

ECLIPSES AND THE MOTION OF THE MOON

Chapter 3

INTRODUCTION The orbital motion of the Moon, phases, synodic and sidereal periods, and the geometric relationship of the Sun, Earth, and Moon are discussed in detail. The Moon shines only from the reflected light of the Sun and the phases of the Moon are due to where the Sun is in relationship to the orbital position of the Moon. Since the moon is in synchronous orbit around the Earth, it presents the same face towards Earth at all times. The phases are not due to a shadow of the Earth being cast upon the Moon. A lunar eclipse occurs when the shadow of the Earth is being cast on the surface of the Moon. The orbital plane of the Moon is not exactly in the same plane as the ecliptic, thus lunar eclipses can only occur at times when the Moon is simultaneously full and its orbit intersects the ecliptic. Likewise, solar eclipses can occur only during new moon and only when the lunar orbit intersects the ecliptic. Because of these geometric requirements, eclipses do not occur every month.

- GOALS**
- ✓ It is important to understand that the Moon shines from the reflected light of the Sun. It does not itself produce any light.
 - ✓ Understanding the Moon may be important for understanding the early stages of the origin of the Earth. And for as much as we know about the Moon, its origin is not well-understood.
 - ✓ The phases of the Moon are probably the most well known celestial event; so well known in fact that they are rarely noticed. It is important to understand the origins of the phases of the Moon.
 - ✓ When viewed at the same time, the Moon appears to move from west to east against the backdrop of the stars at a rate of about 12° per day. Thus, it is actually possible in one night to observe the Moon move across the stellar background and appreciable distance (about one lunar diameter per hour). Recall that the Sun moves west to east against the backdrop of the stars at only about 1° per day.
 - ✓ Recognize that the Moon is in synchronous rotation. It rotates once on its axis in the same time that it takes to go around the Earth once. Thus, the Moon always presents the same face towards us. The "dark side" of the Moon is the side facing away from the Sun, not necessarily the side we don't see.
 - ✓ Realize that the orbital plane of the Moon is inclined from the plane of the ecliptic by about 5° . The result of this inclination is that a lunar or solar eclipse can only occur when the Sun, Earth, and Moon simultaneously lie on the line of nodes.

DEFINITIONS You should have a working knowledge of at least these terms and any others used in lecture and lab. Many of these terms will be found in the glossary at the class website.

annular eclipse
aphelion
apogee
cusp
eclipse
eclipse path
eclipse year
ecliptic
libration
limb
line of nodes
lunar eclipse
lunar month

lunar phases
occultation
partial eclipse
penumbra
perigee
perihelion
plane of the ecliptic
saros
sidereal month
solar eclipse
synchronous rotation
synodic month
terminator

total eclipse
totality
umbra
new moon
waxing crescent
first quarter
waxing gibbous
full moon
waning gibbous
last quarter
waning crescent