Astro 620 Homework 1

1) Explain why the intensity or surface brightness of a galaxy (usually measured in magnitudes per square arcsec or watts per square centimeter or equivalent is nearly independent of its distance (ignore cosmological effects).

2) What is meant by the fundamental plane of elliptical galaxies? What parameters are involved and how are they correlated. With reference to problem 1 state why the observers used surface brightness as one of the parameters.

3) The luminosity function of galaxies is described by the Schecter function (S&G eqs 1.24,1.25 or B&T 1.19,1.19)
        a) $f(L)= (L/L*)^{-a}\exp-(L/L*)$; if a=1.25 show that half the light comes from galaxies with L>0.45L* (incomplete gamma function integral…) see MWB
        b) What fraction of galaxies are brighter than L*, 0.1 L*; what fraction of the light comes from galaxies between 0.5-1.5 L*,.

4) What is the Tully-Fisher relation and what does it imply physically? How does one use it to measure distance. Estimate the distance to a galaxy with velocity width 200km/sec and an apparent magnitude of 14.

5) Since we are into integrals today describe the Sersic formula for the surface brightness of galaxies (B&T 1.17, MBW eq 2.22)
        a) what has one to assume to fit this one dimensional formula
        b) derive eq 2.23 (the Sersic law in magnitudes) for n=1
        c) Integrate the Sersic profile and determine the half light radius (that radius within which half the light is contained) for n=4. Explain how this is used in the fundamental plane.