

Ph 444 Problem Set 1

Due: Friday, September 12, 2014

1. Ryden problem 2.2
2. Ryden problem 2.4
3. Ryden problem 2.5
4. As discussed in lecture, the number of galaxies per unit area on the sky as a function of magnitude is one way to test for the homogeneity of the universe. The figure referenced in the “Homework” section of the home page (Figure 17 in Liske et al. 2003, MNRAS, 344, 307) shows the galaxy number counts from the Millennium Galaxy Catalog, which is based on a survey of 37.5 deg^2 along the celestial equator. This figure shows that the counts depart from the expected slope of 0.6 for a Euclidean universe containing a uniform density of galaxies all with the same luminosity.
 - a. Estimate the magnitude, B_{MGC} , at which the counts begin to depart from the Euclidean slope. If the absolute magnitude of a typical galaxy in the B_{MGC} bandpass is $M_B = -19.5$, what is the distance corresponding to your estimated magnitude?
 - b. Use the figure to measure an approximate slope for the counts fainter than the your magnitude limit from part a).
 - c. The departure of the slope from a value of 0.6 could be due to a non-uniform density of galaxies or to a change of galaxy luminosity with distance (or both). Assume that the density of galaxies is constant but that the luminosity of a galaxy changes with distance as $L = L_0(r/r_0)^a$. This is an approximate way to account for the changing apparent luminosities of galaxies due to redshift and/or the evolution of the stars in the galaxies. Repeat the derivation given in class to determine how the galaxy counts will change with magnitude when the luminosity changes in this way and then find the value for the parameter a implied by your measured slope from b).

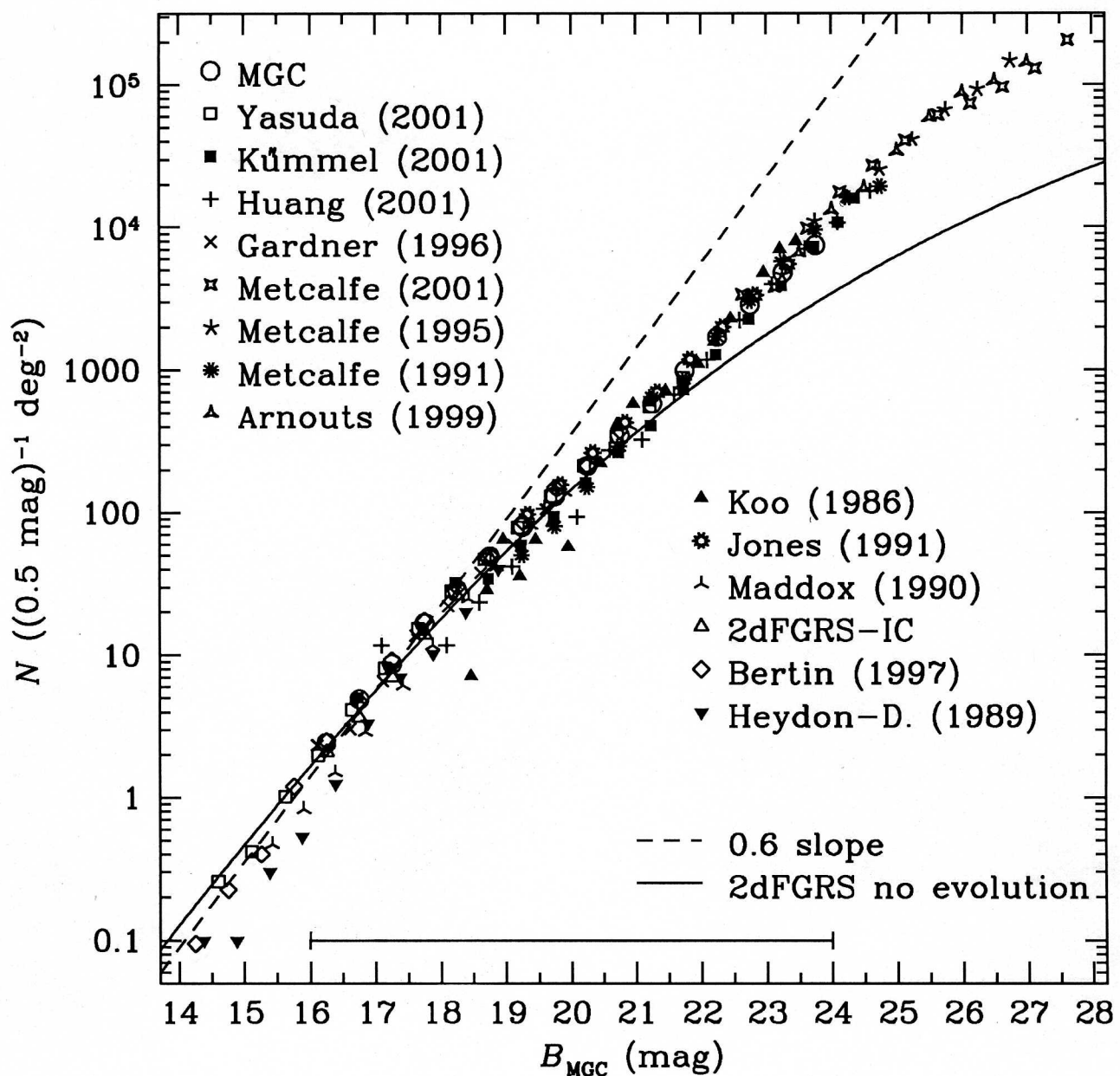


Figure 17. The galaxy number counts derived from the MGC as compared with the number counts of various other authors. The various counts were converted on to the B_{MGC} system assuming $\overline{(B - V)} = 0.94$ (Norberg et al. 2002). The 2dFGRS no-evolution model counts are calculated from the luminosity function parameters given in Table 3 (cf. Section 7.1). Also shown is the 0.6 ‘Euclidean’ slope. This figure is available in colour in the on-line version of the journal on *Synergy*.