

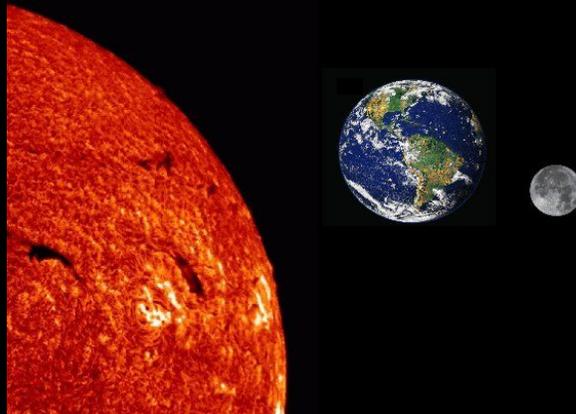


Sun, Earth & Moon

Peterborough Astronomical Association
Novice Astronomy Class #6
September 2, 2022
Brett Hardy

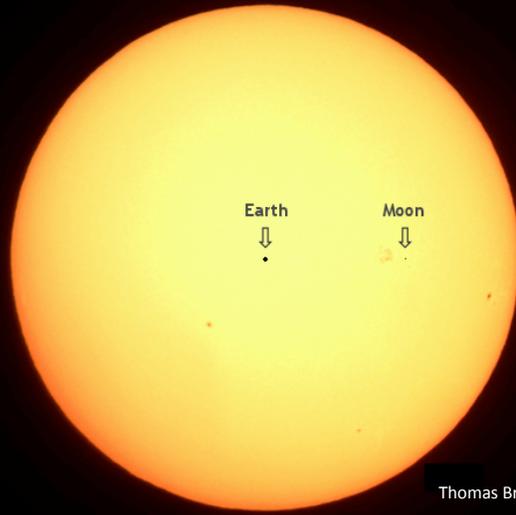
When Three is NOT a Crowd

- The relative motion of the Sun, Earth and Moon cause a variety of phenomena and patterns



Relative Size of Sun, Earth, Moon

- Sun comprises > 99.8 % of solar system's mass
- 109 x wider than Earth's diameter
- > 1,000,000 Earths could fit inside the Sun
- Earth is 4 x larger than the Moon
- Moon is 400 x smaller than the Sun



Thomas Bresson

Our Sun

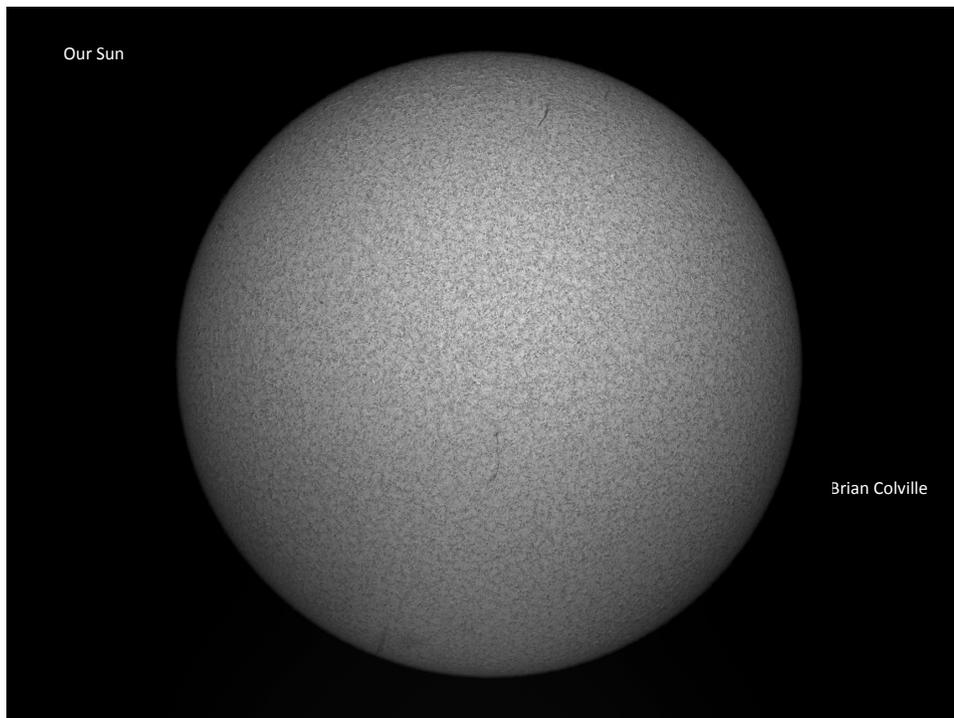
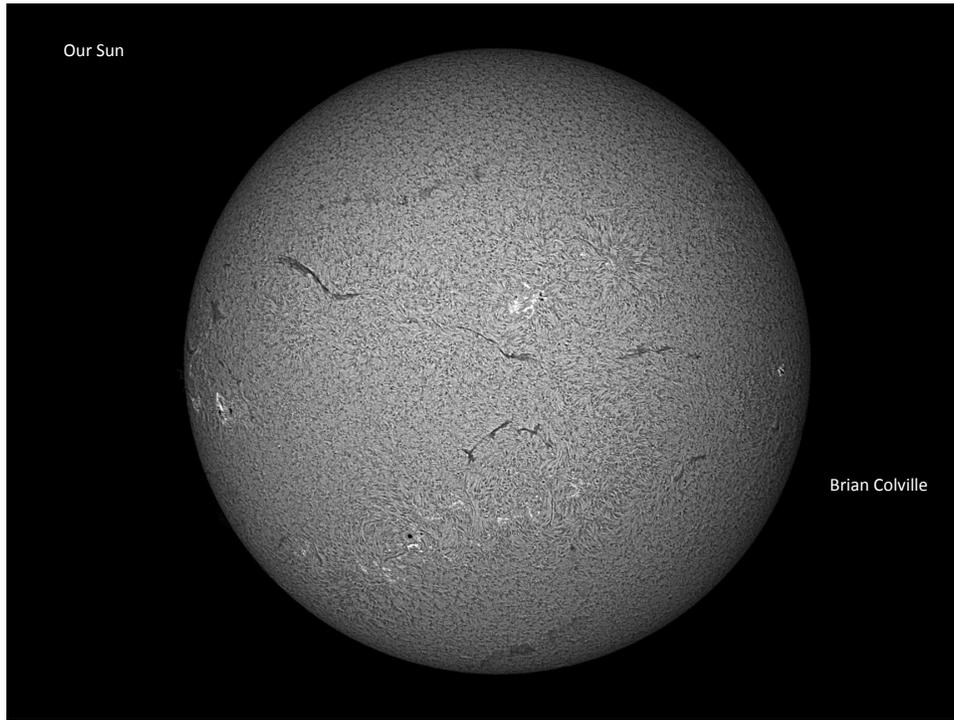
- 4.5 billion years old
- Composition: H_2 & He
- Dominates our solar system
- Responsible for life on Earth
- Rotates counterclockwise
- 27 days
- 11 year solar cycle

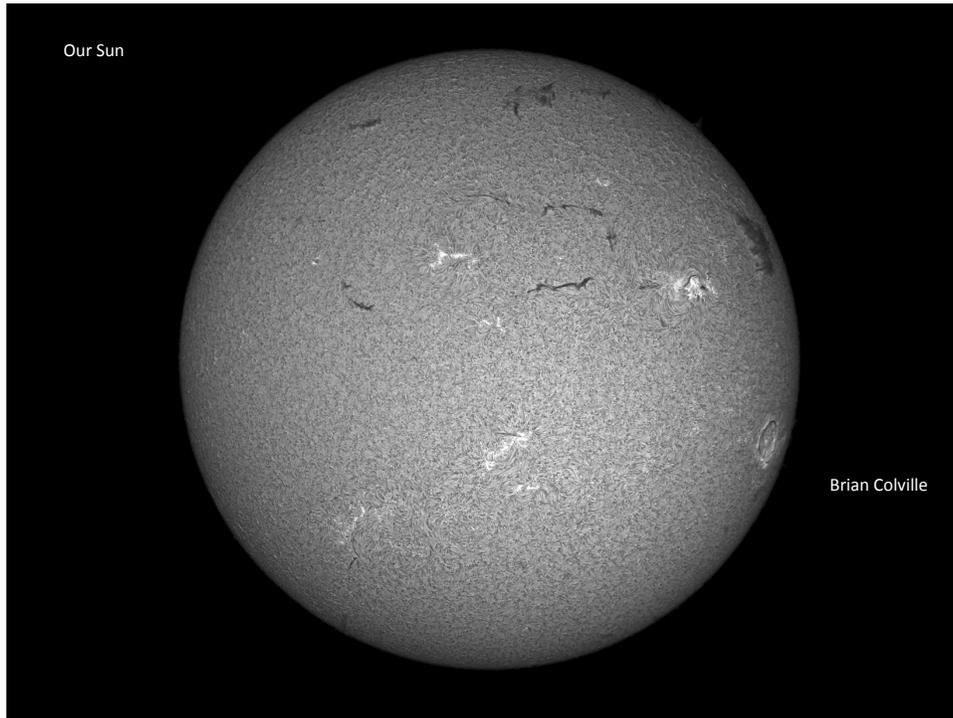


Dave Temple



Montgomery





Moon

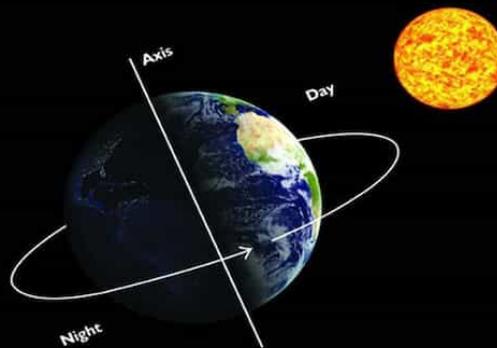
- Natural satellite of Earth
- ~ 400,000 km from Earth
- Distance increasing ~ 3.78 cm/year
- Diameter: 3,475 km
- Circumference: 10,921 km
- Orbits in counterclockwise direction
- Rotational period: 27 days
- Lunar Month: 29.5 days
- Rotation is tidally locked to Earth
- Water ice deposits
- No atmosphere



Brett Hardy

Earth's Rotation

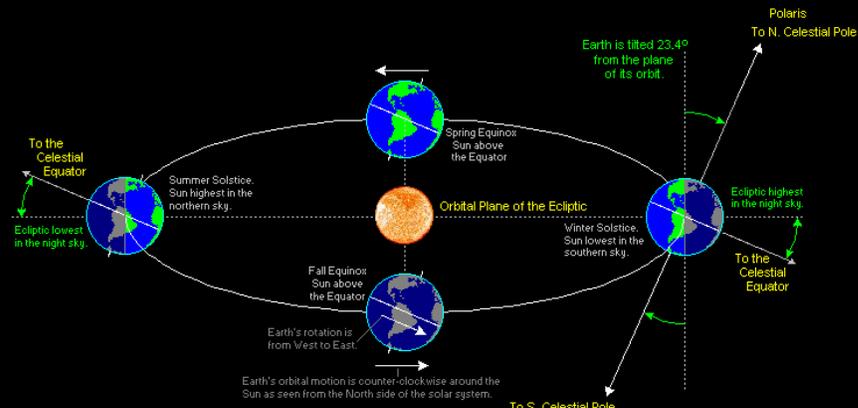
- Earth's rotation is counterclockwise
- Apparent rising and setting of the Sun
- Rotation speed: 1,670 km/hr (1,180 km/hr at 45° latitude)
- One complete rotation takes 23 hours 56 minutes 4.09 seconds = 1 day
- Day length is slowly increasing



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Earth's Orbit

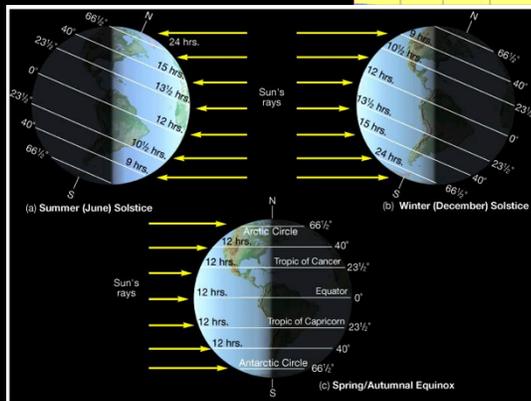
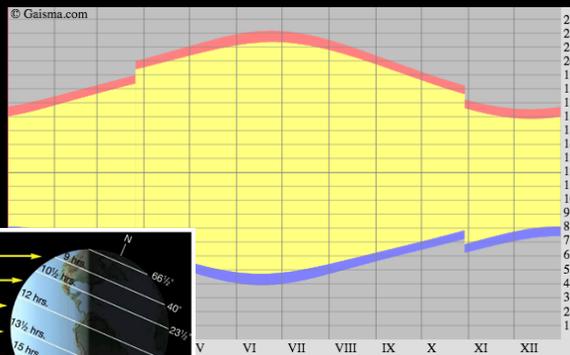
- All the planets orbit the Sun in an elliptical orbit
- Orbital speed: ~ 107,000 km/hr
- Distance Earth travels in one year: ~ 940 million km



Larry McNish

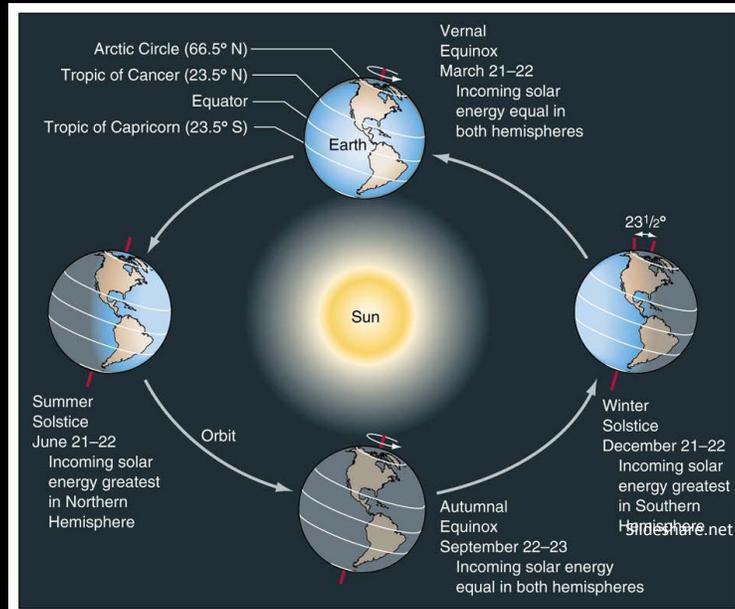
Annual Daylight Variation

- Earth's orbit around the Sun has implications for the number of daylight hours



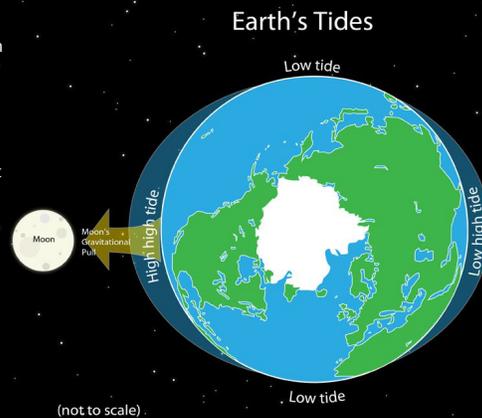
Seasons

- The tilt of our Earth at 23.5° is what causes the seasons
- Known as obliquity
- Obliquity defines the intensity of the Sun's light
- Sun's intensity at the Summer Solstice is 2.5 times greater than at the Winter Solstice
- Hours of sunlight vary with seasons adding a secondary effect on temperature



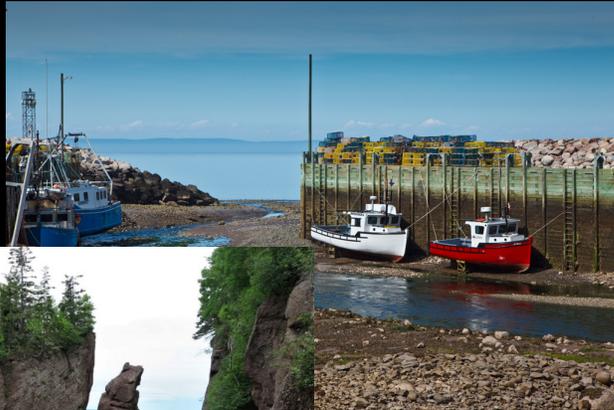
Tides

- Gravitational interaction of Moon and Sun cause tides
- Average height of tides: 2 - 3 m
- Moon is slowly moving farther away
- Rotation of Earth is gradually slowing
- Earth's day was 6 hours long at its formation 4.5 billion years ago
- When Moon formed it was only ~ 20,000 - 30,000 km away - 15 x closer than today



Highest Tides in the World

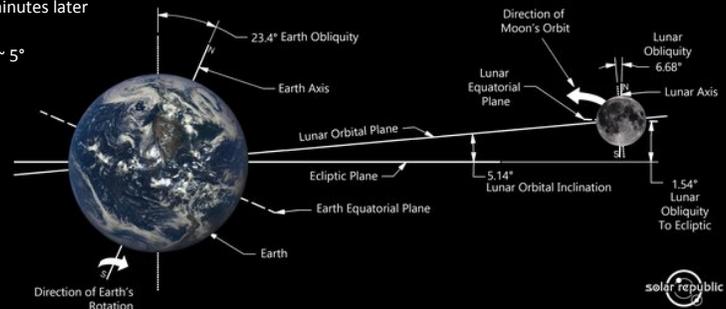
- Bay of Fundy, New Brunswick
- 16 m tides



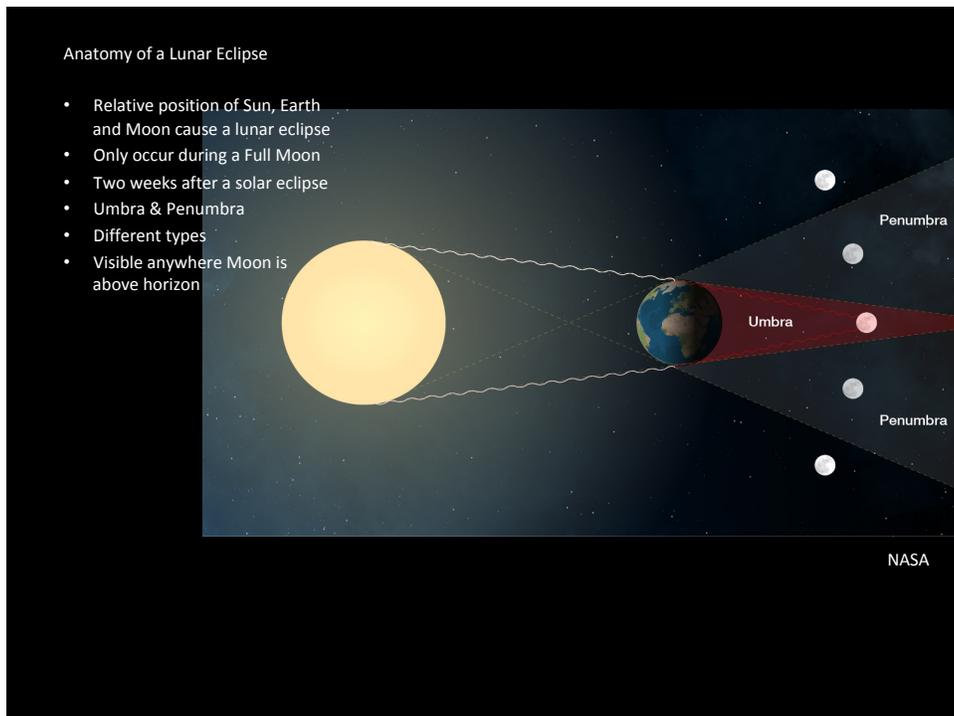
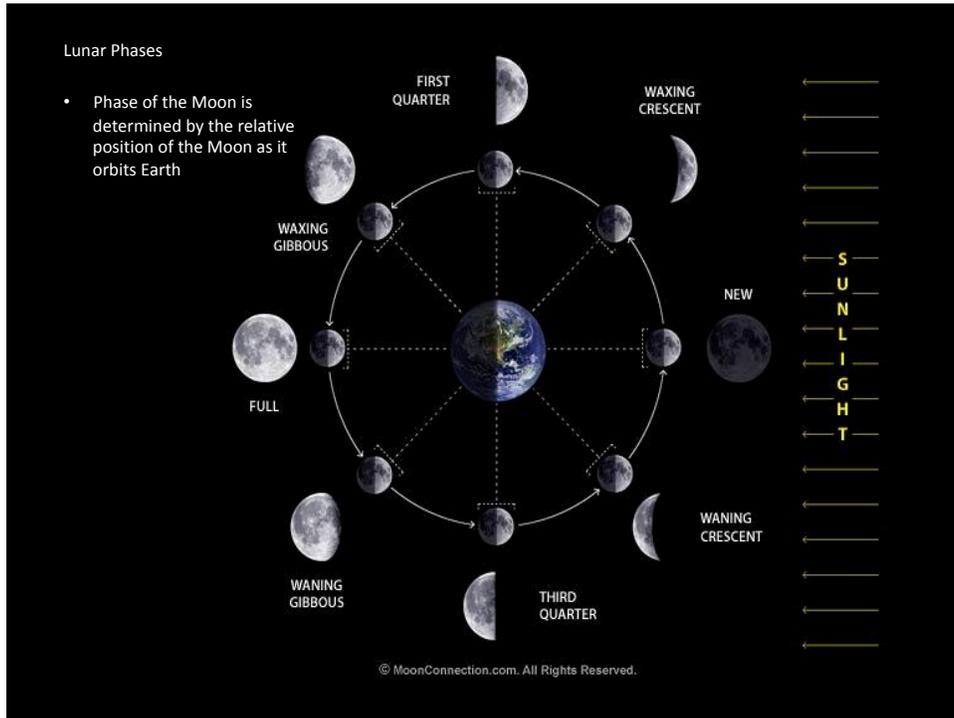
Hopewell Rocks, NB

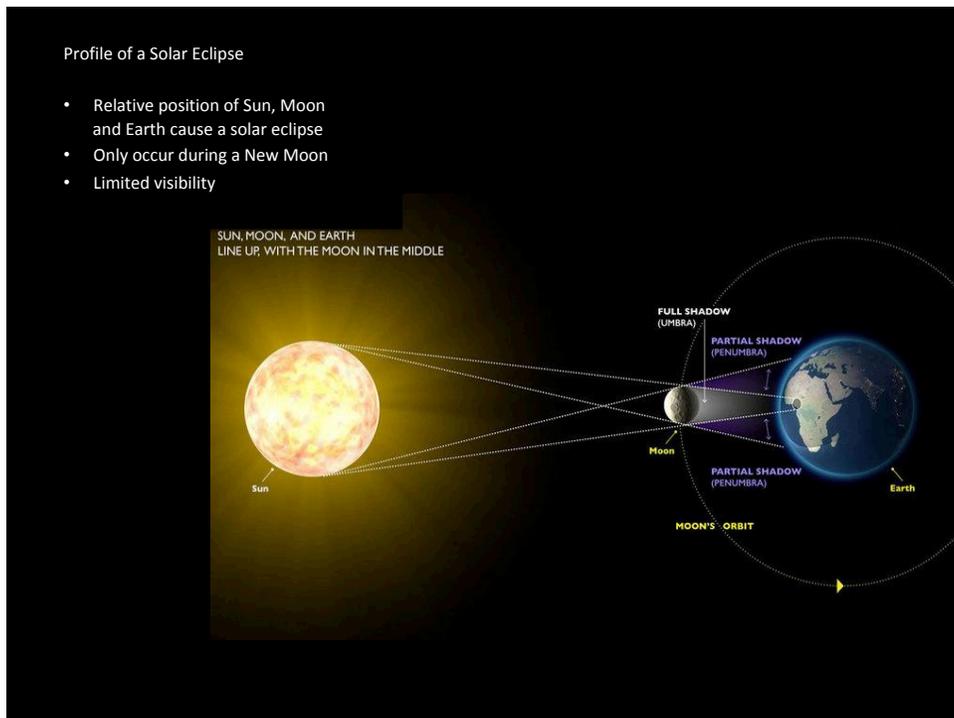
Lunar Orbit

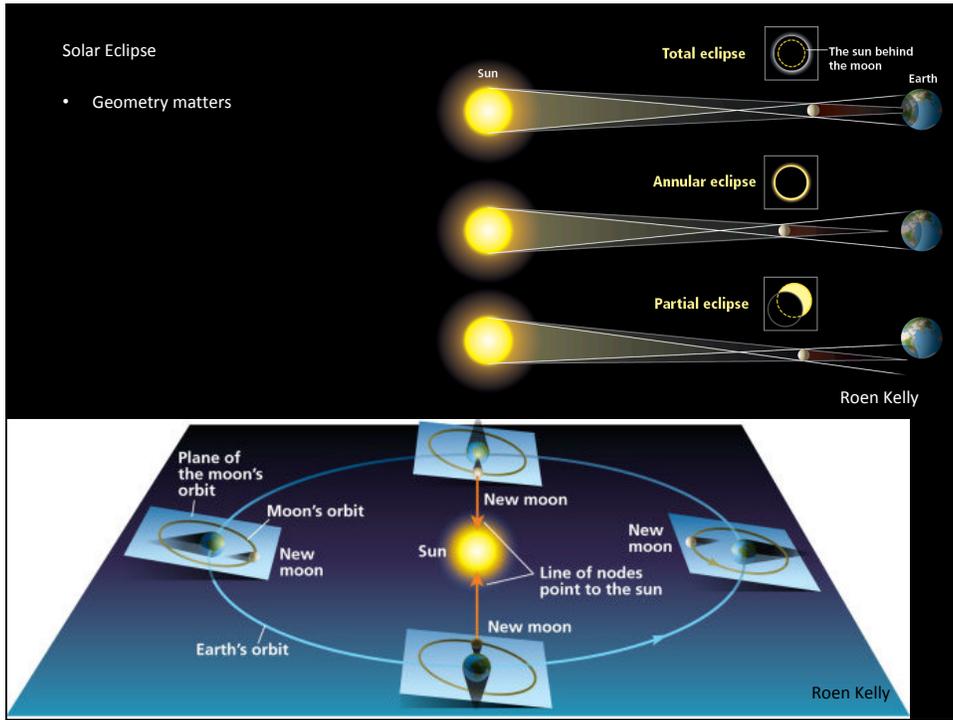
- Elliptical orbit
- Distance varies from 362,000 km to 405,000 km
- Rises about 50 minutes later each night
- Orbit is inclined $\sim 5^\circ$



solar republic
 Earth and Moon Relative Sizes and Angles are Close to Scale
 Earth and Moon Distance are NOT to Scale







April 8, 2024 Path of Totality

