In actual practice a lot of troublesome corrections have to be made;for the force of gravity is influenced by distance from the equator, elevation above sea level and especially by the proximity of hills and mountains. The Torsion Balance is so sensitive that even the presence of the observer is registered by a derlection of the beam. It bears much the same relation in sensitivity to the delicate balance used in chemical analysis as that instrument does to the railroad scales used for weighing freight carsl Extraordinary precautions have to be taken to prevent disturbances other than those due to gravity. The swinging parts, consisting of wire, beam and weights, are enclosed in a double-walled metal case. Even then, the sun's rays might set up tiny air currents inside which would cause temporary deflections of the beam and so the observations are customarily made at night with the instrument housed in a tent with insulating walls.

Experiments are still in progress and commercial considerations make the oil companies reticent in disclosing the successes and failures of the new method for predicting oil.

SKY PINWHEELS ARE STELLAR UNIVERSES 6,000,000,000,000,000,000 MILES AWAY

The spiral nebulae in the sky are universes consisting of uncountable hosts of stars, at distances so inconceivably great from our own starry system that it these light, traveling at the rate of 186,000 miles a second, over a million years to reach the earth. The astronomer who has completed this dizzying discovery is Dr. Edwin Hubble, of the Mt. Wilson Observatory in California, according to an announcement made by the Carnegie Institution of Washington.

Nebulae are the hazy areas of light common in the Milky Way, which may be seen also as isolated patches elsewhere in the sky. Some of these nebulae have a curious spiral outline, appearing in the telescope like vast Fourth-of-July pinwheels.

The question of the nature of the spiral nebulae is one of the most interesting problems of astronomy and has led to a marked divergance of opinion on the part of those who have studied them. Some astronomers have believed that they are at enormous distances from the earth and constitute independent stellar systems or "island universes", while others consider them as objects within our own stellar universe at distances comparable with those of our fainter stars. The number of spiral nebulae is very great, amounting to hundreds of thousands, and their apparent sizesrange from small objects almost star-like in character, to the great nebula in Andromeda which extends across an angle of some three degrees in the heavens, about six times the diameter of the full moon.

"The spiral nebulae are much too distant to admit of the use of the simple method of triangulation employed successfully in the case of the nearer stars," Dr. Hubble explains. "There are, however, powerful methods available which depend upon the possibility of determining directly the true or intrinsic brightness of stars from the characteristics of the light which they send to us. If the intrinsic brightness of a star is known, it is a very simple computation to derive its distance by comparison with its apparent brightness in the sky.

One of these methods and that employed by Dr. Hubble in his investigation of the two brightest spiral nebulae, depends upon the fact that certain stars which vary in light in a definite way are known to show a direct relationship between the period of their light variation and their true or intrinsic brightness. The method has been used successfully by Dr. Harlow Shapley of the Harvard College Observatory

in his studies of the distances of the globular star clusters and the Magellanic clouds of the southern hemisphere.

The investigations of Dr. Hubble were made photographically with the 60 inch and 100 inch reflectors of the Mount Wilson Observaiory, the extreme faintness of the stars under examination making necessary the use of these great telescopes. The resolving power of these instruments breaks up the outer portions of the nebulae into swarms of stars which may be studied individually and compared with those in our own system. From an investigation of the photographs, 36 variable stars of type referred to, known as Cepheid variables, were discovered in the two spirals, Andromeda and No. 33 of Messier's great catalogue of nebulae. The study of the periods of these stars and the application of the relationship between length of period and instrinsic brightness at once provided the means of determining the distances of these objects.

The results are striking in their confirmation of the view that these spiral nebulae are distant stellar systems. They are found to be about 10 times as far away as the Small Magellanic Cloud, or at a distance of the order of 1,000,000 light-years. This means that light travelling at the rate of 186,000 miles a second has required 1,000,000 years to reach us from these nebulae, and that we are observing them by light which left them in the Pliocene age upon the earth. With a knowledge of the distances of these nebulae, we find for their diameters, 45,000 light-years for the Andromeda Nebula, and 15,000 light-years for Messier 33. These quantities, as well as the masses and densities of the systems, are quite comparable with the corresponding values for our local system of stars, the one in which the earth is but a mere speck.

"Although these nebulae are the most distant objects for which we have reliable data, it seems probable that many of the smaller spiral nebulae are still more remote and appear smaller on this account," Dr. Hubble concludes. "From this point if view the portion of the universe within the range of our investigation consists of vast numbers of stellar galaxies comparable to our own, scattered about through nearly empty space and separated from one another by distances of inconceivable magnitude."

NEW KIND OF IMMUNITY DISCOVERED BY CHICAGO SCIENTIST

A new method of combating disease germs has been discovered by Dr. H. W. Taliaferro, formerly of the Johns Hopkins University and now of the University of Chicago.

When dangerous bacteria invade the human body, the automatic defensive mechanism of the body usually throws fighting units, called antibodies, into the front line trenches of the blood. These protective substances kill the harmful disease organisms.

The new substance found by Dr. Taliaferro is related to such usual antibodies But instead of wiping out the invading army of germs, it prevents it from perpetuating itself.

Working on a harmless blood parasite of rats, similar to the organism causing tropical sleeping sickness, Dr. Taliaferro found that the parasite, after an initial period of active multiplication apparently lost the power to reproduce its kind. Furthermore, by certain experimental precedure, he found that this peculiar occurrence is due to some substance produced in the rat's blood, and that blod serum