

HW #3

due in my mailbox in TPL by 5 PM Friday, Oct. 7

1. A supergiant star with a mass 10 times that of the sun has a radius 100 times that of the sun, while a white dwarf with a mass equal to the sun has a radius 1/100 as large as the sun's.
 - a) Compare the average densities in these three stars.
 - b) The recombination rate of electrons with positive ions is a *two-body interaction*, and as such, depends on the **square** of the average density. Compare the relative recombination rate in these three stars.

Stretch question: The spectral sequence is basically a temperature sequence based on the relative strengths of particular absorption lines in a star's spectrum. Consider a supergiant and main-sequence star of the same spectral class. What do you predict for the relative absorption-line strengths in these stars from i) an ionized atom, and ii) a neutral atom?

2. The primary mirror of the new *Gran Telescopio Canarias* (GTC) on La Palma consists of 36 hexagonal segments with an equivalent diameter of 10.0 m. The central cassegrain hole has an equivalent diameter of 2.4 m.
 - a) Calculate the percentage of light that would be collected by a full 10 m mirror (without a hole) that is actually lost due to the GTC's cassegrain hole. How much more light could be detected by a telescope with a diameter equal to the hole than could be detected with our main telescope upstairs?
 - b) Calculate the diameter of a full mirror (without a hole) having the equivalent LGP as the actual GTC has.

Plus:

Kutner Ch. 3: Question 9; Problem 10*, 19

Ch. 4: Questions 3, 7; Problems 17, 26

- * • To save you some calculation for problem 10, the energy difference between the first two levels in hydrogen is 10.2 eV.
- Also, the problem incorrectly states the value for g_2 ; it is **8**, not 6. For hydrogen, g for any level n , is $2n^2$.