

Ph 444 Problem Set 3

Due: Friday, October 1, 2010

1. Calculate the critical mass density and its uncertainty using the current best estimate of the Hubble constant, $H_0 = 70.6 \pm 1.8 \text{ km s}^{-1} \text{ Mpc}^{-1}$.
2. The Millennium Galaxy Catalog yields a local luminosity density in galaxies of

$$j = ((1.986 \pm 0.031) \times 10^8 L_\odot \text{ Mpc}^{-3}) \left(\frac{H_0}{100 \text{ km s}^{-1} \text{ Mpc}^{-1}} \right).$$

The dependence on H_0 comes from the use of the Hubble law to calculate distances to galaxies. Calculate the average mass-to-light ratio (M/L) in solar units for galaxies that would be required if galaxies produced the critical mass calculated in problem 1. Also find the uncertainty in this M/L . Compare your value with the value of $M/L \simeq 2 M_\odot/L_\odot$ expected for a “normal” stellar population.

3. Ryden problem 4.4

4. Ryden problem 4.5 Hint: to calculate the pressure you can either start with Ryden equation (4.32) or use the expression for the pressure of a gas of non-interacting particles with number density n , momentum p , and speed v : $P = npv/3$.