Homework exercise sheet 1

submission date: 28-11-2014

Exercise 1:

Let us assume we have two stars - star A and star B. Star A has an apparent magnitude of $m_A = -1.5$ mag (very bright) and its distance to Earth is $d_A = 8.6$ light-years (very close). Star B has an apparent magnitude of $m_B = 1.25$ mag, but is way further away with a distance of $d_B = 2570$ light-years.

a) Discuss advantages and disadvantages of using magnitudes instead of fluxes.

b) Calculate the absolute magnitude of both stars.

c) The bolometric correction (B.C. $= m_V - m_{bol}$) is 0.35 mag for star A and 0.1 mag for star B. Calculate the luminosity of both stars in solar units ($M_{bol,\odot} = 4.74$ mag).

d) The effective temperature of star A is $T_{eff,A} = 8525$ K and $T_{eff,B} = 9900$ K for star B. Calculate the radii of both stars in solar units ($T_{eff,\odot} = 5780$ K).

e) The binary system ϵ Lyrae consists of ϵ^1 Lyr with $m_1 = 4.82$ mag and ϵ^2 Lyr with $m_2 = 4.77$ mag. The two components cannot be resolved by the human eye. What is the apparent magnitude of the system ϵ Lyrae?

Exercise 2:

Barnard's Star is an orange star in the constellation Ophiuchus. It has the largest known proper motion (motion perpendicular to the line of sight: $\mu = 10.3577"/\text{yr}$) and the fourth largest parallax angle (p = 0.54901"). In the spectrum of Barnard's star, the Hα absorption line is observed to have a wavelength of 656.034 nm when measured from Earth.

a) Determine the radial velocity of Barnard's Star.

b) Determine the transverse velocity of Barnard's Star.

c) Calculate the speed of Barnard's Star through space.