ASTR121 Homework #11 – (Hamilton)
due Thursday May 8 (15 Points)

Please take some time to do your evaluation of ASTR121 at http://www.courseevalumd.edu

Finishing reading Chapter 26 and try these problems.

35. Estimate the age of the universe for a Hubble constant of (a) 50 km/s/Mpc, (b) 75 km/s/Mpc, and (c) 100 km/s/Mpc. On the basis of your answers, explain how the ages of globular clusters could be used to place a limit on the maximum value of the Hubble constant.

41. Calculate the mass density of radiation (ρ_{rad}) in each of the following situations, and explain whether each situation is matter-dominated or radiation-dominated: (a) the photosphere of the Sun ($T = 5800$ K, $\rho_m = 3 \times 10^{-4}$ kg/m^3); (b) the center of the Sun ($T = 1.55 \times 10^7$ K, $\rho_m = 1.6 \times 10^5$ kg/m^3); (c) the solar corona ($T = 2 \times 10^6$ K, $\rho_m = 5 \times 10^{-13}$ kg/m^3).

42. If a photon from the cosmic microwave background had wavelength λ_0 when it was emitted at a redshift z, its wavelength today is $\lambda = \lambda_0(1 + z)$. (a) Let T be the symbol for the temperature of the cosmic microwave background today. Explain why the radiation temperature was $T_0 = T(1+z)$ at redshift z. (b) What was the radiation temperature at $z = 1$? (c) At what redshift was the radiation temperature equal to 293K (a typical room temperature)?

Must keep reading! You'll need Chapter 27 for these problems.

19. Why is it reasonable to suppose that all space is filled with a neutrino background analogous to the cosmic microwave background?

29. How long can a proton-antiproton pair exist without violating the principle of the conservation of mass?

30. The mass of the intermediate vector boson W^+ (and of its antiparticle, the W^-) is 85.6 times the mass of the proton. The weak nuclear force involves the exchange of the W^+ and the W^- . (a) Find the rest energy of the W^+. Give your answer in GeV. (b) Find the threshold temperature for the W^+ and W^-. (c) From Figure 27-6, how long after the Big Bang did W^+ and W^- particles begin to disappear from the universe? Explain.

Congrats!! You are done with the last ASTR121 Homework EVER!! :)