

ASTRONOMY

Jupiter, Saturn Still Visible

Venus shifts from the evening to the morning sky and Jupiter, except for the moon, is the brightest object in the November evening sky, James Stokley reports.

➤ **ALTHOUGH** the planet Venus during November shifts from the evening to the morning sky, Jupiter and Saturn appear all month during the evening and Mars rises before midnight.

Jupiter and Saturn, along with the surrounding stars, are shown on the accompanying maps. These depict the sky as it looks about 10 o'clock, your own kind of standard time, at the beginning of November, an hour earlier in the middle of the month and two hours earlier as it comes to an end.

Except for the moon, Jupiter is the brightest object during the evening, with astronomical magnitude of minus 2.1. It is in the southwest, in the constellation of Aquarius, the water carrier, for the map times. Earlier in the evening, about the first of the month, the star group and the planet will be directly south. Similarly, the whole sky will then be shifted farther toward the east. Jupiter sets about 1:00 a.m. at the first of November, and about midnight at mid-month.

Saturn Visible

Saturn is in the constellation of Capricornus, the horned goat, which is lower and farther west than Aquarius. This planet sets about 10:30 Nov. 1 and 9:30 on the 15th. Thus, on the map, it is shown close to the horizon with its light dimmed on account of the greater thickness of atmosphere that it must penetrate.

At the beginning of November, Venus sets less than half an hour after the sun, so it will be difficult to locate. On the 12th it reaches inferior conjunction, when it moves between sun and earth. Thereafter it will be to the west of the sun, coming up before sunrise. By the end of November it will be conspicuous in the early morning sky, rising more than two hours before sunrise.

Mars comes up in the east about 11:00 p.m. on the first, 10:30 on the 15th and 10:00 on the 30th. At the same time it is increasing in brightness, from magnitude 0.7 to 0.3. This is because the planet is rapidly approaching us. Its distance, at the beginning of November, is about 116 million miles. On the 15th it is about ten million miles closer. When the month ends, it will be a little less than 95 million miles away, only a little more than the sun's distance. (The closest approach, for this visit, will come next Feb. 3. Its distance will then be 62.4 million miles.)

Among the stars of November evenings, the brightest is Vega, in Lyra, the lyre, over in the northwest. Above it is Cygnus, the swan, with first magnitude Deneb; to the left (shown on the map of the southern

half of the sky) is Altair in Aquila, the eagle.

In the northeast is Capella, in Auriga, the charioteer. To the right (southern map) is Aldebaran, in Taurus, the bull. This star is distinctly red in color. And below Taurus, Orion, the warrior, is just coming into view, with two first magnitude stars: Betelgeuse and Rigel. Toward the south, below and a little farther east than Jupiter, stands Fomalhaut. This star is part of the southern fish, Piscis Austrinus.

How far can a person see with the naked eye?

Ask someone this question. Perhaps he will think of the view of some distant state from the top of a high mountain and answer "a hundred miles," or something of that order.

A more correct answer, however, is fifteen quintillion miles—that is, 15 followed by 18 ciphers!

And November evenings afford the best opportunity to look so far, for the object at that distance is high overhead. It is the galaxy in the constellation of Andromeda, often designated as M 31, its number in the catalogue of such objects compiled by a

French astronomer named Charles Messier in 1781.

Because Andromeda, pictured as the chained princess, is directly overhead for the map times, it is shown partly on the northern chart and partly on the southern. The special map, Fig. 1 (p. 278), shows this part of the sky together.

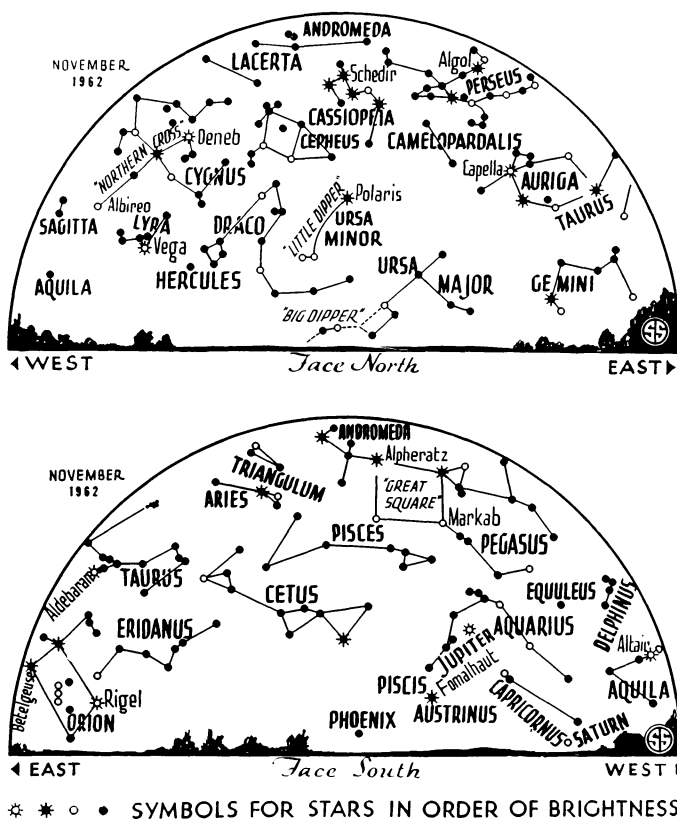
Great Square of Pegasus

Look first for the constellation of Pegasus, the winged horse, high in the southwest. There you can see four stars, arranged in a square, generally known as "the great square in Pegasus." But actually the star in the upper left-hand corner, Alpheratz (sometimes called Sirrah), is not in Pegasus at all. It is part of the next-door constellation of Andromeda. And just to the north of Andromeda is Cassiopeia, who in mythology was Andromeda's mother, the queen. (Cepheus, represented by another constellation nearby, was the king.)

If, from Alpheratz, you look toward the northeast you will come to two other stars about as bright (they are all second magnitude). These are called Mirach and Almak, although the names are seldom used.

Between Alpheratz and Mirach, as between Mirach and Almak, are fainter stars, of the fourth magnitude. And from each of these, as from Mirach, there extend lines of faint stars toward the northwest. Just to

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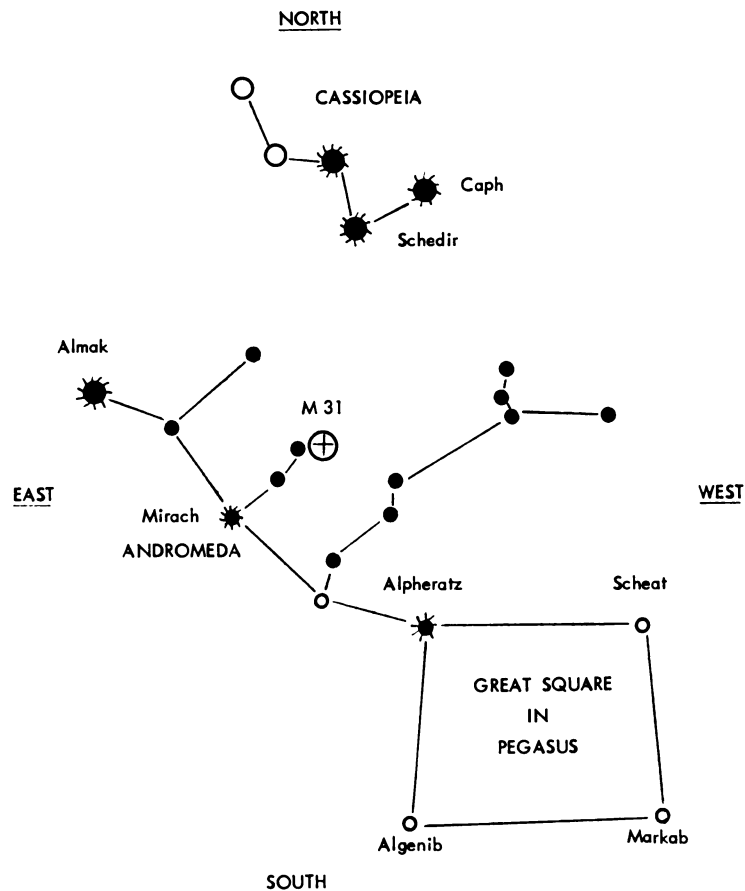


Fig. 1 MAP SHOWING LOCATION OF ANDROMEDA GALAXY -- M 31

(Continued from p. 274)

the west of the second star from Mirach (which has no special name but is designated as nu Andromedae) is a hazy patch of light. You can see it clearly with the naked eye if the sky is clear—and dark.

This is Messier 31, or M 31, 15,000,000,000,000,000 (15 quintillion) miles away! To go that distance, light—which travels at a speed of 186,000 miles every second—takes about 2,500,000 years. Thus, to avoid using such an awkwardly large number as 15 quintillion, the astronomer says that its distance is 2.5 million light years. Or, using another unit, it is 0.77 megaparsecs. A parsec is equal to 3.26 light years, and a megaparsec is a million parsecs, or 3,260,000 light years. When you look at it, the light energy that enters your eye left on its journey long before the human species had evolved on earth.

M 31 is a twin of our galaxy, the Milky Way system of which our sun is a very minor part. This is made up of some hundred billion stars, arranged in the shape of a grindstone about a hundred thousand light years in diameter. We are in it, although not at the center, but part way out toward the edge. As we look in the direction of the center, we see a concentration of stars—so close together that the naked eye does not show them separately, and this causes the effect of the Milky Way.

Toward the sides of the grindstone there

are considerably fewer stars, and in that direction we can look beyond, and see the millions of other galaxies that can be photographed with large telescopes. Of these, the one in Andromeda is one of the closest.

If you were living on a planet, going around one of the billions of stars that make up Messier 31, and looked back toward our galaxy, you would see very much the same thing that you do when you look toward it.

Celestial Time Table for November

Nov.	EST
2	5:42 p.m. Algol (variable star in Perseus) at minimum brightness
4	2:00 p.m. Moon passes Saturn
5	2:15 a.m. Moon in first quarter
6	1:00 p.m. Moon passes Jupiter
10	9:00 a.m. Moon nearest; distance 223,500 miles
11	5:04 p.m. Full moon
12	3:00 p.m. Venus between sun and earth
14	4:58 a.m. Algol at minimum
16	early a.m. Meteors visible radiating from constellation of Leo
17	1:47 a.m. Algol at minimum
18	4:00 a.m. Moon passes Mars
	9:10 a.m. Moon in last quarter
19	10:36 p.m. Algol at minimum
22	11:00 a.m. Moon farthest; distance 252,000 miles
	7:25 p.m. Algol at minimum
27	1:30 a.m. New moon
Subtract one hour for CST, two hours for MST, and three hours for PST.	

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