The Origin of the One Peak in Globular-Cluster and Three Peaks in the Dwarf-Galaxy Mass Function

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Abstract: The reviews of McLaughlin (2003) and of Brodie and Strader (2006) show that the globular cluster mass function in present-day galaxy halos is approximately log-normal with a peak log M = 5.3, where M is expressed in solar masses. On the other hand, our investigation of distribution of disc masses of dwarf spiral galaxies (we used the 36 objects selected by Karukes et al. (6 January 2017)) leads to 3 peaks for log M = 8.017, 7.415 and 6.813. Here, applying the Scale-Symmetric Theory (SST), we showed the origin of such quantization of masses of discs and globular clusters within one coherent model. The peaks follow from the initial large-scale structure of the Universe described within SST.

1. Introduction

The Scale-Symmetric Theory (SST) shows that the very strong short-distance quantum entanglement between the carriers of gluons in nucleons protects their cores from a collapse to a singularity [1]. It leads to conclusion that the black holes (BHs) consist of the neutron black holes (NBHs) and each NBH has mass $f = 24.81$ times greater than the Sun i.e. $M_{NBH} = f\, M_{Sun}$ [2].

Due to the four-object symmetry, NBHs were and partially still are grouped in larger structures [2]. Number of entangled objects in a system is quantized [2]

$$D_{n,S} = 4^d \text{ (for single objects),} \tag{1a}$$

$$D_{n,B} = 2 \cdot 4^d \text{ (for binary systems),} \tag{1b}$$

where for flat/disc-like structures is $d = 0, 1, 2, 4, 8, 16\ldots = 0, 2^n$, where $n = 0, 1, 2, 3, 4, 5,\ldots$ whereas for chains is $d = 3, 6, 12$ [2].

The cosmic structures composed of the NBHs we refer to as follows:

$d = 0$ is for single object,
$d = 1$ is for group,
$d = 2$ is for supergroup,
$d = 4$ is for cluster,
$d = 8$ is for supercluster,
$d = 16$ is for megacluster (the protogalaxies in the early Universe were the megaclusters of NBHs; baryonic mass of each such protogalaxy was $M_{Protogalaxy} = 4^{16} f M_{Sun} = 1.0656 \cdot 10^{11} M_{Sun}$ [2]),
$d = 3$ is for chain,
$d = 6$ is for superchain,
$d = 12$ is for megachain (baryonic mass of each megachain was $M_{Megachain} = 4^{12} f M_{Sun} = 4.1624 \cdot 10^{8} M_{Sun}$).

When gravity dominates then the associations containing smallest number of objects (of course apart from the trivial case $d = 0$) appear most often. Since pairing of cosmological objects is common so very important are objects containing four binary systems – from (1b) we obtain $D_{n=1,B,Typical} = 2 \cdot 4^1 = 8$ constituents. For example, in the CMB we observe an octopole [3].

The above remarks suggest that initially the typical baryonic mass of massive disc galaxy was [4]

$$M_{Initial} = 8\, M_{Protogalaxy} = 2 \cdot 4^{17} f M_{Sun} = 8.5247 \cdot 10^{11} M_{Sun} . \quad (2)$$

Emphasize that there were 8 seeds.

The globular cluster (GC) mass function in present-day galaxy halos is approximately log-normal with a peak $\log M_{GC,peak}\, [M_{Sun}] \approx 5.3$ i.e.
$M_{GC,peak}\, [M_{Sun}] \approx 10^{5.3} M_{Sun} = 2.00 \cdot 10^5 M_{Sun}$ [5].

2. Quantization of baryonic masses of discs of dwarf spiral galaxies

Our investigation of distribution of baryonic masses of discs of dwarf spiral galaxies (we used the 36 objects selected by Karukes *et al.* (6 January 2017) [6]: Table 3, column 2) leads to 3 peaks for $\log M_{Now,discs}\, [M_{Sun}] = 8.029$, 7.421 and 6.806.

Among the 36 objects there are 17 with disc masses within following interval <5.53, 16.0>$\cdot 10^7 M_{Sun}$ with the mean equal to $10.68 \cdot 10^7 M_{Sun}$ but 10 from the 17, i.e. 59%, have masses within <8.03, 12.0>$\cdot 10^7 M_{Sun}$ i.e. within interval 2.6 times narrower. Notice that $\log 10.68 \cdot 10^7\, [M_{Sun}] = 8.029$.

Among the 36 objects there are 12 with disc masses within following interval <1.53, 4.19>$\cdot 10^7 M_{Sun}$ with the mean equal to $2.637 \cdot 10^7 M_{Sun}$ but 6 from the 12, i.e. 50%, have masses within <2.19, 2.77>$\cdot 10^7 M_{Sun}$ i.e. within interval 4.6 times narrower. Notice that $\log 2.637 \cdot 10^7\, [M_{Sun}] = 7.421$.

Among the 36 objects there are 7 with disc masses within following interval <0.33, 1.02>$\cdot 10^7 M_{Sun}$ with the mean equal to $0.639 \cdot 10^7 M_{Sun}$. Notice that $\log 0.639 \cdot 10^7 [M_{Sun}] = 6.806$.

Emphasize that the used sample was not selected by author of this paper.

3. The origin of the 1 peak for galactic cluster and of the 3 peaks for discs of dwarfs

The inflows of dark matter and next of dark energy into the protogalaxies [2] caused that there were separated the megachains of NBHs with a mass of $M_{Megachain} = 4^{12} f M_{Sun} = 4.1624 \cdot 10^8 M_{Sun}$. Due to the four-object symmetry, such megachains decayed to 4^1 or 4^2 or 4^3 or 4^4 parts

$$M_{Now,disc,\mathrm{n=1,2,3}} = M_{Megachain} / 4^{\mathrm{n}} , \quad (3)$$

where $n = 1, 2, 3$ for the present-day discs of dwarf galaxies, and

$$M_{Initial,GC,\mathrm{n=4}} = M_{Megachain} / 4^{\mathrm{n}} , \quad (4)$$

where $n = 4$ for the initial mass of the GCs. Since there was 8 seeds in the initial most massive protogalaxy with a mass of $M_{Initial} = 8 M_{Protogalaxy} = 8.5247 \cdot 10^{11} M_{Sun}$ so the $M_{Initial,GC,\mathrm{n=4}}$ decayed to 8 parts

$$M_{Now,GC} = M_{Initial,GC,\mathrm{n=4}} / 8 . \quad (5)$$

From (3) we obtain

$M_{Now,disc,\mathrm{n=1}} = 4^{11} f M_{Sun} = 10.41 \cdot 10^7 M_{Sun}$ so $log\ 10.41 \cdot 10^7 [M_{Sun}] = 8.017$.

$M_{Now,disc,\mathrm{n=2}} = 4^{10} f M_{Sun} = 2.602 \cdot 10^7 M_{Sun}$ so $log\ 2.602 \cdot 10^7 [M_{Sun}] = 7.415$.

$M_{Now,disc,\mathrm{n=3}} = 4^{9} f M_{Sun} = 0.6504 \cdot 10^7 M_{Sun}$ so $log\ 0.6504 \cdot 10^7 [M_{Sun}] = 6.813$.

We can see that obtained results are very close to results obtained from observational data which are presented in Paragraph 2.

From (5) we obtain

$M_{Now,GC} = 2 \cdot 4^6 f M_{Sun} = 2.032 \cdot 10^5 M_{Sun}$ so $log\ 2.032 \cdot 10^5 [M_{Sun}] = 5.308$.

This result as well is very close to observational data [5].

4. Summary

Here, applying the Scale-Symmetric Theory (SST), we showed the origin of the quantization of the present-day masses of discs of dwarf galaxies and of the present-day masses of globular clusters within one coherent model. The peaks follow from the initial large-scale structure of the Universe described within SST.

SST shows that the mainstream cosmology needs a revision.

References

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