CHAPTER OVERVIEW

18: Spectroscopic Binary Stars

There are many binary stars whose angular separation is so small that we cannot distinguish the two components even with a large telescope – but we can detect the fact that there are two stars from their spectra. In favourable circumstances, two distinct spectra can be seen. It might be that the spectral types of the two components are very different – perhaps a hot A-type star and a cool K-type star, and it is easy to recognize that there must be two stars there. But it is not necessary that the two spectral types should be different; a system consisting of two stars of identical spectral type can still be recognized as a binary pair. As the two components orbit around each other (or, rather, around their mutual centre of mass) the radial components of their velocities with respect to the observer periodically change. This results in a periodic change in the measured wavelengths of the spectra of the two components. By measuring the change in wavelengths of the two sets of spectrum lines over a period of time, we can construct a *radial velocity curve* (i.e. a graph of radial velocity versus time) and from this it is possible to deduce some of the orbital characteristics. Often one component may be significantly brighter than the other, with the consequence that we can see only one spectrum, but the periodic Doppler shift of that one spectrum tells us that we are observing one component of a spectroscopic binary system. Thus we have to distinguish between a *double-lined spectroscopic binary* system and a *single-lined spectroscopic binary system*. As with all topics in this series of notes, there has accumulated over centuries a vast body of experience, knowledge and technical facility, and this chapter is intended only as a first introduction to the basic principles. But all of us, whether beginners or experienced practitioners, have to know these!

Thumbnail: Algol B orbits Algol A. This animation was assembled from 55 images of the CHARA interferometer in the near-infrared H-band, sorted according to orbital phase. (CC BY-SA 3.0; Dr. Fabien Baron, Dept. of Astronomy, University of Michigan, Ann Arbor, MI 48109-1090, labels indicating phase added by Stigmatella aurantiaca).