

## Homework 6

Due **October 15 by 10:45am via Canvas upload**

Please show all work, writing solutions/explanations clearly, or no credit will be given. You are encouraged to work together, but everyone must turn in independent solutions; do not copy from others or from any other sources.

1. Imagine that you make observations of 2 stars, determining their  $V$ -band magnitudes to be  $m_1 = 12$  and  $m_2 = 14.5$ , colors to be  $(B - V)_1 = 0.5$  and  $(B - V)_2 = -0.3$ , and  $V$ -band bolometric corrections to be  $BC_1 = -0.05$  and  $BC_2 = -0.25$ . From other measurements, you know that star 2 has a parallax  $\pi'' = 0.005''$ .
  - (a) What are the approximate temperatures of the stars? Why is the  $BC$  of star 2 more negative than that of star 1?
  - (b) Assuming these are effective temperatures, what is the radius of star 2?
  - (c) If interferometric measurements limit the angular size of star 1 to be  $\theta < 10^{-4}$  arcsec, place a constraint on how far away star 1 is assuming the two stars are the same physical size.
  - (d) Is this distance constraint consistent with the distance estimated from its  $T_{\text{eff}}$  under the same assumption about their relative sizes?
2. The stars  $\beta$  Aurigae A and  $\beta$  Aurigae B constitute a double-lined spectroscopic binary with an orbital period  $P = 3.96$  days. The radial velocity curves of the two stars have amplitudes  $v_A \sin i = 108 \text{ km s}^{-1}$  and  $v_B \sin i = 111 \text{ km s}^{-1}$ . If  $i = 90^\circ$ , what are the masses of the two stars?
3. Astronomers often use the approximation that a 1% change in brightness of a star corresponds to a change of 0.01 magnitudes. Justify this approximation.
4. It's time to start thinking about your Communicating Science project! Please read through the description / assessment / timeline on the project page and start thinking about potential topics / media and whether you want to work on your own or in a 2-3 person group. Given the continued need to social distance, if you decide to work in a group be sure to collaborate safely. For full credit on this HW problem, indicate whether you will work alone or in a group (and provide group member names) and what kind of project you're thinking about doing (will you make a demo, activity, or infographic? what topic(s) are you thinking of tackling?). You can change your mind later—this exercise is meant to get you started.