UNIT 19 - STELLAR PARALLAX

Of the many ways to obtain the distances to the stars, only the method of stellar parallax gives a direct measurement, and then only for the nearest stars. In this laboratory you will see how these measurements are made, and how the distance is calculated from the *parallax angle*. There are four exercises designed to demonstrate the use of the parallax angle:

1. Definition of Angles
2. Relating Parallax Angle to Distance
3. Calibration of the Virtual Telescope
4. Making Measurements

1. Preliminaries - Calculating the Angle of a Triangle
For a right angle triangle, such as the one shown in the diagram to the right, the angle A and the sides a and b are related by:
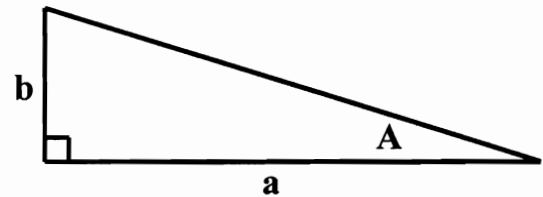

Figure-1

$$\tan A = \frac{b}{a} \qquad (1)$$

If you know any two of these three variables, then you can calculate the third. Of course, to do so you will need to be familiar with trigonometric functions. Fortunately, when measuring the distances to the stars the distance (side a) to the star is very large, and so the angle (A) is very small, much less than 1 degree. In this small angle approximation, the above equation can be replaced by a simpler form:

$$A = \frac{180}{\pi} \frac{b}{a} \qquad (2)$$

In the first exercise you will familiarize yourself with this basic geometry.

1. Choose *Calculating the Angle of a Triangle* from the list of exercises.
2. You will presented with a problem involving a triangle similar to that in figure-1.
3. Enter your answer and then select the button labeled *Check your answer*.
4. Correct any mistakes which are indicated.
5. Select the button labeled *New Problem* to generate another question.
6. If you need help, it is available from the *Help* item on the overhead menu.

2. Preliminaries - Parallax Angle and Distance
Once you have mastered the geometry of the right-triangle, you can move on to the next exercise which involves determining the distance to a near-by star. In this case, a triangle is formed by the star, the Sun, and the position of the Earth. This defines side b as the distance from the Earth to the Sun, a distance of 1 AU. Side a of the triangle is the distance from the Sun to the star. For even the closest star (except our own Sun) this is over 100,000 AU. Thus, the small angle approximation is