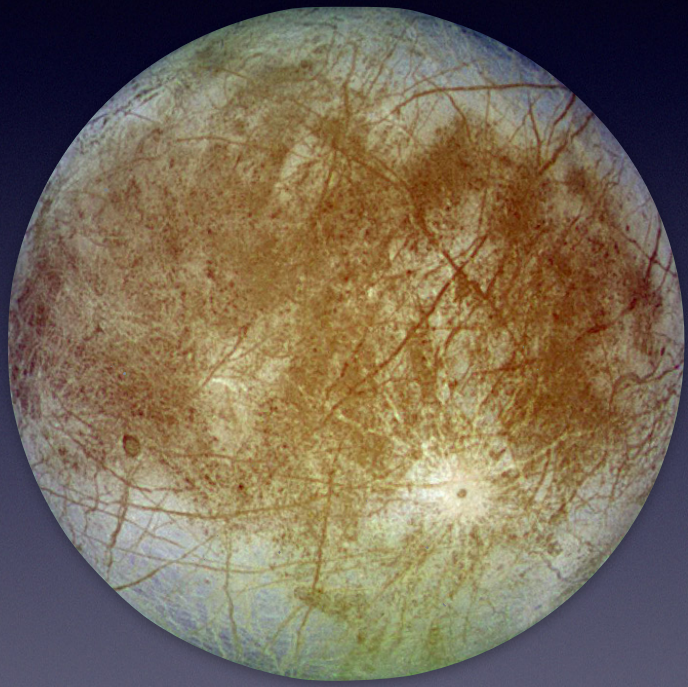
The Moon

What effects does the Moon have on Earth and how does its motions create the phases of the moon?

The Moon

- Moon - a body that orbits a planet or asteroid as they orbit the Sun
- There are 173 moons in our solar system



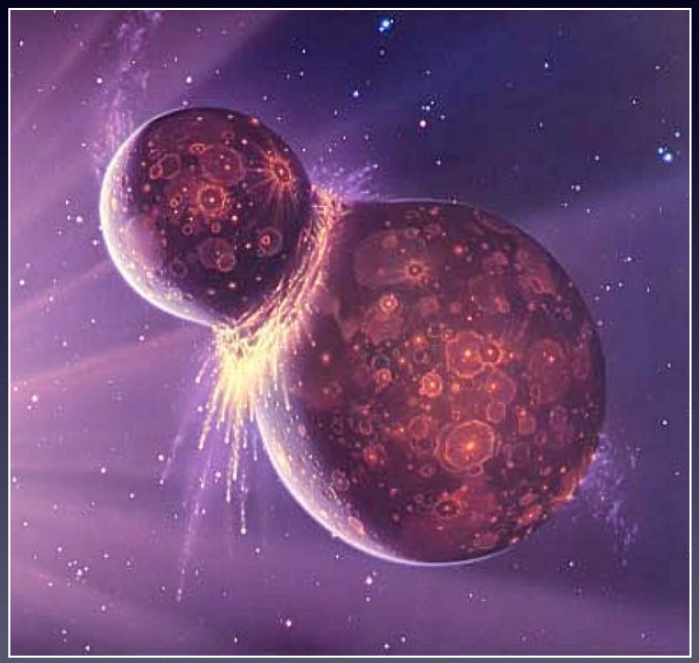
Europa, Jupiter

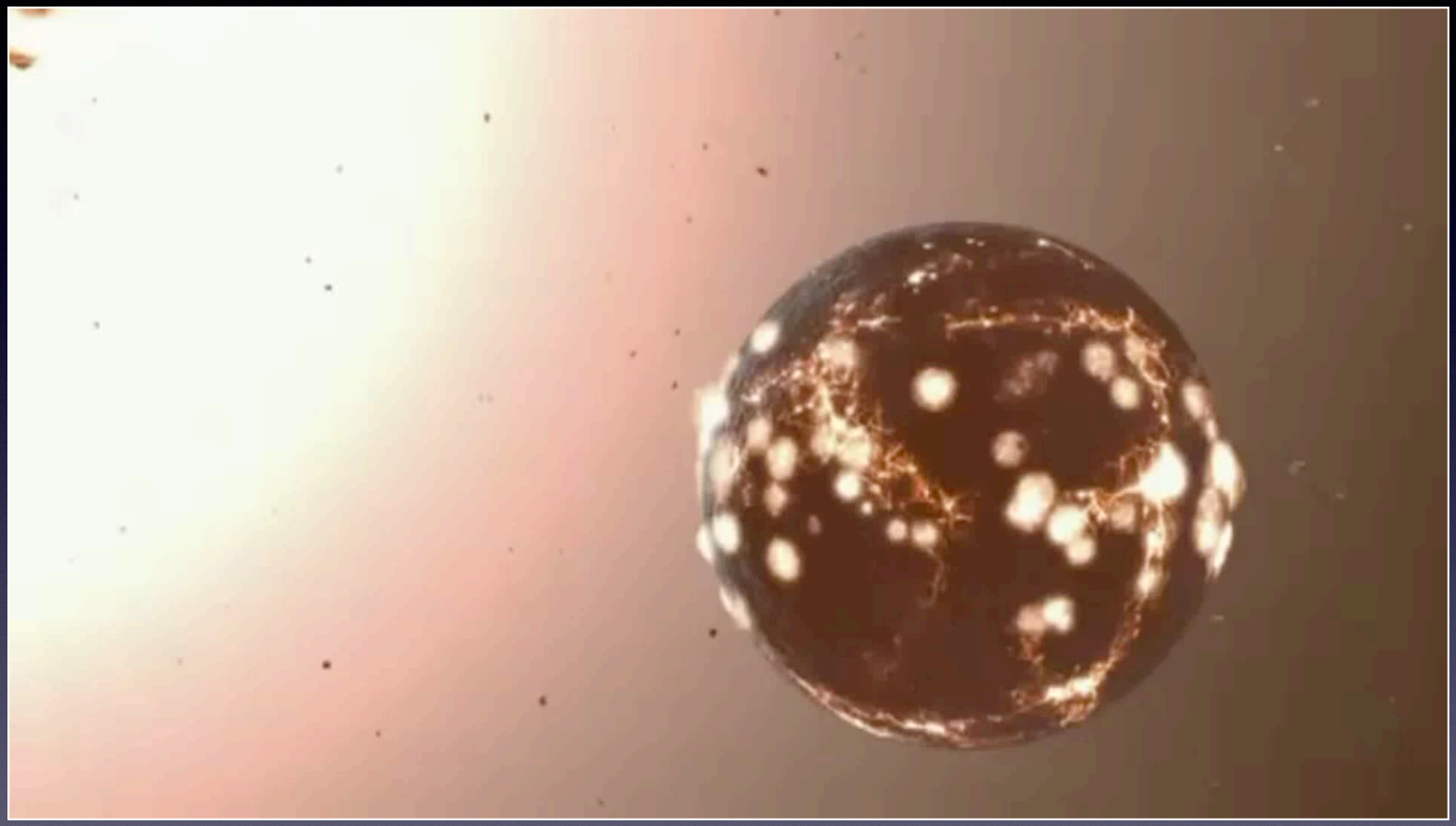
The Moon

- Theory of Earth's Moon Formation
  - Co-formation Theory
  - Capture Theory
  - Fission Theory
  - Giant Impact Theory 

The Moon

- Giant Impact Theory - a planetesimal [size of Mars] struck the earth, ejecting large volumes of matter that condensed to form the Moon in orbit around the Earth





Giant Impact Theory

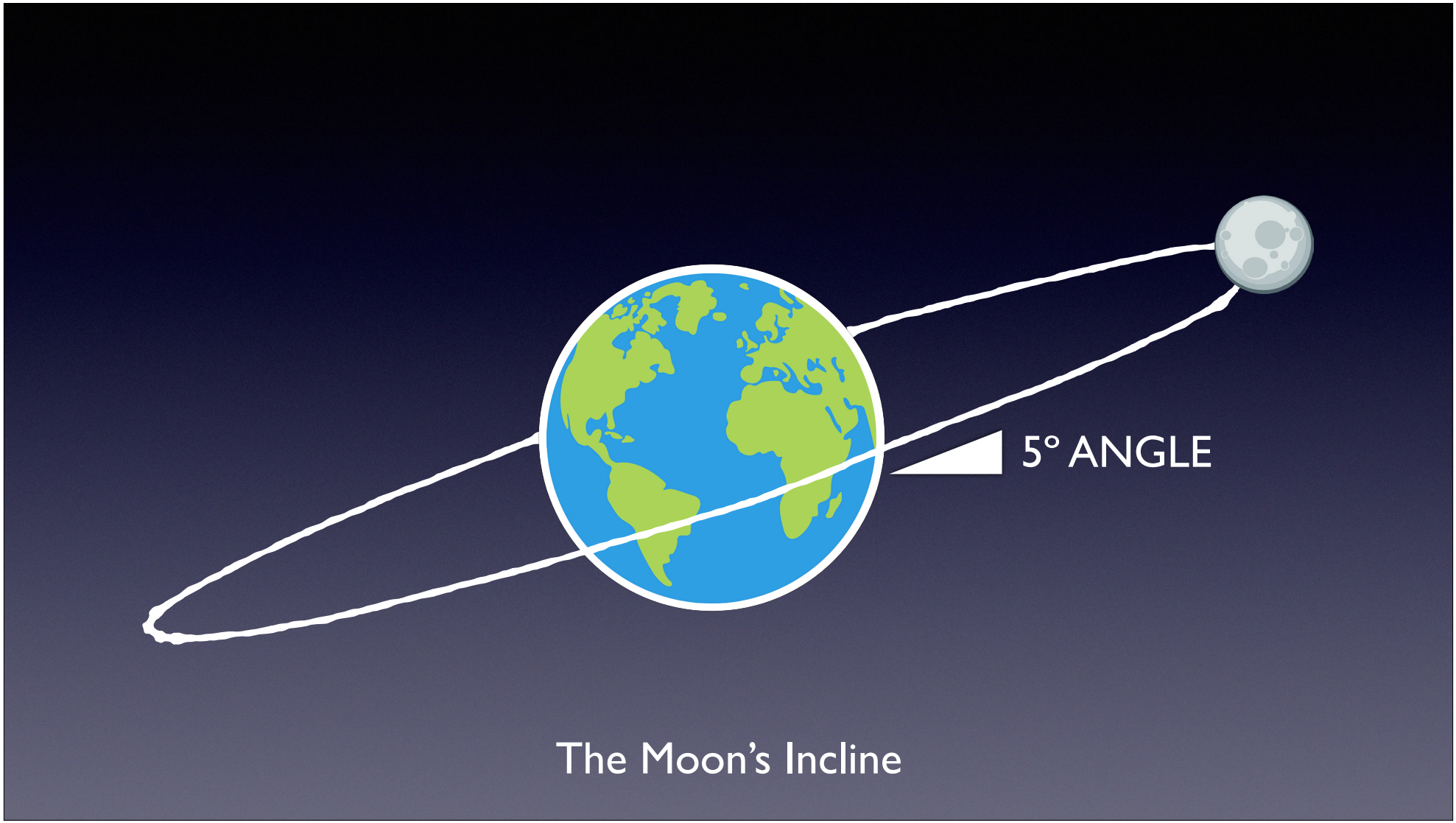
The Moon

- The Moon - large round object that orbits the Earth and that shines at night by reflecting light from the sun

Earth's Moon

The Moon

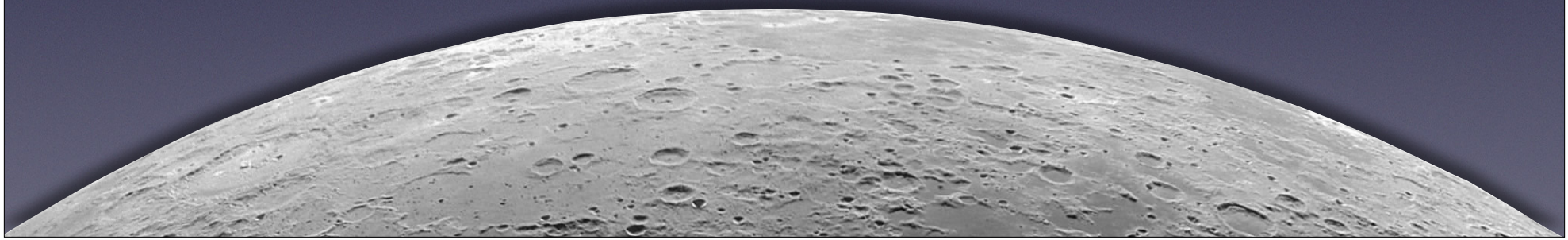
- The Moon orbits is elliptical
- The plane of the moon's orbit is inclined to Earth's at about 5 degrees



The Moon's Incline

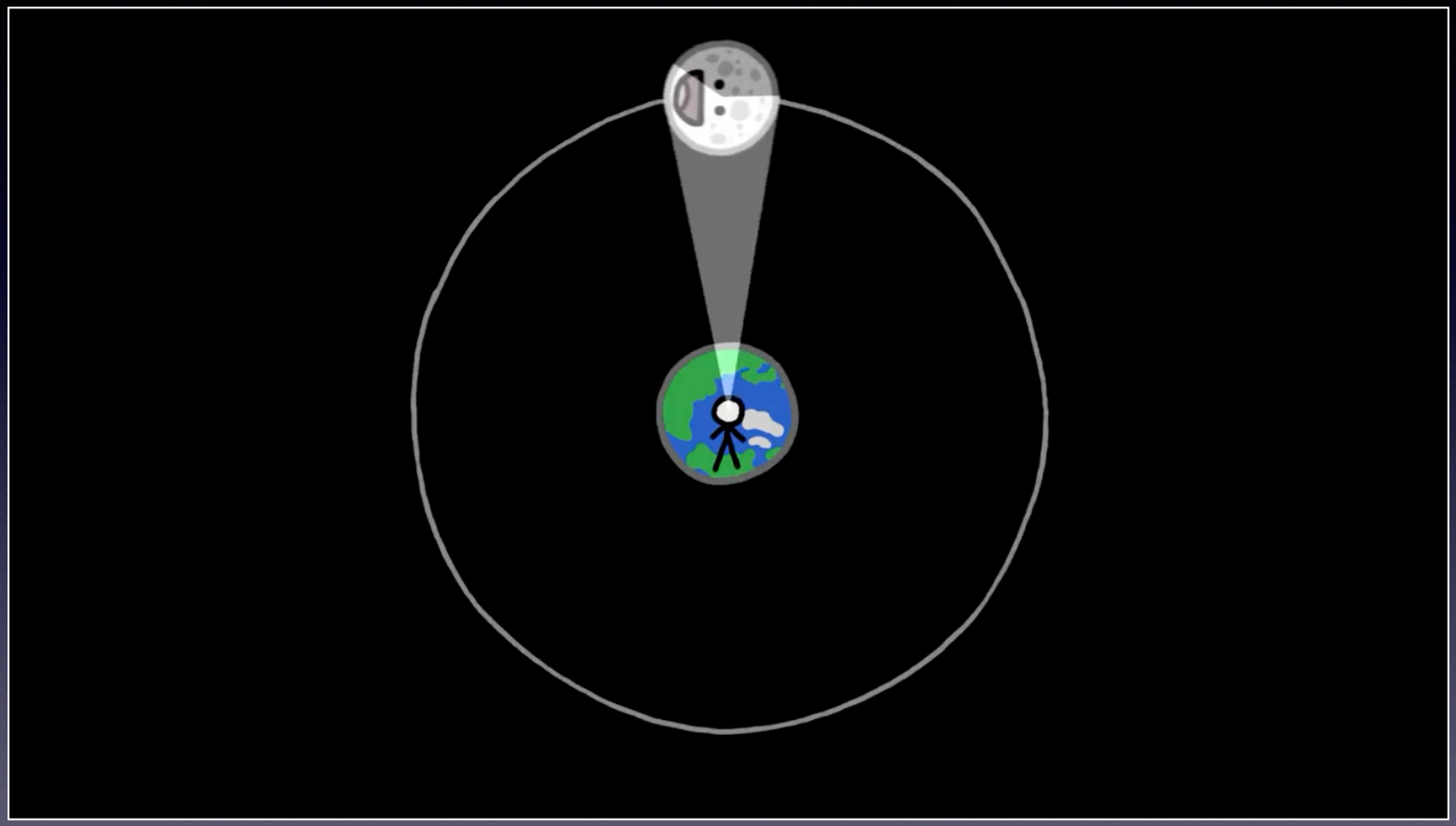
The Moon

- One orbit is 27.3 days
- The Moon rotates once every 27.3 days



The Moon

Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (d=days) (y=years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm^3)
SUN	—	—	27 d	—	1,392,000	333,000.00	1.4
MERCURY	57.9	88 d	59 d	0.206	4,879	0.06	5.4
VENUS	108.2	224.7 d	243 d	0.007	12,104	0.82	5.2
EARTH	149.6	365.26 d	23 h 56 min 4 s	0.017	12,756	1.00	5.5
MARS	227.9	687 d	24 h 37 min 23 s	0.093	6,794	0.11	3.9
JUPITER	778.4	11.9 y	9 h 50 min 30 s	0.048	142,984	317.83	1.3
SATURN	1,426.7	29.5 y	10 h 14 min	0.054	120,536	95.16	0.7
URANUS	2,871.0	84.0 y	17 h 14 min	0.047	51,118	14.54	1.3
NEPTUNE	4,498.3	164.8 y	16 h	0.009	49,528	17.15	1.8
EARTH'S MOON	149.6 (0.386 from Earth)	27.3 d	27.3 d	0.055	3,476	0.01	3.3



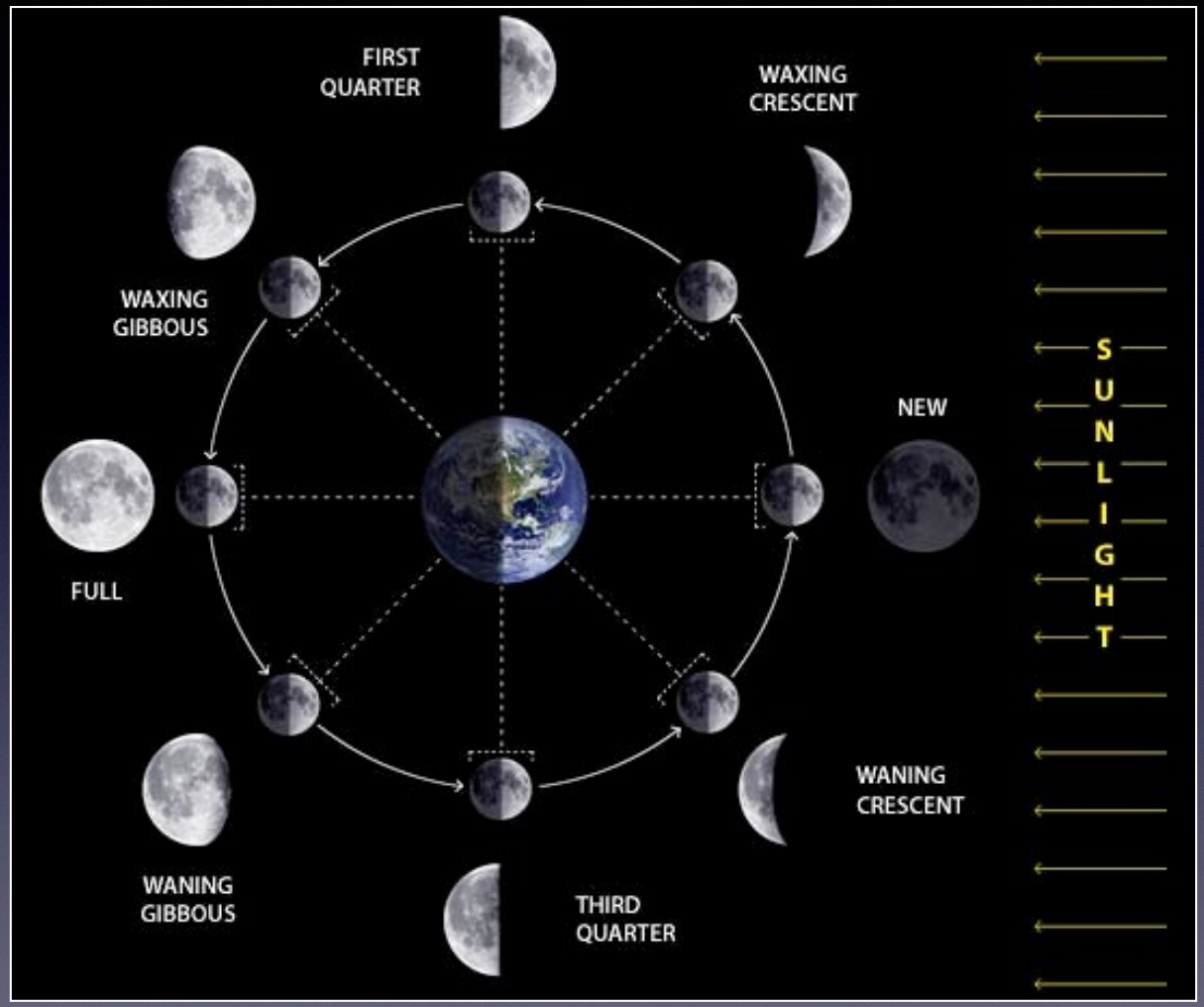
Same Side of the Moon

The Moon

- Half of the moon is always in sunlight
- As the moon revolves around Earth the illuminated portion changes due to our viewing angle
- As a result, the moon appears to change shape during the month creating the phases

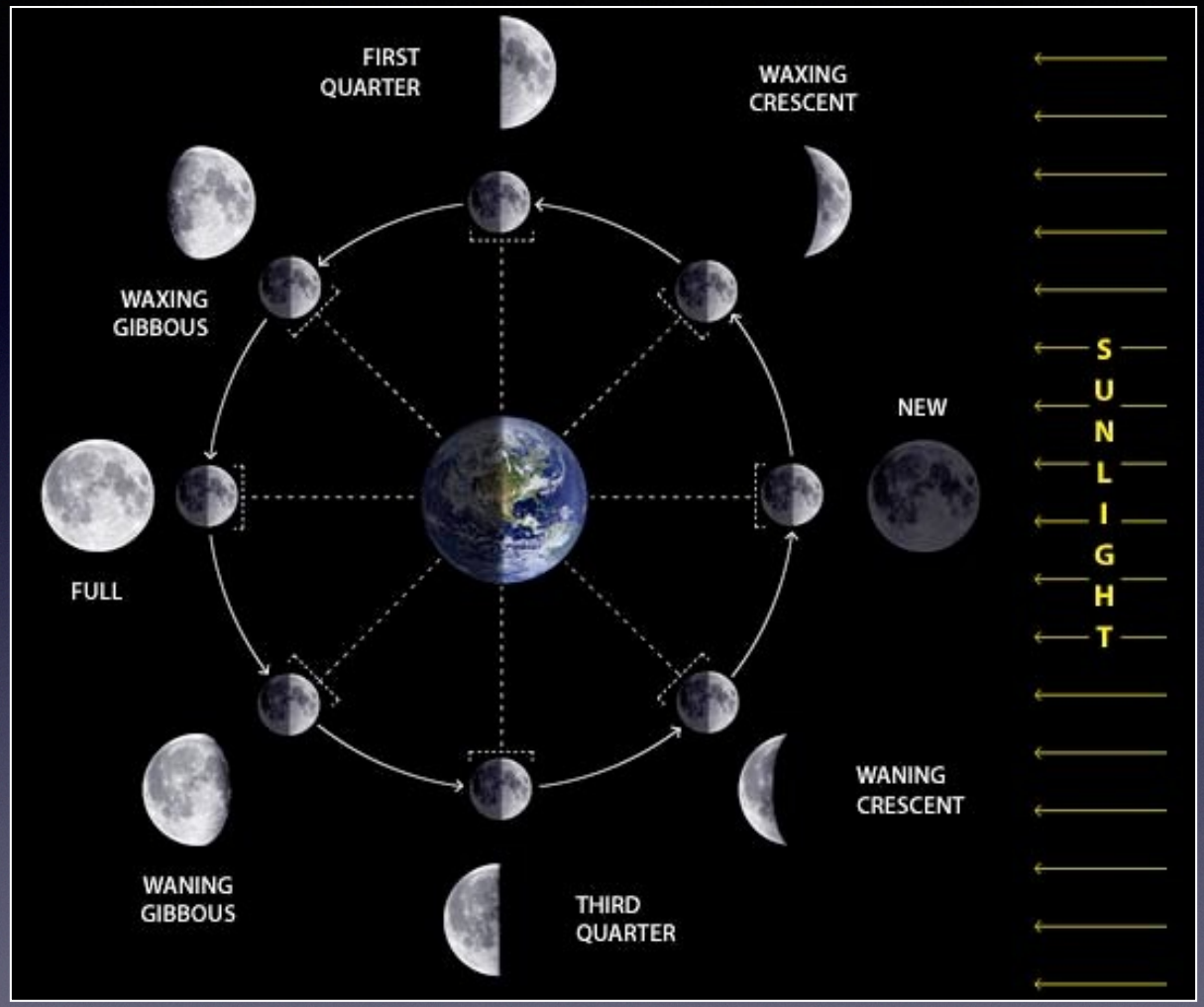
The Moon

- Crescent Moon - phase that is less than half way full
- Full Moon - phase that appears as an entire circle in the sky


FIRST QUARTER
WAXING CRESCENT
WAXING GIBBOUS
NEW
FULL
WANING CRESCENT
WANING GIBBOUS
THIRD QUARTER
SUNLIGHT

The Moon

- Gibbous Moon - phase when the moon is more than half way full
- New Moon - phase where no part is visible from the Earth


FIRST QUARTER
WAXING CRESCENT
WAXING GIBBOUS
NEW
FULL
WANING CRESCENT
WANING GIBBOUS
THIRD QUARTER
SUNLIGHT

The Moon

- Waxing Moon - to increase in size [lit portion] gradually
- Waning Moon - to decrease in size [lit portion] gradually
- *"Light on right… moon grows bright!" - A. Camera*

Phases of the Moon

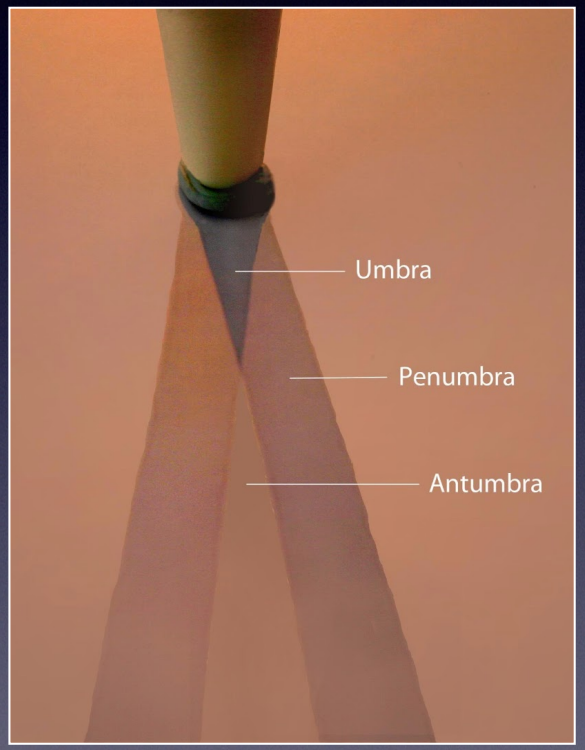
Earth has phases too?

The Moon

- The lunar phase cycle is 29.5 days
  - The Moon spends the extra 2.2 days "catching up" due to Earth traveling an additional 45 million miles in its revolution around the Sun

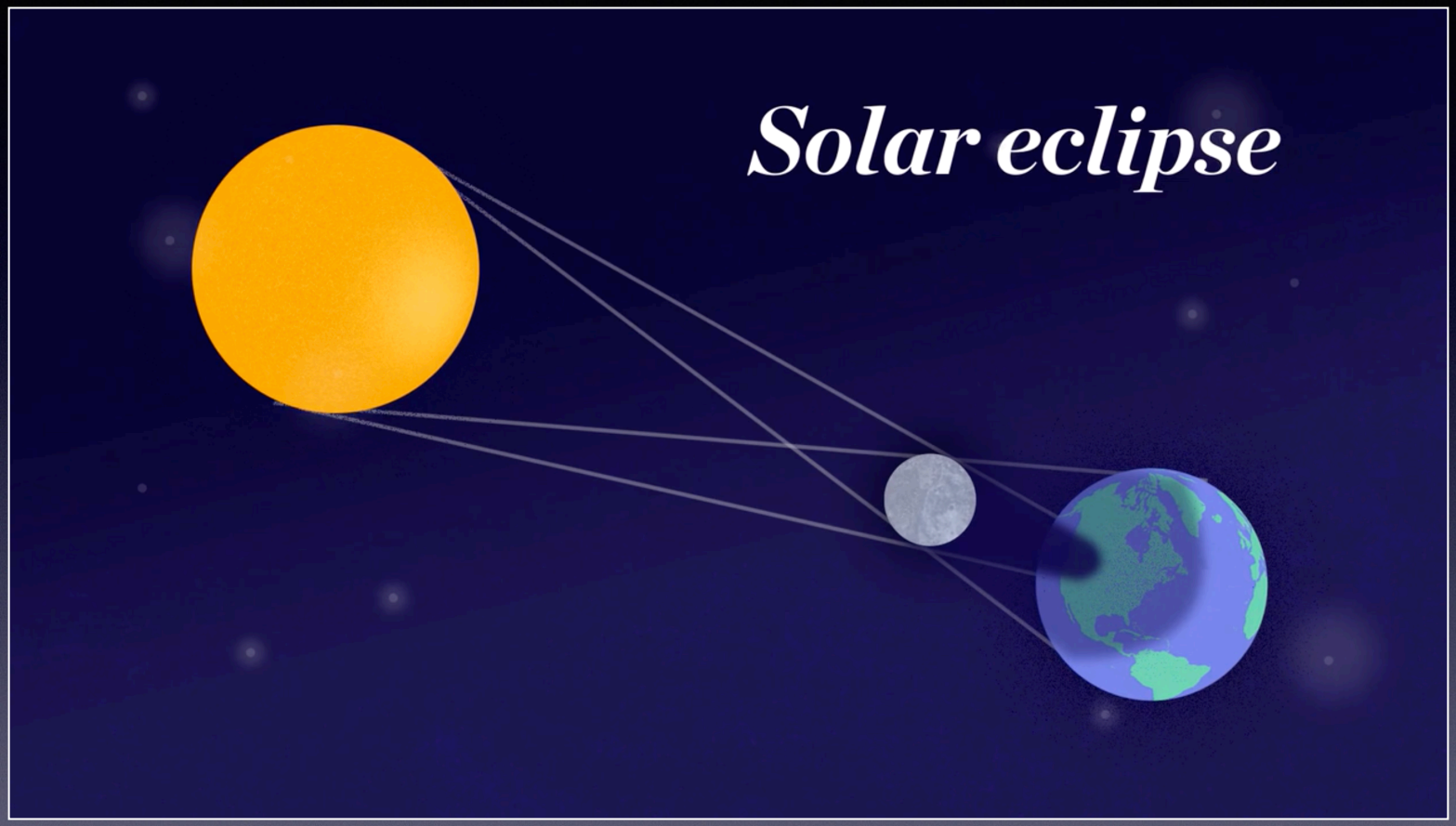
The Moon

- Umbra - the fully shaded inner region of a shadow
- Penumbra - the partially shaded region of a shadow

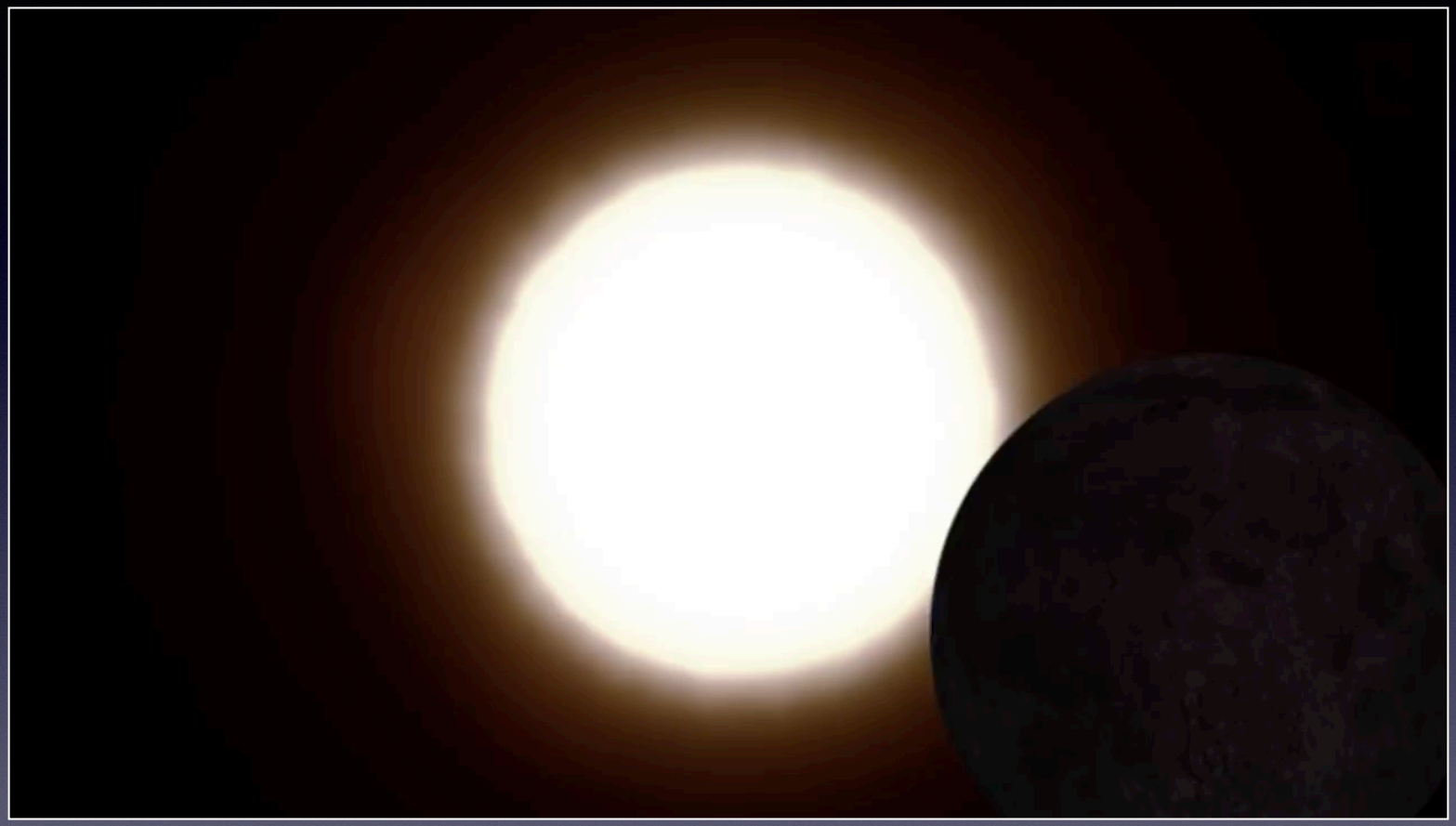


The Moon

- Solar Eclipse - when the Sun is obscured by the moon
  - Occurs only during a new moon
  - The moon's umbra has a width of about 269 km
  - Duration is up to 7 minutes as it passes over



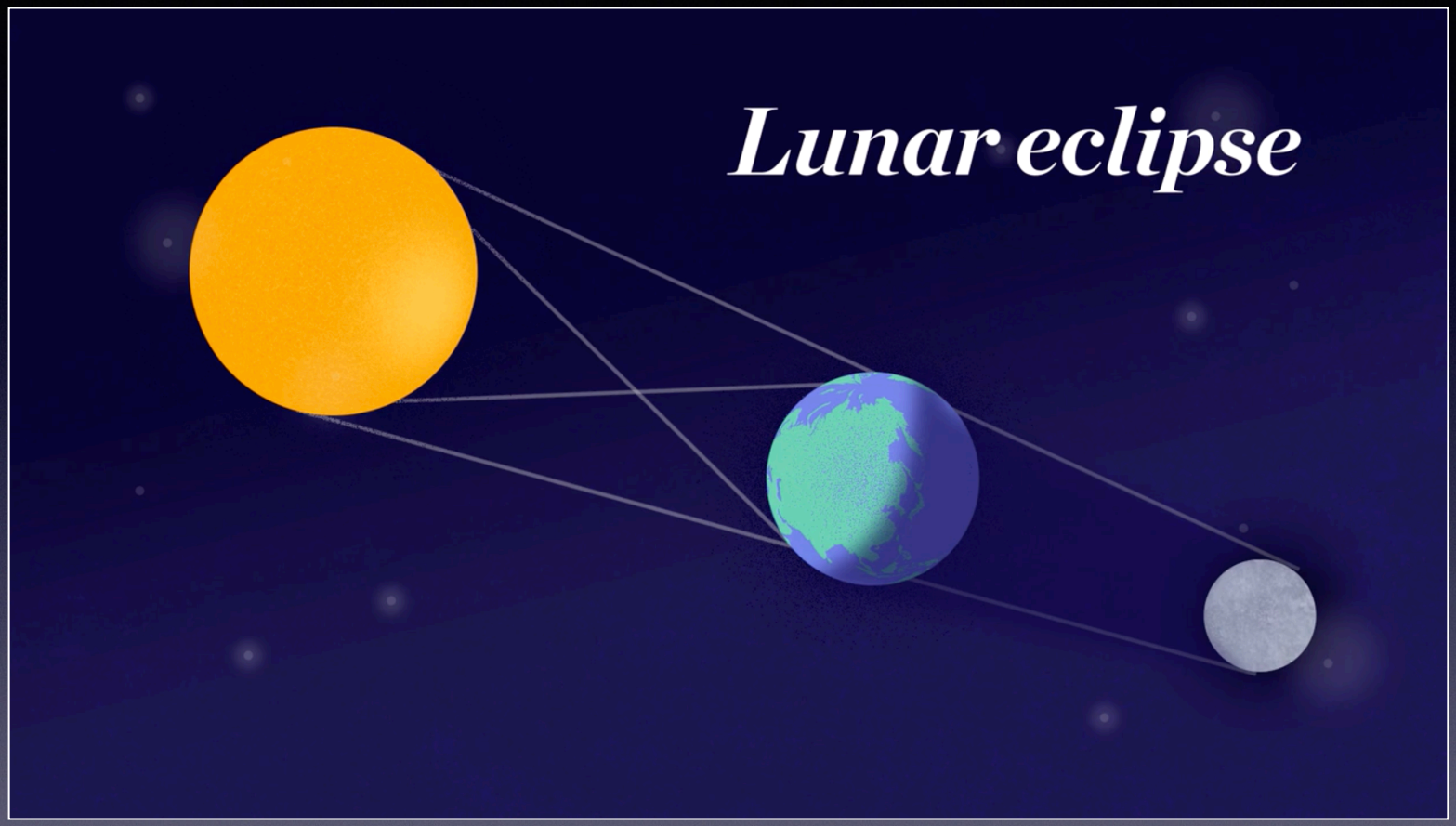
Solar Eclipse



Solar Eclipse

The Moon

- Lunar Eclipse - when the moon appears darkened as it passes into the earth's shadow
  - Occurs during a full moon phase
  - The moon remains visible as a red-orange color due to some sunlight being refracted through Earth’s atmosphere into the umbra
  - Duration may last for up to 1.8 hours



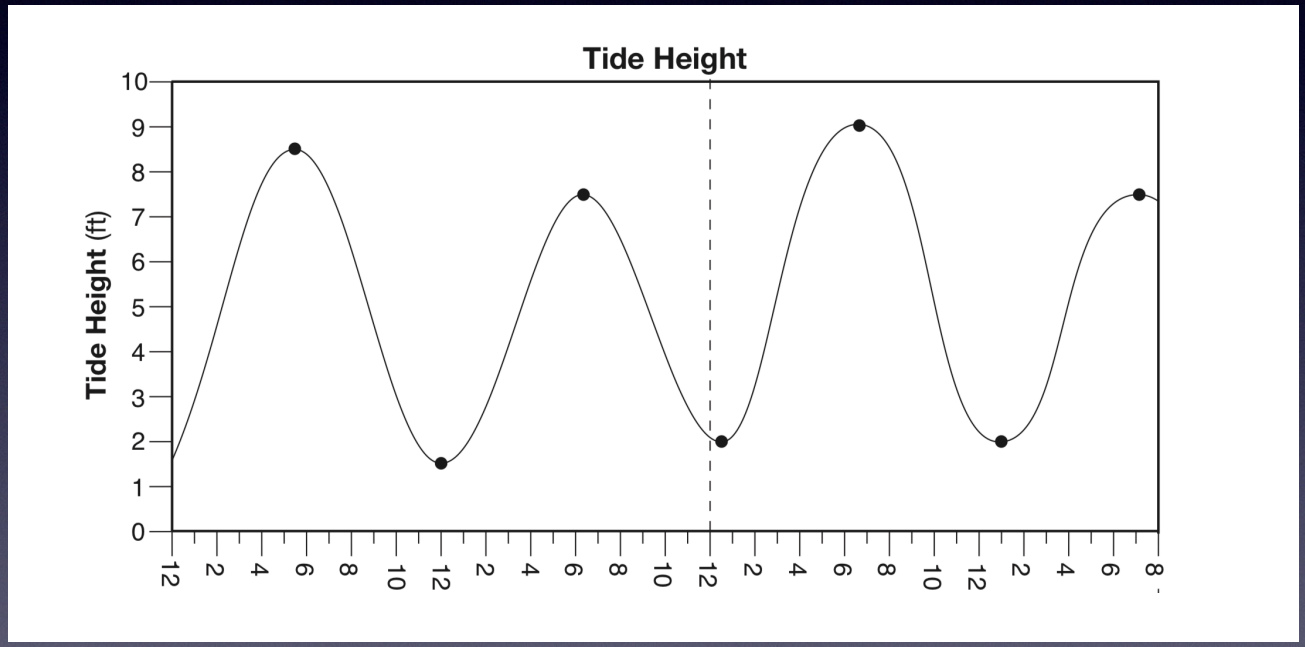
Lunar Eclipse

Lunar Eclipse

The Moon

- Tides - the cyclic rise and fall of sea levels caused by the Moon's gravity, Sun's gravity and Earth's rotation
- Tides are caused by the Moon's gravity, Sun's gravity and the rotation of the Earth
- One tidal cycle is 12 hrs and 25 mins

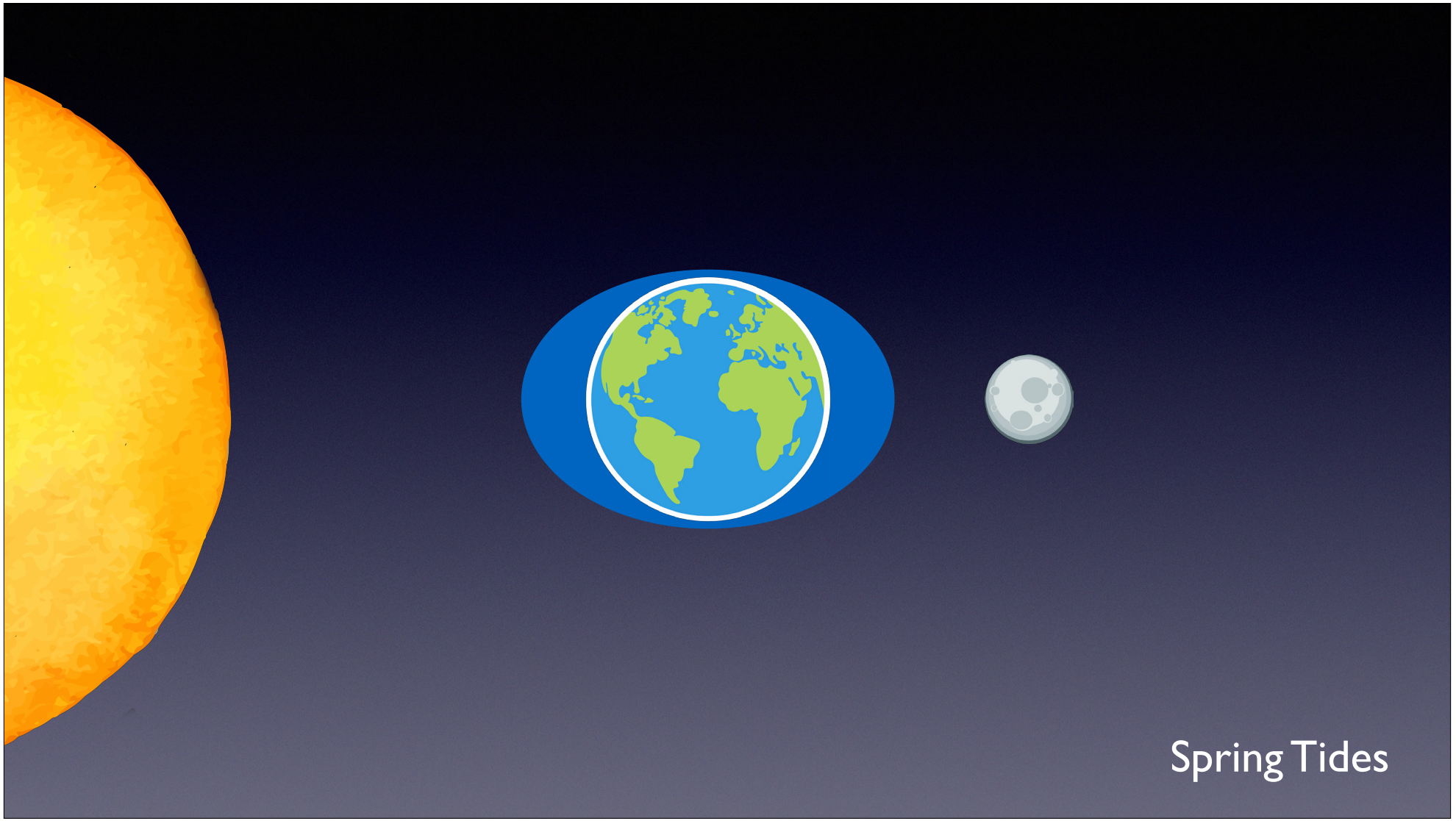
The Moon

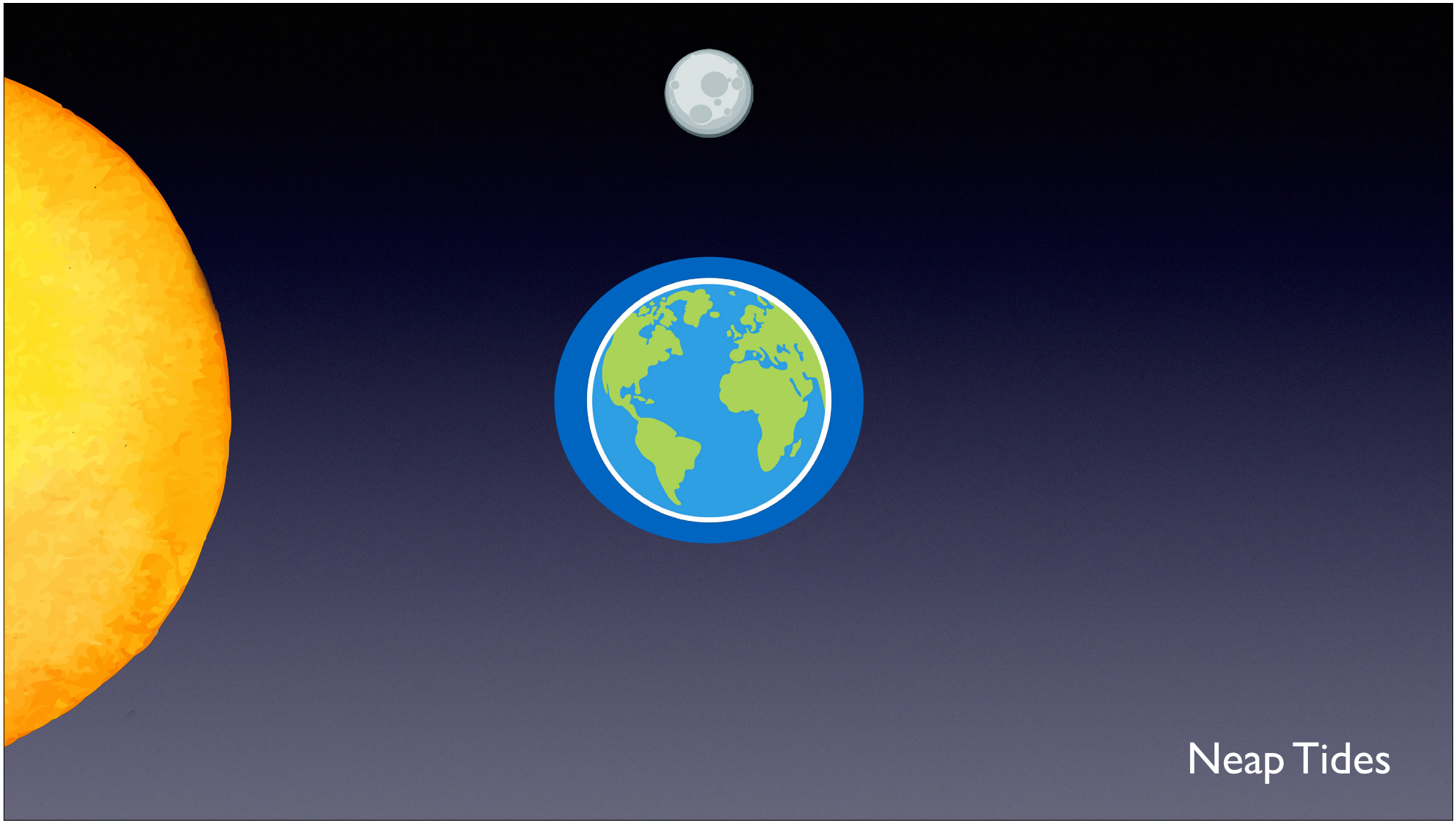


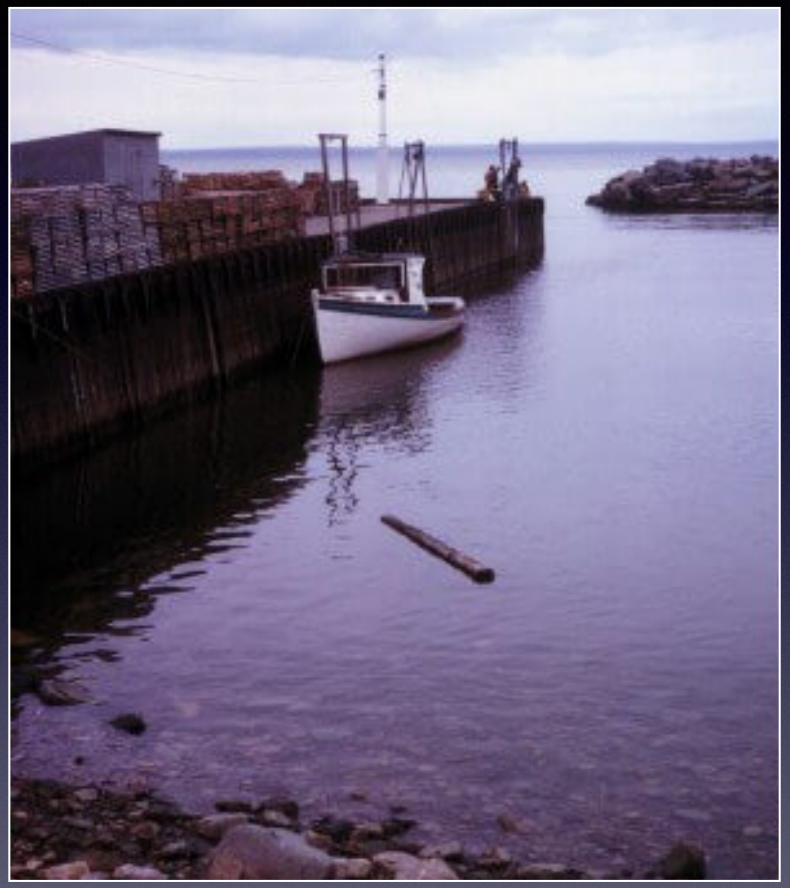
Cyclic Pattern

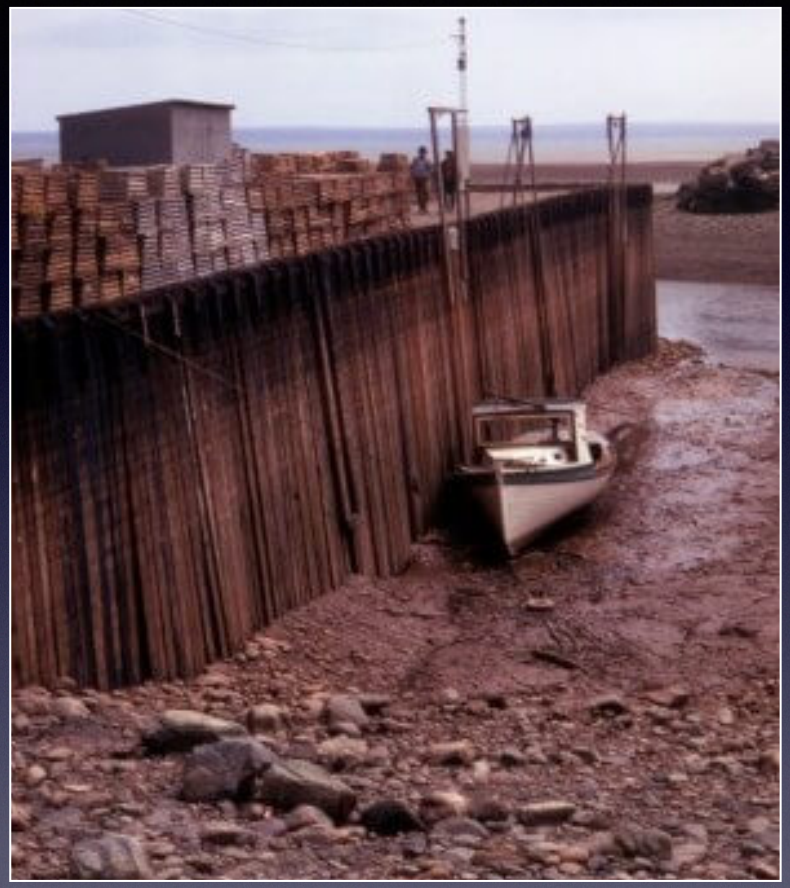
The Moon

- Spring Tide - occur when the Sun and Moon are aligned [full and new moon] causing higher high tides
- Neap Tide - occur when the Sun and Moon are acting on the earth in opposing direction


Spring Tides


Neap Tides





Bay of Fundy, Canada

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