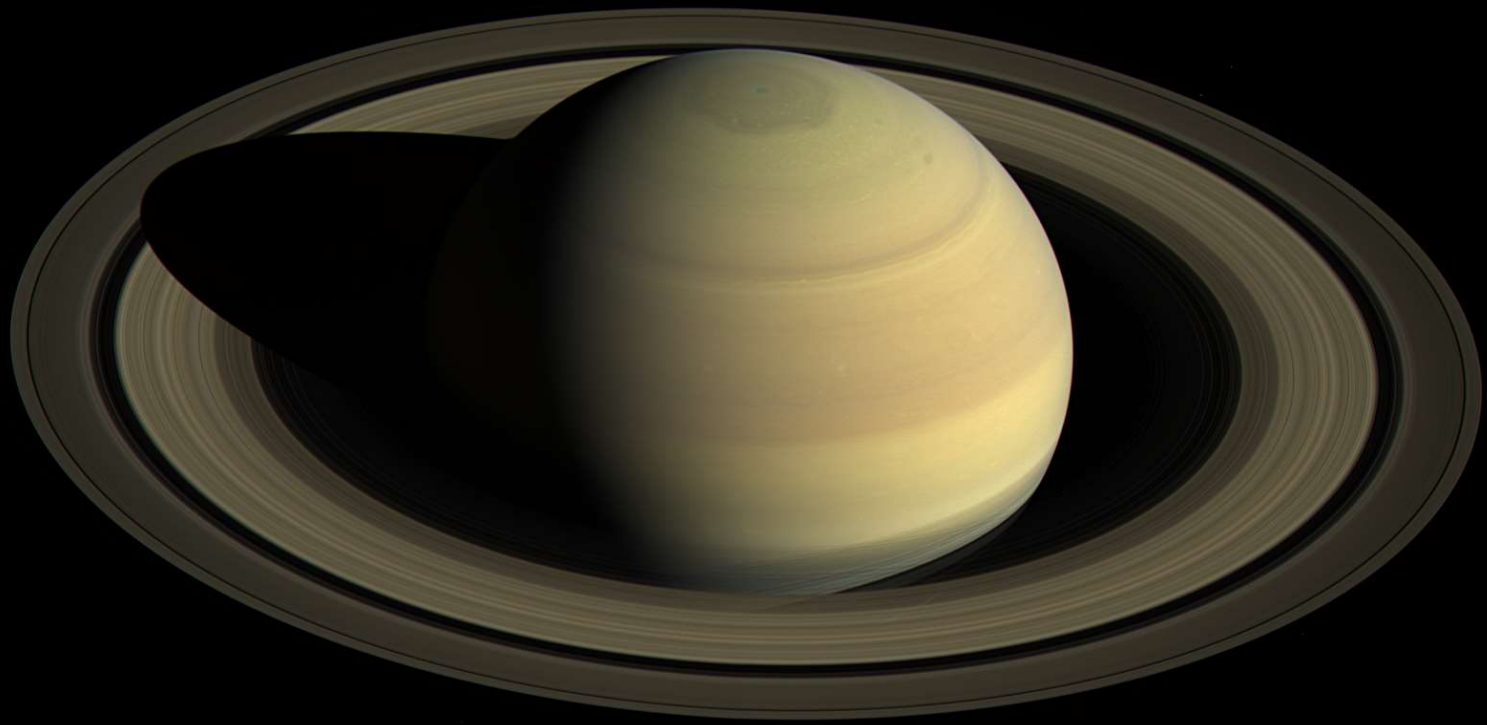
AST 2002
Introduction to Astronomy

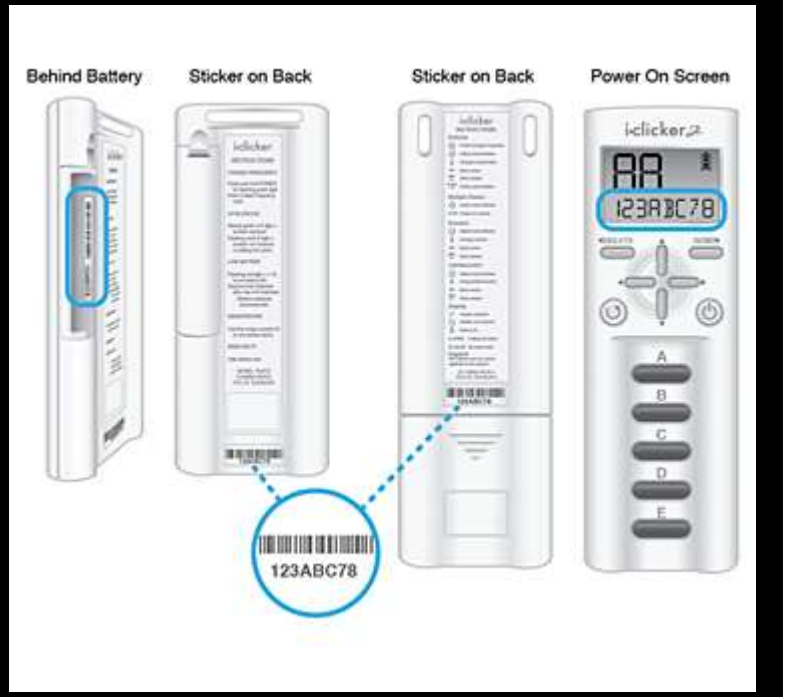


iClicker2

Available at the bookstore.

At the beginning of every class will sync with iClicker base

(code always BC – hint: enter it quickly).



Currently:

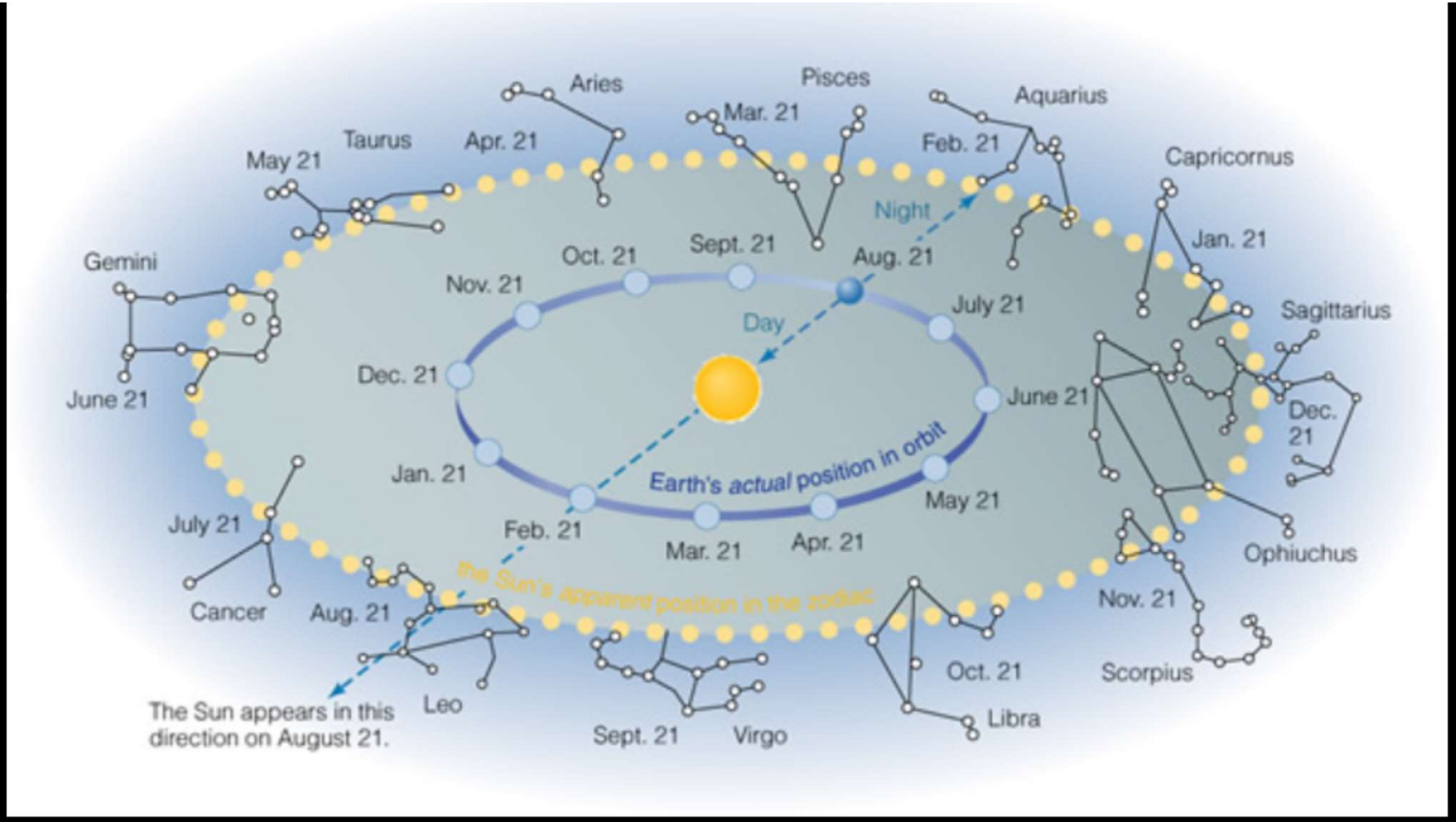
45 'unregistered students'

10 'unregistered iClickers' …

If your ID is below, should just need to register on Webcourses

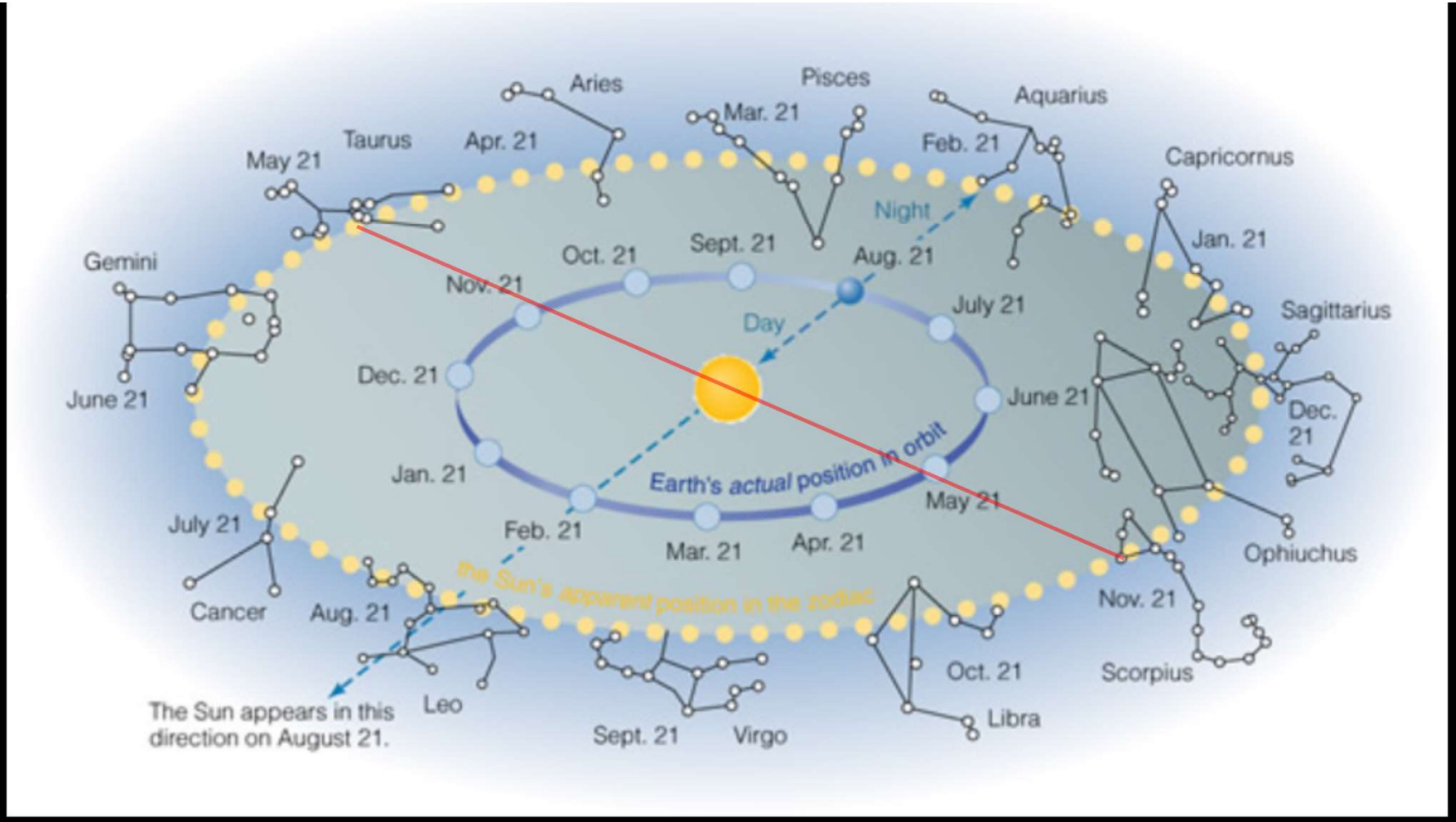
#91E2A2D1	#98E4DCA0	#A06D6CA1
#A4C9A6CB	#A66FAB62	#A7128035
#A7B51C0E	#A9105EE7	#AB9E6451
	#AC174FF4	

+ at least one unregistered REEF mobile user … this I can't fix!



Which of the following statements is true on May 21st (standing at the Equator)?

A: Scorpius is visible in the night sky, the Sun is passing over Taurus
B: Aquarius is visible in the night sky, the Sun is passing over Leo
C: Taurus is visible in the night sky, the Sun is passing over Scorpius
D: Leo is visible in the night sky, the Sun is passing over Aquarius



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D: Leo is visible in the night sky, the Sun is passing over Aquarius

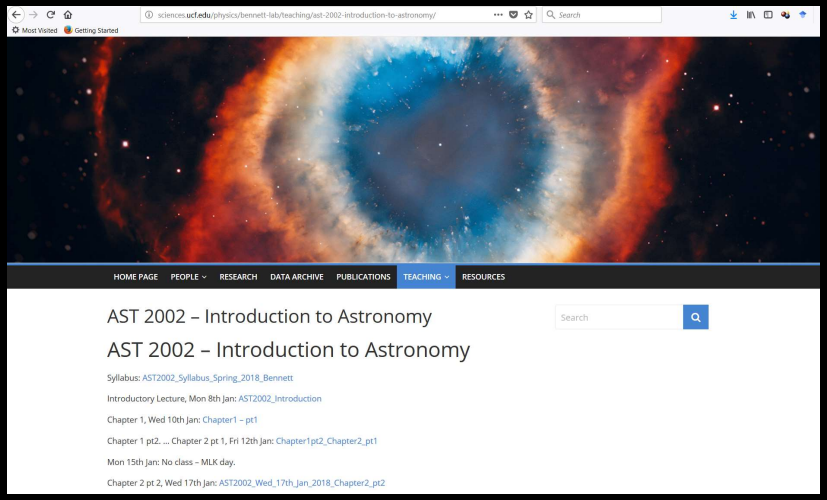
A Few More Things

Homework:

- Out this weekend (Monday at latest)… Will be Due on Tue 30th (why Tue?). Available and due on Webcourses.

Resources:

- Webcourses –
  - Discussions: Apps/websites for Night sky
- My website: (under construction) http://sciences.ucf.edu/physics/bennett-lab/teaching/ast-2002-introduction-to-astronomy/



How the Patterns in the Night Sky are Changing

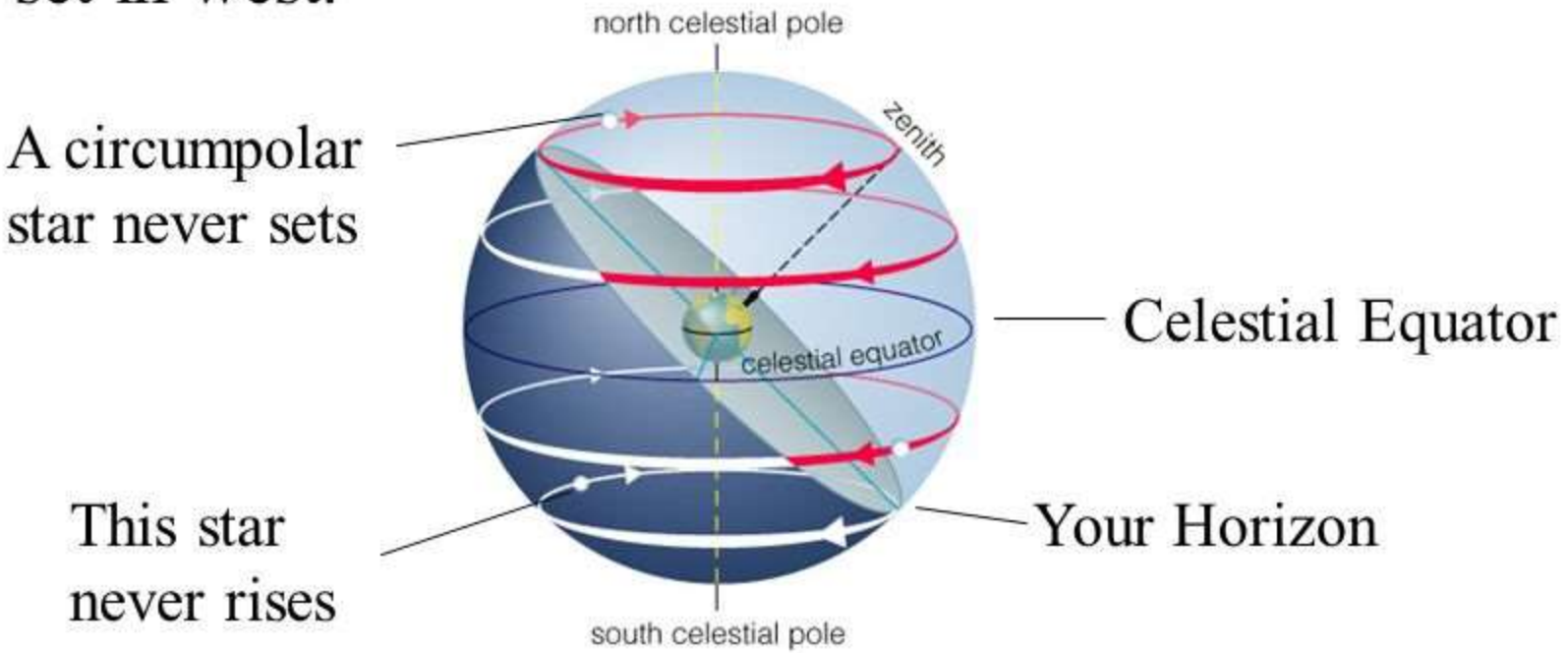
The patterns we observe in the night sky are affected by:

- **The rotation of the Earth**
- **The revolution of the Earth around the Sun**
- **The axial tilt of the Earth**
- **The movement of the Moon around the Earth**
- **The movement of the planets around the Sun**

http://www.universalworkshop.com/2016/12/29/celestial-foretaste-of-2017/

Our view from Earth:

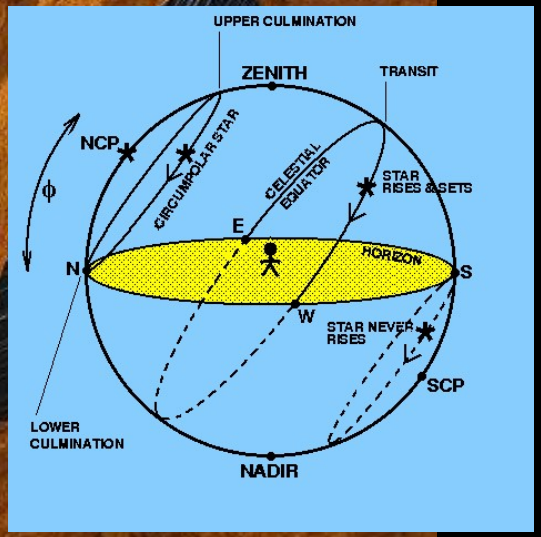
- Stars near the north celestial pole are circumpolar and never set.
- We cannot see stars near the south celestial pole.
- All other stars (and Sun, Moon, planets) rise in east and set in west.



North Celestial Pole

If you are not at the North Pole, The stars will rotate around a point indicative of your latitude

- Zenith at the North pole
  e.g., 90° at 90° N
- ~ at the Horizon if at the Equator
  e.g., 0° at the equator
- In the image to the right, ~ 40° N
  (NCP = North Celestial Pole)



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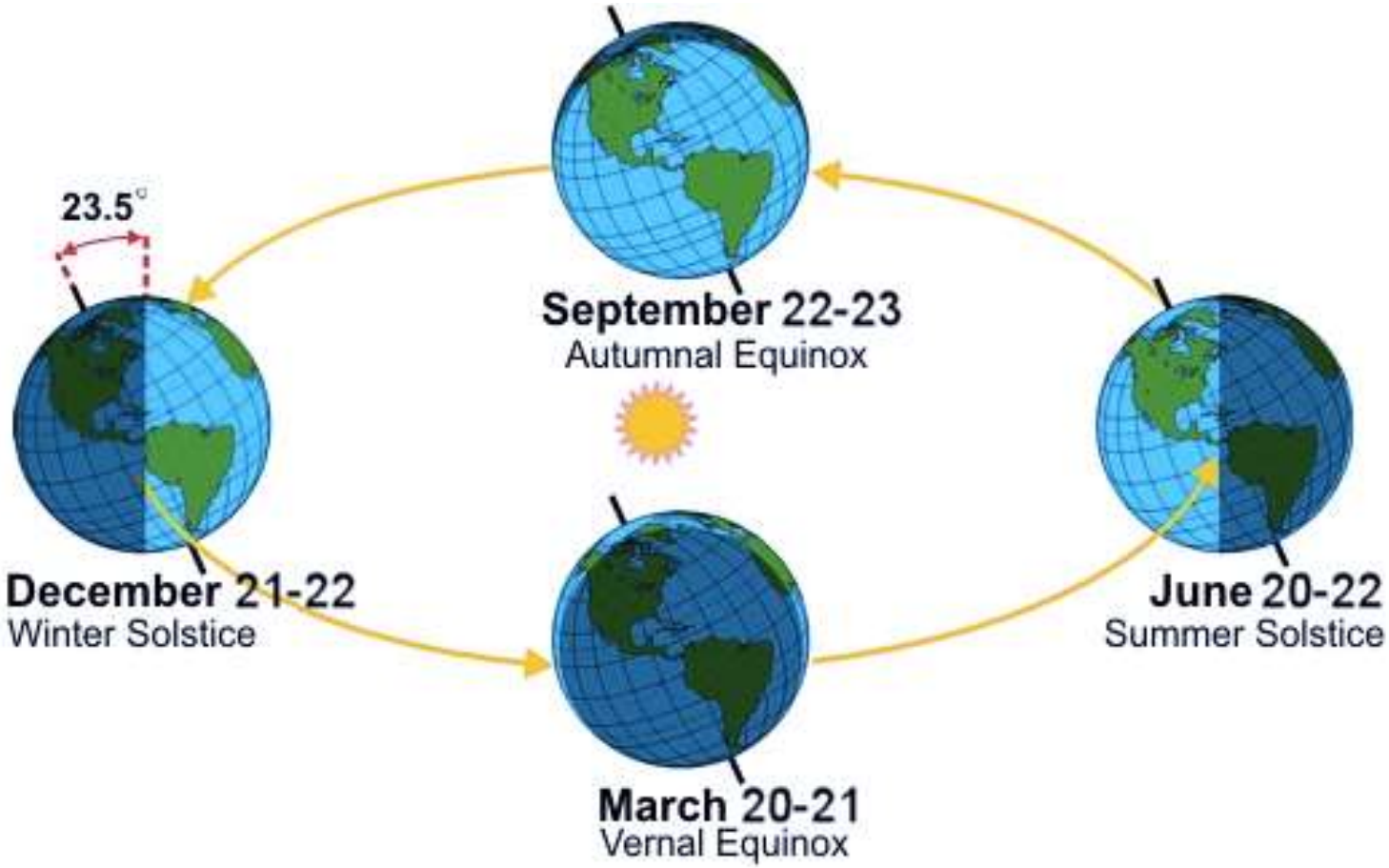
StarCircleAcademy.com

Steven Christenson
StarCircleAcademy.com

The Seasons are caused by the Tilt of Earth's axis



iClicker Question…

How much of the Earth is illuminated by the Sun at all times?

A: 25%

B: 33%

C: 50%

D: 75%

E: 100%

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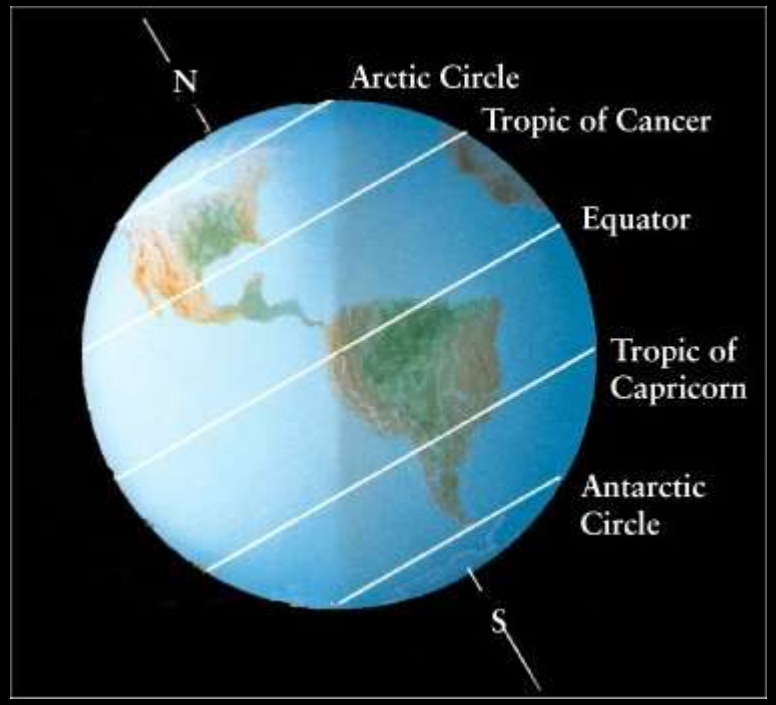
How are the Tropics/Circles Related to Seasons?

The Earth is tilted 23.5°



Tropic of Cancer: 23.5°N

- Sun is directly overhead at noon on June 21st (summer solstice)

Tropic of Capricorn: 23.5°S

- Sun is directly overhead at noon on Dec 21st (winter solstice)

Named ~2000 years ago – due to precession, have shifted ~ 1 constellation. *Tropics of Gemini/Sagittarius anyone?*

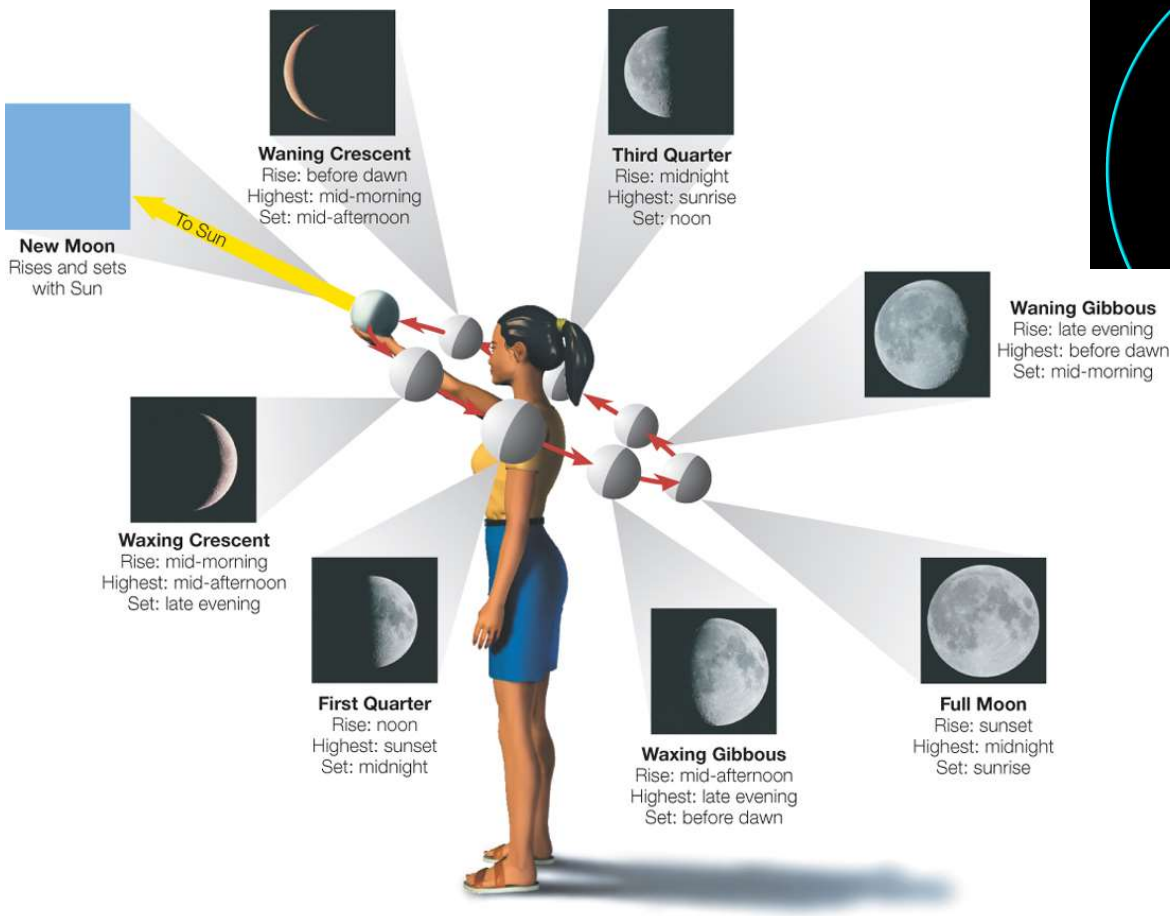
Arctic Circle: 66.5°N (90°-23.5°)

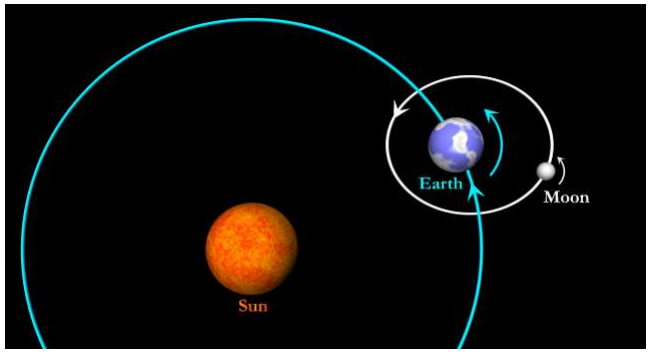
- On June 21st, Sun never sets
- On Dec 21st, Sun never above Horizon

Antarctic Circle: 66.5°S

- On Dec 21st, Sun never sets
- On June 21st, Sun never above Horizon

The Phases of the Moon





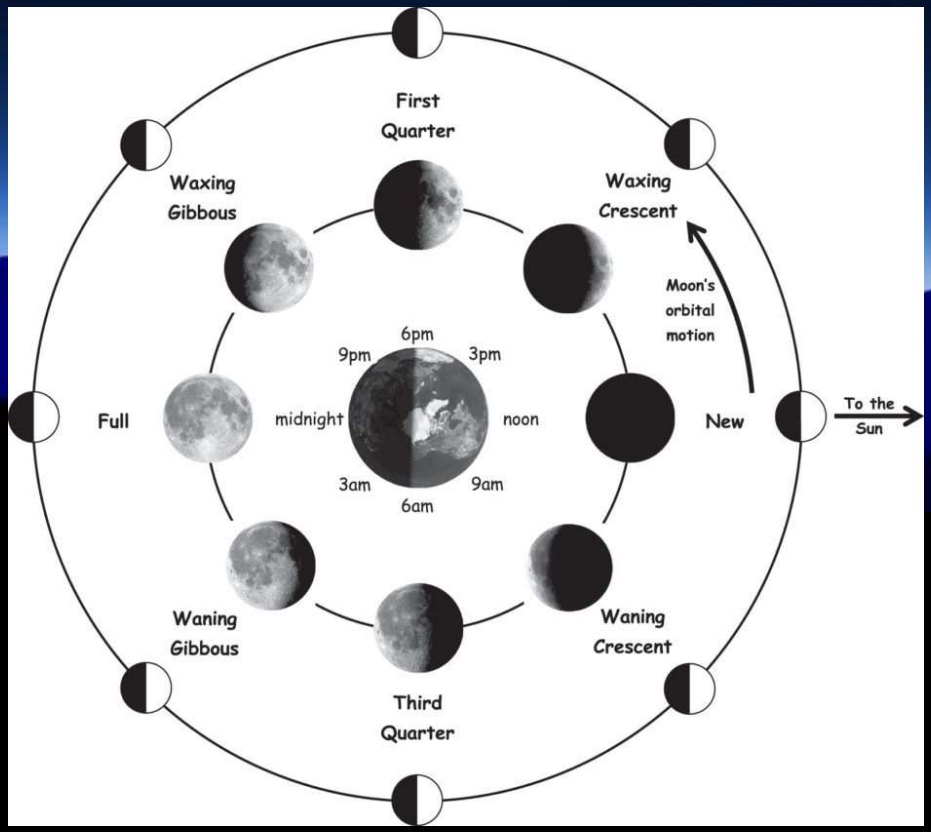
Waxing: Increasing or beginning

Waning: Decreasing or ending

360° = 24 hrs
180° = 12 hrs
90° = 6 hrs

Moon will rotate anti-clockwise. Start moving to the left. If it is to the left, the right side is illuminated first…

The Phases of the Moon



The moon orbits the Earth every ~27 days (sidereal) same position relative to stars…
~29.5 (synodic – lunar month)

iClicker Question

When will the First Quarter Moon be at its Maximum?

A: 6 am

B: Midday

C: 6 pm

D: Midnight

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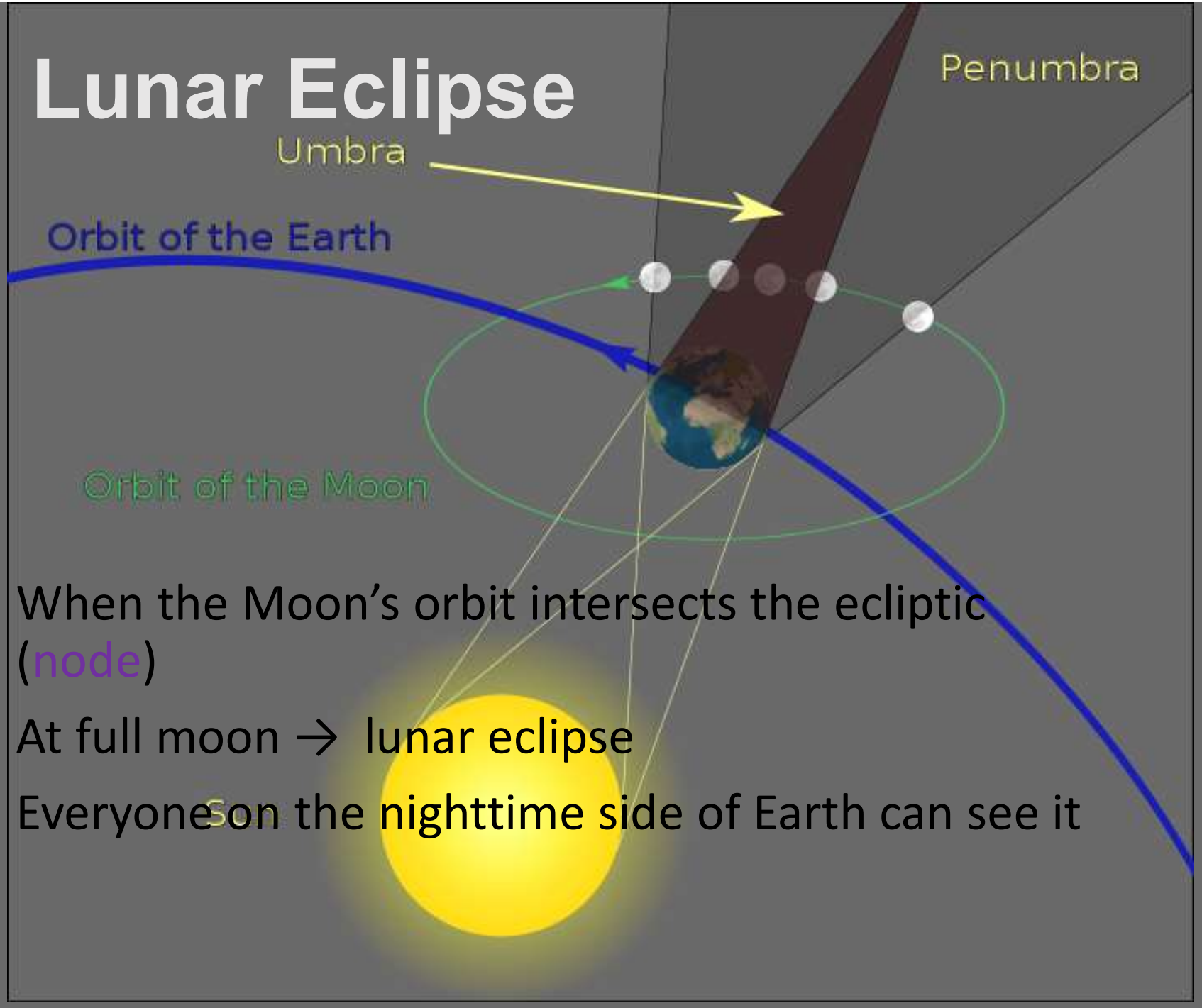
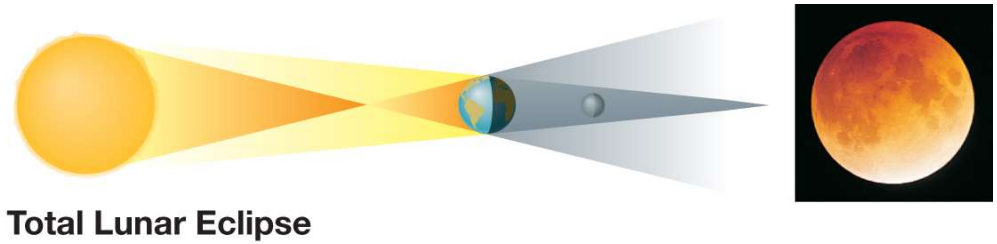
Lunar Eclipse

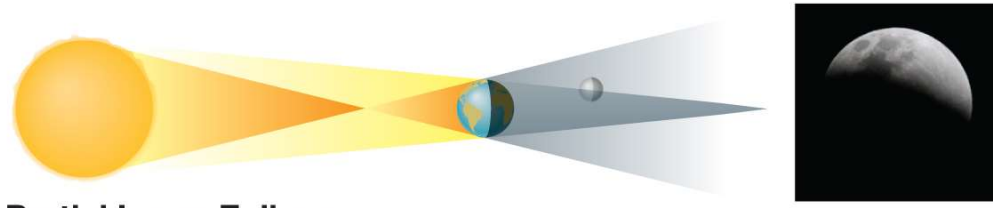


- When the Moon's orbit intersects the ecliptic (node)
- At full moon → lunar eclipse
- Everyone on the nighttime side of Earth can see it

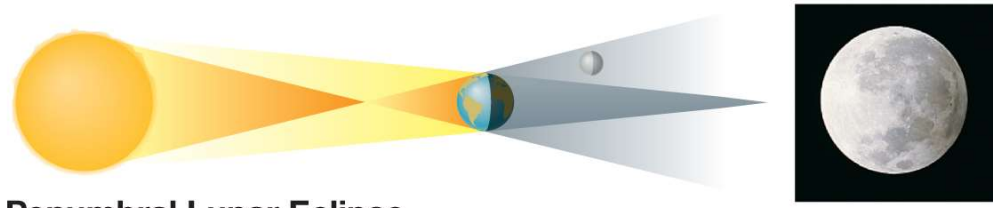
Types of Lunar Eclipse



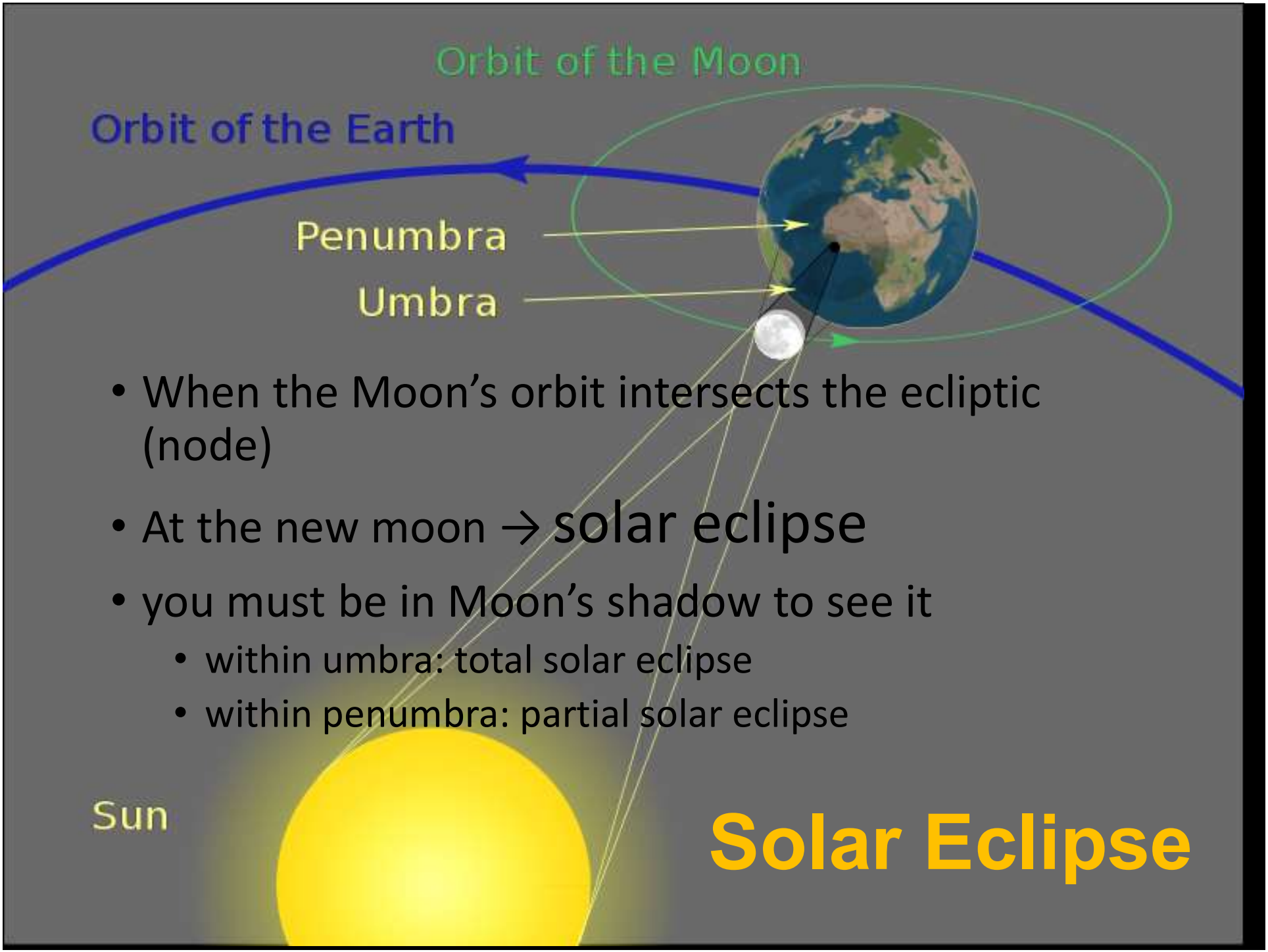
Total Lunar Eclipse



Partial Lunar Eclipse



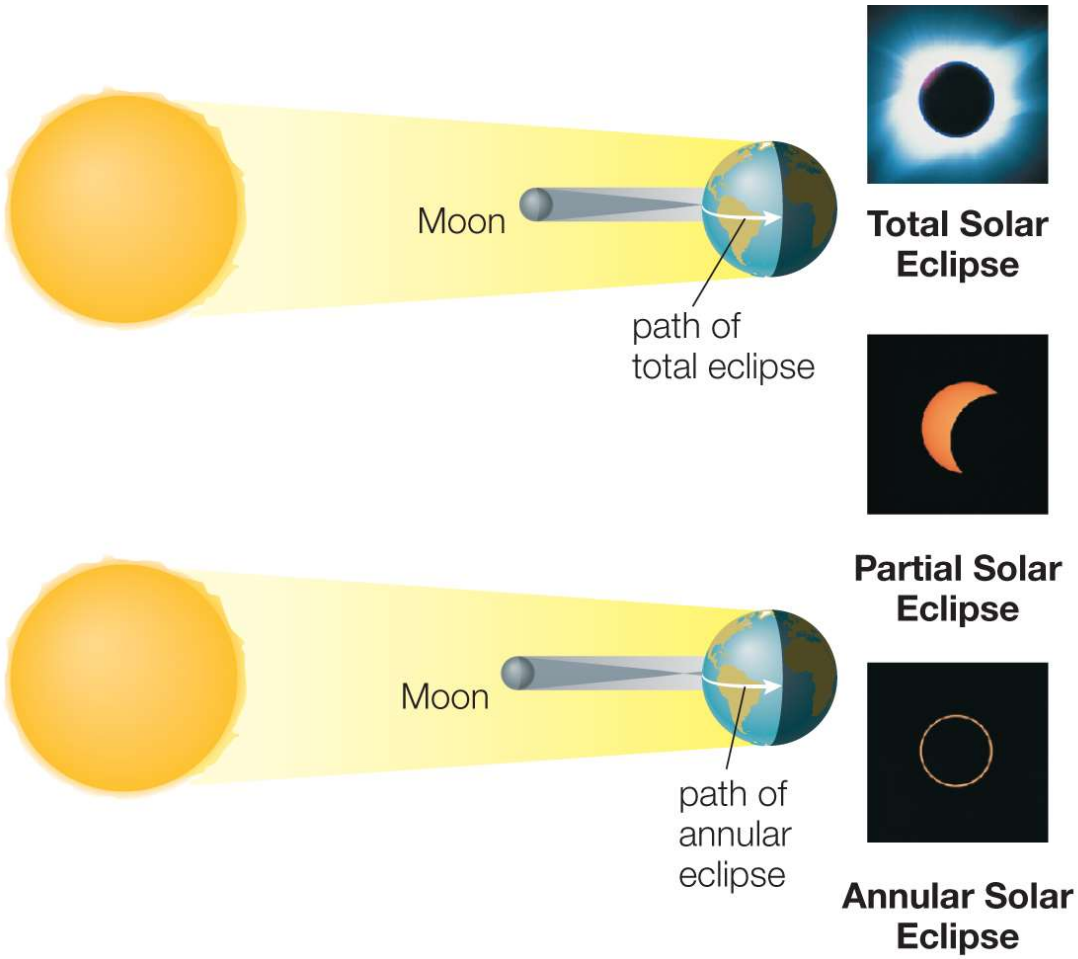
Penumbral Lunar Eclipse



- When the Moon's orbit intersects the ecliptic (node)
- At the new moon → solar eclipse
- you must be in Moon's shadow to see it
  - within umbra: total solar eclipse
  - within penumbra: partial solar eclipse

Solar Eclipse

Types of Solar Eclipse



Blocks out the photosphere of the Sun
Solar Corona is visible!

How Big is the Moon?

In the night sky, varies slightly – because the orbit is slightly eccentric, so the distance changes…

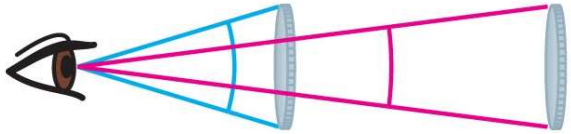
Angular Size

$$\text{angular size} = \text{physical size} \times \frac{360 \text{ degrees}}{2\pi \times \text{distance}}$$

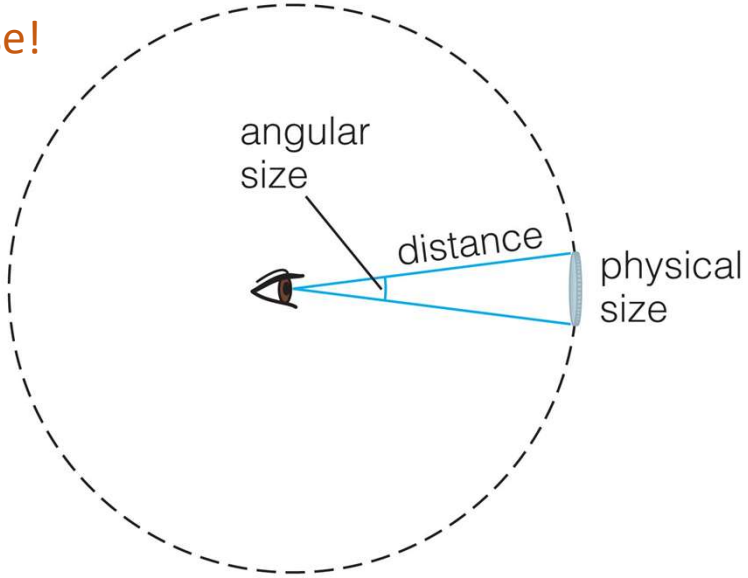
$$\text{angular size} \times \frac{2\pi}{360^\circ} = \frac{\text{physical size}}{\text{distance}}$$

$\frac{2\pi}{360}$ Converts from degrees to radians

Uses "Small angle approximation", where $sin\theta \sim tan\theta \sim \theta$
Distance as hypotenuse, or adjacent length ~ the same
Check your trigonometry to see if this makes sense!



An object's angular size appears smaller if it is farther away.



Example Calculation, How Big is the Moon?

Question: The Moon's angular diameter is about 0.5° and its distance is 380,000 km. What is the Moon's physical diameter?

$$\text{angular size} \times \frac{2\pi}{360} = \frac{\text{physical size}}{\text{distance}}$$

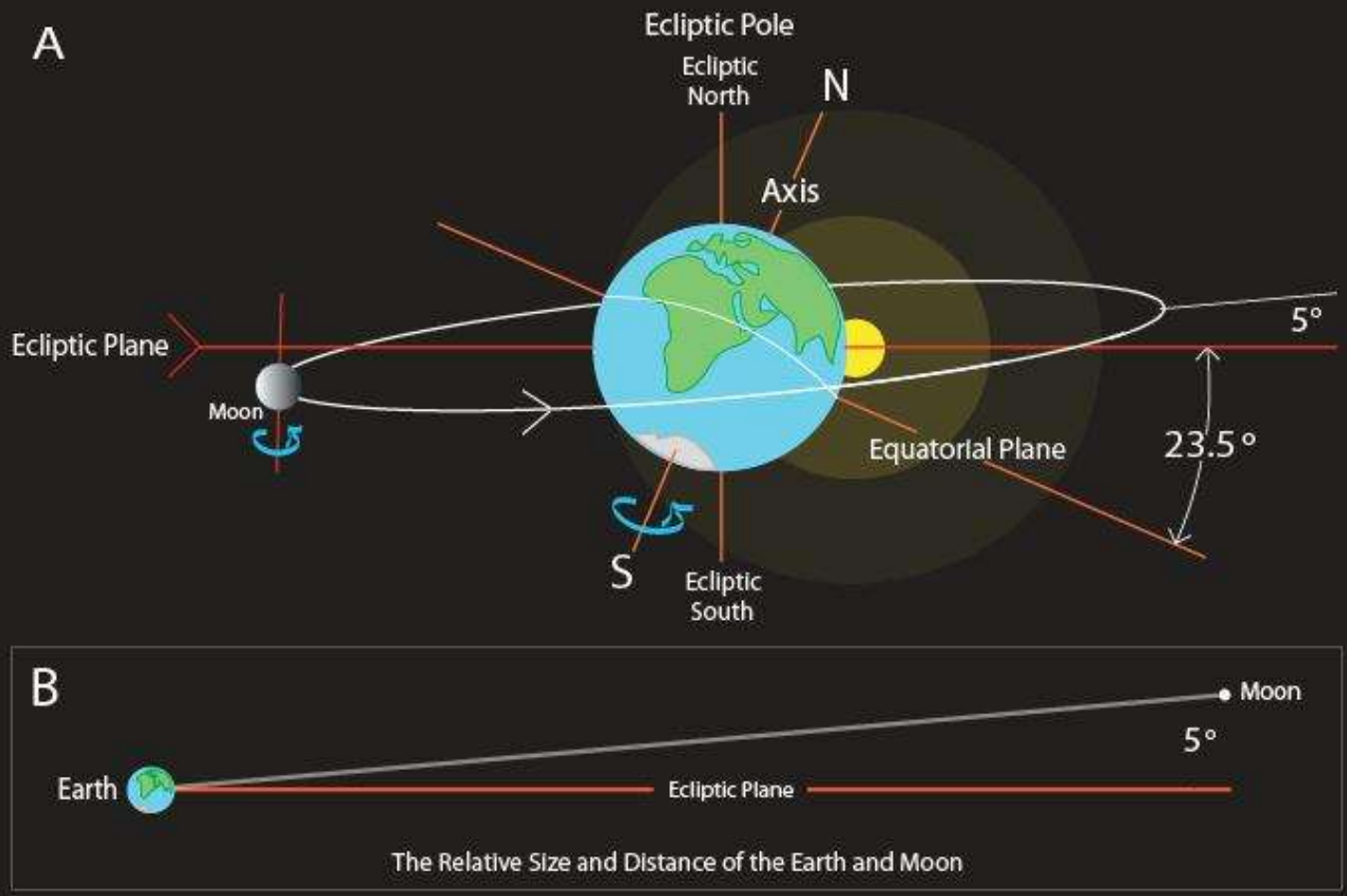
$$\text{physical size} = \text{angular size} \times \frac{2\pi}{360} \times \text{distance}$$

$$\text{physical size} = 0.5° \times \frac{2\pi}{360°} \times 380{,}000 \text{ km}$$

$$\text{physical size} = 3300\ km$$

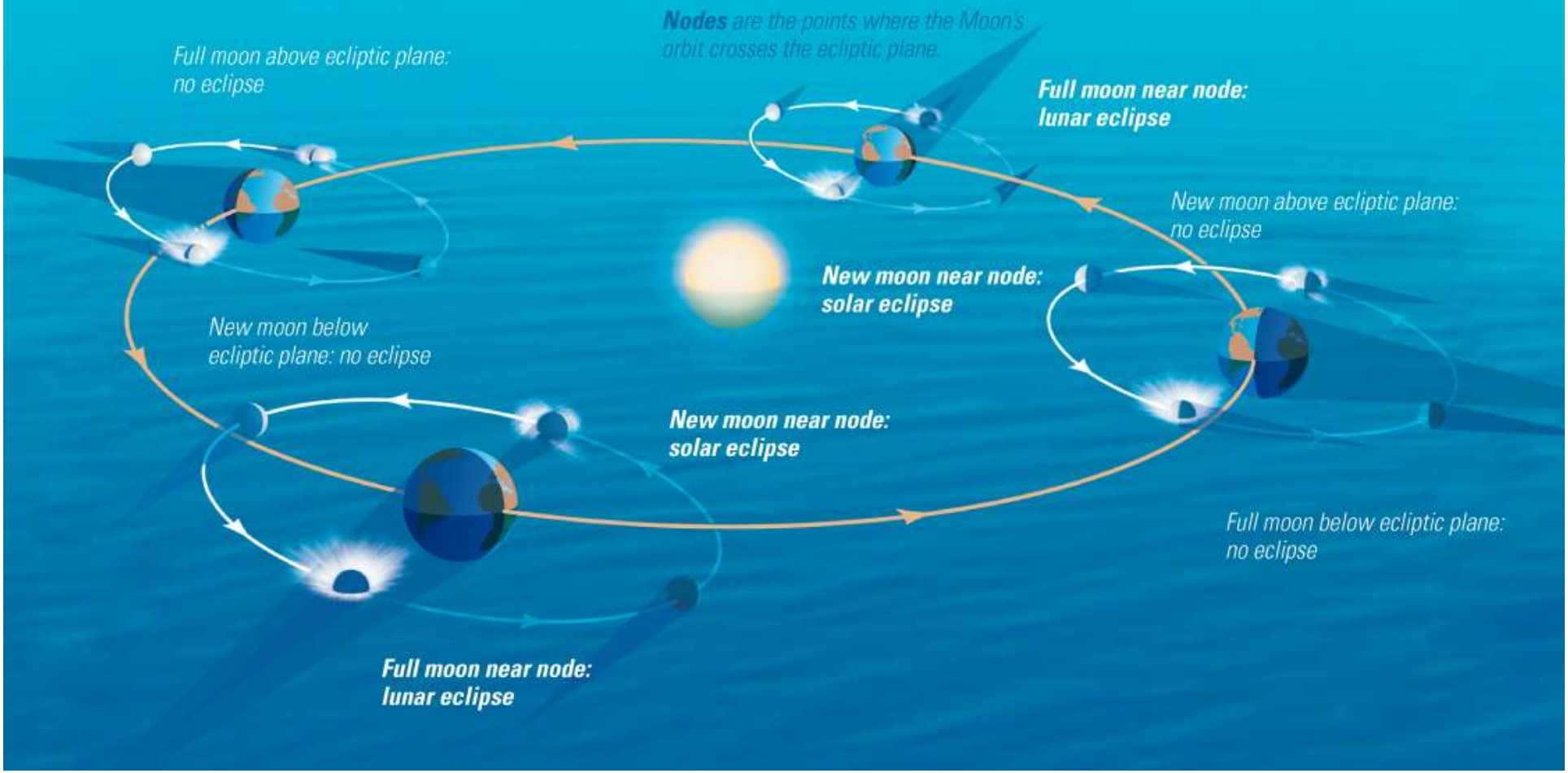
Actual value is 3476 km

Why don't we see a Solar/Lunar eclipse every 29 days?



A Lunar of Solar Eclipse can only occur in the correct part of the orbit (at a node)

Most of the time, the Moon is far from these nodes
Remember that the moons orbit is ~29 days



Eclipse Predictions

- Eclipses recur in the approx. 18 yr, 11 1/3 day (based on the saros cycle)
- But even then, eclipse location and type (e.g., partial, total) may vary

Total Solar Eclipse of 2017 August 21

Why does it travel West to East??

Greatest Duration 2m 40.2s

Greatest Eclipse 2m 40.1s

Courtesy of Fred Espenak, MrEclipse.com

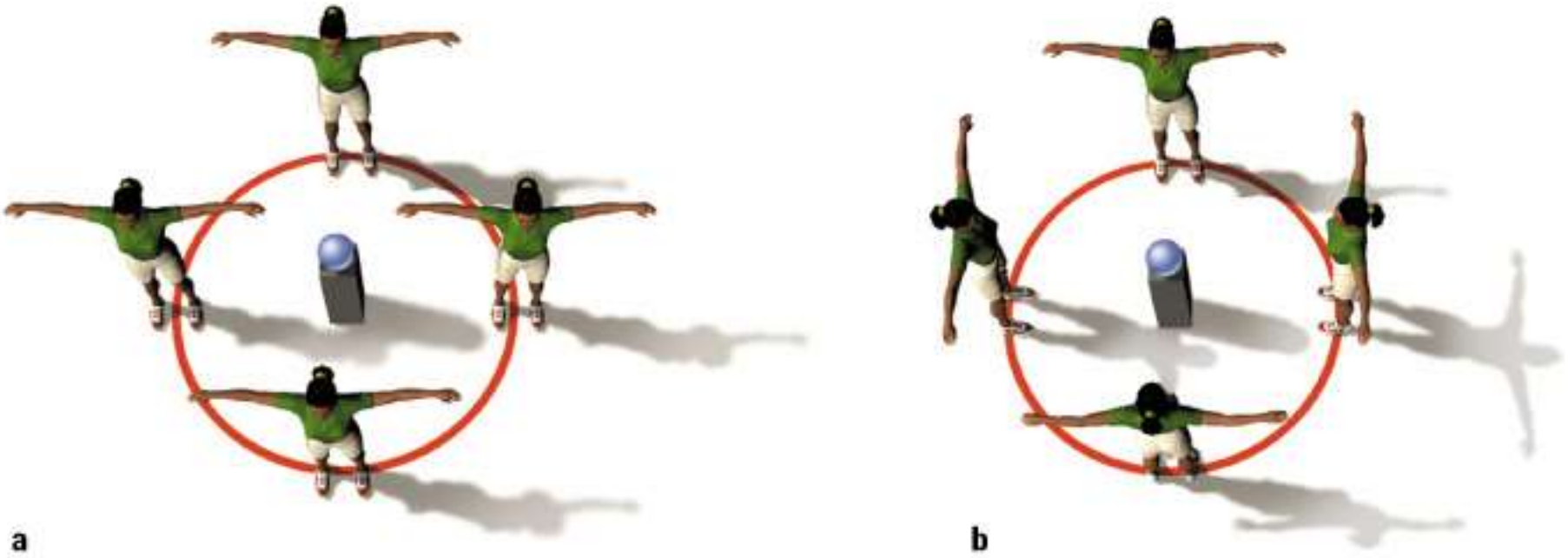
http://eclipse.gsfc.nasa.gov/SEmono/TSE2017/TSE2017.html

Why do we see always see the same face?

Rotation period = orbital period

No dark side of the moon. Gravitationally bound ("tidally locked")

The Moon is very slowly moving away from the Earth..



a b

Coming Next Week:
The Wandering Planets

https://www.youtube.com/watch?v=FtV0PV9MF88

End of Todays Lecture