

Last time: Motions of the Sun, and the Seasons

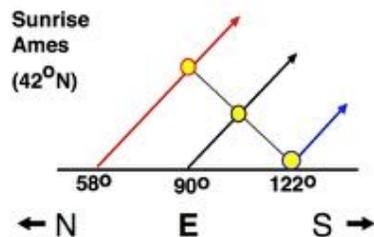
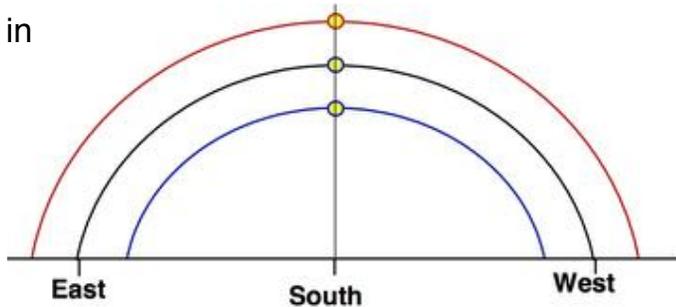
- Finding the celestial pole and equator from anywhere
- Diurnal motions; the sidereal day and circumpolar regions
- The Motion of the Sun
 - the solar day (4 minutes longer than the sidereal day)
- The Ecliptic
 - inclination of the ecliptic = 23.5 degrees to celestial equator

Today: More on the Seasons. The Moon in Our Sky

- The Seasons
- The (eastward) motion of the Moon w.r.t. the stars
 - Sidereal vs. synodic month
- The Phases of the Moon
- The Moon's Orbit

... in the Northern hemisphere ...

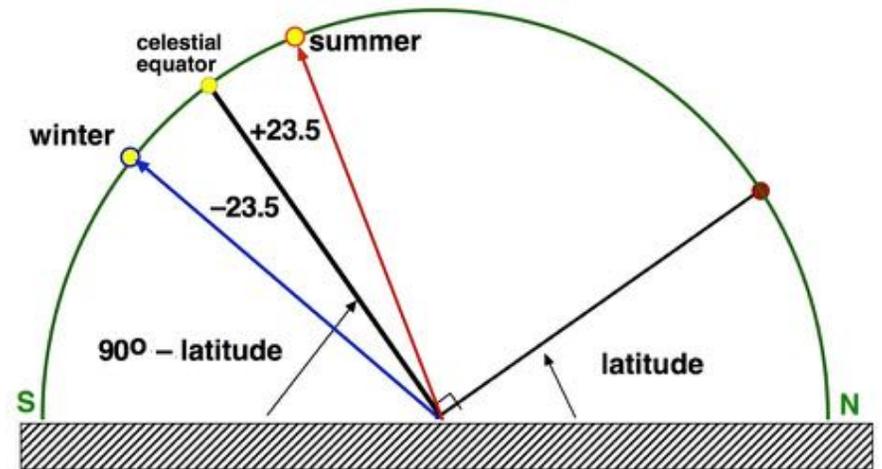
Arc of the Sun in
 summer
 spring/fall
 winter



- Sun rises in
 - NE in summer
 - due E in spring/fall
 - SE in Winter
- Sun rises 3 hours earlier in the summer than winter

The Seasons

The Sun at local noon: altitude via meridian diagram



Reasons for the Seasons

- Higher altitude sun = more direct heating
- Longer daylight = more solar power delivered
- Earth's distance from the Sun is NOT a factor!
 - Winter in Northern Hemisphere at same time that it is Summer in the Southern Hemisphere
 - Earth is (3%) closer to the Sun in early January
- climate effects are much more important



The Motion(s) of the Moon

- eastward motion with respect to the stars
caused by

- orbit of the Moon around the Earth

Complete circle in one sidereal month = 27.3 days
Rate of motion is about 13 degrees/day

BUT

Time between successive full moons is 29.5 days
This is the synodic month

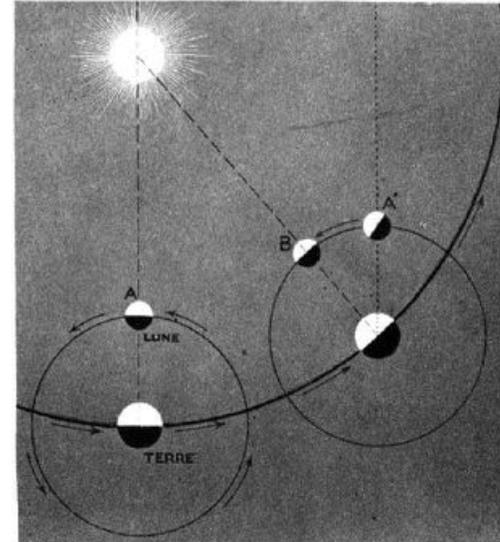
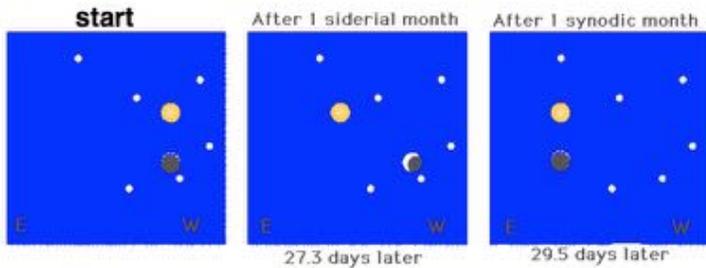
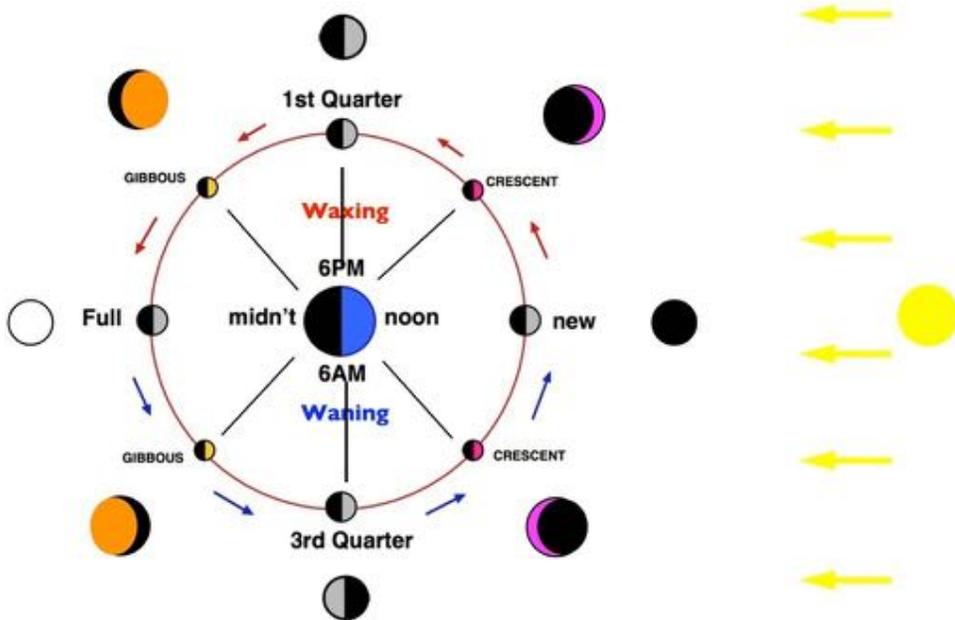


FIG. 42. — RÉVOLUTION SIDÉRALE ET RÉVOLUTION SYNODIQUE.

The Phases of the Moon



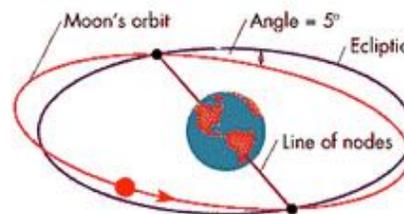
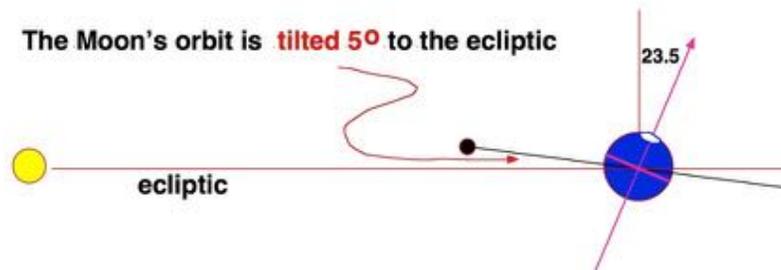
The Phases of the Moon

Phase	crosses meridian	appearance
New Moon	noon	
waxing crescent		
1st quarter	sunset	
waxing gibbous		
Full Moon	midnight	
waning gibbous		
3rd quarter	sunrise	
waning crescent		

why not ECLIPSES every new and full moon?

The Moon's Orbit is Tilted!

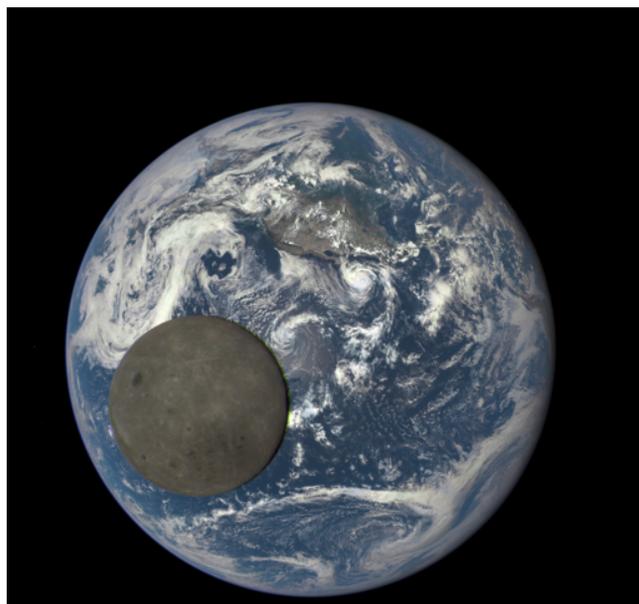
The Moon's orbit is tilted 5° to the ecliptic



Nodes:
crossing points of lunar orbit with ecliptic

Line of Nodes:
connects lunar nodes

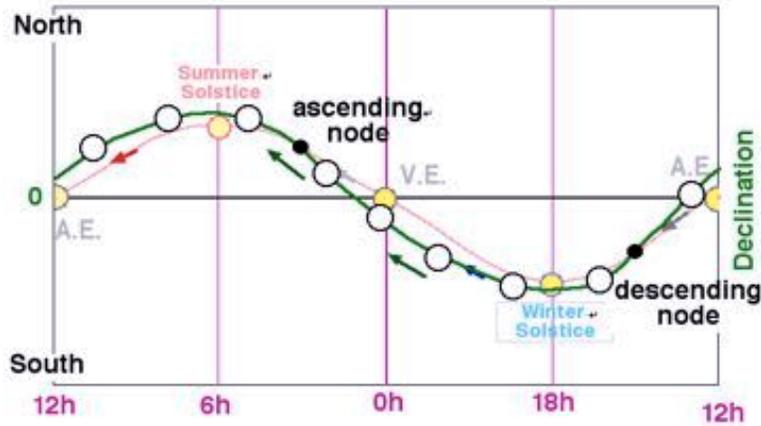
A view from space (Deep Space Climate Observer):
what is the phase of the moon viewed from Earth?



New Moon



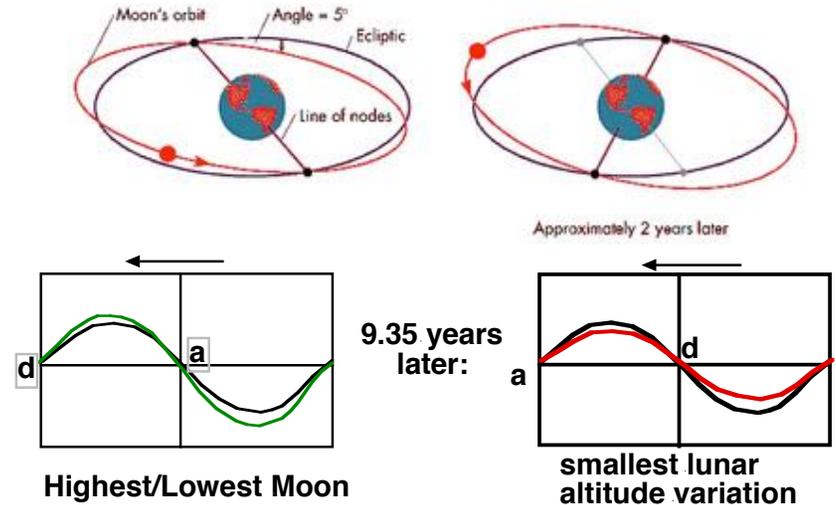
New Moon crescent - July 8 2013 7:14 UTC
© Thierry Legault



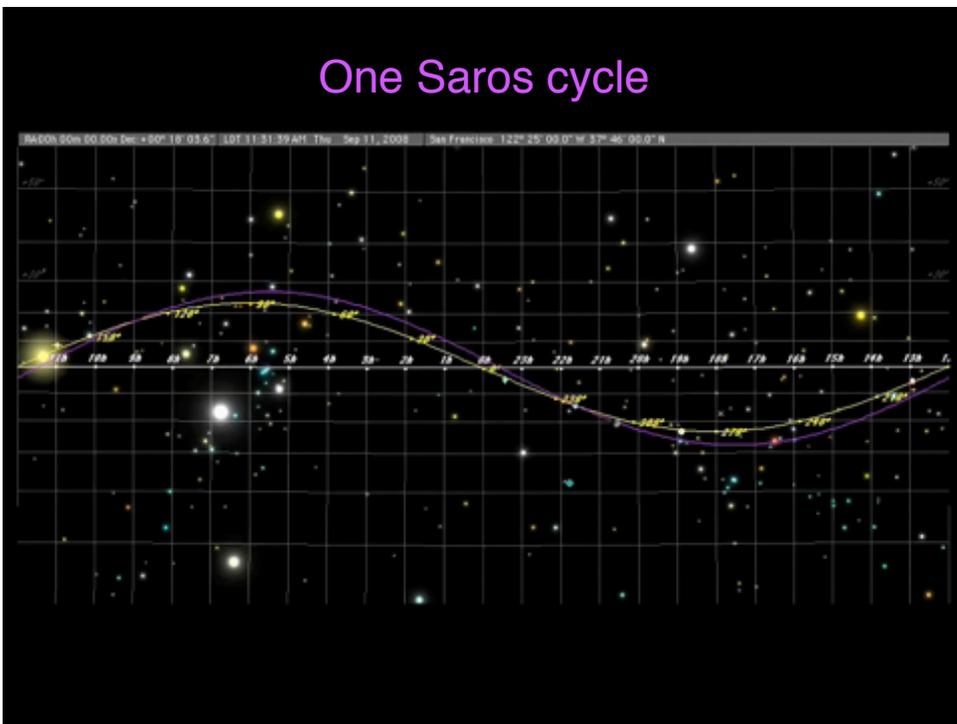
Need the Sun to lie at a **node** at new or full moon for an **eclipse** to occur

Regression of the line of nodes:

Line of nodes circles WESTWARD in 18.7 years (caused by “torquing” effect of the Sun):



One Saros cycle



Lincoln and the “almanac trial”

- Fatal fight in Virgin’s Grove at 11pm on August 29, 1857
- “eyewitness” claimed to see two murderers by light of the bright moon
- Lincoln examined the witness, showing an almanac page with “[moon] runs low”
- witness impugned, defendant cleared!

