

Galaxies and Extragalactic Astronomy

Exercise 4: We carry out a spectroscopic survey of galaxies brighter than $r = 18$. We find 500 galaxies in the area studied. With the survey we obtain the data tabulated in the following file:

data_p04.ascii

where the columns have the following information: 1) apparent magnitude in the r filter; 2) absolute magnitude (M_r); 3) redshift; 4) luminosity distance (Mpc); 5) survey volume to the galaxy redshift (Mpc^3); 6) maximum redshift at which the galaxy would have been observed with the survey magnitude limit; 7) maximum volume (Mpc^3)

1) Calculate and draw a plot of the luminosity function in a non-parametric way using for example 15 bins of 0.5 magnitude width from $M_r = -23.5$ to $M_r = -16.0$

2) Guess just looking at the previous plot the parameters M^* and α of the parametric Schechter luminosity function. If you prefer, you can do a formal fit of the data to a Schechter function and thus get M^* and α .

Help: Schechter function: $\Phi(M) = (0.4 \ln 10) \Phi^* 10^{-0.4 (\alpha+1) (M-M^*)} \exp(-10^{-0.4 (M-M^*)})$

3) Draw a histogram of the absolute magnitudes (M_r) and calculate the median of this distribution and compare it to the value of M^* from the previous point.

4) Draw a histogram of the galaxy redshift distribution and calculate its median. What would be the median redshift if the survey had been limited at $r = 17$?