

# Eclipses and Lunar Phases

By the Lunar and Planetary Institute

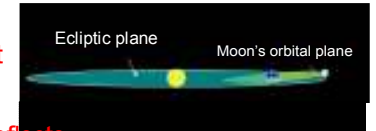
For use in teacher workshops



[http://solarsystem.nasa.gov/multimedia/gallery/Earth\\_Moon.jpg](http://solarsystem.nasa.gov/multimedia/gallery/Earth_Moon.jpg)

Before students can understand the reason for phases, they need to understand:

- The Moon orbits the Earth
- The Moon orbit at an angle with respect to the Earth's orbit around the Sun
- The Moon doesn't shine on its own; it reflects sunlight
- The scale of the Moon and Earth's sizes and distance



- New (couple days)
- Waxing Crescent (several days)
- 1<sup>st</sup> Quarter
- Waxing Gibbous (several days)
- Full
- Waning Gibbous (several days)
- 3<sup>rd</sup> Quarter
- Waning Crescent (several days)
- New



- The Sun shines on the Moon.
  - When the sunlight reflects off the Moon's far side, we call it a New Moon
  - When the sunlight reflects off on the Moon's near side, we call it a Full Moon
  - Between New and Full, we see parts of the daytime side of the Moon.

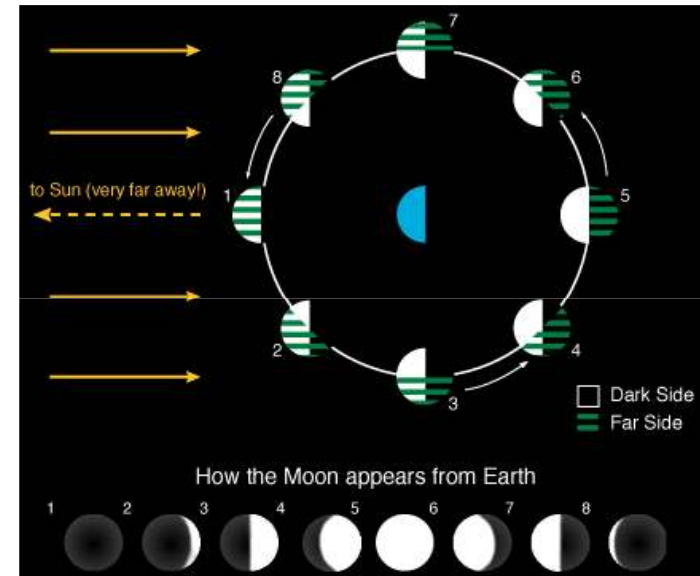
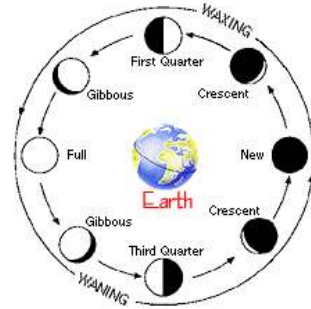
## Golfball and Blacklight Activity

Please do NOT use this to teach phases;  
use to test for comprehension

Moon, Earth, Sun as viewed from above our Solar System

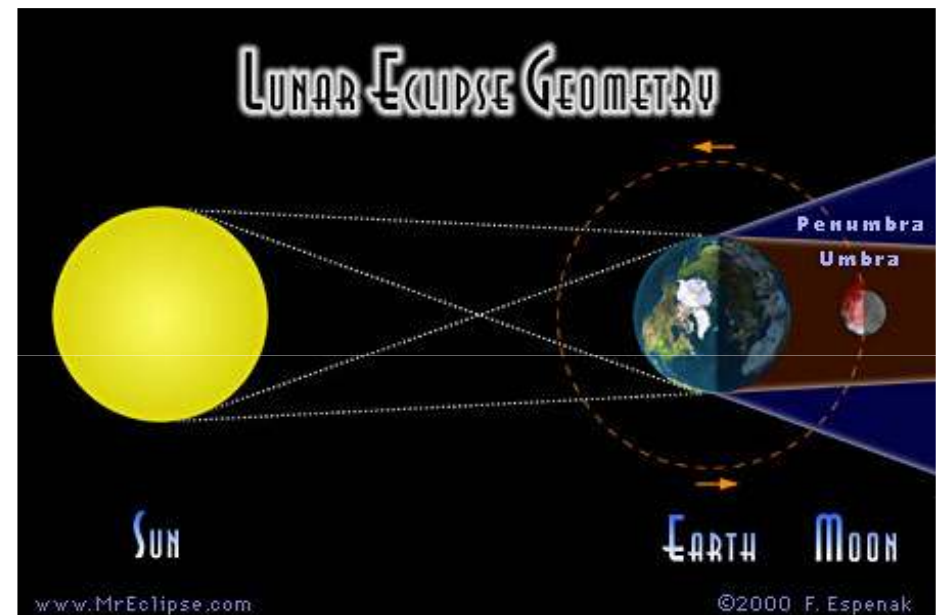


The Moon as seen from Earth



[starchild.gsfc.nasa.gov/docs/StarChild/questions/phases.html](http://starchild.gsfc.nasa.gov/docs/StarChild/questions/phases.html)

- The Sun and Moon occasionally line up so that we have an eclipse.
  - These eclipses happen every year
  - To see a solar eclipse, you need to be on a particular part of the Earth



When the Earth's shadow covers the Moon, we have a lunar eclipse

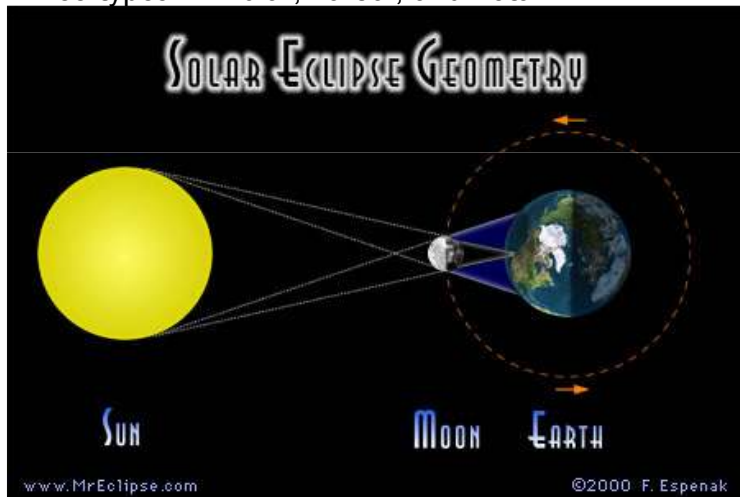
- Penumbral lunar eclipse—the Moon only passes through the penumbra of Earth’s shadow
  - Partial lunar eclipse—part of the Moon passes through the umbra of Earth’s shadow
  - Total lunar eclipse—the entire Moon passes through the umbra of Earth’s shadow
- Who on Earth will be able to see a lunar eclipse?  
Anyone who can see the Moon (anyone who is on the nighttime side of the Earth during the eclipse)



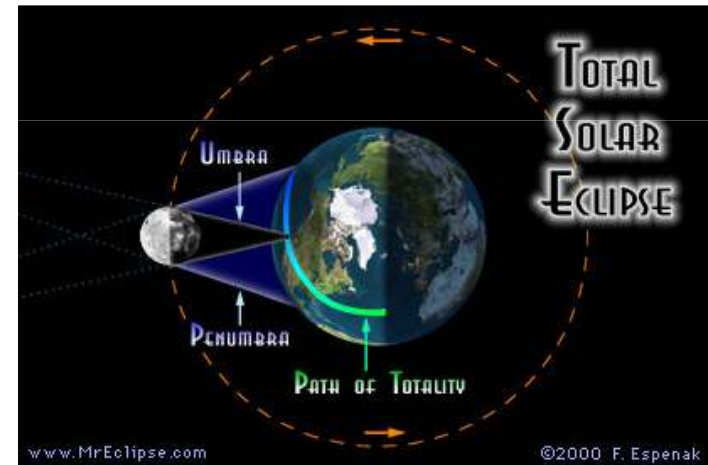
- The Earth’s atmosphere filters some sunlight and allows it to reach the Moon’s surface
- The blue light is removed—scattered down to make a blue sky over those in daytime
- Remaining light is red or orange
- Some of this remaining light is bent or refracted so that a small fraction of it reaches the Moon
- Exact appearance depends on dust and clouds in the Earth’s atmosphere

- Mar 3, 2007, total lunar eclipse— partial eclipse visible in USA
- Aug 28, 2007, total lunar eclipse— partial eclipse visible in USA
- Feb 21, 2008, total lunar eclipse— total in eastern USA and Texas
- Aug 16, 2008, partial lunar eclipse— not visible in USA

- When the Moon's shadow covers part of the Earth
- Only happens at New Moon
- Three types: Annular, Partial, and Total

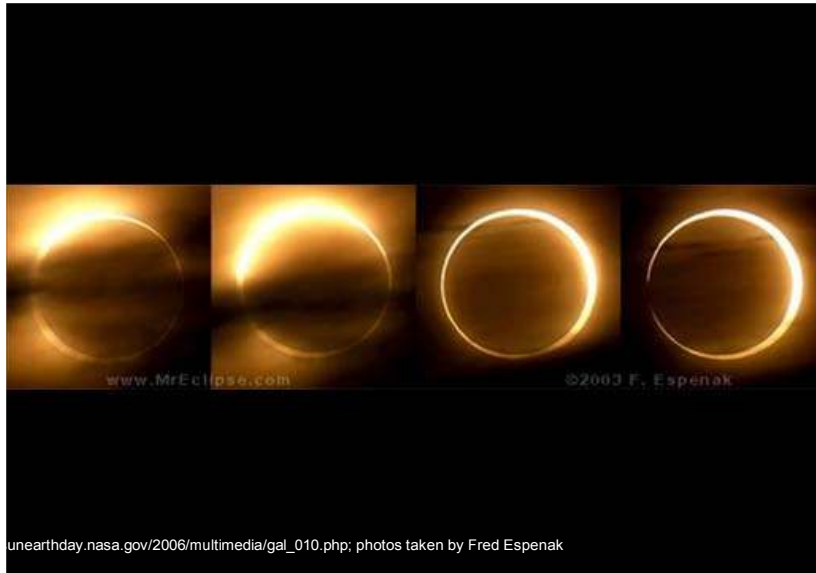


- Observers in the "umbra" shadow see a total eclipse (safe to view the Sun); can see the corona
- Those in "penumbra" see a partial eclipse—not safe to look directly at Sun
- Only lasts a few minutes
- Path of Totality about 10,000 miles long, only 100 miles wide



- When the Moon is too far to completely cover the Sun—the umbra doesn't reach the Earth
- Sun appears as a donut around the Moon





- Mar 19, 2007, partial solar eclipse— visible in Asia and Alaska
- Sep 11, 2007, partial solar eclipse— visible in South America and Antarctica
- Feb 7, 2008, annular solar eclipse— visible in Antarctica and Australia
- Aug 1, 2008, total solar eclipse— visible in Canada, Greenland, Europe and Asia
  
- Next Total Solar Eclipse in USA—August 21, 2017

- The Moon's gravity tugs on the Earth.
  - It pulls the most on the part of Earth closest, which raises the atmosphere, the oceans, and even the rocks (a little)
  - It pulls the least on the part of Earth that's farthest, which allows the oceans and atmosphere to be further from the Moon (and higher)
  - The Sun's gravity does the same thing, but to a lesser extent