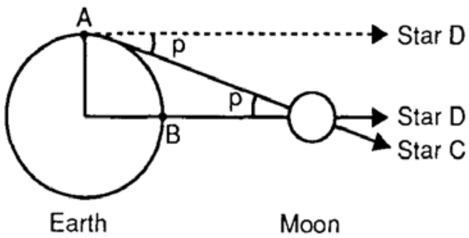
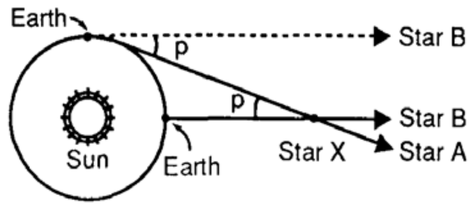
Star Distance

Using *geocentric parallax* an astronomer is able to find the distance from the earth to the moon. Consider two observatories A and B. Observatory A aligns the moon with star C, and observatory B aligns the moon with star D. Because star D is so distant, the light from the star can be considered parallel. Observatory A can measure the angle between stars C and D, use the known value for the radius of the Earth, and solve using the tangent ratio.

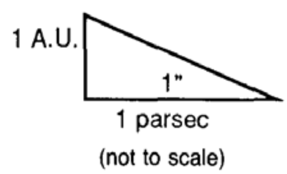




To measure the distance to a nearby star X, the radius of the earth is too small a value to use. The radius of the earth's orbit about the sun, 1 A.U. about 93 million miles, is used. An observatory aligns the star X with a more distant star A. Three months later the same observatory records star X is aligned with another distant star B. Measuring the angle between stars A and B the astronomer can determine the angle formed at star X. This is called *heliocentric parallax*.

Astronomers use two units of measurement when calculating the distance to a star, a *parsec* and a *light year*. One parsec is the distance to a star with a parallax angle of 1″ or 1/3600 of a degree. One light year (LY) is equal to the distance light can travel in one year at 186,000 mi/s.

The number of miles in 1 parsec and 1 LY:



$$\tan 1'' = \frac{1 \text{ A.U.}}{1 \text{ parsec}}$$

$$1 \text{ parsec} = \frac{1 \text{ A.U.}}{\tan 1''}$$

$$= \frac{93 \times 10^6 \text{ miles}}{0.000004848} = 19.2 \times 10^{12} \text{ mi} = 19.2 \text{ trillion mi}$$

$$1 \text{ LY} = (186{,}000 \text{ mi/s})(31{,}536{,}000 \text{ s/yr}) = 5.8 \times 10^{12} \text{ mi/yr}$$

$$= 5.8 \text{ trillion mi in one year.}$$

$$1 \text{ parsec} = 3.3 \text{ LY}$$

1. The star Alpha Centauri, the closest star to the sun, has a parallax angle of 0.75″. Find the distance in miles and light years to this star. ____________________

2. Find the distance to a star with a parallax angle of 2.25″ in miles and light years. ______________________________