ASTRONOMY

Wide-Angled Telescopes

These mighty candid cameras are being used to find out more about the Milky Way galaxy of which the earth is a part. Little is known of its appearance.

By MARTHA G. MORROW

➤ WIDE-EYED TELESCOPES, that take in large areas of the sky at a glance, are exploring the Milky Way system of stars to which our sun and earth belong. These mighty candid cameras of the heavens produce astronomy's best images of near and distant stars.

This newest family of telescopes is also useful in tracking the flight of V-2 rockets. Conceived less than two decades ago by the late Bernhard Schmidt, German instrument maker, further improvements have been added by the brilliant optical designer, Dr. James G. Baker of Harvard University. The most advanced of this new kind of telescope, the Baker-Schmidt, is now under construction.

"Schmidt telescope-cameras are contributing largely to the solution of some of the most urgent present-day problems in astronomy," stated Dr. Harlow Shapley, director of Harvard Observatory where pioneering research on our Milky Way galaxy is being conducted. "We are finding out what kind of universe we belong to and where we are headed," he said.

Central Plane

The bright, star-studded band of the Milky Way visible any clear night outlines the central plane of our own star-system. A hundred billion stars or more belong to it.

Milky Way dimensions are not astounding by astronomical yardsticks, but very large by earthly standards. Some stars in our own Milky Way universe are so far away that the starlight which reaches us these summer nights started on its way ten to twenty thousand years ago.

As yet we know little about the appearance of our own galactic system. Being on the inside looking out, we can only guess that it is spiral in shape. Our sun is located in a cloud of stars in the outer part of the system, well beyond the main body of the spiral.

We are far from the galaxy's dense central cloud of stars, nebulae and other luminous material. There may even be a relatively star-empty region between us and the center of the Milky Way galaxy.

More observations are needed to settle this and other questions about our near neighbors in space. The family of Schmidt telescopes will be the explorers in this project, making available the information we need.

Instruments of this type, rarely used for visual observation, are notable because they produce superb images over a relatively large area. On a photographic negative they record a portion of the sky as much as a hundred times larger than the photographs taken with a large reflecting telescope. They have great speed, so many pictures can be made on a single clear night. They are less sensitive to atmospheric disturbances than the long-focus reflectors.

Not only are these telescope-cameras important in exploring the heavens, but modified forms are used for studies closer at hand. Schmidt-type instruments, by tracking V-2's and other rockets in flight, will help protect us against guided missiles of the future. As a projecting system, this arrangement has been found useful in television reception.

Unpredictable Happenings

Comets, exploding stars and other outstanding but unpredictable happenings of the heavens can best be detected with such telescopes. It was with a Schmidt that astronomers found a large red nebula, first of its kind. Also two supernovae, the 16th and 17th known to the world of astronomy, were spotted within a fortnight of each other with such an instrument.

Although invented comparatively recently, 40 to 50 members of this family of telescopes are already in existence.

When the four-foot Schmidt at Palomar Mountain, Calif., swings into action late this summer, it will be the largest in operation. It has a 72-inch spherical mirror, thus is much larger than the 48-inch aperture might indicate.

In some ways this instrument has excited astronomers as much as its greatly publicized partner, the 200-inch Hale telescope of the California Institute of Technology and the Carnegie Institution of Washington. The two telescopes are not competitors: each will be far more effective because of the other. The Schmidt, for instance, is excellent for patrolling the heavens and can pick out objects worthy of the "big eye's" time.

The Mexican National Observatory at Tonanzintla boasts a Schmidt telescope with a 26-inch lens, made with Harvard's cooperation. Telescopes of this type with 24-inch correcting lenses are also located at the Oak Ridge observing station of the Harvard College Observatory and the Case Institute of Technology in Cleveland.

A telescope for Harvard's South African Observatory at Bloemfontein is under construction. Its mirror and correcting plate will both be 60 inches across. Several other large Schmidts are in the making and still others are in the planning stage.

The Schmidt camera is neither a reflector nor a refractor, but rather combines the two since it employs both a mirror and a lens. The first ones used in this country were built by amateurs, though many observatories today have professionally made instruments.

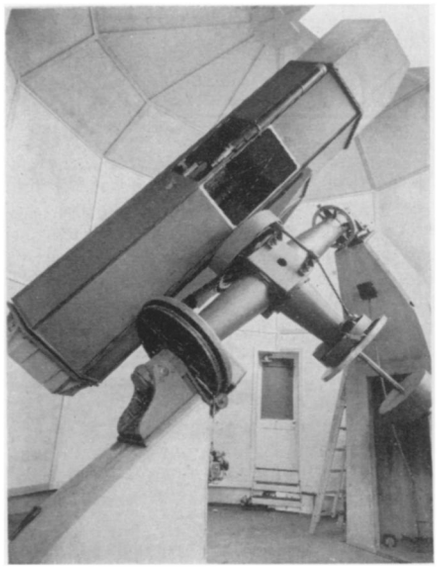
The ordinary reflecting telescope focuses the rays of light from a star by means of a mirror of special design. Rather than being sphere-shaped, it is a paraboloid.

Rays Bent by Lens

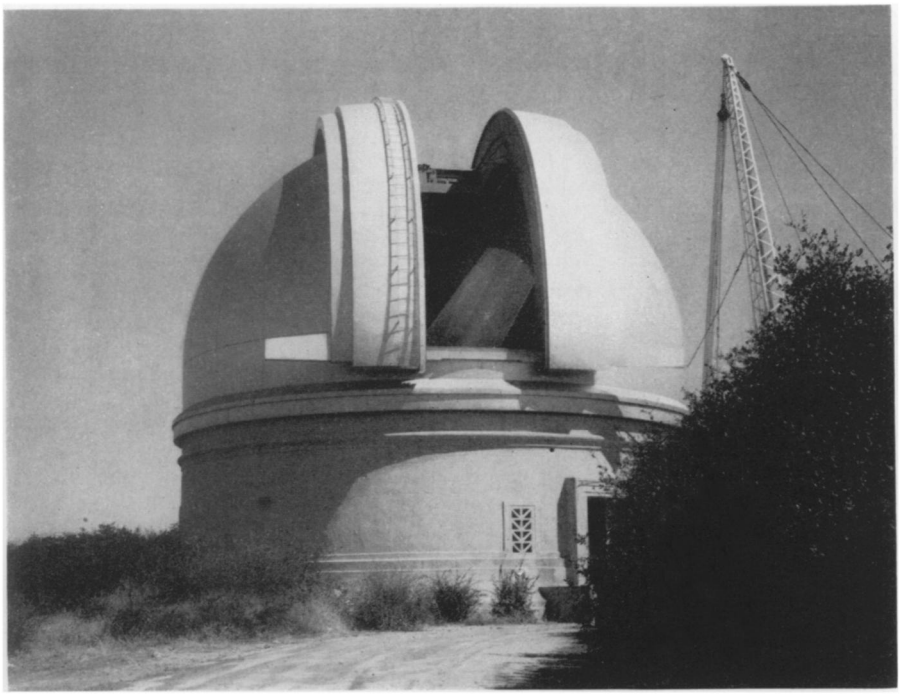
Bernhard Schmidt of the Hamburg Observatory at Bergedorf, Germany, hit upon the idea of placing a specially figured lens far in front of a spherical mirror. Light rays entering the telescope are bent by this lens, before they strike the mirror, in such a way that all are brought to a focus at about the same point.

The correcting lens is partly convex and partly concave. The center is raised as is the edge of the thin disk, while the region in between is slightly depressed. This lens is so thin that the hump in the middle is hardly visible to the unaided eye.

The combination of correcting lens and spherical mirror produces images without distortion out to the very edge of the plate. But the rays which fall near the edge have the same focal length as those that pass near the center. So the photographic film,



CORRECTING LENS—It measures 24 inches across and is part of Harvard Observatory's Schmidt, the mirror of which is 33 inches in diameter.



SCHMIDT DOME—Tube of the 48-inch Schmidt telescope-camera is visible within the dome atop Palomar Mountain.

placed halfway between the mirror and correcting lens, must be bent back a little to give sharp images.

Although a number of ingenious suggestions have been made to improve the Schmidt telescope, those of Harvard's young Dr. Baker are considered the most promising. His advanced design will reduce the length of the telescope and also eliminate the need for curving the plate.

Dr. Baker suggests that a second mirror be inserted within the telescope system. Under the new set-up, light entering through the correcting lens proceeds to the concave spherical mirror, is reflected back to a convex spherical mirror which reflects it to the film. The second mirror straightens out the light rays so that a sharp image is produced on a flat photographic plate or film.

A telescope of the modified Baker-Schmidt type, the first of its kind to be built, is now under construction. It will have a 32-inch correcting plate and 36-inch primary mirror. The second convex mirror is 17 inches in diameter.

Scheduled to be completed within another year, this telescope-camera will be located at Harvard's South African station. It is to be operated jointly by the Armagh Observatory of Northern Ireland, the Dunsink Observatory of Eire, and Harvard Observatory.

The center of our Milky Way system is located in the constellation of Sagittarius, the archer. These star clouds are favorably located for studies at observatories in the Southwest United States, in Mexico, and especially in South Africa. They pass directly overhead at Harvard's Boyden Station at Bloemfontein, South Africa, where two of the world's largest Schmidts soon will start exploring them.

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Idea for Telescopes First Used for Lamp

Astronomy's most promising "big baby" among telescopes, the Schmidt-type instrument, might have been born about 20 years earlier. A similar arrangement, in reverse, was applied to searchlights by an American inventor. But it had to be applied to photographing the sky later.

In 1910 the late Dr. Gustav A. Hermann Kellner was granted patent No. 969,785, which he assigned to the Bausch and Lomb Optical Company, on "A Projecting Lamp." Essentially a reverse-Schmidt, no claim was made that this same type of system could be used in photography.

Later in Germany the Schmidt telescope-camera was developed.

Science News Letter, August 14, 1948

ASTRONOMY

Giant World Telescopes

➤ THE MAJORITY of the world's most powerful telescopes are located in the United States. This list of the "giants" includes their size, when completed, where located, and by whom operated.

Outstanding among the reflecting (mirror) telescopes are:

200-inch, 1948, Palomar Mountain, Calif., California Institute of Technology and the Carnegie Institution of Washington.

120-inch-to-be, Mt. Hamilton, Calif., Lick Observatory of the University of California.

100-inch, 1917, Mt. Wilson, Calif., Mount Wilson Observatory of the Carnegie Institution of Washington.

82-inch, 1939, Mt. Locke, Tex., McDonald Observatory of the Universities of Texas and Chicago.

74-inch, 1948, Pretoria, South Africa, Radcliffe Observatory.

74-inch, 1933, Richmond Hill, Ontario, David Dunlap Observatory of the University of Toronto.

72-inch, 1919, Victoria, British Columbia, Dominion Astrophysical Observatory.

69-inch, 1932, Delaware, O., Perkins Observatory of Ohio Wesleyan University.

Large refracting (lens) telescopes include:

40-inch, 1897, Williams Bay, Wis., Yerkes Observatory of the Universities of Chicago and Texas.

36-inch, 1888, Mt. Hamilton, Calif., Lick Observatory of the University of California.

32.7-inch, 1889, Meudon, France, Observatory of Paris.

31.5-inch, 1899, 1916, Potsdam, Germany, Astrophysical Observatory.

30-inch, 1914, Pittsburgh, Allegheny Observatory of the University of Pittsburgh.

30-inch, 1886, Nice, France, Bischoffsheim Observatory of the University of Paris.

Outstanding among wide-angle Schmidt camera-telescopes are:

60-inch-to-be, Bloemfontein, South Africa, Harvard College Observatory.

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