REDSHIFT OF QUASARS AND TIME DILATION

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ABSTRACT

The most of the cosmic objects moves along a screw line: a rotation and progressive motion. The shift of the spectrum of the emitting bodies is due to the time difference in the motionless and moving reference frames. In the case of the progressive motion, the Doppler effect takes place, in the case of rotation – the Sagnac effect is observed. It is shown that the observed redshift (and blue shift as well) of the spectra of cosmic objects is due to the Sagnac effect. The parameter of redshift z depends on the parameters of its own non-inertial reference frame of every cosmic object (its angular velocity and dimension). It is intrinsic ones for every object and does not determine the distance from us to a cosmic object.
It was shown that the Sagnac effect predominates, and therefore, the time dilation and the change of the distances between close objects have to be negligible even at great z.
Therefore, the Hubble law and the hypothesis about the Universe expansion don't have their main grounds and are wrong.

Key words: Redshift; time dilation; the Big Bang.

1.INTRODUCTION.

In the emission spectra from stars, quasars and galaxies, against the background of a continuous spectrum, the spectral lines of certain atoms and ions are observed (hydrogen, oxygen, magnesium and so on). They are often greatly shifted relatively to the spectral lines of these atoms on the Earth (redshift or blue shift).
This phenomenon was discovered by V.M.Slipher in the period between 1912 – 1917 [1]. Blue shift is observed rarely (for example, the Andromeda Galaxy). The spectrum shift z is defined in wavelength as $z = \frac{\lambda_1 - \lambda_0}{\lambda_0}$, where λ_0 and λ_1 are the wavelength of the spectrum of a motionless emitter on the Earth and the observed emission from a cosmic object, respectively. The parameter z does not depend on λ_0.
There are many attempts to explain the spectrum redshift [2-17]. The majority of researchers believe that the main mechanism of redshift is the longitudinal Doppler Effect. But this hypothesis leads to many difficulties. For example, that galaxies, stars, quasars, star clusters with a large redshift, move away from us with velocities which are close to light velocity c (when $z \sim 3 \div 6$); that quasars should be thousands of times brighter than any previously known extragalactic source; if galaxies are running away, why do their dimensions not change in time? The estimation of the time of the Universe's expansion and the estimations of the ages of stars, galaxies, and quasars differ on many orders. There is the anomalous redshift anisotropy of nearby galaxies.
Over the past 20 years a great deal of evidence has been unveiled which shows that many quasars with large redshift are physically associated with galaxies having much smaller redshifts. It is also unclear why all cosmic objects move away namely from our galaxy.
These observations raise a question about the validity of the Doppler nature of the redshift and show the necessity of further researching the redshift issue.

In this work, we propose a new simple and natural explanation of the spectral redshift (and blue shift as well). The most of the cosmic objects moves along a screw line: a rotation and progressive motion. The shift of the spectrum of the emitting bodies is due to the time difference in the motionless and moving reference frames. In the case of the progressive motion, the Doppler effect takes place, in the case of rotation – the Sagnac effect is observed. It is shown that the observed redshift (and blue shift as well) of the spectra of cosmic objects is due to the Sagnac effect. The parameter of redshift z depends on the parameters of its own non-inertial reference frame of every cosmic object (its angular velocity and dimension). It is intrinsic ones for every object and does not determine the distance from us to a cosmic object.
The taking account of these two effects during the motion along the screw line shows that the Sagnac effect predominates: in the case of the main contribution of the Doppler effect, the distances between the close objects and the time dilation have to increase in $1+z$ time. Whereas in the case of the Sagnac effect, these two changes are negligible even at great z. It agrees with the observations. [1]

2. NON-INERTIAL REFERENCE FRAMES.

Most of the objects in nature – from the heavenly bodies to elementary particles, - are non-inertial reference frames. On the Earth, the inertial reference frames are mainly used (which are approximately correct for the macroscopic bodies). Therefore the misunderstanding of certain phenomena arises. Stars, quasars, galaxies are essentially non-inertial reference frames, which rotate around one axis with the constant angular velocity. Evidently, in this case we must use only the Hamilton theory. Now the Lagrange theory is not equivalent to it and is not applicable. It is necessary to introduce the action variables and the corresponding angular coordinates. Having solved the problem of the spectrum redshift, we find the action variable H_q for the cosmic objects as well.
The Hamilton function $H(q_i, p_i, t)$ depending on coordinates, q_i, pulses, p_i, and time, t, is introduced. The function $H(q_i, p_i, t)$ determines the energy of a system. In the case of the periodical motion, the Hamilton function is not dependent on time: $H(q_i, p_i)$. The energy of a system $H(q_i, p_i) = E$ is a constant.
For the periodical motion, it is convenient to use the canonical variables J_k, w_k in which the energy depends only on J_k and does not depend on w_k. Then: $\dot{J}_k = -\dfrac{\partial H}{\partial w_k} = 0$ and J_k is a constant during the motion. From the second equation we have: $w_k = \omega_k t$. J_k is an action variable, and w_k -is an angular variable. An action variable J_k is an adiabatic invariant and can be quantized. If a system of variables are separable variables, then the action variable J_k has a form: $J_k = \oint p_k dq_k$, where the integral has taken over all space. And the condition of quantization is $\oint p_k dq_k = hn_k$. Here n_k is an integer and h is the quantum of an angular momentum, which is equal to the Plank constant for micro objects.
The traditional determination of an intrinsic mechanical momentum of electron as $\sigma = \hbar s$ where $s = \dfrac{1}{2}$, is based on the fact that spin has only two orientations and $2s+1=2$. But introduction of

semi-integer quantum numbers contradicts the rule of a moment quantization: $\oint p_k dq_k = hn_k$, where n_k - is an integer. This difficulty can be avoided if this integral would be taken correctly. In the case of an orbital momentum, the integral should be taken over the orbit

$$l = \oint p_k dq_k = 2\pi p_k r_k = hn_k$$

In the case of quantization of the intrinsic mechanical momentum, the integration should be taken over complete solid angle ($d\Omega = \sin\vartheta \cdot d\vartheta \cdot d\varphi$)

$$\iint J_s d\Omega = J_s \cdot 4\pi = h\tilde{s}; J_s = \frac{\hbar}{2}\cdot\tilde{s};\ \tilde{s} = \pm 1, \pm 2...$$

In the case of quantization of an intrinsic mechanical momentum of a cosmic object, the integration should be taken over a complete solid angle as well:

$$\iint J_q d\Omega = J_q \cdot 4\pi = H_q\tilde{s}; J_q = \frac{H_q\tilde{s}}{4\pi}$$

There are two directions for angle φ - clockwise and counter clockwise, therefore, $\tilde{s} = \pm 1, \pm 2...$.

The lowest energy of an oscillator, which generates the electromagnetic wave in the inertial reference frame, is equal to $E_0 = \frac{1}{2}\hbar\omega_0$. The total energy of oscillator in the rotating non-inertial frame conserves and is equal to E_0 as well:

$$E_0 = \frac{1}{2}\hbar\omega_1 + \frac{1}{4\pi}H_q \cdot \Omega_q$$

Here Ω_q is the angular velocity of a star. From the law of the conservation of energy we have:

$$\frac{1}{2}\hbar\omega_0 = \frac{1}{2}\hbar\omega_1 + \frac{1}{4\pi}H_q \cdot \Omega_q.$$

I.e. the difference of the frequencies is:

$$\Delta\omega = \omega_0 - \omega_1 = \frac{H_q}{h}\cdot\Omega_q$$

On the other hand, the difference of the frequencies can be obtained from the Sagnac effect [18-20]. In the longitudinal Doppler Effect, the frequency shift is caused by the time shift in the reference frame moving progressively with a constant rate v relatively to our almost motionless reference frame. In the Sagnac effect the frequency shift is caused by the time shift in two reference frames too. But the moving frame rotates and is non-inertial.

General Relativity gives the change of time in different reference frame due to motion:

$$\Delta t = -\frac{1}{c}\oint \frac{g_{0\alpha}}{g_{00}} dx^\alpha$$

In the case of rotation: $$\Delta t = \frac{1}{c^2}\oint \frac{\Omega r^2 d\varphi}{1 - \frac{\Omega^2 r^2}{c^2}} \approx \frac{2\pi R}{c}\left(1 \pm \frac{R\Omega}{c}\right)^{-1}$$

Here R is a radius of cosmic object, Ω is its angular velocity.

The non-equality $\frac{R\Omega}{c} < 1$ is always fulfilled (otherwise, the square of the interval in the 4-th dimension space-time $ds^2 < 0$).

M.G.Sagnac found that in a circular interferometer, the light beam 1 having the same direction as the direction of the disk rotation, and the second light beam 2, having the opposite direction, had the phase change, caused by the different time of motion and, hence, - different optical path. Sagnac had shown that time of round for the beam 1 is equal to:

$$t_+ = \frac{2\pi R}{c}(1 - \frac{R\Omega}{c})^{-1},$$

and for the second beam:

$$t_- = \frac{2\pi R}{c}(1 + \frac{R\Omega}{c})^{-1}.$$

Here R is a radius of interferometer, Ω is its angular velocity.

In general, the vector of the angular velocity $\vec{\Omega}$ does not coincide with the normal to the surface $\vec{n}$, therefore the difference of the optical path is equal to $\Delta L = \frac{4S\vec{\Omega}\cdot\vec{n}}{c}$ (here S is an area of a region, confined by the light trajectory). The phase change is equal to $\Delta\varphi = \frac{2\pi\cdot\Delta L}{\lambda_0}$ (here λ_0 - is a wavelength of light in the inertial reference frame).

This effect has been used for the creation of the optical fiber gyroscopes. Later, the more precise and convenient active laser gyroscopes were produced. In such a gyroscope the difference of the frequencies of two beams is measured [21].

Light frequencies can be only generated when they satisfy the resonance condition: in the inertial reference frame and the length of resonator L, the resonance frequency is equal to $\nu_{0m} = \frac{\pi c}{L}\cdot m$; here m is an integer. In the non-inertial system and at the rotation clockwise, the effective length of resonator is L_+, at the rotation counter clockwise, the effective length of resonator is L_-: $L_\pm = L(1 \pm \frac{R\Omega}{c})$. In the active laser gyroscope, the frequencies for the beams 1 and 2 can be generated: $\nu_\pm = \frac{\pi c}{L_\pm}\cdot m$. And their difference is equal to

$$\Delta\nu_g = \nu_- - \nu_+ \approx \frac{2\pi R\Omega}{L} m = \nu_{0m}\cdot\frac{2R\Omega}{c}. \qquad (6)$$

Stars, quasars and galaxies are also generating objects, rotating with different angular velocities and having different dimensions. The light frequencies which they emit, just as in the case of the active laser gyroscopes, depend upon their dimension, angular velocity $\vec{\Omega}$ and the angle between $\vec{\Omega}$ and the normal to the emitting surface $\vec{n}$.

Redshift is caused by the difference of frequencies $\Delta\nu_c = \nu_0 - \nu_1$. Here $\nu_0 = \frac{m\pi c}{L}$ - is a frequency of resonator in the inertial reference frame; and $\nu_1 = \frac{m\pi c}{L_+}; L_+ = L_0\cdot(1 + \frac{R\vec{n}\vec{\Omega}}{c})$ - is a frequency of the resonator in the non-inertial reference frame. The difference of the frequencies is equal to

$$\Delta\nu_c = \nu_0 - \nu_0\cdot(1 + \frac{R\vec{n}\vec{\Omega}}{c})^{-1} \qquad (7)$$

If the angle between $\vec{n}$ and $\vec{\Omega}$ is more than $\frac{\pi}{2}$, then the cosine of this angle is negative, and the blue shift of the spectrum will be observed. Perhaps, it happens rarely and blue shift is not often observed.

Let us write the parameter of redshift z, using the difference of the frequencies $\Delta\nu_c$:

$\Delta\nu_c = \frac{c}{\lambda_0}(1-\frac{\lambda_0}{\lambda_1})$; $\Delta\nu_c \approx \nu_0 \cdot \frac{R\vec{n}\vec{\Omega}}{c} = \nu_0 \cdot \kappa = \frac{c}{\lambda_0} \cdot \kappa$, where $\frac{R\vec{n}\vec{\Omega}}{c} = \kappa$. Therefore, the relations between z and κ are:

$$z = \frac{\kappa}{1-\kappa}; \kappa = \frac{z}{1+z} \tag{8}$$

It is seen that the parameter z does not depend on the wavelength λ_0 as it has been observed formerly. The difference of the frequencies $\Delta\nu_c$ does however depend on the light frequency ν_0.

This analysis and the experimental observations show that the redshift of stars, quasars and galaxies is the intrinsic property of each of them and is due to their rotation around their axes, i.e. due to the non-inertial reference frames of these cosmic objects where the generation of light takes place. All cosmic objects rotate with different angular velocities, have different dimensions and temperatures of emitting surfaces, therefore their parameters z are very different. Very young cosmic objects (quasars), with very high angular velocities have, apparently, the highest z parameters.

3. THE ABSENCE OF TIME DILATION.

The hypothesis of the connection of redshift with the Doppler effect, assumes also the time dilation – the increase of the time scale in $1+z$ time. However. M.Hawkins, investigating the Fourier -spectra of quasars with different redshifts, calculated from their light curves during the time from 50 days to 28 years, have shown the absence of the time dilation [22].

The explanation of the absence of the time dilation we see in the fact, that time shift (and redshift, caused by it) is due to the Sagnac effect (by its rotation around its own axis) but not to the Doppler effect.

Compare the differences of time in the references of frame of quasar and observer (in linear approximation according to the relation the velocity of quasar to velocity of light).

In the case of the Doppler effect the shift of the frequencies is equal to:

$$\omega_0 - \omega \approx \omega_0 \cdot \frac{v}{c}; z = \frac{\lambda}{\lambda_0} - 1 = \frac{v}{c}$$

The time variable change is equal to: $t \approx t_0 + \frac{v}{c} \cdot \frac{L}{c} = t_0(1+\frac{v}{c}) = t_0(1+z)$

As Hawkins (and other investigators) had thought, the time had to increase by $1+z$ time.

The stretching of distance of the cosmological object in this case and this approach is equal to:

$$x \approx x_0 + \frac{v}{c} \cdot ct_0 = x_0(1+\frac{v}{c}) = x_0(1+z)$$

It increases with the increase of the redshift. But the increase of the dimensions of galaxies in time is not observed.

In the case of the Sagnac effect the shift of the frequencies is equal to:

$$\omega_0 - \omega \approx \omega_0 \cdot \frac{R\Omega}{c} = \omega_0 \frac{z}{1+z}$$

The time variable change is equal to:

$$t \approx t_0 + \frac{2\pi R}{c} \cdot \frac{R\Omega}{c} = t_0 + \frac{2\pi R}{c} \cdot \frac{z}{1+z} = t_0 + \tau \frac{z}{1+z} = t_0 (1 + \frac{\tau}{t_0} \frac{z}{1+z})$$

Here, $\tau = \dfrac{2\pi R}{c}$ is the time during which light passes the length of quasar's "equator" , $\tau << t_0$, ($t_0 = \dfrac{L}{c}$, here L is the distance from us to quasar). It is seen that in the case of the Sagnac effect, $t = t_0$ with the great accuracy. Therefore, the time dilation is absent.

The stretching of distance of the object in the case of the Sagnac effect is absent because the distance doesn't depend upon both the angular velocity and redshift.

It is the additional argument that the adopted hypothesis of the Doppler effect as the reason of the redshift is wrong. The cosmic object rotation is the main reason of the observed redshift.

The next facts say that redshift is the intrinsic effect of a cosmic object:

1. The neighboring objects have the different values of z ;
2. The absorption and emitting spectra of the same object have the different values of z ;
3. The velocities of quasars with great value of z can't be close to the velocity of light (as it would be from the Doppler effect);
4. The time dilation of quasars is absent ;
5. The dimensions of galaxies don't change in time;
6. The distances to quasars are not proportional to the different values of z ; (so called " The finger of God" effect, where the galaxy distribution is elongated in redshift space, with an axis of elongation pointed toward the observer [4,19,23]);
7. The intensities of the emission of quasars with a great z aren't greater the intensities of all known stars. Simply, they are much closer to us.

In the case of possible velocities, ($\dfrac{v}{c} < 1$ and $\dfrac{R\Omega}{c} < 1$), the frequency shifts of the Doppler effect and the Sagnac effect are equal to: $\Delta\omega_D \approx \pm\omega_0 \dfrac{v}{c}$ and $\Delta\omega_S \approx \omega_0 \dfrac{R\vec{n}\vec{\Omega}}{c}$, respectively.

It is seen that both effects lead to analogical results, but the first – in the case of progressive motion and the second – for rotational motion. In the case of the Doppler Effect the observed large values of the redshifts lead to an unreasonable result – that the rates of movement away from us approach the light velocity. If the Sagnac effect takes place, the large meanings of z correspond to reasonable conclusion of the large angular velocities of the cosmic objects and their large dimensions.

Pulsars spin at a very high rate as well, but do not have redshift, because they emit light from 'poles", where the time shift is practically absent.

4. THE ANGULAR MOMENTUM FOR COSMIC OBJECTS.

From the law of energy conservation, the difference of the frequencies in two reference frames is: $\Delta\omega = \dfrac{H_q}{h} \cdot \Omega_q$. On the other hand, the difference of the frequencies, obtained from the

Sagnac effect, is $\Delta\omega_c \approx \omega_0 \cdot \frac{R\vec{n}\vec{\Omega}}{c}$. From here we derive the angular momentum H_q for cosmic objects (for $\cos\vartheta = 1$):

$$H_q = h \cdot \frac{2\pi R}{\lambda_0} = h \cdot \frac{L}{\lambda_0} \qquad (12)$$

On the perimeter L of the emitting resonator, the integer number of wavelength λ_0, which is equal to $\frac{L}{\lambda_0}$, has to be packed up. The angular momentum H_q is proportional to this integer number and to the Plank constant h. Note, that it is purely optical effect. Here, the cosmic object is the resonator.

When $\cos\vartheta \neq 1$, then the integer has to be equal to $\frac{L}{\lambda_0} \cdot \cos\vartheta$. We see that the quantum of an angular momentum is proportional to the same constant, h, both for an electron and for a cosmic object.

5.COMPARISON WITH OBSERVATIONS.

The estimations of the angular velocity of a cosmic object can be made. For example, if $z=2$, then $\kappa = \frac{z}{1+z}=0.666$. I.e. $\frac{R\vec{n}\vec{\Omega}}{c} = \kappa=0.666$; and $\Omega = \frac{2}{3} \cdot \frac{c}{R}$. If the radius of this object is of the same order as the Sun, then its angular velocity is equal to $\Omega = \frac{2}{7} \cdot \frac{1}{\sec}$.

The measured value of the redshift of Sun is equal to $z \sim 10^{-6}$.

The estimation of the value z, using the angular velocity and radius of Sun, leads to very close value: $k = \frac{R\Omega}{c} \approx \frac{7 \cdot 10^5 \cdot 10^{-5}}{3 \cdot 10^5 \cdot 2.54 \cdot 2.4 \cdot 3.6} \approx 1.1 \cdot 10^{-6}$; $z \sim 1.1 \cdot 10^{-6}$. Good agreement.

Now we carry out the estimation of the temperatures of the cosmic emitters. Let us determine the distribution function of value z for the visible light, in a model of black-body emission. The analysis of such a distribution, based on the observed data [2-12,14-16,23], shows that the probability of z increases, has a maximum near z~2, and then decreases. For the model of black-body emission, the distribution function can be written in the form:

$$f(\Delta\omega) = \Delta\omega \cdot E(\omega_1) = A_1 \cdot \Delta\omega \cdot \frac{(\omega_0 - \Delta\omega)^3}{[\exp(\frac{\hbar(\omega_0 - \Delta\omega)}{KT}) - 1]}$$

Note, that $\Delta\omega = \omega_0 \cdot \frac{z}{1+z}$, then:

$$f(z,b) = A \cdot \frac{z}{(1+z)^4 (\exp(\frac{b}{1+z}) - 1)} \qquad (9)$$

Here $b = \frac{\hbar\omega_0}{kT}$, ω_0 –is the frequency of the emitted light in the inertial reference frame and T is a temperature of emitter. Below, the distribution functions are given for several meanings of parameters b (fig.1). The maximum of the distribution function depends strongly upon b, i.e. on the temperature of emitter and the wavelength of emitting light wave. The different cosmic emitters have different these parameters, therefore a single curve, apparently, does not take place. The different cosmological objects emit light of different spectral ranges and have different temperatures of emitting surfaces. And, apparently, several distribution functions $f(z,b)$ can be observed.

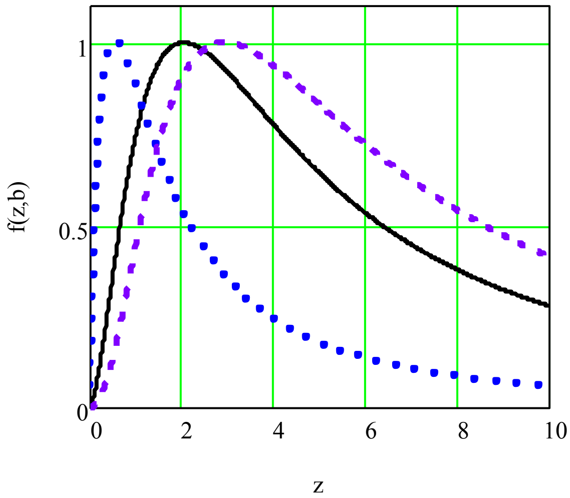

Fig 1. The distribution function $f(z,b)$ for several meanings of b: dotted line - b =*0.5;* - solid line b =*6.8;* dashed line - b =*9.5.*

6.CONCLUSION.

The research conducted shows that the main reason of the redshift (and blue shift) of the spectrum of emitted light is the rotation of stars, quasars and galaxies (the Sagnac effect).

The most of the cosmic objects moves along a screw line: a rotation and progressive motion. In the case of the progressive motion, the Doppler effect takes place, in the case of rotation – the Sagnac effect is observed.

The taking account of these two effects during the motion along the screw line shows that the Sagnac effect predominates: in the case of the main contribution of the Doppler effect, the distances between the close objects and the time dilation have to increase in $1+z$ time. Whereas in the case of the Sagnac effect, these two changes are negligible even at great z. It agrees with the observations.

The parameter of redshift z depends on the parameters of its own non-inertial reference frame of every cosmic object (its angular velocity and dimension). It is intrinsic parameter for every object and does not determine the distance from us to a cosmic object. The parameter of redshift z depends on the parameters of its own non-inertial reference frame of every cosmic object (its angular velocity and dimension).

Hence, the Hubble law and the hypothesis about the Universe expansion, the Big Bang, don't have their main grounds and are wrong.

Now, the estimation of the irradiated energy of quasars will not exceed on several orders the irradiated energy of the hot stars. The age of the Universe and the ages of quasars and galaxies, as such, better correlate with each other.

The anisotropy of z for the nearby objects can be explained by their different orientation relatively to the axis of their rotation and different radiuses of the emitting contour. The blue shift of the spectrum does not signify the approaching of the object. In this case, the angle between the $\vec{n}$ and $\vec{\Omega}$ is more than $\frac{\pi}{2}$.

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