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

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.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Mean dist. [Mpc]</th>
<th>probability of CSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>627</td>
<td>0.39</td>
</tr>
<tr>
<td>5000</td>
<td>351</td>
<td>0.71</td>
</tr>
<tr>
<td>10000</td>
<td>277</td>
<td>$&lt; 2.2 \times 10^{-16}$</td>
</tr>
<tr>
<td>20000</td>
<td>217</td>
<td>$&lt; 2.2 \times 10^{-16}$</td>
</tr>
</tbody>
</table>

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References