Phases of the Moon

- The Moon goes through a set of phases about once every month.
- “Month” comes from the word “moon.”
- Time period of the phases (from Full Moon to Full Moon) is 29.5 days.

The different phases have different names:
- Getting larger = waxing
- Getting smaller = waning
- Less than 1/2 visible = crescent
- More than 1/2 visible = gibbous
- 1/2 visible, getting larger = 1st quarter
- 1/2 visible, getting smaller = 3rd quarter
- Entire Moon visible = Full Moon
- None of the Moon visible = New Moon

More Phases

- Full
- 1st Quarter
- Waning Crescent
- Waxing Crescent
- New
- Waning Gibbous

Two perspectives: On Earth, or outside the Moon’s orbit

- At any time (except during lunar eclipses), 1/2 the moon is lit up.
- Phases happen because the amount of lit up moon we can see from Earth changes.

Phases of the Moon Demo
Lecture Tutorial: The Cause of Moon Phases (pg. 81-83)

- Work with a partner!
- Read the instructions and questions carefully.
- Discuss the concepts and your answers with one another.
- Come to a consensus answer you all agree on.
- If you get stuck or are not sure of your answer, ask another group.
- If you get really stuck or don’t understand what the Lecture Tutorial is asking, ask me for help.

Moon Rise & Set Times

- Moon’s orbit position determines its phase
- Also determines what time the Moon is up in the sky

Moon Rise & Set Times: Examples

- New Moon: Same side as the Sun
  - Rises at sunrise, sets at sunset
- Full Moon: Opposite the Sun
  - Rises at sunset, sets at sunrise

Eclipses

- “The cutting off of all or part of the light of one body by another”
- Rare events when light from the Sun or Moon is blocked for a short time
- Eclipses occur when the Sun, Moon, and Earth are lined up just right

Lunar Eclipses

- The Moon gets darker as it passes into Earth’s shadow
- Sometimes glows with a slightly reddish color at the middle of the eclipse
- The Moon is always in the Full phase during a lunar eclipse
- The next one is on Aug. 7, but only partial and not visible from North America (our next one is Jan. 31, 2018)

A Lunar Eclipse

- Several pictures of a total lunar eclipse
- The moon gets “eaten up” by Earth’s shadow
- Sometimes glows with light bent through Earth’s atmosphere
What’s going on during a lunar eclipse

Solar Eclipses

- The Sun disappears behind the Moon
- The Moon is always in the New phase during a solar eclipse
- Can only be seen from certain places on Earth
- These events are even more rare than lunar eclipses
  - Next solar eclipse is Feb. 26, but only visible from South America, Africa, and parts of Antarctica
  - Next one visible from the USA is in August 2017 (total!)

What’s going on during a solar eclipse

Partial, Total, and Annular

- Partial: Takes out a bite

- Total: Covers the Sun
  - Moon slightly closer

- Annular: Leaves a ring
  - Moon slightly farther away

Total Solar Eclipse on March 29, 2006 (viewed from Turkey)

Diamond Ring Effect

This occurs when sunlight shines through a dip (usually a crater or valley) on the edge of the Moon’s disk
Geocentric vs. Heliocentric Models of the Universe

- Geocentric (Earth-centered)
- Heliocentric (Sun-centered)

How the Greeks modeled the heavens

Ancient Greek Universe

- Earliest mostly complete recorded attempt to explain the heavens without supernatural sources

Ancient Greek Model

- Stars reside on celestial sphere
- Celestial sphere rotates once a day
- Sun follows path called **ecliptic** going around Earth once in one year

Philosophical Ideas

- The heavens represent perfection.
- All heavenly bodies are perfectly formed.
  - Spherical
  - Unblemished
- The heavens are unchanging.
- The circle is the perfect shape.
- All heavenly motions must be circular.
But there was a complication ....

- Some stars appeared to move across the sky without staying in a constellation
- WANDERING STARS
  - “Planet” comes from Greek word for “wanderer”

Planets were often called wandering stars because they seem to slowly move from one constellation to the next.

Prograde and Retrograde Motion

- Prograde Motion (normal) – Apparent West to East motion over many nights
- Retrograde Motion (irregular) – Apparent East to West motion over many nights
- Motions occur against backdrop of stars

Retrograde Motion Lecture Tutorial: Page 99-100

- Work with a partner or two
- Read directions and answer all questions carefully. Take time to understand it now!
- Come to a consensus answer you all agree on before moving on to the next question.
- If you get stuck, ask another group for help.
- If you get really stuck, raise your hand and I will come around.