ASTRONOMY

Ten Years at Mt. Palomar

In the ten years since the 200-inch telescope atop Mt. Palomar first began functioning, astronomers have learned much about the sun, stars, planets and other celestial bodies.

➤ THE WORLD'S largest telescope, the 200-inch mirror atop Mt. Palomar in California, is aimed at almost every kind of object in the sky.

It has been turned on an invisible star with the smallest mass known, about one-twelfth that of the sun, and the largest yet discovered, the giant Alpha Herculis, 200-000 times the solar diameter, which is visible to the naked eye.

Many heavenly objects whose light is gathered by the giant mirror, however, are not visible with any other telescope. Most of them are not single stars like the sun at all, but swarms of millions and millions of stars formed into clusters known as galaxies.

Yet even these huge clusters of billions of suns are so far away their light can be caught only on photographic plates. Studies of the light from such far-distant systems give scientists clues to the age and structure of the universe.

One finding, so unexpected much more research is being performed to confirm it, is that the rate at which the universe appears to be expanding seems to be slowed down at the very limits of space visible with the 200-inch.

Instead of accelerating at a rate that grows faster and faster directly with distance, there is some evidence the rate falls off for the very faintest objects, which are thought to be both the oldest and the farthest away. Their age is believed to be five billion years, and their distance about two billion light years, one light year being the distance light traveling at 186,000 miles a second covers in one year.

Law of the Red Shift

These far-away galaxies still seem to be moving away from the solar system with more speed than the nearer ones. It is the rate of acceleration with growing distance that shows an apparent slowdown. The so-called law of the red shift by which a star's light is shifted toward the red end of the spectrum the farther away it is, does not seem to hold at the fringes of the visible universe.

This red shift indicates the farthest galaxies are speeding outward at a velocity about one-fifth that of light. However, measurements on other faint galaxies show rates of recession that would be expected if the universe were expanding at a uniform rate.

These conflicting observations are now being resolved by further studies.

Dr. Ira S. Bowen, director of Mount Wilson and Palomar Observatories, said only a few galaxies can be used for this purpose. Some of these most distant clusters are in good position for viewing either in the fall or spring for a short time only, Dr. Bowen pointed out, so it is taking astronomers quite a long time to confirm the seeming decrease in expansion rate or to show it in error.

Astronomers who use the 200-inch telescope actually make their "discoveries" in Pasadena some 130 miles away. Only on nights when they are taking photographs with one of the three telescopes on the mountain top, or listening to the radio waves broadcast from the heavens, do staff members or visiting astronomers make the nearly four-hour trip from Pasadena to Mt. Palomar.

Usually five or six consecutive nights are allotted to one person for observing with the 200-inch. This is because special equipment is often needed and adjusting the devices is time-consuming.

More than enough photographs can be taken during these few nights, however, to keep an astronomer busy in Pasadena for the weeks between observing times.

After arriving at the 5,600-foot plateau, an observing astronomer spends the afternoon making sure everything is in readiness for the first night's work.

No Moonlight for Photography

Some astronomical studies, those requiring direct photography, can be made only on clear, moonless nights. Moonlight interferes less with catching a particular star's light as it is fanned out by the spectrograph, so such studies are made on nights when the moon is bright. About one-half the observing time of the 200-inch is devoted to spectroscopic work.

Although only one astronomer uses the 200-inch at any time, a night assistant is always on duty, not only for safety's sake but also to help keep the giant telescope precisely aimed. The telescope's time is considered much too valuable to be used for visual studies, but to make sure they are photographing the desired star, astronomers occasionally take a look through the 200-inch.

To insure that the telescope will have the same temperature as the outside air, the huge dome is opened as early as possible in the evening, often half an hour before sunset. On a mile-high mountain, even in southern California, temperatures can drop quite low, so observing astronomers and their assistants wear extra-warm clothing and heavy gloves, as well as thick-soled shoes for insulation from the concrete floors.

Besides the 200-inch telescope on Mt. Palomar, there are two more optical telescopes and one radio telescope.

Of these, the 48-inch Schmidt telescope, with its wide field of view, is probably the best known. The other optical instrument is an 18-inch Schmidt. Using the 48-inch, Mt. Wilson and Palomar astronomers have completed a photographic survey, in both red and blue light, of all the heavens that can be seen from Mt. Palomar. This study occupied virtually the whole observing time of the instrument for seven years starting in July, 1949.

The sky survey, which recorded objects throughout a volume of space about 25 times as large as previously, was financed by the National Geographic Society. The photographs have been reproduced in atlas form, available to interested institutions.

With the 48-inch Schmidt, areas of the sky equal to that of 200 moons can be photographed at one time. Interesting objects located on such plates are then scanned in detail by the 200-inch. A Schmidt telescope has a correcting lens through which the star's light passes before reaching the mirror.

Large Schmidt-type telescopes have no provision for use by the human eye, but are used entirely as cameras.

Radio Astronomy Program

The radio telescope has a 32-foot antenna. Its operation marks the beginning of a long-term radio astronomy program by the California Institute of Technology, which, with the Carnegie Institution of Washington, manages Mt. Wilson and Palomar Observatories.

This equipment will serve mainly as a pilot model and as a training instrument for astronomers and electronic specialists. The observatories also operate a pair of radio astronomy antennas. Both of them are 90 feet in diameter and they are located in Owens Valley on the California desert.

The two large antennas are steerable and mounted on railroad flat-cars on 1,600-foot-long rails set in north-south and east-west directions and meeting at a point. With this set-up, the instruments can be operated separately or as an interferometer whose axis and spacing can be varied over considerable ranges, giving them exceptionally high ability to distinguish between sources of radio waves that are close together.

These radio telescopes are teamed up with the Schmidt telescopes and the 200-inch in programs planned to increase man's knowledge of the universe.

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GEOPHYSICS

IGY Scientists Vote To Extend Activities

➤ THE CURRENT International Geophysical Year, scheduled to end Dec. 31, has been extended. A new program of further research in geophysics and related sciences will begin on Jan. 1, 1959.

Several of the scientific groups voted to expand research activities and requested an indefinite extension of cooperative studies. Scientists at the fifth IGY meeting in Moscow agreed to call the new program "International Geophysical Cooperation, 1959."

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