**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_**

**Unit 1: Worksheet 5 -**

**Measuring Distance to Stars by Parallax**

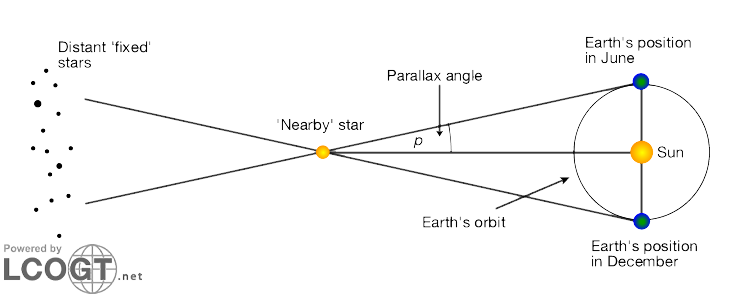
It should be clear at this point that as objects get farther and farther away, their parallax shift gets smaller and smaller for observations from two locations a given distance apart (i.e,. baseline). Recall the difference in the parallax of your thumb when held in front of your eyes versus at arm’s length. Parallax angle and distance are, therefore, inversely related.

In the previous activity, we used data from images taken at two locations on Earth to measure the parallax of the Moon and calculate its distance. For any star, the distance from Earth is so large that using two terrestrial points produces a parallax so small that it is not measurable.

This fact limited the use of parallax for determining distance until astronomers made a novel realization. Two photos of the same star (with reference background stars) from the same telescope, but taken 6 months apart provide a baseline of 2 Astronomical Units (2 AU).

Recall that 1 AU is the average distance between the Earth and the Sun (93 million miles or 1.5 x 108 km.). Suddenly, astronomers have a practical solution to their parallax problem.

Here is a diagrammatic model of the application of parallax for the 2 AU baseline:



The right side of the diagram shows the baseline of 2 AU created by two positions of the Earth’s orbit around the Sun, 6 months apart. Note that the Earth and Sun are not to scale and that Earth’s orbit is shown as circular, rather than elliptical. Remember, all models are flawed!

Notice also that the parallax angle (***p***) is identified as one-half the full angle. This is a convention used by astronomers to define another distance unit, ***parsec***. However, we will continue to call the full angle (between June and December) the parallax angle and use the Parallax Equation as we have been doing up to this point.

In case you are wondering, a parsec is defined as the distance to an object whose parallax angle is one arcsecond. One parsec is a little more than 3 LY. Recall the Andromeda Galaxy that we determined in Activity 5 to be 2.5 million LY from Earth? That is 800,000 parsecs.

1. Proxima Centauri. The parallax angle to our nearest star, Proxima Centauri, has been very precisely measured by the Hipparcos satellite in Earth orbit. It’s value is 1.544" for the 2 AU baseline. Calculate the distance to Proxima Centauri. Show your work, including units. Express your final result in light years (LY). 1 LY = 9.4 E12 km.
2. Betelgeuse. Calculate the distance (LY) to Betelgeuse, the red giant star in the constellation Orion. Its parallax angle is 10.14 milliarcsecs for the 2 AU baseline. Show your work, including units.
3. Create a summary of the steps required for determining the distance from Earth to distant stars using images. Include all necessary formulas and appropriate units.