

UNIVERSE EXPANDS WHEN ASTRONOMER DISCOVERS OTHER STELLAR SYSTEMS

The limits of the universe have been pushed outward and great stellar system comparable to our own tremendous galaxy are shown to exist by the astronomical research of Dr. Edwin Hubble that won for him half of the \$1000 prize.

Using the largest telescope in the world, the 100 inch reflector at the Carnegie Institution's Mount Wilson Observatory at Pasadena, Calif., Dr. Hubble has solved the mystery of the great heavenly objects that look like pinwheels in the sky, the spiral nebulae.

Nearly overhead in the sky at the present time in the constellation of Andromeda there is the most famous of these spirals, the Great Nebula of Andromeda. To our eyes viewing it from the earth it has several times the area of the full moon although it is so faint that good sight is required to spot it in the heavens.

In small telescopes it looks merely like a cloud of matter, but when Dr. Hubble turned the great Mt. Wilson 100-inch telescope upon it, he found the outer ends of the spiral contain immense numbers of very faint stars, a hundred thousand to a million times fainter than the stars that the naked eye can see.

A study of such photographs and the application of known astronomical laws led Dr. Hubble to the following facts about the Andromeda nebula.

It is so distant that it takes light nearly a million years to travel from it to the earth. That is, it is some 6,000,000,000,000,000 miles away.

It is the most distant object known to science.

It is as large and has as much stuff in it as our own galaxy.

Its total light is one billion times that of the sun.

It contains some three or four thousand million stars.

In shape and form it is not unlike the great stellar system or galaxy of which the Milky Way and most of the stars we see at night are a part and in which the sun and its revolving planets are but pin points.

It is at four times as great a distance as ever previously established for any celestial object, with the exception of the faint star cloud N.D.C1 6822 which Dr. Hubble has shown to be 750,000 light years from the earth.

It is an "island universe", a concentration of stars, gaseous stuff, and perhaps even planets, out in the space of the great all-inclusive or super-universe and billions of miles away from other universes or galaxies like our own.

And the spiral in the constellation Triangulum seems to be nearly a twin to that in Andromeda.

How can evidence of such gigantic "universes" be obtained?

First of all Dr. Hubble's photographs, better than any previously obtained, showed "dense swarms of actual stars" in the outer parts of spiral nebulae. Then it was found, by taking photographs night after night, that some of these stars were what is called Cepheid variables. They fluctuate in brightness, going through a period of sudden rise to brilliance and slow fall to dimness in times ranging from a few hours to 50 days. At maximum they range from 4000 to 8000 times the sun's brightness. This was the clue to the determination of the great distance of the nebulae.

Some years ago Dr. Harlow Shapley of Harvard worked out a useful relationship between star brilliance and the period of these Cepheid variables, so named because they are most prevalent in the constellation of Cepheus. He found that if the period of variation was known the absolute brightness, dependent only upon the temperature of the star and not upon its distance from the earth, could be determined. A simple comparison of absolute brightness of the star with the brightness shown through the telescope tells the distance of the star from earth.

When Dr. Hubble applied this law to the variable stars he discovered in the Andromeda nebula, he found that they were all about 930,000 light years away in another island universe.

While Dr. Hubble is the first man to prove the distant existence of such vast conglomerations of matter outside our own locality of space, their character has been suspected for about a century. Sir William Herschel, English astronomer of 100 to 125 years ago, when he saw the spiral nebulae poetically called them "island universes". The name stuck and now Dr. Hubble has given it justification.

Undoubtedly more distant spiral nebulae, now known to be stellar galaxies, lie even farther out in space. There are more than 100,000 of these spirals known to astronomers and most of them instead of being great patches of light like the one in Andromeda, appear merely as points of light in telescopes and on photographs.

Imagination totters when it attempts to conceive of the distances that must intervene between these galaxies or "universes" and our own.

Space, or the super-universe, with the aid of Hubble, Einstein, and other scientists, has been swollen enormously in the past few years.

PROTOZOA KILLING PROMISES TO AID MAN'S HEALTH

Killing of the thousands of minute animals that inhabit termites or "white ants" and digest their woody food for them may seem an unimportant accomplishment. Yet this is what won Dr. L.R. Cleveland, National Research Council fellow working at the Johns Hopkins University, Baltimore, half of the annual American Association for the Advancement of Science prize.

The microscopic protozoa that live in the digestive tracts and blood systems of man, animals and insects are mostly harmless or helpful, yet there are some that cause serious diseases, like malaria, sleeping sickness and dysentery. The importance of Dr. Cleveland's success in killing the protozoa of termites without hurting their involuntary hosts lies not in the practical application of this one accomplishment, although the method may be used in destroying troublesome "white ants", but in the promise of new biological and medical methods that it contains. His new technic has possibilities of application in widely different fields ranging from the cure of disease to the protection of property.

Dr. Cleveland's studies began about five years ago, on the protozoa that inhabit the digestive systems of termites, or "white ants", wood-eating insects very destructive to all timber structures in the southern states and in all warm countries. He found that they played a very important role in the lives of most species of these insects. In some termites half the body weight is made up of swarms of protozoa. Dr. Cleveland, wondering whether these internal guests might not be necessary to the termites, sought for methods to kill them without killing the hosts. He found that this could be accomplished in any of three ways: 1. By keeping his termites at a temperature of about 95 degrees Fahrenheit for 24 hours; 2. By starving them for a time; 3. By exposing them to air or pure oxygen under pressure. Under any one of these treatments the protozoa perished and the termites survived.

But they did not survive long. Deprived of their "inhabitants", they starved