THE NEW ATLAS OF THE SKIES

IN observatories all over the world astronomers are examining excitedly the "pages" of a new sky atlas such as the world has never seen before—a superb map of the heavens which is already revealing secrets of the universe. Undertaken by the National Geographic Society (U.S.A.) and the California Institute of Technology which operates the Mount Palomar Observatory, the atlas is the first section of a giant map of the universe, the result of some seven years of intensive work.

Intriguingly, the results of this intensive study are already posing new queries, while the answers to others seem tantalisingly close.

One special piece of optical equipment—the "Big Schmidt" telescope—has brought reality to the astronomers' dreams by making it possible to photograph the heavens to a hitherto unprecedented depth in space—600 million light years. In reality Big Schmidt is a huge camera, named after its designer Dr. Bernhard Schmidt, a German optical specialist. It has a wide aperture lens measuring 48" across and a reflecting mirror of 72". It is a superb camera, penetrating with high fidelity ten times deeper into the heavens and covering a space volume a thousand times greater than any previous attempts, to chart the skies photographically. These qualities enable it to take pictures of hitherto unknown sharpness and clarity at enormous distances. A "light-year" is the distance light travels in one year—roughly six million million miles. The Big Schmidt can

FIG. 1. Andromeda Nebula photographed with the Schmidt telescope.

reach out some 600 million light years to obtain its pictures.

Originally, this telescope was not designed specifically as a "camera" but rather as a "scouting instrument" for the 200" Hale telescope at Palomar Observatory. But in the Sky Survey it was soon found that the 48" Big Schmidt was of paramount importance. With its wide angle reflector, its telescope "eye" recorded on supersensitive film all visible objects in great cone-shaped slices of space, reaching out to an average distance of 2,000 billion billion miles. It accomplished in a few years a task for which the 200" Hale telescope would have needed 10,000 years or so, though the latter "sees" about three times as far.

EXPLODING STARS FAR BRIGHTER THAN THE SUN

Yet the Hale is vital too, for when the Big Schmidt discovers some unusual phenomena. they are studied intensively by the Hale telescope. The immense scope of the work may be better visualized when it is known that the new sky atlas will keep astronomers all over the world busy studying the results for an estimated period of 50 to 100 years.

When conditions are suitable, the Big Schmidt goes into action, but even then it is possible to obtain (usually) only four matching pairs of red and blue photographic records a night.

Each section of the sky is photographed on 14-inch photographic plates, through red and blue filters. This "double" exposure reveals more clearly, the colour, temperature and brilliance of distant stars, and moreover will enable astronomers to learn more about the "novæ" and "supernovæ"—those stars that suddenly and inexplicably explode and swiftly burn themselves out, amid a brightness estimated to be millions of times greater than that of the Sun.

In all, nearly three-quarters of the sky visible from Palomar have been photographed and recorded.

Almost from the beginning of the survey, astounding discoveries have been made. In 1950, for instance, the discovery of two new dwarf stellar systems in the Constellation of Leo was announced. Up to this time, the smallest known galaxies were estimated to possess a diameter of about 3,000 light years; the smallest among the newly discovered is estimated to have a diameter of only 1,500 light years, which suggests that perhaps even smaller stellar systems exist.

GALAXIES TWO BILLION LIGHT YEARS AWAY

Then, in 1951, came the announcement of a much more startling discovery, namely, that

there are more than 1,000 clusters of nebulæ in the heavens, as compared with the twenty known prior to the survey. These clusters are great masses of stars and gas, some as far as 350 million light years away.

FIG. 2. The 'Big Schmidt' telescope.

But the most revolutionary discovery of all was made by Dr. Walter Baade, early in 1953. Working at Palomar, Dr. Baade found that, contrary to scientific belief, all stellar systems beyond the earth's own galaxy (the Milky Way) are twice as far away as previously believed. The most distant galaxies visible through the 200" Hale telescope, Dr. Baade discovered, are two billion light years away.

What is the significance of this discovery? The observable universe has a volume eight times as great as believed, while its age is put at four billion years.

Almost daily new aggregations of stars and systems of stars, nebulæ like the Milky Way, are discovered. Of the Milky Way itself much new information has been added. In shape it is now seen as a great flat wheel of stars, slowly spinning in space, with "arms" of stars, gas and dust spiralling off its rim.

The foregoing is but a microscopic fragment of new knowledge about the universe which the sky atlas has already revealed. Equivalent in size to about 20 very fat volumes, the completed sky atlas will comprise 1,758 photomaps. The first section of the atlas is in the form of 14-inch unbound prints, totalling about 200 sky charts. Overall cost of one printing and handling only, and omitting all other expenses involved, will be about £ 712 ($ 2,000) per copy. By 1959, it is planned, all sections of the atlas will have been printed and despatched to the hundred or so observatories which have ordered it.

With its aid. perhaps we shall learn how large creation really is. We may even learn whether the universe is of uniform structure, and whether it had a definite beginning in space and time? Perhaps, also, we may discover whether the universe will end one day, or simply go on extending outward endlessly into space.—*UNESCO.*

ARIZONA METEORITE CRATER

DURING the summer of 1956, the smithsonian Astrophysical Observatory sent an expedition to investigate the distribution of pieces of meteoritic material that are scattered through the mantle of soil surrounding the Arizona Meteorite Crater, the object being to determine more accurately the mass of the meteorite that made the crater and also the direction of its flight.

Estimates of the total mass of finely divided meteoritic material around the crater suggested that this is about 12,000 tons, but this figure is subject to some uncertainty. It is believed that about one-fourth of this mass may be terrestrial oxygen that combined with the meteoric iron after its encounter with the earth. In addition, there does not appear to be any way for ascertaining accurately the amount of contaminating material present. After taking into consideration a number of uncertain factors, it is believed that the computed mass of 12,000 tons may have to be reduced by about 10-20%.

It is suggested that the meteorite approached the earth from a south-westerly direction, and after the collision threw forward large quantities of meteoritic material to the position where it now rests. As no piece more massive than 2,000 lb. has ever been found, while thousands of pieces weighing a few ounces or less have been recovered, it is believed that the meteorite was shattered into fragments when it struck the earth, melting and evaporation accompanying this disintegration. The results so far provide no indication as to whether a large mass of meteoritic material lies buried in the crater.