PROBLEM SET 3

Astronomy 218

DUE: Oct 20, 2009

1. A. For the Schechter function:

\[ \Phi(L) = \left( \frac{\Phi^*}{L^*} \right) \left( \frac{L}{L^*} \right)^\alpha \exp\left( -\frac{L}{L^*} \right) \]

show that the total luminosity per unit volume

\[ l_{tot} = \Phi^* L^* \Gamma(2 + \alpha) \]

where \( \Gamma \) is the gamma function.

B. What galaxy luminosity contributes most to the luminosity of galaxies in the Universe at the present epoch?

2. Two galaxies have the same luminosity \( L \) but one has a de Vaucouleurs surface brightness profile and the other has a Freeman (exponential) surface brightness profile. For which profile is the half-light radius smaller? Do this quantitatively and show what the ratio of half-light radii is.

3. A. Consider a galaxy that has a bulge with a de Vaucouleurs surface brightness profile and a disk with a Freeman profile, with each profile integrated to infinity contributing half of the light. Plot the resulting face-on surface brightness profile as a function of radius. Show any algebraic work you need to solve this problem.

B. Repeat part A for a galaxy where the bulge contributes 20% of the light and the disk 80%. Which galaxy most closely resembles the light profile of NGC 2841?

4. A group of astronomical objects has a differential power law mass distribution, \( dN/dM \) with an index of -2. What can you say about the mass distribution of the objects in this group?