

ASTRONOMY

Overhead Is Andromeda Nebula

**Nearest Island Universe, 900,000 Light Years Away,
Only One Visible to Naked Eye; Meteors Due on the 15th**

By JAMES STOKLEY

THE CONSTELLATION of Andromeda, now directly overhead in the evening, can be recognized from the two streams of stars which extend to the northeast from Alpheratz, the star in the corner of the Square of Pegasus. In the row of fainter stars, the one nearer Cassiopeia, there is a faint patch of light which can be seen upon a dark clear night, that is the most distant object that can be seen with the naked eye. The sun is about 93 million miles from earth, the nearest stars are a million times as far, the luminous spot in Andromeda is a hundred thousand times as far as that.

Naturally such a large figure, expressed in miles, would be rather awkward to handle, and so the astronomer uses another unit. This is based on the speed of light, which travels eleven million miles a minute. The radiation of the sun takes about eight minutes to come to the earth; that of Sirius, the nearest bright star seen from northern latitudes, takes about as many years; so the astronomer says that its distance is eight light years. One light year is about six million million miles. Sirius, therefore, is about 48,000,000,000,000 miles from us.

Recent Discovery

Until about a decade ago the tremendous distance of the Andromeda object was unknown. During the 1890's, Isaac Roberts, an English astronomer, had shown by his photographs that it had a spiral structure, similar to other spiral "nebulae" which had been observed previously. Long before that Sir William Herschel had shown that the sun and all the stars that we can see in the sky, and most of the other objects as well, are part of a great grindstone-shaped system—the Galaxy. As we look out toward the edge of the grindstone, we see a great concentration of stars. This is the Milky Way. Toward the side we see the stars more sparsely distributed.

Until 1924 there were two ideas regarding the Andromeda "nebula" and the other spirals. One was that they were also part of our own galactic sys-

tem, though their distribution was a point against it. They are most numerous in the parts of the sky where the stars are scarcest. The other theory was that they were "island universes"—other galaxies, similar to our own, but outside its limits.

In 1924 the answer to the puzzle was found by an astronomer at the Mt. Wilson Observatory, Dr. Edwin P. Hubble. With photographs taken through the hundred-inch reflector, the world's largest telescope, he recorded for the first time the individual stars in the Andromeda spiral and in one other.

Many Thousands

Just as the Milky Way appears to the unaided eye as a continuous patch of light, while even opera glasses show the stars of which it is made; so smaller telescopes had previously failed to reveal those in these "nebulae." Some of the stars which Dr. Hubble found were such that he could determine their distance. This proved to be about 900,000 light years, for the Andromeda object, and a little farther for the other. So it was finally shown that there are other systems outside our own.

As the word "nebula" really means a cloud, like the one of glowing gas in the constellation of Orion, astronomers have now stopped applying it to these ob-

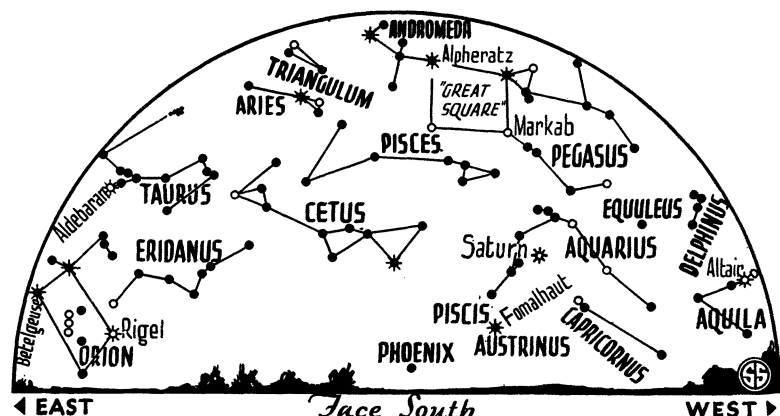
jects and they are called "galaxies." The one in Andromeda is the nearest, and the only one that can be seen with the naked eye. Many thousands have been observed, extending out as far as the hundred-inch telescope can reach.

Until the past year or two, however, there seemed to be an important difference in size between our own galaxy and the others. Some authorities thought the diameter of ours to be 200,000 light years, while the one in Andromeda was estimated to be as small as 30,000 light years. About 1930 Dr. R. J. Trumpler, of the Lick Observatory, and Dr. Piet Van de Kamp, of the McCormick Observatory, both found incontrovertible evidence of absorbing material in our Milky Way. Space between the stars is not perfectly transparent, as we used to think, but is permeated with a sort of fog. Not knowing this, astronomers had previously thought that the difference in brightness between most of the stars was due mainly to the greater distance of the fainter ones. With the light of even a bright star absorbed on the way, it would appear at a greater distance than it really is. These researches brought the size of our galaxy down to about a hundred thousand light years or less—the exact size is still somewhat uncertain.

Electric Eye

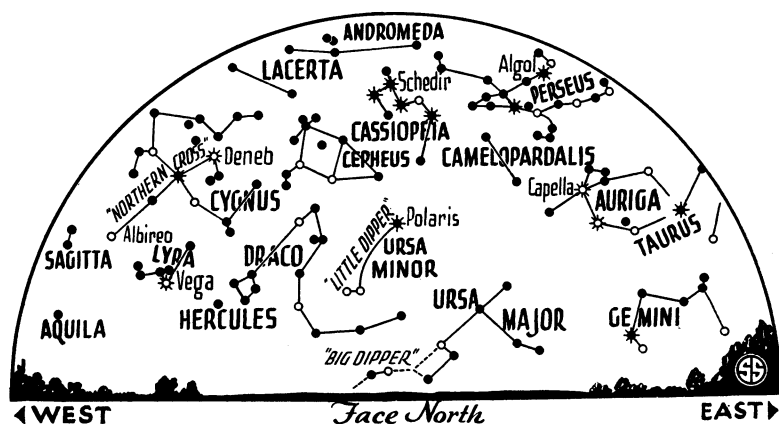
Even this left the Andromeda galaxy much smaller than ours, until Dr. Joel Stebbins, working at Mt. Wilson with the photoelectric cell—the "electric eye"

☼ * ○ • SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS



WINTER STARS

In the east these evenings are the first of the glorious winter stars—in the constellations Auriga, Taurus, Orion, and Gemini.



NEAREST ISLAND UNIVERSE

High overhead may be seen great Andromeda nebula, only one visible to the naked eye.

—attached to the hundred-inch telescope, showed it to be about twice as large as formerly supposed. Extending beyond the limits of this galaxy shown on the photographs there are many more stars, which were detected by the electric eye. So now the sizes of the two galaxies are believed to be about the same. Probably others are of similar size, and one of the reasons that makes astronomers await eagerly the completion of the two-hundred-inch telescope of the California Institute of Technology is that they hope this great instrument will reveal further facts about these important objects.

On the night of November 15, and the early morning hours of the 16th, astronomers expect to see some of the Leonid meteors that come every year, but they hope that the display will not be as disappointing as it was in 1933 and 1934. In 1799, 1833 and 1866, November brought famous showers of these meteors, or shooting stars. They seem to radiate from the constellation of Leo, the lion, which rises in the early morning hours, hence their name. Actually the meteors, most of which are no larger than the head of a pin, are moving around the sun in parallel paths. When the earth crosses their orbit in November of each year, we encounter some of them, and their paths seem to converge in the distance in the direction from whence they came, which happens to be toward Leo. As they enter the atmosphere, they are burned by the friction, and disappear in a flash of light.

The Great Showers

Though there are some meteors all around the path, at one place they are more concentrated. In the years of the great showers, the earth encountered this swarm. It missed us in 1899 and 1900, when it was thought another great show-

er might have been seen, and again in the last two years. But there may be a few more than usual this year, and astronomers who are particularly interested in meteors will watch the sky on the night of the 15th, as well as those before and afterwards, in case the display is early or late.

Amateur observations of shooting stars are always welcomed. The easiest one to make is simply a count of those seen during half-hour periods; for instance, from midnight to 12:30, 12:30 to 1:00 a. m., and so on. More meteors are seen after midnight, because then we are on the advancing side of the earth and meet them head-on, whereas before midnight they must catch up to us. On ordinary nights it is usually possible for one person to see them at the rate of one or two an hour, but on the nights of the showers, they may come as fast as one a minute. On nights of the great showers hundreds could be seen at once.

Dr. Charles P. Olivier, director of the University of Pennsylvania's Flower Observatory at Upper Darby, Pa., is one of the leading authorities on meteors. Amateur observations should be sent to him.

Bright Saturn

Only one of the naked-eye planets appears in the evening skies this month at the times for which these maps are prepared (10 p. m. Nov. 1; 9 p. m. Nov. 15; 8 p. m. Nov. 30), though red Mars, rather faint, can be seen low in the southwest just after darkness has descended. Saturn, however, appears in the south, with a steady glow, as brilliant as a first magnitude star. But even without the brilliant display of planets that we enjoyed earlier this year, the November evening skies are interesting, for now begin to appear the first of the glo-

rious winter constellations—Auriga, Taurus, Orion and Gemini.

An excellent way of starting to find the stars now visible is from the four high in the south that form the "Great Square in Pegasus." When you find it, you have located two prominent star groups, the star in the upper left corner is Alpheratz. Together with two rows of fainter stars extending over to the northeast, this forms the figure of Andromeda, represented in mythology as the princess who was chained to the rock. The other three stars in the square, as well as those near the westernmost corners, outline the winged horse, Pegasus.

Southwest of Pegasus, easily identified because of the presence in it of Saturn, is Aquarius, the water-bearer. Still lower, and farther south, is Fomalhaut, in Piscis Austrinus, the southern fish.

This is not the only heavenly fish on view this month, for two others, the constellation Pisces, can be seen below and to the left of the Great Square. Sprawling his great length across the southeastern sky, below this group, is Cetus, the whale. Still another watery constellation, though not as conspicuous, is Eridanus, the river, below Cetus.

The Bull's Eye

Toward the east is Taurus, the bull. Red Aldebaran marks his eye; a V-shaped group of stars of which he is part, with the point to the south, outlines the face. Over them are the Pleiades, the famous "seven sisters," a little cluster of stars in the animal's shoulder. Only six of the sisters ordinarily appear to the unaided eye, though one particularly keen, or aided with opera glasses, can see many more. A little higher than Taurus, farther north, is Auriga, the charioteer, with the first magnitude Capella, and below this group are the twins, Gemini, with Castor above and Pollux below. Below Taurus is Orion, the warrior, who can easily be found because of the three stars in a vertical row that mark his belt. Later in the evening these are followed by Procyon, in Canis Minor, the lesser dog, and still later by Sirius, the dog-star, brightest in the sky, in the southeast.

To the west can be viewed the northern cross, or Cygnus, the swan, with Deneb at the top of the cross, now in a vertical position. Below, to the north, is Vega, marking Lyra, the lyre, while Altair can be seen farther south, in Aquila, the eagle. Low in the northern sky is the Great Dipper, part of Ursa Major, the great bear. Above it is the Little Dipper, with Polaris, the pole

star, at the end of the handle. Almost overhead in the north is the W-shaped group Cassiopeia, close to her daughter, Andromeda.

During the month the moon is at first quarter on the third, full on the tenth, at last quarter on the 17th and new on the 25th, so that the first ten days or so will have moonlit evenings. On the eighth it will be at "perigee," or nearest the earth, only 225,500 miles away. "Apogee," when it is most distant, will come on the 20th, with 251,550 miles separating us.

Science News Letter, November 2, 1935

CHEMISTRY

Butter Analysis Method Makes Dirt Detection Easy

DIRTY butter is less likely to find its way to American tables in future, thanks to a new analysis method devised by W. S. Greene, microanalyst of the Food and Drug Administration, U. S. Department of Agriculture.

Although most creameries are kept clean as hospitals, an occasional careless or slipshod handling plant will expose butter, or the cream from which it is made to contaminants. And once in, they are impossible to detect by ordinary means; only everlasting vigilance by handlers and inspectors can keep butter dependably clean.

In food inspection laboratories, the method is basically to get rid of all the butter, leaving only the tiny dabs of contaminating substance on a sheet of filter paper. The difficulty of preparing for such inspections in the past has been due to the presence in butter of a certain small percentage of casein, the principal food-substance in cheese, which coated over the dirt particles and made them almost impossible to get out and examine. Chemical treatments efficient in dissolving away this casein coating also dissolved contaminants.

Mr. Greene's contribution consists in the discovery that a simple solution of borax will do the trick. A sample of butter is heated to a boil with a quantity of the borax solution, and the mixture passed through a paper filter under suction. This filter paper is then rinsed with gasoline, to remove any residual grease. This leaves the filter paper entirely clean if the butter is entirely uncontaminated; if there is any dirt in it, it stands out on the white surface and can be picked off for microscopic examination and identification.

Mr. Greene's new method is described in detail in the trade journal *Food Industries*. (Sept. 25).

Science News Letter, November 2, 1935

ARCHAEOLOGY

Announces Altar Find Solving Great Monte Alban Mystery

THE MYSTERY of Monte Alban, buried city in southern Mexico where spectacular treasure was found in 1932, has cracked.

No longer an orphan among cities of ancient America, Monte Alban proves to have a close relative in both Toltec and Mayan Indian civilizations of prehistoric Mexico. Evidence thus clearing up the identity of the long-abandoned city was reported in Washington, D. C. by Dr. Alfonso Caso, Mexican archaeologist. Dr. Caso announced his discoveries before the Pan American Institute of Geography and History, which assembled in Washington a notable group of scientists from American countries.

Dr. Caso found his evidence when he dug under an old altar site in a secret sunken court in Monte Alban ruins. He was following a hunch that the people of this city might have followed Mayan Indian custom of putting things precious to them under altars. The hunch worked and with unexpectedly rich results. He unearthed exquisite male and female figurines of jade, and other sacred green stones carved in style he

recognized perfectly as like that of Toltec Indians. There were bone fragments of an eagle and a tiger buried there, also. As these animals symbolized the sun as a god in ancient Mexico, they perhaps tell in whose honor the altar was set up. Mayan custom of altar cornerstone-like deposits, and Toltec art ideas showed Dr. Caso where the ancients of Monte Alban had their cultural alliances.

Under this rich deposit, proved very old by its link with Toltec Indian civilization, he unearthed cruder pottery offerings from an even earlier time in prehistory.

A big, stone-lined underground passage, discovered under the altar site, is now identified as part of a great sewer system by which the Indians drained the massive earthwork of the city's North Platform. The tunnel, which was five feet high and peak-roofed, ran diagonally under the sunken patio where the altar was. When first detected, the tunnel mystified the archaeologists, who wondered what its purpose could have been.

Science News Letter, November 2, 1935

MEDICINE

High Fever Kills Cancer Cells But is Not a Cure

TWENTY minutes' exposure to a temperature of 111.4 degrees Fahrenheit will destroy all the malignant tissues in the body of a rat that has cancer, Dr. George Walker, of Baltimore, has found. Unfortunately, however, the discovery does not provide a method of curing the cancer, since the rat is unable to survive this high temperature, Dr. Walker reports. (*American Journal of Cancer*, October)

The results of the research might be expressed in the old phrase, "The treatment was successful but the patient died."

But the work has further significance. For one thing, Dr. Walker's research brings out the fact that some methods of inducing artificial fever may be safer

than others. In these days when fever is being induced deliberately to treat disease, notably to treat the mental disease resulting from syphilitic infection, this finding of Dr. Walker's appears to be of importance.

The artificial fever produced by high frequency apparatus, in which the temperature of the body is elevated by passing short radio waves through it, appears more dangerous than the artificial fever produced by the thermostat, Dr. Walker reported. In his work with the rats he used both methods.

Discovery of the effect of high temperatures on cancer cells was made in the course of test-tube experiments with a certain type of breast cancer from which Dr. Walker's colony of rats suf-