

Correlation of Radial Fluctuations in Deep Galaxy Surveys

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Fluctuations of the number of galaxies in different catalogs are compared using the method of estimation of sizes and amplitudes of the radial fluctuations for different redshift bins. The Pearson correlation coefficient of fluctuations derived for these samples has the value $\rho = 0.7 \pm 0.12$ for the redshift interval $0.1 < z < 1.7$. This correlation of independent surveys of different research groups confirms the existence of super-large galaxy structures with sizes up to 1000 Mpc/h.

1 Statement of the problem

Determination of the maximum size of large-scale inhomogeneities in the distribution of galaxies is one of the most important problems in the modern observational cosmology.

For example, the Sloan Digital Sky Survey shows that at small redshifts there are inhomogeneity structures with a size of 400 Mpc/h. This work shows that there are similar and larger structures on large redshifts in the beam surveys. These structures should be correlated in the same fields in independent surveys of different research groups.

2 The method

Estimation of the fluctuation amplitude and size within galaxy distributions method (Fig. 1) was first proposed in [1] and modified in [2]. The left panel of the figure illustrates the wide-angle (CfA, 2df, SDSS) and beam (zCOSMOS, UVISTA, ALHAMBRA) surveys. The right panel shows the visible and model (uniform) galaxy distributions for the beam survey. The gray areas indicate the fields of deficiency or excess of the galaxy number. The fluctuation amplitude is a ratio of the visible galaxy number to the model galaxy number. The fluctuation size is a distance between the zero intersections of fluctuations with different signs.

The compared catalogs are as follows: ALHAMBRA [3], UltraVISTA [4], 10k-zCOSMOS [5], XMM-COSMOS [6], and HDF-N [7].

Table 1 shows the Pearson correlation coefficient ρ , its error σ_ρ , and its authenticity R from Student's table that were used to indicate the catalogs correlation.

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Table 1: Correlation coefficients

| The catalogs pair | ρ | σ_ρ | R |
|---------------------|--------|---------------|-------|
| ALH-F4 & XMM-COSMOS | 0.82 | 0.29 | 0.975 |
| ALH-F4 & UVISTA | 0.59 | 0.36 | 0.9 |
| ALH-F4 & zCOSMOS | 0.58 | 0.2 | 0.995 |
| ALH-F5 & HDF-N | 0.61 | 0.21 | 0.99 |

3 Results

In the deep COSMOS field there are fluctuations of the number of galaxies on the redshift $z \sim 2$ with the amplitude of 20% and the linear dimensions varying from 500 to 1500 Mpc.

The independent beam surveys of the COSMOS field are consistent in both the amplitudes and the linear dimensions of inhomogeneities with the correlation coefficient equal to 0.7 ± 0.12 .

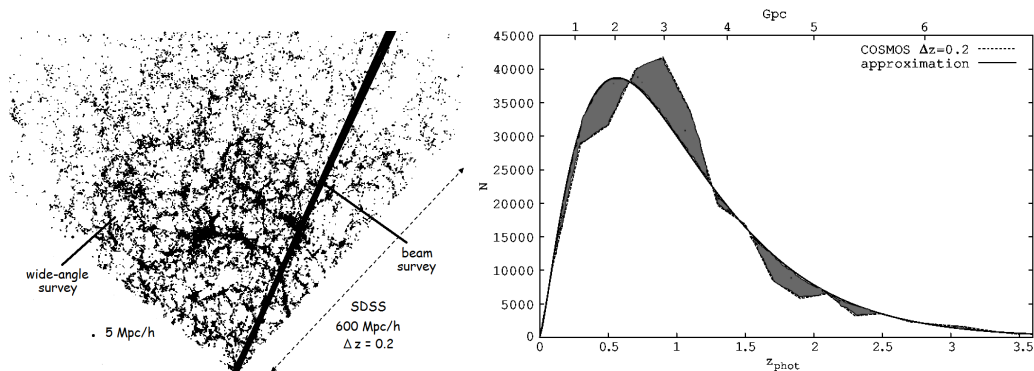


Figure 1: The method illustration.

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