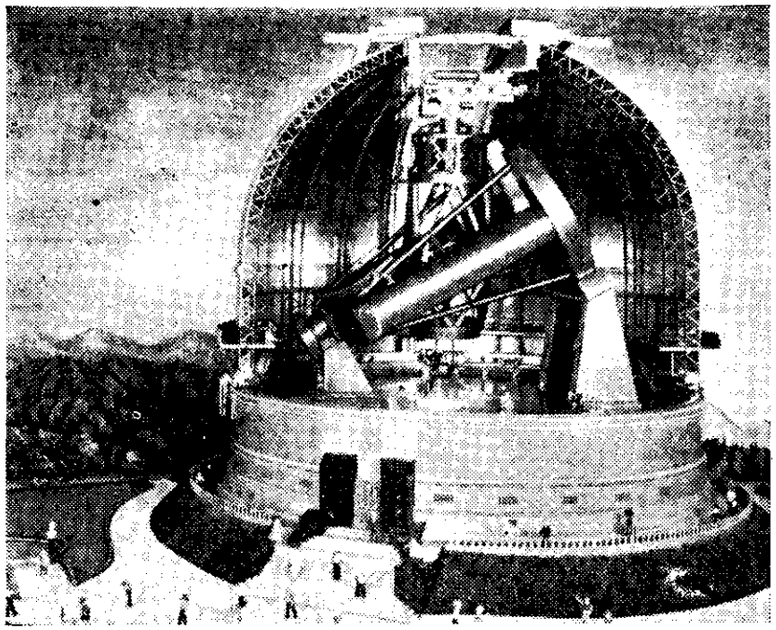


SCALE MODEL of the observatory, showing the telescope tube and mounting, and the general layout of the equipment

find headlines in your newspaper such as "Martians Construct Strange Edifice," or "Lunar Craters Grow Bigger," or "Six New Comets Last Night."

There is one other important consideration worth mentioning about the design of the telescope. Amateur photographers know that a "fast" lens has a short focal length. The large concentration of light on a relatively small image means a reduction of exposure time. This principle has been applied to make the 200-inch mirror more effective. The ratio of its focal length to diameter (or aperture) is only 3.3, so the focal length (about 55 feet) is comparatively short. This property of extreme light concentration will make it incomparable in the photography of very faint objects. By other supplementary mirrors, higher focal ratios of 16 and 30 can be used in work on any source which gives enough light, such as the sun, moon and nearer planets. These longer focal lengths give a higher magnification. The observations will be mainly of two kinds—direct photographs of selected areas or faint objects, and spectograms. A spectrogram is a photographic record of the analysis of the radiation received. It shows the intensities and wavelengths of the component radiations.

Two Kinds of Telescope

Telescopes fall naturally into two classes; the refractors which use a lens (like the eye), and the reflectors which use a mirror. It has not proved practicable to construct successfully a lens greater than 40 inches in diameter, which is the size of the one in the Yerkes Observatory telescope. The true function of a large telescope may be made clear by simple considerations. Since the only light which enters the instrument is that which falls on the lens or mirror, as the case may be, this should be as large as possible. When fully dilated the pupil of your eye has a diameter of about a third of an inch. In that condition it can record the light of a few thousand bright stars. Dimmer stars are swallowed up on the black background. If your eye had a diameter of just over two inches—the size of Galileo's lenses—the light gathering area would be increased 60 times, and half-a-million stars could be viewed. The area of the Mt. Wilson mirror brings into photographic view over 1000 million stars. By doubling the diameter of the mirror the light-gathering power is increased four-fold, so that the Mt. Palomar telescope is expected to add hundreds of millions of stars to the number previously observable.

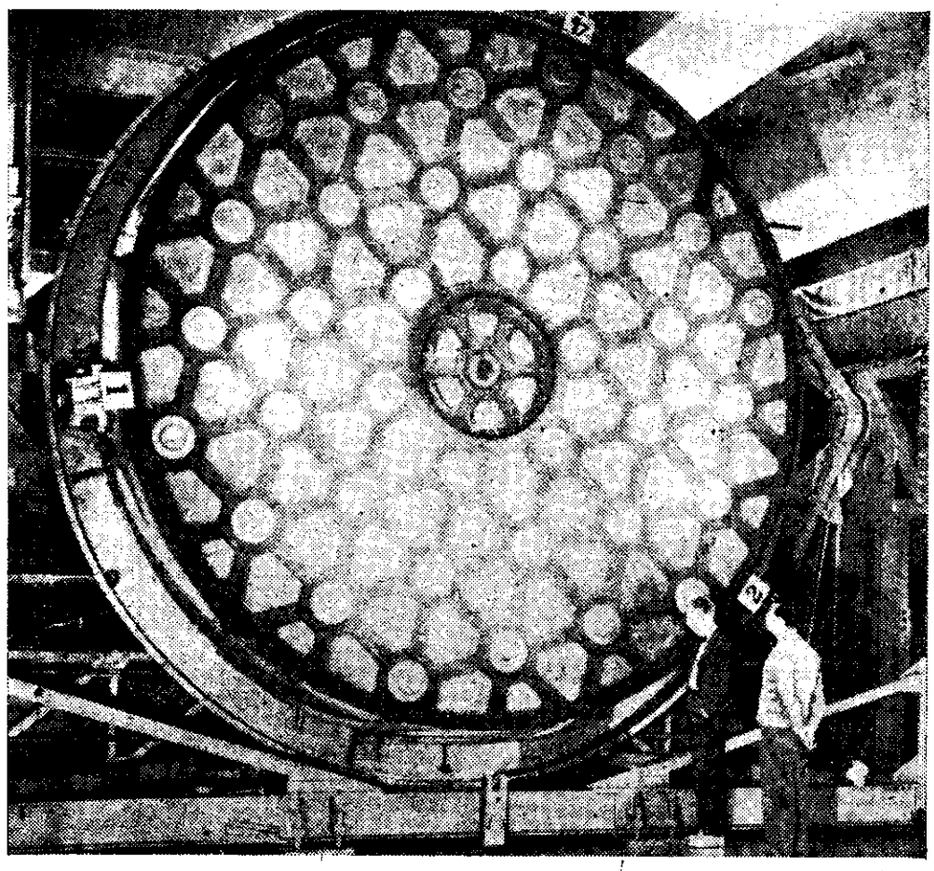
About a century ago Lord Rosse excited the wonder of the world by constructing his great six-foot reflector in Ireland. He secured a two-fold advance: he could see fainter stars, and he saw them more clearly defined. Nebulae which in smaller telescopes appeared as hazy masses of gas were "resolved" into myriads of tiny faint stars. There were, however, nebulae which his telescope could not resolve, and presumably others which were too faint to be located at all. The situation was completely changed as the result of three important discoveries. The spectroscope showed that some of the nebulae, at any rate, were masses of luminous gas, not collections of stars. Later, photography provided an alternative to increasing the size of telescopes by prolongation of exposure time. The third discovery was a method of measuring the distances of stars and nebulae containing stars even when they are exceedingly remote.

The effect of these discoveries has profoundly influenced the deductions drawn from the records gathered at many observatories. One riddle in particular may remain unsolved unless further evidence is available from the outermost reaches of the universe. Over a long period of years Dr. Edwin Hubble has made observations of the spectra of distant galaxies. The most straightforward explanation of these observations is that the universe is expanding at an ascertainable rate. This hypothesis, which is based on the well-established physical principle known as the Doppler effect, has received support from leading cosmologists. Dr. Hubble and some others, however, state that the consequences of this hypothesis appear to be unacceptable, so they prefer to await an alternative explanation, which they think may be found in a new principle of physics.

Primeval Light

The feature of the known universe is its vastness. This is inconceivable to the layman and hardly conceivable to the scientist, who, in general, has been trained to think in terms of atomic dimensions rather than in terms of stellar distances. Astronomers prefer a unit of length called the *parsec*, which is convenient for their measurements, but they sometimes use the *light year*, which is of suitable size and easier to explain. It is the distance light travels in one year at its colossal speed of 186,000 miles every second. A light year is approximately six million million miles. I know of no adequate way of forming a clear concept of this unit, which is so totally different in order of magnitude from distances on the earth. The nearest star is more than three light years away from us. The farthest galaxy yet observed is about 500 million light years away, so the only information we can receive from it to-day is a message it sent out long, long ago. The new telescope is expected to more than double this limit of telescope recording. Thus it will increase the volume of space exposed to astronomical investigation at least eight times, probably considerably more.

No time will be wasted with the world's largest telescope. It is so valuable scientifically, and so costly an investment, that every moment of available time will be wisely used in accordance with a plan of co-operative research. Probably its most important applications will be the study of very remote nebulae, the analysis of the nearer large spiral nebulae, and the complete spectrographic investigation of many stars in our own galaxy. There are many other problems both physical and astronomical, which await illumination from it. Judging from the case of its predecessor at Mt. Wilson, its most striking usefulness may eventually be in some direction at present unforeseen or just dimly discernible. This will add to the excitment in the astronomical world. It may even provide an excuse for the incompleteness of this outline of what is expected from Mt. Palomar Observatory.



THE REFLECTOR, with the cellular pattern of the back showing through the face of the disc—a photograph taken at the California Institute of Technology.