Radiophysical Research Institute, Nizhny Novgorod
Higher Education State Committee of Russia

P r e p r i n t N 400

EVIDENCE AGAINST THE COSMOLOGY OF BIG BANG

Troitsky V.S.

Nizhny Novgorod 1994

T r o i t s k y V. S.

EVIDENCE AGAINST THE COSMOLOGY OF BIG BANG

Cosmological tests show, that the generally accepted Big Bang model is imperfect. The experimental data correspond to the static model of the Universe, where the red shift is defined by the gravitational shift of the frequency and the microwave background radiation - by the thermal emission of stars in infinite Universe.

Подписано в печать 30. 05.94 г. Формат 60 x 84/I6
Бумага писчая. Печать офсетная. Объем 0,73 усл.п.л.
Заказ 54I6. Тираж 80

Отпечатано в фирме "Уни-принт"

I. INTRODUCTION

To proof the cosmological theory a comparison is used between the observed and theoretical dependences of the apparent luminosity m(z) and the angular dimension Θ(z) of galaxies on the red shift z. The result of the comparison must be the experimental definition of the distance function up to the galaxies $R(z,q_o)$, which is predicted by the theory. For this purpose a method was used for half a century in building m(z) depencence over galaxies of standard luminosity (the method of "standard candle"), and for building Θ(z) - the galaxy of standard dimension (the method of "standard line"). Galaxies of the standard luminosity were usually selected from the first ranked galaxies in clusters and that of the standard dimensions - from binar radio galaxies and radio quasars. As it was shown in the detailed surveys by Burbidge, 1989 /1/ and Baryshev,1992 /2/, these methods by the present time did not solve the problem and verification of the theory appears to be in a deadlock. The reason of the failure is ignoring the statistical nature of m(z) and log Θ(z), which at each z are subordinated to the normal law of distribution. The galaxies selected according to the above criteria are at arms of the Gaussian distribution and thus, cannot provide a single-valued choice. Such objects are uncommon, exotic objects, which do not represent the basic population of the Metagalaxy. They are likely the subject of strong evolution of luminosity and dimensions not taken inte consideration in the above method of selection. Under these conditions, when m(z) and log Θ(z) are random processes, the single-valued dependence is the dependence on Z of the mathematical expectation, which is obtained by simple averaging at any Z. Evidently, for this purpose one can use the maximum possible amount of galaxies. In this case m(z) and log Θ(z) dependences are built as if over objects lying at the top of the curve of the Gaussian distribution. The process described is the known method of the regression analysis. The obtained regression dependence of m(z) and log $\theta(z)$ are the world ones, since they characterize the properties of the Metagalaxy as a whole. So, they are used below for the comparison with the theory.

II. EXPERIMENTAL DATA

The general regression m(z) relation was defined in V-range in the interval of the red shift $10^{-2.5} \leq z \leq 4$ over the ensemble of 9000 galaxies of all types and 4000 of all known quasars. Here we take into consideration the effect of Malmquist selection (Troitsky, et al. 1992 /3/, 1993 /4/), as well as K-correction was introduced, being calculated over averaged spectra of galaxies and quasars. In each interval $\Delta \log z=0.1$ we verify the subordination of the law of normal distribution m(z), which shows that both for galaxies and quasars the RMS deviation in each interval Z_k is equal to $\sigma(m)=1.2^m \pm 0.1$. The obtained regression dependence is given in Figure 1 in comparison with a family of theoretical curves (Troitsky, et al., 1994 /5/). In the analytical expression in star and physical units it is equal to:

$$m(z)=(2.8 \pm 0.1)\log z + 18.6;\ E(z)=Z^{-1.12}10^{-7.44};\ 10^{-2.5} \leq z \leq 4. \quad (1)$$

Naturally, this dependence radically differs from sampling curves for exotic galaxies.

The general regression dependence log $\theta(z)$ was obtained by measurements of 12600 normal galaxies in V-range. Here, an analysis had been made for possible systematic distortions of $\theta(z)$ function in using isophot measurements due to a probable evolution of the surface brightness of galaxies. The calculation show the absence of any essential distortions (Troitsky, Aleshin, 1993 /6/). The equation of the regression function in logarithmic and linear expressions is equal to:

$$\log\theta(z)=(0.55 \pm 0.05)\log z + 0.93;\ \theta(z)=8.5''/Z^{0.55};\ 10^{-2.5} \leq Z \leq 0.5. \quad (2)$$

Figure 2 shows the function in comparison with the theoretical dependence for the model $q_o=1$. The obtained regression dependence is also radically unlike to the dependence for sampling exotic objects given in papers by Sandage, 1972 /7/, Kapahi, 1987 /8/ and Kellerman, 1992 /9/.

From the experimental relations between (1) and (2) we obtained the surface brightness averaged over the galaxy disk $\mu(z)=-2.5\log(E/\theta''^2) = m(z)+5\log\theta''(z)$ of the magnitude of arc sec^{-2}, which appears to be practically independent of Z:

$$\mu(z) = m(z) + 5\log\theta(z) = (0.05 \pm 0.1)\log z + 23. \qquad (3)$$

Direct measurements of the surface brightness carried out recently gave the value $22 \le \mu \le 24$ independently of the source red shift in the interval of the red shift $10^{-2.5} \le z \le 0.5$ (Greham, 1983 /10/, Hoessel, et al., 1987 /11/, Dresler, et al., 1987 /12/, Peltier, 1990 /13/). This is a good confirm for the accuracy of the experimental relations (1),(2), which further will be used for the comparison with the theory as basic independent equations, and (3) - as an auxiliary control relation.

III. A COMPARISON BETWEEN THE THEORY AND OBSERVATIONS

Let us write theoretical relations in the most general form real for different cosmological theories:

$$E_t(z)=\frac{L(z)}{R^2_m(z)}, \quad \theta_t(z)=2\cdot 10^5\frac{\ell(z)}{R_\theta(z)}, \quad \mu(z)=-2.5\log\left(\frac{L(z)}{\ell^2(z)}\frac{R^2_\theta}{R^2_m}\right)+26.6 \qquad (4)$$

Here L(z) is the absolute luminosity, $l(z)=\sqrt{ab}$ is the equivalent visible dimension of the galaxy (a and b are the large and small axes of the visible ellipse), $R_m(z)=R_o\,\psi_m(z)$ and $R_\theta(z)=R_o\,\psi_\theta(z)$ are the effective distance up to the galaxy being different in the general case. In the standard cosmology $\psi_m(z)=\psi(z)\,\alpha_m(z)$ and $\psi_\theta(z)=\psi(z)\,\alpha_\theta(z)$, where at q=1 $\psi(z)=z/(z+1)$ is the theoretical function of metric distance up to the galaxies. The function $\alpha_m(z)=(z+1)$ is associated with the assumption of the red shift formation in propagation of light in space and $\alpha_\theta(z)=(z+1)^{-1}$ - with a hypothesis of space expansion. Making a comparison between (1), (2) and (4) we obtain $R_m(z)=z^{0.56}\,10^{3.72}\sqrt{L(Z)}$ and $R_\theta(z) = z^{0.55}\cdot 10^{4.37}\, l(z)$. Excluding z from here we have:

$$\frac{R_\theta}{R_m}\;\frac{\sqrt{L(z)}}{l(z)}=\frac{\alpha_\theta}{\alpha}\;\frac{\sqrt{L(z)}}{l(z)}=4.5\;. \qquad (5)$$

Functions α_θ/α_m and $\sqrt{L(z)}/l(z)$ have different physical nature due to this fact they are independent. Here, to satisfy relation (5), they must be equal to a constant value. Besides, equality $R_m=R_\theta$ must be fulfilled at $z \approx 0$, then $\alpha_\theta=\alpha_m$ and finally:

$$\frac{L(z)}{l^2(z)}=\frac{L_0}{l_0^2}=20\;, \qquad R_m(z)=R_\theta(z)=R(z)\;. \qquad (6)$$

Making a comparison between the experimental value of the surface brightness (3) and the theoretical one (4) we obtain $L(z)/l^2(z) = 27.6$ that characterizes the correlation of the experimental results obtained for three series of independent measurements of m, θ and μ .

The obtained law $L(z)/l^2(z)$ = constant is confirmed by a number of investigations summarized in paper /4/, 1993, as well as by the investigations of luminosity and galaxy dimension correlation of UGC catalog (Troitsky, Aleshin, 1994 /6/).

In the standard cosmology the relation $\alpha_\theta/\alpha_m=(z+1)^{-2}$ that contradicts to the experimental results $\alpha_\theta/\alpha_m=1$, the definition accuracy of which is sufficient to give up the hypothesis of space expansion. For the alternative cosmologies this relation as a function of the red shift nature is in the limits of $1 \leq \alpha_\theta/\alpha_m \leq (z+1)^{-1}$. So, for the unknown functions we have:

$$R(z)=z^{0.55}R_0\sqrt{L(z)/L_0}\;,\quad R_0=10^{3.72}\sqrt{L_0}\;, \qquad (7)$$

$$\frac{\sqrt{L(z)}}{l(z)}=\frac{\sqrt{L_0}}{l_0}=4.5\;.$$

Here $L(z)/L_0$ is a free function. We shall shown, that one cannot select such a function which would correlate to both theoretical expressions $E_t(z)$ and $\theta_t(z)$ in the standard cosmology with the given observations. Really, we accept $L(z) = L_0 z^{\gamma}$. Then, for the model $q_0 = 1$ $E_t(z) = L_0 Z^{\gamma} / R_0^2 Z^2$ and taking into account that according to (7) it must be $l(z) = l_0 \sqrt{L(z)/L_0}$, we obtain $\theta_t(z) = l_0 Z^{0.5\gamma}(z+1)^2/R_0 Z$. For $\gamma = 0.9$ $E_t(z)$ is agreed with the observed dependence (1), and $\theta_t(z)$ sharply contradits to the observed (3), having the minimum at $Z = 0.29$ that is not observed. At any $0 < \gamma \leq 0.9$ both theoretical relations do not correlate with observations, and the minimum $\theta_t(z)$ remains at $z = \gamma/(4-\gamma)$.

Thus, the theory of the standard cosmology cannot be correlated with observations by sampling any luminosity evolution. It can be trivially explained by the fact, that for correlation of $E_t(z)$ with the experience it is necessary that $L(z)$ would incease with the growth of z galaxies, and for correlation with $\theta_t(z)$ the dimension of these galaxies must decrease, that contradicts to the law $\sqrt{L(z)}/l(z) = \text{constant}$.

From the above consideration it inevitably follows, that the theory of the Universe Big Bang formation is in dissonance with reality. The obtained results do not contradict to the static non-expanding Universe at any function of the luminosity evolution including $L(z) = \text{constant}$ and $l(z) = \text{constant}$. The absence,on the average, of the luminosity evolution and dimension evolution corresponds to the stationarity of the Universe. The evidence of this is the independence of dispersion $m(z)$ of the red shift both for galaxies and quasars (Troitsky, Bellustin, 1994 /5/).

The stability of the random process $m(z) - \overline{m(z)}$ testifies to the equilibrium state of the Universe galactic system, and hence, to a large age of it, exceeding many orders of magnitude the age of galaxies. On the average, the independence of galaxy and quasar spectrum forms of their red shift testifies also to this fact (Troitsky, Gorbacheva, 1993 /14/; Troitsky, Gorbacheva, et al., 1992 /3/).

To define R_0, L_0, and l_0 we use the known mean luminosity of galaxy groups in the radius $z \leq 0.02$, which is equal to

$M = -21^m \pm 0.5$. As it is known, $-2.5 \log L_o = M - 5$, from here $L_o = 10^{10.4}$ and in physical units $P = L_o L_\odot = 10^{43}$ erg/s . Finally, according to (7):

$$R(z) = R_o z^{0.55}\ , \quad R_o = (830 \pm 200)\text{Mpc},\ l_o = (35 \pm 8)\text{Kpc}\ ,$$

$$M = -21^m\ . \qquad (8)$$

Here R_o is the distance up to galaxies having $z=1$.

IV. THE NATURE OF THE RED SHIFT AND THE MICROWAVE BACKGROUND RADIATION .EXPERIMENTAL MODEL OF THE UNIVERSE

The dependence $z \propto R^2$ permits us to explain the red shift of galaxies as ordinary gravitational red shift. According to the classical physics it is not difficult to find, that at the uniform distribution of matter $(z+1) = \exp R^2/2\, r^2 g$, where $r^2 g = 3C^2/8\pi G \rho$ is the gravitational radius. In the relativistic treatment verified for weak fields $(z+1) = (1 - R^2/r^2 g)^{-0.5}$; that coincides with the first expression under the condition $R << r_g$.

To correlate with (8) both formulae of the gravitational shift require the matter density $\rho \approx 10^{-28}$ g.cm^{-3}. According to estimations such density is 30 times larger than the observed one, and hence, 97% of the mass is in the "dark" form. In conformity with the empirical function $R(z)$ the Universe is practically unlimited system of galaxies. This makes it possible to explain the observed microwave background radiation by the sum of the star thermal radiation in the optical wave range. The observed radiation flux from stars at radio wavelength λ_o in the solid angle Ω at the distance R in the element volume $\Omega R^2 dR$ will be $dp(\lambda_o) = r^2 nm \Omega F(\lambda, T) dR d\lambda$. Here $F(\lambda, T)$ is the Planck function for the black body radiation, $\lambda = \lambda_o/(z+1)$ is the wavelength of the radiation of the star in its frame of reference, r is the mean radius of a star, n is the volume density of galaxies, m is the mean number of stars in galaxies. This radiation to its way up to the observer will experience the absorption by the central regions of galaxies and screened by stars. The attenuation function is approximately equals to $\eta = (1 - 0.33\, nl^2 R)$, where l is the mean dimension of the central region of galaxies $l \approx 7$kps. Multiplying $dp(\lambda_0)$ by η, and integrating over R at $R = R_0 \sqrt{Z}$ we shall obtain the total observational flux of radiation at the wavelength λ_0 in the band $d\lambda_0$. To define the equivalent temperature flux we equate it to the flux from the black body in the solid angle Ω at the wavelength λ_0 and the temperature T_b, that gives:

$$0.5 r^2 nmR_0 \int_{z=1}^{z} \frac{z^{2.5}\eta(z)\cdot dz}{\exp\left(\frac{hcz}{KT\lambda_0}\right) - 1} = \left[\exp\left(\frac{h\,c}{K\lambda_0 T_b}\right)\right]^{-1}. \quad (9)$$

For the wave $\lambda_0 \geq 1$cm, $\exp\left(\frac{hc}{K\lambda_0 T_b}\right) - 1 = \frac{hc}{K\lambda_0 T_b}$ and the expression is simplified:

$$T_b = 0.5\, r^2 n\, m\, R_0 \int_{z=1}^{z_0} \frac{h\,c}{K\lambda_0} \frac{z^{2.5}\eta(z)\,dz}{\exp(hcz/KT\lambda_0) - 1}.$$

Here Z_0 is defined from $\eta(Z_0) = 0$.

Calculation of T with rather realistic parameters gives the observed background temperature, which is formed by the optical radiation of stars at the distance up to 50 000 Mpc at $1 \leq Z \leq 4000$ and is independent of the wavelength of observation in the range 0.1 cm $\leq \lambda \leq 10$ cm.

In conclusion it should be noted, that the contradiction of the dependence $R \propto \sqrt{z}$ in the generally accepted Hubble law $R \propto Z$ is not a cogent argument against the obtained results, since this law is stated for small values $z \leq 0.02$ under which any smooth function including $R = R_0 \sqrt{z}$ are defined as a stright one. Finally, recently, new measurements occur for the dependence R(z) on the basis of Tulli-Fisher law given in the paper by Arp and van Flandern, 1992 /15/ as well as measurements by Giraud, 1985 /16/, which are well correlated with the obtained empirical dependence of the red shift distance relation $R(z) \propto \sqrt{z}$ confirmed thereby by a more realistic hypothesis of the red shift.

It is necessary to note, that the quadratic red shift distance law was predicted by Segal, 1976 /17/ in the form $z = \tan^2 (R/2R_0)$, where R_0 is the Universe radius. The experimental investigations by Segal (1978-93) /18-20/ using the statistical analysis method of some group of m(z) data for galaxies with $z \leq 0.05$ and quasars with $0.2 \leq z \leq 3$, gives that $z \propto R^2$.

Our experimental results confirm this data using sufficiently data basis m(z) and also $\theta(z)$.

Segal's expression for the red shift demontrates the finiteness of the Universe size, the radius of which $R_0 = (160 \pm 40)$Mpc, leads to a conclusin that the distance up to galaxies is by five times smaller than our estimations. Moreover, Sigal did not explain the physics of the red shift nature. So, our experimental data do partly correlate with the chronometric theories of cosmology.

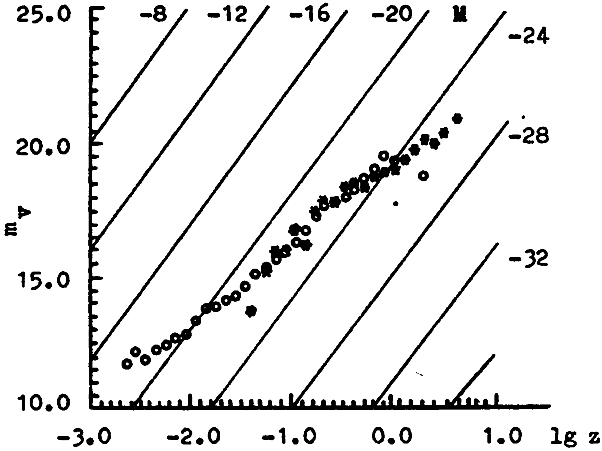

Fig.1. General regression Hubble diagram. ° - galaxies , * - quasars, dotted line is the family of theoretical curves $m(z,M) = 5\log z + M + 43$ for $q_o=1$, $H_o=75$ km s^{-1} Mpc^{-1}.

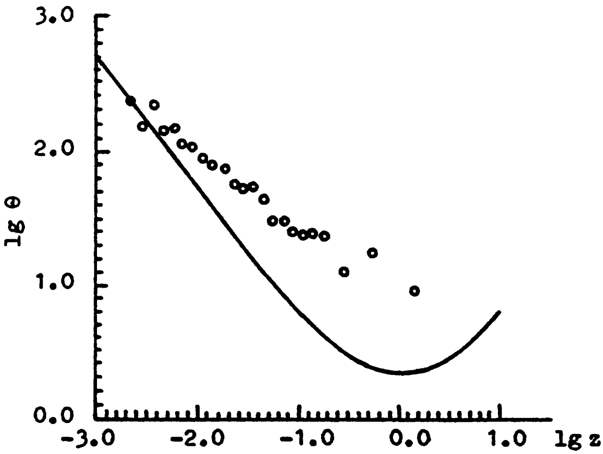

Fig.2. General regression dependence of the angular dimension of galaxies (circles). Solid line is the theoretical curve for $q_o = 1$, $l(z)$ = constant.

REFERENCES

1. Burbidge G.R. Intern.Theoretical Physics, 28, 983, (1989).
2. Baryshev Yu.V. The results of science and technique.V.4, Gravitation. M.: 1992, 89.
3. Troitsky V.S., Gorbacheva I.V., Suchkin G.L., Bondar L.N. Astron.J.(Russia), V.69, p. 913 (1992); Astrophys.Space Sci., 190, 9, (1992).
4. Troitsky V.S. Astrophys.Space Sci. 201, 203, (1993).
5. Troitsky V.S., Bellustin N.S., Paramonova L.A. Astron.J. (Russian) in press.
6. Troitsky V.S., Aleshin V.I., Letters in Astron.J. (Russian), (1993) in press.
7. Sandage A.R. Astrophys.J., 173, 485 (1972).
8. Kapahi V.K. IAU Symp. N.124."Observational Cosmology" 251, (1987).
9. Kellerman K.I., Nature, 135, 12.
10. Greham J.A. Highlights of Astronomy, 6, XVIII, General Assembly of the IAU, 1982.
11. Hoessel J.G., Oegerle W.R., Shneider D.P. Astron.J., 94, 1111, (1987).
12. Dresler A., Linden-Bell D., Burstein D. Ap.J., 313, 42 (1987).
13. Peltier R.L., Davies G.D., Illingworth L.E., Davis M., Gawson J.Astron.J., 100, 1091 (1990).
14. Troitsky V.S., Gorbacheva I.V. Letters in Astron.J.(Russian), V.19, N.4, 329 (1993).
15. Arp H.C., van Flandern T. Physics Letters A., 164,363 (1992).
16. Giraud E. Astron.Astrophys., 153, 125 (1985).
17. Nicol J.F., Segal I.E. Annals of Physics, V.113, N.1, 1-27 (1978).
18. Segal I.E., Nicol J.F., Wu P., Zhon Z. Naturwissenschaften, V.78, 289-296 (1991).
19. Segal I.E., Nicol J.F., Wu P.,Zhon Z. Ap.J. 411, 465-484 (1993)
20. Segal I.E.,Proc.Nat.Acad.Sci., V.73,N.3,689 (1976).