

# The ESO Survey Telescopes — Mapping the Sky in the Finest Detail



European Southern Observatory

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Two powerful survey telescopes — the Visible and Infrared Survey Telescope for Astronomy (VISTA) and the VLT Survey Telescope (VST) — are sited at ESO's Paranal Observatory in northern Chile. They are arguably the most powerful dedicated imaging survey telescopes in the world and greatly increase the scientific discovery potential of the Paranal Observatory.

Many of the most interesting astronomical objects — from tiny, but potentially dangerous, near-Earth asteroids to the most remote quasars — are rare. Finding them is like looking for a needle in a haystack. The largest telescopes, such as ESO's Very Large Telescope (VLT) and the NASA/ESA Hubble Space Telescope, can only study a minute part of the sky at any one time, but VISTA and the VST are designed to photograph large areas quickly and deeply. The two telescopes are busy performing a total of nine carefully designed surveys and creating vast archives of both images and catalogues of objects that will be harvested by astronomers for decades to come.

The survey telescopes have a vital role in preparing the way for future facilities such as the European Extremely Large Telescope (E-ELT) and the James Webb Space Telescope (JWST).

The surveys are producing science directly, but, in addition, interesting objects discovered by the survey telescopes are forming targets for detailed study both by the neighbouring VLT and by other telescopes on Earth and in space. Both survey telescopes are housed in domes close to the VLT and share the same exceptional observing conditions as well as the same highly efficient operational model.

VISTA has a main mirror 4.1 metres in diameter and is by far the largest telescope in the world dedicated to surveying the

sky at near-infrared wavelengths. VISTA was conceived and developed by a consortium of 18 UK universities led by Queen Mary, University of London, and its construction was managed by the UK Science and Technology Facilities Council's UK Astronomy Technology Centre in Edinburgh. VISTA was given to ESO as an in-kind contribution as part of the UK's accession agreement.

VISTA's main mirror is the most highly curved mirror of its size ever made and its construction is a formidable accomplishment. At the heart of VISTA is a 3-tonne camera containing 16 special detectors sensitive to infrared light with a combined total of 67 megapixels. It has the widest coverage of any astronomical near-infrared camera.

Observing at wavelengths longer than those visible to the human eye allows VISTA to study objects that are impossible to see in visible light because they are cool, obscured by dust clouds or because their light has been stretched towards redder wavelengths by the expansion of space during the light's long journey from the early Universe.

VISTA can detect and catalogue objects over the whole southern sky with a sensitivity that is 40 times greater than achieved with earlier infrared sky surveys such as the highly successful Two Micron All-Sky Survey. The VISTA surveys started early in 2010.

The VST is a state-of-the-art 2.6-metre telescope equipped with OmegaCAM, a monster 268-megapixel CCD camera with a field of view four times the area of the full Moon. It complements VISTA and is surveying the visible-light sky.

The VST was the result of a joint venture between ESO and the Capodimonte Astronomical Observatory (OAC) of Naples, a research centre of the Italian

National Institute for Astrophysics (INAF). The VST became operational at Paranal early in 2011.

The scientific goals of the surveys include many of the most exciting problems in astrophysics today, ranging from the nature of dark energy to the threat of near-Earth asteroids. Large teams of astronomers throughout Europe are conducting the surveys. Some cover most of the southern sky while others focus on smaller areas.

Both VISTA and the VST are producing huge quantities of data — far more every night than all the other instruments on the VLT put together. A single picture taken by VISTA has 67 megapixels and images from OmegaCam on the VST have 268 megapixels. Together, the two survey telescopes produce more than 100 terabytes of data per year.



The VLT Survey Telescope (VST) at Cerro Paranal.

## About ESO

ESO, the European Southern Observatory, is the foremost intergovernmental astronomy organisation in Europe. It is supported by 16 countries: Austria, Belgium, Brazil, the Czech Republic, Denmark, France, Finland, Germany, Italy, the Netherlands, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom, along with the host country of Chile.

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

## ESO

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