ФІЗИКО-МАТЕМАТИЧНІ НАУКИ

УДК 531.51+521.11
DOI: 10.15587/2313-8416.2017.94021

THE ANALYSIS OF GRAVITY MODEL ON EXAMPLE OF COSMOLOGICAL EXPANSION

© A. Sidorov

Предложена модель гравитации, как поток 3-х мерного плоского пространства в материю и сверена с космологическими наблюдениями расширения Вселенной – на соответствие закону Хаббла. На этом принципе заложена основа для самодостаточной космологической модели Вселенной, не требующей применения таких понятий, как «тёмная материя» и «тёмная энергия», ответственные в современной физике за ускоренное расширение Вселенной
Ключевые слова: *поток пространства, плотность пространства, инвариант пространства, анизотропия пространства, красное смещение*

1. Introduction

The offered gravity model is in fact most similar to the Riemann's one. In his integral theory of field, offered as a report in 1853 year [1], *«…space is filled with some matter that continuously rushes in atoms and disappears there from the tangible world. At that the weighty bodies that consist of atoms, are the place of touch between tangible and intangible worlds…"*. But for that moment of astronomy development the Universe as a whole could be an object of the study of the gravity theory, offered by him. That is why his work dealt with combination of gravitational and electromagnetic interaction at microlevel that was an unreal task.

2. Literary review

Today the vortex space flow is considered as elementary matter by many authors but only several of them succeeded in supplying the verbally described physical model with mathematical apparatus that allows use it practically:

– the article [2], that considers the vortex flow of four-dimensional space at microlevel – between proton and electron – and as a result, for example, the maximal number of electrons on correspondent orbits is deduced in atoms of chemical elements, Lorenz's transformation of atom radius;

– in the book [3] the author tried to expound the nature of elementary matter on the example of electron by the movement of two annular (vortex) flows in three-dimensional space – in anisotropic "continual" sphere. For this aim the parasitic stereotypes of notions such as mass and electric charge that were considered as fundamental ones in physics, were rejected. But having rejected the traditional fundamental notions, the author did not construct the new more fundamental laws (THE LAWS OF SPACE) as a basis over superstructure that is for today the numerous physics, not connected with each other. That is why the author did not succeed in creation of integral model of elementary vortex – electron.

In the publications [4–7] the author expounds the principles of matter structure on the base of vortex space more fully. On this base he tries to combine the physical laws of micro- and macrocosm but without studying laws of space as initial matter.

Taking into account the complication that faced the aforesaid authors in the development of vortex nature of matter at microlevel, at the first stage it is necessary to study the properties and laws of the space at macrolevel – in cosmology, the branch, most studied on practice. And if the science about space is really the basis over the science about matter, the received laws can be correctly applied in microcosm too.

3. Aim and tasks of research

The aim is the construction of gravity model as the space flow in matter.

The following tasks were set to attain this aim:

1. The acceptance of fundamental laws of space at macrolevel.

2. The construction of cosmological model of the Universe on their base.

3. The study of the offered model for the correspondence of effects of cosmological Universe expansion.

4. To carry out the analysis of presented cosmological model with universally recognized one.

5. The estimation of prospects of the space physics development.

4. Gravitation as a space flow in matter

Gravitation is considered in this study as absorption of three-dimensional space by elementary matter. Besides the space is "initial matter" itself. It consists of

two orthogonally placed two-dimensional Euclidean subspaces "A" and "B".

Let's introduce such notions as:

a) the space flow – F through the sphere S is equal to the product of sphere area by the speed of piercing sphere by this space:

$$\Phi = \frac{dV}{dt} = \mathbf{S} \cdot \mathbf{r}'_t, \quad (1)$$

b) the space flow acceleration

$$\frac{d\Phi}{dt} = \frac{d^2V}{dt^2} = \mathbf{S} \cdot \mathbf{r}''_t. \quad (2)$$

The flow of accelerating space to the mass m1, catches on its way the flows, rushing to m2, and thus gives acceleration $r''_t = -\frac{m1 * \bar{G}}{4\pi r^2}$ to the mass m2. Substitute it in (2) and get the acceleration of space flow to the body with mass m1:

$$\Phi' = S\frac{-m1\bar{G}}{4\pi r^2} = -m1\bar{G}$$

where $\bar{G} = 4\pi G$ – deduced constant of gravitation. In general case:

$$\Phi' = \frac{d^2V}{dt^2} = -m\bar{G} = \mathbf{inv№1}. \quad (3)$$

The identical equality follows from (3): ***the space flow acceleration in matter depends only on the matter mass, concluded in the sphere S, and does not depends neither on sphere radius (r), nor on time.***

The masses gravitationally interact through their space flows in offered model. To change the speed of any body, it is necessary to change the space flows in this body. The more massive is the body, the more space flow inflows in it and the more external space flow is needed for its acceleration.

Let's determine the value of flow F in matter with mass **m** from the time of Universe birth:

$$\Phi = \frac{dV}{dt} = -\int_0^t m\bar{G}dt = -m\bar{G}t. \quad (4)$$

The more space was absorbed by the matter (proportionally to the Universe age), the more its volume would be further absorbed in the unit of time. These reasons give grounds to suppose the existence of some "Isothermic law" about the constancy of absorpsion of the same quantity of any value, that characterises more fully the space than its volume, by the matter in time. Let's name this space the ***"second Invariant",*** that must be determined.

Having integrated repeatedly the expression (4) by time and substituting in it the mass **M** of Universe and its age **t**, we get the dependency of absorbed space since the moment of Universe birth (t=0) till the time t.

$$V_{m\,abs.} = -M\bar{G}\int_0^t tdt = -\left(\frac{M\bar{G}}{2}\right)t^2\Big|_o^t,$$

$$V_{m\,abs.} = -\frac{M\bar{G}}{2}t^2. \quad (5)$$

5. Space density – the missing link in the theory

To discover the definition of the ***"second Invariant"***, let's introduce the notion of ***space density φ.***

As opposite to the "field physics" that doesn't discover the nature of matter interaction and gives to the space the only function of remoteness coordinates, the offered space model must "be responsible" for all interactions itself, so must have such property as density φ, that is best characterized by the light speed in vacuum. Cartesian approach in the nature cognition, shared by the author, excludes a possibility of transmission of, for example, electromagnetic energy (photon) in "empty" space. In this case the simultaneous change of tension E and H from 0 to maximum on the trajectory of photon movement is offered to be considered as a harmonic change of "A" and "B" subspaces density in space.

So, at the choice of space density dimensionality φ it must be taken into account that its "deformation" - **grad(φ)** must correspond to the force characteristic. Based on these reasons, let's present the space density φ at proportionality coefficient – 1, equal to the square of light speed in vacuum: $\boldsymbol{\varphi} = 1 \cdot c^2 = c^2 \cdot [m^2/s^2]$.

If expound it at microlevel, the space density consists of the product of densities of orthogonal subspaces "A" and "B":

$$\varphi = \varphi_A \cdot \varphi_B = c_A \cdot c_B = c^2. \quad (6)$$

6. Base equation of the Universe

The volume of absorbed space for all time of all matter existence in Universe according to the formula (5), is practicaly actual geometrical volume of Universe. That is $V_{abs} = -V_{geometr}$.

At once after the "birth" of Universe, the space absorption by initial matter according to the formula (5) diminished the space density by some share. But the less is the space density, the less are all interaction forces, transmitted through it by the matter. For example, Kulon forces or gravitational ones will be less by the value, equivalent to the increment of square of distance between charges. Such weakening of forces at the expanse of space density decrease will be considered by "internal observer" as a removal of all interacting objects from each other that is as some geometrical growth of Universe. Thus the almost zero volume and huge space density at the initial stage of Universe development as a result of its absorption by the matter during the time t_0, led in such a way to its density decrease to $\varphi_o = c_0^2$ and to today "quasigrowth" of volume to V_0

$$V_{(t=0)} \cdot \varphi_{(t=0)} = V_0 \cdot c_0^2. \quad (7)$$

The giving of additional physical sense of the light speed, as characteristic of the space density, allows explain the effect of ***quasigrowth*** of Universe geometrical volume owing to its ***isothermal*** density decrease: $V \cdot \varphi = const$.

The space density decrease –dφ at the expanse of its absorption by the matter can be observed only as a growth of remoteness between the observed objects (growth of geometrical volume dV). In general case for any Universe age:

$$\mathbf{V_{(t)} * \varphi_{(t)} = inv№3 = K}. \quad (8)$$

This ***basic equation*** of the offered ***model of Universe*** reflects most precisely the causal effect of gravitation and expansion of the Universe. The role of Einstein's cosmological constant in the offered model is played by gravitation itself, if consider it as a continuous process of space density decrease at the expanse of its absorption by the matter.

Let's name this invariant value "K" as "***Space Quantity***". The received ***adiabatic invariant in*** (8) is based purely on philosophical interpretation of perception of remoteness of subjects in space. And in the same way the equality of absorbed and geometrical volumes of Universe $\left(V_{absorbed} = -V_{geometrical}\right)$ can be accepted purely on conceptual level as equivalent of the space density loss. So, geometrical volume of Universe in any moment:

$$V_{geometr.} = M\bar{G}t^2/2. \quad (9)$$

From (8) it follows, that the ***space quantity "K"*** of the Universe in time, as opposite to the energy that decreases proportionally to the space density decrease, is a constant value and numerically equal to $V_o\varphi_0 = 4,33527E+95\left[m^5 s^{-2}\right]$. The mass of Universe $1{,}5 \cdot 10^{53}$ kg was accepted at calculation.

7. The calculation of the Universe parameters

Then, through the solution of (8), we get the dependencies of most Universe important physical values on time: $c_{(t)}, \varphi_{(t)}, V_{(t)}$.

From (8) we get:

$$d\left(V \cdot c^2\right)/dt = 0;$$

Differentiate it and make the series of transformations:

$$dVc^2 + V2cdc = 0 \text{ or } 2dc/c_t = -dV/V_t;$$

$$\frac{dV}{dt}\frac{dt}{V_t} = -\frac{2dc}{c_t}.$$

Substitute instead of dV/dt *and* V_t their values from (4) and (6) and after integration of its parts get:

$$\frac{-m\bar{G}t}{-\left(\frac{m\bar{G}}{2}\right)t^2}dt = -\frac{2dc}{c_t}; \quad \frac{2dt}{t} = -\frac{2dc}{c_t};$$

$$\int_t^{t_0}\frac{dt}{t} = -\int_c^{c_0}\frac{dc}{c_t}.$$

$$\ln t\Big|_t^{t_0} = -\ln c\Big|_c^{c_o}; \text{ or } \ln\frac{t_0}{t} = \ln\frac{c}{c_o}; \quad \frac{c}{c_0} = \frac{t_0}{t}.$$

The notion of ***relative time*** $\tau = \frac{t_0}{t}$ is introduced for ease. The dependency of light speed and space density on the relative time is finally gotten:

$$c = c_0\tau. \quad (10)$$

$$\varphi = c_0^2\tau^2. \quad (11)$$

From (8), the Universe volume from relative time:

$$V_t = V_0/\tau^2. \quad (12)$$

Now, when the dependencies of most important Universe physical values on time are received: $c_{(t)}, \varphi_{(t)}, V_{(t)}$, we can return to interpretation of (4), at which it was presupposed the constancy of absorption of the same quantity of some value by mass in time, as opposite to its pure volume, named as ***Invariant №2***. Let's consider an expression $\Phi_t \cdot \sqrt{\varphi_t}$:

$$\Phi_t \cdot \sqrt{\varphi_t} = m\bar{G}t \cdot c_t = m\bar{G}t \cdot c_0\frac{t_0}{t} = m\bar{G}c_0\mathbf{t_0}.$$

$$\Phi_t \cdot \sqrt{\varphi_t} = K_\perp, \quad (13)$$

– in any period of the Universe development from its birth to the regeneration in Black hole, ***the product of space volume, absorbed by the mass m in the unit of time*** **-dV/dt,** ***by space density C_t represents this value, constant in time "The absorbed subspace quantity"*** **– $\mathbf{K}_\perp$**

Really, the right part of considered expression, except m, presents constants. The absorbed subspace quantity for the unit of mass:

$$k_\perp = \frac{\Phi_t \cdot c_t}{m} = \bar{G}c_0t_0. \quad (14)$$

Its value $\mathbf{k}_\perp$ =6,9628E+16 $m^4 \cdot kg^{-1} \cdot s^{-2}$.

The received constancy of absorption of the same quantity of subspace A and B by gravitating mass indicates that this invariant is such fundamental driving mechanism that is "responsible" for the whole evolution of the Universe. It is just fundamental tachometer as opposite to time, considered in this model as purely math-

ematical parameter. That is the Universe evolves not because the time flows, but because the subspaces A and B are absorbed according to the formula (14), and an "Observer" only fixes these changes, having introduced the value, proportional to them, – time.

8. The study of gravity model for correspondence to cosmological observations. Cosmological model

The expression (10) allows determine the emitted length of luminous wave, came from the early Universe and measured by us as λ_0 :

$$\lambda_t = \frac{h}{mc} = \frac{h}{mc_0 \cdot t_0/t} = \lambda_0 \frac{t}{t_0}$$

$$\lambda_\tau = \lambda_0/\tau, \qquad (15)$$

Wave frequency $\nu = \frac{c}{\lambda} = \frac{c_0\tau}{\lambda_0/\tau} = \nu_0\tau^2$

$$\nu = \nu_0\tau^2. \qquad (16)$$

The dependency of the Universe radius on time (fig. 1) was received using formula, reverse to the sphere volume: $\tau = \left(\frac{3}{4\pi}V\right)^{1/3}$, where the volume of Universe space V with regard to (9) can be replaced with $M\bar{G}\,t^2/2$

$$r = \left(\frac{3}{8\pi}M\bar{G}\right)^{1/3} \cdot t^{2/3}. \qquad (17)$$

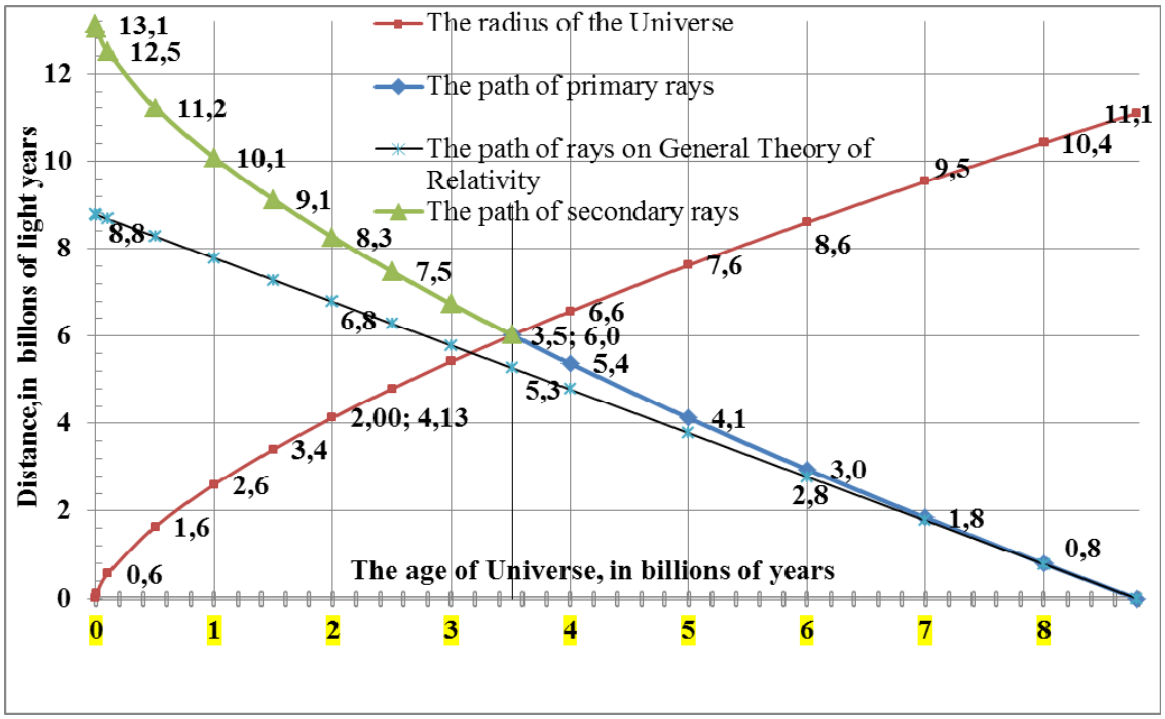

Fig. 1. Universe radius and the way, passed by the light from its age

For simplification in (17) we'll assume that the Universe gravitational mass M_t=**constant**. So, the Universe radius or can be expressed through its today radius –r_0:

$$r = r_0 \cdot (t/t_0)^{2/3} = r_0\tau^{-2/3}. \qquad (18)$$

Obviously, the formulas of the Universe radius from time are correct for any other material object of the Universe.

The speed of the Universe growth can be received by differentiation of (11) by t

$$r'_{(t)} = \frac{d}{dt}(r_0 \cdot t/t_0)^{2/3} = \frac{2/3 r_0}{t_0^{2/3}t^{1/3}}. \qquad (19)$$

This expression characterizes the dependence of speed of removal of object, observed on "horizon" from the "Observer" (Fig. 2, "growth speed of the Universe").

For determination of space run-up speed and together with it the visible matter in any point of the Universe, let's refer to run-up speed on the Universe horizon – $r'_{(t)}$ and having taken the proportion of distance to the arbitrarily chosen object – L, to the Universe radius – $r_{(t)}$ determine in such a way the speed of removal of this object from "Observer":

$$\upsilon_{(t)} = L' = \left(\frac{r'_B}{r_B}\right) \cdot L;$$

$$\upsilon_{(t)} = \frac{\frac{2}{3}r_0}{t_0^{2/3}t^{1/3}} \cdot \frac{L}{r_0 \cdot (t/t_0)^{2/3}} = \frac{2}{3}\cdot\frac{1}{t}L_t$$

$$\upsilon_{(t)} = \frac{2/3}{t}L_t = H_t L_t. \qquad (20)$$

The received result in (17) and (20) fully ***coincides with Friedman's equations*** **[8],** for both ***scale factor*** from time $\alpha \infty t^{2/3}$ (18), and ***Hubble's constant*** for "dust" (of gravitating matter): $H_t = \frac{2/3}{t}$.

We get the Universe age t_0 from Hubble's law for "dust" (20) at t=t$_0$:

$$\frac{2}{3t_0} L = H_0 \cdot L.$$

$$t_0 = \frac{2/3}{H_0}. \quad (21)$$

At accepted H=74,2 km/s for megaparsec, let's determine the Universe age: $t_0 = \frac{2/3}{H_0} = 8,780983$ billion years that also ***coincides for Friedman's "dust".***

$$r_0 = \left(\frac{3}{8\pi} M\bar{G}\right)^{1/3} t_0^{2/3} = 1,04816 \cdot 10^{26} m$$

The nonlinear dependence of the light speed on time in the formula (10) leads to nonlinearity of the way, passed by the light from observed object. For getting unambiguous solution of (20), it is necessary to express the variable of the right part– t and L_t through each other. The earlier Universe is observed, the less sense is in variable L. Time is more reliable parameter that characterizes the removal of objects. So, let's express L in (20) through the temporal remoteness.

The speed of light from "observed" object and way, passed in coordinates of today "Observer" depends on run-up of the space that moves in direction, opposite to the light, with speed depending on this remoteness. That is the light, emitted from object towards today "Observer" in coordinates of the object itself (Observed) has speed $dL^*/dt = c^* = c_0 \cdot t_0/t$, and the space, flying away from "Observer" according to (13) $\upsilon_{(t)} = -\frac{2}{3} \cdot \frac{1}{t} L$ diminishes its speed by this difference. ***The rule of relativistic speed summation is*** absolutely ***inappropriately in this case;*** because Lorenz's transformations related to the summation of the speeds of material objects in static space. In this case we deal with removal of the space itself from "Observer". Just classic difference of these speeds is the speed of the light approaching to "Observer" in its coordinates. In this case the equation for expression of L, dL/dt in "Observer's" coordinates, from t is:

$$L_t' = c_0\, t_0/t + \frac{2}{3} \cdot \frac{1}{t} L.$$

Let's deduce to the form of nonlinear differential equation of the first kind:

$$L_t' - \frac{2}{3} \cdot \frac{1}{t} L_t = c_0 \cdot t_0/t$$

Its solution: $L_t = \frac{3}{2} c_0 t_0 \left[\left(t/t_0\right)^{2/3} - 1\right]$ or through: τ

$$L_\tau = \frac{3}{2} c_0 t_0 \left(1/\tau^{2/3} - 1\right). \quad (22)$$

All beams, gotten in present time, are on the curve, described by the expression (22) (Fig. 1). Let's name it "The line of receiving". It is notable, that the light, emitted earlier than 5,3 billion years ago has already passed the Universe once before coming to us. Let's name such remote beams the "secondary" ones. On the Fig. 1, 2 it is a whole area from 0 to t$_1$ =3,513243 billion years. Only the area from t$_1$ to the present time includes beams, not having come repeatedly – "primary" beams. The expression (22) allows get the way, passed by the light at maximal speed (t=0). $L_{t=0} = 3/2\, c_0 t_0 = 13,14$ billion light years.

Having gotten L_t, let's present ***Hubble's law in temporal remoteness:***

$$\upsilon_{(t)} = \frac{2}{3} \cdot \frac{1}{t} L_t = \frac{2}{3} \cdot \frac{1}{t} \frac{3}{2} c_0 t_0 \left[\left(t/t_0\right)^{2/3} - 1\right] =$$
$$= c_0 \left[\left(t_0/t\right)^{1/3} - \left(t_0/t\right)\right].$$

Final Hubble's law in temporal remoteness with regard to the sign (speed of the space run-up from "Observer" – with minus sign):

$$\upsilon_{(\tau)} = c_0 \left(\tau^{1/3} - \tau\right). \quad (23)$$

Having differentiated L_t for t, get the required dependency of the light speed to "Observer" on the temporal remoteness– τ:

$$c_{(t)\,\text{obs}} = L_t' = \frac{3}{2} c_0 t_0 \left[\left(t/t_0\right)^{2/3} - 1\right]' =$$
$$= \frac{3}{2} c_0 t_0 \cdot \frac{2}{3} \frac{1}{t^{1/3} \cdot t_0^{2/3}} = c_0 \left(\frac{t_0}{t}\right)^{1/3}.$$

$$c_{obs.(\tau)} = c_0 \tau^{1/3}. \quad (24)$$

For the observer of just our epoch the "horizon" of Universe moves away on the concurrence of the "line of receiving" with the curve of Universe growth with speed υ$_1$=342451 km/s.

The physical sense of the light speed decrease relative to "Observer", gotten in (24) from $c_0 \cdot \tau$ to $c_0 \tau^{\frac{1}{3}}$, (Fig. 2, 3), is reduced to the following: the space, dispersing from the remote observer with the speed $HL = c_0 \left(\tau^{1/3} - \tau\right)$ leads to the anisotropy effect of the space density in this direction. As a result the electromagnetic perturbations become weaker in this direction equivalently to the space density decrease from $\varphi = c^2 = \left(c_0 \tau\right)^2$ to

$$\varphi_{obs.} = \left(c_0\tau + c_0\left(\tau^{1/3} - \tau\right)\right)^2 = c_0^2\tau^{2/3}$$

The heterogenic and isotropic static space for "Observed" object is not such for the remote "Observer". That is why the light speed in this direction changes not by (7):

$$c = \sqrt{\varphi} = c_0\tau,$$

but only as

$$\sqrt{c_0^2\tau^{2/3}} = c_0\tau^{1/3}.$$

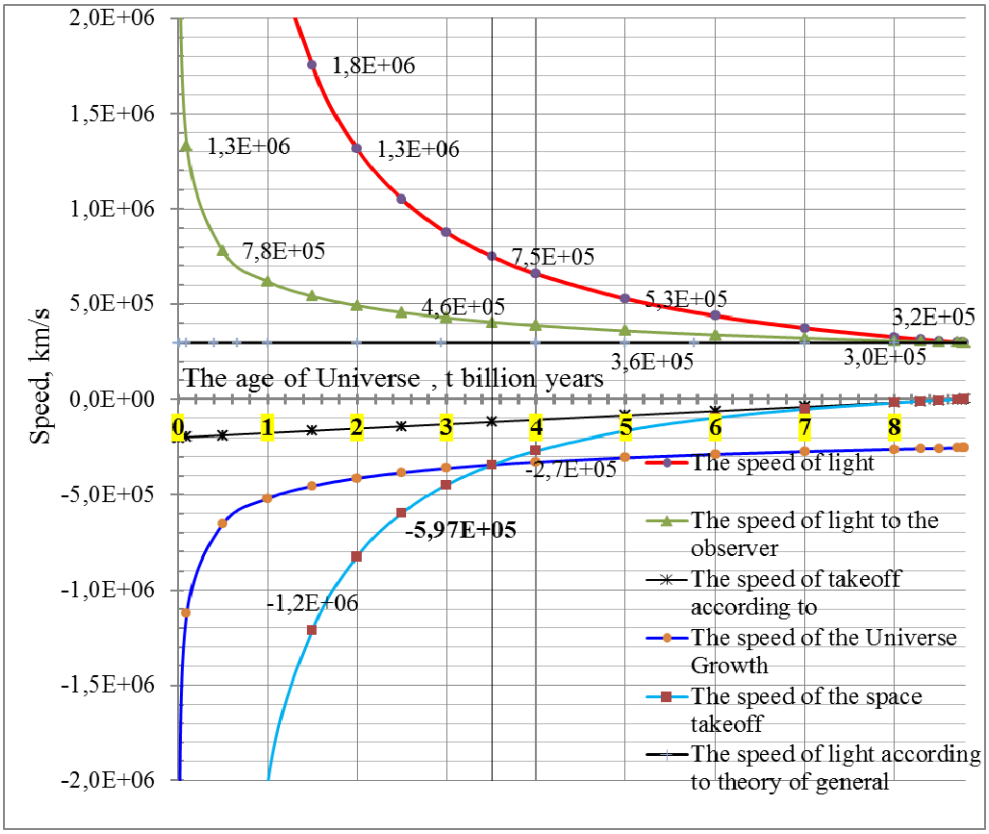

Fig. 2. Dependence of speeds on the Universe age

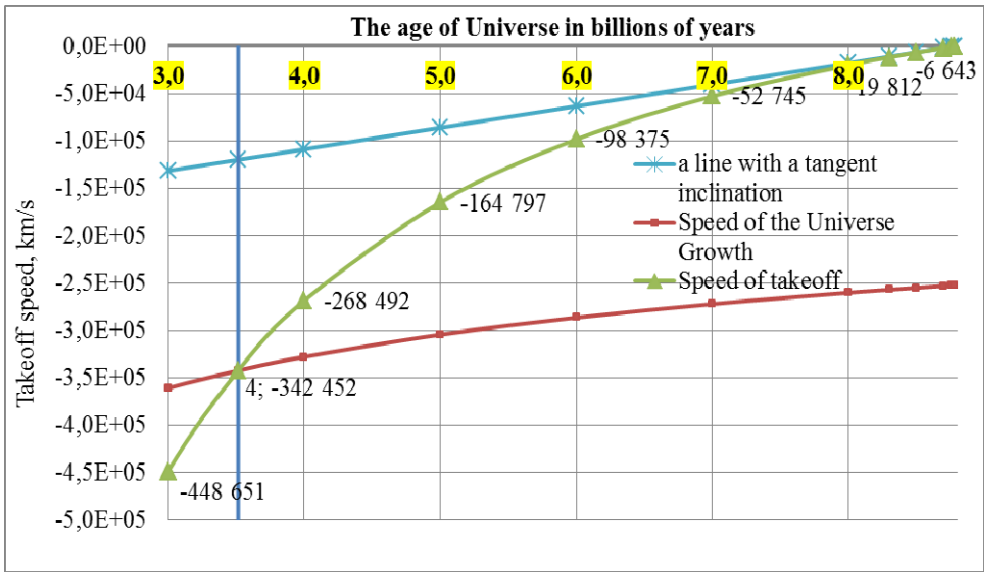

Fig. 3. Run-up speeds in the scale of "Primary" beams

It is not possible to interpret such weakening of the light wave by Doppler effect. Because it is not an instant process of light emission by moving object in immovable space but the permanent decrease of light speed, caused by the counter run-up of space and thus resulting in anisotropy of its density. ***The light speed decrease in direction of remote "Observer" is equivalent to the space density decrease in this direction.***

Let's deduce the coefficient of ***anisotropic red shift*** of the light wave length from the temporal remoteness:

$$Z_{a\lambda} = \frac{\lambda_a - \lambda_t}{\lambda_t} = \frac{\lambda_0/\tau^{1/3} - \lambda_0/\tau}{\lambda_0/\tau} = \tau^{2/3} - 1,$$

$$Z_{a\lambda} = \tau^{2/3} - 1, \qquad (25)$$

where $\lambda_a = \frac{h}{mc_a} = \frac{h}{mc_0\tau^{1/3}} = \lambda_0/\tau^{1/3}$; $c_a = c_{obs.} = c_0\tau^{1/3}$ – light speed with regard to anisotropic effect – to "Observer".

The effect of the light speed decrease at approaching to "Observer" from $c_0\tau^{1/3}$ to c_0 (fig. 2) in expression (24), is explained by the space density decrease φ from $\left(c_0\tau^{1/3}\right)^2$ to c_0^2 The space, losing density at photon movement, is equivalent to the optical lens with decreasing density.

The red shift of such ***lensing*** by the light wave length $Z_{L\lambda}$ from temporal remoteness:

$$Z_{L\lambda} = \frac{\lambda_0 - \lambda_a}{\lambda_a} = \frac{\lambda_0 - \lambda_0/\tau^{1/3}}{\lambda_0/\tau^{1/3}} = \tau^{1/3} - 1,$$

$$Z_{L\lambda} = \tau^{1/3} - 1, \qquad (26)$$

If take into account that $Z_{a\lambda} - 1 = \lambda_a/\lambda_t = \tau^{2/3}$ and the same for ratio, $\lambda_0/\lambda_a = \tau^{1/3}$ the summary wave "weakening"

$$\lambda_0/\lambda_t = \left(Z_{a\lambda} - 1\right)\left(Z_{L\lambda} - 1\right) = \frac{\lambda_a}{\lambda_t}\frac{\lambda_0}{\lambda_a} = \tau^{2/3}\tau^{1/3} = \tau.$$

So, the ***summary red shift*** by the wave length for remote "Observer":

$$Z_\lambda = \tau - 1. \qquad (27)$$

The received coefficient is the very "red shift", being observed by astronomers for more than one century. Several physicists explain its nature as Doppler red shift. The majority agree that it is the effect of space expansion and increase of all geometrical sizes of matter in time, including the light wave, reflected by Hubble's quantum law. Let's get this law on the base of given model.

Let's differentiate the expression (15) $\lambda_t = \lambda_0 \frac{t_0}{t}$ by t: $d\lambda/dt = \lambda_0/t_0$. Let's divide the gotten expression by λ: $\frac{d\lambda/\lambda}{dt} = \frac{\lambda_0/\lambda}{t_0}$. In (15) replace the right part λ_0/λ with t_0/t. Then

$$\frac{d\lambda/\lambda}{dt} = \frac{t_0/t}{t_0} = \frac{1}{t}.$$

Having presented $d\lambda$, as wave length increment $\Delta\lambda$ for time dt, as vibration period T, ***get the well-known quantum law*** of wave damping for one period of vibration:

$$\frac{\Delta\lambda/\lambda}{T} = \frac{1}{t}. \qquad (28)$$

To discover the complicated character of the light wave length growth from λ to λ_a, and then to λ_0, we expounded this process above on the example of red shift in details. As far as the offered model provides the equivalence of two fundamental parameters such as light speed and space density, the weakening of photon speed towards remote "Observer" at the expanse of counter moving space is equivalent to the space density decrease in this very direction.

The coefficient of energy transmission of the light wave, moving towards remote "Observer" – to the opposite side from dispersing space, is also proportional to the change of space density that is equivalent to the change of square of the light speed towards "Observer". Let's name such coefficient as ***anisotropic red shift*** by energy (***by frequency***) – Z_{av}.

$$Z_{av} = \frac{\varphi_t - \varphi_a}{\varphi_a} = \frac{v_t - v_a}{v_a} = \frac{v_0\tau^2 - v_0\tau^{2/3}}{v_0\tau^{2/3}} = \tau^{3/4} - 1.$$

Where the light frequency towards "Observer" with regard to anisotropic decrease of space density:

$$v_a = \frac{c_a}{\lambda_a} = \frac{c_0\tau^{1/3}}{\lambda_0/\tau^{1/3}} = v_0\tau^{2/3}.$$

$$Z_{av} = \tau^{4/3} - 1. \qquad (29)$$

The red shift of lensing by frequency Z_{Lv}:

$$Z_{Lv} = \frac{v_a - v_0}{v_0} = \frac{v_0\tau^{2/3} - v_0}{v_0} = \tau^{2/3} - 1,$$

$$Z_{Lv} = \tau^{2/3} - 1. \qquad (30)$$

If consider that $Z_{av} - 1 = v_t/v_a = \tau^{4/3}$ and the same for ratio $v_a/v_0 = \tau^{2/3}$, the summary "weakening" of frequency

$$v_t/v_0 = \left(Z_{av} - 1\right)\left(Z_{Lv} - 1\right) = v_t/v_a \cdot v_a/v_0 = \tau^{3/4}\tau^{2/3} = \tau^2.$$

So, ***the summary red shift*** by frequency for remote "Observer":

$$Z_v = \tau^2 - 1. \qquad (31)$$

As opposite to traditional (field) physics, in this model the red shift by photon energy (its frequency) has stronger dependence on remoteness (31), than the shift

on wave length (27). It becomes particularly observed at big remoteness (Z>0,5) with growth of technical equipment at observations of supernovas of Ia type. The decrease of their brightness (proportionally to photon energy), that determines the distance to supernova, happens significantly "faster" than the spectrum "becomes red", that determines Hubble's speed. ***The false conclusion was made*** from it about as if less run-up speeds at the early stages of Universe comparing with modern epoch. The cause of transfer from decelerated to accelerated expansion of the Universe in the middle of its evolution, unexplained within the "field" physics, needed explication. The "official" cosmological model needed introduction of more and more number of phantom "supports" such as "dark matter", antigravitation, responsible for expansion, and finally in 1998 introduction of "dark energy", responsible for as if accelerated run-up of the Universe [9]. Within the presented gravity model, based on space flow in gravitating matter, the seeming accelerated run-up of Universe space is explained by the different law of the "red shift by wave length and photon frequency" (Fig. 4).

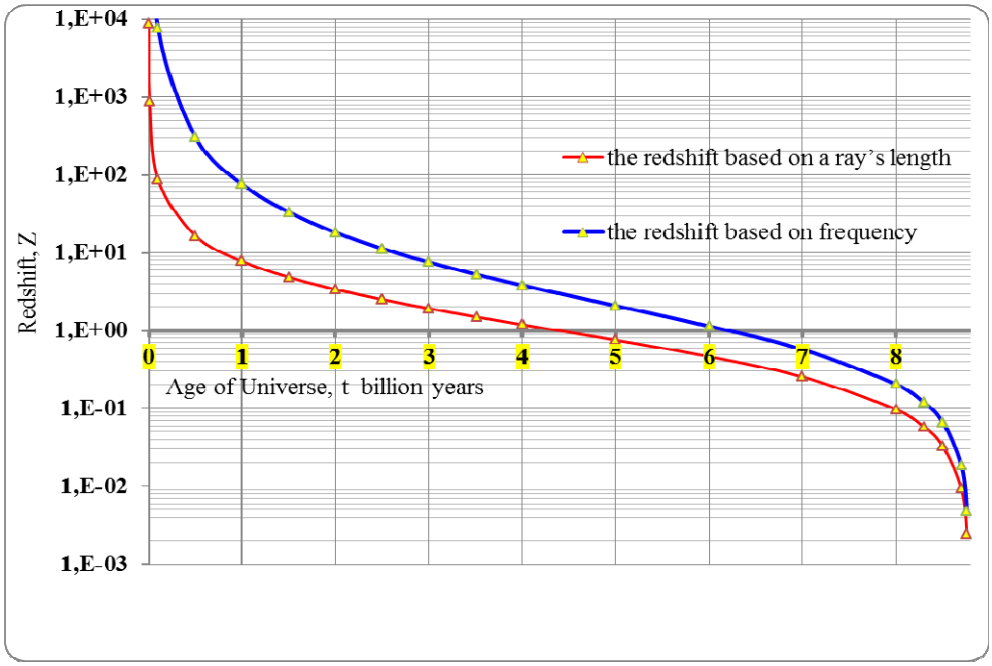

Fig. 4. The divergence in shifts by wave length and frequency, "guilty" of introduction of the notion "Dark energy"

9. Results of research

1. The offered model of the Universe with all its assumptions, destructive for the orthodoxes of relativistic physics, was verified for correspondence to the astronomers' observations of the Universe run-up and allows get the quantitative answers to many questions of cosmology. Cosmology becomes closer to exact science. The introduced physical notions such as space flow in matter F, space density $\boldsymbol{\varphi}=c^2$, Invariant of space quantity – $V_{(t)} \cdot \varphi_{(t)}$, invariant of absorbed space quantity – $\Phi_t \cdot \sqrt{\varphi_t}$, are grounded parameters. I would name them fundamental for presented model.

2. The given model discovers the nature of the Universe space expansion without necessity of using such mystic, unessential notions as antigravitational cosmological constant, dark energy, as if "responsible" in modern physics for as if accelerated space expansion.

3. The expressions from (4) to (19) were gotten with knowingly accepted simplification: gravitational mass didn't change in the process of Universe evolution. But the very essence of the theory of space flow as an exponent of gravitational mass provides its loss – in photons. The latter don't have gravitation, because the space flow in photon, already moving with light speed, is impossible. Let's estimate the error magnitude of such simplification.

Using invariant No. 3: $K = V_t \cdot \varphi_t$, get the formula, connecting the space quantity "K" with energy, contained in this volume, on example of "birth" of two photons as a result of electron and positron annihilation:

$$K/E_v = \frac{V_t \cdot c_t^2}{mc_t^2} = \frac{\frac{m\bar{G}t^2}{2}}{mc_t^2}.$$

$$K/E_v = \bar{G}t^2/2. \qquad (32)$$

The right part of gotten equation is a value, inverse to the mean density of gravitating matter in space: $1/p = \bar{G}t^2/2$:

$$p = \frac{M}{V} = \frac{M}{M\bar{G}t^2/2} = \frac{2}{\bar{G}t^2}. \qquad (33)$$

Let's finally write (32), as a connection of space quantity K in unit of volume, contained in born photon, with density of energy in this volume:

$$K \cdot p_t = E_v. \qquad (34)$$

If consider the arbitrary macrovolume of space V, losing matter with mass M as a result of transfer into photons, in this volume will be emitted the ener-

gy: $K \cdot p_t V = E_v V$ that is we get the ***integral variant of this law:***

$$K \cdot M = E. \quad (35)$$

Having divided the left and right parts (34) by the volume of created photon: $\frac{K}{V} \cdot p_t = \frac{E_v}{V}$, get ***differential variant*** of connection of the space density and matter density loss with density of energy increment in microvolume:

$$\varphi_t \cdot dp_t = d\varepsilon. \quad (36)$$

Taking into account that $\varphi = c_0^2 \tau^2$

$$dp/d\varepsilon = \frac{1}{c_0^2 \tau^2}. \quad (37)$$

The received expression allows state that ***till the present time the mass loss of Universe for emission is negligibly small and will become actual in remote future;*** because the ratio between the matter density loss to the emitted energy density growth increases proportionally to the square of temporal remoteness τ – in future. Based on it, we can also state, that the growth of Universe temperature and entropy is proportional to the intensity of matter decay into more and more simple components that is proportional to the Universe age and not vice versa. According to Gamov, the "Hot Universe" doesn't correspond to the received formula. It also results in inconsistency of introduction of the "hot" period of ultrarelativistic matter during the first third of the Universe evolution (its hot stage). That is Hubble's law for Friedman "dust", received in this model too $\upsilon_{(t)} = \frac{2/3}{t} L_t$, is correct for the whole period of the Universe evolution.

The aforesaid formation of photons with less energy than at annihilation (34), for example, at its emission at the moment of transfer of electron in atom from the bigger orbital to the smaller one, principally cannot have differences with aforesaid example. Taking into account that in this theory an electron is an orbital – thin vortex ring [3], the loss of volume by orbital is also equivalent to the emitted photon energy in correspondence with (34): $\Delta V_t c_t^2 \cdot p_t = v_t h.$

The universal character of formula (34) is that it connects energy of any origin that is not constant in time because of space density decrease with invariant value K, which component is a volume, occupied by any form of the matter (that includes mutual movement of subspaces). The formula is acceptable also for "pure" space, deprived of this mutual movement – in vacuum without matter. In this case the matter density ρ_t in left part of equation and its energy in the right one will be equal to null.

5. The non-compliance of star masses movement around the center of spiral galaxies with Newton's laws of celestial mechanics is explained by the huge loss of gravitational mass in Black holes that resulted in introduction of another deity – "Dark matter". But such anomalous movement of stars around the kernels of elliptic galaxies – "quasars" and other is organically inscribed in offered gravity model.

The absorption of matter with mass m, going away beyond the event horizon of Black hole in Quasar at the angle γ, is attended by increment of radial and tangential components of the space flow respectively: $\Delta\Phi_\perp = -m\bar{G}t \cdot \sin\gamma; \Phi_\parallel = -m\bar{G}t \cdot \cos\gamma.$ The kinetic energy of mechanic rotation moment of masses, having gone beyond the event horizon doesn't disappear utterly. It accumulates as vortex component of space flow: $\Phi_\parallel = -m\bar{G}t \cdot \cos\gamma = S \cdot \upsilon_\parallel$ .This flow has a form of disk with internal radius, equal to the event horizon, and external one, limited by the volume of vortex flow

$$V_\parallel = \sum_i m_i \bar{G}t^2 \cos\gamma/2 .$$

Such vortex flow like the traditional gravitational one – $\Phi_\perp$, pierce the star masses and also creates their radical acceleration in this disk but in opposite to $\Phi'_{\perp(r)}$, because of even linear flow speed on its radius $\left(grad\upsilon_{\parallel(r)} = 0\right)$, its centripetal acceleration changes by the law of the round movement: $g_{\parallel(r)} = \upsilon_\parallel^2/r$, whereas the radial acceleration of the space flow (Newton's acceleration) is inversely proportional to the radius square: $g_{\perp(r)} = -M\bar{G}/4\pi r^2$. So, firstly, the more quasar is in the center of spiral galaxy (more than r), the more the law of round movement prevail over Newton's movement of celestial bodies.

Secondly, if take into account that at the early stage of the Universe the mass loss of Black hole at the expanse of Hawking's evaporation is proportional to $c^4 = c_0^4 \tau^4$, for example, for the Universe age of 10^6 years this value is $\sim c_0^4 \cdot 10000^4$! Such colossal ***mass loss by the Black hole for billions years significantly diminished the Newton's component of acceleration*** $\mathbf{g}_\perp$***, whereas the vortex component of acceleration*** $g_\parallel$ ***only increased during all this time.***

The totality of these two factors explains:

– the significant prevalence of the space vortex centripetal acceleration over Newton's acceleration in time;

– the constancy of linear speeds of stars rotation in "inertial disk", often covering the whole galaxy sizes.

– vortex character of gravitation $\left(g_\parallel\right)$, that focuses the emission from the whole surface of Black hole sphere in narrow flow of high-energy matter at its poles;

– the "lensing" of beams, passing through the accretion disk, creating the effect of as if "additional mass" for adherents of "Dark matter".

6. The same phenomenon – the space emission by the matter causes both attraction of masses at relatively short distances and their "dispersion" at long ones for dense bodies, because of space density decrease, perceived as its geometrical growth. The traditional Newton's formula $g = -\frac{MG}{R^2}$, along with one, specified by Schwarzschild

$$g = -\frac{mG}{r^2\sqrt{1-\frac{2mG/r}{c^2}}}$$

is correct only in restricted limits, because it doesn't take into account the run-up of space. Taking into account the run-up of space for masses from elementary particles and including the planetary ones, we get the resulting acceleration:

$$\frac{d^2r}{dt^2} = \frac{d}{dr}\left(\frac{1}{2}\left(\frac{2}{3}\frac{1}{t}r\right)^2\right) - \frac{M\bar{G}}{4\pi r^2} =$$

$$= \frac{d}{dr}\left(\frac{1}{2}(Hr)^2\right) - \frac{M\bar{G}}{4\pi r^2} = H^2 r - \frac{M\bar{G}}{4\pi r^2},$$

$$\frac{d^2r}{dt^2} = H^2 r - \frac{M\bar{G}}{4\pi r^2}. \quad (38)$$

Having leveled this equation to the null, we get the distance, at which the masses attraction changes for dispersion:

$$r_{eq.} = \sqrt[3]{M\bar{G}/H^2}. \quad (39)$$

For example, the equilibrium radius for proton– 268 mm, for Earth – 4,33 light years.

The same for early Universe (at evenly distributed mass) with regard to gotten in (38):

$$\frac{d^2r}{dt^2} = H^2 r - \frac{M\bar{G}}{4\pi r^2} = H^2 r - p\frac{4\pi r^3}{3}\frac{\bar{G}}{4\pi r^2} =$$

$$= H^2 r - \frac{9}{2}\frac{H^2}{\bar{G}}\frac{4\pi r^3}{3}\frac{\bar{G}}{4\pi r^2} = H^2 r - \frac{3}{2}H^2 r.$$

$$g = -\frac{1}{2}H^2 r. \quad (40)$$

The mean density of the Universe matter from (33) is expressed through H:

$$p = \frac{2}{\bar{G}t^2} = 2\frac{9/4\cdot H^2}{\bar{G}} = \frac{9}{2}\frac{H^2}{\bar{G}}.$$

From (40) it follows, that the attraction factor of evenly distributed masses always prevails over their dispersion. As opposite to GTR, in this model the constant loss of gravitational mass in the Universe (matter density decrease) has absolutely no effect on the character distributed masses interaction (from '–' to '+'), but only decreases the intensity of space absorption by the matter, that influences only the Universe life time. In this model the single possible influence of the matter on space is its absorption, so, its density decrease.

The one causative factor – space absorption by the matter, *manifested* ***at short-range interaction with gravitational attraction of masses***, caught by this space, at long-range action results in ***Universe space decrease*** that is perceived by Observer as the Universe geometric volume growth.

Initially, the evenly distributed mass in the Universe, tending to compression by (40), is attracted by expanded space, according to (12). As a result of matter density fluctuations on the space volume, its redistribution in separate clots of the matter as more stable equilibrium states takes place. At the Universe evolution the matter density in such new growths will only grow further like the distances between these clots, based on (40). ***We observe this stage of Galaxies formation.***

7. At the space density decrease and as a result weakening of the "strong interaction" energy, the whole evolution of the Universe matter can be considered as radioactive decay of hyperformation of electron-positron couple into the lighter non-elementary particles – nucleons with less mass and its loss as photons. And thus, in remote future, such decay will result in elementary vortexes of subspaces – electrons and positrons, that earlier formed nucleons. The latter, not already combined in nucleons, annihilate at the final stage of evolution that finally results in disappearance of visible matter. The remains of space will be absorbed only by fast growing Black holes. The radius of their horizon grows according to Schwarzschild τ^{-2},

$$r_{s(\tau)} = 2mG/c^2 = 2mG/\left(c_0^2\cdot\tau^2\right),$$

$$r_{s(\tau)} = r_{s0}/\tau^2. \quad (41)$$

Whereas the Universe age (18) only $\tau^{-2/3}$,

$$r_a = r_o/\tau^{-2/3}$$

that will result in their confluence in one Black hole with radius, fast overtaking the Universe one. At the moment, when the whole volume of Universe space is beyond the event horizon, the Black hole, without surrounding space, will stop existing by definition. According to this theory, it was presumed, that gravitation is the space absorption by matter. With absorption of whole space by the Black hole, the huge sizes of Black hyperhole itself will lose sense. Now it can be considered only from inside as the newborn Universe with very high matter and space density and entropy value close to null. ***The full regeneration of Black hyperhole*** in Universe ***will stop*** with keeping the same invariant – space quantity of the Universe $K = V_{(t)}\cdot\varphi_{(t)}$, as in previous "life". The beginning of such regeneration takes place already at appearance of first BH in young Universe. In very early Universe the conditions for stable existence of BH are impossible because of high space density – its evaporation according to Hawking takes place:

$$\frac{dM}{dt} = -\frac{\hbar c^4}{15360\pi G^2 M^2} = -\frac{\hbar c_0^4}{15360\pi G^2 M^2}\cdot\tau^4. \quad (42)$$

Even at its birth as a result of masses confluence, its evaporation factor will prevail over its growth factor.

It's notably that the authors of the works [10] and [11], that have little in common with offered theory of gravitation, have come to the same conclusion. The earliest mention about the Universe as a Black hole is given in the article [12] of American physicists-theoretician Lee Smolin. Referring to the famous American physicist J. A. Wiler, he writes: It can be supposed, that each BH in our Universe leads to creation of new Universe, so, the Big Bang in our past is a result of Black Hole formation in other Universe".

10. Conclusions

1. Conceptually accepted "Isothermal principle" of the Universe quasigrowth allowed to get three basic invariants:

– the constancy of gravitational space flow acceleration in time;

– the law of Universe space quntity as adiabatic invariant;

– the consistency of A and B subspaces flow into matter in time;

2. The cosmological model of the Universe was received on the base of these laws.

3. The study of offered model for correspondence of effects of cosmological expansion of the Universe was carried out:

– the law of Universe expansion, correspondent to Hubble's one including its quantum variant was received;

– the nature of Galaxies creation as separate star clusters was explained;

– the more suitable version of Hubble's law – from temporal remoteness – was deduced for big remoteness;

4. The analysis of offered cosmological model comparing with GTR model:

– in offered model is proved the stronger dependence of photons "red" shift on remoteness by frequency than by the wave length that allows reject the mystic notion "dark energy", forcedly introduced for keeping GTR model;

– within the theory of vortex space flow was explained the abnormal law of celestial bodies movement in spiral Galaxies, whereas the common model loses its integrity without introducing the notion "Dark matter";

– the offered model proves the regularity of today Universe evolution in "Black hyperhole", just a "cold" stage of so-called "Big Bang" at birth of new Universe of "Black hyperhole" that cannot be grounded by the traditional model.

5. The laws of gravity model, received at macrolevel, proved their relevance at verification, arising from its cosmological model. The offered gravity theory is a pure physical model, much easier in understanding and application comparing with four-dimensional geometrical theory of space-time continuum. This model has a big potential in its development at macrolevel, that is absent in GTR. It would be better to expound the fundamental gravitation mechanism as hypercompression of absorbed space at the level of elementary matter, properties and structure of space in next article, devoted to the "close" interaction, based on the results of this article.

References

1. Riman, B. Fragmenty filosofskogo soderzhanija [Text] / B. Riman // Sochinenija. – Moscow-Leningrad: OGIZ, 1948. – P. 461–542.

2. Mun, R. Osnovy vihrevoj teorii prostranstva [Electronic resource]: konf. / R. Mun, V. Vasil'ev. – JADRO – 2003, 2003. – Available at: http://www.new-philosophy.narod.ru/RGM-VVV-RU.htm

3. Afonin, V. V. Ponjatie vremeni. Struktura jelektrona [Text] / V. V. Afonin. – Moscow: LENAND, 2010. – 96 p.

4. Pakulin, V. Structure of Matter. Vortex Model of Microworld [Text] / V. Pakulin. – Saint Petersburg: ISTRA, 2010. – 62 p.

5. Pakulin, V. Razvitie materii. Vihrevaja model' mikromira [Text] / V. Pakulin. – Saint Petersburg: NPO «Strategija budushhego», 2011. – 120 p.

6. Pakulin, V. Structure of Matter. Vortex Model of Gravitation [Text] / V. Pakulin. – Sarrebruck: Lambert Academic Publishing, 2013. – 56 p.

7. Pakulin, V. N. Struktura materii. Vihrevaja model' mikromira [Text] / V. N. Pakulin // Filosofija i kosmologija. – 2014. – P. 93–125.

8. Fridman, A. A. Izbrannye trudy [Text] / A. A. Fridman; L. S. Polaka (Ed.). – Moscow: Nauka, 1966. – 464 p.

9. Perlmutter, S. Measuring the acceleration of the cosmic expansion using supernovae [Text] / S. Perlmutter // Physics-Uspekhi. – 2013. – Vol. 56, Issue 10. – P. 1021–1037. doi: 10.3367/ufne.0183.201310e.1060

10. Pathria, R. K. The Universe as a Black Hole [Text] / R. K. Pathria // Nature. – 1972. – Vol. 240, Issue 5379. – P. 298–299. doi: 10.1038/240298a0

11. Shulman, M. H. Alternative cosmology [Text] / M. H. Shulman. – Moscow, 2015. – 98 p. – Available at: http://www.timeorigin21.narod.ru/rus_time/Alt_cosmology.pdf

12. Smolin, L. The fate of black hole singularities and the parameters of the standard models of particle physics and cosmology [Electronic resource] / L. Smolin. – 1994. – Available at: https://cds.cern.ch/record/261481/files/9404011.pdf

Дата надходження рукопису 12.01.2017

Sidorov Aleksandr, Director, LC "Elektrostal Service", Dniprovs'ke highway, 1, Zaporizhzhia, Ukraine, 69069
E-mail: elstalsidor@gmail.com