

The Very Large Telescope —  
The World's Most Advanced Visible-light Astronomical Observatory



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The Very Large Telescope array (VLT) is the flagship facility for European ground-based astronomy at the beginning of the third millennium. It is the world's most advanced optical instrument, consisting of four Unit Telescopes with main mirrors 8.2 metres in diameter and four movable 1.8-metre Auxiliary Telescopes. The telescopes can work together, in groups of two or three, to form a giant VLT Interferometer (VLTI) allowing astronomers to see details up to 25 times finer than with the individual telescopes. The light beams are combined in the VLTI using a complex system of mirrors in underground tunnels where the light paths must be kept equal to distances less than 1/1000 mm over a hundred metres. With this kind of precision the VLTI can reconstruct images with an angular resolution of milliarcseconds, equivalent to distinguishing the two headlights of a car at the distance of the Moon.

The 8.2-metre Unit Telescopes can also be used individually to obtain images of celestial objects as faint as magnitude 30 in a one-hour exposure. This corresponds to seeing objects that are four billion times fainter than those visible to the naked eye.

The VLT instrumentation programme is the most ambitious ever conceived for a single observatory. It includes large-field imagers, adaptive optics corrected cameras and spectrographs, as well as high resolution and multi-object spectrographs and covers a broad spectral region, from deep ultraviolet (300 nm) to mid-infrared (20  $\mu\text{m}$ ) wavelengths. The 8.2-metre telescopes are housed in compact, thermally controlled buildings, which rotate synchronously with the telescopes. This design minimises any adverse effects on the observing conditions, for instance, from air turbulence in the telescope tube, which might otherwise occur due to vari-

ations in temperature and wind flow. The first of the Unit Telescopes, Antu, began routine scientific operations on 1 April 1999. Today, all four Unit Telescopes and all four Auxiliary Telescopes are operational.

The VLT has made an undisputed impact on observational astronomy. It is the most productive individual ground-based facility, and results from the VLT have led to the publication of an average of more than one peer-reviewed scientific paper per day. VLT contributes greatly to making ESO the most productive ground-based observatory in the world. The VLT has stimulated a new age of discoveries, with several notable scientific firsts, including the first image of an exoplanet, tracking individual stars moving around the super-massive black hole at the centre of the Milky Way, and observing the afterglow of the furthest known gamma-ray burst.

Although the four 8.2-metre Unit Telescopes can be combined in the VLTI, they are mostly used for individual observations and are only available for interferometric observations for a limited number of nights every year. But four smaller, dedicated Auxiliary Telescopes (ATs) are

available to allow the VLTI to operate every night. The ATs are mounted on tracks and can be moved between precisely defined observing positions from where the beams of collected light are combined in the VLTI.

The ATs are very unusual telescopes, as they are self-contained in their ultra-compact protective domes, and travel with their own electronics, ventilation, hydraulics and cooling systems. Each AT has a transporter that lifts the telescope and moves it from one position to the other.

The VLT hotel, the Residencia, is an award-winning building, and served as a backdrop for part of the James Bond movie *Quantum of Solace*.

*"This is a tribute to the human genius. It is an extraordinary contribution to the development of knowledge, and as Commissioner for Research, I am proud that this is a European achievement."*

Philippe Busquin, European Commissioner for Research (2000–2005)

[www.eso.org/vlt](http://www.eso.org/vlt)



Bird's eye view of the Very Large Telescope

## About ESO

ESO, the European Southern Observatory, is the foremost intergovernmental astronomy organisation in Europe. It is supported by 14 countries: Austria, Belgium, the Czech Republic, Denmark, France, Finland, Germany, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland and the United Kingdom.



ESO carries out an ambitious programme focused on the design, construction and operation of powerful ground-based observing facilities enabling astronomers to make important scientific discoveries. ESO plays also a leading role in promoting and organising cooperation in astronomical research.

ESO operates three unique world-class observing sites in the Atacama Desert region of Chile: La Silla, Paranal and Chajnantor.

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