Cosmological Redshift at Stationary Universe

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Introduction.

We postulate that *the Physical Vacuum is a physical medium and the manifestations of the properties of this medium is the substance of our Universe*.

It is possible to show that the experimental experience and the kinematic model for discrete motion of micro-particles satisfy this postulate [1]. In this case, the notorious entrainment of the Physical Vacuum matter with moving body will be absent. Moreover, electromagnetic waves is vibrations of continuous and absolutely elastic matter of the Physical Vacuum (Ether).

This approach allows us to consider the hypothesis of the existence of a stationary Universe. In the case of a stationary Universe it raises the question about the rate of birth of its matter. Is this a one-time event (Big Bang), or the process is permanent? It is possible that we are witnessing this process in "metal-deficient young blue compact galaxies" today. There are well observed regions of intensive star formation. The age of the young galaxies of this type may be only 500,000,000 years [2]. In addition, these galaxies have not yet been ordered by gravity like old galaxies. This fact also confirms the youth of these objects. Another fundamental issue is the explanation of the existence of the cosmological redshift.

Gravitational redshift of electromagnetic oscillations in a stationary Universe.

We have made the following assumption. In the case of the formation of our substance from the matter of the Physical Vacuum (PhV) for this it needs a certain amount of the PhV matter. Material concentration leads to tension in the continuous medium. Tension must be presence due to the continuity of the PhV matter. This tension in the PhF generates the force field, which we know as the gravitational field.

Electromagnetic photon is an oscillation of the PhV medium. Therefore, if the mass exists in the Universe, the gravitational redshift of a wavelength is a result of the energy loss of an oscillations due to overcoming the tension in the Vacuum.

The gravitational frequency shift for weak gravitational field and an infinitely distant observer is described by the well-known formula:

$$\nu=\nu_0\cdot\left(1-\frac{|GM|}{Rc^2}\right) ,$$

where ν is radiation frequency for an infinitely remote observer, ν_0 is radiation frequency at a distance R from the center of the gravitating mass M , G is the gravitational constant, c is speed of light. We suppose here that the gravitational constant G , as well as speed of light, not depends on the value of the mass density in the Universe.

Writing $\nu=c/\lambda$, we have

$$\lambda=\frac{\lambda_0}{\left(1-\frac{|GM|}{Rc^2}\right)} .$$

How does the wavelength of light change when it passes the path equal to N *cm* in the gravitational field?

If $\lambda_1=\frac{\lambda_0}{\left(1-\frac{|GM|}{Rc^2}\right)}$, then $\lambda_2=\frac{\lambda_1}{\left(1-\frac{|GM|}{Rc^2}\right)}=\frac{\lambda_0}{\left(1-\frac{|GM|}{Rc^2}\right)^2}$, $\lambda_3=\frac{\lambda_0}{\left(1-\frac{|GM|}{Rc^2}\right)^3}$, ..., λ_n .

where

$$\lambda_n=\frac{\lambda_0}{\left(1-\frac{|GM|}{Rc^2}\right)^n} . \qquad (1)$$

We rewrite equation (1) as

$$\lambda_n=k\cdot\lambda_0 , \qquad (2)$$

where

$$k=\frac{1}{\left(1-\frac{|GM|}{Rc^2}\right)^n} . \qquad (3)$$

Here n is the number of the unit lengths on the selected distance. For example, $n=d*3.08567758128E+24$ *cm*, where d is the number of *Mpc* and 1 *Mpc* = $3.08567758128\cdot10^{+24}$ *cm*.

Will the dependence of the wavelength from the distance the linear or non-linear? Let the normed potential of the gravitational field of the unit volume in any part of the Universe to be constant due to the homogeneous distribution of a substance on a large scale:

$$\frac{|\phi|}{c^2}=\frac{|GM|}{Rc^2}=Const .$$

Here $\frac{G}{c^2}=Const$, therefore

$$\frac{M}{R}=Const \quad . \tag{4}$$

In this approximation, every centimeter of the way will decrease the energy of the photon on the constant value due to the presence of a constant potential of the gravitational field. Hence, in the frame of our approach, the wavelength and therefore the redshift will increase with the distance non-linearly (see. Fig. 1).

We know that the redshift happens, firstly, when a light source moves away from an observer with some speed, secondly, when light moves out of a gravitational field, thirdly, due to interaction with substance, resulting in a loss of photon energy and, fourthly, due to expansion of space-time. We cannot check directly last case because it is only result of the mathematical calculations in frames of ΛCDM and some others models based on Einstein's theory of general relativity or its modifications. But in the frame of our approach the expansion of space-time is absent.

Below, we will consider the cosmological redshift, which is caused by the gravitational field of the Universe.

According to (4), we rewrite (3) as follows:

$$k^{'}=\frac{1}{\left(1-\frac{|G|}{c^2}\cdot 1\right)^n} \quad , \tag{5}$$

where M/R = 1.

We do not know is the relation M/R equal to unity for all time of the university life or not? We do not know also, the value of the relation G/c^2 is the constant for all time or not. We do not know, constants G and c change the own values for all time or not? Finally, the numerical values of these constants depends on the total mass in the Universe or not?

For a given distance d the equations (2) and (5) allow us to calculate the value of the cosmological gravitational redshift, $Z_e=(\lambda_{obs}-\lambda_{lab})/\lambda_{lab}$, for a stationary Universe. For values which are obtained by the formulas (2) and (5) we use index "e" (*Ether*). For the Hubble constant and non-relativistic velocity, which are obtained by the classical formulas, applies index "*eff*" (*Effective*): H_{eff} and V_{eff} .

In the Table 1 the first column shows the values of the distance in *Mpc*, the second column shows the redshift Z_e caused by the loss of energy of a photon in the gravitational field of the Universe, and the third column shows the *effective* value of the Hubble constant.

Table 1.

d (*Mpc*)	Z_e	H_{eff} (*km/c/Mpc*)	d (*Mpc*)	Z_e	H_{eff} (*km/c/Mpc*)
$3.24\cdot 10^{-25}$	0.000	68.655	1500	0.410	81.923
1	0.000	68.663	2000	0.581	87.082
20	0.005	68.812	2500	0.773	92.666
50	0.012	69.050	3000	0.988	98.714
100	0.023	69.448	4000	1.499	112.378
200	0.047	70.252	5000	2.143	128.714
300	0.071	71.069	7500	4.571	182.722
500	0.121	72.741	10000	8.877	266.111
700	0.174	74.465	11000	11.419	311.195
1000	0.257	77.153	12000	14.615	365.109

Fig.1 shows the dependence of the redshift on the distance according to Table 1.

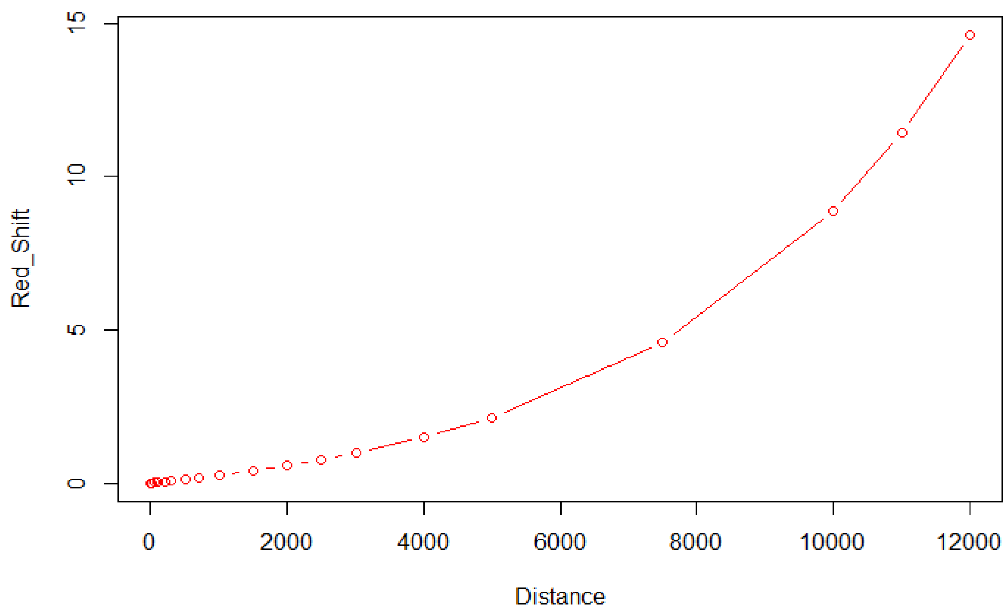

Fig. 1: Dependence of the cosmological redshift on the distance (Mpc).

We have found that in the place where the photon is born H_{eff} ≈ 68.7 *km/c/Mpc*. Our result has a good coincidence with the value, which was published in 2014 [3]: H_{eff} = 70 *km/c/Mpc*. In [4] the Hubble constant was calculated with the best precision of today using results of the microwave observations: H_{eff} = 67.8 ± 0.7 *km/c/Mpc*. At the point where the photon was born our value H_{eff} coincides with the value from [4] with high accuracy: ΔH_{eff} = 68.7 - 67.8 = 0.9 *km/c/Mpc*. The difference in the error is 1.3σ .

To compare our results with the experimental data on the redshift at a certain experimentally determined distances, we used the results of research [5]. The value of the Hubble constant in this study is H_{eff} = 72 ± 8 *km/c/Mpc*. Here the error is much larger than in the above-mentioned two papers due to the fact that different types of space objects and different methods have been used. But the importance of this work is that there are the actual distances to space objects were determined with high accuracy up to 400 *Mpc*.

Fig. 2 shows the dependence of the *effective* velocity on the distance, where blue line represents the *effective* velocity, which was calculated in accordance with the value of the redshift for stationary Universe, and the red line corresponds to the *effective* velocity according to H_{eff} = 72 *km/c/Mpc* [5]. The red line is interrupted at a distance of about ~400 *Mpc* as in [5].

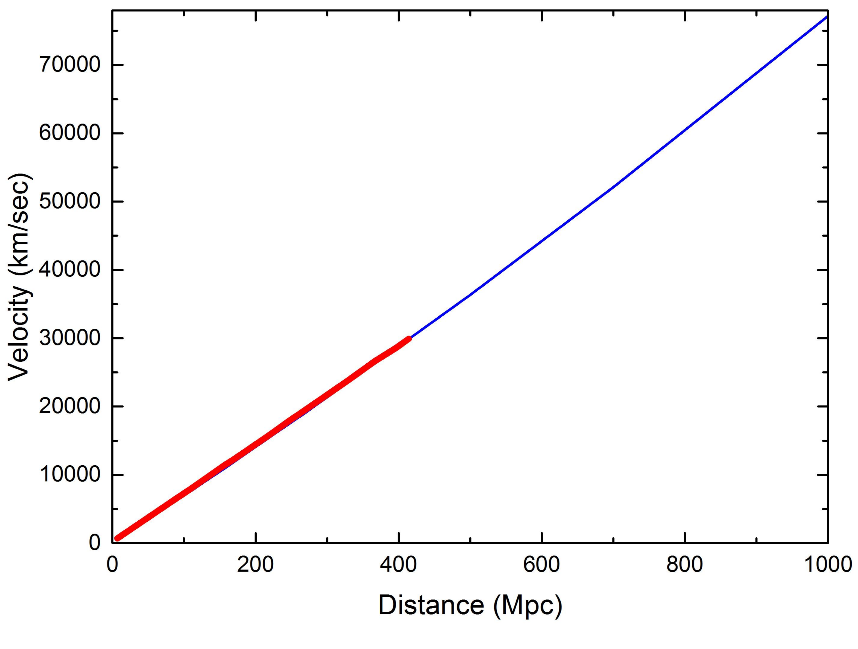

Fig. 2: The dependence of the velocity on the distance.

As illustrated by Table 1 and Fig. 2, for relatively short distances, Z < 0.2, our result are in satisfactory agreement with the H_{eff} = 72 *km/c/Mpc* [5], which was obtained from *direct measurements* of distances to cosmic objects.

Conclusions.

The method of calculation of the cosmological redshift was based on the hypothesis that *the Physical Vacuum is a physical medium and the manifestations of the properties of this medium is the substance of our Universe*, and electromagnetic waves are oscillations of continuous an absolutely elastic PhV.

Our results were obtained under the assumption of a uniform and constant distribution of the gravitating mass and the gravitational potential in the Universe over life-time of the Universe.

We used the equation (2) and (5) to calculate the value of the redshift caused by the loss of energy in the gravitational field of the Universe. For redshift $Z < 0.2$ (~800 *Mpc*) our result are in a good agreement with the $H_{eff} = 72 \pm 8$ *km/c/Mpc* [5] which was obtained by authors from *direct measurements* of distances to cosmic objects.

After ~1000 *Mpc* nonlinear dependence of the redshift on the distance becomes obvious, see. Fig. 1.

For the stationary Universe the place where the photon is born $H_{eff} \approx 68.7$ *km/c/Mpc*. In frame of typical errors this H_{eff} coincides with the $H_{eff} = 70$ *km/c/Mpc* [3] and with the $H_{eff} = 67.8$ *km/c/Mpc* [4]. In the last case the difference is only 1.3σ .

References

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