

ASTRONOMY

Jupiter Now Prominent

A total lunar eclipse and Jupiter's shining appearance in southern skies, studded with an unusual number of bright stars, highlight December evenings.

By JAMES STOKLEY

➤ **SHINING MORE BRIGHTLY** than any other planet—or any star—visible on evenings of December, the planet Jupiter is now very prominent in the southern sky. It adds to the splendor of a region containing an unusually large number of bright stars.

The accompanying maps show the appearance of the heavens in December about 10:00 p.m., your own kind of standard time, at the beginning of the month; 9:00 p.m. at the middle of the month; 8:00 p.m. at the end.

Jupiter is high in the south, in the constellation of Aries, the ram. Just to the left you can see Taurus, the bull, which contains the bright reddish star called Aldebaran. Although it is of the first magnitude on the astronomer's brightness scale, Aldebaran is about a nineteenth as bright as Jupiter.

Farther to the left and lower than Taurus stands Orion, the great warrior, with first magnitude stars Betelgeuse and Rigel. Between them is a row of three fainter stars that represent Orion's belt according to the way the group has been pictured.

A little higher than Orion and to the left is the constellation of Gemini, the twins.

Part of this group is on the northern sky map, including its brightest stars of Castor and Pollux.

Below Orion are the two dogs. In Canis Major, the big dog, is Sirius, known as the "dog star." This is the brightest star visible in the night sky. However, its brilliance is now somewhat reduced because of its low altitude and the increased absorption of its light by the earth's atmosphere. Procyon is the bright star in the little dog, Canis Minor.

Saturn in Southwest

Another planet, Saturn, appears in the southwest, in Aquarius, the water carrier, considerably fainter than Jupiter. Above Aquarius is Pegasus, the winged horse, with three of the four stars that form the familiar "great square." Low in the northwest is Vega, the bright star of Lyra, the lyre, now greatly dimmed by its low altitude.

Although Mars rises too late to be shown on our maps, it is the third planet visible on December evenings. The "red" planet rises in the east just before midnight at the beginning of December, and about 10:30 p.m. at the month's end. It is in the constellation of Virgo, the virgin.

About two and a half hours before sun-

rise, early in the month, Venus rises above the eastern horizon. It is even more brilliant than Jupiter and is in Libra, the scales. Mercury, this month, is too near the direction of the sun to be seen easily.

Sun Farthest South

On Monday, Dec. 21, at 2:50 p.m., E.S.T., the sun will be farthest south—directly over a point in the south Pacific Ocean about 400 miles northwest of Easter Island. For those of us who live in the Northern Hemisphere, this marks the beginning of winter and we have the shortest period of daylight. But in countries south of the equator it will be the first day of summer—and the longest from sunrise to sunset.

Although December will bring two eclipses (the last of six during the year), one will be of little interest. This is a partial eclipse of the sun on Dec. 3. Over most of the northern Pacific Ocean, northeastern Asia and southwestern Alaska, it will be possible to see the moon pass in front of the sun, covering as much as 75% of the solar diameter.

This occurs, like all eclipses of the sun, at the time of new moon. Two weeks later, when the moon has traveled half way around the earth and reached full phase, it will enter the earth's shadow and there will be a total eclipse of the moon. Generally when the moon is full, there is no eclipse, because it passes either north or south of earth's shadow.

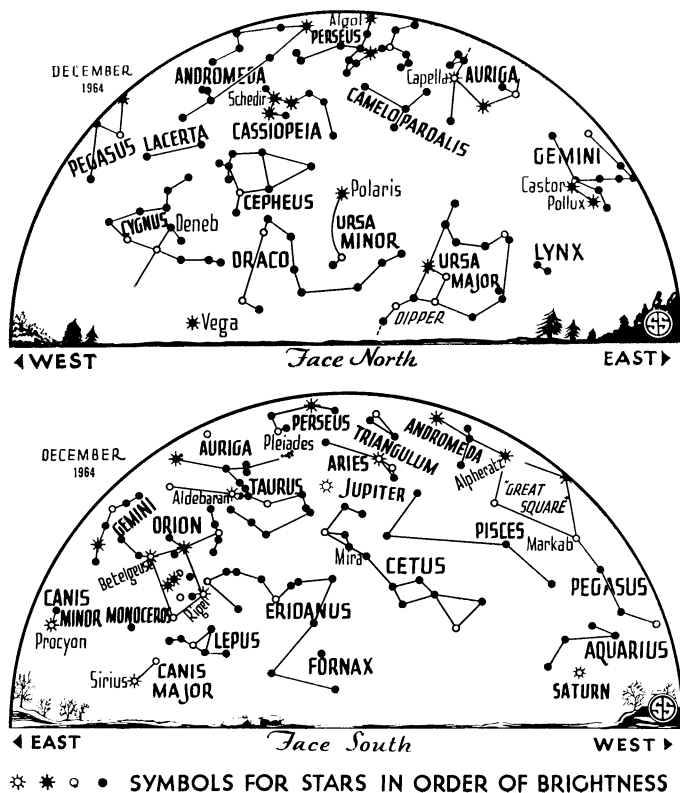
On Friday evening, Dec. 18, people in both North and South America, where the sky is clear, will be able to see the brilliant light of the full moon fade as the eclipse reaches its height, and then return to full brilliance when it is over.

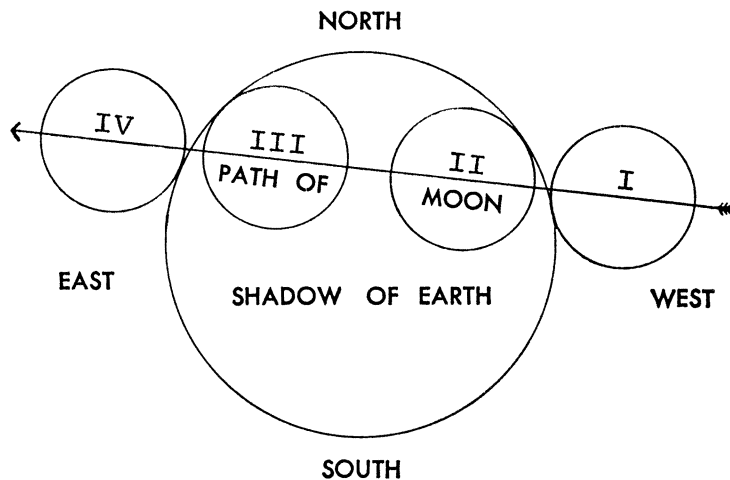
The accompanying diagram shows the principal stages of the eclipse. North (i.e., the direction of Polaris, the north star) is at the top and the large circle represents the earth's shadow. At 8:00 p.m., E.S.T. (subtract one hour for Central, two hours for Mountain and three hours for Pacific Standard Time), the edge of the moon will just be entering the shadow, as indicated at I.

Stages of Eclipse

Within a few minutes the curved edge of the shadow will be visible, then it will slowly creep across the lunar surface. At 9:08 the moon will be completely immersed in the shadow (II) and the total eclipse will begin. At 10:08 (III) the total phase ends and the moon begins to emerge from the shadow. By 11:16 (IV) the moon will be completely out of earth's shadow.

Generally, the moon does not disappear from view completely when it is totally eclipsed, but shines with a dull, coppery red glow. This is because the layer of air around the earth acts as a prism, to bend into the shadow some of the sun's rays. As sunlight passes through the atmosphere, some of its





blue waves are scattered, which make the daytime sky look blue. Thus the light that passes through and shines on the moon has a higher proportion of red than normally, giving the eclipsed moon its characteristic color.

If there are thick layers of high clouds in the part of the atmosphere through which the sunlight passes, much of it may be cut off, and the eclipsed moon will be darker than usual. Occasionally the moon may disappear completely, as it did at a total eclipse of the moon a year ago. This one, however, will probably not be as dark.

Scientifically a total lunar eclipse is of relatively little significance compared with one of the sun, but it is a fascinating spectacle. This one will be widely observed in the United States and Canada if the weather is good, since the eclipse occurs at a convenient viewing hour in the evening.

Celestial Timetable for December

DEC.	EST	
3	8:19 p.m.	New moon, partial eclipse of sun
6	7:00 a.m.	Moon farthest, distance 252,500 miles
10	4:00 a.m.	Algol (variable star in Perseus) at minimum brightness
	7:00 a.m.	Moon passes south of Saturn
12	1:02 a.m.	Moon in first quarter
13	early a.m.	Meteors visible apparently radiating from constellation of Gemini
	12:50 a.m.	Algol at minimum
15	9:30 p.m.	Algol at minimum
16	4:00 a.m.	Moon passes south of Jupiter
18	4:00 p.m.	Mercury between earth and sun
	6:20 p.m.	Algol at minimum
	9:42 p.m.	Full moon, total eclipse
19	6:00 a.m.	Moon nearest, distance 221,700 miles
21	2:50 p.m.	Sun farthest south, winter begins in Northern Hemisphere
24	2:00 p.m.	Moon passes north of Mars
25	2:27 p.m.	Moon in last quarter
31	9:00 a.m.	Moon passes south of Venus

Subtract one hour for CST, two hours for MST, and three hours for PST.

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ASTRONOMY

Jupiter's Magnetic Poles Found in Unusual Position

► THE MAGNETIC POLES of Jupiter are in a strange position, far to one side of the axis about which the planet rotates every ten hours, radio astronomers have found.

Dr. David Morris, a research fellow in radio astronomy, and Glenn Berge, a graduate student, both at the California Institute of Technology's Owens Valley Radio Observatory, located the magnetic axis some 30,000 miles from the center of Jupiter, which is 89,000 miles in diameter. The center of the axis, they found, is 40,000 miles above the equatorial plane.

Earth's magnetic axis misses the earth's center by only about 200 miles, and its magnetic poles are only some 800 miles from the geographic poles.

The observations help explain a mystery about Jupiter that has puzzled astronomers for a decade—the origin of bursts of low frequency radio signals that apparently come from fixed places on the cloud-covered planet.

The best explanation required an off-center magnetic field like that now discovered. The bursts are detected when Jupiter's rotation brings the magnetic poles into the proper position to beam the planet's electromagnetic radiation toward the earth.

Jupiter is also ringed, like the earth, with a vast radiation belt. The Jovian belt is doughnut shaped, some 300,000 miles in diameter and 80,000 miles in cross section.

This radiation doughnut wobbles as the planet rotates. It also seems alternately to accelerate and decelerate in relation to the planet's position in its orbit around the sun. This alternating cycle lasts ten hours, and is believed to be caused by a bulge in one side of the radiation doughnut.

The scientists used the twin 90-foot receivers of the radio observatory as an interferometer to obtain their picture of this abnormality. The observation wavelength was ten centimeters.

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TECHNOLOGY

Nuclear Experiment May Unleash Oil Reserves

► A DREAM that oil men have held for many years may be one step closer to reality now that the Atomic Energy Commission exploded a nuclear device deep in a carbonate rock formation.

Even though it is no longer economical to take oil from a so-called depleted field, a fair amount usually remains in the ground. A nuclear blast detonated in such an oil-bearing formation could create new channels through which oil could flow.

By heating the oil the blast might also make the oil flow more freely. Another dividend could be that some of the oil would be turned into gas, driving additional oil to the surface.

The experiment by the Atomic Energy Commission to set off a deeply buried underground nuclear device, equivalent to about 10,000 tons of TNT, tests the feasibility of such practical applications of underground explosions.

It is the first nuclear blast in carbonate rock in the Plowshare Program, aimed at developing peaceful uses for atomic detonations.

Carbonate rock, which is similar to limestone, is often associated with deeply buried oil and gas, as well as minerals which might also be recovered by nuclear explosions.

With nuclear methods, exploitation of the vast reserves of oil shale, not profitable to work now, might become available for commercial production.

The AEC detonation took place Nov. 5 in a drilled vertical hole at a depth of 1,320 feet. The radioactive debris from the explosion is sealed in, since the hole was filled with concrete and gravel.

The University of California's Lawrence Radiation Laboratory is conducting exploratory operations to determine the underground effects.

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GENERAL SCIENCE

Laud Weizmann Institute On 20th Anniversary

► THE WEIZMANN INSTITUTE OF SCIENCE will celebrate its 20th anniversary in New York December 9th with participation by more than 436 dignitaries from 16 countries, including 32 Nobel Laureates.

Located at Rehovoth, Israel, the 60-million-dollar institute now includes a faculty of 450 scientists, a technical staff of 750, and about 200 current research projects in such fields as applied mathematics, biochemistry, biophysics, cell biology, electronics, genetics, isotope research, nuclear physics, organic chemistry and X-ray crystallography.

The institute was founded in 1944 when friends in Britain and the United States made a gift of the Weizmann Institute of Science to Chaim Weizmann, Israel's first president and its premier scientist statesman.

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