The energy of wave vortices (loks).

Абстракт. Development of the mathematical model of the elastic universe. The energy of the loks (0,0), (1,0) and (1,1) are calculated. Assumptions are made regarding other loks. The first conclusions on the identification of elementary particles in a set of loks are made.

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1. The essence of the hypothesis.

Our mathematical model is that:

1. The universe is a rigid elastic continuum = gukuum. This continuum does not have any numeric parameters or constraints. This continuum may not have any mass or density. But by virtue of the law of conservation, it has some resistance to deformations.
2. In this continuum ALWAYS existed and ALWAYS will exist all kinds of waves. The movement of the waves creates the whole picture of the universe that we observe. Including wave vortices create material particles. The mathematical description is attached.
3. All visible and invisible objects of the universe, from large to small, are wave objects in this continuum. All visible and invisible objects of the universe, from large to small, are solutions of the wave equation:

The uniform formula of all Matter, of all Particles, of all Fields and all Quantums of our Universe:

$$\frac{\partial^2 \mathbf{W}}{\partial t^2} - c^2 \Delta \mathbf{W} = 0;$$

$\overline{\mathbf{W}}$ - **displacement vector of elastic space**

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(1-1)

4. All wave objects in the gukuum are described by an algebraic task parameters of elasticity of a solid body and a three-dimensional wave equation. When This simply assumes that these are "small" and "linear" waves. All questions like "what is" does not make sense. Continuum and everything.
5. As physical = letter parameters it is convenient to use the Lame coefficients L_1, L_2, L_3 (these are elementary combinations of the coefficients of compression, shear and torsion of a solid body). There are no numerical restrictions on the Lamé coefficients. Just the coefficients of Lame L_1, L_2, L_3 and everything.
6. Thus, the universe and all the matter contained in it are described only by letters, algebra. However, objects can be compared numerically. For example, the mass of the proton wave vortex can be numerically compared with the mass of the electron wave vortex.

7. All elementary particles, fields, photons, ball lightning, even lightning, dark matter are different kinds of solutions to the wave equation. So far we know several types of solutions to the wave equation, three spherical and three cylindrical, but perhaps this is not the only way the universe is limited.
8. **The nonlinearity** that exists in the universe is explained by the law of "**winding a linear solution on itself**". This is a very important law that makes it possible to understand the formation of elementary particles. As a result of such winding, or layering, the linear solution becomes non-linear and creates all the variety of the material world. This law consists in adding to the integral for the energy a factor $1/r^2$.

2. Calculation of the energy of loks.

Next, everywhere we work in spherical coordinates.

So, we take in mind the wave vortex = lok, and position it so that the rotation of the wave occurs around the axis Z. We make the assumption that all the oscillations in the loks occur in the same direction. So it or not we do not know yet. But this assumption is close to the truth. It is true in the first degree of approximation. This is our mathematical model. We locate the lok in such a way that these oscillations in the loks occur along the axis Z, and the wave itself ran around the axis Z. Similarly, it runs around the axis Z and the energy of lok. And in exactly the same way the movement of the energy of the lok creates an angular momentum = spin.

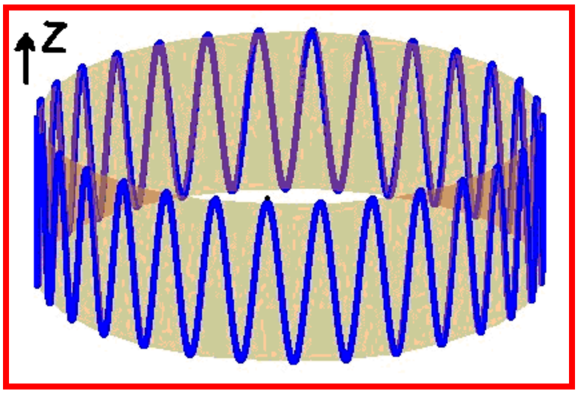

Fig.1.

Figure 1 shows a fragment running around the axis Z wave. The oscillations in it are directed along the axis Z. And the wave runs around the axis Z. As will be seen from the following, the carrier frequency (in blue) is constant over the whole wave vire. However, with the distance from the axis Z the amplitude of the traveling wave changes. In addition, with the distance from the axis Z the angular velocity of the wave changes. That is, the outer layers are lagging behind the inner ones.

A particular solution of the wave equation, spherical standing waves:

$$\boxed{W\left(r,\theta,\phi,t\right)_{i,j,m} = \tilde{N}_{i,j,m}\cdot J_j\cdot(k\cdot r)\cdot Y_{j,m}\cdot\left(\theta,\phi\right)\cdot\Phi_m\left(m\cdot\phi - k\cdot c\cdot t\right)}$$

(1-2)

This formula is obtained from a linear combination of two solutions with different $\Phi_m(\varphi)$.

i,j,m - whole numbers. i=1,2,3. j=0,1,2… m=0,1,…,j;

$J_j(k\bullet r)$ - Spherical Bessel functions of the first kind;

$Y_j(\theta,\varphi)$ - spherical surface harmonics;
$Y_j(\theta,\varphi)=P_{jm}(cos\theta)\bullet\Phi_m(\varphi)$;
$\Phi_m(\varphi)=sin(m\bullet\varphi-k\bullet c\bullet t)$;
$P_{jm}(cos\theta)$ - The adjoint Legendre function of type 1, of order m and rank j:

$$\boxed{P_{j,m}(x) = \left(1-x^2\right)^{\frac{m}{2}} \cdot \frac{1}{2^j \cdot j!} \cdot \frac{d^{j+m}}{dx^{j+m}}\left(x^2-1\right)^j}$$

(1-3)

In formulas, the quantity k. It is related only to the actual mass (energy) of the particle, and it is determined by it. This is the link between ω in the vibrational part of the solution and the radial coordinate in the Bessel function: $\omega=k\bullet c$, c - speed of light. In Fig. (1-1) $\omega=k\bullet c$ – это частота синей синусоиды, «несущей» волновой частоты. Также $k=1/\lambda$, where λ – approximate size of the wave vortex. The physics is such that in each particle (in each solution), due to physical reasons, the frequency of the wave traveling along the circle and its particle size are set. Physical causes are determined by the form of the solution, and the way the solution is wound up on itself, and how the whole system stabilizes to a stable state. Also, particles have excited states. To explore this is the business of the future. This can only be observed. Thus, all further solutions and formulas are an illustration of the actual state in which all the wave vortices are located = loks = elementary particles.

Since our lok is placed vertically, the following relationships hold. In the solution for the displacement vector $\boldsymbol{W}$ there is only one component W_Z . W_x и W_y are equal to zero. We have:

$W_x=0$	$W_y=0$

(1-4-1)

The following formulas for the transition between Cartesian and spherical coordinates:

Standard conversions between Cartesian and spherical coordinates:	
$W_r = W_x\, sin\theta\, cos\varphi + W_y\, sin\theta\, sin\varphi + W_z\, cos\theta$;	}
$W_\theta = W_x\, cos\theta\, cos\varphi + W_y\, cos\theta\, sin\varphi - W_z\, sin\theta$;	
$W_\varphi = - W_x\, sin\varphi + W_y\, cos\varphi$;	
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(1-4-2)

In this way:

$$\boxed{W_r = W_Z \cdot cos(\theta) \quad W_\theta = W_Z \cdot (-sin(\theta)) \quad W_\phi = 0}$$

(1-5)

Next, we go for simplicity to the dimensionless length:

$$\boxed{k \cdot r = q}$$

(1-6)

According to mathematical reference books, we have a formula for the bias W_Z for the first three loks (0,0), (1,0), (1,1):

(0,0)	$W_Z(q,\theta,\phi) = \dfrac{sin(q)}{q}\cdot 1\cdot 1$
(1,0)	$W_Z(q,\theta,\phi) = \dfrac{sin(q) - cos(q)\cdot q}{q^2}\cdot cos(\theta)$
(1,1)	$W_Z(q,\theta,\phi) = \dfrac{sin(q) - cos(q)\cdot q}{q^2}\cdot sin(\theta)\cdot sin(\phi)$

(1-7)

Useful formulas:

$P = \dfrac{sin(q)}{q}$	$Q = \dfrac{cos(q)\cdot q - sin(q)}{q^2}$	$R = \dfrac{2\cdot sin(q) - 2\cdot q\cdot cos(q) - q^2\cdot sin(q)}{q^3}$

(1-8)

Further, we write out the formulas for the displacements in spherical coordinates:

	(0,0)	(1,0)	(1,1)
A	$W_q = P\cdot cos(\theta)$	$W_q = Q\cdot cos(\theta)^2$	$W_q = Q\cdot cos(\theta)\cdot sin(\theta)\cdot sin(\phi)$
B	$W_\theta = P\cdot(-sin(\theta))$	$W_\theta = Q\cdot cos(\theta)\cdot(-sin(\theta))$	$W_\theta = Q\cdot sin(\theta)\cdot(-sin(\theta))\cdot sin(\phi)$
C	$W_\phi = P\cdot 0 = 0$	$W_\phi = Q\cdot cos(\theta)\cdot 0 = 0$	$W_\phi = Q\cdot cos(\theta)\cdot 0 = 0$

(1-9)

We have formulas for the strain tensor in spherical coordinates:

The strain tensor in spherical coordinates:	
$W\phi\theta = \dfrac{1}{2q\cdot sin(\theta)}\cdot\dfrac{d}{d\phi}B + \dfrac{1}{2q}\cdot\dfrac{d}{d\theta}C - \dfrac{cos(\theta)}{2q\cdot sin(\theta)}\cdot C$	$Wqq = \dfrac{d}{dq}A$
$W_{q\theta} = \dfrac{1}{2}\cdot\dfrac{\frac{d}{d\theta}A}{q} + \left(\dfrac{d}{dq}B - \dfrac{B}{q}\right)\cdot\dfrac{1}{2}$	$W_{\phi\phi} = \dfrac{1}{q\cdot sin(\theta)}\cdot\dfrac{d}{d\phi}C + \dfrac{B\cdot cos(\theta)}{q\cdot sin(\theta)} + \dfrac{A}{q}$
$W_{q\phi} = \dfrac{1}{2}\cdot\left(\dfrac{d}{dq}C - \dfrac{C}{q}\right) + \dfrac{\frac{d}{d\phi}A}{2\cdot q\cdot sin(\theta)}$	$W_{\theta\theta} = \dfrac{1}{q}\cdot\dfrac{d}{d\theta}B + \dfrac{A}{q}$

(1-10)

The total energy of the lok after all simplifications is expressed by the formula:

$$\int_0^{\infty}\int_0^{\pi}\int_0^{2\cdot\pi}\left[\frac{L_1}{2}\left[Wqq^2 + (W_{\theta\theta})^2 + (W_{\phi\phi})^2\right] + L_2\cdot\left[(W_{q\theta})^2 + Wq\phi^2 + W\phi\theta^2\right]\right]\cdot sin(\theta)\,d\phi\,d\theta\,dq$$

(1-11)

Further, we calculate the elements of the strain and energy tensor for each lok separately.

Lok (0,0).
For it, only two terms of the strain tensor are nonzero:

$$Wqq = Q\cdot\cos(\theta) \qquad W_{q\theta} = Q\cdot\frac{\sin(\theta)}{2}$$

(1-12)

The energy of the lok (0,0). Here the square of the strain tensor is integrated over the space. The volume element contains a factor q^2 , But the law of winding the solution contains $1/q^2$. These factors cancel each other and simplify the integral.

$$E_{0,0} = \int_0^{\infty}\int_0^{\pi}\int_0^{2\cdot\pi} \frac{L_1}{2}\cdot(Q\cdot\cos(\theta))^2\cdot\sin(\theta)\, d\phi\, d\theta\, dq + \int_0^{\infty}\int_0^{\pi}\int_0^{2\cdot\pi} \left[L_2\cdot\left(Q\cdot\frac{\sin(\theta)}{2}\right)^2\right]\cdot\sin(\theta)\, d\phi\, d\theta\, dq$$

(1-13)

After substituting the value Q by the formula (1-8), we obtain:

$$E_{0,0}(q) = \frac{2}{3}\cdot\pi\cdot(L_1 + L_2)\cdot\int_0^{q}\left[\frac{(\cos(q)\cdot q - \sin(q))}{q^2}\right]^2 dq$$

(1-14)

Lok (0,0) has an axial symmetry. This can be seen from the formula for the displacement, there are no angular coordinates in it. The graph of radial energy distribution and energy density has the form:

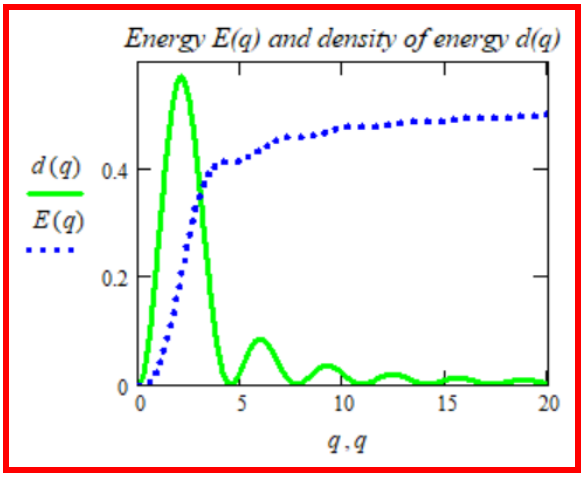

Рис.2.

As can be seen from the graph, the lok (0,0) has a low density in the center, as if emptiness.

Lok (1,0).

Note that here q quite different than for lok (0,0).

Non-zero elements of the strain tensor:

$$W_{qq} = R\cdot\cos(\theta)^2 \qquad W_{\theta\theta} = \frac{Q}{q}\cdot\sin(\theta)^2 \qquad W_{q\theta} = \frac{\left(\cos(\theta)\cdot\sin(\theta)\right)}{2}\cdot\left(\frac{Q}{q} - R\right)$$

(1-15)

After integrating formula (1-11) with respect to the angular coordinates, we obtain:

$$E_{1,0}(q) = L_1\cdot\left(\frac{16}{15}\cdot\pi\right)\cdot\int_0^q Q^2\,dq + L_1\cdot\left(\frac{2}{5}\cdot\pi\right)\cdot\int_0^q R^2\,dq + L_2\cdot\left(\frac{2}{15}\cdot\pi\right)\cdot\int_0^q \left(R - \frac{Q}{r}\right)^2 dq$$

(1-16)

Assuming that $L_1 = L_2$, which in most cases is valid for all terrestrial materials, we obtain the following graphical dependences of the radial energy distribution and energy density:

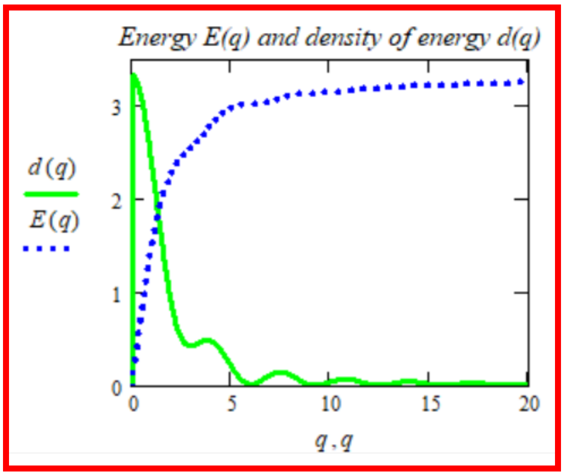

Рис.3.

As can be seen from the graph, the lok (1,0) has a high density in the center, the so-called "core". This property exists for a proton and for a neutron.

Lok (1,1).

Note that here q quite different than for loks (0,0) and (1,0).

Non-zero elements of the strain tensor:

$$W_{qq} = R\cdot\cos(\theta)\cdot\sin(\theta)\cdot\sin(\phi) \qquad W_{\theta\theta} = \frac{Q}{q}\cdot\left(-\cos(\theta)\cdot\sin(\theta)\right)\cdot\sin(\phi) \qquad W_{\theta\phi} = \frac{Q}{2\cdot q}\cdot\left(-\cos(\phi)\cdot\sin(\theta)\right)$$

$$W_{q\theta} = \left[\frac{Q}{2\cdot q}\cdot\left(1 + \sin(\theta)^2\right) - \frac{R}{2}\cdot\sin(\theta)^2\right]\cdot\sin(\phi) \qquad W_{q\phi} = \frac{Q}{2q}\cdot\cos(\phi)\cdot\cos(\theta)$$

(1-17)

Lok (1,1) is not axisymmetric due to the presence of the dependence on φ.

After integrating formula (1-11) with respect to the angular coordinates, we obtain:

$$E_{1,1}\cdot(q) = \frac{6\cdot L_1}{15}\cdot\pi\cdot\int_0^q R^2\,dq + \frac{2\cdot L_1}{15}\cdot\pi\cdot\int_0^q \left(\frac{Q}{r}\right)^2 dq + \blacksquare$$

$$\blacksquare + \frac{15 \cdot L_2}{15} \cdot \pi \cdot \int_0^q \left(\frac{Q}{r}\right)^2 dq + \frac{10 \cdot L_2}{15} \cdot \pi \cdot \int_0^q \left(\frac{Q}{q} - R\right) \cdot \frac{Q}{r}\, dq + \frac{4 \cdot L_2}{15} \cdot \pi \cdot \int_0^q \left(\frac{Q}{q} - R\right)^2 dq$$

(1-18)

Assuming that $L_1 = L_2$, which in most cases is valid for all terrestrial materials, we obtain the following graphical dependences of the radial energy distribution and energy density:

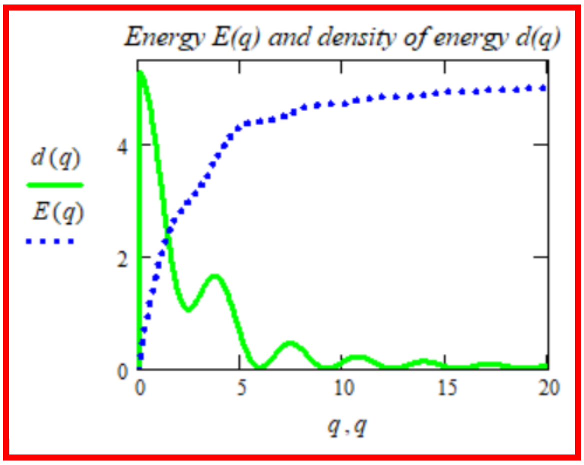

Рис.4.

As can be seen from the graph, the lok (1,1) also has a high density in the center, the so-called "core". This property exists for a proton and for a neutron. Therefore, it is very likely that the loks (1,0) and (1,1) are a proton and a neutron. But who is who, we do not know yet. Identification will continue in the study of the angular momentum of loks.

As our analysis shows, which is not given here, Loks (3.0), (3.1), (3.2), (3.3), and also Lok (5.0) also have finite energy. Large values of integer arguments create serious computer problems. Loks (2,0), (2,1), (2,2) and all Loks (4,0), (4,1), (4,2), (4,3), (4,4) have energy integrals that go to infinity. Of course, this does not mean the physical meaninglessness of these loks. Simply this means that the given solution is not physically stable and creeps into some other solutions described by other solutions (not spherical) of the wave equation.