



Stars Parallax





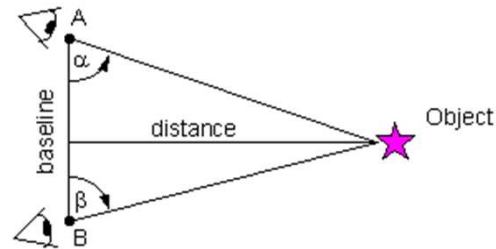
Stars: Parallax

Overview

In the continuing effort to discern the distances to objects, Astronomers can use a tool, long known to surveyors, as Parallax.

Parallax simply measures a shift in object position against a background when the observer is positioned in different locations.

Parallax is useful for some close stars, but is ineffective for objects at great distances.



(c) Boyce Research Initiatives and Education Foundation.
Visit: Boyce Astro @ <http://www.boyce-astro.org>

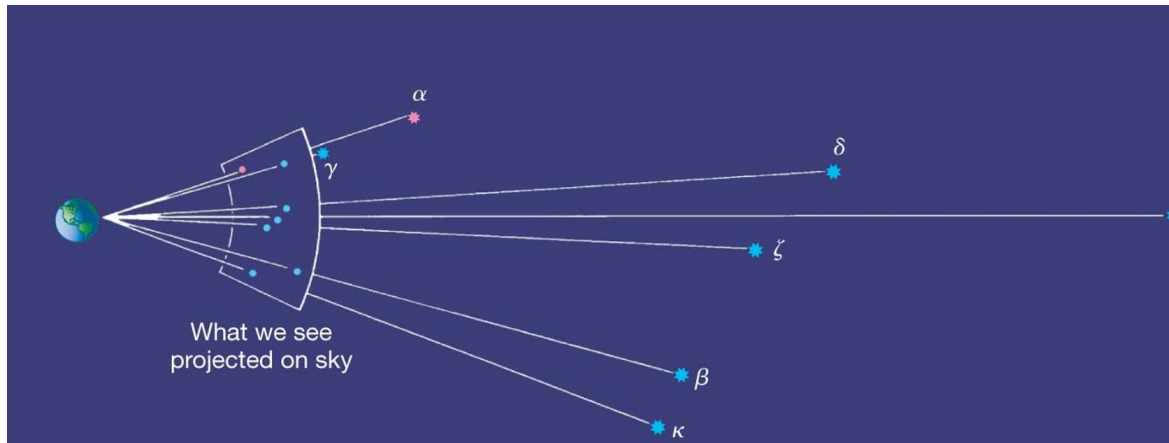
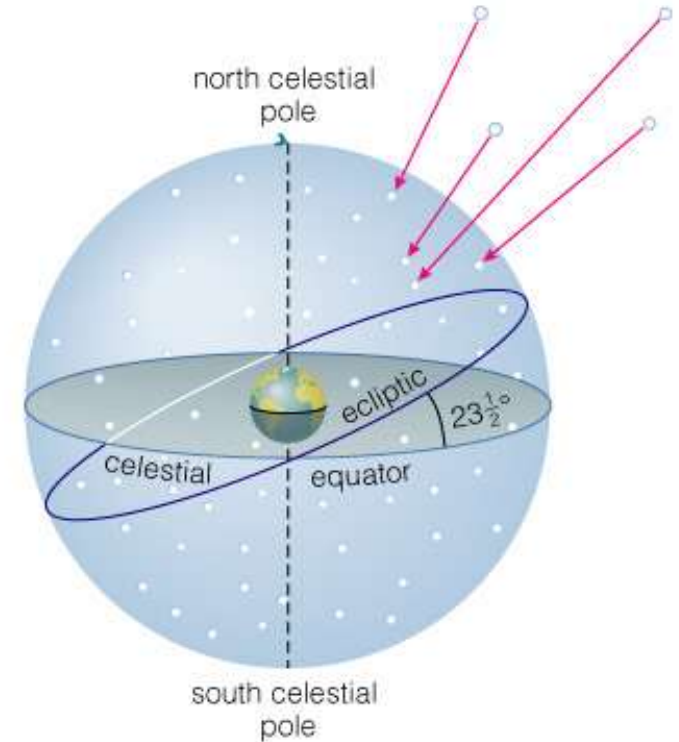


Stars: Parallax

Stellar Positions in Space

As the image below demonstrates, stars appear to be placed evenly on the night sky. But this is deceiving.

Stars are actually located at differing distances from one another in space.



(c) Boyce Research Initiatives and Education Foundation.
Visit: Boyce Astro @ <http://www.boyce-astro.org>



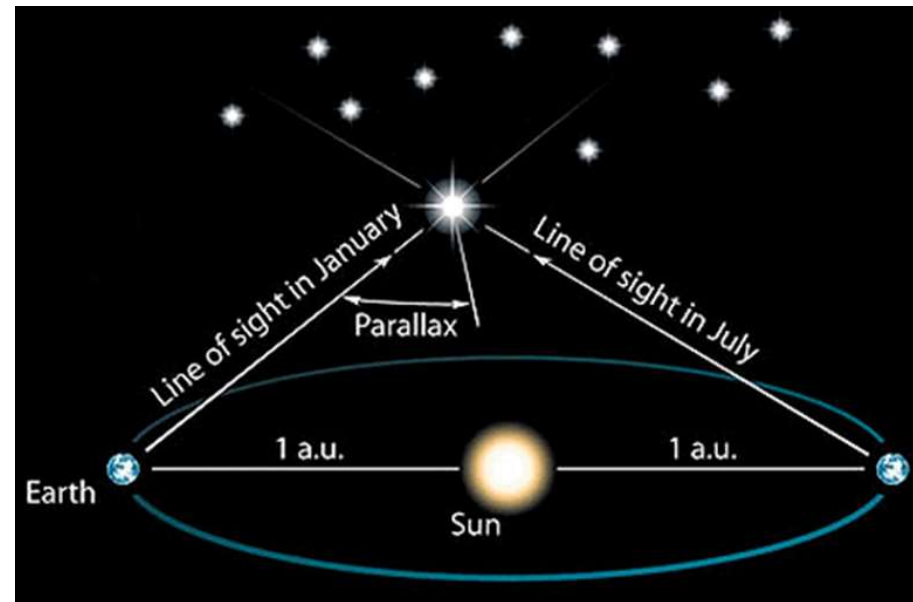
What is Parallax

Parallax: The apparent displacement of an object because of a change in the observer's point of view.

A simple demonstration can help you understand parallax. Hold one finger out at arm's length and close one eye. Then close that eye and open the other. Blink your eyes back and forth. It will appear as though your finger is moving left and right relative to the background.

Repeat with your finger closer and farther away.

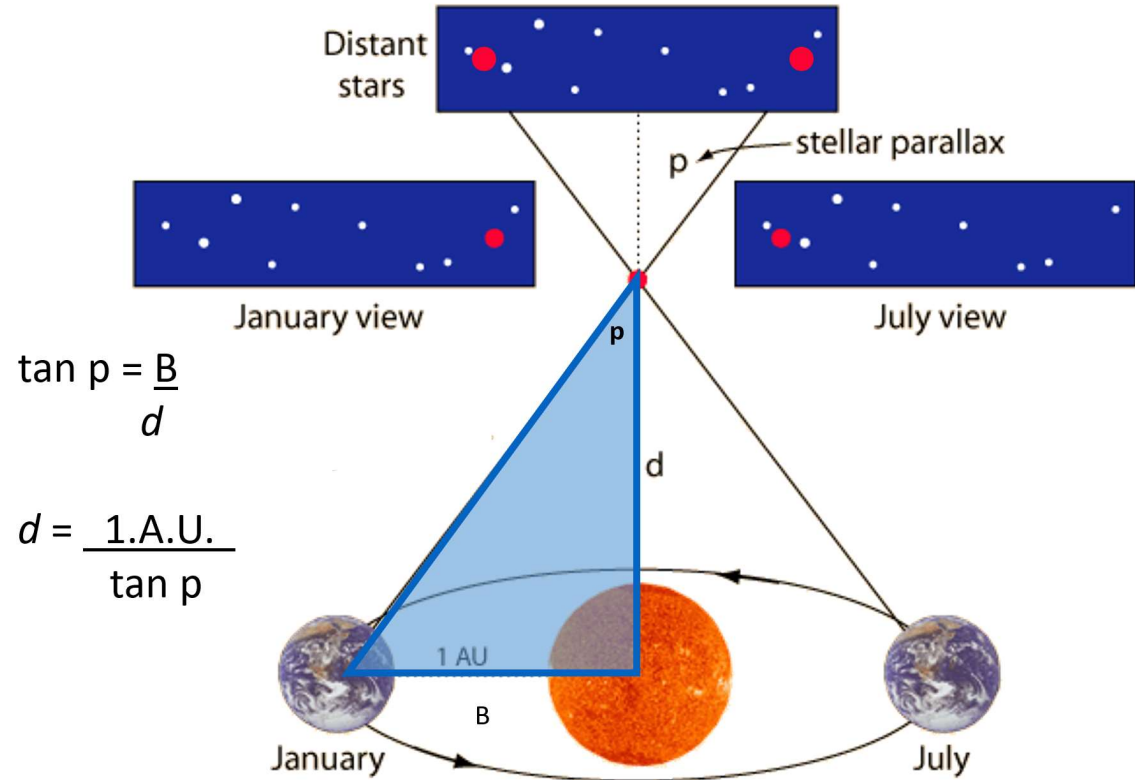
The same principle applies when we look at stars as Earth orbits the sun.





What is Parallax

The parallax of a star is equal to half the angle through which the star's apparent position shifts (B) as Earth moves from one side of its orbit to the other.





Stars: Parallax

How Parallax is Measured

The primary measure of parallax is in parsecs.

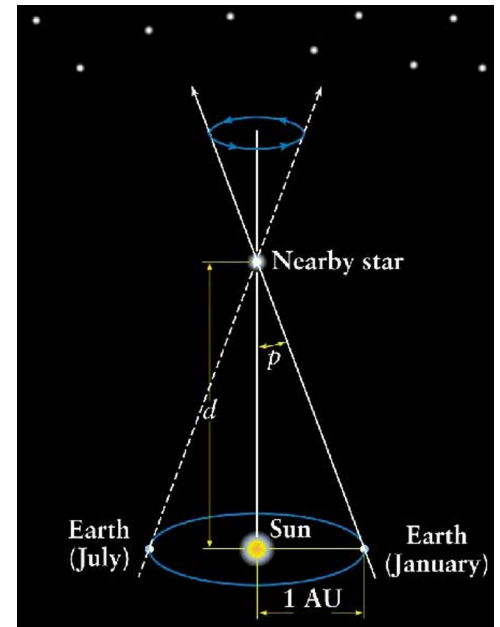
A star with a parallax angle of 1 second of arc ($p = 1$ arcsec) is at a distance of 1 parsec ($d = 1$ pc).

The word “parsec” is a contraction of the phrase “the distance at which a star has a parallax of one arcsecond.”

1 parsec equals 3.26 ly (3.09×10^{13} km or 206,265 AU)

If the angle p is measured in arcseconds, then the distance d to the star in parsecs is given by the following equation:

$$d_{pc} = 1/p_{arc\ seconds}$$



The bright star Vega has a measured parallax of 0.1 arcsec ($p = 0.1''$)

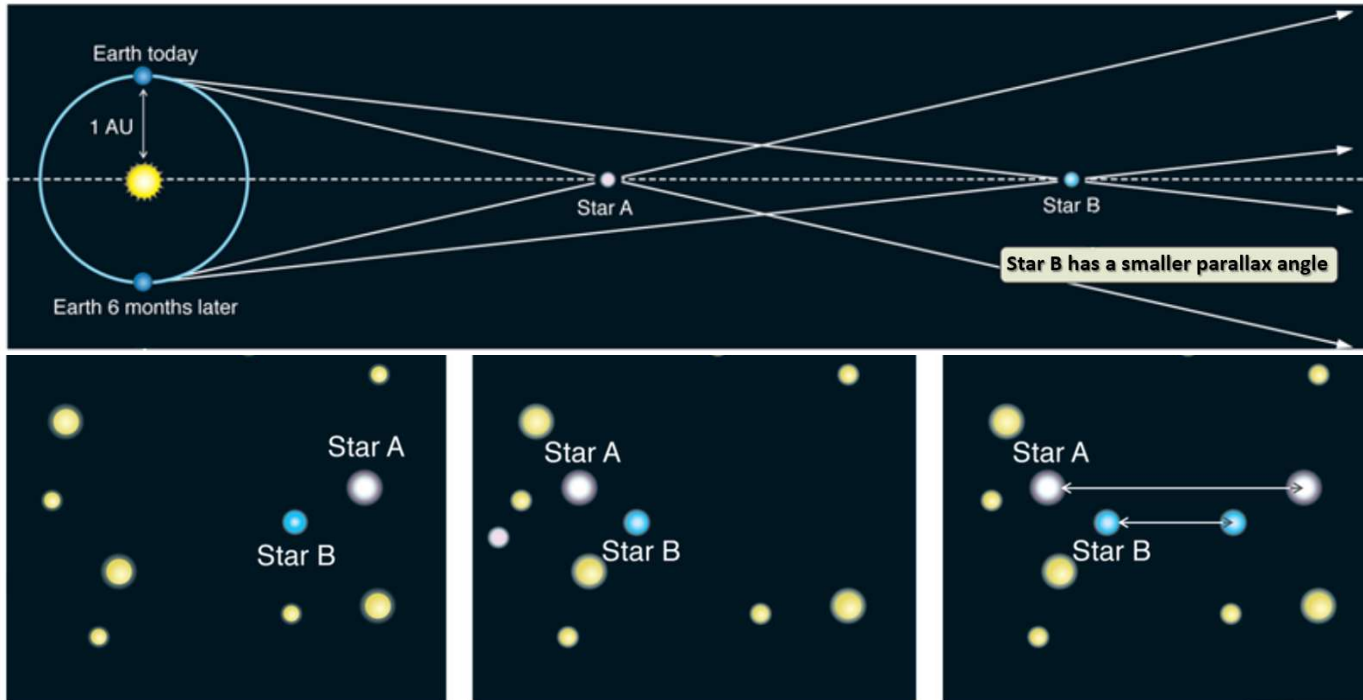
$$D(pc) = 1/p('') = 1/0.1 = 10 \text{ pc}$$

Vega is 10 pc (parsec) from Earth
(remember: 1 pc = 3.26 light years)



How Distance Effects Parallax

The larger the parallax p , the smaller the distance d to the star (compare Star A to Star B).



(c) Boyce Research Initiatives and Education Foundation.
Visit: Boyce Astro @ <http://www.boyce-astro.org>



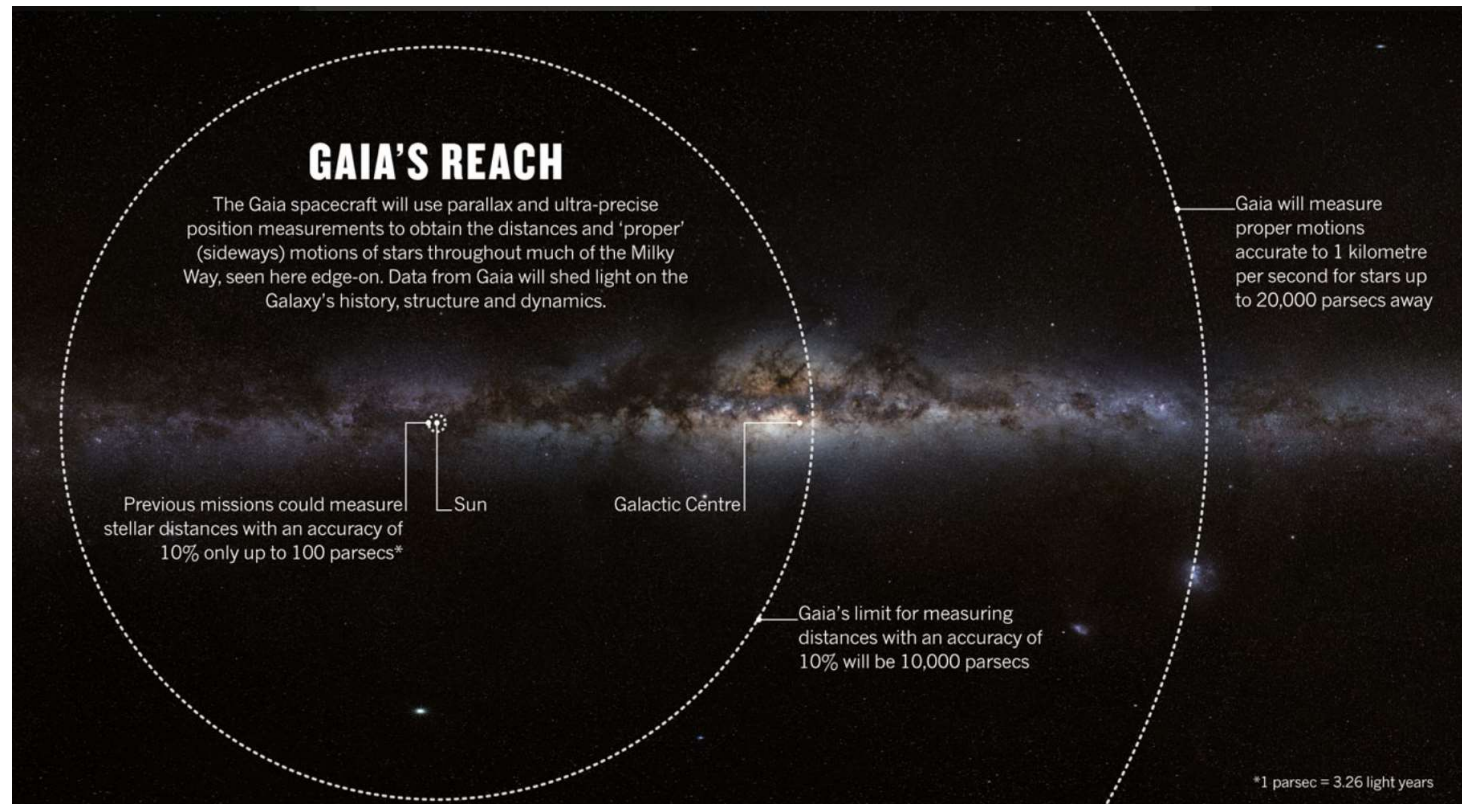
Stars: Parallax

Summary

Parallax can be an effective way to measure the distance to objects.

However, these objects must be relatively close.

GAIA has recently expanded the breadth of how far parallax can be used.





Questions?