

ASTRONOMY

# Sky Journeys

## A Telescope, Costing Less Than Cheapest Automobile, Would Make Possible Infinitely Longer Trips in Space

By JAMES STOKLEY

TO anyone who has a small telescope, or who is fortunate enough to have access to one either small or large, the part of the sky overhead on September evenings affords an excellent chance for celestial sight-seeing. The marvelous discoveries made with the great telescope at such observatories as Mt. Wilson have had a tendency to overshadow the work that can be done with smaller instruments, especially in the minds of the public. But there are plenty of opportunities by which the owner of a small instrument can do good scientific work.

Such a telescope can be purchased for a cost less than that paid for even the cheapest automobile, yet the journeys that the telescope owner can take into space make the motorist's longest trips seem insignificant. If even this is too great an expense, one can do as many amateurs have done—build his own. An expenditure of from \$25 to \$50, in addition to some time and work, is enough to provide an instrument that will equal professional products costing many times as much.

### Planets First

The planets, of course, are the things that one would first examine this month. Turning the instrument towards Jupiter, we see that he is not alone, but is attended by four satellites. From night to night these change their positions as they are constantly revolving around the planet. On September 1, for instance, three are seen to the left, one to the right. On September 2, three are to the right and one to the left. On the third, two are to the right and one to the left—the fourth seems to have vanished. But on the fourth, four are again visible. The one that disappeared on the third was then hiding behind Jupiter.

Looking at Jupiter itself, using a higher power in the telescope, we find that it is not uniformly colored, but has light and dark bands across its surface. These are the cloud belts, we see no solid surface but only the tops of the clouds, which are of varying color. But these are not clouds of water vapor, like those

above the earth; they are clouds of methane and ammonia. These compounds are gaseous on earth, but the temperature is so low on Jupiter that they exist there in solid form.

Saturn shines in the east, so next the instrument is turned in his direction. At the present time Saturn's rings do not show up to their best advantage, because they are almost in line with the earth, and are so thin that we cannot see them as actual rings. Instead, we see the ball of the planet, looking somewhat like a smaller Jupiter, and the rings appear as a thin line thrust through it. The largest of Saturn's satellites is visible with even a very small glass, a somewhat larger one shows four others.

### No Martians

But by this time the observer is anxious to see Mars. However, the first view is probably disappointing, because no "canals" are visible, no Martians can be seen walking around! Sensational articles about Mars have made the layman expect too much, for the very existence of the canals is doubtful. The curious straight lines which have given rise to theories concerning them are only seen with the largest of telescopes.

However, as we look at Mars, we can see the ruddy color of the planet, and dark markings, which are probably areas of vegetation.

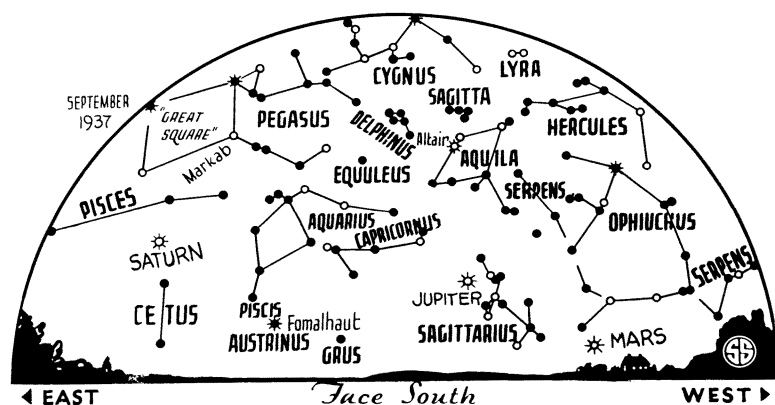
### Moon at Quarter

Perhaps we are observing on a night when the moon is visible. Contrary to many ideas, the best time to see it is not when full, but when near first quarter. When full, the light is falling on it from directly behind us, there are no shadows, and we only see the light and dark areas. These are called "seas," even though we know that the moon lacks water, as well as an atmosphere. But at first quarter, though half the moon is in darkness, the sunlight is shining on the other half from the side, the mountains, craters, etc., that make the moon so interesting cast shadows, bringing them into relief.

The moon and the planets are all in our own system, so now let us go out beyond its limits, among the distant stars. Overhead is Vega, but when we look at it, or at any star, we find that though brighter it is only a point of light. The stars are distant suns, but so far away that even if we magnify them thousands of times they are still mere points of light. The nearer planets are magnified enough to make them appear as actual discs.

There are two faint stars nearby, forming an equilateral triangle with Vega.

☼ \* ○ ● SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS



STILL WITH US

*The three bright planets still beautify the southern skies.*



If you have a small telescope, look high in the heavens for Vega, considered by many the most beautiful star.

The northernmost one is epsilon Lyrae. To a very keen eye, or with a pair of binoculars, this one is seen to be two stars. And now, if we turn our telescope on the pair, we find that each is in turn made up of two others. This is the famous "double-double." Many stars in the sky that look as one without a telescope, really consist of two, or even more, revolving around each other. Nearby Al-bireo, the star at the foot of the northern cross, or the head of the swan, is also a double, in which one component is a golden yellow, the other blue, making it a magnificent sight.

West of Lyra is Hercules, in which six of the brighter stars form the outline of a butterfly, the direction of the body east and west. About half way between the two stars that form the western edge of the northern wing a faint patch of light can be seen on a dark night. Through the telescope we find that this is not a double star but a huge cluster of suns! It is known as the great cluster in Hercules, and its distance is so great that its light, though traveling eleven million miles a minute, takes some 35,000 years to reach us. About 100,000 stars comprise it, yet at its distance a star only as bright as our sun would be invisible through the biggest telescope.

Great Galaxy

Andromeda is close by, made up largely of two streams of stars that run northwards from the northern corner of the square of Pegasus. In the uppermost of these streams, if the night is dark, and one is away from city glare, another hazy spot is visible to the naked eye. Through the telescope it is seen a little better, but it is really remarkable that we see it at all, for this object, "great galaxy in Andromeda," is at the appalling distance

of 680,000 light years—that is, its light takes that many years to reach us. This is another swarm of stars, but far greater than the Hercules cluster, for many such are included in it. It is a whole stellar system, similar to that formed by the Milky Way, and of which the sun and all the stars we see are part. It is the nearest of the outer galaxies, of which many million can be observed with the greatest telescopes. As our instrument takes us out to this, we begin truly to realize something of the immensity of the universe!

Those who count only on their unaided eyes to enjoy the beauties of the heavens may also enjoy the skies in September.

Still With Us

The three planets which were seen in the evenings last month will still be with us. Brightest is Jupiter, low in the south as indicated on the accompanying maps (drawn for 10:00 p. m. on Sept. 1, 9:00 p. m. on the 15th and 8:00 p. m. on the 30th). It is in the constellation of Sagittarius. Mars is fainter, and farther west, in Ophiuchus, the serpent carrier. It has a reddish color, and sets about four hours after the sun. Saturn, still fainter, though brighter than most of the stars, is in Pisces, directly south of the "great square" in the constellation of Pegasus.

Later in the night the other two naked eye planets will appear. Venus, brightest of all, though fainter than it has been lately, is seen about three hours before sunrise, in the southeast. At the very end of the month, seldom-seen Mercury will be well above the southeastern horizon in the morning twilight, as it rises then about an hour and a half before the sun.

Six first magnitude stars adorn the September evening sky. Most brilliant is Vega, part of Lyra, the lyre, which is high in the west. Farther south is Aquila, the eagle, with Altair, a bright star attended above and below by a fainter companion. Directly overhead is Cygnus, the swan, the brighter stars of which form such a good cross that it is sometimes referred to as the "northern cross." The top of the cross, marked by the star Deneb, is to the northeast, the vertical member runs to the southwest. Deneb is the tip of the swan's tail, in fact, this name is the Arabic word for "tail." The crossarms form the bird's wings, outstretched in flight, and the bottom of the cross his long neck. Vega, Deneb and Altair form a large triangle in the sky which can be easily located.

Low in the southeast is the constellation of Piscis Austrinus, the southern fish, with the star Fomalhaut, one of the most southerly bright stars visible from the United States. In the northwest is Bootes, the bear-driver, with Arcturus, which can be located, as usual, by following the curve of the handle of the great dipper. Capella, of Auriga, the charioteer, is just coming into view above the northeastern horizon.

Autumn Arrives

During September the sun's motion through the sky, actually the result of the annual motion around it of the earth, will take it to a position in which it is directly over the equator. This is the autumnal equinox, which marks the beginning of autumn. It happens at 6:13 a. m., eastern standard time, on the 23rd.

The moon's phases during the month are given in the table below. From about the 10th to the 23rd, the evenings will be moonlit. The full moon on the 20th is the "harvest moon." At this time the moon rises for several nights only slightly later than on the night before. The moon is most distant from the earth during the month at 5:00 p. m. on the 11th, at a distance of 251,130 miles. On the 23rd it will be closest, 227,880 miles away.

Phases of the Moon

E.S.T.

New Moon.....	Sept. 4	5:54 p.m.
First Quarter.....	12	3:57 p.m.
Full moon .....	20	6:32 a.m.
Last Quarter.....	27	12:43 a.m.