Observational Aspects of the Metagalaxy’s Structure

Rezo Natsvlishvili and Nino Kochiashvili

E. Kharadze Abastumani Astrophysical Observatory, Ilia State University, Georgia; rezo@iliauni.edu.ge

Abstract. We are considering the changes of the structure of the Metagalaxy from its most distant, observable edge to the nearest space in the framework of the model, in which the presumption made that the large scale objects in the Universe have disposable origin. On the basis of this model, the nearest galaxies go through evolutionary phases of objects of different status according to the distance. In the case of this model the quasars are the earlier evolutionary stages of the galaxies. On the assumption of observations, in the large scales, the Universe instantly or in every moment of time is homogeneous and isotropic. The observed space of Metagalaxy is isotropic but it is homogeneous only spherical-concentrically. The method is considered how it is possible to estimate the age of the Metagalaxy using the redshifts of objects located at different distances.

1. Introduction

Real understanding of the cosmogonic hierarchy of the Universe is the basis of investigation of structure and evolution of the Metagalaxy. This could be reached using comparison of the astronomical observational data. The possibility to observe objects on different evolutionary stages due to distance, contemporaneously, made it possible to give chronological picture of their development according to distance and see the evolutionary changes of structural formations. Discovery of the Hubble Law made it possible to investigate dynamical evolution of the Universe.

By using the modern powerful observational facilities we have a possibility gradually to recover evolutionary structural changes from today situation to the Big-Bang moment. Durable effort of astronomers is needed for finding reality in the cosmology. However, the tendency of development of astronomy and further prospect have revealed true directions for research for understanding of the essence of the Universe evolution. This helps us by means of future appropriate observations, to single out from alternative hypothesis the most acceptable one and chose a logical direction of the research.

The cosmological model of the Universe could be build up in consequence of existing physical laws and pure mathematical considerations. But without certain conformity with astronomical objects and phenomena it cannot create an adequate picture of the Universe structure and evolution. Every cosmological model can turn into the object of versatile criticism if it does not conform with observations. A model can acquire a refined form by its comparison only with unbiased observational data and bringing into accord with them.
2. On the Evolutionary Hierarchy of the Metagalaxy

Based on Einstein General Relativity Theory (Einstein 1917) the idea about expansion of the Universe begins from Friedmann’s prediction (Friedmann 1922, 1924) and is confirmed with the discovery of Hubble Law \( v = Hr \) (Hubble 1929). Because of the expansion, from the moment of the Big Bang in the Universe, on average, a gradual transition of matter from more dense state to the less one takes place. If the expansion is characterized by Hubble constant, as a constant it characterizes the Universe only instantly, because of variation of the Universe expansion rate after Big Bang, the Hubble constant varies with time \( H = H(t) \). If we had been able to observe the whole Universe simultaneously, then would have established the present value of the Hubble constant \( H_0 \). But to observe the whole Universe simultaneously is impossible. On the other hand it is possible to observe the objects located on different distances in the Metagalaxy space, in different epochs of the real time, or we are observing the Metagalaxy areas and objects simultaneously on different evolutionary stages. Therefore, we are getting possibility to trace the structural characteristics and evolutionary changes of the areas around us located on different distances from the remotest objects of the Metagalaxy through the all stages up to the present epoch. So, our nearest objects represent the nowadays versions of formations of earlier epochs.

As seen from observations, the same type objects do not situated on quite different distances. As, for example, quasars do not observed on near distances and galaxies do not exist on the distances corresponding to quasars. Therefore the suggestion about the disposable origin of the large scale, different evolutionary state objects of the Universe is logical and of the same type objects do not originate on different epochs. So for the moment neither galaxies nor quasars originate. Quasars represent early evolutionary stage of galaxies. More distant objects than quasars, or the formations with higher redshifts could not be galaxies, though they are called the most distant galaxies. Objects with the higher redshifts than the \( z \) of quasars, are proto-quasars. Quasars are a kind of compact objects and it is logical to presume earlier evolutionary stage. If the more distant objects then quasars have any structure it does not mean that they are objects like galaxies. If these structural formations are characteristic of the highest \( z \) objects, then it is logical to suppose that the proto-quasars have tremendous intrinsic nonstability than quasars and the observed structures are the result of the ejection of matter from proto-quasars. Even earlier state of proto-quasars should be searched in “formations” which are creating the 3K microwave radiation (Penzias 1965). For that we think that the term “relic” is inappropriate, as the radiation of quasars and proto-quasars is also relic. In reality, in today’s era they already do not exist, as well as galaxies do not exist in the epoch of proto-quasars and quasars.

Thus should be strictly separated observed picture of the early Universe and of the nowadays real Universe (Metagalaxy). As the space around us in the large scales is isotropic, it does not mean that the observable Universe is homogenous. In reality, the Universe (Metagalaxy) is homogenous and isotropic in each moment. But the observable Universe is isotropic but not homogenous. The Universe is homogenous only spherical-concentrically. Spherical-concentrically manifested the Universe’s (Metagalaxy) evolutionary changes from the Big Bang to the today’s era.

If trace the Universe spherical-concentrically due to the increasing of distance, or according to the increasing of the \( z \), then we could reproduce the picture of the structural-dynamical development from the epoch of the Big Bang to today.
As quasars represent objects of the earlier evolutionary epoch then galaxies, so the nearest galaxies should be the oldest formations in the Universe. The big difference exists between the physical parameters of quasars and nearest galaxies. So it is logical that between the types of these objects should be intermediate objects. We think that these intermediate objects mainly differ by evolutionary state; it means they differ by redshift and are intermediate between quasars and nearest galaxies. Which is confirmed by the distribution of these objects on diagram “redshift-visible magnitude” Fig.1 (Natsvlishvili 2002). These are: Lacertae objects, Radiogalaxies, N-Galaxies, Seyfert galaxies, galaxies with ultraviolet excess, galaxies with dense nuclei - cerns, compact galaxies, on the whole, galaxies with active nuclei and other type galaxies which are anomalous by different physical parameters.

Figure 1. The dependence of Redshift vs apparent Magnitude for the extragalactic objects. There are objects with known redshifts (Veron-Cetty 1998; Huchra 1996; Wei 2000; Fan 2000; Schneider 2001; Fan 2001) on the diagram: Quasars, Lacertae objects, Seyfert galaxies and galaxies - about 36930 objects altogether. This sequence of objects is represented on the diagram from high to low redshift (z).

On Fig.1 it is evident that quasars have the highest absolute luminosity. It is logical to suggest that they should be also the most massive objects, because they represent more earlier evolutionary stage of the galaxies and during the evolution to the galaxies they have to losing huge mass in the form of radiation, if not talk about the direct losing
of matter. It is also noteworthy, that as higher $z$ objects are revealing for today, so the tendency of increase of their absolute luminosity is outlined. This also strengthens the version of the disposable origin of objects in the Universe.

So quasars represent not the non-stationary nuclei of distant galaxies but they represent the earlier evolutionary stage of galaxies and they have exact place in the Metagalaxy, different from other objects.

3. On the Age of the Metagalaxy and the Universe

As the state of an object on the certain $r$ distance represents its appearance for the fixed time moment of the real time, taking into account the scale factor for the each time moment the Hubble constant is: $H(t) = \frac{1}{t} \cdot \frac{dt}{dR}$. So the recessional velocity according to the Hubble law is a function of distance: $v(r) = H(r) \cdot r$. Consequently, the difference between the ages of the objects located on the boundary of the Metagalaxy and the nearest ones, which we can consider as the age of the Metagalaxy, should be:

$$
\Theta = \int_0^R \frac{dr}{v(r)}
$$

where $R$ is the radius of the Metagalaxy (Natsvlishvili 2002). This relationship should be precise in case of knowing the functional expression for $v(r)$.

The $T$ age of the Universe should be the age of objects on $R$ distance $\Psi$, plus the age of the Metagalaxy: $T = \Theta + \Psi$.

If we take into account the relationship between the recesional velocity $v(r)$ and $z(r)$ redshift, for the age of the Metagalaxy we have (Natsvlishvili 2010).

$$
\Theta = \frac{1}{c} \int_0^R \left[ 1 + \frac{2}{z^2(r) + 2z(r)} \right] dr
$$

When using 2 relationship, the estimation of distance to the objects is problematic, because of the evolutionary changes the absolute standards of the luminosity should not to be exist, especially for a model of the Universe where the process of origin and development of objects is disposable.

Due to the growth of space of the Metagalaxy its age also will grow and it will gradually approach to the age of the Universe.

4. Conclusion

On the basis of the observational facts we consider that the chronological picture of the Universe’s evolution should be got using structural-dynamical changes of the spherical-concentrical located from us areas and objects. In such a hierarchy of the Universe the origin of the similar objects is disposable process and not occurs on the different evolutionary stages of the Universe. In such a model of the Universe, quasars represent earlier evolutionary stage of galaxies and are the objects of rather different evolutionary status than are galaxies. This version strengthened by the fact of not existence of quasars in near space and by not existence of galaxies in the distances where quasars
are located. The evolutionary phases of the objects of the Universe are determined by their redshifts or distances. With the growth of the objects’ redshifts their corresponding ages, the time interval from the Big Bang to the epoch of their modern observable types, diminish.

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