

ASTRONOMY

Midnight Solar Eclipse

Alice-in-Wonderland Phenomenon Ends on Christmas, Begins Day Later; Can be Seen Best at South Pole

By JAMES STOKLEY

THE MOST surprising astronomical event of the month is an eclipse of the sun that ends on Christmas day, begins the day after (no, this is not a typographical error), and is seen at its height at midnight! Unfortunately, no one in the United States will have the privilege of seeing this strange sight. From the southern part of South America, New Zealand, and Antarctica it will be observed, as a partial eclipse, with the moon only partly covering the sun.

At no place will the sun be wholly covered, for this eclipse is not total, but annular. That is, it occurs when the moon is nearly at its greatest distance from earth, and its apparent size is a little less than that of the sun. Therefore, even where it can be seen to come directly in front of the sun, that body will not be hidden. Around the dark disk of the moon will be seen a ring of sunlight, called the annulus. Such annular eclipses are of no scientific importance, because even the ring of the sun's disk that remains in view gives enough light to prevent any of the observations for which astronomers sometimes travel thousands of miles at the time of a total eclipse.

Near South Pole

This is rather fortunate, for astronomers would have a difficult time reaching it. They would have to be polar explorers as well if they wanted to see it, for the line of the central eclipse (where the moon comes exactly in front of the sun) passes within about 150 miles of the South Pole. This is the middle of the six months of day at the South Pole. It happens that at the point where the eclipse is at its height it will then be midnight, and the eclipsed sun will be visible to the south, directly over the pole. At no place along the path will it occur at noon, as usually happens with a solar eclipse.

The paradoxical behavior of the eclipse in apparently ending before it starts is a result of the way that time is measured from the International Date Line. The line joining the centers of sun and moon, which traces out the path of the

central eclipse, will first touch the earth on Christmas day, at 12:18 p. m., Eastern Standard Time. It will leave the earth at 1:41 p. m., the same afternoon. But the point where it first touches, South Australia, is close to the Date Line, which nearly corresponds to the 180th meridian of longitude, and passes over the western Pacific Ocean. Each new day begins at the Date Line, and then travels eastwards around the earth. Consequently, at the place where the annular eclipse begins, it has already passed, and there it is 2:18 a. m., on the 26th, according to local clocks, if there happen to be any in that inhospitable region. The central eclipse only lasts an hour and 23 minutes, so it ends at 1:41 p. m., Eastern Standard Time, on Christmas afternoon. The point where it leaves the earth is about 1,300 miles south of the Cape of Good Hope, so it has gotten far ahead of the new day. At that point it will still be Christmas evening, 8:21 p. m. local time.

Seventh This Year

This eclipse will be the seventh of the year, and the fifth of the sun. No more can occur in one year. Not until 1982 will there again be seven eclipses, but then three will be of the moon and four of the sun.

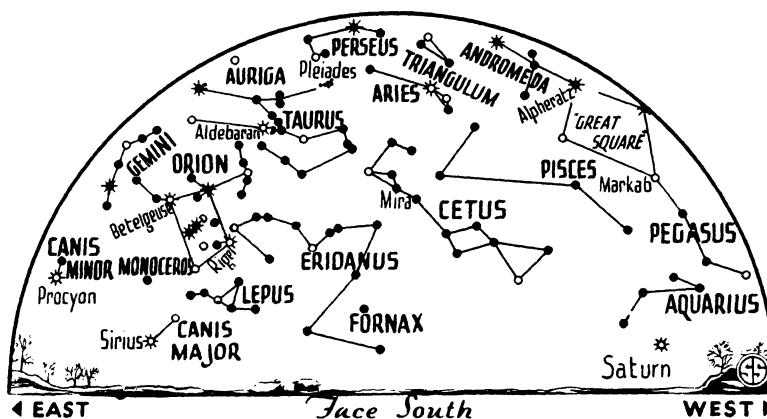
Since a solar eclipse can only occur

when the moon is new, this phase will occur on the 25th. First quarter comes on the third, full moon on the 9th and last quarter on the 17th, as indicated on the table below. Twice during December will the moon be in perigee, the point in its orbit where it makes the closest approach to earth. On the 5th, at 5:06 p. m., it will be 228,950 miles from us. Then it will recede to apogee, its greatest distance, on the 17th at 4:57 p. m., when it will be 251,300 miles off. Approaching, it will again come to perigee on the 30th, its distance then being 229,500 miles.

Only One Planet

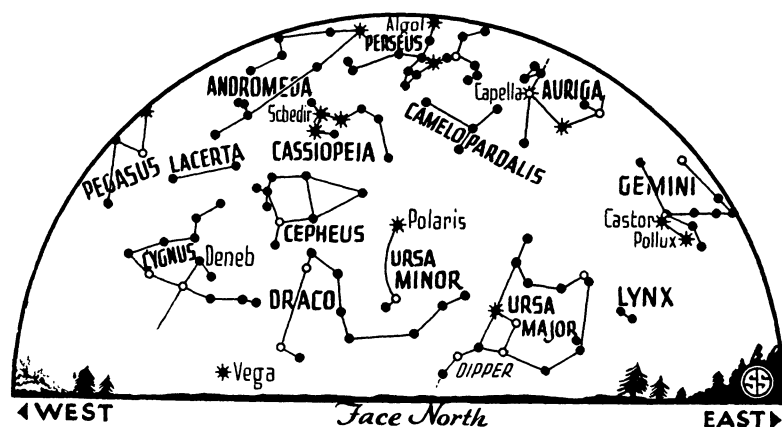
Though the brilliant stars of winter are now coming into the evening skies, all but one of the planets have departed from it. Only Saturn, 585,440,000 miles away on December 15, remains in view, in the constellation of Aquarius. This group is low in the southwest for the time that the accompanying maps are prepared: 10:00 p. m., on the first, 9:00 p. m., on the 15th and 8:00 p. m. on the 31st. Earlier, however, just after sunset, Mars may be glimpsed still lower, in Capricornus, and may be identified by its red color. It is quite faint, for a planet, because it is now getting very far away; 177,240,000 miles at the middle of the month.

☉ * ○ • SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS



EASILY FOUND

Orion, with the three bright stars in a row forming his belt, is the most conspicuous constellation of December evenings.



LOW IN THE NORTH

The familiar dipper and bright Vega are now seen close to the horizon.

Orion is the most conspicuous constellation of December evenings. It is seen in the southeast, and the three stars in a row, forming the warrior's belt, make it easy to find. Betelgeuse, in one of his shoulders, stands to the north, and Rigel, in his foot, about an equal distance to the south. Below him is one of his dogs, Canis Major, marked by brilliant Sirius, brightest star of the sky. About as high above the horizon, almost directly east, is the other dog, Canis Minor, with Procyon. Higher, and still farther north, are the twins, Gemini, with Castor above, and the brighter Pollux below.

Directly above Orion is the bull, Taurus, which he is supposed to be striking with an upraised club. The ruddy Aldebaran marks the animal's eye, the V-shaped group of which it is part—the Hyades—his face, and the Pleiades, a little cluster of stars over them, the shoulder. Above the twins is Auriga, the charioteer, in which is found the first magnitude Capella, a star that very closely resembles the sun. Low in the northeast is Ursa Major, the great bear, of which the big dipper is part.

Taurus, the Bull

Turning to the western sky again, Vega, in Lyra, can be seen just above the northwestern horizon. Next to it, on the left, is the swan, Cygnus, otherwise known as the northern cross. The cross is now vertical, and the bright Deneb marks its top. High in the west is a group of four stars that makes an excellent guide from which to locate other constellations. This is the Great Square of Pegasus, standing on one corner. The three lower stars are part of Pegasus, the winged horse, but the uppermost one is Alpheratz, in the neighboring figure of Andromeda, the princess who was chained to the rock. Just

north of Andromeda, very appropriately, is her mother, Cassiopeia, a group shaped like the letter W. Between Cassiopeia, and the Pleiades, is Perseus, the hero who rescued Andromeda, according to the mythological story.

Another planet decorates the eastern morning sky just before sunrise. This is Venus, now the "morning star," which rises about four hours before the sun. It is in the constellation of Virgo, and on the first of December is just north of the star Spica, so that the two will make an interesting pair, though the star is much fainter. The magnitude of Venus is minus 3.8, and on the 15th it is 81,582,000 miles from the earth.

Towards the end of the month, Jupiter will also become a morning star, rising in the constellation of Scorpius, as the twilight gives way to the sunrise itself. On the 15th this planet will be 585,440,000 miles distant. The remaining naked eye planet, Mercury, is now so close to the sun that it will not appear at all during the month.

The moon is at first quarter on Dec. 3, 2:28 a. m.; full on Dec. 9, 10:10 p. m.; at last quarter on Dec. 17, 4:57 p. m.; and new again on Christmas at 12:49 p. m.

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RADIO

Tuesday, Dec. 3, 4:30 p. m., E.S.T.
AMERICA 8,000 B.C., by Edgar B. Howard, University Museum of the University of Pennsylvania.

Tuesday, December 10, 4:30 p. m., E.S.T.
PURE WATER, by Dr. Henry B. Ward, Permanent Secretary, American Association for the Advancement of Science.

In the Science Service series of radio addresses given by eminent scientists over the Columbia Broadcasting System.

ARCHAEOLOGY

City Built Over Caves To be Explored in Mexico

ONE OF Mexico's strangest Indian cities—a city that stood on a mountain-top and used caves underfoot for its mysterious subterranean halls—is to be explored by Mexican archaeologists, beginning this month.

The ruined city is called Xochicalco, meaning Flower-House Place. Although only 60 miles south of Mexico City, it has eluded scientific study because of its isolation, which a new road to the summit now ends.

Brush-clearing activities on the flat top have already brought out ancient streets, house foundations, rooms, and other suggestions of city plan. The ruins have long been distinguished by a handsome sculptured pyramid of great undulating feathered serpents.

In the heart of a grottoed limestone region, Xochicalco has under its foundations eerie caves which the ancient inhabitants made into vast interior halls. The entrances were left at crawling height, supposedly for easy defense. Xochicalco also had man-made subterranean chambers, stone-lined, and resembling big narrow-necked bottles. Some archaeologists believe these were underground astronomical observatories for watching star movements and for calculating time.

Much interest attends the excavations, because the city is recognized a key spot in Mexico's unknown ancient history. On walls of the bird-snake pyramid, sculptured priests sit precisely like gods on Mayan Indian temples far to the south. Hieroglyphic writing on this pyramid closely resembles that found at Monte Alban, ancient city half-way south to the Mayan zone. The meaning of these relationships will be sought.

The excavations are part of a long-time research plan of Mexican government archaeologists. By thoroughly studying representative sites, they aim to determine the exact nature of the Mayan and Toltec civilizations of ancient Mexico, and to trace their relationship by excavating ruins that lie between, such as Monte Alban and Xochicalco.

As part of this project, excavations have been resumed at El Tajin, where ruins of an advanced culture lie in the lowland jungle of Vera Cruz. A more primitive site in the north-central state of Zacatecas, called La Quemada, will be worked at in the hope of finding out how far north the Toltec nation spreads.

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