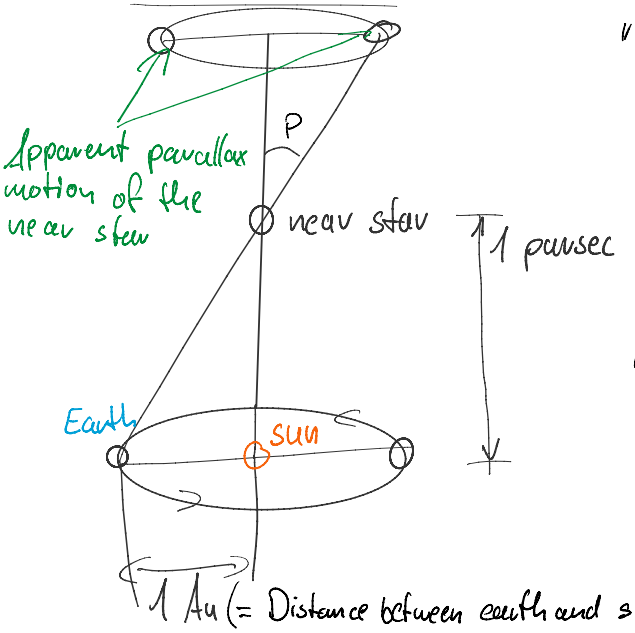
1. What is the "distance ladder"?

Dienstag, 29. Oktober 2019 14:55

- Also called "extragalactic distance scale"
↳ It's the succession of methods to determine distances in space
e.g. from here to a celestial object or between objects
- A direct measurement is only possible for close objects: $d < 1000$ pc

---

Extra: The unit parsec: 1 pc = 1 "parsec" ~ 31 petameter ~ 3,26156 ly



"A parsec is the distance between the sun and an astronomical object that has a parallax angle of one arcsecond"

1 arcsecond = $\frac{1}{3600}$ degree

parallax ≈ alternation
↳ is a displacement or difference in the apparent position of an object viewed along two different lines of sight.

(src: wikipedia)

- Several of those methods rely on "Standard Candles"
↳ known properties like luminosity

↳ calculate the distance by the absolute magnitude in brightness

$D = 10^{(m-M-10)/5}$

m: apparent magnitude
M: absolute magnitude
D: distance in [kpc]

↳ Measured distance is called luminosity distance

- Another class is the "Standard Ruler"
↳ astrophysical object where the actual size is known (e.g. by trigonometry)

$\vartheta \approx \frac{r}{D}$

ϑ: angular diameter [rad]
r: actual diameter
D: distance

↳ The distance measured by the standard ruler is called angular diameter distance

- Next: Standard Siren

↳ Gravitational waves originating from compact binary systems which are in their inspiral phase (decay)
↳ A shrinking orbit is directly observable as an increase in frequency
↳ Just as with the standard candles, given the emitted and received amplitudes, the inverse-square law determines the distance

So... in general:

- close enough: direct measurement (< 1000 pc)
- not close enough: search for something close to it which is recognizable and homogeneous enough (depends upon physical assumptions)
  ↳ There are many way, we just named the standard ones!