many critical areas such as thermal control, adaptive optics, and instrumentation. Innovative solutions are being developed for the EST by the EAST partner institutions, in close collaboration with European industry.
The construction of EST offers a unique opportunity for technological developments and industrial contracts to enhance European expertise in the design and fabrication of mechanical structures, large-format optical elements, high-speed detectors, precision scientific instrumentation or data management systems.

Multi-Conjugate Adaptive Optics (MCAO)

Thermal variations on small scales create turbulence in the Earth's atmosphere and degrade the image quality. To minimise this problem, a MCAO system has been embedded in the EST design from the outset. It will correct the wavefront distortions arising from two separated layers of the atmosphere. A vigorous development program is being carried out by EST partners to improve the performance of MCAO deformable mirrors and wavefront sensors.

New instruments for 2D solar spectro-polarimetry

The properties of solar magnetic fields can be inferred through the analysis of spectropolarimetric observations. Slit spectrographs produce the most sensitive measurements, but they are slow because the solar surface needs to be scanned step-by-step to create 2D maps. EST will overcome this problem with innovative tunable etalons and Integral Field Units based on multi-slit image slicers or microlens arrays. Prototypes are currently being developed by the EST partners.



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