

In the late 1990's, the European Space Agency satellite *Hipparcos* measured the parallax of stars with a precision of 0.002". The farthest star whose distance was measured by this satellite is:

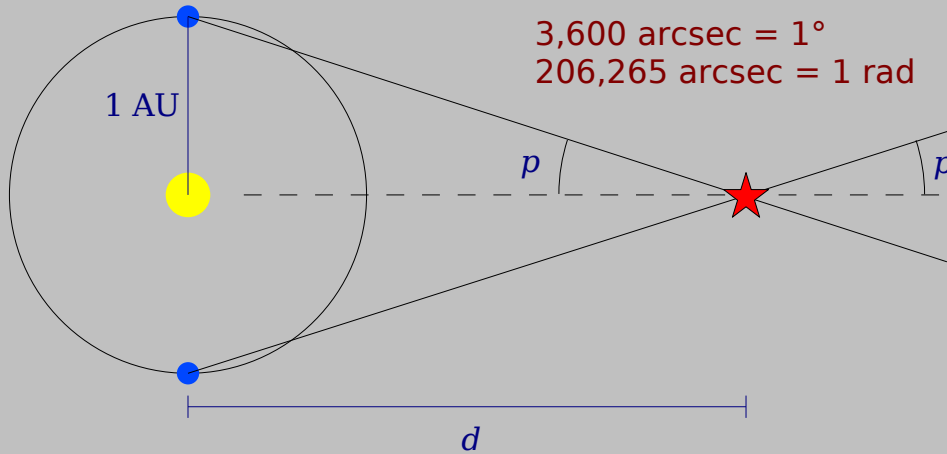
- A Within 30 light-years of the Sun (i.e. in the Solar Neighborhood)
- B In the same general region of the Milky Way as the Sun**
- C On the far side of the Milky Way
- D In the Large Magellanic Cloud
- E In the Andromeda Galaxy.

$$d = 1/p = 1/0.002'' = 500\text{pc} = 0.5 \text{ kpc} : \\ \text{well within the Milky Way}$$

Parallax formula: $d = \frac{1}{p}$

d = distance to star in parsecs

p = parallax angle in arcseconds



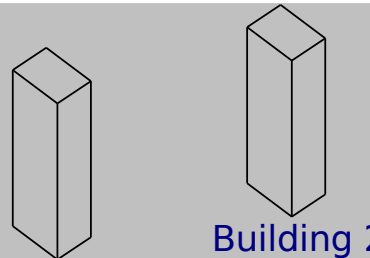
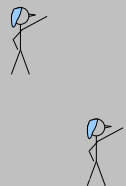
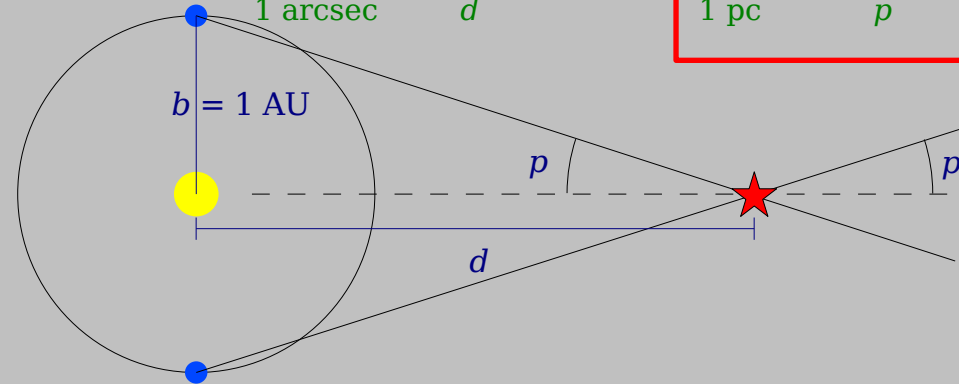
From the small angle formula to the parallax formula...

$$\frac{p}{1 \text{ rad}} = \frac{b}{d} = \frac{1 \text{ AU}}{d}$$

$$\left(\frac{1 \text{ rad}}{206265 \text{ arcsec}}\right) \left(\frac{p}{1 \text{ rad}}\right) = \left(\frac{1 \text{ AU}}{d}\right) \left(\frac{1 \text{ pc}}{206265 \text{ AU}}\right)$$

$$\frac{p}{1 \text{ arcsec}} = \frac{1 \text{ pc}}{d}$$

$$\frac{d}{1 \text{ pc}} = \frac{1 \text{ arcsec}}{p}$$



Building 1

Building 2

You are looking at two buildings; Building 2 is farther from you than Building 1. You measure the distance to them by measuring a parallax angle standing in two different positions as shown.

- A Building 1 has greater parallax than Building 2
- B Building 2 has greater parallax than Building 1
- C Buildings 1 and 2 have the same parallax.
- D You must wait 6 months before measuring the buildings' parallax

Vega has a parallax of 0.129". How far away is it?

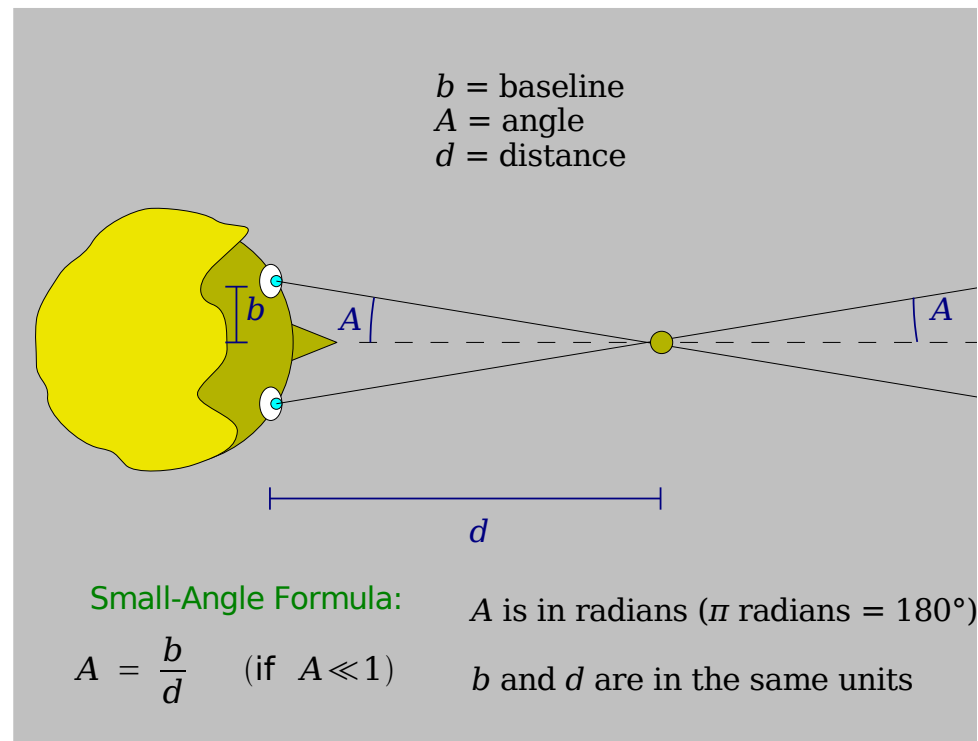
- A 0.78 pc
- B 7.8 pc
- C 78 pc
- D 780 pc
- E 7.8 kpc

Alpha Centauri has a parallax of 0.75". How far away is it?

- A 0.13 pc
- B 0.45 pc
- C 1.3 pc
- D 13 pc
- E 45 pc

The Cosmic Distance Ladder (Incomplete)

Distance Method	Used For	Good To
Thermonuclear Supernovae	Nearby and Distant Galaxies	10 Gpc
(Tully Fisher)	Spiral Galaxies	<100 Mpc
(Surface Brightness Fluctuations)	Elliptical Galaxies Spiral Bluges	10 ¹ Mpc
Cepheid Variables	Close Spiral Galaxies	10-20 Mpc
RR Lyrae Variables	Globbies, Very Near Galaxies	100 kpc, few Mpc
Main-Sequence Fitting	Clusters in the Milky Way	10 ¹ kpc
Parallax	Close Stars in the Milky Way	10 ⁰ kpc



For those of you who know trig....

$$\sin A \approx \tan A \approx A \quad \text{for } A \ll 1, A \text{ in radians}$$

...the rest of you, don't worry about it; take the small angle formula as given.

