

ASTR 545
SPRING 2010
Homework 1
DUE: August 30, 2010

1. **Morgan-Keenan Spectral Classification:** (a,b)
 - (a) Describe the defining characteristics of the Morgan-Keenan spectral classification method. Why are standards so critical to the method? Be sure to address what characteristics of a stellar spectrum are key to its classification and which are not considered in the classification. Include both spectral class, sub-class (0-9), and luminosity class in your description of characteristics.
 - (b) Briefly describe how the method is applied to observed stars, i.e., you take the spectrum of a star and you want to determine its spectral type as accurately as possible— what steps do you take so that you decide it is a F3 III star for example?

2. **Spectral Classes and Luminosity Classes:** (a,b,c,d)
 - (a) What is the single most important physical macroscopic parameter that defines the Spectral Class of a star? Write out the common Spectral Classes of stars in order of increasing value of this parameter. For one of your Spectral Classes, include the subclass (0-9).
 - (b) Broadly speaking, what are the primary spectral features that define each Spectral Class (you are encouraged to make a small table). How/Why (physically) do each of these depend (change with) the primary macroscopic physical parameter?
 - (c) For an A type star, write the Spectral + Luminosity Class notation for supergiant, bright giant, giant, subgiant, main sequence star, and White Dwarf. From the HR diagram, obtain approximate luminosities and radii for each of these A stars. Present your work as a small table.
 - (d) Qualitative describe how the Balmer hydrogen lines change in strength and shape in these A stars as a function of Luminosity Class.

3. **Spectral Index:** (a,b,c,d) You obtained the spectrum of a given star and now you want to know its $B - V$ index. For this problem you need the filter responses of the B and V Johnson-Cousins filters, the spectrum of your target star and the spectrum of Vega. The spectra are all flux calibrated, f_λ [$\text{erg s}^{-1} \text{cm}^{-2} \text{\AA}^{-1}$]. The required data are given on the class “Topics and Assignments” webpage (under Homework of Section 2).
 - (a) Write the equation for how you would compute the Vega B magnitude of your star. Write a small code to compute B . Hand in your well documented code.
 - (b) Write the equation for how you would compute the Vega V magnitude of your star. Write a small code to compute V . Hand in your well documented code.

(c) Compute $B - V$. Looking at Figure 1.5 from Gray, what is the approximate Spectral Class of your star (though this is NOT how you determine it!)?

(d) If the reddening is $E(B - V) = 0.25$, what is $(B - V)_0$ for your star? How does this change your conclusion about the Spectral Class of your star?