3 TECHNOLOGY TO THE RESCUE

ESO'S NEW TECHNOLOGY TELESCOPE

The octagonal enclosure housing the European Southern Observatory's 3.6-metre New Technology Telescope (NTT) at Cerro La Silla in northern Chile was a technological breakthrough when completed in 1989. The telescope chamber is ventilated by a system of flaps that makes the air flow smoothly across the mirror, resulting in very sharp images. The NTT was also a testbed for fully computer-controlled alt-azimuth mounts, thin mirrors, and active optics.

Progress in telescopic astronomy would have come to a grinding halt in the second half of the twentieth century if it weren't for the digital revolution. Powerful computers have enabled a wealth of new technologies that have resulted in the construction of giant telescopes, perched on high mountaintops with monolithic or segmented mirrors as large as swimming pools. Astronomers have even devised clever ways of undoing the distorting effects of atmospheric turbulence and of combining individual telescope mirrors into virtual behemoths with unsurpassed eyesight. The optical wizardry of 21st century telescope building has ushered in a completely new era of ground-based astronomical discovery.

“Just as modern cars don’t look like Model T-Fords, current telescopes look very different from traditional instruments”

THE NEW TECHNOLOGY TELESCOPE PEERS INTO A STAR-FORMING REGION

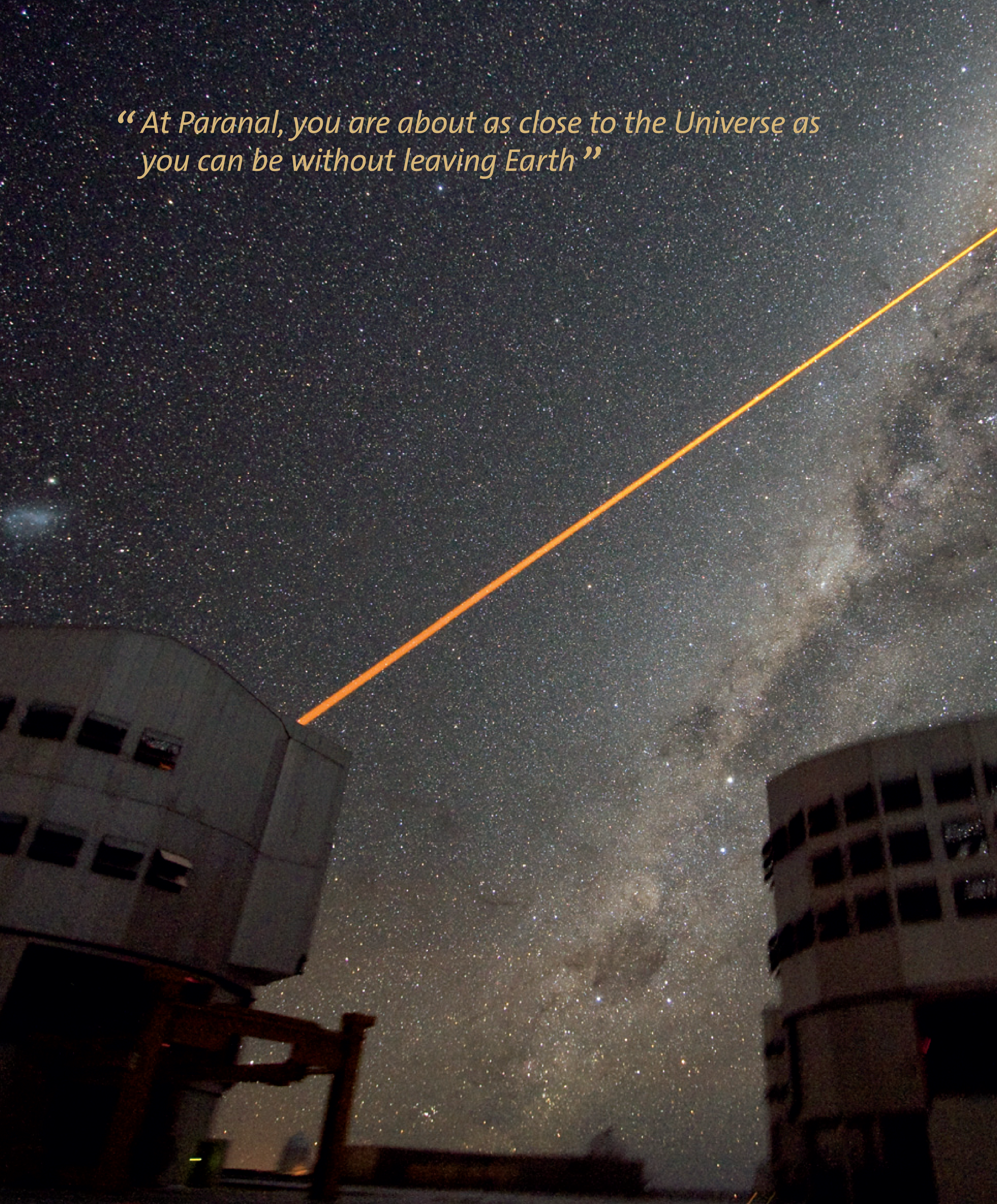
A giant star-forming region known as the Omega Nebula reveals its dusty secrets to the near-infrared electronic eyes of ESO’s New Technology Telescope. Located 5000 light-years away in the constellation of Sagittarius, the Archer, the Omega Nebula contains numerous young stars that are invisible to optical telescopes because of obscuring dust. At near-infrared wavelengths, however, most of the dust becomes transparent.

Just as modern cars don’t look like Model T-Fords, current telescopes look very different from traditional instruments like the 5-metre Hale Telescope. Most obviously they have much smaller mounts. The mount is the support structure for the telescope tube. Astronomers want to be able to point a telescope wherever they like, so the mount consists of two perpendicular axes. By judiciously rotating the telescope about these two axes it can be trained on any point in the sky. But to keep an object in the eyepiece, the telescope also has to move continuously. The Earth’s daily rotation means that not only the Sun, but the stars appear to rise in the east and set in the west. A telescope needs to track this apparent daily motion of the sky to keep the star under observation in the field of view.

Tracking the sky’s motion becomes very easy if one of the two axes of the telescope mount points toward the Pole Star, the point on the sky about which the stars appear to rotate. To keep the stars in view, the telescope only has to rotate around this polar axis at the same constant speed as the stars. Known as an equatorial mount, this design was used in the big telescopes that were built in the first half of the twentieth century, but such mounts take up a great deal of space and are very heavy.

In contrast, the alt-azimuth mount, with one vertical and one horizontal axis, is much more compact. Here, the telescope is pointed like a cannon. Choose your bearing and elevation, and away you go. But tracking the motion of the sky becomes much harder. The telescope has to rotate at varying speeds around both axes at once, which needs precise computer control — something that only became available in the 1970s.

All the current big telescopes have computer-controlled alt-azimuth mounts. They are cheaper to build, and they fit into smaller domes — another cost-saving factor. Take the twin Keck Telescopes on Hawaii, for example. Their 10-metre mirrors collect four times more light than the Hale Telescope, but the Keck domes are smaller than the one on Palomar Mountain!


“At Paranal, you are about as close to the Universe as you can be without leaving Earth”