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ASTRONOMY

Big Telescopes to Bring Skies Closer

By James Stokley

The astronomer is never satisfied!

Recently Dr. Edwin Hubble, of the Mt. Wilson Observatory, estimated that he had observed nebulae in the sky so far distant that their light takes 140,000,000 years to reach us. As light travels 186,000 miles in a single second, these distant objects are something like 840 million million million miles away.

And yet the human eye desires to see still farther, and better.

To do this three things are necessary, in the opinion of Dr. Hubble. His views are shared by other astronomers.

First of all, astronomers need better photographic plates.

Then they need more big telescopes in the southern hemisphere.

Lastly, they need one or more super-giant telescopes. Such an instrument has already been planned by Francis G. Pease, builder of the great 100-inch reflecting telescope at Mt. Wilson—the one with which Dr. Hubble worked.

The need of the big telescopes in the southern hemisphere arises from the shape of the globe on which we live. Unless a telescope is precisely on the equator, there is a piece of the sky that it can never observe. If the telescope is in the northern hemisphere, like those in the United States, there is a large circular area, centered at the South Pole of the heavens, which never rises above the horizon at all. And a still larger circle of stars never rises high enough to be really satisfactorily observed.

The equator is not the ideal location for a telescope, however. While on this imaginary line it is theoretically possible to see every star in the heavens at some time or other, those around both poles never rise very high. The best way to do is to have two telescopes. One should be well to the north of the equator, the other well to the south.

For many years several American observatories have had branches in southern countries. The Lick Observatory, of the University of California, has one in Chile. Here are observed stars that are invisible in California. The observatory of Harvard University has had a branch since 1889 in Peru. Now they are moving to South Africa, where conditions are better.

Largest Southern Telescope

At this branch will be not only the instruments from Peru, but also some new ones. Chief of these will be a great reflecting telescope with a mirror five feet in diameter. This will be the largest telescope in the southern hemisphere. It is already being constructed in a plant in Pittsburgh. This is the same plant that made the six-foot mirror for the big telescope at Victoria, B. C., the largest outside of the United States.

Like all reflecting telescopes, this great instrument will have a mirror which takes the place of the convex lens in the telescope of most familiar type. The mirror is dish-shaped,

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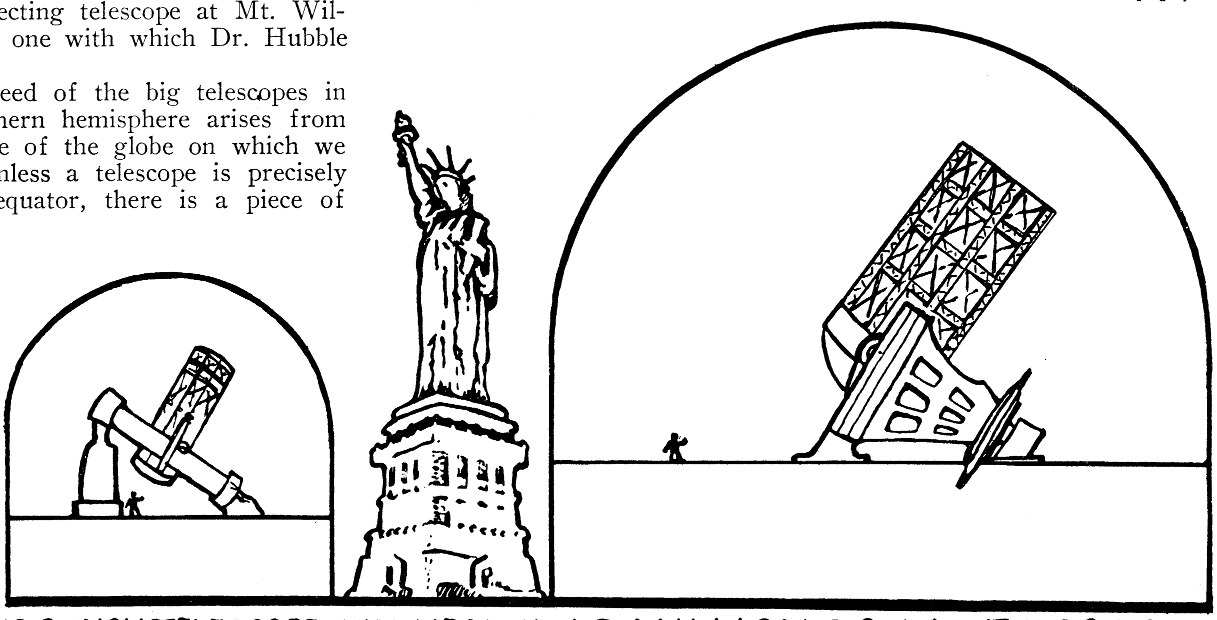

100 INCH TELESCOPE AT MT. WILSON—LARGEST IN THE WORLD   MISS LIBERTY 151 FEET HIGH   12 MILLION DOLLAR TELESCOPE PLANNED BY F. G. PEASE

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and faces the stars. It is at the bottom of the telescope. The light of the star is reflected back from it, and a smaller mirror at the top of the telescope reflects the light to the side. Here it can enter the eye of the astronomer or fall on the sensitive photographic plate.

The Harvard astronomers will have company, even though they are so far away from home. Within the last two years the University of Michigan and Yale University have established branch observatories in South Africa, but at both of these stations are refracting telescopes, not reflectors.

There are other reflecting telescopes in the southern hemisphere, though not as large as the new Harvard one. Nearly a century ago, the great English astronomer Sir John Herchel, took his great 4-foot telescope, at that time one of the largest that had been built, to the Cape of Good Hope. He was the first astronomer to use a large instrument in southern latitudes. From his researches arose the British Royal Observatory at the Cape.

Australia also has a big reflector. This is a more modern instrument than Sir John's, for it was built in 1870. Its mirror is also four feet in diameter. This year it has been overhauled for use in observing Pons-Winnecke comet.

$12,000,000 Telescope Planned

But all these instruments fade into insignificance before a telescope that has been planned by F. G. Pease, designer and constructor of the 100-inch Mt. Wilson telescope. According to Mr. Pease, the principal item necessary for the construction of this monster research instrument is the cost. Twelve million dollars, he estimates, would provide it. A large amount, of course, but only about a third the cost of a modern battleship!

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FRANCIS G. PEASE, builder of the 100-inch telescope, who has planned one three times as large, to cost an estimated total $12,000,000

Big Telescopes

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And how much more good would the telescope do for the world than the battleship, for it would increase man's knowledge of the universe about him!

There are mechanical difficulties to be solved before such an instrument could be made, it is true. However, Mr. Pease probably knows more about such matters than any man living. This is what he says:

"The question has often been asked 'How large a telescope can be built today?' My reply would be that anything up to a hundred feet in aperture can be built provided one wants to pay for it."

One of the problems to be solved is the material of which to make the mirror. Present telescope mirrors are mostly made of glass. On this is coated a layer of silver to reflect the light, much as in the ordinary looking glass. The chief difference is that the telescope mirror is silvered on the front instead of the back. Hold a coin to your looking glass and you will see the reason. In the glass you see two coins, one bright, reflected from the silver on back, and one faint, reflected from the glass surface. In astronomy such a double image would be a serious defect. So the silver is coated on the front, and is renewed occasionally.

However, in the large size contemplated there might be some defects of a block of glass as huge as would be required. Glass transmits heat slowly. When the temperature goes down, the great mirror would cool on its surface sooner than inside. The result would be that the outside would contract a little and the mirror would be slightly twisted until it reached the same temperature throughout. Though very minute, the twisting would be enough to be serious in accurate observing. So it may be that some metallic alloy, which transmits heat quickly to its interior, will prove better than glass.

Faster Photographic Plates

But astronomy doesn't want merely bigger telescopes. Even more welcome to the world of star-gazers would be better and faster photographic plates. Most astronomical observations today are made with the aid of photography. If you visit the modern astronomer at an observatory, you are not likely to find him peering through a telescope. Instead, you will probably find him looking through a microscope at a photographic negative made with the telescope.

In a single night at a big observatory enough photographs might be made to keep the astronomers busy for a month. The plate has one great advantage over the eye because it doesn't get tired. If you look through a telescope, you see as much in the first second as you will see if you look steadily for an hour. Of course, if there is a lot of fine detail, it may take time to give it careful scrutiny. But long gazing doesn't make details visible which were at first invisible. In fact, the eye gets tired, and really sees less after prolonged looking than at first.

The photographic plate is untiring. If a star of a certain brightness can be photographed in five minutes, one half as bright can be photographed in ten minutes, or one a quarter as bright in twenty. Some nebulae are so faint that even in the great Mt. Wilson telescope they can not be seen with the eye. But when a photograph of one is made with a long exposure, it is revealed in all its glory. Sometimes exposures as long as twenty or thirty hours are made, on several nights. All night long the plate is exposed, and then covered at the approach of dawn. Then the next night it is again uncovered, and it is kept pointed at the object for all of that night. In this way things are seen in the sky that without photography would have remained ever beyond our ken.

But photographic plates are not perfect. Some are more sensitive to light than others. The fast plates that the newspaper photographers use in their cameras record a scene even in poor light in a fraction of a second. The "wet plates" that the photoengraver used in making the illustrations for this article require long exposures with brilliant arc lights.

Fast Plates Show "Grain"

It might then seem that the astronomer should merely use the same kind of plates as the newspaper

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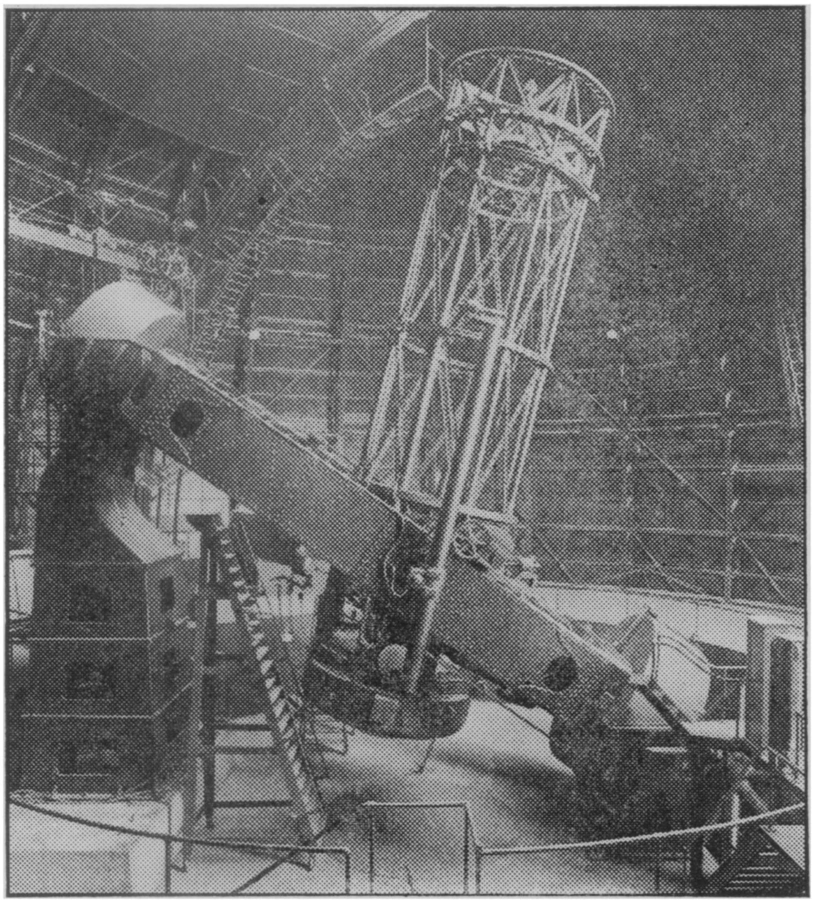
GREAT NEBULA IN ORION, photographed with the 100-inch telescope. Such objects as these would be shown in far greater detail with a still larger telescope, such as Mr. Pease has planned



ONE HUNDRED-INCH REFLECTING TELESCOPE of the Mt. Wilson Observatory in California, now the largest in the world

Big Telescopes

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camera man. However, as soon as you begin to magnify the picture on one of these plates, the "grain" appears. It is like looking at a halftone reproduction of the photograph of Mr. Pease on this page. As soon as you look at it through a magnifying glass, the dots that make up the picture become so evident that the picture is no longer recognizable. In the plate, the grain is irregular, unlike the uniform rows of dots, but it is no less troublesome.

The plate of the photoengraver does not suffer from this defect. Even with the most powerful microscope, no one has ever seen the grain of a wet plate of this kind. But the astronomer cannot use it, because it would take such long exposures. He has to compromise on a fairly fast plate, with a fairly fine grain.

What a boon it would be for him if he had a plate as fast as the news plate and as grainless as the wet plate! Perhaps this is an ideal impossible of attainment, but photographic research laboratories are working on the problem. Even a plate twice as fast as those used at present and with no coarser grain would mean that every existing photographic telescope would immediately have its light-gathering power doubled. So perhaps the next great advance in astronomy will originate in the chemical laboratory of a photographic plate factory!

This was the idea expressed by Dr. Hubble. In his estimation, the needs of astronomers at present are threefold. First of all, is needed better and faster plates. And then, comes more large telescopes in the southern hemisphere. Last of all comes the great telescopes surpassing in size the present instruments. When they have all three of these things, the astronomers of the world will doubtless think that the millenium has arrived!

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The star-gazer fish has eyes on the top of its head.

Railway trains of aluminum are being built in Germany.

Italy exports three-fourths of the automobiles it manufactures.

Artificial silk fiber is more regular than fiber made by silkworms.

The earliest tobacco pipe was probably only a hollow reed or a roll of bark.

A huge organ just completed in Liverpool Cathedral, in England, has 10,934 pipes.

Rubber building blocks are a recent novelty to make house building safer for children.

The United States Forest Service is investigating the question of what trees are most often struck by lightning.

Natural heat from the Kilauea volcano is used to heat the superintendent's office in the Hawaii National Park.

The stones used in the Egyptian pyramids must have been brought from great distances, as no quarries exist near these monuments.

Ancient inhabitants of Peru often made pottery jars in the shape of vegetables, such as ears of corn, squash, potatoes, and beans.

The hairnet industry in Chefoo, China, kept 17,000 women and girls busy in 1921; but now only about 2,000 make a living at this work.

European grapes, such as Malagas, Hamburgs and Tokays, have been experimentally grown in New York, and horticulturists say they may, with care, succeed in eastern grape districts.