

## Student Notes: Unit 2- The Earth in Space

### Part 4 – Earth in Motion

#### Earth's Motion in Space:

- every object or body in the universe is in constant and extreme motion even if you do not feel like it
- galaxies are moving away from each other, the Milky Way is orbiting around its black hole, the Earth is revolving around the sun as well as rotating on its own axis.

#### Earth's Rotation:

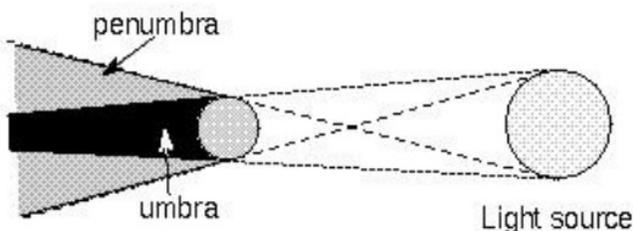
- Rotation = the spinning of the Earth around its axis (the imaginary line joining the north and south poles) which is tilted at an angle of  $23.5^\circ$ .
- It takes Earth 24 hours to complete one full rotation ( $360^\circ$ ) around its axis.
- Earth rotates in a counterclockwise rotation from East to West.

#### Earth's Revolution:

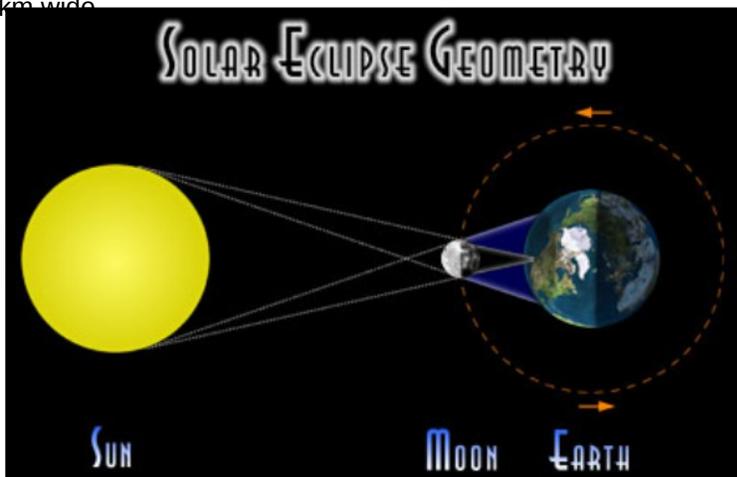
- Revolution = the movement of Earth orbiting around the Sun
- It takes 365.24 days to revolve once around the sun (1 year)
- The earth rotates in a counterclockwise rotation from East to West
- Due to the elliptical orbit of the Earth around the sun the distances between the Earth and the Sun change.
  - Perihelion = when Earth is closest to the Sun
  - Aphelion = when Earth is furthest from the sun

#### Solar Eclipse:

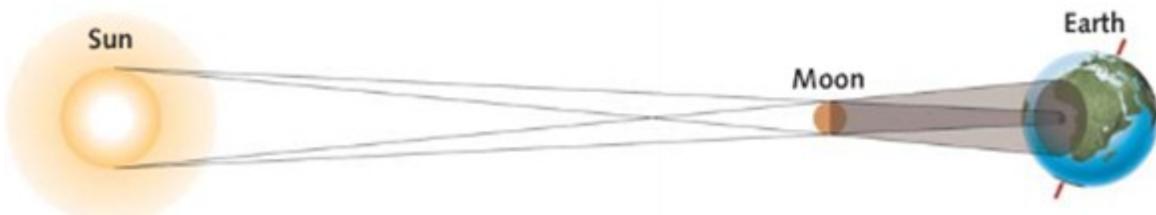
- Positions of the moon:
  - The point when the moon is closest to Earth during its orbit around Earth is called perigee.
  - The point when the moon is furthest from Earth during its orbit around Earth is called apogee.
- Shadows cast by any opaque object (an object light cannot pass through) have two parts:
  1. umbra = the area of total shadow
  2. penumbra = the area of partial shadow



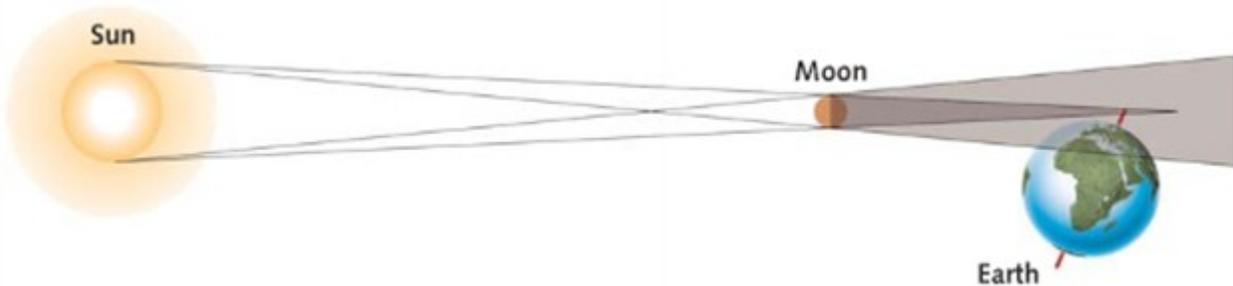
- Both the Earth and moon are opaque and cast shadows into space.
- A solar eclipse occurs when the moon comes between the sun and Earth, and the moon's shadow hits Earth's surface.
- The entire shadow is about 7000 km wide; however the umbra where eclipse is most dramatic never exceeds 270 km wide.



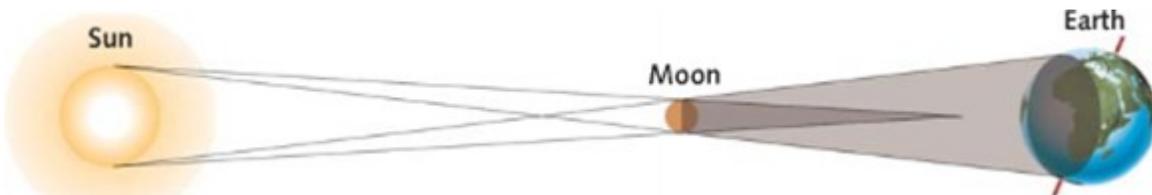
- A solar eclipse occurs only at the new-moon phase; however a total eclipse is very rare as the moon's shadow usually falls above or below Earth.
  - A total solar eclipse occurs when the moon is at perigee in areas on the Earth within the moon's umbra.



- A partial solar eclipse occurs when the moon is at perigee when only a partial solar eclipse is visible in areas of the Earth within the moon's penumbra.



- An annular eclipse occurs when the moon is at apogee and the umbra fails to reach the Earth. From the Earth we see that the moon's disk is slightly smaller than the sun's.



### Lunar Eclipse:

- An event when the Earth's shadow prevents the sunlight from reaching the moon.
- They can only occur at the full moon phase; however does not occur each month because the full moon is usually above or below Earth's umbra.
- During a lunar eclipse the moon remains visible; however has a coppery color to it caused by the Earth's atmosphere bending some sunlight, mostly the longer red wavelengths.

# LUNAR ECLIPSE GEOMETRY

