

ASTRONOMY

Dr. Hubble Finds Galaxies Evenly Scattered in Space

Each of 30 Million is Similar to Milky Way System Which Comprises All Stars That Can be Seen

AS FAR as the largest present-day telescope can reach into space—a distance of 300 million times the six trillion miles that light will travel in a year—there are uniformly scattered a total of 30 million island galaxies. Each of these is a system of stars similar to the Milky Way system, of which the Sun, and all the other stars that we can see, are part. Further, the space between them is perfectly transparent, at least as nearly as we can judge.

In a report to the Carnegie Institution of Washington, Dr. Edwin P. Hubble, of the Mt. Wilson Observatory, told of his latest researches in studying these objects, the most distant observed by astronomers.

On the average, he has found, the distance between neighboring nebulae or galaxies, is about $1\frac{1}{2}$ million light years. Many of them are arranged into clusters, but, if large volumes are considered, their distribution is uniform. This was learned by a study of photographs made with three different telescopes, including the Mt. Wilson 100-inch, the world's largest. With so many objects, they may all be assumed to be of the same brightness, and the photographs showed that when nebulae four times as faint were recorded, there were eight times as many. As the faintness of a nebula varies not with the distance directly, but with its square, one that is four times as faint as another must be at twice the distance. Therefore, the number of nebulae vary with the cube of the distance, and this means that they are uniformly distributed.

Dr. Hubble also considered the question of what is beyond the observable region. Of course, larger telescopes, such as the 200-inch now under construction at Pasadena, will reach still farther, but does the uniform distribution of galaxies hold indefinitely?

"There is no evidence of a thinning out, no trace of a physical boundary," he said. "The universe, we must suppose, stretches out beyond the frontiers, and for a while, at least, the unknown regions are probably much like the

known. This is a legitimate extrapolation, but it cannot be pushed indefinitely. An infinite homogeneous universe is not compatible with the observed darkness of the sky and the stability of the stellar systems. Yet, if the universe is not homogeneous, then the observable region is not a fair sample and extrapolations lose their significance."

This dilemma, he explained, can be escaped by means of the theory of relativity, which assumes a closed universe with a finite volume, but no boundaries, something like the surface of a sphere. This fits in, he explained, with the apparent high velocities observed for some of the more distant galaxies. One cluster, in the bowl of the Great Dipper, is at a distance of 75 million light years, and seems to be receding at a speed of more than 7,000 miles a second.

This apparent speed can now be used to measure nebular distances, but Dr. Hubble expressed the view that it is not a real speed. Instead, it is probably a consequence of the curvature of space, in some other than our familiar three

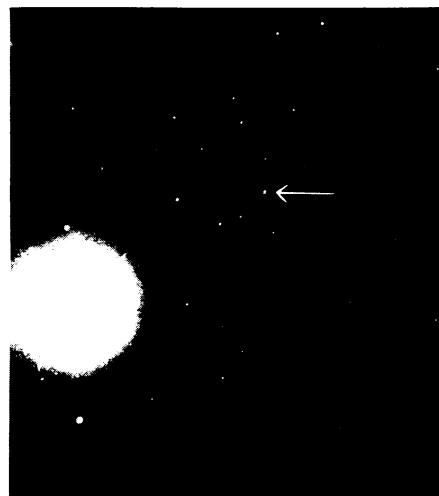
METEOROLOGY

New Weather Stations Map Asiatic Air Currents

THE four meteorological stations which the Sven Hedin Asiatic expedition established in the interior of Asia are being operated now by Chinese scientists.

These stations, the only ones of their kind in an area as great as the continent of Australia, are gathering much information about the exchange of air currents between the polar regions and the equator, according to word received in Peiping.

Three years ago, Dr. Hedin established the stations, and meteorologists of his expedition started the work of



THE LITTLE DOT

Indicated by the arrow is a galaxy of the Ursa Major cluster and is made up of thousands of stars. It is the most distant galaxy ever measured, having been found by Dr. Hubble to be 75 million light years from the Earth. Even when looking through the world's largest telescopes, the eye cannot see this galaxy; it is revealed only by photographic plates after many hours' exposure. The large bright spot is a nearby star, much brighter than the galaxy but equally fainter than the stars we see in the night sky.

dimensions. As an analogy, Dr. Hubble mentioned a map, in two dimensions, of the curved surface of the Earth. If a small area is represented, the flat map differs little from the curved Earth, and it is fairly accurate. But if the whole Earth is represented, the parts away from the center of the map are greatly distorted.

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sending up balloons filled with hydrogen gas, which were watched by telescopes. By this method, the air currents are being charted. Chinese students who accompanied the expedition were taught the method and last year Dr. Hedin presented the stations, fully equipped, to the Chinese government.

Apart from the general scientific value of the weather data, it is hoped that the work will prove of definite practical value to China by making it possible to predict storms coming from the Northwest.

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