10.13: Analyzing Starlight (Exercises)

For Further Exploration

Articles

Berman, B. “Magnitude Cum Laude.” *Astronomy* (December 1998): 92. How we measure the apparent brightnesses of stars is discussed.

Dvorak, J. “The Women Who Created Modern Astronomy [including Annie Cannon].” *Sky & Telescope* (August 2013): 28.

Hearnshaw, J. “Origins of the Stellar Magnitude Scale.” *Sky & Telescope* (November 1992): 494. A good history of how we have come to have this cumbersome system is discussed.

Hirshfeld, A. “The Absolute Magnitude of Stars.” *Sky & Telescope* (September 1994): 35.

Kaler, J. “Stars in the Cellar: Classes Lost and Found.” *Sky & Telescope* (September 2000): 39. An introduction is provided for spectral types and the new classes L and T.

Kaler, J. “Origins of the Spectral Sequence.” *Sky & Telescope* (February 1986): 129.

Skrutskie, M. “2MASS: Unveiling the Infrared Universe.” *Sky & Telescope* (July 2001): 34. This article focuses on an all-sky survey at 2 microns.

Sneden, C. “Reading the Colors of the Stars.” *Astronomy* (April 1989): 36. This article includes a discussion of what we learn from spectroscopy.

Steffey, P. “The Truth about Star Colors.” *Sky & Telescope* (September 1992): 266. The color index and how the eye and film “see” colors are discussed.

Tomkins, J. “Once and Future Celestial Kings.” *Sky & Telescope* (April 1989): 59. Calculating the motion of stars and determining which stars were, are, and will be brightest in the sky are discussed.

Websites

Discovery of Brown Dwarfs: http://w.astro.berkeley.edu/~basri/b...SciAm-book.pdf.

Listing of Nearby Brown Dwarfs: http://www.solstation.com/stars/pc10bd.htm.

Spectral Types of Stars: http://www.skyandtelescope.com/astro...ypes-of-stars/.

Stellar Velocities https://www.e-education.psu.edu/astr...ent/l4_p7.html.

Unheard Voices! The Contributions of Women to Astronomy: A Resource Guide: http://multiverse.ssl.berkeley.edu/women and http://www.astrosociety.org/educatio...esource-guide/.

Videos

When You Are Just Too Small to be a Star: https://www.youtube.com/watch?v=zXCDsb4n4KU. 2013 Public Talk on Brown Dwarfs and Planets by Dr. Gibor Basri of the University of California–Berkeley (1:32:52).

Review Questions

1. What two factors determine how bright a star appears to be in the sky?
2. Explain why color is a measure of a star’s temperature.
3. What is the main reason that the spectra of all stars are not identical? Explain.
4. What elements are stars mostly made of? How do we know this?
5. What did Annie Cannon contribute to the understanding of stellar spectra?
6. How do objects of spectral types L, T, and Y differ from those of the other spectral types?
7. Do stars that look brighter in the sky have larger or smaller magnitudes than fainter stars?
8. The star Antares has an apparent magnitude of 1.0, whereas the star Procyon has an apparent magnitude of 0.4. Which star appears brighter in the sky?
9. Based on their colors, which of the following stars is hottest? Which is coolest? Archenar (blue), Betelgeuse (red), Capella (yellow).

10. Order the seven basic spectral types from hottest to coldest.
11. What is the defining difference between a brown dwarf and a true star?

Thought Questions

1. If the star Sirius emits 23 times more energy than the Sun, why does the Sun appear brighter in the sky?
2. Table 17.3.1 in Section 17.3 lists the temperature ranges that correspond to the different spectral types. What part of the star do these temperatures refer to? Why?
3. Appendix I lists some of the nearest stars. Are most of these stars hotter or cooler than the Sun? Do any of them emit more energy than the Sun? If so, which ones?
4. Appendix J lists the stars that appear brightest in our sky. Are most of these hotter or cooler than the Sun? Can you suggest a reason for the difference between this answer and the answer to the previous question? (Hint: Look at the luminosities.) Is there any tendency for a correlation between temperature and luminosity? Are there exceptions to the correlation?
5. What star appears the brightest in the sky (other than the Sun)? The second brightest? What color is Betelgeuse? Use Appendix J to find the answers.
6. Suppose hominids one million years ago had left behind maps of the night sky. Would these maps represent accurately the sky that we see today? Why or why not?
7. Why do you think astronomers have suggested three different spectral types (L, T, and Y) for the brown dwarfs instead of M? Why was one not enough?
8. Sam, a college student, just bought a new car. Sam's friend Adam, a graduate student in astronomy, asks Sam for a ride. In the car, Adam remarks that the colors on the temperature control are wrong. Why did he say that?

Figure 10.13.1 (credit: modification of work by Michael Sheehan)