

OpenStax Astronomy, Ch.19: WS Problems (Apr-2021)

Review Questions

1. Explain how parallax measurements can be used to determine distances to stars. Why can we not make accurate measurements of parallax beyond a certain distance?
2. Suppose you have discovered a new cepheid variable star. What steps would you take to determine its distance?
3. Explain how you would use the spectrum of a star to estimate its distance.
4. Which method would you use to obtain the distance to each of the following?
 - A. An asteroid crossing Earth's orbit
 - B. A star astronomers believe to be no more than 50 light-years from the Sun
 - C. A tight group of stars in the Milky Way Galaxy that includes a significant number of variable stars
 - D. A star that is not variable but for which you can obtain a clearly defined spectrum
5. Most distances in the Galaxy are measured in light-years instead of meters. Why do you think this is the case?
6. The AU is defined as the *average* distance between Earth and the Sun, not the distance between Earth and the Sun. Why does this need to be the case?
7. What would be the advantage of making parallax measurements from Pluto rather than from Earth? Would there be a disadvantage?
8. Parallaxes of stars are sometimes measured relative to the positions of galaxies or distant objects called quasars. Why is this a good technique?
9. Which of the following can you determine about a star without knowing its distance, and which can you not determine: radial velocity, temperature, apparent brightness, or luminosity? Explain.
10. A G2 star has a luminosity 100 times that of the Sun. What kind of star is it? How does its radius compare with that of the Sun?
11. A star has a temperature of 10,000 K and a luminosity of $10^{-2} L_{\text{Sun}}$. What kind of star is it?
12. What is the advantage of measuring a parallax distance to a star as compared to our other distance measuring methods?
13. Luhman 16 and WISE 0720 are brown dwarfs, also known as failed stars, and are some of the new closest neighbors to Earth, but were only discovered in the last decade. Why do you think they took so long to be discovered?
14. Most stars close to the Sun are red dwarfs. What does this tell us about the average star formation event in our Galaxy?
15. When Henrietta Leavitt discovered the period-luminosity relationship, she used cepheid stars that were all located in the Large Magellanic Cloud. Why did she need to use stars in another galaxy and not cepheids located in the Milky Way?

16. In 1974, the Arecibo Radio telescope in Puerto Rico was used to transmit a signal to M13, a star cluster about 25,000 light-years away. How long will it take the message to reach M13, and how far has the message travelled so far (in light-years)?

17. The New Horizons probe that passed by Pluto during July 2015 is one of the fastest spacecraft ever assembled. It was moving at about 14 km/s when it went by Pluto. If it maintained this speed, how long would it take New Horizons to reach the nearest star, Proxima Centauri, which is about 4.3 light-years away? (Note: It isn't headed in that direction, but you can pretend that it is.)

18. What physical properties are different for an M giant with a luminosity of $1000 L_{\text{Sun}}$ and an M dwarf with a luminosity of $0.5 L_{\text{Sun}}$? What physical properties are the same?