To the problem of modeling of the gravitation and time.

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Abstract

Five-dimensional model of space-time (anti-de-Sitter space), described within the dodecahedron symmetry is offered in the article. According to the offered model graviton is the double five-dimensional vortex (soliton) that provides its stability and allows it to unite the Universe. The interaction between graviton and particles of the Universe stipulates the discrete current of time. The size of a quantum of time $\Delta t \approx 10^{-103}$ seconds has been evaluated. Wave properties of the mass particles follow from the model.

Key word: graviton, discrete, time, anti-de-Sitter space, symmetry, and dodecahedron.

The history of physics progress in the 20-th century shows that its rapid development always began with appearance of revolutionary ideas (hypothesis). For example, it was so with quantum physics. Similarly, the elementary particle physics, investigating only external displays of particles, has received a powerful impulse of the development with appearance of the M.Gell-Mann and G.Zweig ideas on their internal constitution (idea of quarks) [1].

The similar situation is observed in the theory of gravitational field. There are a great number of theories concerning external displays of a field. The requirements for development of hypotheses touching models of gravitons and their physics have ripened. The given investigation is just devoted to this problem.

While building the model, the author has paid attention to that fact that main laws of the nature are the laws of symmetry, and at the same time, our world, on the first view, appears to be asymmetric.

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First of all, it concerns the mass of free particle, energy and temperature (effective temperature which can be assigned to the system of excited particles in the state of the universe density of population and which is not true temperature will not be considered here). All of us have got used that a particle mass, energy and temperature are always positive that disorders symmetry of the Universe. Deficiency of symmetry also concerns the current of time. We consider by default, that time is a characteristic of space, which has a constant value of its vector. Nobody studied physics of time.

It is important to introduce several postulates for the further consideration:

1. The modern theories of creation suppose that for the description of natural phenomena it is necessary to bring in many coordinates, from which only three are responsible for macroscopic space, and the rest are enclosed in a ring with extremely small radius. Since indicated three coordinates were created because of a primary explosion, which led to creation of the Universe, it is understandable, that before the explosion, these coordinates were similar to others. After the explosion, which had a certain force, they remained enclosed in a ring with big radius. So, all coordinates without exception are enclosed.

2. Numerous historical and geological data pointed out in the literature (beginning from Plato and Pythagoras up to the modern theories of civilizations origin and of lithologic plates) testify that the Earth is in the field, which is characterised by the symmetry of a dodecahedron (regular icosahedron). So, the symmetry of a dodecahedron (in a local approximation) should characterise physics of the Universe.

3. Common for us four-dimensional space corresponds to the symmetry of a cube, which three edges at the apex correspond to three spatial co-ordinates and quadrangular facet belongs to four measurements. Accordingly, the dodecahedron symmetry testifies availability of three spatial co-ordinates (three edges at apex) and five measurements (pentagonal facet).

Having used the dodecahedron symmetry is, as indication of the global symmetry, predetermining the law of the Universe, it is possible with the help of a group theories to ascertain the types and dimensions of subspace, responsible for time, mass, gravitational waves and so on.

It was proved, that the group of a dodecahedron (Y) supposes the existence of two one-dimensional ($\Gamma_{1g}, \Gamma_{1u}$), four three-dimensional ($\Gamma_{2g}, \Gamma_{2u}, \Gamma_{3g}, \Gamma_{3u}$), two four-dimensional ($\Gamma_{4g}, \Gamma_{4u}$) and two five-dimensional ($\Gamma_{5g}, \Gamma_{5u}$).
Γ₅ᵅ) representations (subspaces). All indicated representations appear by pairs, one of which is symmetric and the second one is asymmetric comparatively with operation of inverse, which responds to the actual property of the space. An attempt to consider these subspaces through the symmetry of a cube (group $O_h$) has shown, that the four-measuring subspace of group $Y$ is parted thus on one and three-dimensional spaces, and five-dimensional - on two and three-dimensional spaces of group $O_h$. Such transformation of subspaces leads to impossibility of the real processes describing in $O_h$ group. These processes are described by four-measuring and five-measuring representations of the groups $Y$ and being responsible for unity of the Universe.

Table 1. Rules of transformation of the representations in the transition from group $Y$ to group $O_h$.

| $\Gamma_{1g}$ → $A_{1g}$ | $\Gamma_{2g}$ → $T_{1g}$ | $\Gamma_{3g}$ → $T_{1g}$ | $\Gamma_{4g}$ → $A_{1g} + T_{1g}$ | $\Gamma_{5g}$ → $E_{g} + T_{2g}$ |
| $\Gamma_{1u}$ → $A_{1u}$ | $\Gamma_{2u}$ → $T_{1u}$ | $\Gamma_{3u}$ → $T_{1u}$ | $\Gamma_{4u}$ → $A_{1u} + T_{1u}$ | $\Gamma_{5u}$ → $E_{u} + T_{2u}$ |

Quantity and symmetry of the representations of the group $Y$ gives the foundation to presume that there are four sorts of matter: matter (mass $m$), antimatter (antimass $\bar{m}$), minus - matter (minus-mass $\bar{m}$) and anti-minus-matter (anti-minus-mass $\bar{\bar{m}}$). Thus, the magnitudes $m$ and $\bar{m}$ are positive, and $\bar{m}$ and $\bar{\bar{m}}$ is negative. This will provide a complete symmetry of the Universe concerning mass. As negative energy of free particles corresponds to the negative mass of these particles, this ensures symmetry of the World concerning both the energy and temperature. As follows from Table 1, the subspaces $\Gamma_{2g,u}$ and $\Gamma_{3g,u}$ of the group $Y$ correspond to the same subspace $T_{1g,u}$ of group $O_h$ that hindered to bring a pair of negative masses within the framework of the four-dimensional space.

The world must be integrated; otherwise, it has no right to exist. So, there is a parameter (field, interaction), responsible for wholeness of the world. Such interaction must be spread instantaneously in our usual time; otherwise the wholeness is lost. For the spread description of such interaction the additional temporary dimension it is offered to bring in (besides usual time $t$ we shall bring in orthogonal to it time coordinate $\tau$). The gravitation field with its quantum - graviton is logically considered a carrier. The introduction in consideration of two time co-ordinates testifies that we have space de-Sitter II of (anti-de-Sitter space [2]) kind. Naturally, such space, with the availability of spherical symmetry is unlocked that contradicts to
the first postulate. The decrease in the space symmetry this paper makes space enclosed again [3].

The symmetry of a graviton must correspond to the representation of maximal dimensionality inasmuch as the role of the World combining is assigned to it. The provision of the interaction demands that the graviton description must be performed by three spatial co-ordinates and two times \( t \) and \( \tau \). The instantaneity (in time \( t \)) of the interaction transfer superimposes an additional demand to graviton: it must have zero mass. So, it cannot be a source of the secondary gravitational radiation. The requirement of zero mass for graviton may be provided depicting the graviton as the two-particle soliton in the structure of which there is the mass \( m \) and minus-mass \( \bar{m} \), so, the sum of masses making up the soliton is equal zero. As the graviton must have properties of a wave (in time \( \tau \)), the graviton components should be figured of as a stable pair of the vortexes of cyclone-anticyclone type. Such pair of the vortexes always has finite excitation energy (unlike of a single vortex, the energy of which in an equilibrium state is infinite), just what stabilises it [4]. It is known, that an anticyclone twisting in the surface of the Earth as the right screw, success up the air, due to what the increased pressure is always in its centre. Similarly, the cyclone creates airflow along its axis downwards that results in pressure drop in its activity region. So, the pair cyclone-anticyclone will be compulsorily combined by the third vortex, which raises its stability and makes it a multidimensional soliton.

We assume the material Universe consisting of three components \((m, \bar{m}, m)\), disjointed by time intervals \( \Delta t/2 \), where \( \Delta t \) is quantum of time (state \( A \)) to model of discrete current of time (quantum of time). In such case, the complete mass equals \( m \). The graviton, which is in the past as to the matter, interacts with mass, which responds to time \( t=0 \), adsorbs it (naturally the vortex \( \bar{m} \) is adsorbed, and the vortex \( m \) blurs the function of element mass \( m \) in time). The movement of the graviton along closed time co-ordinate \( t \) ensures its total absorption of mass \( m \). This adsorption transfers the system in state \( B \), in which the first element \( m \), blurred in time, is overlapped with the second device \( \bar{m} \). The structure instability arises, in which this pair \((m,\bar{m})\) disappears, and instead of it a new pair \((\bar{m}, m)\) with time co-ordinates \(3\Delta t/2 \) (\( \bar{m} \)) and \(2\Delta t \) (\( m \)) (state \( C = A + \Delta t \)), appears symmetrically relatively to the third element \( m \) as well as a new graviton, displaced relatively to the first graviton in time by \( \Delta t \). The process will repeat infinitely.

For current of time \( t \) in an opposite direction the mass must have structure
(\bar{m}, m, \bar{m})$. In such case (state B), the graviton must be above upper element of the mass \(\bar{m}\) (that is, hereafter from the point of view of substance). Then this element will adsorb a vortex \(m\) of a graviton. Further process will run as above described, with formation of a new state, displaced by \(-\Delta t\), that is, for negative masses the time from the point of view of positive masses will move to the past. Similarly, from the viewpoint of positive masses, for negative masses the processes of the radiation will be change by the processes of adsorption and vice versa, as the signs of energies connected with matter, during the transition to minus-material will be changed. The special role is assigned to a quantum, which from the viewpoint of the world of substance and the world of minus-material moves in opposite directions of time and space that ensures its identical perception from both points of reference.

The quantity of time quantum \(\Delta t\) can be estimated, starting from the formula \(\Delta t = \frac{h}{M_U \cdot c^2}\), where \(M_U\) is mass of the Universe. Here, the supposition is made that Plank constant is also attributed to discreteness of time. Considering it in a rough approximation the Universe to be spherical (such approximation contradicts to the first postulate, mentioned above) with radius \(R_U \approx 10^{10}\) light year = \(10^{28}\) cm, and average density of a matter equal to critical \(\rho_m = \rho_c = 2 \cdot 10^{-29}\) g/cm\(^3\), we fined \(M_U = 4\pi\rho_cR_U^3/3 = 10^{53}\) kg \([5]\). Hence, \(\Delta t \approx 10^{-103}\) seconds. This quantity really will be quantum of time combining and synchronising the Universe.

It is known, that from a gravitational constant \(G\), the speed of light \(c\) and the Plank constant \(h\) it is possible to form the length \(l_g = \sqrt{Gh/c^3} = 1.6 \cdot 10^{-33}\) cm, which is named “fundamental” and “gravitational” \([6]\) in literature. Time \(t_g = l_g/c = 5 \cdot 10^{-44}\) s, the value of which exceeds by 60 orders the value of time quantum corresponds to this length. So, “gravitational length” does not relate to the structure of time-space.

At the same time, each material particle of the Universe will have its time interval \(\Delta t_i = \frac{h}{m_ic^2}\), responsible for wave properties of elementary particles. For an electron \((m_e = 9, 1085 \cdot 10^{-31}\) kg) the value \(\Delta t_e = 0, 809 \cdot 10^{-20}\) s, that by 83 orders exceeds the value of the time quantum. Let’s note, that the value \(\Delta t_e\) on its origin has nothing common with the period of the de-Brogl wave, though it will be close to its relativistic velocities. It is understandable, that for the synchronisation of the Universe it is necessary that \(\Delta t_i = N_i\Delta t\) where \(N_i = M_U/m_i\) should be whole number. From the latter ratio follows that the ratio of two particle mass \(m_i/m_j = N_j/N_i\) is rational number. This also will concern the identical particles moving with different
velocities, that is, the travelling particle speed can vary only discretely. It is truth, the discreteness step will be miserable and unnoticeable, that ensures quasi-continuous dependence of the particle mass on its motion velocity.

If the unity of the world could be absent then the graviton radiated by an elementary particle would interact only with the same particle, inasmuch as other elementary particles could exist in other time points. This could result in the absence of the gravitation interaction and, as the consequence, in the disappearance of the material world. So, the unity is absolutely necessary and it is ensured in the whole Universal by the mutual sensation of all identical elementary particles. And this, in its turn, will lead to that each elementary particle with a particular phase of its existence function will be represented in every moment of the discrete time (e.g., the function of the particle existence may be described by the expression $\psi_i = a \cdot \exp(-i\omega_i t)$, where $\omega_i = 2\pi/\Delta t_i$, $a = c \cdot \sqrt{m_i/h}$ - normalised factor).

Thus, the used symmetry of a dodecahedron as local symmetry of the Universe, in this paper, has allowed to bring to the symmetry of the structure of a substance, scale of energy and time as well as to proposal of the graviton model of providing unity of the Universe and discrete current of time. The model becomes the basis of wave properties of elementary particles, that is, expostulates of their wave nature.

Inasmuch as for the creation of the gravitation model and time the dodecahedron symmetry of the Universe field is used in which the Earth exists the opposite conclusion corresponding to the reality: the dodecahedron symmetry of the Earth surface must follows from the proposed model.
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