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Dynamic Leonov interferometer for detecting the field of dark matter particles

Professor Vladimir Leonov
E-mail: leonquanton#gmail.com

Abstract: We present the design of a Leonov dynamic interferometer for detecting the field of dark matter particles and obtained positive results from its testing. Unlike the Michelson interferometer, in which the arms of the interferometer are located at an angle of 90^0 and rotate in a horizontal plane, in the Leonov interferometer, the shoulders are turned in opposite directions at an angle of 180^0 and the light rays from the laser in the shoulders also move in opposite directions and converge on the screen, forming interference fringes. In this case, the slightest deviation of the arms of the interferometer from the horizontal leads to a sharp shift of the interference fringes on the screen. We have given a theoretical justification for the fact that the shift of interference fringes is caused by the deformation (Einstein curvature) of the field of dark matter in the field by terrestrial gravity. We have shown that the spherical field of terrestrial gravity is formed as a result of spherical deformation of the field of dark matter, which is a four-dimensional quantized space-time. We found that the carrier of the field of dark matter is a four-dimensional particle - a quantum of space-time (quanton), which has no mass but accumulates electromagnetic energy. Quanton is the only four-dimensional particle that combines time and space, and is the carrier of electromagnetism and gravity. The concentration of quantons in a unit volume characterizes the quantum density of the medium, which in accordance with the theory of Superunification sets the speed of light in vacuum. In the Earth's gravitational field, a field of dark matter is deformed, which leads to a change in the quantum density of the medium in the vertical direction (along the radius). This leads to a change in the speed of light in the radial direction relative to the earth's horizontal. We see this fact as a shift of interference fringes when the shoulders of the dynamic interferometer are turned relative to the horizontal (Leonov effect), thereby registering a change in the concentration of dark matter particles. This experiment confirms the validity of the theory of Superunification [1-5].

Keywords: dark matter, quanton, quantized space-time, quantum density of the medium, speed of light, interferometer, gravity, theory of Superunification.

1. The problem of finding particles of dark matter. The search for dark matter particles is one of the most important tasks of fundamental physics. Physicists have made numerous attempts over the past two decades (and even earlier) to detect experimentally dark matter particles have proved to be untenable and failure. There you can specify about 50 such unsuccessful projects. In [6], a list of projects for the search for dark matter particles was carried out. So, in 2013 there were 36 such projects, and in three years by 2016 their number increased to 48. Moreover, new projects appeared there, and some of the old projects were liquidated due to their inefficiency. In addition, there are other projects that are not listed in these lists. In total, physicists currently have more than 50 projects for the search for dark matter particles [6].

Paradoxically, physicists do not have a unified theory explaining the nature of dark matter with so many active projects to search for dark matter particles (table 1, [6]). At the same time, physicists have a large number of diverse and conflicting hypotheses, which is about 20 (Table 2, [6]) and causes us to be perplexed. With such a large number of universities (table 3, [6]) and scientists involved in projects to search for dark matter particles, we can talk about the crisis of global fundamental science. We see the helplessness of scientists who cannot explain the nature of the new observed astrophysical effects (curvature of a ray of light in the absence of gravitational masses, accelerated motion of galaxies and others).

The reason for these failures lies in the complete misunderstanding by modern physicists of the nature of dark matter and its quantized discrete structure [7]. This, despite the fact that the basis of dark matter is the quantum of space-time (quanton), which I introduced into theoretical physics back in 1996, and dark matter is nothing but quantized space-time [1, 7-10]. I apologize to readers that I have to give references mainly only to my published works due to the absence of other convincing works about the nature of dark matter and the structure of cosmic vacuum.

2. Quanton is the only four-dimensional particle carrier of dark matter. The fact that dark matter is the basis of the cosmic (physical) vacuum is now beyond doubt. In this case, from the standpoint of Einstein's general theory of relativity (GR), dark matter should possess the properties of four-dimensional space-time, that is, it should be a carrier of time and space at the same time. In addition, dark matter must possess electromagnetic and gravitational properties in order to be simultaneously a carrier of electromagnetic and gravitational fields. In the experiments of Michelson and Morley it was found that the cosmic vacuum does not consist of particles having mass, like a gas-like mechanistic ether that does not exist in nature. Thus, dark matter is weightless matter. Therefore, all attempts to find a dark matter particle with mass (like an axion) were unsuccessful [11].

So, a particle of dark matter should have the following properties:

- ✓ this particle must be four-dimensional;
- ✓ this particle must be a carrier of time and a carrier of space at the same time;
- ✓ this particle should not have mass;
- ✓ this particle must be a carrier of electromagnetic and gravitational fields, simultaneously;
- ✓ this particle should be the carrier of a new previously unknown field of dark matter and the fifth fundamental force [1].

Quanton is the only four-dimensional particle satisfying the properties listed above. Fig. 1 show the structure of a quanton consisting of four quarks in a projection. Quanton is formed as a result of electromagnetic compression of an electromagnetic quadrupole (Fig. 2), previously unknown in physics [1, 9, 12].

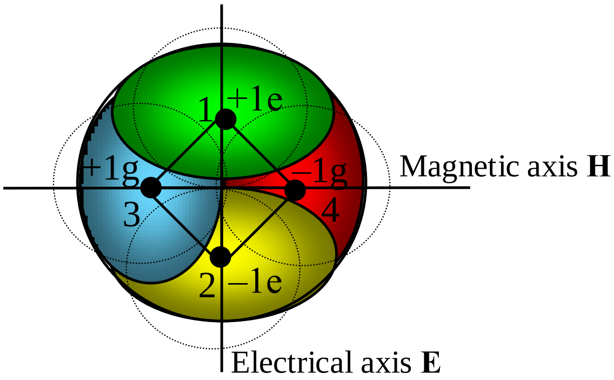

Fig. 1. The quanton in projection (rotated in space).

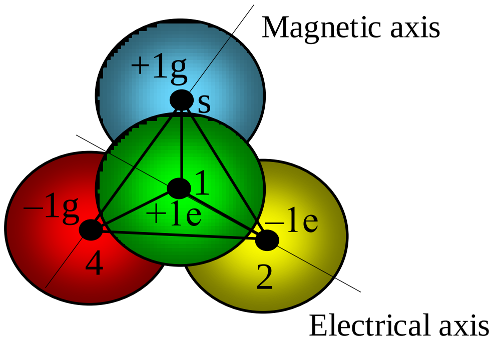

Fig. 2. The electromagnetic quadrupole (top view).

Quanton includes four integer quarks (charging): two electrical (+ 1e and -1e), and two magnetic (+ 1g and -1g), installed at the vertices of the tetrahedron. Magnetic quarks were previously unknown in physics. Magnetic and electric integer quarks have no mass, but are carriers of electromagnetic energy. For the first time in 1996, I found the correct relationship between a integer magnetic quark (± 1g) and a integer electric quark (± 1e) [1, 9, 12]:

$$g = C_o e = 4.8 \cdot 10^{-11} \text{Am} \quad \text{(Leon)} \tag{1}$$

where $C_o \sim 3 \cdot 10^8$ m/s is the speed of light in vacuum.

The calculated diameter of the quanton is $L_{qo} \sim 10^{-25}$ m and it represents the fundamental length (Leonov's length) [1, 13]:

$$L_{qo} = 0.74 \cdot 10^{-25} \text{m} \tag{2}$$

The process of physical quantization is the process of filling space with quantons. Figure 3 show a grid model of quantized space-time in projection onto a plane in the form of lines of force of an electromagnetic field. Figure 4 show a solid-state model of quantized space-time is presented. These models clearly characterize the structure of dark matter as a discrete structure.

Quantized space-time (dark matter) is characterized by the quantum density of the medium ρ_o, ρ_1, ρ_2 (there is a concentration of quantons per unit volume [q/m^3]) taking into account L_{qo} (2) [1, 14]:

$$\rho_o = \frac{k_3}{L_{qo}^3} = \frac{1{,}44}{L_{qo}^3} = 3.55 \cdot 10^{75} \frac{q}{m^3} \tag{3}$$

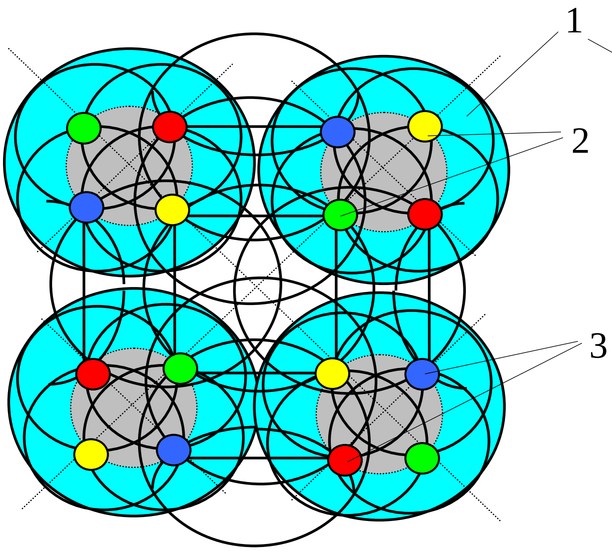

Fig. 3. Grid model of the quantized space-time in projection in the form of lines of force. 1) quantons; 2) electrical quarks; 3) magnetic quarks.

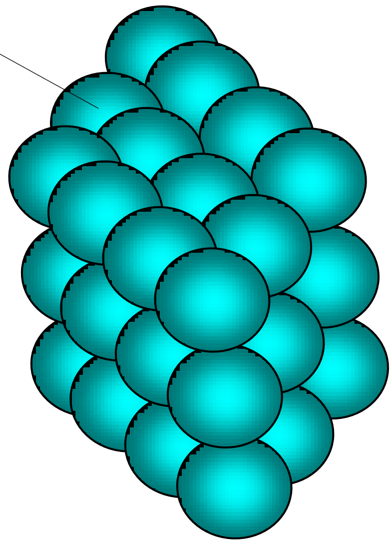

Fig. 4. Solid-state model of quantized space-time.

In order to experimentally fix the traces of dark matter particles, we need to control the quantum density of the medium ρ_1 and record its change. It should be noted that it is not possible to detect single quantons. First, the diameter of the quanton is very small and amounts to about 10^{-25} m (2). The sensitivity of electromagnetic methods is insufficient to penetrate so deep into the depths of dark matter. Secondly, single quantons in nature do not exist; they are connected into the global electromagnetic field of dark matter in the form of a power electromagnetic grid of the Universe (Fig. 3) [1, 14].

3. Justification of the design of the interferometer for recording the field of dark matter particles. One of the most sensitive instruments for recording the field of dark matter is considered to be a Michelson interferometer. The interferometer arms in the projects have a length of: LIGO - 4 km, VIRGO - 3 km, KAGRA - 3 km and are located horizontally in a static state. The results of these experiments are negative [15]. An analysis of negative experiments on the search for dark matter particles indicates that experimenters do not fully understand the quantized structure of dark matter as a luminiferous medium.

An interferometer reacts to a change in the speed of light by a phase shift of an electromagnetic light wave in the form of a shift of interference fringes when two light beams are superimposed. The change in the speed of light under terrestrial conditions can be observed as a result of the deformation of the field of dark matter by the gravitational field of the Earth. In the theory of Superunification, it is established that the speed of light C is a variable that is determined by the square root of the quantum density of the medium ρ_1 (dark matter) around the Earth [1, 16]:

$$C = C_o\sqrt{\frac{\rho_1}{\rho_o}} \tag{4}$$

The distribution of the quantum density of the medium ρ_1 for the Earth's spherical gravitational field is described by solving the two-component Poisson equation with distance r from the center of the earth [1, 17]:

$$\rho_1 = \rho_0\left(1 - \frac{R_g}{r}\right) \tag{5}$$

where R_g is the gravitational radius of the Earth (without a factor of 2):

$$R_g = \frac{Gm}{C_o^2} \tag{6}$$

where G is gravitational constant; m is mass, kg; C_o^2 is maximum gravitational potential of quantized space-time (dark matter), J/kg.

We substitute (5) in (4) and obtain the formula for the speed of light C in the central gravitational field:

$$C = C_o\left(1 - \frac{R_g}{r}\right)^{\frac{1}{2}} \tag{7}$$

We expand (7) in a series and for r >> Rg and discard terms of higher orders, we get:

$$C = C_o\left(1 - \frac{R_g}{r}\right)^{\frac{1}{2}} \approx C_o\left(1 - \frac{1}{2}\frac{R_g}{r}\right) = C_o - \frac{C_o R_g}{2r} \tag{8}$$

Formula (8) allows you to calculate the deceleration of the speed of light ΔC on the Earth's surface in comparison with remote space. For this, we substitute the values in (8): the speed of light $C_o \sim 3 \cdot 10^8$ m / s; Earth's gravitational radius $R_g = 4.44 \cdot 10^{-3}$ m (6); the average radius of the Earth $r = 6.67 \cdot 10^6$ m and we get the value ΔC (8) on the surface of the Earth:

$$\Delta C = -\frac{C_o R_g}{2r} = -\frac{3 \cdot 10^8 \cdot 4.44 \cdot 10^{-3}}{2 \cdot 6.67 \cdot 10^6} = -0.1 \text{ m/s} \tag{9}$$

The deceleration of the speed of light ΔC (9) on the Earth's surface is 0.1 m/s. This is consistent with GR. But we are interested in the change in the speed of light C in the Earth’s radial gravitational field as a gradient gradC in the direction along the radius r:

$$\mathrm{gradC} = \frac{dC}{dr} = \frac{d}{dr} C_o \left(1 - \frac{1}{2} \frac{R_g}{r} \right) = \frac{C_o R_g}{2r^2} \tag{10}$$

Formula (10) allows us to estimate the sensitivity of the interference method of changing the speed of light of the radial gravitational field of the Earth on its surface under spherical deformation of quantized space-time (dark matter). To do this, we substitute the corresponding parameters in (10) and we obtain the value gradC (10) on the surface of the Earth:

$$\mathrm{gradC} = \frac{C_o R_g}{2r^2} = \frac{3 \cdot 10^8 \cdot 4.44 \cdot 10^{-3}}{2 \cdot (6.67 \cdot 10^6)^2} = 15 \cdot 10^{-9} \frac{m/s}{m} = 15 \frac{nm/s}{m} \tag{11}$$

So, the change in the speed of light inside dark matter deformed by spherical Earth's gravity on the Earth’s surface in the radial direction is 15 nm/s/m (11). A sensitivity of 15 nm/s /m of the interference method are sufficient to observe a shift in the interference fringes at the arm of the interferometer less than 1 m at a red laser wavelength of 635 nm.

A change in the speed of light will not be observed in the horizontal direction at r = const and C = const in accordance with (11): gradC = 0:

$$\mathrm{gradC} = \frac{d(C = \mathrm{const})}{dr} = 0 \tag{12}$$

Therefore, in LIGO, VIRGO, KAGRA projects, even with a horizontal interferometer arm length of 3–4 km, experimenters cannot detect the horizontal change in the speed of light from the change in the quantum density of the medium (dark matter): gradC = 0 (12), obtaining negative results in experiments on the search for dark matter particles [15].

4. The design of a dynamic interferometer and the results of its tests. Fig. 5 shows a scheme of a dynamic interferometer: a) a top view, b) a side view that includes: laser 1, splitter 2, mirrors 3-6, lens 7, screen 8, base 9, axis 10.

The interferometer works as follows. The light beam 11 from laser 1 enters the splitter 2. The splitter is a 4 mm thick transparent glass plate mounted at an angle of 45^0 to the laser beam. Next, the laser beam is divided into two beams, which are directed in opposite directions to the mirrors 3 and 4, and being reflected from them, converge on the screen 8, forming interference fringes. For this, mirrors 4 and 5 are additionally installed. Lens 7 serves to enlarge the image on the screen 8. The base 9 is a massive slab of black marble with an axis 10, excluding its thermal and mechanical deformation. The length of the interferometer arms L_1 and L_2 is 250 mm, but it works well with shoulders of 100 mm or less.

As we see, in contrast to the Michelson interferometer in which the arms of the interferometer are located at an angle of 90^0, the Leonov interferometer arms are turned in opposite directions at an angle of 180^0. In this case, the light rays 11 from the laser 1 in the arms L1 and L2 also move in opposite directions, and further the rays converge on the screen 8, forming interference fringes (Fig. 5a). In this case, the slightest deviation of the interferometer arms on the axis 10 from the horizontal by an angle φ leads to a sharp shift of the interference fringes on the screen 8 (Fig. 5b). We observe this effect as a result of a change in the speed of light in the deformed gravitational field of the Earth in accordance with formulas (10) and (5).

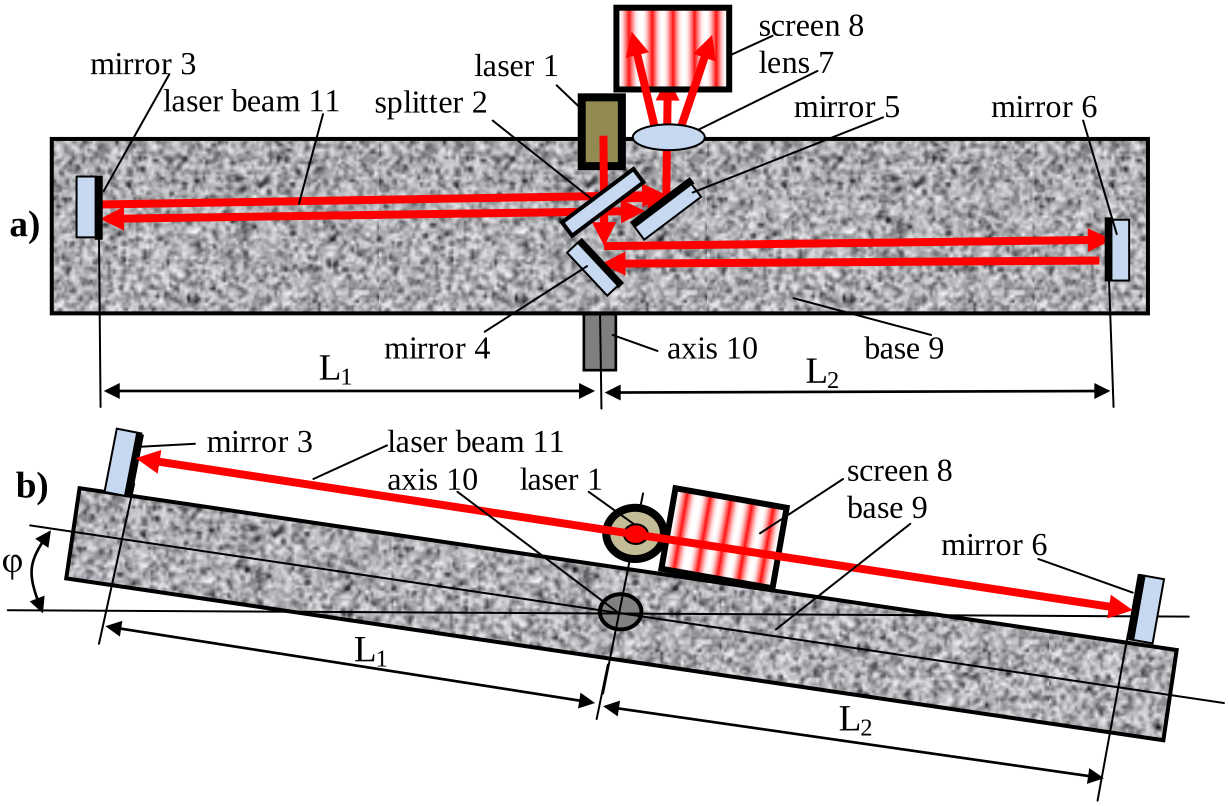

Fig. 5. The dynamic Leonov interferometer scheme for detecting the field of dark matter particles in the Earth's gravitational field (Fig. 5b not shown: splitter 2, mirrors 4-5 and lens 7).

I want to note that the principle of operation of the Leonov interferometer based on the new physics (the theory of Superunification [1]), which established the quantized structure of dark matter and gave the rationale of the new design of the interferometer for detecting of field of the dark matter particles. Many dynamic laser interferometers of various applications are produced in the world, but they cannot detect the field of dark matter particles unlike the Leonov dynamic interferometer.

5. Conclusion: We were the first in the world to successfully detect the field of dark matter particles, confirming experimentally the validity of the theory of Superunification. This new theory completed the unification of fundamental interactions begun by Einstein in GR [1-18, 19]. I introduced a new parameter in quantum theory is the quantum density of the medium. This allowed us to significantly simplify the computational mathematical apparatus of the quantum theory of gravity and make it clear to the engineer. This allows us to study the properties of dark matter in terrestrial conditions using a dynamic Leonov interferometer.

Currently, we are developing a whole series of small-sized various devices of the type Leonov interferometer for controlling cosmic quantized space-time and controlling the concentration of dark matter which makes up 100% of the Universe and not 85% as is commonly believed.

Photo 1, 2, 3 shows dynamic Leonov interferometer in operation.

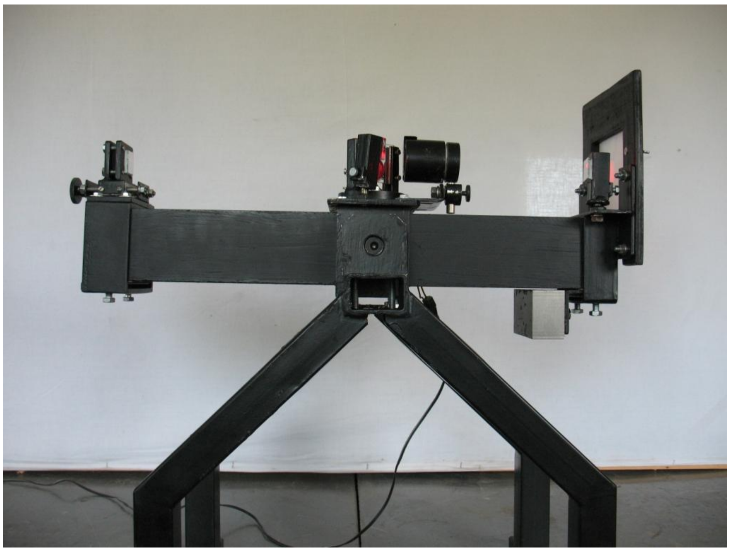

Photo 1 shows the horizontal position of the interferometer (it captures the horizon of the earth's surface itself).

Photo 2 shows the rotation of the interferometer by an angle φ to the earth's surface. The vertical component of the speed of light is increasing with distance from the Earth. The speed of light is

decreasing towards the Earth. The speed of light is decreasing towards the Earth as a result of spherical deformation of dark matter, which forms the Earth's gravitational field.

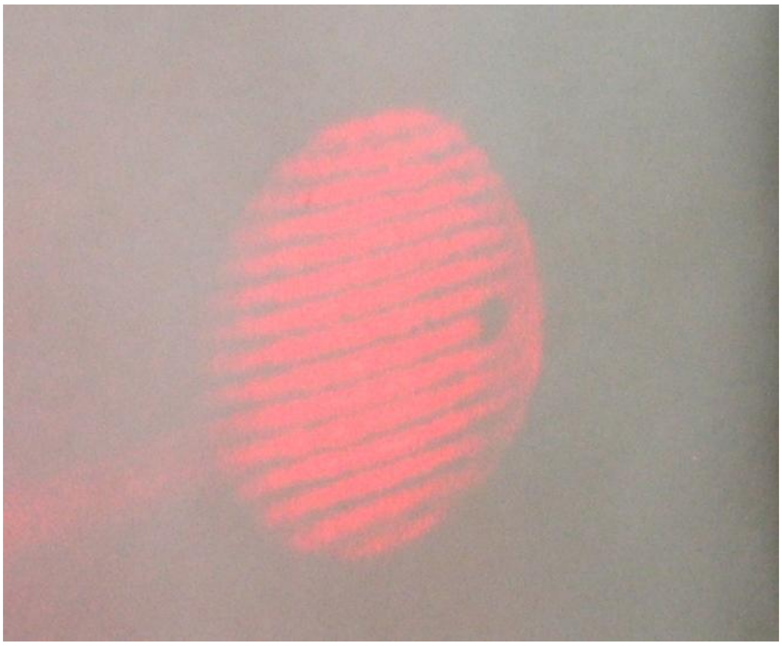

Photo 3 shows the interference pattern as a result of the addition of two laser beams in opposite directions. When the interferometer is rotated, the vertical component of the speed of light of the laser beams changes, which leads to a sharp shift in the interference fringes.

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