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First telescope with active optics

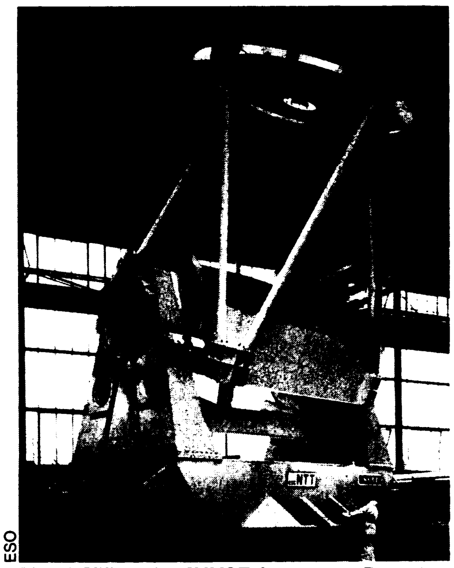
The world's first telescope for general astronomical use with "active" computer-controlled optics is about to be installed at the European Southern Observatory (ESO) at Cerro La Silla, Chile. Unlike traditional telescope mirrors, the 3.58-meter mirror of this New Technology Telescope (NTT) does not depend on the thickness of glass to keep its shape. It is only 24 centimeters thick, and is thus quite flexible. Therefore, its shape will be maintained by active supports pressing against its back under the control of a computer. ESO astronomers hope to begin observations with the telescope by the end of this year.

A similar principle of active support is used on the 10-meter Keck telescope being built on Mauna Kea in Hawaii by the California Institute of Technology and the University of California, but this much larger project will take a few more years to complete. The NTT is a forerunner and testing ground for design ideas for ESO's Very Large Telescope, a planned array of four 8-meter mirrors that will be able to work separately or together.

The building for the NTT—featuring an unusual octagonal design that was determined by wind-tunnel tests at the Technical University of Aachen, West Germany—was constructed by a consortium of Italian companies (Mecnafer of the Mestre suburb of Venice, Zollet of Belluno and Ansaldo Componenti of Genoa). Shipped from Europe in knocked-down form, it arrived at Valparaiso, Chile, early in February, and was trucked to La Silla. ESO estimates it will take about six months to assemble it on the mountain.

Traditionally, an optical telescope sits in a round building with a rotating dome on top. In the dome is a slit, the cover of which is pulled back to expose the telescope to the sky. For the NTT, the whole building will revolve, and it is designed to expose the telescope to the external environment as much as possible but to protect it from strong winds and dust. The floor of the building will be actively cooled to keep the interior temperature the same as that of the exterior. The reason for all this exposure and cooling is to minimize air turbulence around the telescope. Temperature differences are a major cause of such turbulence. With minimal turbulence, the NTT's images should be significantly sharper than those of telescopes of comparable size.

A rotating 350-ton building requires some large bearings. One for this project, manufactured by the RKS company of France, is a roller bearing 7 meters in diameter. (The first telescope with a rotating building seems to have been the Multiple Mirror Telescope on Mt. Hopkins in Arizona, completed about a decade ago.)



ESO

The NTT at the INNSE factory in Brescia, Italy, where it was built.

The mechanical structure of the telescope itself, built by the INNSE company of Brescia, Italy, will be disassembled and shipped to Chile shortly. It, too, involves a number of innovations that exemplify recent trends in telescope design.

Usually optical telescopes have been hung in what is called an equatorial mounting, with one rotation axis parallel to the plane of the celestial equator and the other parallel to the line between the celestial north and south poles. When pointing was done mainly by eye and moving from target to target was often by hand, this arrangement made pointing and moving the telescope easier, but it complicated the stresses the structure, and particularly the mirror surface, had to bear.

The trend among modern telescopes, including the NTT, is to use an altazimuth mount, in which one rotation axis is horizontal, the other vertical. This simplifies the stresses but makes pointing and tracking very complicated. However, the mechanical structure of the NTT is also computer controlled, and the computer has no problem doing the necessary calculations quickly enough. ESO astronomers expect to be able to point the telescope with an accuracy of 1 second of arc, which they say is "a figure unsurpassed by any other existing telescope of this size." The computer system may even permit remote control of the telescope from ESO headquarters in Garching, West Germany.

The NTT project began in 1982 when Switzerland and Italy joined ESO. ESO decided to use the entrance fees from these two countries for the project — which will cost an estimated 25 million German marks, or $15 million, and is intended to be the world's finest telescope of the 4-meter class at one-third the cost of a conventional project.

— D.E. Thomsen

DOE to limit radwaste operations

Water leaking into the United States' first underground repository for nuclear waste has forced the Department of Energy (DOE) to limit its plans to place large amounts of waste into the facility starting in October.

Located near Carlsbad, N.M., the Waste Isolation Pilot Plant (WIPP) repository was scheduled during the next five years to accept 125,000 drums of plutonium-contaminated waste generated by the Defense Department's weapons program. But in response to recommendations last week from the National Academy of Sciences, DOE will temporarily fill only 3 percent of the repository — 20,000 to 30,000 drums—as part of a series of tests on the water problem and other issues.

Until these tests can satisfy the questions of the Academy, the DOE will not continue loading the other 100,000 drums that are part of the pilot phase of the repository operation, says Wendell Weart of the Sandia National Laboratories in Albuquerque, N.M., who is in charge of the testing program at the repository. He believes the studies may be completed in as little as a year and a half.

"If we can in fact show that we have resolved these uncertainties in a year and a half and then proceed with the other waste, then it really isn't that major an impact," says Weart. "If we cannot gain the Academy's support in a year and half, then it would start to impact the waste proceedings."

Carved from salt beds about 2,000 feet below ground, the repository was designed so that the rooms of ductile salt would slowly collapse and encapsulate the waste during the next hundred years. It has become apparent in the last three years that the salt beds are more saturated with water than had originally been assumed. Most of the moisture presently seeping into the repository is removed by ventilation systems before the water accumulates on the floor.

Recently, a state commission and an independent scientific panel voiced concern that after the repository is sealed, water might begin to fill the rooms before they have collapsed completely. If the chambers close too slowly, water might dissolve the steel drums and turn the waste into a mobile radioactive slurry that could potentially reach the surface (SN: 1/23/88, p.54). Until now, however, DOE has denied that the water problem necessitated any change in scheduling.

Aside from addressing the water issue, government tests will measure the amount of gas generated from the decomposition of the waste, which is mostly contaminated trash. Gas from the waste may slow the collapse of the salt walls.

— R. Monastersky