Lecture 1. If it moves then how do we know it.

1 Intro to class. and subject covered.
* Solar system
* Tools
* stars
* Galaxy
* Universe — is universe finite?

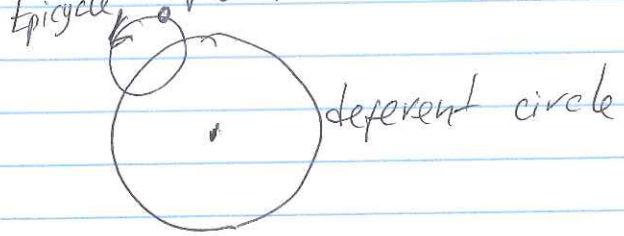
2 Back to Greeks.
GeoCentric system. — Ptolemey system

Q: Who beleives that Earth is moving? Who does not?

The class goal to remove beleive from the equation.

Stellarium demo of stars and planet motions:

Observations: Stars seems to move in sync. Planets → wondering stars moves along and have retrograde motion



Magelan expedition 1519-1522

Copernicus (1473-1543) Geleo centric

1546 — 1601 → 1609 book based on Mars

~~Kep~~ Tycho → Kepler ⇒ elliptical motion

↓ 4' accuracy ↘

to low to measure distances

Galilei -1608 telescope

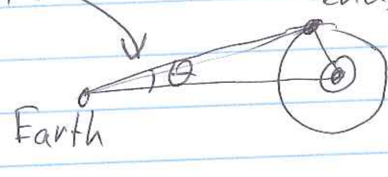
↙ Jupiter satelites ↘ Milkyway consist of stars

~~Halley~~

3. Q: How do we know that Venus and Mercury are closer to Sun?

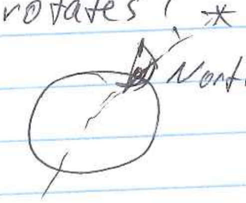
A: We saw their transits over sun.

⟹ elongation → Venus = 47°



Beleive if the Earth is moving we should feel it: wind blow etc.

4. Q: Proves that Earth rotates?
A: Foucault pendulum



5. Q: Does Earth move?
Cassini Mid 1650 → Sun angular size difference
3.4%

6. Halley 1656 – 1742

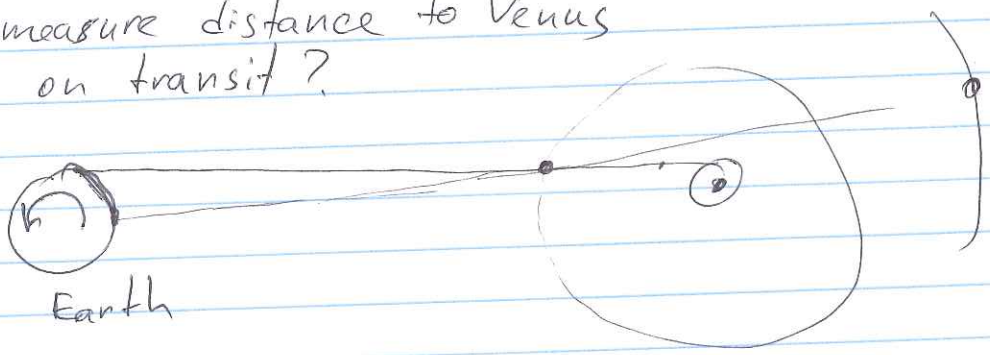
1718 → Compared ancient star position with current ⟹ "proper motion"

(lecture stopped here + computer refused to work stellari...)

A: 7. Bessel 1838 parralax of the star
61 Cygni ⟹ 0.314″ updated 0.348″
on a background of 5.2″ proper motion

1729 8. Bradley. Aberration of light due to finite speed of light — apparent shift

Q: How to measure distance to Venus based on transit?



Clocks. → Definition of the seconds

Use to be $1/86400 = \frac{1}{24 \cdot 60 \cdot 60}$ of the mean solar day but it is not very stable due to Earth perturbations =>

1 sec = 9,132,631,770 oscillations of Cs.

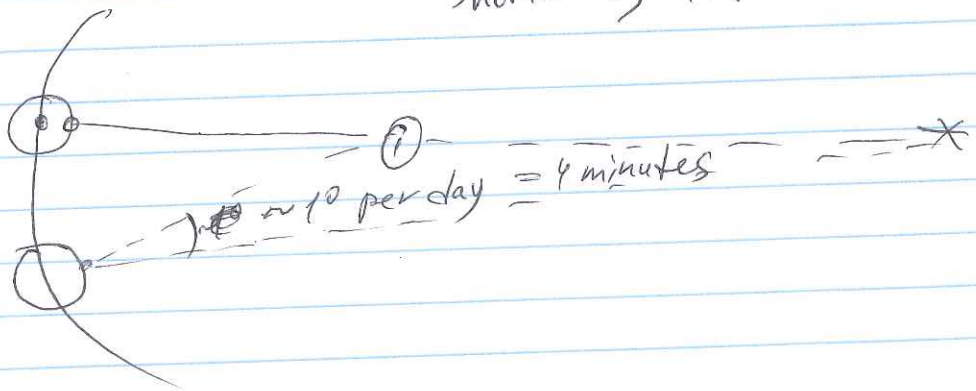
Solar year changes by 0, 1, seconds per year

Julian year = 365.25 days

Q: which way Earth moves along its orbit

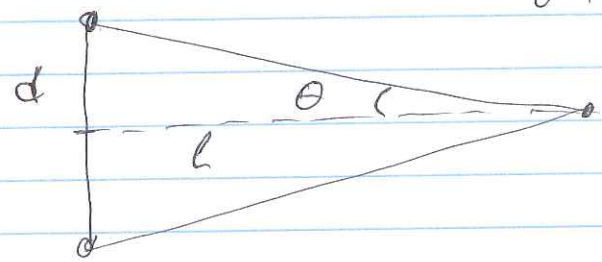
Solar day vs Sidereal day

↑ shorter by 4 min



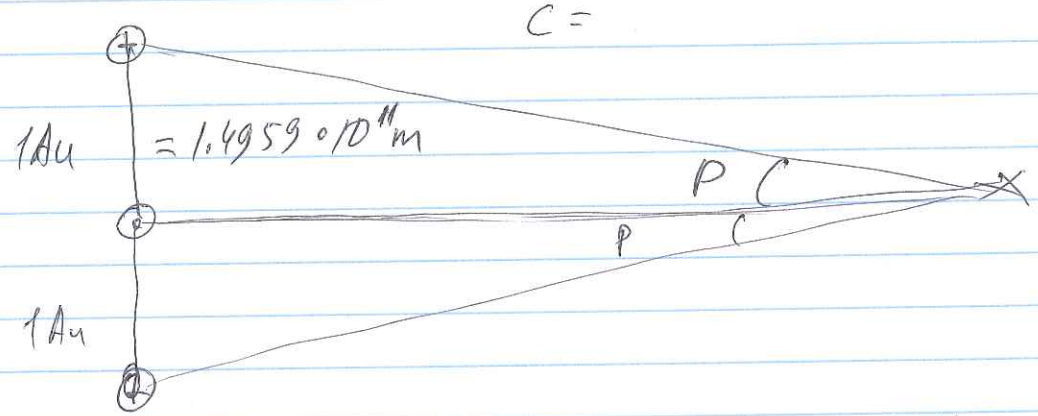
~~Parallata~~ ~~Parallax~~ Parallax

$\theta \approx 1 \Rightarrow l = \frac{d}{\tan\theta} = \frac{d}{\theta}$



$R_E = 6.378 \cdot 10^6 m$

c =



$1\ parsec = \frac{1AU}{1''} = \frac{1Au}{\frac{1^\circ}{3600}} = \frac{1Au}{\frac{\pi}{180} \cdot \frac{1^\circ}{3600}}$

$= 206264 AU$

Q: Simple question if distance is 4 parsec is ~~parallax~~ parallax 4 times bigger or smaller?

Amusement, 1

* There is a rumor that Galileo's assistant was able to see phases of Jupiter and Venus with naked eye. Is it possible? pupil $\varnothing$ = 5mm

* Glases ~~lenses~~ appear around 1280-1290

* Telescope patent 1608 by Lipperhey (Dutch)

Galileo telescope August 25, 1609