

ASTRONOMY

Shadows in Space

Eclipses This Month of Sun and Moon Are Visible Only From Abroad While a Star Occultation Can be Seen at Home

By JAMES STOKLEY

THOUGH two eclipses, one of the sun, the other of the moon, form the features of the celestial program for the month of September, an American who wants to see them will have to do some travelling. Not until next year, on the 31st of August, will he be able to see a solar eclipse at home, while the next lunar eclipse visible from the United States is even later. But, in addition, September brings the first occultation, or eclipse, of a naked eye star in some months, an event which can be watched from this country.

The solar eclipse occurs on the afternoon of September 11. As always, this is due to the shadow of the moon, cast by the sun, sweeping across the earth, but only the outer part of the shadow touches our planet. If all the brightness of the sun were concentrated in a point, instead of being spread out over an area half a degree in diameter, the moon's shadow would be sharply defined. One point, on the side of the moon away from the sun, might be in the shade, another, a short distance away, might be exposed to the full solar glare. But the sun is much closer than any of the other stars, so unlike them it presents a disc, and not a point of light. Consequently the moon's shadow is divided into two parts. If, with some inter-planetary rocket craft of the future, you were to travel around the moon at a distance of 240,000 miles, approximately that of the earth, you would see the sun unobscured most of the time. Then you would come, perhaps, to a place where your position, the edge of the moon, and the opposite edge of the sun were directly in line. As you travelled a little farther, the moon would begin to come in front of the sun. This would be a partial eclipse, and you would be in the outer part of the shadow, what is called the penumbra. Suppose that you went still farther. More and more of the sun would be obscured, but still a little would be seen, until you reached the inner part of the shadow. As you got to this point, your

ship, one edge of the moon and the same edge of the sun would all be in line. You would go still farther and none of the sun would appear, you would be in the inner part of the shadow—the umbra—and the sun would be in total eclipse.

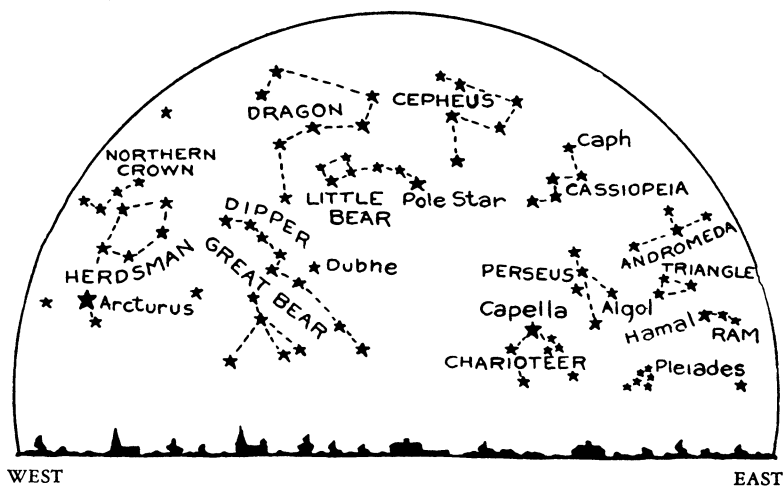
In order to have a total eclipse, therefore, the moon's umbra must reach the surface of the earth, for as yet we have no such rocket ships to chase eclipses all around the universe. When a total eclipse does occur, as is the case during next August, the umbra only reaches a small part of the earth.

Engulfed in Penumbra

All around it is a region engulfed in the penumbra, so every total eclipse is accompanied by a partial eclipse over a much larger area. But sometimes just the penumbra touches earth, and the umbra misses it completely. Then we have a partial eclipse without a total—the condition occurring on September 11. When this happens, the penumbra touches somewhere in the polar regions. This month it includes Alaska, Bering Strait and East Cape. Even where the sun is obscured to its maximum extent, the moon will extend over only a twentieth of its diameter.

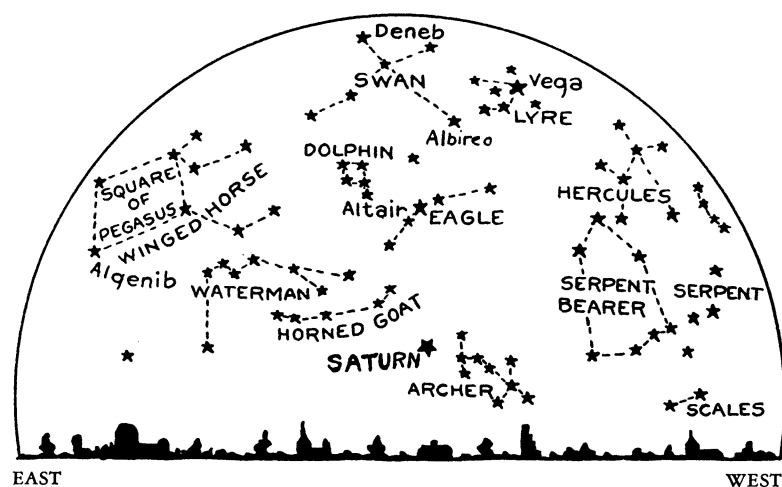
This is so slight that people in Alaska will not notice any diminution in the brightness of the sunlight. Only by looking at the sun, through smoked glass, will they be able to see a tiny section apparently bitten out of it. Such an eclipse has no scientific importance whatever, and no astronomical expeditions will observe it. Even if an astronomer happened to be there at the time, he would probably give it no more than a passing glance.

The eclipse of the moon is a little better in one respect, for at least it is total. Just as the moon casts a shadow out into space on the side away from the sun, so does the earth cast a similar shadow. The earth's shadow also contains the inner umbra and the outer penumbra. And just as the earth sometimes enters the moon's shadow, so does the moon occasionally wander into the shadow of the earth. But there is one important difference. The earth is 7,900 miles in diameter, as compared with the moon's 2,200 miles, so our shadow is much bigger. Thus, the moon's shadow can never fall on more than a small fraction of the earth's surface, but the earth's shadow can, and does, completely engulf the moon. This happens on September 26, and at any part of the earth where the moon has risen, the eclipse will be visible. Even in eclipse, the moon can usually be seen, because the atmosphere of the earth bends a little sunlight around into the shadow,



NORTHERN SKIES DURING SEPTEMBER

Here are found two bright stars, Arcturus in the west and Capella near the northeastern horizon. In addition, there are such familiar figures as the Great and Little Bears, the Dipper, and the Pole Star.



VEGA IS MOST CONSPICUOUS

Of the stars to be seen this month. Its position will be almost overhead. Just east of Vega in the southern heavens is the constellation of the Swan, sometimes called the northern cross. Deneb is at the head of the cross and Albireo marks the foot.

which has the effect of illuminating the moon with a ruddy glow.

As it must always be when eclipsed, the moon is full on the night of the 26th, and so it rises at sunset, or 5.48 P. M., local time. Unfortunately for would-be eclipse observers, the total eclipse ends at 3:30 P. M., Eastern standard time. That is the moment when the moon begins to emerge from the umbra. At 4:41 P. M., Eastern standard time, it has withdrawn from the umbra completely. At 5:55 P. M., Eastern standard time, it completely leaves the penumbra, and the eclipse is entirely over. Thus, in the eastern part of the country, for a few minutes after moonrise, the moon will still be very slightly eclipsed, but it will be so slight that no instruments could detect the diminution in its light. Only where the total eclipse can be seen will anything of interest be noted. This area will include, for the beginning, the western Pacific Ocean, Asia, Australia, the Indian Ocean Europe and all of Africa but the northwestern part. The ending will be visible in all but the eastern part of this area, and, in addition, the Atlantic Ocean and the eastern part of South America. But though a lunar eclipse is of considerable interest as a spectacle, it, also, is of little scientific value, and no expeditions are being made to observe it. However, established observatories that can see it will possibly make routine observations to check up the times of the different parts of the eclipse.

The remaining event, that can be witnessed from the United States, is an occultation. Besides occasionally coming between the earth and the sun, the

moon can also come between us and a star. This is called an occultation. Because there are so many more stars than the sun, occultations are much more common than eclipses, but most are of faint stars, visible only in a telescope. On September 4, at 1:07 A. M., eastern standard time, the moon comes in front of the star 27 Tauri. This is one of the fainter stars in the constellation of Taurus, the bull, characterized by the red Aldebaran, which shines in the eastern sky in the early morning hours. 27 Tauri is of the 3.7 magnitude. Though this is well above the usual limit of naked eye visibility, the fact that it is so close to the moon, then just before last quarter, will make it rather difficult to see. A small telescope, or even a good pair of binoculars, or opera glasses, will aid considerably in revealing the star. The bright edge of the moon will approach the star, suddenly covering it, when the star will do a disappearing act completely and precisely on the instant.

Moon Lacks Atmosphere

Nearly an hour later, at 2:05 A. M., eastern standard time, the moon will have passed on and the star will reappear, from behind the dark edge of the moon. This is particularly interesting to watch, for no star will be seen up to the moment of emergence, then instantaneously it will be visible, shining with full brilliancy. Such an observation is a good proof that the moon lacks an atmosphere. Were there a layer of air around our satellite, as there is around the earth, the star's light would shine through an increasingly

thin layer of gas, and the light would reappear gradually.

Such occultations are regularly observed by observatories, because they afford an excellent means of checking the moon's position. So numerous are the influences which pull the moon, first one way, then another, that exact prediction of its motions is one of the most difficult problems of modern astronomy. This makes a constant check necessary on its positions, to detect possible errors. Because the positions of the stars are known with great precision, and the abruptness of an occultation gives a very definite time to measure, occultations are of great value. Sometimes, also, it is possible to tell something about a star from an occultation. Very rare observations have been made when a star did not reappear as suddenly as expected, but took an appreciable fraction of a second to reach maximum brightness. This is not due to any lunar atmosphere, but to the star's diameter being so large that it takes the moon a fraction of a second to traverse it. But most of the stars are so nearly single points of light, that this effect is seldom seen. Recently, however, a South American astronomer, Dr. B. H. Dawson, noticed that when a star called sigma Scorpii reappeared after an occultation, there were two appreciable steps. This was probably due to the two parts of the star reappearing separately. This star is known to be a spectroscopic binary. That is, it consists of two separate spheres, each revolving around the other, but so close that even the most powerful telescope is too feeble to separate them. Only by studying its light in the spectroscope are astronomers able to detect its duplicity, except by means of an occultation.

Most conspicuous of the stars to be seen this month, is Vega, nearly overhead and marking the group of Lyra, the lyre. Just east of Vega, though considerably fainter, is Deneb, marking Cygnus, the swan. This constellation is also known as the northern cross. The bottom of the cross points to the southwest, and Deneb is at the head. The star Albireo, still fainter, marks the foot. Just south of Cygnus is the bright star Altair, more brilliant than Deneb, though inferior to Vega. Altair is in the group of Aquila, the eagle. Two other bright stars, exceeded only by Vega among those now visible, are to be seen in the northeast and in the west, but the fact that they are very low in the sky reduces their brilliance. In the west, a little to the north, is Arc-turus, in Bootes; (*Turn to page 156*)

helix produced a deflection of thirty-seven degrees; from two helices both on the same rod fifty-two degrees, and from three fifty-nine degrees: but when four helices were used, the deflection was only fifty-five degrees, and when to these were added the helix of smaller wire around the armature, the deflection was no more than thirty degrees. This result may perhaps have been somewhat affected by the want of proper insulation in the several spires of the helices, it however establishes the fact that an increase in the electric current is produced by using at least two or three helices instead of one. The same principle was applied to another arrangement which seems to afford the maximum of electric development from a given magnetic power; in place of the two pieces of iron and the armature used in the last experiments, the poles of the magnet were connected by a single rod of iron, bent into the form of a horse-shoe, and its extremities filed perfectly flat so as to come in perfect contact with the faces of the poles: around the middle of the arch of this horse-shoe, two strands of copper wire were tightly coiled one over the other. A current from one of these

helices deflected the needle one hundred degrees, and when both were used the needle was deflected with such force as to make a complete circuit. But the most surprising effect was produced when instead of passing the current through the long wires to the galvanometer, the opposite ends of the helices were held nearly in contact with each other, and the magnet suddenly excited; in this case a small but vivid spark was seen to pass between the ends of the wires and this effect was repeated as often as the state of intensity of the magnet was changed.

In these experiments the connection of the battery with the wires from the magnet was not formed by soldering, but by two cups of mercury which permitted the galvanic action on the magnet to be instantaneously suspended and the polarity to be changed and recharged without removing the battery from the acid; a succession of vivid sparks was obtained by rapidly interrupting and forming the communication by means of one of these cups; but the greatest effect was produced when the magnetism was entirely destroyed and instantaneously reproduced by a change of polarity.

Science News Letter, September 5, 1931

COMMERCE

Floods May Increase Sale Of American Goods in China

THE Yangtze River, whose appellation "China's sustenance" has now become singularly ironical, may aid American commerce at the same time it brings sorrow to the area around the city of Hankow. Data at the Far East division in the U. S. Department of Commerce point to the probability of an increased sale in China of United States goods to replace those destroyed there by the recent floods.

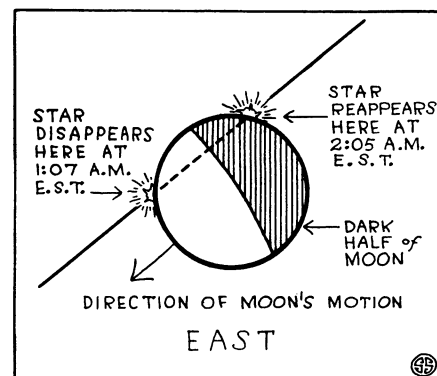
At this time of the year, when American vessels ply the trade route from San Francisco direct to Hankow, there exists a marked need for all kinds of stocks, from flour and other foodstuffs to machinery, from clothing to building materials. Cables to the Department of Commerce say that the majority of the reserve supplies have been lost by the raging waters, making supply from outside necessary and enlarging the market for United States goods.

The flooded Yangtze has made pos-

sible the passage of the large ocean-going steamers, which in low water time unloaded cargo at Shanghai for transshipment by smaller vessels. The city of Shanghai, which because of its proximity to the mouth of Yangtze has been believed by many to be flooded, actually has not been touched by the raging waters, nor is it likely to be. The highest water level has been reached, reports state, and the swollen streams are beginning the long ebb back to normal size.

The Yangtze river, itself, which has done so much damage to Hankow, is the collecting and distributing center of half the commerce of all China. It winds down from the Tibetan plateau across the ridges and plains to the Yellow Sea, a distance of some 3,000 miles. Its drainage area in Szechuen and below is about 650,000 square miles, four-fifths of which lie above Hankow.

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BEHIND THE MOON

As the diagram shows, is where Atlas, or "27 Tauri," was for almost an hour on the morning of Sept. 4.

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and near the northeastern horizon is Capella, in Auriga, the charioteer. Fomalhaut, in Piscis Austrinus, the southern fish, appears low in the south. It is slightly brighter than Deneb, but its proximity to the horizon partially dims it also.

As for the planets, only Saturn is visible in the evening this month. It is in the constellation of Sagittarius, the archer, low in the Southwest, below Aquila. The two eclipses give a good indication of the phases of the moon this month, for a solar eclipse can only occur when the moon is new and a lunar one only when it is full. It is at last quarter, therefore, on September 5, new on the 11th, at first quarter on the 18th and full on the 26th, so that from the middle to the end of the month the evenings will be moonlight.

At 7:24 P. M., on September 23, the sun, having advanced on its southward journey through the sky, crosses the equator. This is the autumnal equinox, and marks the official beginning of autumn.

Science News Letter, September 5, 1931

LINGUISTICS

Variability in American Speech to be Shown

A LINGUISTIC atlas of the United States is being prepared by the American Council of Learned Societies in Washington.

Language experts headed by Dr. Hans Kurath of the Ohio State University have begun to cross-examine the vocabularies of New England farmers, fishermen, social leaders, laborers, and other groups.

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