Outdoor Parallax Measurements

Goals:
1. To observe and to measure the parallax of a relatively distant object such as a tree or a flagpole.
2. To determine the distance to the object using the indirect measurement technique of parallax shift.

Equipment needed: ruler, meter stick, labeled diagram for outdoor measurement

Procedure: For the following steps use the separate outdoor diagram as a guide.

1. Go to the designated area outside and locate the object whose parallax and distance are to be measured. This will probably be a pole or a tree. The description below will use the word "pole".

2. Before you perform any measurements, make an estimate of the distance to the "pole". Please use meters. Record this estimate. Making an estimate ahead of time will allow you to appreciate how well you can visualize distances that are beyond your reach. It will also help in determining whether your result at the end is reasonable or not.

3. Identify an area where you might be able to lay a baseline in the range of 10 meters long and from where you can sight the "pole" at approximately the two ends, points A and B on the diagram.

4. Walk along the prospective baseline to locate a point A from which you can sight on the "pole" and line up an easily seen object in the far distance, hopefully a few miles or more behind the pole. We will call the position of that distant object point C.

5. Positions A and C are now located. Be sure and mark position A in some manner so you can return to it.

6. Now walk along the baseline towards the other end. Locate a point B from which you can line up the "pole" with another, easily seen object in the far distance. We will call the position of this second, distant object, point D.

7. Positions B and C are now located. Be sure and mark position B on the baseline.

8. Now measure the baseline in meters. It is the distance between A and B. This distance should be in the range of 5-10 meters. Record this distance on the diagram. It is indicated by the letter b.

9. There is only one more measurement you need to make and that is the parallax angle of the pole, as measured against the distant background. To do this you will stand somewhere along the baseline where you can view both points C and D in the distance. If this can be done while standing in the center of the baseline, that is recommended. However any point along the baseline will work. Then, with the help of a partner, measure the angle between points C and D as viewed from your location. This is angle p' on the diagram. You will use the same technique, with ruler and meter stick, that you used in class to measure angular size. In this case you are measuring the angular "size" of the space between points C and D. Record you measurements. Make sure each person in your group gets a chance to measure this parallax angle.

10. At this point make sure you have measured the baseline, b, and have taken the necessary measurements to determine angle p'.

11. Follow the procedure given during the earlier presentation to calculate the angle, p'. Express this result in degrees. Then continue with the given procedure to calculate the distance to the pole, d. Compare your measured distance to the value you estimated in step #2 above. Do you believe your measured result is reasonable? Explain. Which step of the procedure do you believe had the most potential for error? Without doing a major error analysis, approximately what percent error do you feel there is in your result of distance to the pole?