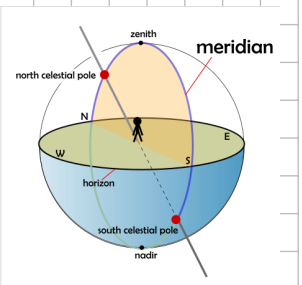
Ch 2 Time

Solar Noon - the sun reaches its apparent highest point in the sky
  └ the sun crosses an observer's Meridian

Meridian - great circle passing through celestial poles & observer's zenith



- Dividing a "day" into 24 hours is seemingly arbitrary (potentially predating ancient Egyptians)
  └ depending on the system used to define the hour, the length of a hour could change. (Greeks split daylight into 12 equal segments and darkness in 12 segments too)

- Splitting hour & minute into 60 segments is vestiged of Babylonian sexagesimal system
  - use left fingers & right phalanges to count to 60!

- 4 fingers w/ 3 phalanges = 12 (right)
- 5 digits on left → 5 × 12 = 60

* Daily Motion of Sol is orisinal basis of our timekeeping systems *

Types of time

1) Solar time
2) Dynamical time
3) Sidereal time

Types of Calendar

1) Julien
2) Heliocentric Julien
3) Gregorian

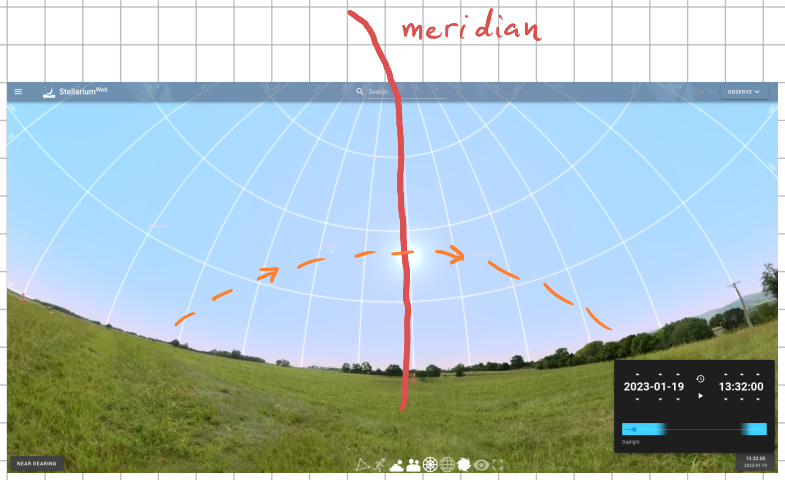
Solar time

Suppose you define noon to be when the sun crosses your meridian line.

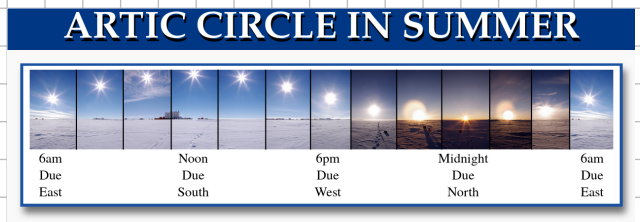
- You track noon w/ a sundial & an accurate watch.
  - from May - Nov sundial noon occurs before watch noon
  - from Feb - July sundial noon occurs after watch noon

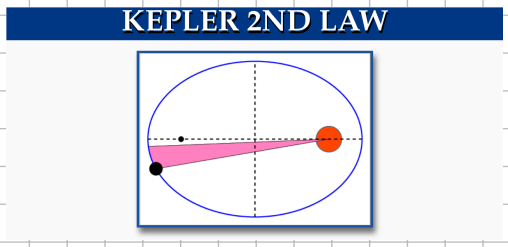
- Two reasons for this discrepancy
  1) elliptical orbit
  2) obliquity

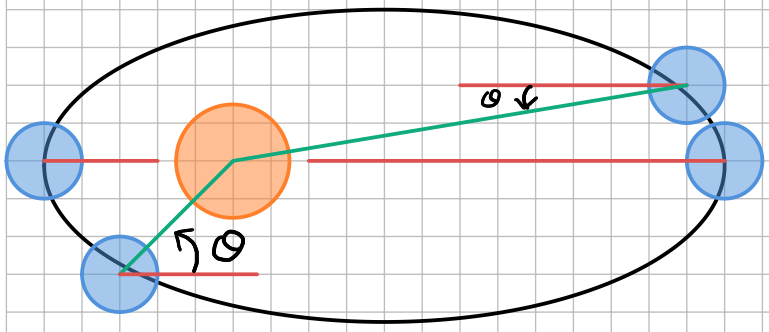
1) Elliptical shape of Earth's orbit



Show transition on stellarium site





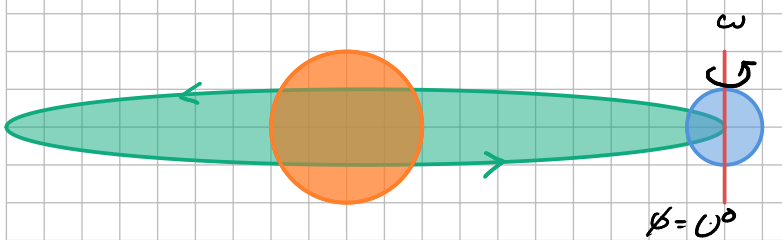


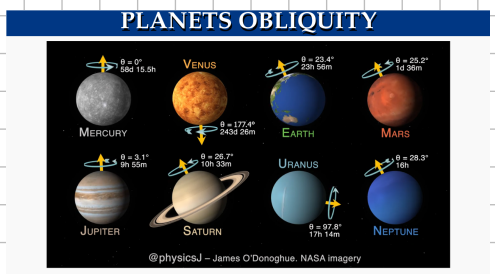
slow orbital speed

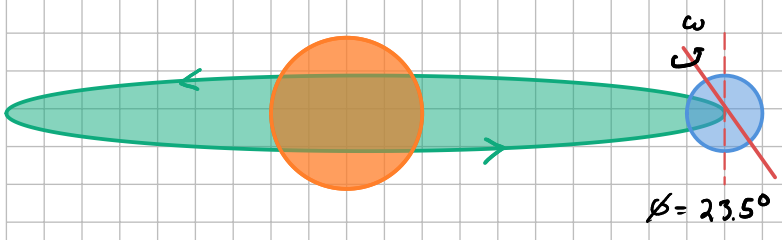
3rd Law $P^2 \propto r^3$

fast orbital speed

2) Tilt of Earth's axis (obliquity)

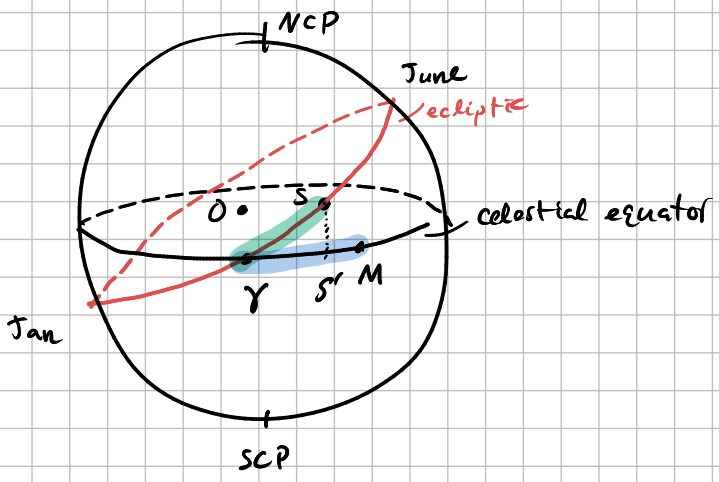






Consider the path of the sun (S) along the ecliptic (assume uniform speed)

Now imasine a fictitious or Mean sun moving the the celestial equator (same uniform speed)



$|\gamma S| = |\gamma M|$

(S' is projection of S onto celestial equator)

From $\gamma \rightarrow$ June S' is behind M!

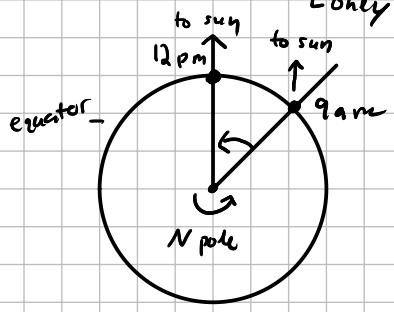
Equation of time captures the combined effect of both (elliptical orbit & obliquity)

Equation of time = (True Solar time) − (Mean Solar time)

$$EoT = TST - MST$$

True Solar time (TST) = time recorded by sundial (NOT uniform)

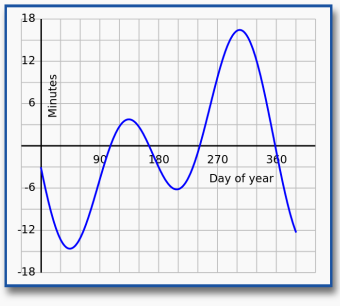
Lonly valid for observers on agreed upon longitude



Mean Solar time (MST) = day in MST is average of all TST days in one year.

└ our clocks are synced to MST

EQUATION OF TIME



Above the x-axis, sundial is ahead of local mean time.
(Sundial is "fast")