ASTRONOMY

June Brings Rare Eclipse

Longest Eclipse Seen in Twelve Centuries Occurs On June 8; Visible From Parts of Pacific Ocean

By JAMES STOKLEY

TWICE a year, at least, the moon passes completely or partly in front of the sun, and produces an eclipse of that body. Said another way, the moon's shadow then sweeps across the earth. The shadow consists of two parts. The inner part, called the umbra, tapers to a point and is about 232,000 miles long. In this the moon completely hides the sun. But around the umbra is an outer part, the penumbra, where the sun is only partly hidden.

Because the average distance of the earth from the moon is about 240,000 miles, on the occasions when the moon comes between the sun and earth, the shadow fails to reach the surface. Then the moon appears a little smaller than the sun, and even though it is seen directly in front of the sun, there is a ring of sunlight visible around it. This is an annular eclipse (from the Latin word annulus, meaning "a ring"), and is not of great scientific importance.

But sometimes the shadow reaches the earth. The nearer the moon, compared with the sun, the farther it reaches, and the larger is the shadow itself as cast upon the earth's surface. When everything is just right—when the eclipse occurs when the moon is nearest the earth and the sun farthest away, and when the shadow goes across the equator—it is possible for the shadow to be about 167 miles in diameter.

Path of Totality

However, the earth is turning, and the moon is moving around the earth, so the shadow does not "stay put." It sweeps across land and sea, tracing a "path of totality." Obviously, the larger the shadow, the longer it takes to pass a given point. It travels faster in some places than others. When it first touches the world, or when it leaves, its axis is almost tangent to the globe, and its motion is most rapid, as much as 5000 miles an hour.

But if it passes at a place where the sun and moon are overhead, which would be near the equator, the speed is much slower, only 1060 miles an hour. Considering all these things, the longest that it is possible to see the sun covered from one place is 7 minutes and 40 seconds.

Probably never in the millions of years since the earth was born has a 7 minute and 40 second eclipse occurred. Not since 1803 has there been one lasting as much as seven minutes. Not in the past twelve centuries has there been one as long as seven minutes and four seconds. Yet that is the length of the one visible from parts of the Pacific Ocean on Tuesday, June 8. Here, surely, is the chance of a millennium to study the many phenomena of a total eclipse which are so important to astronomers.

Longest Over Water

It would be, but for one thing. The greater part of the path, and all the part where the sun is in the best position and the duration longest, is over the water. Only in two areas, near the ends of the path, is there land upon which the necessary instruments can be erected with the necessary stability. At the western end, the shadow crosses some of the Phoenix Islands, British possessions. Two of them are considered possible.

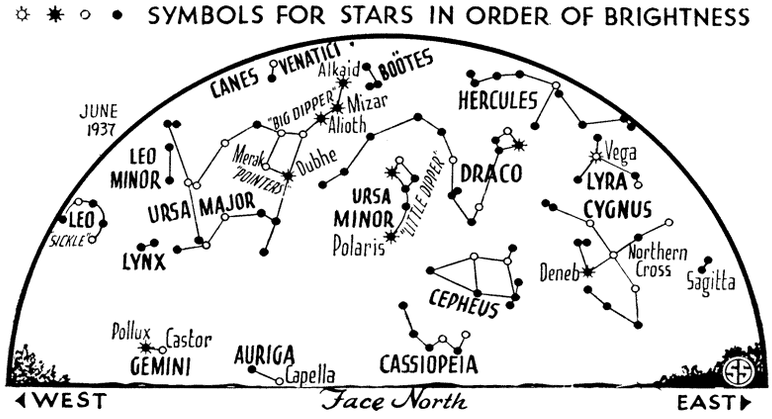
One is Enderbury, about two and a half miles long and a mile wide, 30 feet high, uninhabited, with no fresh water, no anchorage and a difficult landing. The other is Canton Island, a coral atoll 10 to 12 feet high, nine miles long and four miles wide. It has a spacious lagoon, with anchorage in 10 fathoms, so that is better for landing apparatus. Cocoanuts have been planted on the island, and there are a few people.

Canton would seem to be preferable, but it is a little farther from the center of the path, and totality lasts only 3 minutes 45 seconds, as compared with 4 minutes 8 seconds for Enderbury. The total eclipse occurs at each about 7:07 a. m. local time, or 2:07 p. m. Eastern Standard Time, with the sun not yet high in the eastern sky, only about 23 degrees above the horizon.

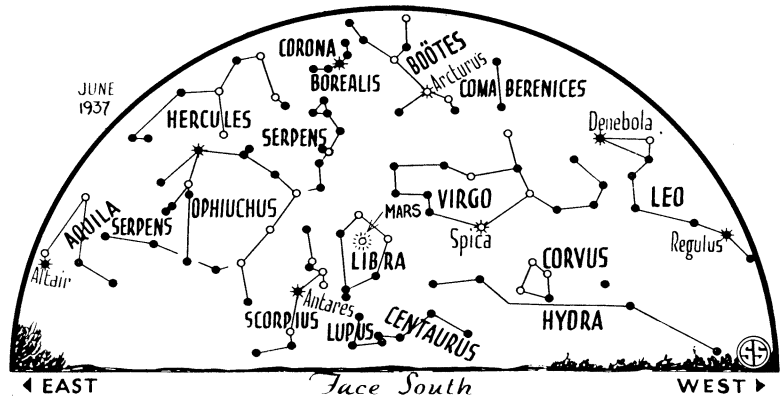
Best Available

Despite their disadvantages, these two islands are the best available, and, after all, even 3 minutes and 45 seconds is longer than the average length of a total eclipse. A group from New Zealand, with the cooperation of their Navy, is to make observations from Canton. Also an American group, representing the U. S. Naval Observatory, the National Bureau of Standards and the National Geographic Society, with personnel recruited from several other institutions as well, have journeyed to Canton, traveling from Honolulu in the Navy minesweeper "Avocet."

The other possible observing area is the coast of Peru. This is considerably more accessible than the Phoenix Islands, because commercial steamers run there regularly, but, astronomically, con-



DIPPER IN NORTH



MARS SHINES IN SOUTH

ditions are much worse. There the total eclipse happens at 5:25 p. m. Eastern Standard Time. This is also, approximately, the Peruvian local time, because the western coast of South America is directly south of the eastern United States. At the time of the eclipse it is about 45 minutes before sunset, the sun is only 8 degrees above the western horizon, and totality lasts 3 minutes and 20 seconds.

Peru will be the scene of at least two parties. One is Japanese, from the Kwasan Observatory at Kyoto. The other will represent the Hayden Planetarium, New York City. The University of San Marcos, the oldest in the western hemisphere, is cooperating with the visitors.

At both locations the observations will be of the same sort.

Though the eclipse overshadows other astronomical events of the month, there is another that is welcome. This happens on June 21. On that date, at 3:12 p. m. Eastern Standard Time, the sun reaches its farthest north position in the sky, and this is the summer solstice, the beginning of summer. This day is the longest of the year.

Vega Brightest

On the evenings of June the brightest star visible appears high in the east. This is Vega, of Lyra, the lyre. But this June it is not the brightest sky object. The moon and two planets, now visible, exceed it in splendor. One, shown on the accompanying maps (in which the skies are depicted for 10:00 p. m., standard time, at the beginning of the month, 9:00 p. m. in the middle, and 8 p. m. at the end) is Mars, in the group of Libra, the scales, in the south. Just to the left is Scorpius, the scorpion, with the red star Antares.

The name, by the way, means "rival of Mars," applied no doubt because of its color. This month we have a good chance to compare them and we find that it is a rather feeble rival, as far as brilliance is concerned.

The other planet of the June evenings is Jupiter, which appears to the southeast about 10:30 p. m., standard time, and is even brighter than Mars. It is in the constellation of Sagittarius, the archer, to the left of the scorpion, and it is not shown on the maps.

Look for Pointers

To locate other bright stars of the June sky, one might start with the great dipper, high in the north. The two lower stars in the bowl are the famous pointers, indicating the direction of the pole-star. The curved handle is also a guide post. If we follow its curve to the south, we come first to Arcturus, in Bootes, the bear driver, and then to Spica, in Virgo, the Virgin.

Descending in the west is Leo, the lion, with the star Regulus at the end of the handle (to the south) of a subgroup called the sickle. Near the horizon, in the northwest, are Castor and Pollux, of Gemini, the twins, and still lower, and farther north, is Capella, in Auriga, the charioteer. However, this is so near the horizon, that it is very difficult to see during the month.

Below Vega, to the east, is the northern cross, of Cygnus, the swan. Deneb is the brighest star, at the top of the cross, which is on its side. Altair, in Aquila, the eagle, is a neighbor, to the right.

Phases of the Moon

		E. S. T.
Last Quarter..... June	2	12:24 a. m.
New Moon	8	3:43 p. m.
First Quarter	15	2:03 p. m.
Full Moon	23	6.00 p. m.

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rona was obtained. As a result scientists exposed for the bright light and let the faint part fade out into nothingness. Naturally they have always wondered about the knowledge that might be gained from the faint, lost part.

Also on the coast hills and mountains of Peru will be the Hayden Planetarium Grace Expedition from the American Museum of Natural History in New York City. Members of this party include: Dr. Clyde Fisher of the Planetarium as leader; Charles H. Coles, Dorothy A. Bennett; Prof. William H. Barton, Jr., Capt. A. W. Stevens, Dr. S. A. Korff, and Hans Christian Adamson.

In the South Seas expedition to the islands of the Phoenix group will be: Dr. S. A. Mitchell, director of Leander McCormick Observatory, University of Virginia, as leader; Capt. J. F. Hellweg, superintendent of the U. S. Naval Observatory; Dr. Paul A. McNally, director of Georgetown College Observatory; Dr. Floyd K. Richtmyer of Cornell University; Dr. Irvine C. Gardner, National Bureau of Standards; Dr. Theodore Dunham, Mt. Wilson Observatory; John W. Willis, U. S. Naval Observatory; Richard H. Stewart, National Geographic Society, Charles G. Thompson, Foundation for Astrophysical Research, and Charles Bittinger, Washington artist.

Broadcast

A world-wide broadcast will be made from the scene of the eclipse with George Hicks as announcer and Walter R. Brown and Marvin S. Adams, field engineers for the National Broadcasting Company. The Columbia Broadcasting System has prepared facilities to cover the event from Peru where Capt. Albert S. Stevens will describe his plans to make photographs from an airplane.

Because of the rarity of eclipses, and their brief duration, an astronomer who observed all the eclipses of his lifetime would see the corona for less than an hour, so even a few minutes more will add materially to the time during which it has been observed. Full knowledge of the sun is desirable not only because of its importance to us, but also because the sun is the only star which we can see in detail. What we learn of it helps us better to understand the more distant celestial bodies.

The coronal observations are by direct photography, with large cameras, and with the spectroscope, which analyzes its light. Other spectroscopic observations are of the chromosphere, the