

Cta200 Project: virtual galaxies

May 3, 2016

For this project, we will use the virtual galaxy catalogues of the Horizon-AGN simulation and plot some statistics. Those catalogues are located on the Horizon cluster and available via ssh.

Reading the catalogues

- a) Find the information about the cosmological parameters used in this simulation (h , Ω_m , etc) together with the redshift of the output 782.
- b) Read the “list_gal_00782.dat” catalogue in `/data52/Horizon-AGN/Catalogs`. How many galaxies are there?

Mass functions

- c) Plot an histogram of the stellar mass (second entry) of galaxies in the output 782.
- d) Overplot the same histogram for two other redshifts in order to see the redshift evolution of the mass distribution.
- e) Read the SFR of each galaxies in the output 782 (list_sfrgal) and build a 2D histogram of stellar mass and sSFR (=SFR (third column) /Mass (fifth column) and can be multiplied by 10^9 to be in units of Gyr^{-1}) similar to Figure 14 of <http://mnras.oxfordjournals.org/content/444/2/1453.full.pdf>.

Two-point statistics

- f) Plot the two-point correlation function of galaxies in the output 782 by counting the pairs of galaxies separated by a given distance.

$$\xi(r_i) = \frac{\text{\#pairs separated by } r_i}{\text{\#galaxies} \times (\text{\#galaxies} - 1)} 2 \times \text{\#bin} \quad (1)$$

where \#galaxies is the total number of galaxies and the separations between galaxies are binned in \#bin intervals from r_0 to $r_{\text{\#bin}}$. Note that the spatial position is encoded in the entry 3 to 5 of list_gal_00782. A naive approach where we look at each pair of galaxies to compute the separation is sufficient here (a more efficient way would be to build a tree). In particular, the size of the bin of separation (i.e the r_i , $i = 1 \dots \text{\#bins}$) has to be carefully chosen so that the plot is not too noisy.

Error bars could possibly be overplotted if there is enough time. In that case, we can divide the catalogue of galaxies in four subsamples, compute the correlation function for the four subsamples and define the error as the standard deviation/ $\sqrt{4}$.