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Once More About g. Gamow's "Fireball"

Poghosyan, S. S.*

Yerevan, Armenia

***Corresponding author:** Poghosyan, S. S., Yerevan, Armenia.

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The article presents a new hypothesis that the theory of Gamow's "Fireball" does not refer to our universe or the Metagalaxy, it refers to the main structural unit (component) of the Metagalaxy - superclusters of galaxies.

To my mind, each supercluster of galaxies is a separate, autonomic component of the large-scale structure of our Metagalaxy (MG). Any supercluster of galaxies emerges and develops as one, united physical system. Consequently, if superclusters are expanding today, they used to be compressed, in a compact state, with high density and temperature in the past. And really, if standard cosmological model (SCM) views the expanding universe as compressed and extremely dense in the past, why could not superclusters of galaxies (which, as specialists believe, are subject to the Hubble expansion), too, were regarded as extremely compressed, extremely dense and hot in the past?

This hypothesis of mine contradicts to the SCM but fully corresponds to the concept of Gamow's "Fireball" (to the requirements of the recombination of hydrogen in the adiabatically expanding volume).

What are my bases for claiming that superclusters of galaxies are autonomic, separate physical systems with their unique physical parameters (characteristics), composition, special laws of change and development:

a) On scales larger than 100 Mpc the Metagalaxy is homogeneous and is inhomogeneous on smaller scales [1,2]. It is confirmed by astronomical observations of homogeneous distribution of superclusters of galaxies: there are approximately 100 superclusters of galaxies in the volume of $V = (10^{27}\,cm)^3 = 10^{81}\,cm^3$ [3]. Consequently, their number reached about $N_{c.c.} = 10^5$ in the Hubble volume $\left(V_{mg.} = 10^{84}\,cm^3\right)$. The background scanning of CMB found out that the first peak of intensity corresponds to 1^0 and is connected with the concentration of baryons on these scales of space – the more the concentration, the higher the peak of intensity [4]. It is therefore not accidental that the first peak corresponds to the spatial scale of superclusters of galaxies-10^{26}cm. On larger scales, more than 100 Mpc., the fluctuations of RR are not strong, which, too, attest that on larger metagalactic scales superclusters of galaxies are distributed homogeneously and there are not physical systems larger than superclusters of galaxies in the Metagalaxy. Thus, the commonly accepted fact that the Metagalaxy is homogeneous on large scales is determined by the very even and homogeneous distribution of superclusters of galaxies in the Metagalaxy.

b) Let us compare the above mentioned with the following obvious and commonly accepted fact (established through observations and accepted by everyone)–on spatial scales smaller than 100 Mpc., the Metagalaxy is strictly inhomogeneous: there are vacuums and vice versa high concentration of matter here and there. The latter are mainly superclusters of galaxies while the first ones are voids formed between them. As gravitational grouping and clusterization is typical of only dark matter and baryonic matter, they are mainly concentrated in superclusters of galaxies in the Metagalaxy. As it was discovered in the last two decades ago, dark matter is distributed in galaxies, clusters of galaxies and superclusters in a spherical-

symetric way, according to the laws of $M(R) \propto R$ and $\rho \propto \frac{1}{R^2}$ [5]. This means that there is not dark matter beyond superclusters of galaxies. "Quite a big contrast in density implies a gravitational coupling of supercluster (Ursa Major) on the whole... The supercluster Ursa Major is sufficiently isolated system" [6]. A striking example of the disconnection is the recently discovered supercluster of galaxies of Laniakeya [7].

All the mentioned enables us to claim that though **superclusters of galaxies are subject to Hubble expansion, they are all the same separate, autonomic and complete physical systems.** This means that superclusters of galaxies used to be more compressed and compact with high density and temperature.

Let us do a mental experiment: let us compress the contemporary superclusters so much as to make their present radius - $R_{s.g.} = 10^{26}\,cm$ decrease 10^3 times, i.e. Friedmann's cosmological model will be used in relation to contemporary galaxies, preserving $m_{s.g.} = \rho V = const.$ It means that the number of protons in superclusters of galaxies does not change in course of time – $N_{p(s.g.)} = 10^{72} = const,$ does not change the number of relic photons – $N_{\gamma(s.g.)} = V_{s.g.} \cdot n_{\gamma} = 10^{81(2)} = const$ in the volume of superclusters $(V_{s.g.} = 10^{79}_{cm^3})$, too, from which follows $S = \frac{N_{\gamma}}{N_p} = 10^{10} = const.$

So superclusters of galaxies in a compressed state, when $R_{s.g.} = 10^{23}_{cm}$, have an average density - $\rho_{s.g.} \approx 10^{-21}_{\frac{g}{cm^3}}$, and temperature - $T_{s.g.} = 3 \cdot 10^3\,K.$

That is to say all the conditions for Gamow's "Fireball" are present: a) There is the adiabatically expanding volume of the plasma with the corresponding requirements - $m = \rho V = const$, $S = \frac{N_{\gamma}}{N_p} = const$, $R_{s.g.} \sim r \sim \frac{1}{T}$ and so on.

b) The condition for the recombination of hydrogen – $\rho_{s.g.} = 10^{-21}_{\frac{g}{cm^3}}$, $T_{s.g.} = 3 \cdot 10^3\,K.$

What prevents us from accepting and acknowledging that in the past (at $z = 10^3$) in the condition of Gamow's "Fireball" were precisely these proto superclusters of galaxies, each of them has undergone that phase of evolution (but not together and simultaneously) and not our universe or Metagalaxy, as SCM states.

Let us compare these two models of "Fireball" to find out which of them is superior and which is closer to reality.

"Fireball"- Universe (SCM)	"Fireball" – Proto-superclusters of galaxies (our model)
$m_{Un} = 10^{55(6)}_{g} = const.$ $R_{Un} = 10^{25}_{cm}$ $\rho_{Un} = 10^{-21}_{\frac{g}{cm^3}}$ $T_{Un} = 3 \cdot 10^3\,K$ $t_{Un} = 1{,}2 \cdot 10^{13}_{c}$ - time of recombination $E_{Un} = 10^{76(7)}_{erg} = const.$ $\varepsilon_{Un} \approx 1_{\frac{erg}{cm^3}}$ $L_{Un} = 10^{63}_{\frac{erg}{c}} >> L_{pl} = \frac{c^5}{G}$	$m_{s.g.} = 10^{48}_{g}$ $R_{s.g.} = 10^{23}_{cm}$ $\rho_{s.g.} = 10^{-21}_{\frac{g}{cm^3}}$ $T_{s.g.} = 3 \cdot 10^3\,K$ $t_{s.g.} = 1{,}2 \cdot 10^{13}_{c}$ $E_{s.g.} = 10^{69}_{erg}$ $\varepsilon_{s.g.} = 1_{\frac{erg}{cm^3}}$ $L_{s.g.} = 10^{56}_{\frac{erg}{c}} << L_{pl} = \frac{c^5}{G} = const.$
$R_{Un} << R_{g}$ $R_{Un} >> ct_{Un}$	$R_{s.g.} > R_{g}$ $R_{s.g.} = ct_{s.g.}$
$m_{Un} = 10^{55(6)}_{g}$ the whole mass of the universe emerged at the very beginning of the expansion (before and after inflation) and remains unchanged before and after recombination.	The mass of superclusters of galaxies does not change after the recombination.

This comparison shows the absolute superiority the suggested model of the "Fireball", superclusters of galaxies, and its correspondence to reality.

Thus:

1. Firstly, the Friedmann-Gamow model presupposes that in the period of recombination the radius of the expanding volume of the plasma, i.e. the radius of the universe is $R_{rec} = 10^{25}_{cm}$, which means: a) the mass of the universe changed and took the corresponding gravitational radius- $R_{Un(rec)} << R_{Un(g)}$, i.e. the universe turned into a black hole, i.e. recombination processes are out of the question, b) $R_{Un(rec)} >> ct_{Un(rec)}$, which is an insuperable controversy for the Friedman's basic model, too.

In the suggested model of us, the radius of the expanding volume of the plasma, i.e. the radius of the compact proto supercluster of galaxies is $R_{s.g.(rec)} = 10^{23}_{cm}$, which is greater than the gravitational radius - $R_{s.g.(rec)} = 10^{23}_{cm} > R_{s.g.(g)} = 10^{20}_{cm}$ and at the same time - $R_{s.g.(rec)} = ct_{s.g.(rec)}$.

2. Secondly, SCM implies that during recombination $L_{rec} = \frac{E_{Un}}{t_{rec}} = \frac{10^{76}_{erg}}{10^{13}} = 10^{63}_{\frac{erg}{c}}$, which is much greater than the marginal luminosity existing in nature, so I mean the Plank value of luminosity- $L_{pl} = \frac{c^5}{G} = 3 \cdot 10^{59} = const.$ In our model $L_{rec} = 10^{56}_{\frac{erg}{c}} << L_{pl} = \frac{c^5}{G}$ and consequently, it is more realistic. By the way, during a comparatevly short period of the recombination, as it is known, the great deal of thermal energy ($E_{s.g.} = 10^{69}_{erg}$) is realesed, which leads to the great explosion of the compact proto-superclusters of galaxies. Apparently the assumption of the Nobel laureate - Hannes Alfvén is confirmed, that Big explosions were many times in our universe or in Metagalaxy.

3. And at last, thirdly: on the problem of the mass of the plasma subject to recombination. How to determine the numerical value of m_{rec}? Friedmann's hypothesis stipulates – $m = \rho V = const.$ It is a working idea, but we have no experimental basis to use this idea in relation to our universe or the Metagalaxy, meanwhile we have a definite basis to use it in such astrophysical systems, as superclusters of galaxies. The Friedmann-Gamow theory of the "Fireball", on condition that $m = \rho V = const.$, is true in relation to superclusters of galaxies, as confirmed by the following well-known law -

$$\frac{L_{rec}}{4\pi R^2_{rec}} = \sigma T^4_{rec} = \frac{m_{rec}}{t^3_{rec}}.$$

It follows from this that the mass of the plasma, subject to recombination, is equal to $m_{rec} = \sigma T^4_{rec} \cdot t^3_{rec} = 10^{48}_{g}$, if we put into the equationonly two quantities, characterising physical processes of the neutral recombination of hydrogen, accepted by all specialists –

$$T_{rec} = 3 \cdot 10^3 K,$$
$$t_{rec} = 10^{13}_{c}$$

Thus it becomes clear, that the contemporary cosmological understandings (SCM) about the epoch of the recombination does not correspond to reality. Recombination of hydrogen gas could not take place throughout the whole volume of our universe. Because of different reasons many researchers have sought **local sources** of background microwave radiation (relic radiation), but such investigations were carried out mainly in the frames of the stationary cosmological model. We managed to find a model of the local source of the relic radiation, which proceeds from the cosmological model of the expanding universe and corresponds to it. But our new concept about the recombination epoch is based on a new, GchU cosmological model of the universe with a strictly flat space [8]. This theory changes our understanding about our universe and its subsystem–the Metagalaxy.

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