Level 2 Stars, Workshop 1

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1. Calculating basic stellar properties

Two stars have the same apparent magnitude (m=2.5 mags) and the same physical radii.

a) Star A has a temperature of 4,000 K while star B has a temperature of 30,000 K. On the basis of these properties, how much further away is star B than star A?

b) Star A has a measured parallax of 0.056 arcsec. Calculate the distance to star A and determine its absolute magnitude. Using this information also estimate the parallax angle for star B and determine both the distance and absolute magnitude for star B.

c) A stellar interferometer is used to determine the angular size of star A and measures Φ=0.005 arcsec. Using this information determine the physical radii of star A and therefore calculate the luminosities of stars A and B.

d) Do these stars lie on the main sequence of the Hertzsprung-Russell diagram?

2. Stellar spectroscopic features

a) If the observed energy of a star peaks at 550nm what is its effective temperature?

b) Given the temperature in part a, what is the relative fraction of Hydrogen in the n=2 excited state to the n=1 ground state?

c) Over what wavelength range will you expect to see absorption lines corresponding to the n=2 excited state?

d) A photon of 200nm is absorbed by a Hydrogen atom with an electron in the n=3 excited state. Is the photon energetic enough to ionize the Hydrogen atom?

[$M_\odot = 1.99 \times 10^{30}$ kg; $L_\odot = 3.85 \times 10^{26}$ W; $R_\odot = 6.96 \times 10^{8}$ m; 1 pc = 3.09×10^{16} m; 1 eV=1.60×10^{-19} J; 1 AU = 1.50×10^{11} m; c=3.00x10^{8} m s^{-1}; σ=5.67 x 10-8 W m^{-2} K^{-4}; k=1.38×10^{-23} J K^{-1}]