Galaxies at High Redshift and Their Evolution Over Cosmic Time
Proceedings IAU Symposium No. 319, 2015
S. Kaviraj, ed.

doi:10.1017/S1743921315010820

Spatial distribution of GRBs and large scale structure of the Universe

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Abstract. We studied the space distribution of the starburst galaxies from Millennium XXL database at $z = 0.82$. We examined the starburst distribution in the classical Millennium I (De Lucia *et al.* (2006)) using a semi-analytical model for the genesis of the galaxies. We simulated a starburst galaxies sample with Markov Chain Monte Carlo method. The connection between the large scale structures homogenous and starburst groups distribution (Kofman and Shandarin 1998), Suhhonenko *et al.* (2011), Liivamägi *et al.* (2012), Park *et al.* (2012), Horvath *et al.* (2014), Horvath *et al.* (2015)) on a defined scale were checked too.

Keywords. methods: data analysis, methods: numerical, methods: n-body simulations, galaxies: structure, cosmology: observations, gamma rays: observations

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We found a relationship between the starburst galaxies and the dark matter density distribution in Millennium I. We determined the Millennium I and Millennium XXL galaxy bias function to SFR galaxies from dark matter density: $\log_{10}(f_{gal}) = 0.91\rho_{DM} - 9.42$.

We simulated a starburst galaxies sample with Metropolis-Hastings Markov Chain Monte Carlo method. Groups with a characteristic size of 280 Mpc can be detected with a sufficiently large sample (Table 1.): samples above $N = 10000$ significantly differ from the completely spatially random (CSR) case. Note that this size is consistent with the cosmological principle and more than six times smaller than the GRB ring from Balazs *et al.* (2015). It may indicate that the spatial distribution displayed by the galaxies in general is not necessary identical with that shown by the GRBs. Consequently, if the XXL simulation correctly represents the large scale structure the GRBs reveal it as CSR on the scale corresponding to the sample size.

Table 1. Mean distances to the $k = 12^{th}$ nearest neighbor of star forming galaxies at different sample sizes in the MXXL simulation.

Sample size	Mean dist. [Mpc]	probability of CSR
1000	627	0.39
5000	351	0.71
10000	**277**	$\mathbf{< 2.2 \times 10^{-16}}$
20000	**217**	$\mathbf{< 2.2 \times 10^{-16}}$

Acknowledgement

This research was supported by Hungarian OTKA grant NN111016. The Millennium Simulation were constructed as part of the German Astrophysical Virtual Observatory and the "Galformod (Galaxy Formation Models)" project.

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https://doi.org/10.1017/S1743921315010820 Published online by Cambridge University Press