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ASTROPHYSICAL OBSERVATIONS EXCLUDE THE HYPOTHESIS ON THE UNIVERSE EXPANSION

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As it is known the correlation between the observed visible luminosity $m(z)$, angular dimension $\theta(z)$ of galaxies on the red shift z and the similar theoretical relations of the standard cosmology is possible only under the assumption of the existence of the luminosity and object dimension evolution being equal to $L(z) = L_0(z+1)^{3.2}$ and $\ell(z) = \ell_0(z+1)^{-2}$, respectively. This evolution is hypothetical, since it is defined by the theory which is not confirmed by the experiment. So, to solve the problem on the reality of the Universe expansion it is sufficient to proof or disproof these conclusions using the measurement method being independent of the theory. One of the methods consists of defining the dependence of the radiation spectra of galaxies and quasars on z which evidently is proportional to the spectrum of absolute luminosity $L(\lambda, z)$. As a result, it was shown that the spectrum form is practically independent of the red shift, i.e. remains constant during the life-time of galaxies and quasars. From here, to explain the luminosity increase demanded by the standard cosmology it is necessary to admit completely unreal identical at all wavelengths of the optical spectrum increase of the radiation spectral density by $(z+1)^{3.2}$ times. We can conclude that in reality the luminosity evolution is either absent or at least its power index is by an order of magnitude smaller and so, the found evolution is the result of nonadequacy of the standard cosmology.

Another method is in the use of the observed relations between the parameters of L and ℓ galaxies. A number of measurements made by different authors gives the relation $\ell \propto L^a$ where $0.33 \leq a \leq 1.6$, from here it follows that $\ell(z) \propto (z+1)^{3.2 \cdot a}$. This dependence of the galaxy dimension is inverse to the dependence predicted by the standard cosmology. Besides, in order to make a correlation between the $\ell(z) \propto (z+1)^{3.2a}$ and measurements of $\theta(z)$ it is necessary that indices of the luminosity evolution degree would be by an order of magnitude smaller.

Thus, the luminosity increase and simultaneous decrease of galaxy and quasar dimensions predicted by the standard cosmology are not confirmed by the direct astrophysical measurements and is the consequence of incorrectness of the hypothesis of the Universe expansion and the relativistic cosmology based on it.

As it is known, the main tests for verification of cosmological theories are comparisons between the observed and theoretical dependences of the visible stellar magnitudes m(z) , the visible angular dimension θ (z) of galaxies on the red shift. However, the difference between the theoretical curves of all possible models began to appear only at $z > 1$, where galaxies are practically absent. A hope for the model identification occurs with detecting of quasars with a larger shift. But it turns out that the data of m(z) quasars have a rather large spread and, besides, they are aside from m(z) dependence of galaxies. In virtue of the above, quasars are not used in this test up to the present time. A better situation with quasars occurs for θ(z) - test where the data having a large spread both for galaxies and quasars are well correlated forming a unique function.

To include quasars in m(z)-test Troitsky and Gorbacheva (1989) in their paper have realized the idea of building the statistical m(z) curve which is based on averaging of all m(z) data of quasars available at present. It is evident that here a standard "statistical candle" is formed being free from randomness as well as a mean value of m(z) for each z unaffected by both random variations of quasar luminosity. For averaging the authors used measurements in V-range of 3400 quasars of Hevitt-Burbidge catalogue (1987). As it turns out the statistical m(z) curve of quasars coincides with ordinary Hubble stright line for 160 galaxies and is continued to the side of large red shifts forming a unique curve. So, quasars appeared to be included also in another main cosmological test.

In the paper by Troitsky, et al. (1992) the method of statistical standard candle is hold also for galaxies in order to obtain in the future the average m(z) dependence for the Universe. As a result, the general statistical Hubble curve has been built which includes 1100 galaxies from different surveys. For quasars the data of two catalogues are used - from the above mentioned and from Veron-Cetty and Veron (1989), as well as newest measurements at large red shifts $z \approx 5$ (Fig.1).

The both papers show a large deviation of the statistical curve from the expected theoretical one, in particular, in the region of quasars at $z > 1$, that is rather naturally can be explained by the luminosity evolution, namely, its increase with increase of z. This permits one to use in papers on the test for the solution of the inverse problem - definition of a unique function of galaxy and quasar luminosity evolution.

As it is known, there is a sharper deviation of observations from the predictions of the standard cosmology for the test $\theta(z)$ than for m(z), however, it is also easily explained by an assumption on the existence of evolution of galaxy and quasar dimensions which decrease with the growth of z (Fig.2).

It should be remembered that these explanations saving the theory are only the hypothesis which serves a correlation between the experience and the theory, here the latter becomes more complicated. The problem of reality for the theory of the Universe expansion in these tests is transformed in reality into the problem demanded by the theory of a large luminosity increase with simultaneous considerable decrease of galaxy and quasar dimensions. Thus, to confirm or disproof the theory of expanding Universe it is necessary to obtain independent of cosmological theories stright lines of measurements the galaxy and quasar dimensions and luminosity at different z. However, such measurements are likely to be possible. The present paper suggests a method of solution based on a simple idea.

As it was mentioned, the obtained from tests functions of evolution of dimensions $\ell(z)$ and luminosity $L(z)$ of galaxies and quasars make it possible excluding z to define the predicted by the standard cosmology functional relation between the given parameters ℓ and L. These functional relations have been studied at present by independent of the theory methods for a local group of galaxies in the limit of distances of about 100 Mps ($z \approx 0.025$). Coincidence or difference of these dependences with that predicted by the standard cosmology is evidently the crucial test. This method is used in the present paper.

Another, most crucial test is investigation of evolution of galaxy and quasar spectrum. Investigation of the spectra and their dependency on z is a powerful, most informative and objective method, independent of the cosmological theories. The present paper is devoted to application of these methods and to solution of a problem on this basis on the reality of the Universe expansion hypothesis.

I. Some theoretical relation of standard cosmology for measuring values.

To make a comparison with observations one needs theoretical expressions of some measured values by natural parameters of galaxies and quasars which follow from the hypothesis of the Universe expansion. The basic measuring values for cosmological investigations at present are: the spectral density of luminosity $E/Wt.ster^{-1}.ps^{-1}\mathring{A}^{-1}/$ taking place at the earth from the galaxy, its visible angular dimension $\theta(z)$ and the surface brightness $\mu(z)$. All these values are reffered to the moment of time in measurement which took place R/c $\approx \tau$ years ago, where R is the distance up to the observed object. The distance and time are defined by the measured value of the red shift z over the theoretical relation which follows from this or that cosmological model. Here τ and the distance are practically directly proportional to z up to z=0.5, so, z is convenient for the consideration of evolution processes.

The measured luminosity is proportional to the spectral density of the galaxy light power in its reference frame in the past being equal to $L(z,\lambda_0)Wt.ster^{-1}\mathring{A}^{-1}$ and inversely proportional to metric distance square up to it $R(z_z q_0)$ existing at the moment of observation. Besides, it is weakend due to the red shift which leads to the decrease of light quantum energy by z + 1 times and to rarefaction of the. flux by the same number. As a result, the visible spectral density of luminosity is

$$E(z,\lambda) = \frac{L(z,\lambda)\Delta\lambda}{R^2(z,q_0)(z+1)^2\Delta\lambda_0}. \qquad (1)$$

Here λ_0 and $\Delta\lambda_0$ are the wavelength and the wave band of the radiation received in the reference frame of the observer, $\lambda = \lambda_0(z+1)^{-1}$; $\Delta\lambda = \Delta\lambda_0(z+1)^{-1}$ are the wavelength and the band of the same radiation in the reference frame of the source. The value $R(z,q_0)$ is the theoretical expression of the metric distance which in the standard cosmology for a dust model is

$$R(z,q_0) = CH_0^{-1}(z+1)^{-1}q_0^2\left[q_0 z+(q_0-1)\left(\sqrt{2q_0 z+1}-1\right)\right].$$

The value $L(z\lambda)$ is the galaxy luminosity which is dependent on λ, so, sources with different z will be observed at different wavelemgths $\lambda = \lambda_0(z+1)^{-1}$ due to the red shift making E dependent not only on the distance z that is to be found, but also on the form of the galaxy spectrum. To exclude this effect a so-called K-correction is introduced which leads to the luminosity at the observation wavelength λ_0. For this we write in (1) that $L(z,\lambda)=L(z,\lambda_0)L(z,\lambda)/L(z,\lambda_0)$. The measured luminosity E in stellar magnitudes is equal to $m(z)=-2.5\log E$, then according to (1)

$$m(z,\lambda) = 5\log R(z+1) + M(z,\lambda_0) - 5 - 2,5\log\frac{\Delta\lambda}{\Delta\lambda_0} - 2,5\log\frac{L(z,\lambda)}{L(z,\lambda_0)}.$$

Here $M(z,\lambda_0)=-2.5\log L(z,\lambda_0)\cdot 10^{-2}$ is the absolute stellar magnitude of the galaxy at the wavelength λ_0, and the last two terms are the expression $K(z,\lambda_0)$ of the effect which is subtracted from the measured $m(z\,\lambda)$ to obtain $m(z,\lambda_0)$.

We are interested in the case when one can assume that $L(z,\lambda) = \beta(z)F(\lambda)$, where $F(\lambda)$ is the spectrum of the galaxy emission and $\beta(z)$ is the dimensionless function giving the luminosity evolution as uncoupled with variation of the spectrum form. With correction for $K(z\lambda_0)$ effect we obtain

$$m(z,\lambda_0) = 5\log(z+1)R + M(z,\lambda_0) - 5, \tag{2}$$

where $M(z,\lambda_0)=-2,5\log\beta(z)F(\lambda_0)$ is the time dependent absolute stellar magnitude of the galaxy. For $\beta(z)$=const, $M(\lambda_0)$=const. Next, an important relation is presentation of the luminosity evolution by the evolution of the dimension and the natural surface brightness of the source which are practically independent variables:

$$L(z,\lambda_0)=I(z,\lambda_0)\ell^2(z,\lambda_0), \qquad (3)$$

where $I(z,\lambda_0)\,\mathrm{Wt.sr^{-1}ps^{-2}\mathring{A}^{-1}}$ is the spectral density of the radiation brightness of the source surface in its eigen reference frame, $\ell(z,\lambda_0)$ is the effective diameter of the source in parsec being dependent on the wavelength of observation. Due to weakness of this dependence for normal objects, it can be neglected. Further, for simplification of the formulas presentation we shall omit the indication of the evident value dependence on the observation wavelength λ_0.

In the stellar magnitudes a relation between the absolute luminosity, surface brightness and the galaxy dimensions is:

$$M(z)=M_S(z)-5\log\ell(z). \qquad (4)$$

Here $M_s(z)=-2.5\log\left[I(z)\cdot 10^{-2}\right]$ is the natural absolute surface brightness in the stellar magnitudes in the reference frame of the source. For the symmetry with the definition of $M(z)$ the value $M_s(z)$ is calculated by the luminosity from radiation of a unity of the galaxy area at the distance of 10 ps.

The angular dimension of the galaxy which is observed at the present time is equal to the angular dimension in the past at the moment of the light emission and coming to the observer in the recent epoch. It is defined by the relation of the galaxy dimension $\ell(z,\lambda_0)$ in the past and the distance up to the observer at the same period of time, i.e. $\theta(z)=\ell(z,\lambda)/r(z)$. But due to expansion of the Universe the distance r(z) is by (z+1) times smaller than the contemporary one $R(z,q_0)$, then,

$$\theta(z) = \frac{\ell(z,\lambda)(z+1)}{R(z,q_0)}. \tag{5}$$

There is one more directly measured parameter. In contrast to the above it is unaffected by the space curvature and that of the distance. It is the luminosity E_s on the earth from a part of the galaxy surface forming for the observer a space angle equal to one quadratic second of an arc. We use the concept of the average luminosity equal to $E_s = E/\theta''^2$, where $E(z)$ and $\theta(z)$ are the observed or theoretical values. In the stellar magnitudes the visible from the Earth average surface brightness is equal to $\mu(z) = -2{,}5\log E_s$. From here in the expression of the measured values

$$\mu(z) = m(z) + 5\log\theta''. \tag{6}$$

The theoretical expression for the average surface brightness by the primary parameters in linear or logarithmical values in the standard cosmology is equal according to (1),(3),(5) to

$$E_s = \frac{L}{4\cdot 10^{10}\ell^2(z+1)^4} = 0{,}25\cdot 10^{-10} I(z)(z+1)^{-4},$$

$$\mu(z) = M_s(z) + 10\log(z+1) + 21{,}5, \tag{7}$$

where $M_s = -2{,}5\log L/10^2\ell^2 = M(z) + 5\log\ell(z)$ is the surface brightness in the stellar magnitudes for arc $\sec^{-2}$. The constant value is connected with recalculation of steradians into square angular seconds. From calculations it is clear that $E_s(z)$ and $\mu(z)$ are the average over the galaxy disk surface brightness.

In the above expression the values $(z+1)^4$ and $10\log(z+1)$ called sometimes the Tolmen signal, occured due to explanation of the red shift by the Universe expansion and represents the known attenuation of the absolute brightness of the object observed from the moving reference system.

It is evident that values of the natural parameters of quasars and galaxies L, l, I being defined by the observed values E, θ, E_s depend on the accepted cosmological theory. In particular, in the theory of the standard cosmology the representation of L,l,I depends essentially on the values (z+1) occured in the recalculation formulas due to the hypothesis on the Doppler nature of the red shift. Another influence of the theory on the representation appears much weaker also by the dependence of R on z and more weaker on the curvature of space q_o.

2. Statistical m(z) dependence of galaxy and quasars and the character of the expected evolution of their luminosity.

Fig.1 shows the statistical m(z) dependence for galaxies and quasars obtained in the paper by Troitskij et al.(1992) and corrected with taking into account K-effect. The curve is well approximated in all the interval of the red shifts $10^{-3} \leq z \leq 4.7$ by the function

$$m(z) = 5\log z - 8\log(z+1) + 21{,}5 . \qquad (8)$$

A concrete cosmological model defined by the values q_o must be used for a comparison with the theoretical dependence. For that we accept the model of closed Universe corresponding to $q_o=1$ for H_o= 75 km/s Mps. Due to a small difference between models with permissible $0 \leq q_o \leq 1$ this choice does not affect the results. Here, according to (2) for the theoretical expression m(z) we have

$$M(z) = 5\log z + M(z) + 43 . \qquad (9)$$

Equating (8) to (9) we find the function of the galaxy luminosity evolution as well as quasars in the stellar and linear magnitudes

$$L(z) = L_0 (z+1)^{3,2},$$
$$M(z) = -8 \log(z+1) - 21,5. \qquad (10)$$

The obtained evolution of luminosity is reasonably to call further a conventional, relative or hypothetical evolution underlying by this that it is finally defined relative to the theory and depends on it.

For visuality of the graphic comparison with the theory Fig.1 shows a grid of theoretical stright lines for the accepted model which is obtained at different constant values of luminosity M_0 instead of $M(z)$ in (9). With the given structure the path of the experimental curve is compared with the theoretical stright lines $m(z)$ without evolution of luminosity when $L(z)$ = const. It is visually demonstrated by a continuous quantitative variation of galaxy and quasar luminosity depending on z and, hence, on time. From the relation obtained and from the diagram it is seen that z=0.1, the average absolute luminosity of galaxies is increased by ~ 1.5 in comparison with that at z= 0.003. The luminosity of quasars at z=4.5 is appeared to be higher than the galaxy luminosity by ~ 6÷ ~8 stellar magnitudes. The same numerical results are given for some choice of quasars in the interval $0.2 \leq z \leq 3$ in the detailed work by Baldwin, Wampler and Gaskell (1989). In the paper by Marchall (1985) the function $L = L_0 (z+1)^{3.5}$ is given for the luminosity evolution of only quasars that is close to the results of our works which give the general function of galaxy and quasar luminosity evolution presented in (10).

3. Statistical $\theta(z)$ dependence and the assumed evolution of galaxy and quasar dimensions.

The statistical $\theta(z)$ dependence has been investigated by a number of authors. A qualitative jump in investigations has been obtained by Miley and Leg who used the data $\theta(z)$ for quasars and showed that they smoothly applicable for galaxies making a general dependence $\theta(z) \propto z^{-1}$. In the recent paper by Kapahi (1987) these investigations have been made using more extensive and contemporary experimental data. In the result, over measurements of 215 galaxies and 300 quasars the statistical $\theta(z)$ dependence has been obtained up to $z \approx 2.5$. The experimental curve (Fig.2) correspomds to the dependence $\theta(z) \propto z^{-1}$ with the minimal rms deviation. However, in the limits of the inaccuracy band one can build the curve $\theta(z) \propto (z+1)z^{-1}$. We use further both approximations in the form

$$\theta_1(z) = \frac{\theta_0''}{z}, \qquad \theta_2(z) = \theta_0'' \frac{z+1}{z}, \tag{11}$$

where $\theta_0'' = 2\cdot 10^5 \ell_0 / H_0^{-1} c$, here $H_0^{-1} c$ is equal to the radius of the Universe.

The theoretical expression of the angular dimension in the standard cosmology for the accepted model for $q_0=1$ according to (5) is

$$\theta(z) = \frac{H_0}{c} \frac{\ell(z)(z+1)^2}{z}. \tag{12}$$

The correlation between this prediction and observations (11) will take place if we accept a hypothesis on the evolution of the galaxy dimension in the form $(z+1)^2 \ell(z) = \ell_0$ in the first variant or $(z+1)\ell(z) = \ell_0$ in the second, i.e. for the evolution of the linear galaxy dimension we shall have

$$\ell_1(z) = \frac{\ell_0}{(z+1)^2}, \qquad \ell_2(z) = \frac{\ell_0}{z+1}. \tag{13}$$

It is seen that in the second variant the dimension of galaxies and quasars is increased with time as well as the dimension of the Universe, in the first variant all these occur still faster. Note, that the second expression $\theta_2(z)$ coincides with the corresponding expression for the angular dimension of galaxies in the static Universe which follows from thé hypothesis that the red shift is associated with evolution of the light speed(Troitskij, 1987, 1991). In this case instead of (5) $\theta_2(z) = \ell_0 / R(z, q_0)$ and for $q_0=1$ $\theta_2(z) = H_0 c^{-1} \ell_0 (z+1) z^{-1}$.

From the obtained hypothetical dependences of the luminosity (10) and dimensions (13) of galaxies the hypothetical evolution is found according to (3),(4) for the natural absolute surface brightness in the linear and stellar magnitudes:

$$I_1(z) = I_0(z+1)^{7.2}, \quad I_2(z) = I_0(z+1)^{5.2},$$

$$M_{s1} = M_s(0) - 18 \log(z+1), \quad M_{s2} = M_s(0) - 13 \log(z+1). \tag{14}$$

Here $I_0 = L_0 \ell_0^{-2}$, and $M_s(0) = 2{,}5 \cdot \log I_0 10^{-2}$ is the stellar magnitude of the surface brightness at $z=0$. The expected average visible surface brightness being equal according to (7) $E_s = E / \theta''^2 = L(z) \ell^{-2}(z) \times 0.25 \cdot 10^{-10} (z+1)^{-4}$ in linear and stellar magnitudes will be according to (10) and (13)

$$E_{s1}(z) = 0.25 \cdot 10^{-10} I_0 (z+1)^{3.2}, \quad E_{s2}(z) = 0.25 \cdot 10^{-10} I_0 (z+1)^{1.2},$$

$$\mu_1(z) = M_s(0) - 8 \log(z+1) + 21.5, \quad \mu_2(z) = M_s(0) - 3 \lg(z+1) + 21.5. \tag{15}$$

Making a comparison between (15) and (14) we are convinced that it must be so, they are differ by the values $(z+1)^4$ and $10\log(z+1)$ respectively.

Thus, we have obtained the mutually correlated system of functions for the evolution of luminosity (10), dimensions (13) and the surface brightness (14),(15) which follows from the experimental data of both tests and the theory of expanding Universe. But if the red shift is explained by other reasons, then, naturally, from the same observational data a new theory for other evolutional relations must be obtained.

From the above it is seen that both cosmological tests do not permit us as such to solve the problem of experimental check of the theory. In the result we obtain only expressions for the expected evolution of galaxy and quasar parameters. The solution of the problem of the theory reality is transfered now in another region and is in definition of the fact - are the obtained relations correspond to the evolution reality?

For this,methods should be applied which do not use any cosmological theory. Up to the present it was impossible, but unexpectidely appears to be very simple. Further we give and use two independent methods which make it possible to solve unambiguously the problem.

4. The test for reality of the hypothetical evolution of galaxy and quasar luminosity.

The test is based on a simple idea - evolution of luminosity, its increase in the past inevitably must be associated with variation of the spectra of galaxy and quasar emission. The spectra are measured directly independently of any cosmological hypothesis. Hence, making a comparison between the hypothetical evolution of luminosity and the real evolution of the spectra one can finally find the truth. In our paper (1992) we have investigated 100 spectra of galaxies and near 300 spectra of quasars at different z. The dependence of the spectrum form on z is investigated, i.e. in fact $L(\lambda, z)$ with the given z of the object. For the analysis, each spectrum of a quasar was approximated by the function $L(\lambda, z) = (\lambda/\lambda_0)^{\alpha} F(\lambda_0)$ which sufficiently well presents the spectrum form in all the working range of wavelengths $\lambda_0 = 0.55$ mkm up to the wavelength $\lambda = \lambda_0/(z+1)$ achieving 0.1 mkm with the maximal z of the objects. With such a spectrum the luminosity evolution can be realized only due to the dependence α and $F(\lambda_0)$ on z. In other words, it can be realized both due to variation of the spectrum form and due to general similar variation of the spectral density at all the given wavelength of the spectrum.

Quite unexpectedly appears it that the quasar spectrum form is independent of z! As an example fig.3 presents the values of α for 200 quasars being brighter 19^m in the interval of shifting $0.1 \leq z \leq 3$. From the Figure it is seen that the average spectral index in each small interval of shifting is in the limits $\alpha = -1.6 \pm 0.1$.

According to our data the galaxy spectrum is also practically constant at least up to $z \approx 0.5$. The similar conclusion is made in the paper by Lilly and Gunn (1985).

From the spectrum obtained, the unambiguous conclusion follows that the mean statistic luminosity of quasars and galaxies increases with the increase of z only due to rigorously similar growth of the spectral density of emission at all wavelengths of the above given range! This character of luminosity evolution testifies to the stability of the physical nature of quasar and galaxy emission during all the period of their existence, the growth of the object luminosity must be explained only by simple quantitative increase of the number of stable radiators.

The periodics has not given so far the similar results of the spectrum investigations, though the data on the dependence of the color index testifies to a number of cases on independence of the spectra on z.

In this connection we give a remark by Schneider, Schmidt and Gunn (1989) on the spectra of ten quasars at $z=4$. " The most surprising conclusion which must be primarily done from these spectra is in the fact that there is no any distinguishing features from that with smaller red shift".

The absence of evolution of galaxy and quasar spectra and, in particular, that of quasars are not correlated reasonably with a strong evolution of these object luminosity predicted by the standard cosmology. It is difficult to explain the luminosity increase due to a simple increase of the radiation source number which have a constant spectrum during their existence. From the above a single easily derived conclusion follows - the obtained hypothetical evolution of luminosity is fictious, producing by the wrong theory based on the hypothesis of the Universe expanding.

5. The test for the reality of hypothetical evolution of galaxy and quasar dimensions.

The essence of the test is in comparison between the correlative relations of L, ℓ, I investigated by the present time, parameters of galaxies and the similar relations of parameters which are predicted by the standard cosmology. These dependences can be defined by the function of evolution $L(z)$, $I(z)$, $l(z)$ excluding z from them.

Really, the process of evolution of the considered parameters of galaxies and quasars can be presented in the form of a certain curve in three-dimensional space l, I, z, described by a definite function $\Phi(l,I,z)=0$. The found functions of the evolution $l(z)$, $I(z)$ are only the projection of functional relations on a plane $I-z$, and a plane $l-z$. Excluding the value z from the evolution function $l(z)$, $I(z)$ we obtain a projection of a space track of the evolution on $I-l$ plane, i.e. interrelations of these parameters. At last, using the relation $L=I\,l^2$ one can find the relation $L-\ell$, $(M-\log\ell)$; $L-I\,(M-M_S)$.

Note, that all these relations are the mean-statistical ones over the ensemble of the data with different z.

The standard cosmology leads to the following relations of the parameters. From (10) and (13)

$$\ell_1 \propto L^{-0.63}, \qquad \ell_2 \propto L^{-0.31},$$

$$\log\frac{\ell_1}{\ell_0} = 0.25(M-M_0), \quad \log\frac{\ell_0}{\ell_2} = 0.125(M-M_0). \tag{16}$$

From (10) and (14)

$$I_1 \propto L^{2.2}, \qquad I_2 \propto L^{1.66},$$

$$(M-M_0)=0{,}45(M_{S1}-M_{S0}), \quad (M-M_0)=0{,}6(M_{S2}-M_{S0}). \tag{17}$$

From (14) and (13)

$$I_1 \propto \ell_1^{-3.6}, \qquad I_2 \propto \ell_2^{-5.2},$$

$$\log \frac{\ell_1}{\ell_0} = 0.1(M_S - M_{S0}), \qquad \log \frac{\ell_2}{\ell_0} = 0{,}077(M_S - M_{S0}). \qquad (18)$$

We consider now the observed in reality statistical relations between the parameters L, I, l of galaxies. Here it should be remembered that setting the relations of primary parameters L, I, l is inevitably made using the formulas of the standard cosmology for the transition from the measured m(z), θ(z), μ (z) values of the object to the primary ones. If we have the computed data of L, I, l for this or that group of objects we can find the mean-statistical relation of any two parameters. However, with the given recalculation we shall obtain natural primary parameters which are differ from the real ones if the theory does not correspond to the reality. This distortion will be excluded or at least reduced to minimum if we find the relation between the galaxy parameters with a small red shift. Over estimations at $z \leq 0.05$ the distorting influence of the theory does not come out of the limits of systematic errors of measurements.

The established functional relations will be free from the effect of the cosmological hypothesis only for galaxies the distance from which is defined not by the red shift. They are in the local vicinity of space with the radius no more than 100-150 Mps, i.e. at $z < 0.05$. The considered relations of parameters are in a series of works and referred yet to the galaxies only. A general drawback is the use of comparatively small ensemble of data.

After these remarks we consider concrete examples of relations between the galaxy parameters and their correlation with the above obtained conclusions of the standard cosmology.

Completely independent of the standard cosmology presentation are the investigation results obtained by Souček (1988). In this detailed work on the basis of measurements of m and θ, investigations were carried out for the relation between the parameters μ, ℓ, M for 15 galaxies of the local group with 8 spiral and 7 unregular galaxies being at a distance in the limits up to 4 Mps. For the calculation of ℓ and M he took distances known over measurements by the usual methods (not over z). Formally the red shift corresponding to the given limiting distance was less than $z = 10^{-3}$. So, the values of ℓ and M have been found irrespectively of any cosmological theories. This is the peculiar validity of the investigation. In the paper all the experimental data of the known values after a number of the proved corrections and improvements are put practically without deviations down to the corresponding stright lines of regression.

As a result it is obtained

$$\left.\begin{aligned} \log \ell &= -0.13(M+14)+3.2 \\ \mu(M) &= M_S + 21.5 = 0.33(M+14)+21.5 \end{aligned}\right\} \quad 14 \leq -M \leq 20\,, \qquad (19)$$

where ℓ is the effective diameter in parsec. In the second expression it is taken into account that due to smallness of the distance up to the chosen galaxies their visible surface brightness is proportional to the natural brightness M, since the term 10 log (z+1) in (7) can be neglected. Both expressions show that the increase of the galaxy luminosity is induced by the increase of their dimension simultaneously with the increase of the natural surface brightness.

For visuality of the comparison we transform (19) to expression through linear physical values. From the first relation with taking into account (3) we have

$$L \propto \ell^3, \qquad I \propto \ell. \qquad (19a)$$

The same functions follow from the second expression (19). Meanwhile, the analoguous relations of the standard cosmology (16)-(18) give the functions $L \propto \ell^{-1.6}$, $I \propto \ell^{-3.6}$ with opposite sign. If the luminosity evolution is really equal to $L=L_0{}^*(z+1)^{3.2}$ according to (10), then the function of evolution and dimensions and the surface brightness according to (19a) must take the form:

$$l(z) \propto (z+1), \qquad I(z) \propto (z+1).$$

Making a comparison between (13) and (14) we see that the standard cosmology and the tests demand the inverse dependence on z for l and the direct one but essentially strong for I(z).

A strong argument of confidence for the obtained by Souček laws is the following: according to (4),(7) the relation $\mu - 5\log l = M + 21.5$ must take place, substituting here μ and $\log l$ from (19) we are satisfied that they are well confirmed to this equation.

In the capital work by Smith and Heckman (1989) measurements are given in V-range of m(z), θ (z) values and the visible brightness distribution over the surface for each of 72 powerful radio galaxies in the interval of the red shifts $0.01 \leq z \leq 0.3$. Over the data obtained we give values calculated over the formulas of the standard cosmology for the mean visible surface brightness μ, isophot radius $0.5 l_{\mu}$ over the levels of the surface brightness μ =22, 24 and 25 of the stellar magnitude, the effective radius $1/2 l_e$, luminosity M_{μ} inside the same isophot and luminosity M_8 of the galaxy area limited by the radius of 8 Kps. The given galaxies form the mean Hubble curve m(z) =(5.4 $\pm$ 0.1) log (z) +21.5 with a sufficient small rms deviation $\pm$ 0.2. Unordinary large slope of the curve dm/dlogz =5.4 according to the standard cosmology must be explained by weakening of luminosity with increase of z,i.e. galaxy as if flamed up by the present time. However, most likely the "inverse" evolution of luminosity is the effect of selection but it evidently does not prevent the definition of the statistical relation between the parameters M, l, μ . Making a comparison of the obtained function m(z) and (9) we shall have the function of luminosity of the chosen galaxies:

$$M(z) = (0.4 \pm 0.1) \log z - 21.5. \qquad (20)$$

Approximately the same dependence is obtained directly from the diagram M - Z. The most distinct is the relation between the luminosity M_μ and the corresponding isophot dimensions ℓ_μ /Kps/:

$$\log 0.5\,\ell_\mu = -0.17(M_\mu + 19.5) + a_\mu, \quad 19.5 \leq -M_\mu \leq 22.5. \quad (21)$$

where M_μ is the luminosity of a part of the galaxy limited by the isophot of μ -th stellar magnitude and $a_{25}=1$, $a_{24}=0.8$, $a_{22}=0.45$, $a_e=0.6$. From the relation (21) it is seen that with an increase of luminosity the dimension of galaxies increases. This contradicts to the similar relations of the standard cosmology (16) over the law of the process. Expressing the relation (21) by the physical values we obtain $L \propto \ell^{2.36}$, $I \propto \ell^{0.36}$ from here at $L=L_0(z+1)^{3.2}$ the following functions of evolution follow $\ell \propto (z+1)^{1.35}$, $I \propto (z+1)^{0.5}$.

For elliptic galaxies the Faber-Jackson law is known $L \propto \sigma^4$ which states the relation between the luminosity and dispersion of the stellar velocities of the galaxy, It is stated for galaxies having the red shift no more than z = 0.03. Using the virial theorem and constancy of the relation between mass and luminosity the Faber-Jackson relation is transformed into $L \propto \ell^2$. Since it must be $L = \ell^2 I$, then for the elliptic galaxies I=const. Increasing the assumed evolution of luminosity $L=L_0(z+1)^{3.2}$ we obtain the evolution of parameters $\ell(z) \propto (z+1)^{1.6}$ and $I(z)$=const.

The similar result is obtained in using the Tulli-Fisher law $L \propto v^3_{max}$ for spiral galaxies, where v_{max} is the maximal velocity of the galaxy rotation. From here it follows that $L \propto \ell^3$ then $I \propto \ell$ and the evolution of parameters $\ell \propto (z+1)$ $I \propto (z+1)$ According to the luminosity in the near infrared range /J-range/ for spiral, the law $L \propto v^4_{max}$ is also taken place that leads to the same conclusion as in using the Faber-Jackson law.

In the paper by Peletier, et al (1990) the data are given z, μ, M for 39 elliptical galaxies in B-range for m, $0.02 \leq z \leq 0.3$. The Hubble curve of this choice of galaxies is well described by the equation $m(z)=(2.4 \pm 0.1)\lg z/z_0 + 10$.

A small slope dm/dlgz = 2.4 is explained in the framework of the standard cosmology by a strong increase of luminosity with the growth of z . The function of luminosity evolution according to the obtained m(z) dependence and formula (9) is

$$M(z) = -(2.6 \pm 0.2) \log \frac{z}{z_0} \cdot \qquad (22)$$

We can follow the evolution of the mean visible surface brightness

$$\mu(z) = (1{,}5 \pm 0{,}2) \log \frac{z}{z_0} + 20.2 \, , \qquad (23)$$

where $z_0 = 0.01$.

Due to smallness of the red shift being equal to 0.06 on the average, we can neglect the influence of the term 10 lg(z+1), then $\mu(M) = M_s + 21.5$. Taking into account this fact from the corresponding diagrams we find the next functional relations of the parameters

$$\log 0.5\ell = -(0.34 \pm 0.05)(M+19) + 0.1 \qquad (24)$$

$$19 \leq -M \leq 24 .$$

$$\mu(M) = M_s + 21.5 = -(0.6 \pm 0.1)(M+19) + 19.5 \qquad (24a)$$

The dependence $\mu(M)$ results also from (22) and (23). According to (24a) the increase of luminosity is defined by the increase of the galaxy dimensions accompanied here by the drop of the surface brightness / μ is increased/.

Really, from both expressions (24) practically similar relations $L \propto \ell^{1.2}$, $I \propto \ell^{-0.8}$ follow. From these relations with luminosity evolution $L \propto (z+1)^{3.2}$ we obtain for the function of evolution of dimensions and the surface brightness:

$$\ell(z) \propto (z+1)^{2.65}, \quad I(z) \propto (z+1)^{-2.1}. \tag{25}$$

In the paper by Schneider, Gunn and Hoessel (1983) measurements were carried out of the surface brightness of 249 galaxies being in the nucleous of 83 Abel clusters at $0.05 \leq z \leq 0.3$. The ensemble of galaxies is presented in the form of three equal over number groups composed of galaxies of the first, second and third one over the brightness in the cluster nucleous. The obtained expression of the l-M_s relation is given for each group. The deviation of coefficient values in formulas between groups amounts less than 5%. The relation l-M_s averaged over all the galaxies is equal to

$$\log 0.5\ell = 0.29 M_s + 1{,}0 . \tag{26}$$

In the same paper a relation $L \propto \ell^{0.7}$ is found. From (26) $I \propto \ell^{-1.37}$ follows, from here according to (3) $L \propto \ell^{0.63}$ then $\ell(z) \propto (z+1)^5$, $I(z) \propto (z+1)^{-7}$.

In the paper by Hoessel, Oegerle and Schneider (1987) measurements of the surface brightness of 372 elliptical galaxies were carried out, which are in the centre of 97 clusters of the Abel galaxies for $\bar{z} = 0.07$. A corrections was made in measurements which excludes the effect of darkening by $(z+1)^4$ times that according to (7) gives the values of the natural surface brightness $M_s + 21.5$ in the stellar magnitude per quadratic second of the arc. The mean dependence for bright and weak galaxies is equal in r-range to:

$$M_s + 21.5 = 3.1 \log 0.5\ell + 19.$$

Substituting M_s into (4) we shall have $\log \ell = -0.525\, M + \text{const}$. From here we find $L \propto \ell^{0.75}$, $I = L\ell^{-2} = \ell^{-1.25}$, or $I = L^{-1.67}$. Taking into account that $L \propto (z+1)^{3.2}$ we obtain $\ell(z) \propto (z+1)^{4.3}$, $I(z) \propto (z+1)^{-5.4}$.

So, all five papers and two empiric laws show that the increase of the galaxy luminosity with the increase of the red shift can occur according to the dynamic laws between parameters of galaxies only due to the increase of their dimensions accompanied by either a weak growth of luminosity or even its considerable decrease. Table 1 gives all the results which show that according to dynamic laws of the galaxy development the evolution of their dimensions is inverse to that predicted by the standard cosmology. Again, this evolution quantitatively, in a considerable part of data sharply contradicts to the test $\theta(z)$! Really, as seen from the Table, the increase of the galaxy dimensions leads according to the relation to $\ell(z)=\hat{\ell}_0(z+1)^{\gamma}$, where $1 \leq \gamma \leq 5$. This gives the expression for the angular dimension $\theta(z) \propto (z+1)^{\gamma} z^{-1}$, which at $\gamma > 1$ does not correspond to the observed relations (11) taking place at γ =0 or at least γ =1. In the given Table the case γ =0 is absent and examples 1, 4 correspond to the value γ =1, which are responsible for a small value of the red shift. In other cases with higher z and the luminosity of the investigated objects $\gamma > 2$, that results in the increase of the angular dimension with the growth of z! From the Table it is seen that this result is connected with the fact that with the increase of luminosity M of the investigated objects the correlation coefficient ℓ and M equal to $d\log\ell/dM$ are increased. Such a dependence is shown in detail in the paper by Sandage and Perelmutter (1991). In principle, the dependence $d\log\ell/dM$ on the red shift can take place which is associated either with evolution or as was noted with nonadequacy of the theory. In the first case these are real measurements of correlations, in the second - false. However, a small difference between red shifts in the given examples does not permit one to detect these relations. The obtained relations of parameters are evidently rather objective.

Since the dimension of galaxies according to all relations $L-\ell$ is proportional to the value L , the deviation between the evolution ℓ and the test $\theta(z)$ is excluded if the evolution of luminosity is absent or sufficiently small.

Thus, to exclude the occured contradiction, the large hypothetical evolution of luminosity should be considered unreal. From here it follows that the evolution of luminosity defined in the standard cosmology does not correspond to astrophysical observations. This can be connected with only nonadequacy of the universal model in the standard cosmology.

As for quasars, there are practically no investigations given above. We can cite the recent work by Masson (1980), where a review of such investigations is given and is confirmed on the basis of the analysis of the absence of dimension evolution of radio quasars 3 CR and 4C catalog. Again, coincidence of the Hubble curves for galaxies and quasars in a sufficiently large interval of shifting $0.05 \leq z \leq 0.3$ makes it possible to assume that the laws for galaxies are real also for quasars.

8. GENERAL DISCUSSION

In connection with the problem discussed the attention should be paid to a detailed and argumented by large observational data recent work by Sandage and Perelmutter (1991) where the reality of the Universe expansion is proved. The method is based on a comparison between the theoretical function of the visible surface brightness equal to $\mu(z) = -2.5 \log L(z) l^{-2}(z) + 10 \log(z+1) + \text{const}$, according to (7) and the observed one. For this data m(z) and $\theta(z)$ are used for 19 galaxies with the red shift in the interval $0.03 \leq z \leq 0.59$. A set of galaxies differes by the fact that their visible stellar magnitude m(z) is rather accurately coincides with the theoretical dependence at L(z)= const, /M=const/ and the linear dimension l(z) calculated over the formulas of the standard cosmology is practically the same. Here the theoretical visible surface brightness must be equal to $\mu(z) = \text{const} + 10\ \lg(z+1)$, i.e. be dependent only on the "Tolmen" signal which is the consequency of the hypothesis of the Universe expansion. The observed values $\mu(z)$ are defined over the data m(z) and $\theta(z)$ according to (6) and for the given set of galaxies confirms the predicted theoretical dependence $\mu(z)$ From here a conclusion is made on the validity of the theory on the Universe expansion. However, such a conclusion is incorrect i.e. the initial statement on the constancy of L(z) is made on the basis of the theory the reality of which is to be proved!

The method suggested will work if for this or that set of objects the stability of L(z) and l(z), i.e. in the long run, the stability of $L/\ell^2 = I(z)$ will be stated by methods being independent of the model cosmological presentations. At last, a number of remarks on the calculations carried out. The most open to criticism place of calculation is introduction of K(z) corrections found for completely different galaxies and besides, being compared with the Tolmen signal. All the above mentioned leads to a conclusion that findings of this paper are unproved.

Returning to our results a problem occurs on the dependence of correlative relations of the galaxy parameters on the red shift. The data given in the Table do not permit one to make a reliable conclusion, since they are referredto a rather narrow interval of measurement of z . As it was mentioned, a considerable dependence of correlation coefficients is observed in the absolute luminosity of M galaxies. On this basis we can say that if with large z the luminosity as if strongly increases, then the functions of parameter relation would be also changed. However, since the above results cause us to make a conclusion on the practical absence of the luminosity increase with the growth of z, hence, the stated functions of parameter relations will not be changed. A strong argument in virtue of this conclusion is the fact of absence of evolution of galaxy and quasar spectra.

So, in conclusion we see that observations of m(z) and $\theta(z)$ do not solve the problem as such on verification of cosmological theory but the addition of two tests, namely, observation of evolution of spectra and correlation between the parameters of galaxies and quasars makes it possible to find unambiguously that the standard cosmology is not conformed to astrophysical observations, i.e. it is inadequate to reality. According to this data the Universe is assumed to be a stationary system similar to that suggested by Hoyle.

The results obtained permit us to comprehend on some peculiarities of the theory of standard cosmology. It is not difficult to understand that the introduced hypothesis of evolution of the galaxy luminosity and dimensions plays the role of eliminator of the values $(z+1)^2$ and $(z+1)$ associated with the hypothesis of the Universe expansion from the theoretical expressions E(z) (1) and $\theta(z)$ (5). Really, the functions of evolution $L(z)=L_0(z+1)^{3.2}$ and $\ell(z)=\ell_0(z+1)^{-1}$ compensate the above dependence and by this bring the theory of the standard cosmology to correlation with the observations. It turns out that the dependences $E(z)=L(z)R^{-2}$ and $\theta(z)=\ell_0 R^{-1}$ agree with observations. A price of the hypothesis of expansion is $(z+1)^2$ times larger than the real rate of the absolute luminosity of galaxies and quasars, that leads to a problem of a high energy release from quasars which is not solved yet. A price of agreement with the test $\theta(z)$ is admittance of the increase of galaxy and quasar dimensions with time (with decrease of z) with the rate equal to that of the Universe expansion. This is not only agrees with observations, but contradicts to another statement of the standard cosmology which confirms the insubordination to the Hubble expansion of systems being hold-up by gravitation forces /galaxies, planetary systems, etc/. Thus, the standard cosmology cannot consistently explain the observations and must be rejected. From the above the initial data for a new theory are clear. It must explain observations of m(z) and without the use of specific terms $(z+1)^2$ and $(z+1)$ in formulas for the observed values. The corresponding variants have been considered in the Supplement for some examples of alternative theories.

In conclusion we note that complete discrepancy of the standard cosmology to astrophysical observations can be probably explained by the fact that this cosmology is supported by a powerful mathematical apparatus of the general relativistic theory and the theory of the gravitational field, even so, it is completely physically identical to cosmological theory resulting from Newton laws of motion. Naturally, it cannot came out of these elementary mechanical presentations.

SUPPLEMENT

To calculate evolutions of galaxy and quasar parameters with different cosmological theories we use the available observational data m(z) (8) and the first variant $\theta(z)$ (11).

For the statical model on the basis of conformal metrics (Troitsky, 1987) the theoretical relations $E=L(z)\Delta\lambda/R^2(z,q_0)\Delta\lambda_0(z+1)^2$ and $\theta(z)=\ell(z)/R(z,q_0)$ lead for $q_0=1$ to conventional functions of evolution

$$L(z)=L_0(z+1)^{3.2},\quad \ell(z)=\frac{\ell_0}{z+1},\quad I(z)=I_0(z+1)^{5.2},$$

$$E_s(z)=\frac{L(z)(z+1)^{-2}}{\ell^2(z)\,4\cdot10^{10}}=I(z)\frac{(z+1)^{-2}}{4\cdot10^{10}}=I_0\frac{(z+1)^{3.2}}{4\cdot10^{10}},$$

$$\mu(z)=-2.5\log E_s=M_s(z)+5\log(z+1)+21.5=M_{s0}-8\log(z+1)+21.5.$$

Cosmclogy on the basis of the hypothesis of tired light leads to the following theoretical expressions of the values observed:

$$E=L(z)\Delta\lambda/R^2\Delta\lambda_0(z+1),\quad \theta(z)=\ell(z)/R(z).$$

From heie

$$L=L_0(z+1)^{2.2},\quad \ell(z)=\frac{\ell_0}{z+1},\quad I(z)=I_0(z+1)^{4.2},$$

$$E_s=\frac{I_0}{4\cdot10^{10}}(z+1)^{3.2},\quad \mu(z)=M_s(0)-8\log(z+1)+21.5.$$

At last, cosmology from the hypothesis of evolution of eigen frequencies of atom radiation gives:

$$E = L(z)\Delta\lambda / R^2 \Delta\lambda_0 (z+1), \quad \theta(z) = \ell(z)/R(z)$$

from here

$$L = L_0 (z+1)^{1.2}, \quad \ell(z) = \frac{\ell_0}{z+1}, \quad I(z) = I_0 (z+1)^{3.2},$$

$$E_s = \frac{I_0 (z+1)^{3.2}}{4 \cdot 10^{10}}, \quad \mu(z) = M_{10} - 8 \log(z+1) + 21.5 .$$

In all expressions R(z) are practically identical and are equal to $R(z) = R_0 z / (z+1)$. It is interesting that for all cases considered the dependence $\mu(z)$ is similar.

From the above it is seen that very much desired are the independent direct measurements over a large ensemble of objects of the visible surface brightness μ (z) in a wide range of z In virtue of independent direct measurements μ (z) of the space properties they can give the most pure data for conclusions. Probably it will be the most informative cosmological test.

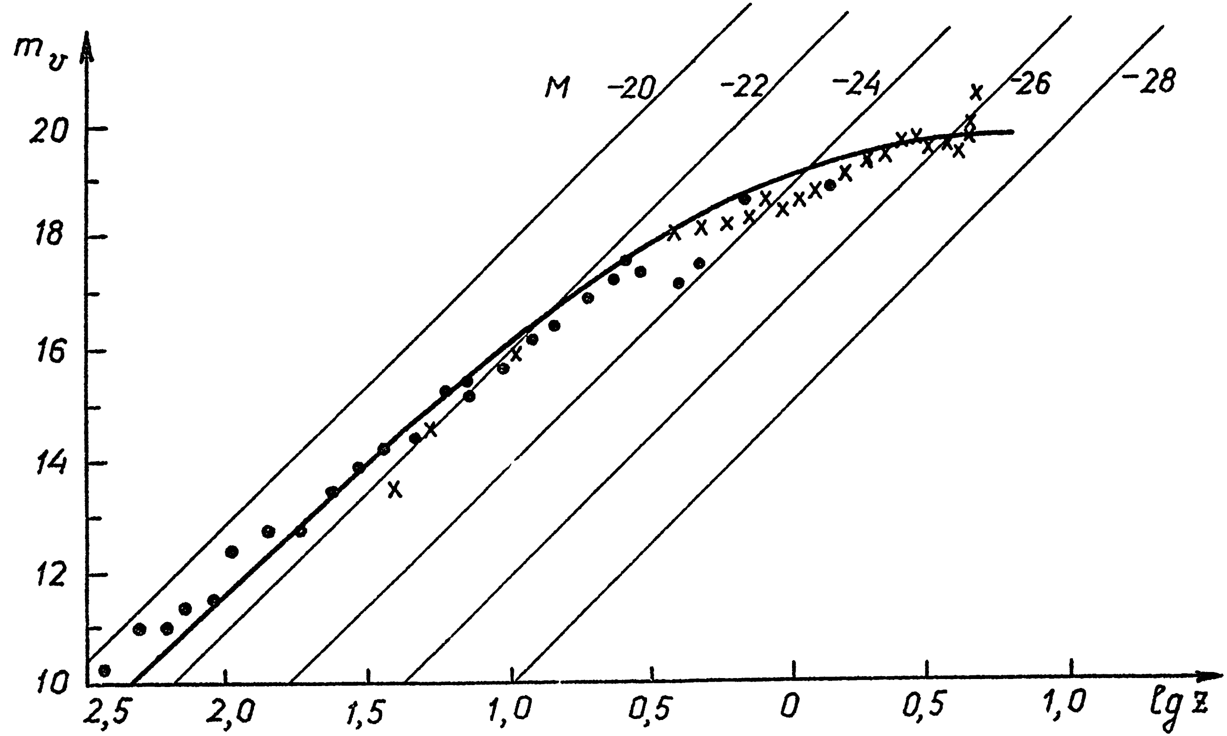

Fig. 1. Statistical Hubble curve for galaxies and quasars. •- galaxies, x - quasars. A grid of stright lines — are theoretical m(z) curves at different values of liminosity.

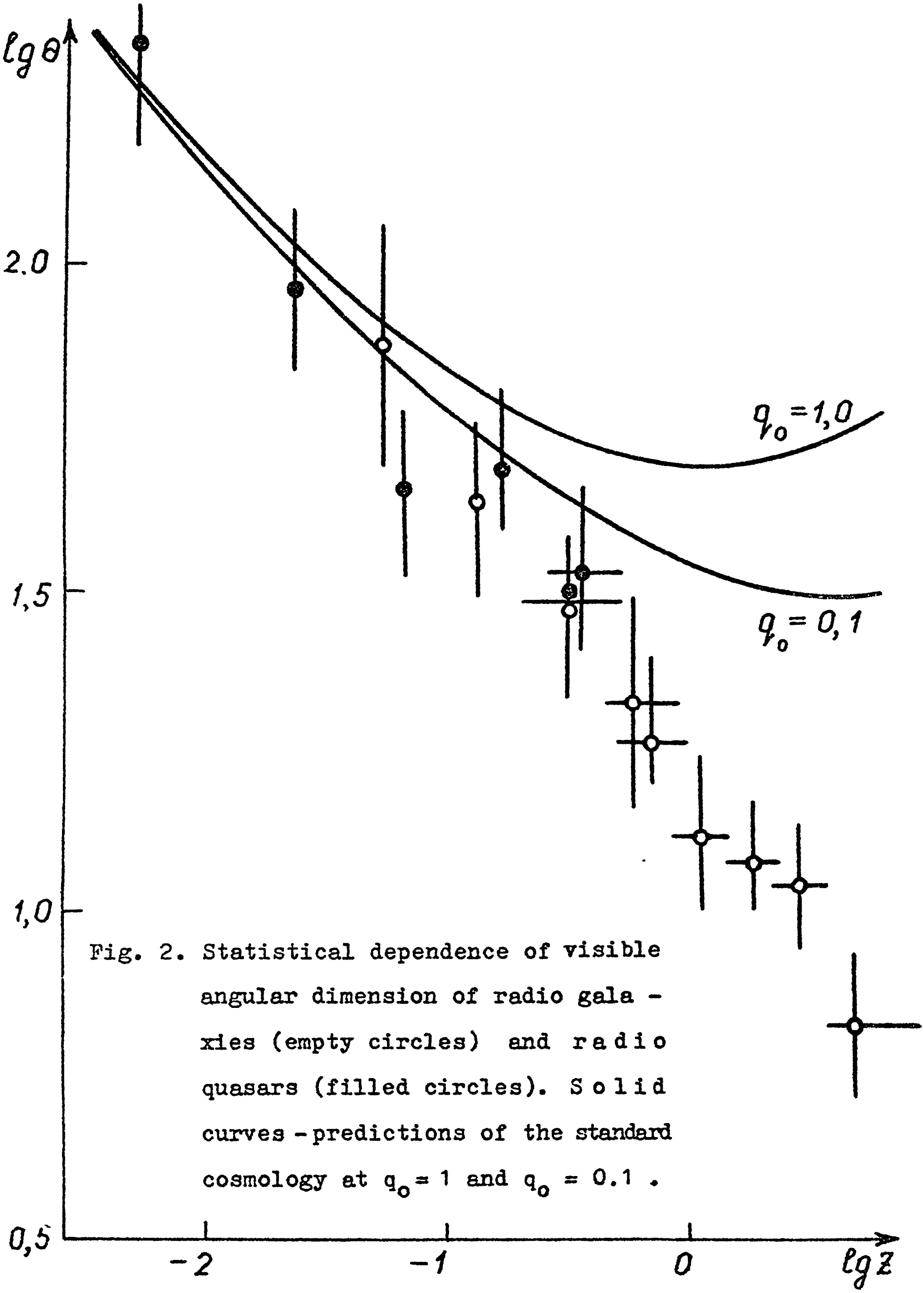

Fig. 2. Statistical dependence of visible angular dimension of radio gala - xies (empty circles) and radio quasars (filled circles). Solid curves - predictions of the standard cosmology at $q_o = 1$ and $q_o = 0.1$.

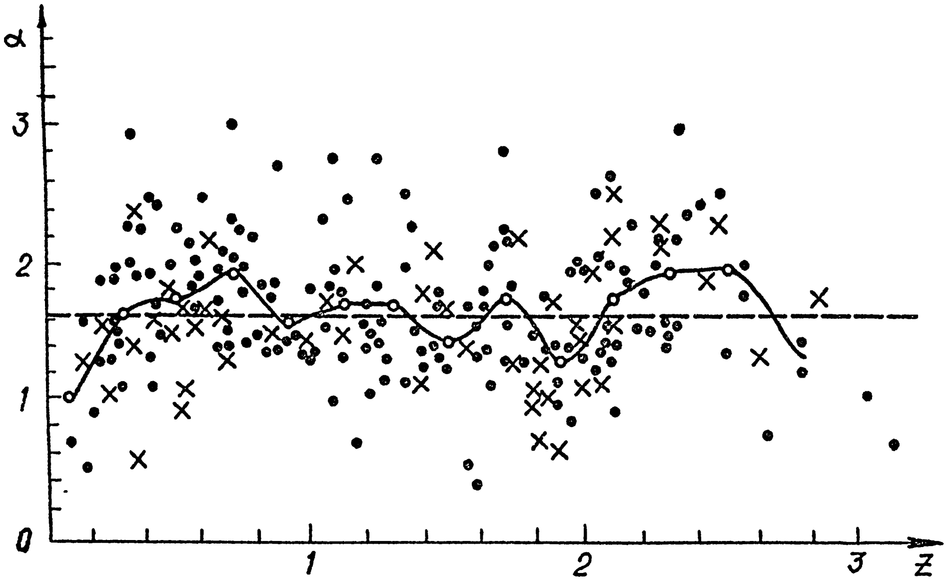

Fig. 3. The dependence of the spectral index of the optical spectrum of quasars in the interval $0,1 \leq z \leq 3$. A solid line - is the averaging in the interval $\Delta z = 0,2$; points - over the Folz work (1989), crosses - over Monk (1988) .

Table 1. Summary of data of correlation of luminosity and dimensions of galaxies

N	Z	Type and number of galaxies	Correlation of parameters	Evolution l,I at L $(z+1)^{3.2}$	M	dlgl/dM	Reference
1	$z < 10^{-3}$	8- spirals 7-unregular	$l \propto L^{0.33}$ $I \propto L^{0.33}$	$l \propto (z+1)^{1.07}$ $I \propto (z+1)^{1.07}$	$-14 \leq M \leq -20.5$	-0.13	Souček
2	$0.01 \leq z \leq 0.3$ $\bar{z} = 0.06$	72 powerful radio galaxies	$l \propto L^{0.425}$ $I \propto L^{0.152}$	$l \propto (z+1)^{1.35}$ $I \propto (z+1)^{0.49}$	$-19.5 \leq M \leq -225$	-0.17	Smith
3	$10^{-3} \leq z \leq 0.03$	ellipses	$l \propto L^{0.5}$ $I \propto$ const	$l \propto (z+1)^{1.6}$ $I \propto$ const			Faber-Jackson law
4	$10^{-3} \leq z \leq 0.03$	spirals	$l \propto L^{0.33}$ $I \propto L^{0.33}$	$l \propto (z+1)^{1.07}$ $I \propto (z+1)^{1.07}$			Tully-Fisher law
5	$0.02 \leq z \leq 0.3$ $\bar{z} = 0.06$	39 ellipses	$l \propto L^{0.83}$ $I \propto L^{-0.66}$	$l \propto (z+1)^{2.65}$ $I \propto (z+1)^{-2.1}$	$-19 \leq M \leq -24$	-0.34	Peletier
6	$0.05 \leq z \leq 0.3$ $\bar{z} = 0.1$	249 brightest ellipses(Abel)	$l \propto L^{1.6}$ $I \propto L^{-2.2}$	$l \propto (z+1)^{5.1}$ $I \propto (z+1)^{-7}$	$-19 \leq M \leq -24$	-0.62	Schneider
7	$\bar{z} = 0.07$	372 brightest ellipses(Abel)	$l \propto L^{1.34}$ $I \propto L^{-1.68}$	$l \propto (z+1)^{4.3}$ $I \propto (z+1)^{-5.4}$	$-21 \leq M \leq -24$	-0.52	Hassel
8	$0 < z \leq 5$	1100 galaxies of all types, 3400 quasars	$l_1 \propto L^{-0.63}$ $I_1 \propto L^{2.2}$ $l_2 \propto L^{-0.37}$ $I_2 \propto L^{1.66}$	$l_1 \propto (z+1)^{-2}$ $I_1 \propto (z+1)^{7.1}$ $l_2 \propto (z+1)^{-1}$ $I_2 \propto (z+1)^{5.1}$			standard cosmology

REFERENCES

Baldwin J.A., Wampler E.J., and Gaskell C.M. Ap.J., 1989,V.338, P. 630.

Folz C.B., and Chaffee F.M., et al. 1989, Astron.J.,V.98,P.1959

Hevitt A., Burbidge G. Ap.J.Suppl.Ser. 1987, V.63, p.1.

Hoessel J.G., Oegerle W.R., Schneider D.P. Astron.J. 1987, V.94, N.5,p.

Kapahi V.K. IAU Symp. N.124, Dordrecht Reidel D.p. 251, 1987.

Lilly S.J., Gunn J.E. MNRAS, 1985, V.217, P. 551.

Marchall H.L. Ap.J. 1985, V.229, P. 310.

Masson C.R. Ap.J., 1980, V.242, P.8

Monk A.S., and Penston M.V., et al. MNRAS, 1988, V.234, P. 193.

Peletier R.F., Davis R.L., Illingworth G.D., et al. Astron.J. 1990, V.100, N.4, P. 1091.

Sandage A., and Perelmutter J. Ap.J. 1991, V.370, N.2, P. 455.

Schneider D.R., Schmidt M., Gunn J.E. Astron.J. 1989, V.98,N.5.

Schneider D.P., Gunn J.E., Hoessel J.G. Ap.J. 1983, V.268,P.476

Smith E.P., and Heckman T.M. Ap.J. J.S.S.1989, V.69, P. 365.

Souček J. Astrophys.Space Sci. 1988, V.141, P. 103.

Troitsky V.S., Gorbacheva I.V. Astron.J. 1989, V.66, P. 470. (in Russian).

Troitsky V.S., Gorbacheva I.V., Suchkin G.L., Bondar L.N. Astroph. Space Sci. 1992; Astron.J.1992 (in Russian).

Troitsky V.S. Astrophys.Space Sci. 1987, V.139, P. 389; DAN USSR, 1986, V.290, N.1.

Troitsky V.S. Astron.J. (in Russian) in press.

Veron-Cetty M.P., and Veron P. A Catalog of Quasars European Southern Observatory, 1989, P.3.