Venus, Brightest, Casts Visible Shadow

Astronomy

By James Stokley

Shadows cast by the sun during the day are familiar to everybody. So are shadows cast by the moon when it is bright. And with the mention of these, most people would probably think that the list of heavenly objects producing visible shadows would be exhausted. But during this month, it is possible to see shadows cast by a third body—the planet Venus. Before March 10, the moon will set well before Venus, and the evenings will be dark. On one of these evenings get away from the bright lights of the city to a place where you can see the planet Venus, shining more brilliantly than any other star or planet, in the western sky. Then, if you hold up a piece of white paper, and move your hand around, you will be able to see its shadow, cast by the light of Venus.

This month Venus is of the minus 4.3 magnitude, as astronomers reckon the brightness of stars. The negative quantity — with the "minus" in front of it—is due to the fact that accurate measurements of stellar brightness are rather recent achievements. The ancient astronomers Hipparchus and Ptolemy started to measure star brightnesses. They arbitrarily divided all the stars into six magnitudes. The first included the brightest, like Sirius, the sixth the faintest visible to the eye. As this was long before the invention of the telescope, they did not know that there were still fainter stars, and thought that they had taken care of everything.

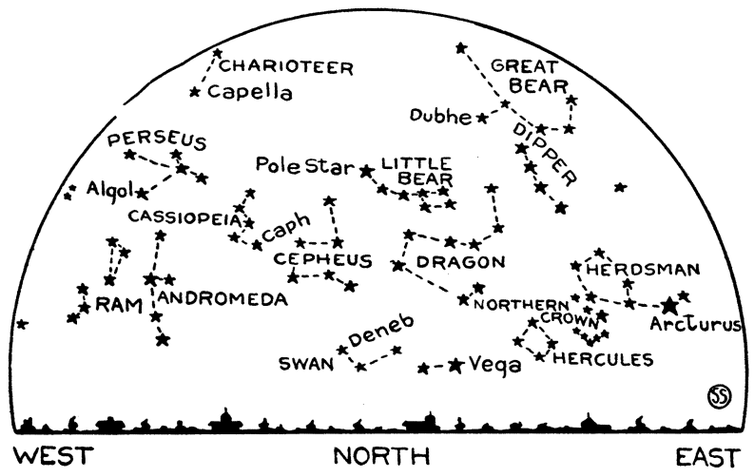
Then came the invention of the telescope in the 17th century. Fainter stars were seen, and as the system had come into such general use, it was extended to the seventh, eighth, ninth, and fainter magnitudes. Today, with the 100-inch Mount Wilson telescope, stars as faint as the twenty-first magnitude can be recorded on the photographic plates.

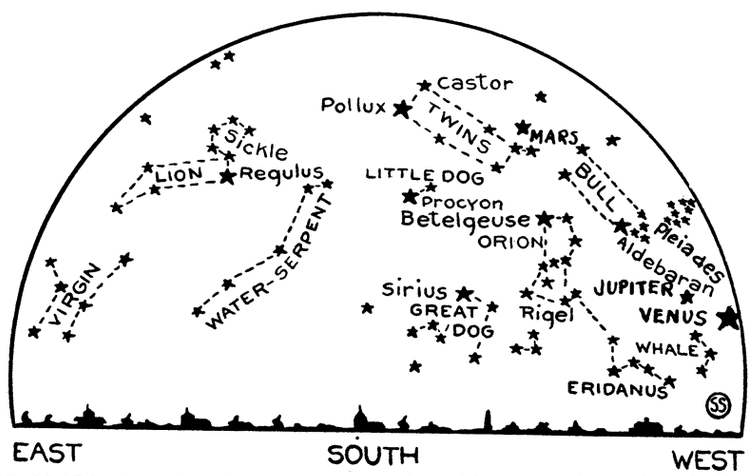
As a definite meaning came to be given the magnitude figures, made possible because of instruments that were able to give precise values of the star's brightnesses, it was found that some of the stars, such as Sirius, were actually brighter than the first magnitude. As the planets become still brighter, it was necessary to use negative quantities. A star of 0 magnitude would be as much brighter than one of first magnitude as a first magnitude star would exceed one of the second magnitude. There would be the same difference between a star of minus 1 magnitude and 0 magnitude. The brightest star, Sirius, is of the minus 1.6 magnitude, so that when we say Venus' magnitude is now minus 4.3, we mean that it is very brilliant. On the same scale the full moon would be minus 12.5 magnitude, while the sun would be minus 26.7.

The stars remain at the same brightness unless they belong to the rather large class of variable stars. Why is it, then. that Venus, a few months ago entirely invisible, is now so bright as to exceed almost everything else in the sky? The reason is found in its motion, and the fact that, being a planet, and not a star, it shines with reflected sunlight.

The orbit of Venus is within that of the earth. Once in about 225 days it makes a complete circuit of its orbit, so that twice in this period is it visible to earth-dwellers—once as a morning star and once, as now, as an evening star. At one time it is to the east of the sun. Then the sun sets first and we see it in the evening after sunset. After that it moves around and comes between the earth and the sun, as it will do in a few months, and then it is lost in the brilliant glare. After that it moves on to the western side of the sun, and can be seen in the morning, for it rises before the sun. Still later, it moves around to a position back of the sun, and is again completely invisible. Then it again reaches the eastern side of the sun, and, 225 days after the first mentioned position, is again an evening star.

On the average, the earth is about 93,000,000 miles from the sun, while Venus is about 67,000,000. Hence, when it is be- (*Turn to next page*)





THESE MAPS show the sky as it appears these March evenings. Just hold them in front of you as you face north or south, and the upper or lower will represent the stars you see on a clear night

Venus Now Casts Visible Shadow—*Continued*

tween the sun and earth, it is only 26,000,000 miles from us, while when it is on the opposite side of the sun, a distance of 160,000,000 miles separates the two planets. The result is that sometimes Venus is seen much larger than at other times, because it is so much closer. But there is another difference. When it is far away, and on the other side of the sun, we see the entire illuminated surface of the planet, and through a telescope it looks round. When it is at the side of the sun, the telescope shows it larger, but as a semicircle, or a little half-moon. And then as it gets still closer, it becomes a crescent. When just about to disappear in the sun's glare, it is seen largest, and as a very narrow crescent.

These phases of Venus are not apparent to the naked eye, though a small telescope will reveal them. But the brightness that the planet has to the naked eye depends on the area of the illuminated surface that we can see. When it is largest, it is a very narrow crescent, and so the entire illuminated area is small. When it is a somewhat wider crescent, about the same as the moon a few days after it is new, the illuminated area presented is greatest, and then the planet reaches its greatest magnitude. This takes place this month on the fourteenth.

However, even this is not the whole story, for some maxima are more brilliant than others. The planets all travel in a path called the ecliptic. Positions in the heavens are measured from the celestial equator, just as latitude on the earth is measured from the terrestrial equator. The celestial equator is the part of the sky directly over the equator of the earth. The ecliptic is inclined to the equator at an angle of 23½ degrees, which means that when a planet is in one part, it is well to the north, but when it is in the opposite part of the sky, it is equally far to the south. It happens that when Venus, or any planet, is seen in the western evening sky in springtime, it is in the northernmost part of the ecliptic. This, in turn, brings the planet much higher in the sky than it can be in the evening at any other part of the year, and the higher a heavenly object is, the less of its light is absorbed by the earth's atmosphere. So, this month, conditions are just right for making Venus appear just about as bright as it can become.

Though Venus is the most brilliant planet in the sky, it is not the only one. Jupiter runs a close second, and can be seen a little to the east of Venus, of the minus 1.7 magnitude. Except for Venus, Jupiter is brighter than any other star or planet. Still farther east, in the constellation of the twins, Gemini, is Mars, the red planet. Compared with its two planetary brethren, Mars is quite faint, though at that, it is brighter than most of the stars. It diminishes in brightness during the month. At the beginning it is of the .4 magnitude, about the same as that of the star Procyon, in the little dog, which appears in the southern sky. By the end of March it will have faded to magnitude 1, somewhat fainter than the star Betelgeuse, northernmost star in Orion, but brighter than Aldebaran, the red star in Taurus, the bull, seen in the western sky. Owing to the different character of the steady light of the planet, and the scintillant brilliance of the stars, it is rather difficult to compare them with the naked eye, however.

On the evening of the thirteenth the display of brilliant planets in the western sky will be augmented by the moon, for on that date Venus and the moon are in conjunction, which means that they are close together. A few days later, on the eighteenth, the moon occults Mars by passing in front of that planet, but as the occultation occurs in the morning, after sunrise, it will not be seen with the naked eye.

The evening sky this month presents ten stars that are brighter than magnitude 1.5, commonly called "first magnitude" stars. These include Sirius, in Canis Major, the great dog, low in the southwest; Capella, in Auriga, the Charioteer, in the west, a little to the north; and Arcturus, in Bootes, low in the east. Rigel, the lower star in Orion, and Betelgeuse, the northern one, already mentioned, also belong in this group. So does Procyon and Aldebaran, Pollux, the southernmost of the twins, Gemini, high in the west; Spica, in Virgo, in the southeast; and Regulus, the bright star at the end of the handle of the "sickle" in Leo, the lion, hanging like a question mark in the south.

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According to available records, there were just 44 Americans in China in 1836.

A careful census of the Navajo tribe, now being taken, indicates that there are about 38,000 of these Indians.