AU, Parsec and Light Year

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Astronomical Unit (AU)

The Astronomical Unit (AU) is a slightly odd one.... It is simply defined as the 'mean distance from the Earth to the Sun' - so it is like the radius or the earth's orbit, assuming that orbit is circular. It is about 150 $x10^6$ Km

The AU is used mostly for measuring distances around the solar system, since it is too small to be useful once you get to measuring stars.

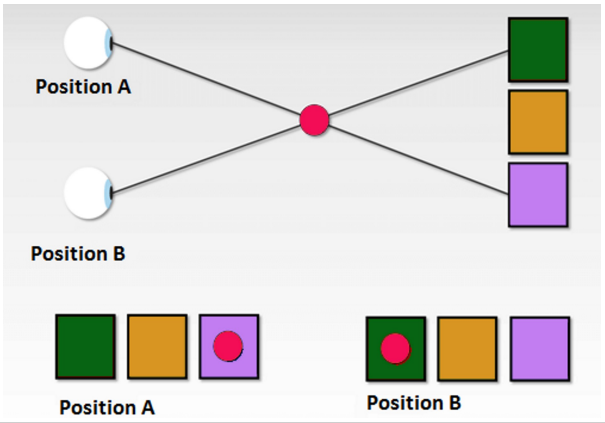
The Light Year (ly)

This is a measurement of distance. It is how far light travels in one year. (So ...a light minute would be how far light travels in a minute)

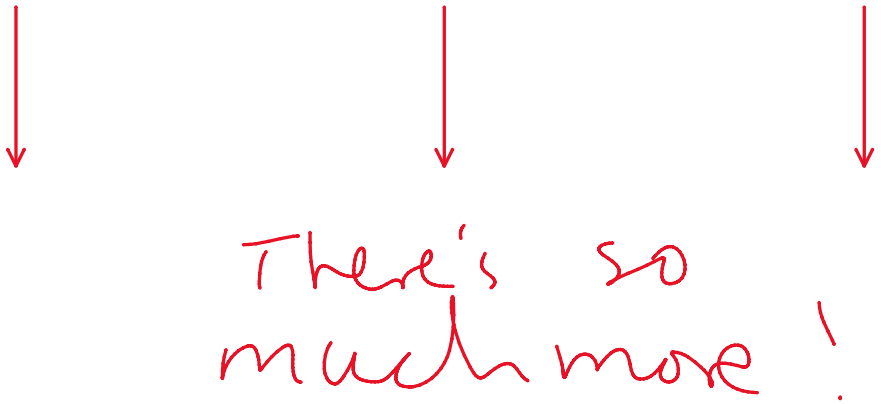
1ly = speed of light x seconds in a year.

1ly = 3x10^8x60x60x24x365 = $9.5x10^{15}$m

Parallax



Parallax is an everyday effect. If you look at a small pink object against a background of three coloured squares you can see that the position of the pink dot relative to the squares depends on where you view the pink dot from. You can see this effect by holding your finger about 30cm in front of you and looking with ONE eye closed. Now swap eyes - you can see your finger moved relative to the background..



Parallax is the idea behind measuring distance to far off stars, and it works by making use of the earth's movement around the sun.

You want to measure to Star X. You look up at the star in January and take note of how it looks compared to the background. Six months later you do the same thing, remembering that the earth has moved to the other side of its orbit around the sun. You then note that Star has moved relative to the background.

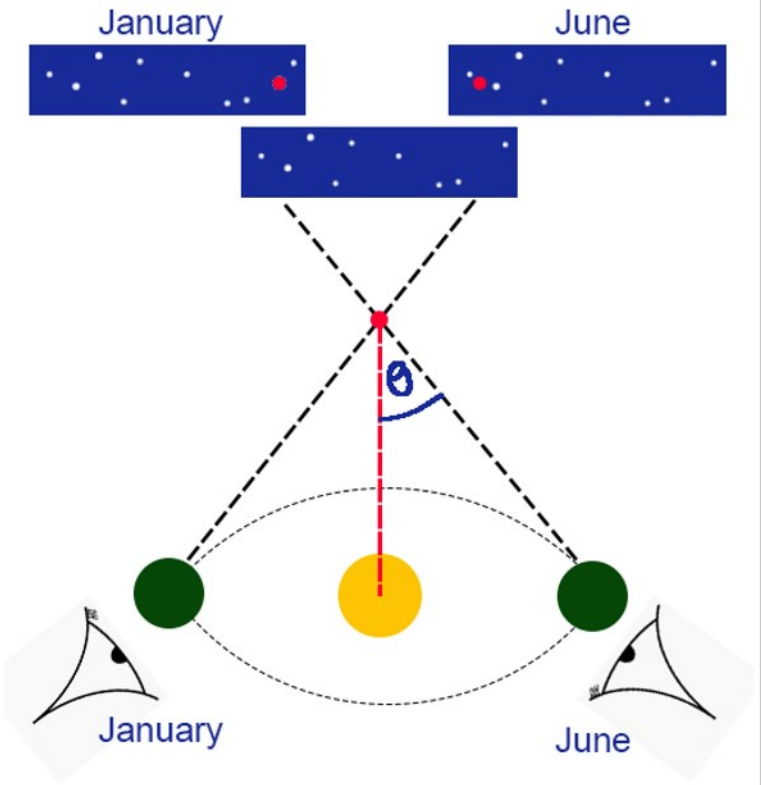
Distance from the sun to the star is d and the radius of the earth's orbit around the sun is r which is 1AU.

From trig we can see:

$$\tan\theta = r/d$$

The angle will be dead small for stars, so we can say $tan\theta \sim \theta$ as long a we are in radians. This gives us:

$$d \sim \frac{\theta}{r}$$



The Parsec

Measuring r in AU is going to lead to some mighty big numbers for the distances to stars. So we have to use a different unit - the Parsec. Also, θ really is tiny, so we have to use a different unit - that of the 'arcsecond'.

An arcsecond is $\frac{1}{3600}$ of a degree

If the distance of the sun to earth is 1AU and the parallax angle is $\frac{1}{3600}$ of a degrees the d is said to be **One Parsec**

So this means that $d = \frac{1}{P}$

Where d is the distance in parsecs and P is the angle of parallax in arcseconds.