**P354 Project 3: Arcturus’ Velocity and Earth’s Orbital Speed**

Due: Jan. 13

On the next page you will find spectra of the star Arcturus taken about six months apart, when they showed maximum Doppler shift. Included is a reference finder chart that allows you to determine the wavelengths (in Angstroms) of the bright lines in the spectra. These come from a reference lamp in the observatory. You can use these to set the scale for the spectra (referred to as the dispersion of the spectra) in Angstroms/mm or some other useful units. The stellar spectra are bright with dark absorption lines, labeled a and b in the image. Also included is a constellation chart. Use this chart to help identify the direction of Arcturus’ velocity relative to the solar system. The Doppler shift in each spectrum results from a velocity that is the combination of Earth’s orbital motion and Arcturus’ presumed constant motion in the Galaxy. As earth orbits its velocity moves from being toward Arcturus to being away from Arcturus cyclically. If Earth’s speed is greater than Arcturus’ speed, you will find one spectrum blueshifted and the other redshifted. If Arcturus has a greater speed, the spectrum will remain blueshifted or redshifted but the shift will grow and shrink. Either way, the result is basically two equations and two unknowns. You must determine the speed of earth in its orbit, and the component of Arcturus’ velocity that is either toward or away from the sun. We can know nothing about the other component. All images are from *Contemporary Activities in Astronomy* by Hoff and Wilkerson.





