

ASTRONOMY

October To Bring Far Away Eclipses of Sun and Moon

American Expedition Sets Up on Lonely Pacific Island While Amateurs at Home Enjoy Local Skies

By JAMES STOKLEY

THE YEAR'S second eclipse of the sun is the most important astronomical event of the month of October. But it will be quite different from its immediate predecessor. That one, on April 28, was visible in its partial phases over practically all of North America, while the total phase, which was just barely total and lasted only for a second or so, was seen along a narrow line from California to Montana.

October 21 brings eclipse number two, but to see even the partial phase, in which the moon covers only part of the sun, leaving a crescent of light still visible, you would have to travel to New Zealand, Australia, New Guinea or the southern tip of South America.

The narrow path of totality, about twenty miles wide at the beginning and end, and fifty miles wide at the middle, stretches for nearly 7000 miles in a southeasterly direction across the south Pacific. The eastern end just reaches southern Chile, where the total eclipse will be visible, weather permitting, just as the sun is setting. Because of its lateness in the day, Chile will not be a favorable observation point. Astronomers want to get near the middle of the path, where the eclipse occurs near noon, when the sun is high in the heavens.

Only Two Islands in Path

These conditions are met by only two bits of land in the great areas of water. The first is Nurakita, a swampy coral island in the Gilbert group. It is uninhabited and almost impossible to reach. The second island is only a little better. It is Niuafoou, in the Tonga group, nearly six square miles in extent and with about 1100 inhabitants, mostly natives.

Two groups of astronomers have already gone to the rocky shores of Niuafoou. One group is from New Zealand.

An American expedition, sponsored by the U. S. Naval Observatory, has established its station at Niuafoou. In

charge of the scientific party is Dr. S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia, and veteran of seven previous eclipses.

Chief of the American instruments is a 63-foot long camera with which large scale photographs will be made of the corona, the sun's outer layer, visible only at an eclipse. This will be operated by Dr. Ross W. Marriott of the Sproul Observatory of Swarthmore College.

Dr. Mitchell himself is mainly interested in observations with the spectroscope, especially of the flash spectrum. This is the outermost layer of the sun ordinarily visible. Except at an eclipse, the light of this layer is completely mixed with the light from the inner parts of the sun, but at the beginning and end of totality, for an instant just before or just after the moon completely covers the sun, this layer shines by its own light. Then only it can be analyzed with the spectroscope, greatly increasing our knowledge of the sun.

Still other cameras will make photographs of the stars around the eclipsed sun, as a further test of the deflection of starlight as it passes the sun. This effect was predicted by Einstein's theory of relativity. Though it was first mea-

sured at an eclipse in Brazil in 1919, and was later verified by American observers of an eclipse in Australia in 1922, still further observations of it will be helpful.

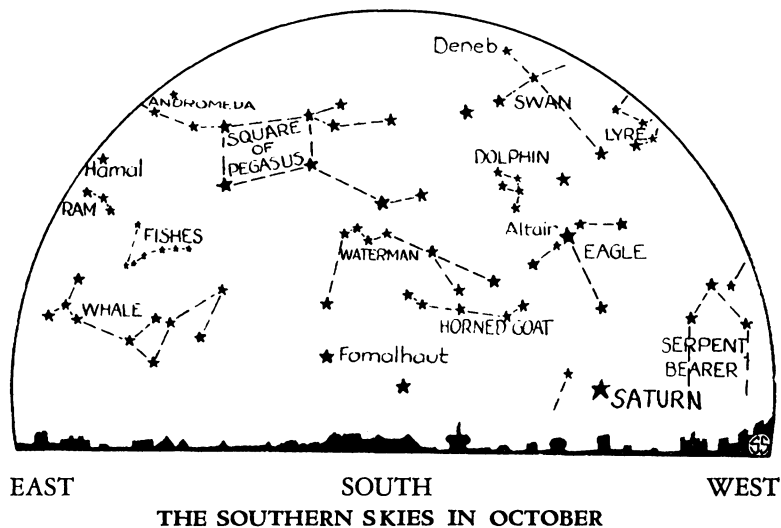
The crucial day is Wednesday, the twenty-second. At 7:58 in the morning, according to the time in use there, the eclipse will begin, and the moon will start to encroach upon the solar disc.

At 9 hours 10 minutes 54.06 seconds, according to the predictions of the U. S. Nautical Almanac Office, the total phase will start. Then the sun will be completely covered by the moon, and the wings of light that we call the corona will appear beyond the black lunar disc. Perhaps a few bright red prominences, huge flames of hydrogen, will appear above the sun's surface.

Work To The Second

As soon as the total eclipse starts, one member of the party, stationed at a chronometer, will start calling seconds. Every exposure of the cameras, in fact every single movement made during the 92 seconds of totality, has been planned in advance, and must be made on time to the second. At 12 minutes 26.10 seconds after nine the bright disc of the sun will again shine out as a narrow crescent and the total eclipse will be over. But not until 10:34 will the moon completely leave the sun.

All this takes place on the morning of Wednesday, the twenty-second, for the astronomers at Niuafoou. That is, it will take place if it is clear. But while it is going on it will be the afternoon of Tuesday, the twenty-first, for Americans. The 92 seconds of total eclipse begins at 3:51 p. m., eastern standard time.



THE SOUTHERN SKIES IN OCTOBER

Another curious circumstance about this eclipse is that it ends before it starts. It starts on the west side of the international date line, which follows approximately the meridian of 180 degrees longitude, and ends on the east side. When the moon's shadow first touches earth north of New Guinea, it is sunrise there, on Wednesday morning. Niuafoou is to the west of the date line, so there it is still Wednesday morning. But soon after it passes Niuafoou it crosses the date line, and then the eclipse suddenly starts occurring on Tuesday morning. A little farther on it is Tuesday afternoon, and when the shadow leaves the earth at southern Chile it does so at sunset on Tuesday, the evening before it started!

This eclipse of the sun is not the only eclipse occurring in October, however. The sun eclipse happens when the moon, in its wanderings, passes between the sun and earth, in other words, when it is new. Just two weeks before this, on the seventh, the moon is one-half of an orbital revolution away from that place, and then it is in such a position that the earth comes partly between it and the sun. Then the moon comes into the shadow of the earth, and is darkened. At that time, as always at the time of a lunar eclipse, the moon is full. But this partial eclipse of the moon will not be visible from any part of North or South America and even where visible it will not be conspicuous.

Though the most striking astronomical features of October are not visible in the United States, the night sky for Americans will not be entirely without interest. The planet Venus still continues to be the brightest object in the night sky, except the moon, of course. For some months Venus has been gradually increasing in brightness and on



READY FOR AN ECLIPSE

The astronomers' apparatus on Niuafoou Island when ready for observing the October eclipse will resemble this set-up. On the right is a 40-foot telescope and a shelter for Einstein cameras, and in the central background and on the left is a polar axis carrying a camera and spectrographs. It is the Crocker Eclipse Expedition from the Lick Observatory to Australia in 1922.

the 18th of October it reaches its maximum brilliance. Then it is of the minus 4.3 magnitude, so that it is just about five magnitudes brighter than the star Altair, in Aquila, the eagle, the bright star which shines above it and to the right. A difference of five magnitudes means that Venus is a hundred times brighter than Altair.

Saturn, also, is still visible in the evening sky, but it is not well placed either. It is directly south a little before five o'clock, local time, so that by the time it gets dark it is well to the southwest. It sets about four hours after the sun.

Later in the night Jupiter can be

seen. About eleven o'clock it rises, in the constellation of the twins, Gemini. About six o'clock in the morning it is directly south. Rising soon after Jupiter, in the next-door constellation of Cancer, the crab, is Mars, red in color and about one-tenth as bright as Jupiter.

Vega, in the constellation of Lyra, the lyre, seen high in the western sky, is the brightest star visible in the October evening sky. Almost above it is Deneb, in Cygnus, the swan, sometimes called the Northern Cross. South of Vega is Altair, in Aquila, the eagle. Low in the eastern sky, in Taurus, the bull, is seen Aldebaran, distinguished by its reddish color. In the northeast, in Auriga, the charioteer, is seen Capella, which is exceeded only by Vega in brightness among the stars now visible. The sixth first-magnitude star to be seen this month in the evening is Fomalhaut, in Piscis Austrinus, the southern fish. This star is low in the south about nine o'clock.

Though not as bright as the stars mentioned, a characteristic feature of the evening sky at present is the "great square of Pegasus" high in the southern sky. Four stars of similar brightness mark the corners of the square. The three to the south and west are in the constellation of Pegasus, the winged horse, though the northeastern one is in Andromeda, the chained lady.

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