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It is known, that the red shift in the theory of standard cosmology defined by the expression $(z+1) = a(t_0) / a(t)$, is explained usually by the kinematic Doppler effect induced b y recession of galaxies. It is shown in the work, that this treatment is physically wrong. According to the mathematical formalism of the standard cosmology the red shift is formed in the process of light propagation, being defined by the space expansion and is therefore, the parametric Doppler effect. It i s shown, that the red shift in the standard cosmology must be defined by the sum of doth Doppler effects, the parametric effect due to space expansion and the kinematic one due to recession of galaxies equal to $(z+1) = \sqrt{(1+v/c)/(1-v/c)}$, that is not taken into account. The existence of the variable scale factor in metrics (the scale of the unit length) leads inevitably to time variation o f physical constants including the light velocity, which is shown to define the parametric Doppler effect. The use of variable scale of lenght and as a consequence the variable light velocity contradicts t h e modern physical ideas. Methods are considered for exclusion the theory contradictions.

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INTRODUCTION

It is shown in the present paper, that the standard cosmology according to its mathematical mechanism is based actually on the conception of light velocity variation with time, due to which the red shift is observed. First, we recall the fundamental statements of the standard cosmology.

The generally accepted cosmology of the Big Bang is based on the space-time metrics:

$$ds^2 = c_0^2\, dt^2 - a^2(t)\left[dr^2 + f^2(r)(d\theta^2 + \sin^2\theta d\varphi^2)\right]. \qquad (1)$$

Here $a(t)$ is the radius of the Universe or otherwise, the scale dimension of space defined by the solution of the gravity Einstein equation; φ, θ are the angular coordinates of galaxies, r ~ is the relative constant radial coordinate. To simplify the expression we shall consider a case of plane space, for which $f(r)=r$. In this case the metric distance up to galaxies detected by the stationary length standard will be according to (1) $R(t)=a(t)r$. This denotes, that the Universe is a sphere of the radius $a(t)$, filled by galaxies the location of which inside the sphere is unchanged with time, i.e. $r=R(t)/a(t)=const$ and $0 \leq r \leq 1$.

1. MISCONCEPTION OF THE RED SHIFT NATURE IN THE STANDARD COSMOLOGY

To define the red shift we consider the radial propagation of the light pulse from the galaxy with coordinate r, φ, θ up to the observer at the beginning of coordinates ($r=0$). The propagation process is defined by metrics (1) under the condition $ds=0$ and $d\varphi = d\theta = 0$, then, $dr=Cdt/a(t)$. This expression is a trivial write of the light propagation in the frame of axis r, where the observer is also located. The expression determines the distance dr the light passes for the time dt with the velocity at the considered moment of time t being proportional to $C/a(t)$. The total relative distance which light propagates from the radiation moment t_1 up to the reception moment t_o by any galaxy will be:

$$r = \int_{t_1}^{t_o} \frac{c_o\, dt}{a(t)} , \qquad (2)$$

galaxies under consideration. The metric distance between these galaxies according to the condition $R(t)/a(t)=r$ will be equal to:

$$R(t_1,t_o) = a(t_o)r = a(t_o) \int_{t_1}^{t_o} \frac{c_o\, dt}{a(t)} \qquad (3)$$

at the moment of observation $t=t_o$.

Note, that the metric distance passed by light $a(t_o)r$ is essentially larger than that at the moment of radiation $a(t_1)r$. This denotes, that while light propagates to the observer the space is expanding and increased. This is reduced to the equivalent decrease of the light propagation velocity. Further, as was above mentioned, in the standard cosmology from expression (2) we find an equation for the red shift by using the light pulse propagation in space between the radiating and receiving galaxies. If the pulse begins propagation at the moment t_1 and finishes at the moment $t_1 + \Delta t_1$, then the beginning and the end of the pulse at the place of the observer will be at moments t_o and $t_o + \Delta t_o$. In virtue of constancy of the relative distances of r galaxies, the forward and backward fronts of the pulse cover one and the same relative distance, i.e.

$$r = \int_{t_1}^{t_o} \frac{c_o\, dt}{a(t)} = \int_{t_1+\Delta t_1}^{t_o+\Delta t_o} \frac{c_o\, dt}{a(t)} . \qquad (4)$$

Presenting the second integral in the form of the sum of integrals $\int_{t_1}^{t_0} - \int_{t_1}^{t_1+\Delta t_1} + \int_{t_0}^{t_0+\Delta t_0}$ and taking into account that at small intervals of time Δt_1 and Δt_0 the radius a(t) is constant, we obtain $\Delta t_1 / a(t_1) = \Delta t_0 / a(t_0)$. We assume Δt_1 be equal to the oscillation period at the radiator and, hence, Δt_0 be equal to the oscillation period at the observer. Then, indicating the periods by the frequency $\Delta t_1 = 2\pi/\omega_1$, $\Delta t_0 = 2\pi/\omega_0$ we obtain $\omega_1/\omega_0 = (z+1)$ the generally known relation for the red shift:

$$(z + 1) = \frac{a(t_0)}{a(t_1)} . \tag{5}$$

From the calculation it can be seen, that the red shift occurs in the process of the light propagation in the space between galaxies. It is independent of the relative velocity of the galaxy observed and so, is not the well-known kinematic Doppler effect. From (5) it is seen, that the red shift is proportional to variation of a certain medium parameter for the time of the signal propagation in it. This parameter is the length scale varying with time, which characterizes the expansion of space by itself. Here, we have the frequency shift arising in the process of electromagnetic wave propagation. This phenomenon is well known in physics and is called the parametric Doppler effect /see, for example, the Physical Encyclopaedic Dictionary, 1984 [I] /.

To explain the nature of the effect, we consider the material medium, where the light velocity is changed with time according to the relation $C(t) = C/n(t)$, where $n(t)$ is the refraction index. Such media take place in the nature and technique. Let in such a medium at the constant distance R from the observer be the radiator which sends the light pulse of Δt_1 . The corresponding moments of reception will be t_0 and $t_0 + \Delta t_0$. Equating expressions for the distance passing by the forward front $R = \int_{t_1}^{t_0} C(t)dt$ and by the backward front $R = \int_{t_1+\Delta t_1}^{t_0+\Delta t_0} C(t)dt$ we obtain using the above calculation, that for $C(t) > C(t_0)$ the red shift takes place:

$$(z + 1) = \frac{C(t_1)}{C(t_0)} = \frac{n(t_0)}{n(t_1)} . \tag{6}$$

This expression is similar to (5) by the physical content. But both expressions have nothing to do with the formula for the kinematic Doppler effect $(z+1) = \sqrt{(1+v(t_1)/c_o)/(1-v(t_1)/c_o)}$

Returning to the red shift formula in the standard cosmology (4), it is not difficult to see, that it is not correct. In fact, to define the red shift, one should consider the events in real, observed space, which is determined by the real metrical distance between galaxies. So, to define the red shift, one must use the expression for the metrical distance between galaxies $R(t_1,t_o)$ (3), but not only its part r.

We consider the light pulse motion between galaxies. Due to recession of galaxies the distance passing by the forward and backward fronts will be different. Their difference is $\Delta R = R(t_1+\Delta t_1, t_o+\Delta t_o)-R(t_1,t_o)$ and depends on the current time t_o and t_1. With a small interval Δt_1 and Δt_o, the value ΔR is close to the total differential $\Delta R = \Delta t_1 \partial R/\partial t_1 + \Delta t_o \partial R/\partial t_o$. From here, according to (3) we obtain:

$$\Delta R = \dot{a}(t_o)\,\Delta t_o r + a(t_o)\left(\frac{c_o\,\Delta t_o}{a(t_o)} - \frac{c_o\,\Delta t_1}{a(t_1)}\right). \qquad (7)$$

Here the first term is the difference of paths of the forward and backward fronts due to variation of $a(t_o)$, and the second one - due to variation of r. But under the condition of the problem solution for the galaxy motion we have $r=\text{constant}$, and so, the total differential $dr=0$. Now, we have two conditions:

$$\frac{dR}{dt_o} = \dot{a}(t_o)\,r \qquad \text{and} \qquad \frac{\Delta t_o}{a(t_o)} - \frac{\Delta t_1}{a(t_1)} = c_o^{-1}dr = 0\,. \qquad (8)$$

Both expressions produce the kinematic and parametric Doppler effects, respectively. Now, according to the mathematical formalism of the standard cosmology the observed red shift of galaxies is formed both due to the light velocity evolution and due to recession of galaxies. The lack of understanding of this fact results in the situation when the red shift in the form (5) in the standard cosmology, corresponding in reality to the parametric Doppler effect, is explained as kinematic Doppler effect, while expression (5) has nothing to do with the expressions for the kinematic Doppler effect. Recently Harrison /2/, 1993 came to the conclusion on the confusion of concepts of different nature of the red shift , which takes place in the scientific literature on the standard cosmology.

Evidently, the consideration of both effects is correct , but this problem is not simple. The shift of the radiating frequency from a moving galaxy is defined, according to the special relativistic theory, by the relative velocity of the galaxy at the moment of radiation, and it is measured by the observer only in millions and even milliards years after that. A question is : by what way the signal being radiated can transmit the value of the recession velocity to the galaxy not existing at the moment of radiation? One has to assume, that light being radiated very long ago carries primary the information on the kinematic Doppler effect and on his path it experiences the parametric Doppler effect as well. Then the sum shift will be defined by the product of effects:

$$(z + 1) = (z_v+1)(z_a +1) = \sqrt{\frac{1+\beta_1}{1-\beta_1}}\ \frac{a(t_o)}{a(t_1)} . \qquad (9)$$

Here $(Z_v + 1)$ and $(Z_a + 1)$ are the shifts of the frequency , respectively, due to kinematic and parametric Doppler effects , $\beta_1 = V(t_1)/C_o$, where $V(t_1)=\dot{a}(t_1)r$ is the relative velocity of the observed galaxy at the radiation moment t_1 .

Let us calculate the sum shift in the model with plane space (q_o=1/2, k=0, p=0) for which $a(t)=(t/t_o)^{2/3}a_o$. The parametric Doppler according to (5) is equal to $(Z_a+1)=(t_1/t_o)^{-2/3}$, we have according to (3) $(t_1/t_o)^{1/3}=(1-H_oR/2C)$. For the exception of t_1/t_o we find the known relation $(Z_a+1)=(1-H_oR/2C)^{-2}$. The kinematic Doppler effect is convenient to present by the relative velocity $V(t_o)$ at the moment of observation. Evidently, $V(t_1)/V(t_o)= a(t_1)/a(t_o) = (t_1/t_o)^{-1/3}$, here using the previous calculation $V(t_1)/V(t_o) =(1-H_oR/2C)^{-1}$, then $(Z_v+1)=(1+H_oR/2C)^{1/2}(1-3H_oR/2C)^{-1/2}$ and according to (9) the general shift of the fequency will be:

$$(z+1)=(z_v+1)(z_a+1) = \left[\frac{1+\frac{H_oR}{2c_o}}{1-\frac{3H_oR}{2c_o}}\right]^{1/2} \frac{1}{\left(1-\frac{H_oR}{2c}\right)^2} . \qquad (10)$$

It is not difficult to see, that at $H_oR/C \ll 1$ the shift is $Z=2H_oR/C$. Therefore, if the shift is defined by two doppler effects, then the measured value of the Hubble constant is $2H_o$, i.e. in reality $25 \leq H_o \leq 50$. This leads to an essential difference of the theoretical expressions for the apparent luminocity $m(z)$ and the angular dimensions $\theta(z)$ of galaxies.

II. PHYSICAL NATURE OF THE PARAMETRIC DOPPLER EFFECT IN THE STANDARD COSMOLOGY

The existence of varying with time scale factor in the interval ds inevitably leads to admitting the variation of all physical values and some constants containing the length scale and, in particular, variation of the light velocity. As a result, it is obtained, that the red shift (5) connected with expansion of space is also defined by the evolution of the light velocity. It defines also the distance between galaxies. Really, according to (3) at the fixed moment of observation $a(t_o)$=constant, we obtain the next expression for the distance up to galaxies radiating the observed light at the moment of time t in the past:

$$R(t) = a(t_o)\int_t^{t_o} \frac{c_o\,dt}{a(t)} = \int_t^{t_o} \frac{c_o\,dt}{n(t)} = \int_t^{t_o} c(t)\,dt . \qquad (11)$$

Here $n(t)= a(t)/a(t_o)$ has the meaning of dimensionless coefficient of the medium refraction the propagation of waves in which defines the variable light velocity $C(t)= C_o/n(t)$, where $C_o=C(t_o)$. At the given fixed moment of observation time $a(t_o)$= constant, R is the metric distance constant and the red shift will be:

$$(z+1) = \frac{c(t)}{c(t_o)} = \frac{a(t_o)}{a(t)} . \qquad (12)$$

From here it is seen, that both methods for the description of the red shift by the space expansion or the light velocity variation defined by the scale factor are completely equivalent . Here the recession of galaxies is absent, i.e. the Universe is stationary. So, the standard cosmology is based in reality on introducing the space where the light velocity varies with time due to variation of the length scale and not taking into account the kinematic Doppler effect denotes the staticity of the Universe. By the way, the well known astrophysics Mac Vitty /1962 ,3/ in his book noted the occurrence of the varying light velocity in formulae of cosmology.

The existence in nature two types of Doppler effects was discovered as early as in 1899 by the Russian physics Mikhelson and published under the oracle title "To the Problem on Correct Application of the Doppler Principle"/4/. He started from the formula of the Doppler effect for $V \ll C_o$, which in the form of recording accepted by us is equal to $(z+1)=1+V/C_o$, where $V=dl/dt$. A case is considered, when on the light path there is a metter with the refraction coefficient n and the dimension Δ . Then the equivalent path length of light is $l=l_c+\Delta\cdot(n-1)$,where l_c is the geometrical distance between the radiator and the observer. Here at any moment of time the frequency shift will be observed:

$$z=dl_c/dtC_o + (n-1)\, d\Delta/dtC_o + \Delta\, dn/dtC_o \;.$$

If Δ =constant, n=constant and $V=dl_c/dt \neq 0$ then we have kinematic Doppler effect takes place due to variation of the geometrical distance. When l_c=constant the frequency shift takes place if Δ or n depend on time, that was confirmed by Perot tests 1924 /5/. At present, this type of the frequency shift is called the parametric Doppler effect. It explains the well known fact of star color scintillation near the horizon ,where both $d\Delta/dt$ and dn/dt are sufficiently large. Kinematic and parametric Doppler effects are simultaneously occured in observations of radio emission of the Earth satellite setting or rising from the horizon . Thus, it is not surprising that in observation of the red shift of the galaxy radiation we measure the summed Doppler effect induced by both variation of the geometrical distance (recession of galaxies) and by variation of conditions of light propagation due to variatipn of the length scale. The peculiarity of this process,which leads to the idea confusions ,is the fact that variation of the distance and the parameter of medium is defined by the same function a(t).

III. RESULTS AND CONCLUSION

We conclude that: 1. The adequate physical interpretation of the mathematical formalism of the standard cosmology shows, that the basis of the latter is the idea of the space expanding by itself, here galaxies as if attached to it and so, are recessing with the velocity of space expanding. Both processes are subordinated to the function of time a(t) ,which is the solution of the gravitational Einstein equation, i.e. are directed by gravitation. 2. The red shift in the standard cosmology is formed by two different reasons: by the influence of the light propagation medium, where its velocity decreases with time as well as by the recession of galaxies. In the first case the parametric Doppler effect occurs, in the second - the kinematic Doppler effect. The observed red shift is defined by the sum of both effects. 3. The standard cosmology corrected from mistakes of the physical interpretation is not free completely from either internal contradictions or confrontations with the fundamental physical laws. Contradictions to the accepted physical laws are induced by introducing the length scale evolution and from here the evolution of the light velocity, that in its turn will induce the evolution of interaction constants, for example e^2/hc, as well as a large amount of other physical values, where the length unit is used. The internal contradictions include the initial statement in definition of ds^2 during the similar time course in all space, that according to SRT cannot take place at recession of galaxies. The theory of the standard cosmology is not also correlated with SRT admitting the existence of an infinitely large relative velocity of recession of galaxies $dR/dt=\dot{a}(t)r\rightarrow\infty$ for $t\rightarrow 0$. How the relativistic cosmology can get free from contradictions with the fundamental physics? Evidently, we cannot completely eliminate the above given principal contradictions without renouncing completely the theory of relativistic cosmology. The most radical way is to renounce the treatment of a(t) as the space expanding and by that to exclude the parametric Doppler effect. Then there remains only the recession of galaxies with the Hubble velocity and the kinematic Doppler effect. However, one can easily see, that this is reduced to a well-developed nonrelativistic Newton cosmology. We can evidently decrease the number of contradictions if we stay in the framework of relativistic cosmology. Really, if we refuse to use the variable length scale inserting the light velocity evolution into metrics, only one problem remains - correlation of the light velocity variation with physical laws. Cosmology on this basis will evidently has the metrics:

$$ds^2=C^2(t)dt^2-a_o^2\left[dr^2+f^2(r)\ (d\theta^2+\sin^2\theta\, d\varphi\ )\right], \qquad (11)$$

where the scale parameter a_o=constant. The model of the Universe, which follows from the given metrics has been investigated in details in /6,7/. The model is the static one, i.e. the recession of galaxies is absent, since the distance between them $R=a_o\,r=$ constant. The light motion is described at ds=0 by the relation $R=\int_{t_1}^{t_0} c(t)dt$ from which the parametric Doppler effect follows (5). The evolution of the static Universe is defined by the function C(t), which can be found from the Einstein equations. In the initial state t=0 the light velocity and the temperature of matter are infinitely large. To explain the observed red shift, the light velocity must decrease with the rate of near 2cm/s per year. The model preserves the idea of the initial hot state of matter, formation of three-degree relict background of the microwave radio emission and estimation of helium abundance. One debatable statement remains in this model, namely, evolution of the light velocity that must lead to evolution of dimensionless constants of interaction, for example, e^2/hc and others. This difficulty is solved by the assumption of synchronous with C(t) variation of a number of constants, that preserves invariable all four constants of interaction. This provides observance the fundamental laws of microphysics including, for example, radiation of atoms and molecules, radioactive decay, etc., but is not correlated with a number of conservation laws, though, the same is true for the standard cosmology. However, it is not yet prooved, that the conservation laws are valid for cosmological scales of time. Actually, the described model does not solve the problem and the development of a new cosmology is necessary which would be free from internal contradictions and be correlated with the modern physics. It is of the imperative need due to the fact, that new astrophysical tests of the standard cosmology theory verification do not confirm the hypothesis of recession of galaxies and expansion of the Universe space /8/.

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