The Earth-Moon-Sun System

I. Lunar Rotation and Revolution
II. Phases of the Moon
III. Lunar Eclipses
IV. Solar Eclipses

iMSS Integrated Middle School Science Partnership
NSF
California State University East Bay
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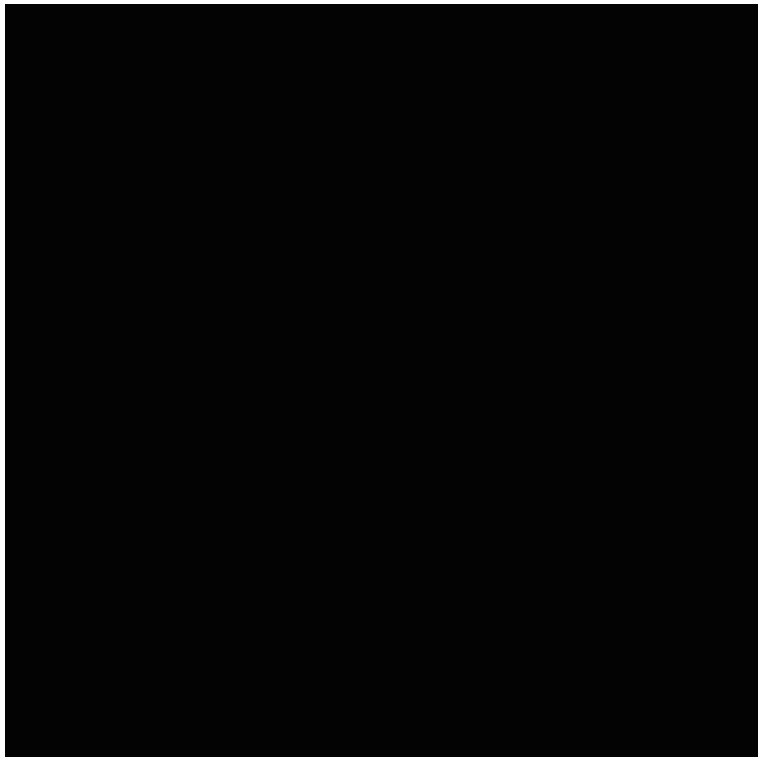
I. Lunar Rotation and Revolution

The Moon rotates on its axis as it circles the Earth - its rotational period is the same as its period of revolution. That means that we only see one side of the Moon from Earth.

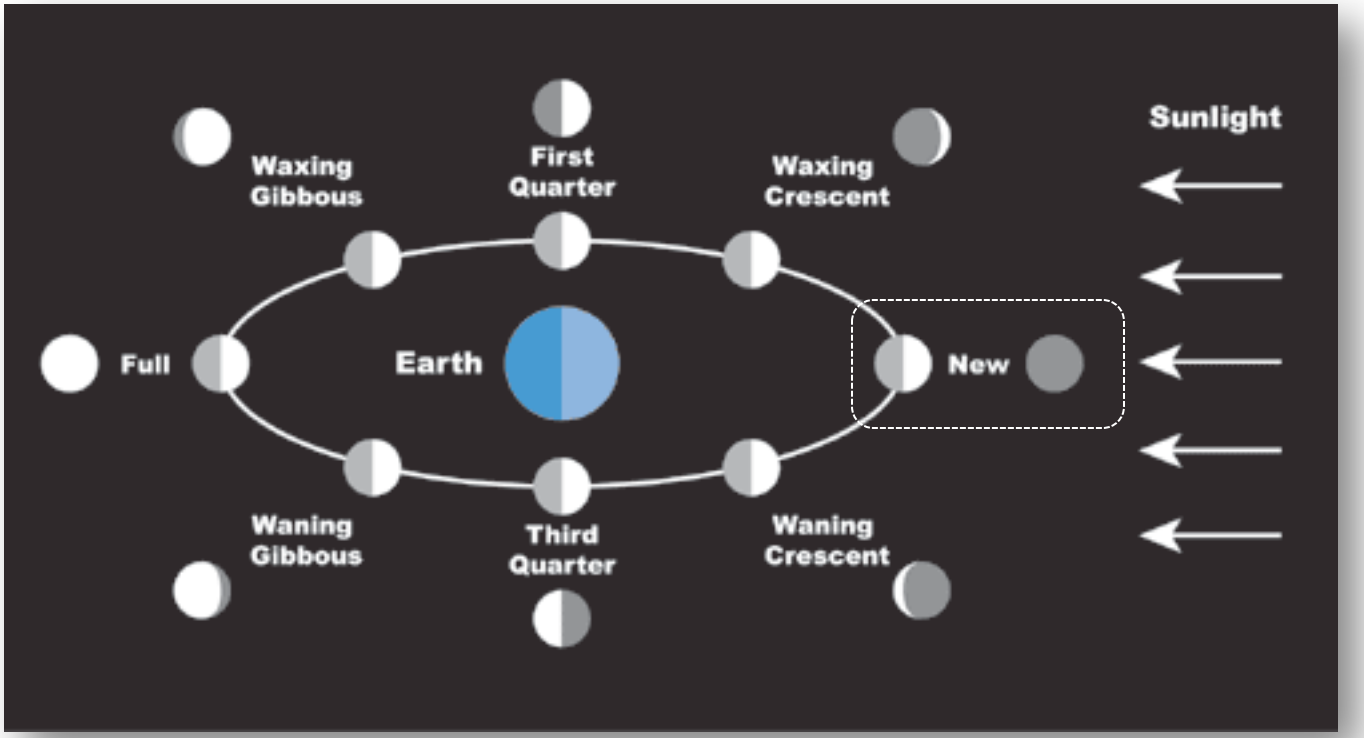


Unlike the Sun and stars, the Moon does not produce its own light - it is visible only by the sunlight that it reflects.

As the Moon moves in its orbit around the Earth, we see different parts of the Moon illuminated - the Moon appears to pass through a sequence of *phases*.

II. Phases of the Moon

The figure shows how the phases of the Moon that are visible from the Earth are related to the Moon's orbital position.



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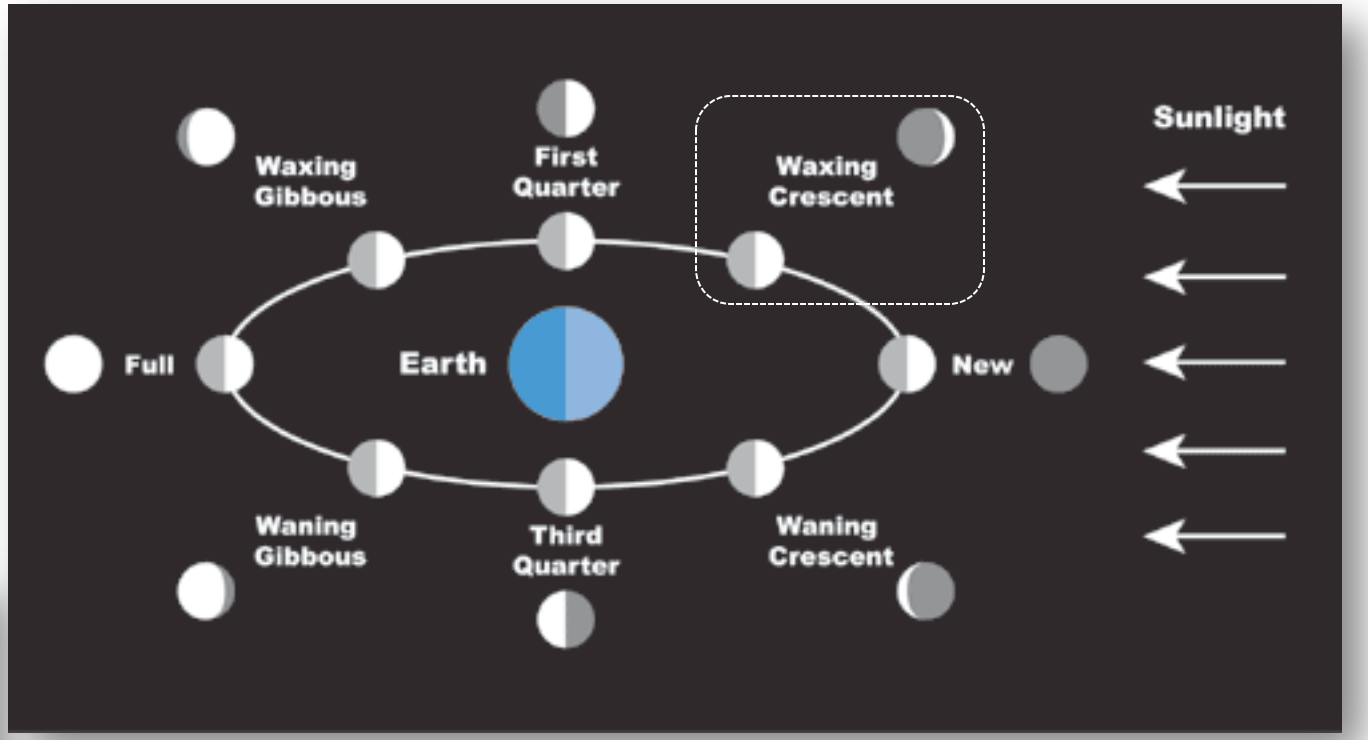
The complete cycle of lunar phases takes 29.5 days - this is about 4 week.

The *new moon* is occurs when the Moon is between the Earth and the Sun - the side that faces the Earth appears dark.

A *new moon* sets in the west with the Sun.

In the days after the *new moon*, the Moon appears as a thin crescent.



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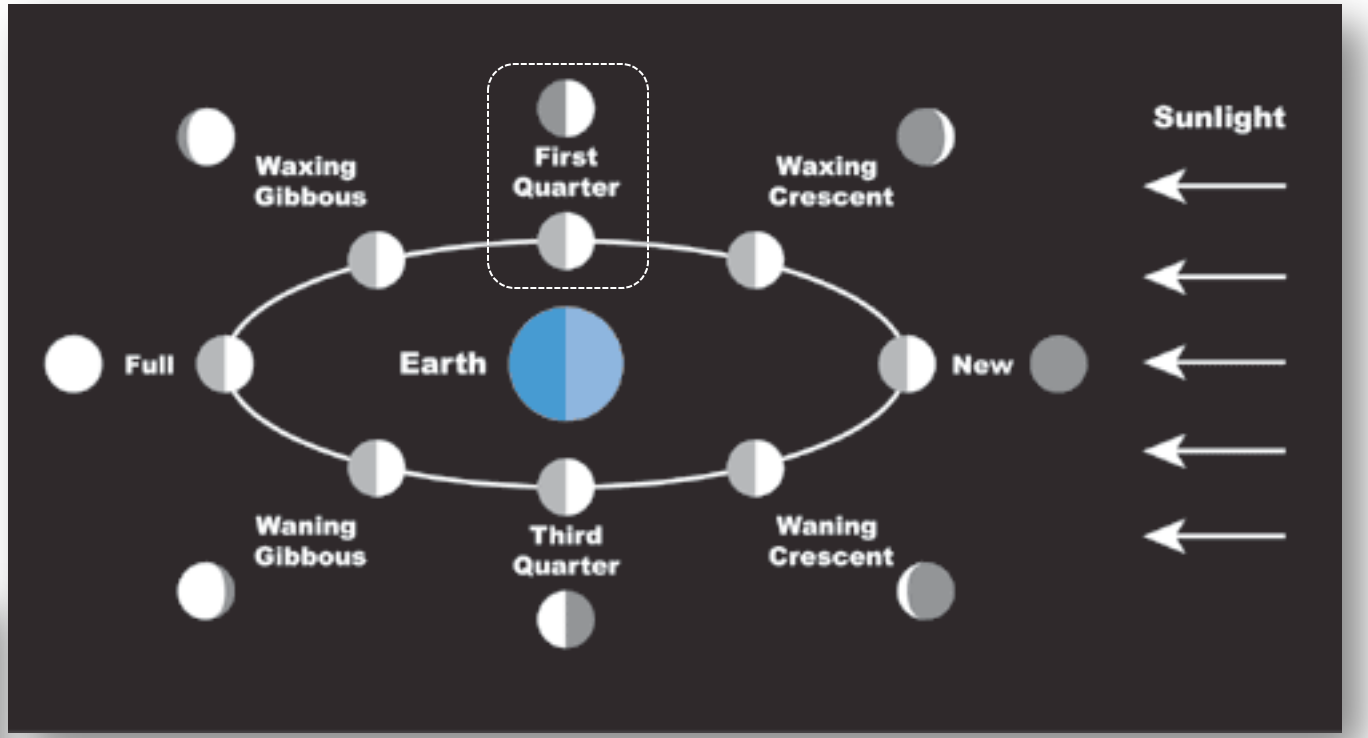
Each night, the crescent gets larger - this is known as *waxing* (growing).

This moon phase is known as a *waxing crescent*.

While the moon is waxing, more of it is illuminated each night.



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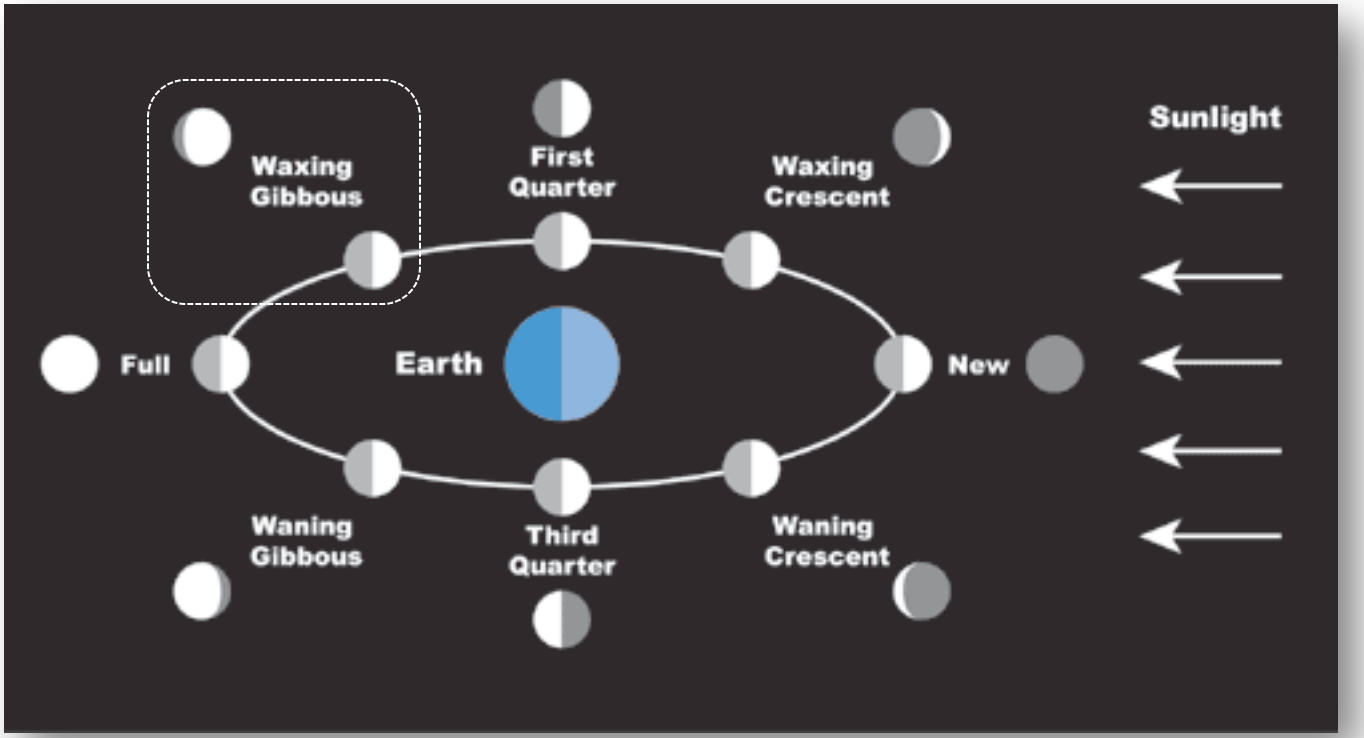
About one week after the new moon, the crescent has grown until we are able to see half of the side of the Moon that faces the Earth.

This moon phase is known as a *first quarter moon*.

After the first quarter, the Moon continues to wax (grow) so that ~3/4 of the face is illuminated.



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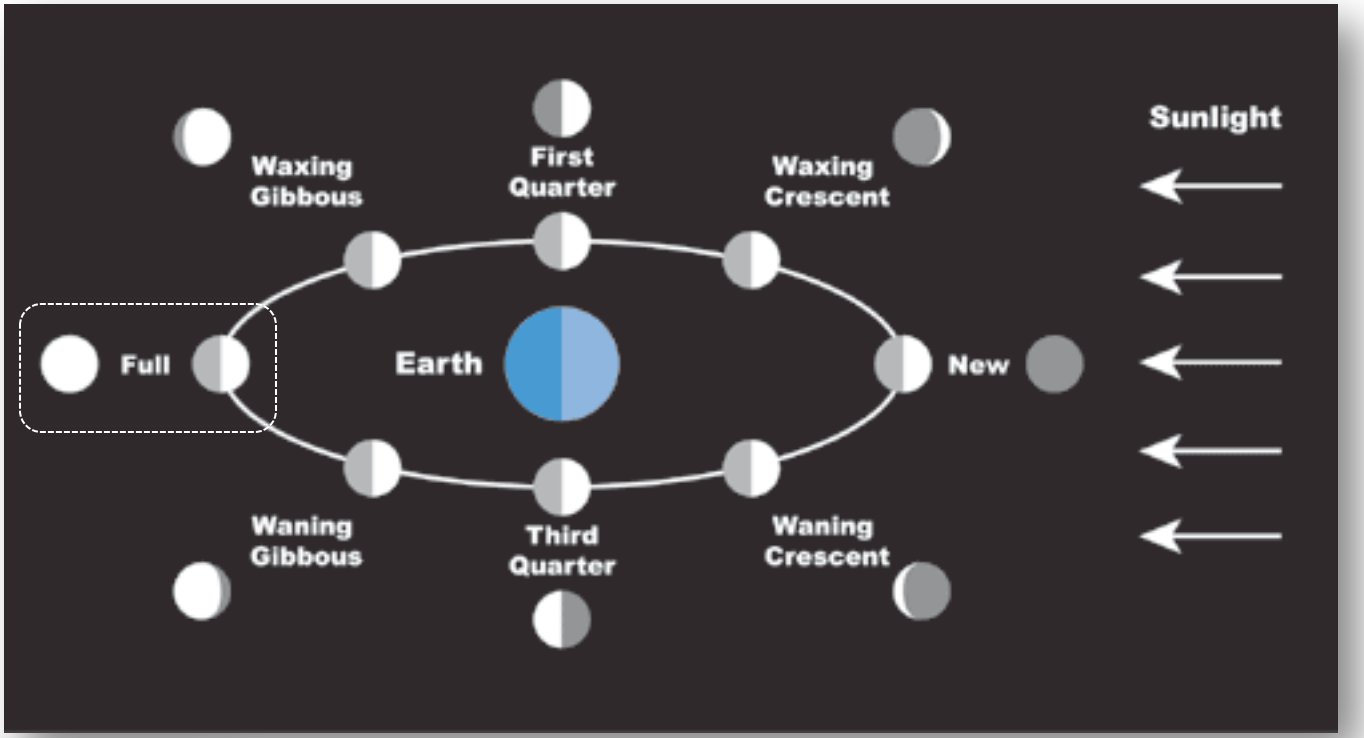
This moon phase is known as a *waxing gibbous moon*.

Half way through the cycle of lunar phases, the Moon is on the opposite side of the Earth from the Sun and its face is fully illuminated.



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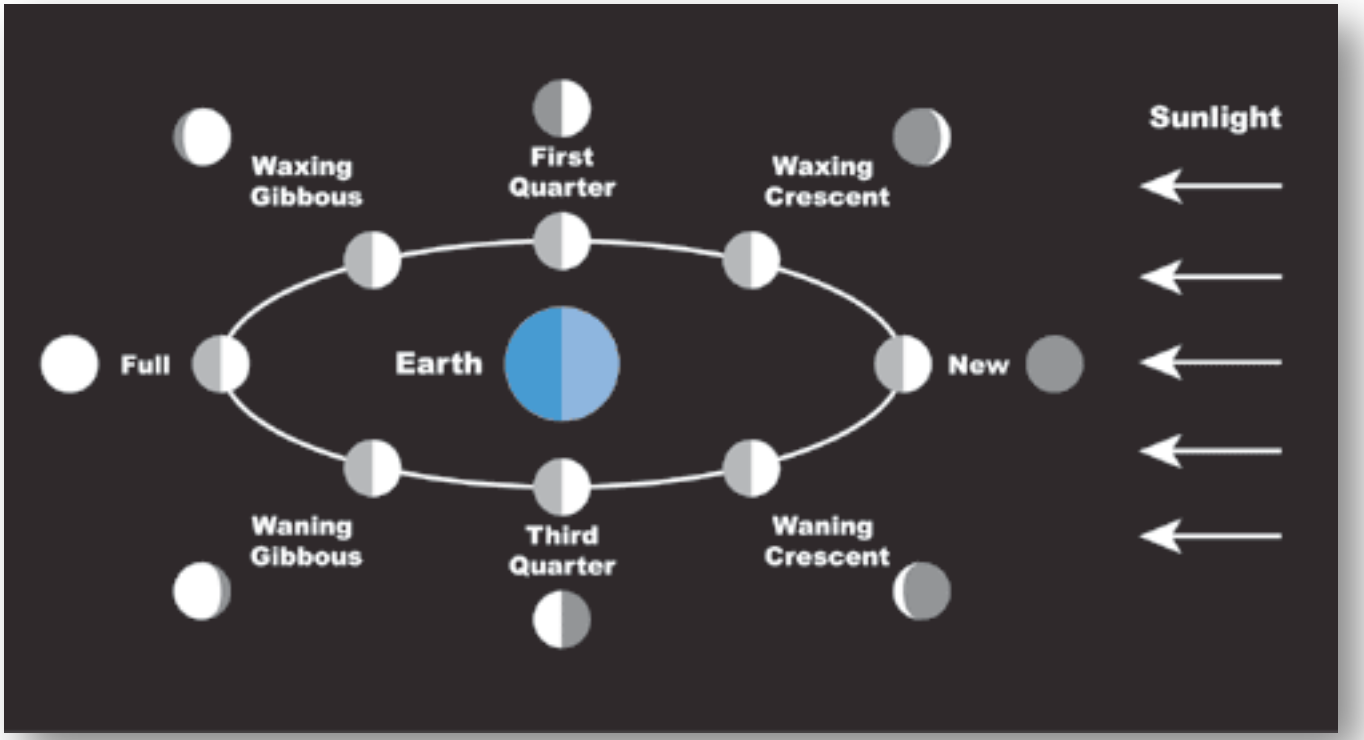
This moon phase is known as a *full moon*.

A *full moon* rises as the Sun sets and sets as the Sun rises.

The second half of the cycle of lunar phases is the reverse of the first half.

After the full moon, the illumination of the moon begins to decrease or *wane*.



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The Moon will *wane* through a *waning gibbous* phase to the *third or last quarter* to the *waning crescent* and eventually back to a new moon.

III. Lunar Eclipses

A *lunar eclipse* occurs when a *full moon* moves through the shadow cast by the Earth.

The lunar eclipse is also known as a blood Moon due to its red color.

As the Moon moves into the shadow, we see it gradually darken.

The sunlight that passes through the Earth's atmosphere has the shorter wavelengths removed (scattered) and the light passing through and reaching the Moon is longer wavelength (reds).

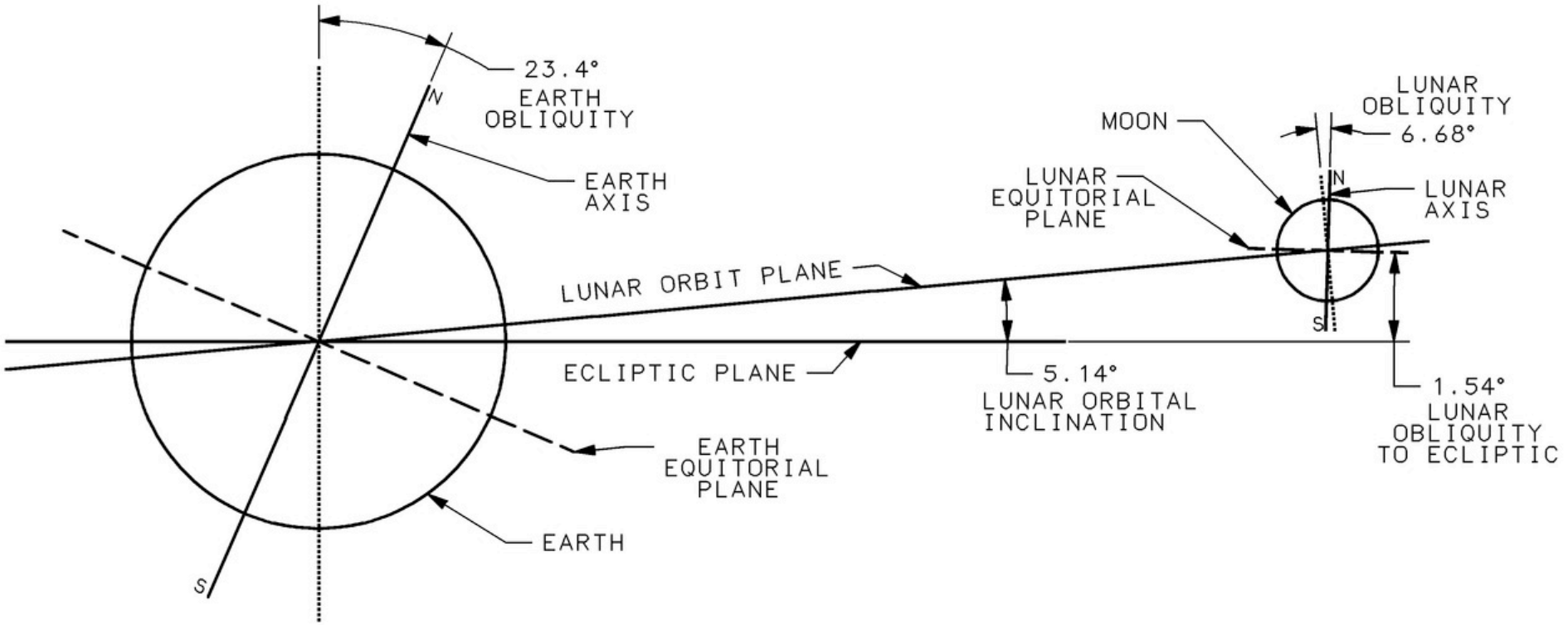
A lunar eclipse lasts for a few hours.

You might expect that there would be a lunar eclipse every month during the *full moon*.

However, the Moon does not orbit the Earth along the same plane that the Earth orbits the Sun. The Moon's orbit is inclined ~5°.

Thus, when the Moon is full, it does not necessarily pass through the Earth's shadow.

There are usually only 1-2 lunar eclipses each year

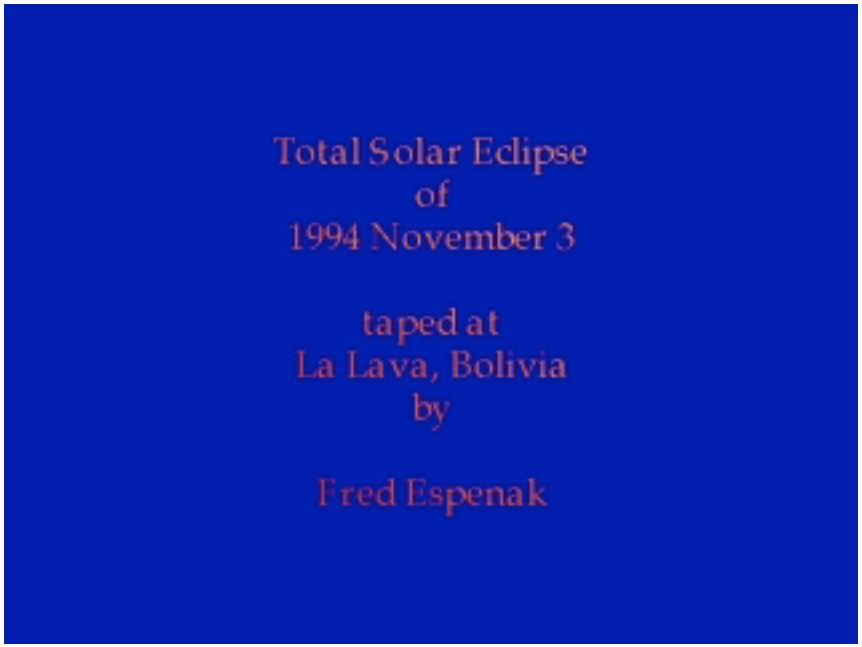


NOTE – EARTH AND MOON RELATIVE SIZES ARE TO SCALE.
EARTH AND MOON RELATIVE DISTANCE IS NOT TO SCALE.

By Peter Sobchak

IV. Solar Eclipses

A solar eclipse occurs when the new moon passes directly between the Earth and Sun and the shadow of the Moon falls on the Earth's surface.



There are generally 1-2 total solar eclipses each year and several more partial eclipses.