Tutorial: Measured Stellar Parallax

Part I: What do we mean by “parallax”?

01. **Predict** what your finger would appear to do against the background if you were to put it about 3-4 inches from your face and closed one eye at a time:

02. Now go ahead and do this. Was your prediction correct? Comment.

03. Now, predict how the apparent motion of your finger would change if you moved your finger twice as far from your face? Would it change at all?

04. Now do this. Was your prediction correct? Comment.

05. If you had amazing Stretch Armstrong arms, is there a limit to how far you could move your finger and still see some apparent motion of your finger? If so, how far away do you think that would be? (To get an idea of this distance have someone far away from you hold up their finger.)

06. What is it about our eyes that allows us to see this apparent motion?
Part II: Understanding Parallax as a Measurable Angle

07. The circle labeled E in the diagram at left represents the Earth in its orbit in January. Use a ruler and draw a line from the Earth to the background stars going through star A. Mark the Earth-Star A-Sun angle. This is called the parallax angle.

08. Describe what you think will happen to that angle if we were to do what we did in question 7 again but for star B, which is farther away.

09. Test your prediction by using the diagram at left. Comment on your results. Were you correct?

10. Now find where the Earth will be 6 months later. Repeat question 7 using star A at this new position in its orbit. Using the diagram below mark where Star A will appear to be in January and then 6 months later.

11. Extend our observations over a number of years. How will Star A appear to move against the background stars?

12. How about star B over the same number of years compared to the motion of star A?

13. From Earth we can see the apparent motion of a star against a background of distant stars over time. This is called stellar parallax. When we see parallax with our eyes we close one and then the other as we did above. This is where depth perception comes from, which allows us to estimate distances. What is it about the Earth that would correspond to our eyes blinking?
14. Below are a set of parallax observations of the different stars. Rank them from nearest to farthest. Explain your logic. Nearest ______  ______  ______ Farthest

![Stars A, B, C with parallax observations]

**Part III : Effect of Changing Baselines**

14. We used the diagram on the previous page to understand the parallax angle of stars A and B. Let’s focus on star A for now. What would happen to the parallax angle of A if we measured it from Mars instead of Earth?

15. Consider this conversation between two tutorial students:

**Student 1**: I think that if we measured the parallax of a star from Mars, the angle would be larger than if we measured it from Earth because Mars has a much larger orbit. This would cause the star to move an angle comparable to that of its orbit.

**Student 2**: If we measured the parallax from Mars, the angle would have to be smaller because Mars is farther from the Sun so the star would also have to be farther away from Mars.

With whom do you agree? Explain.

16. Now test your predictions as well as those of Student 1 and Student 2. Do this by repeating what we did in question 7, but with the Mars in its orbit. What are your results? Why would a longer baseline be desirable?