Part I: Angular Measurement

Imagine that you are standing in an open field. While facing south, you see a house in the distance. If you turn your head and look directly east (to your left), you see a barn in the distance.

1) What is the angle between you, the house, and the barn? (Hint: If you point at the barn with one arm and point at the house with your other arm, what angle do your arms make?)

2) You see the Moon on the horizon just above the barn in the east and also see a bright star directly overhead. What is the angle between you, the Moon, and the overhead star?

3) Compare your answers for the barn–house angle from Question 1 and the Moon–star angle from Question 2. Are they the same?

4) Do the angles from above tell you anything about the actual distance between the barn and house or the Moon and star?

We are often unable to **directly** measure distances to faraway objects in our night sky. However, we can obtain the distances to relatively nearby stars by using their parallax angles. Because even these stars are very far away (up to about 500 parsecs), the parallax angles for these stars are very small. They are measured in units of **arcseconds**, where 1 arcsecond is 1/3600 of 1 degree. To give you a sense of how small this angle is, the thin edge of a credit card, when viewed from one football field away, covers an angle of about 1 arcsecond.

Part II: Finding Stellar Distance Using Parallax

Consider the star field drawing shown in Figure 1. This represents a tiny patch of our night sky. In this drawing we will imagine that the angle separating Stars A and B is just 1/2 of an arcsecond.

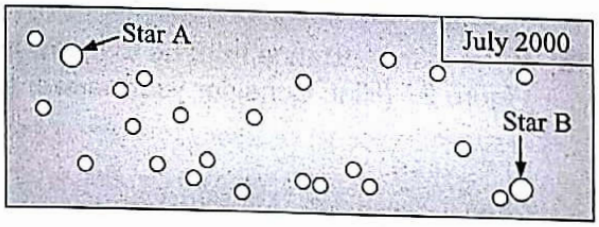

Figure 1

In Figure 2 (see the final page of the activity) there are drawings of this star field taken at different times during the year. One star in the field moves back and forth across the star field (exhibits parallax) with respect to the other, more distant stars.

5) Using Figure 2, determine which star exhibits parallax. Circle that star on each picture in Figure 2.

6) In Figure 1, draw a line that shows the range of motion for the star you saw exhibiting parallax in the drawings from Figure 2. Label the end points of this line with the months when the star appears at those end points.

7) How many times bigger is the separation between Stars A and B compared to the distance between the end points of the line showing the range of the motion for the star exhibiting parallax?

8) Recall that Stars A and B have an angular separation of 1/2 of an arcsecond in Figure 1. Consider two more stars (C and D) that are separated **twice** as much as Stars A and B. What is the angular separation between Stars C and D in arcseconds?

9) What is the angular separation between the end points that you marked in Figure 1 for the nearby star exhibiting parallax?

Note: We define a star's **parallax angle** as **half** the angular separation between the end points of the star's angular motion.

10) What is the parallax angle for the nearby star exhibiting parallax from Question 9?

Note: We define 1 **parsec** as the distance to an object that has a **par**allax angle of 1 arc**sec**ond. For a star with a parallax angle of 2 arcseconds, the distance to the star from Earth would be 1/2 of a parsec.

11) For a star with a parallax angle of 1/2 of an arcsecond, what is its distance from us?

12) For a star with a parallax angle of 1/4 of an arcsecond, what is its distance from us?

13) What is the distance from us to the nearby star exhibiting parallax in the drawings from Figure 2? (Hint: Consider your answer to Question 10.)

a) 1 parsec

b) 2 parsecs

c) 4 parsecs

d) 8 parsecs

e) 16 parsecs

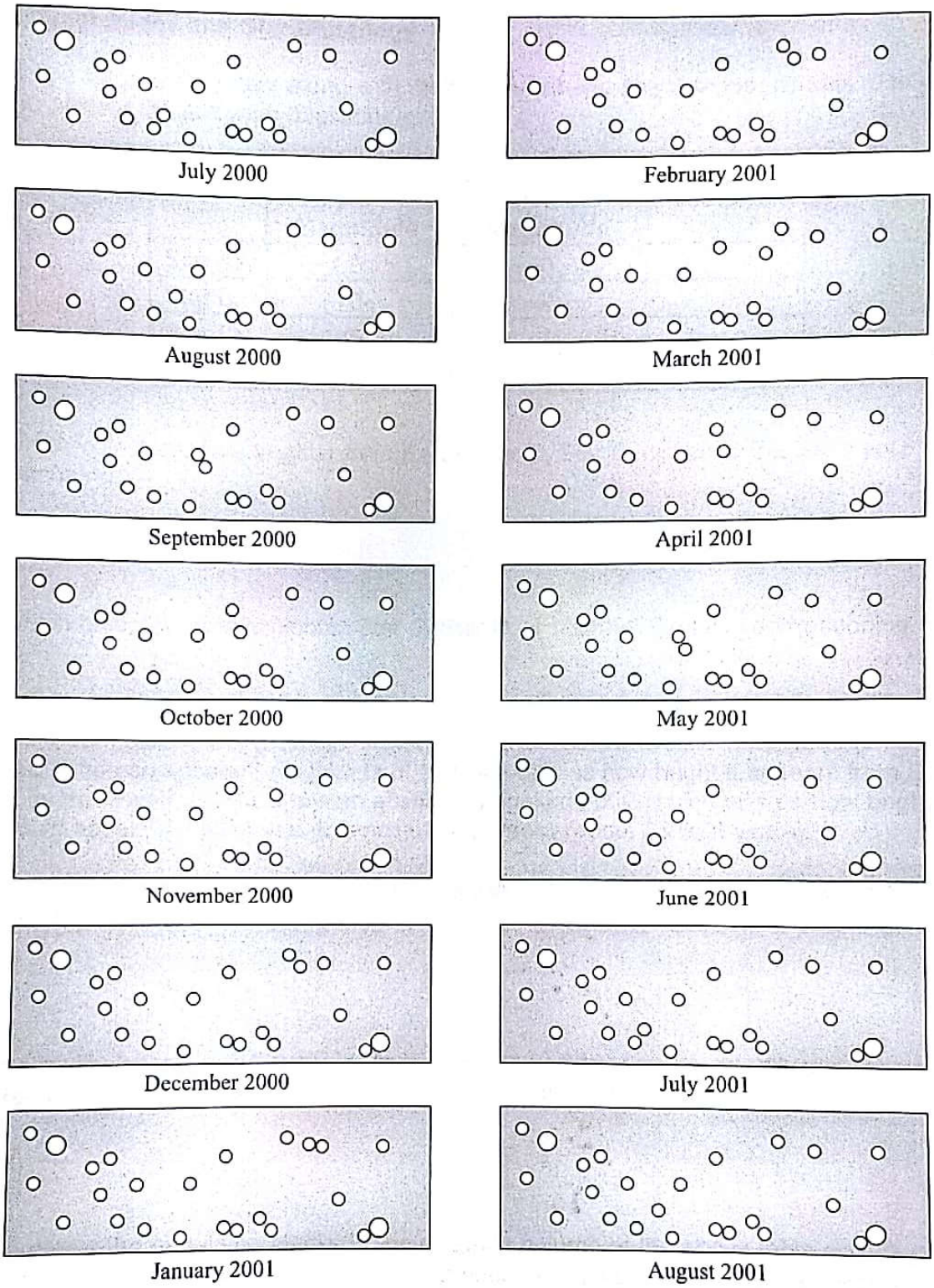
July 2000
February 2001
August 2000
March 2001
September 2000
April 2001
October 2000
May 2001
November 2000
June 2001
December 2000
July 2001
January 2001
August 2001

Figure 2