

## Dark Energy and Matter in the Universe

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We will begin with quotations by well-known Russian scientists regarding the nature of "dark" energy. No better references exist in the literature.

*Dark energy - a surprising phenomenon of nature - has been found in observations of supernovae stars flashing halfway to horizon of the universe. It creates "antigravity" which is shown in the accelerated expansion of the universe as the whole. Because of this global effect, dark energy was postulated by two international groups of space-observers in 1998-99.[1]*

*What are the properties of dark matter and energy? What data from space-observations testify to their existence? What does it say from the point of view of microcosmic physics? What are the prospects of studying the phenomenon under terrestrial conditions?*

*The universe expands and galaxies separate at speeds that are proportional to their distances from us. Space is extended in all directions. Today, this rate of expansion is insignificant compared to earlier periods. It is estimated that all distances will be doubled in approximately 15 billion years. The density of substance in the universe also decreases and will become more rarefied in the future. The red-shifted wavelength of light directly testifies to the stretching of space and the expansion of the universe. This phenomenon was observed by E. Hubble in 1927 and has served as the experimental proof of the expansion of the universe, predicted three years earlier by Alexander Fridman.*

*The characteristics of dark energy are in dispute. It is known to be distributed in regular intervals, has low density, and does not operate by means of fundamental types of interaction, with the exception of gravity. [2]*

A feature of "dark" energy is the surprising connection of the energy of expansion of the universe with the phenomenon of gravity. As Poll Davis, the popular writer of physics states,[3]

*At the moment of birth of the universe, corresponding to 1 second... The speed of expansion would differ from the real value by more than  $10^{-18}$ , and would be enough for the full destruction of the balance (between gravity and expansion).*

From these comments, there follows one **very rigid** conclusion: to know the nature of dark energy, it is necessary to know the nature of gravity. This has been investigated much more fully since the time of Kepler and Newton. The ability of light to be propagated in the physical vacuum is a new insight into the nature of gravity. The term "vacuum" is very misleading. We shall replace with the concept of the **environment** of the universe, which is responsible for dark energy and matter.

In physics, the phenomena of transformation of energy of a photon into matter and antimatter is well known. In particular, a gamma wave with energy greater than **1,022 MəB** forms an electron-positron pair. To be more exact, the energy should not be less than **hν = 1.031 MeV** so that the electron and positron will have scattered without the possibility of immediate annihilation, and without the participation of extraneous particles. On this basis, the electric structure of the **environment** is logically deduced.

Most of the general parameters of the structure of the **environment** are, as a first approximation, determined from the energy equations:

$$h\nu = e_o E \Delta r_e \quad (1)$$

Here **h** – Planck's constant,  $\nu$  – frequency of the gamma - quantum,  $e_o$  – elementary charge, **E** – intensity of the electric field of the **environment**,  $f = e_o E$  – force,  $\Delta r_e$  – a path of the moving charge of the **environment** under the influence gamma – quantum energy. We shall define the intensity of an electric field, where  $N$  – unknown factor as:

$$E = N \xi \frac{e_o}{r_e^2} \quad (2)$$

$r_e$  – Distance between charges (+) and (–) which is not known at present. At the passage of a wave of gamma - quantum deformation of the **environment** whose value depends on the cyclic frequency of a wave,  $\omega = 2\pi\nu$  and time  $t_v$  of a passage, the distance between charges is established:

$$\Delta r_e = 2\pi\nu r_e t_v \quad (3)$$

Let us substitute the intensity from (2) and the deformation from (3) in (1):

$$h = 2\pi N e_o^2 \xi \frac{1}{r_e / t_v} \quad (4)$$

It is possible to assume, that  $r_e / t_v = c = \sqrt{\eta \xi}$  - speed of light. We shall determine number N:

$$N = \frac{h}{2\pi e_o^2 \sqrt{\xi / \eta}} = \mathbf{137.035999815} = \alpha^{-1} \quad (5)$$

Where  $\eta = \frac{1}{\mu} = 1,00000000 \cdot 10^7 [a^2 m^{-1} kg^{-1} s^2]$  - a magnetic constant of the **environment**,

$\xi = \frac{1}{\varepsilon} = 8,98755179 \cdot 10^9 [a^{-2} m^3 kg \cdot s^{-4}]$  - An electric constant of the **environment**. The unknown number returned the value of the fine structure constant. The equation of energy of a photon for the

frequency of a conditional « red border »  $h\nu_{rb}$  and the potential electric energy of an electron–positron pair:

$$w = \xi \frac{e_o^2}{r_e} = 2\pi \alpha^{-1} e_o^2 \nu_{rb} \sqrt{\xi/\eta} = \mathbf{1.64936940 \cdot 10^{-13}} \quad (7)$$

*J.*

The frequency of the gamma-quantum for « red border » pays off in (7) and it appears as  $\nu_{rb} = \mathbf{2.489213 \cdot 10^{20}}$  Hz. The electric intensity of the **environment** between charges (+) and (–) is  $E = \mathbf{1.008552 \cdot 10^{23}}$  V/m. From (7) we find the value of a structural element of the **environment**, and from (1, 2) the limiting deformation of it:

$$r_e = \frac{c}{2\pi \alpha^{-1} \nu_{rb}} = \mathbf{1.3987631 \cdot 10^{-15}} \quad (8)$$

*meter*

$$\Delta r_{rb} = \frac{h\nu_{rb} r_e^2 \alpha}{e_o^2 \xi} = \mathbf{1.020726744 \cdot 10^{-17}}$$

*meter*

The **environment**, having electromagnetic structure, can be a source of gravity and inertia. It is enough to assume, that the **environment** has a (+) or (–) surplus charge. The charged **environment**, with the help of Faraday’s induction, is capable of polarizing any material bodies and drawing them together. This is proven in that the electrified subject draws **uncharged** objects. It is possible to assume that the charge of the **environment** is formed by an infringement on symmetry in amounts of (+) and (–) electric charges. Probably, the difference in the values of charges is determined by the ratio of Newtonian and Coulomb forces at equal distances from the electron mass:

$$\sqrt{\xi} \Delta e^\pm = \sqrt{G} m_e^\pm; \quad \Delta e^\pm = \sqrt{\frac{G}{\xi}} m_e^\pm = \mathbf{7.8490194 \cdot 10^{-41}} \quad (10)$$

*Q.*

Because of the lack of material objects in the universe, Coulomb forces of the charged **environment** create “negative pressure”, which is responsible for the expansion of the universe (**dark energy**). Note that the force of gravity is less than the electric force by approximately  $10^{40}$  times. This can be determined precisely, substituting the electric charge in equation (10). The difference in values of the (+) and (–) charges is equal to the difference in the charges of an electron and positron to the 21<sup>st</sup> power.

The structure possesses the ability of polarization, which is the reason for the attraction of all massive bodies. Newton’s formula for gravity becomes:

$$F = G \frac{M_1 M_2}{R^2} = \xi (4\pi R)^2 \sigma_{12} \sigma_{21} \quad \text{Or} \quad F = \xi (4\pi R)^2 S^2 (\Delta r_{12})^2 (\Delta r_{21})^2. \quad (11)$$

Polarization  $\sigma_{12}$  is created by the first mass at a point on the second mass, and polarization  $\sigma_{21}$  is created by the second mass at a point on the first. Deformation of the **environment**  $\Delta r_{12}$  is created by the first mass in the center of the second mass, and the deformation of the **environment**  $\Delta r_{21}$  is

created by the second mass in the center of the first mass. For gravity, the essential property of the **environment** is a small difference in the values of the (+) and (-) charges. It results in a rough schematic of gravitational interaction:

... + - (+mass1 +) - + - (-environment) - + - + - (+mass2 +) - + - ...

It evidently shows if the charged **environment** has a surplus of negative charge, masses are attracted. In absence of masses or in the empty space of the universe, a Coulomb repulsion or expansion of the universe is effected. This can be named as the "dark" energy of astrophysics. For real electric charges with values  $10^{41}$  times more than the differences of the value of (+) and (-) charges of the **environment**, interaction occurs under the circuit:

... + - (+charge +) - + - (-environment) + - + - (+charge +) - + - ... Is a repulsion of charges of one sign (minuses between charges are more than plusses),

... - + (-charge -) - + - (-environment) + - + - (+charge +) - + - ... Is an attraction of charges of a different sign (an equal quantity of minuses and plusses between charges).

**Thus, electric and gravitational interactions are carried out only with the help of the environment, and are taking place between interacting objects.**

Instead of R. Feynman's diagrams where virtual particles are entered, the physical structure of the vacuum is substituted.

***Current of displacement for light propagation at the environment***

It is accepted that any material bodies or physical fields can propagate in absolute emptiness. Any physical field is born by material carriers (electric charges, movement of charges and masses). Only with the help of the material carriers can physical fields be found. ***“Physical fields can be distributed in absolute emptiness!”*** This is the representation in XX century physics regarding the propagation of any electromagnetic wave, and here the simple logic of physics breaks down.

Light can only be carried by electric charges, both in substance and in the **environment**. In substance, charges are in continuous motion. Therefore there is a dispersion of light, and also the mass of charges, possessing inertia, reduce the speed of light. In the **environment**, electric charges occupy an inflexible space, do not move, do not change amplitude, and have no appreciable inertia. Therefore light in the **environment** is not dispersed, and speed of light has a maximum value. In the propagation of light, electric charges have displacements which are accompanied by Maxwell displacement currents. The displacement current is obligatory for the connection of ***E*** and ***H*** amplitudes of light waves.

Let's find the connection between ***E*** and ***H*** amplitudes with displacement currents for the propagation of light in the **environment**. With fluctuations of material charges there is an involvement with the movement of charges of the **environment** under Coulomb's law, which forms

the phenomenon of light. The amplitude of a displacement current:  $j_a = \frac{e_o}{\Delta r_a} \left[ \frac{d(\Delta r)}{dt} \right]_a$ , formed by

the displacement of an elementary charge (+) or (-)  $e_o$  at distance  $\Delta r_a$  with a speed  $\left[ \frac{d(\Delta r)}{dt} \right]_a$ .

Amplitude of the speed of displacement of a charge is:  $\left[ \frac{d(\Delta r)}{dt} \right]_a = 2\pi v \Delta r_a$ , which is defined by the sine wave character of light  $\Delta r = \Delta r_a \text{Sin}(2\pi v \cdot t)$ . A displacement current after substitution of

amplitude speed:  $j_a = 2\pi \Delta r_a v \frac{e_o}{\Delta r_a} = 2\pi e_o v$ . As a result, the displacement current depends only on an elementary charge and the frequency of light.

To a displacement current, it is probably possible to apply Ohm's law:  $U_a = j_a R$ . On the other side we have:  $U_a = E_a \Delta r_a$ . From here we find, that the electric intensity of a wave of light is equal:

$$E_a = j_a \frac{R_{wave}}{\Delta r_a} \text{ V/m.}$$

Here, the only resistance is the wave resistance of the "vacuum" (an impedance of the "vacuum")  $R_{wave} = \sqrt{\frac{\xi}{\eta}} = \frac{E}{H} = 29,9792458 \text{ [Om]}$ .

The impedance has the value in physics, of  $4\pi$  and is not removed. It changes all fundamental constants in the international system of units, including Planck's constant. Therefore wave resistance of the **environment** is  $4\pi$  times less than that accepted in physics.

Substitution in the formula for electric intensity gives:

$$E_a = \frac{2\pi e_o}{\Delta r_a} v \sqrt{\frac{\xi}{\eta}} = \frac{e_o c}{r_e^2} R_{wave} = 7.359755 \cdot 10^{20} \text{ V/m.}$$

Intensity appears a constant for all frequencies of light and depends on the speed of light, which is defined by gravitation. The magnetic intensity of light, in view of the expression for wave resistance, will be:

$$H_a = \sqrt{\frac{\eta}{\xi}} E_a = j_a \frac{R_{wave}}{\Delta r_a} \sqrt{\frac{\eta}{\xi}} = \frac{e_o c}{r_e^2} = 2.45495006 \cdot 10^{19} \text{ A/m.}$$

The huge amplitudes of E and H are surprising. It is necessary to remember, that all electromagnetic waves are generated by electric charges and basically by electrons. Electric intensity of the electron itself:

$$E_e = \xi \frac{e_o}{r_e^2} = 7.3597584 \cdot 10^{20}$$

V/m. This value coincides with electric intensity. The relation of

electric intensities of light and the intensity of the **environment** is:  $\frac{E_a}{E} = \alpha$ .

### The capacitor

The capacitor is capable of carrying an alternating current. How can there be such a physical phenomenon? Usually, a dielectric is placed between the conducting plates of a capacitor. In the elementary case, this is simply air. How does a dielectric differ from a conductor? There are no free charges in it. There are only connected charges in the structure of a dielectric. So how it is possible to explain the phenomena in the capacitor? It can be explained only with the help of displacement currents introduced into theory by Maxwell. The displacement current speaks for itself: it is formed at turns and displacement connected to atoms and molecules of electric charges. Therefore the capacitor keeps an electric charge. It is necessary to close the plates as the charge induced on the plates from free charges, forms a natural current, unloads the capacitor, and electromagnetic forces return the displaced charges to the condition of initial balance. Presence of the connected charges in the vacuum proves to be true by simple experience. The usual "air" condenser represents the capacitor in the "absolute" vacuum and carries an alternating current in a circuit.

The conclusion – without the connected charges and displacement currents formed by these charges, a capacitor is impossible. From here there is only one conclusion: any vacuum has connected charges, capable of forming displacement currents.

### Conclusions

1. The displacement current of the elementary charges of the structure of the **environment** is necessary for the maintenance of electric and magnetic amplitudes of light.
2. The relationship of electric and magnetic amplitudes of light is constant and also does not depend on the structure of the **environment**. It is equal to a wave resistance of the vacuum.
3. Amplitudes of light do not depend on frequency.

The full stream of a magnetic induction behind a surface  $s$  in the form of a vector  $\vec{B}$  is not zero only in that case where the mass continuum exists in the **environment**, limiting the speed of light by its inertia. The structural element of the **environment** is **37832** times less than the radius of an atom of hydrogen. Therefore, light in a substance passes mostly between particles of the substance and is supported only partially by the charges of the electrons and nucleus, which possess appreciable inertial properties. The inertia of the substance reduces the speed of propagation of light. As a result, the effective speed of light in a substance is lower than the speed in the **environment**. This proves to be true in experiments, and is also observed when the partial convection of ether is found in the movement of substance. Light is transmitted by elements of the substance and the **environment** remains motionless.

Justification for ignoring the **environment** in the propagation of light is found in the results of the **M.-M.** experiment. These experiments could only reveal the displacement of light by the principle of "star aberration" for a cross-sectional placement of the interferometer. Longitudinal positioning could not detect movement of air owing to the summing of equal Doppler effects. A rotation of the installation showed a small constant displacement of interference lines which was considered a mistake. Actually this effect is confirmed by well-known experiments.

**The dark matter** aspect of the structure of the **environment** is not sufficient to investigate the mass continuum. It is responsible for the delivery of "material" for formation of masses of all particles of matter and antimatter, and for the restriction of the speed of light by inertia, with the help of indissoluble connections of the charge and mass of the **environment**.

The nature and essences of electric charge and mass of elementary particles is not known to physics at this time. This impedes progress in the knowledge of Nature. Here we shall try to find connections of parameters of the **environment** with the mass of the electron which we shall consider the elementary mass.

From formulas of Newton and Coulomb, it is easy to determine the following parities for elementary mass:

$$m_e^\pm = \frac{\Phi^2}{2(r_e + \Delta r_{rb})\xi} = 9.1093818850 \cdot 10^{-31} [kg]$$

$$m_e^\pm = \frac{e_o^2}{2(r_e + \Delta r_{rb})\eta} = \mathbf{9.1093818845} \cdot 10^{-31} [kg]$$

$$m_e^\pm = \frac{e_o^\pm \Phi^\pm}{2(r_e + \Delta r_{rb})c} = \mathbf{9.1093818861} \cdot 10^{-31} [kg]$$

$$m_e^\pm = \frac{h}{2\pi c \alpha^{-1} 2(r_e + \Delta r_{rb})} = \frac{h}{2\pi R_e c \alpha^{-1}} = 9.109381889 \cdot 10^{-31} [kg]$$

$$\frac{\Phi^2}{e_o^2} = \frac{\xi}{\eta} = \mathbf{8.987551790} \cdot 10^2 [\Omega^2]$$

– Defines an elementary stream of magnetic induction which is connected to the quantum of stream  $\Phi_q$  accepted in physics under the formula:

$$\Phi = \Phi_q / \alpha^{-1} \pi = 4.8032042 \cdot 10^{-18} \text{ Weber.}$$

$$h = 2\pi e_o^2 \alpha^{-1} \sqrt{\frac{\xi}{\eta}} = 2\pi e_o^2 \alpha^{-1} \frac{\Phi}{e_o} = 2\pi e_o \Phi \alpha^{-1}$$

Thus, Planck's constant is strongly connected through the elementary charge and quantum of a stream of magnetic induction, and through them, to elementary mass.

It is probable, that all the information stated here testifies to necessity for the recognition of a structure of the **environment** as a source of **dark matter and energy**, and also as a source of gravity known to us, and the structure necessary for propagation of light.

Let's determine speed of light from the dependence of relations of squares of a stream of magnetic

induction and an elementary charge:  $\eta^2 \frac{\Phi^2}{e_o^2} = \eta \xi = c^2$  . Speed of light:  $c = \eta \frac{\Phi}{e_o} = \sqrt{\frac{b_{cross}}{p}}$  , where

$b_{cross} [kg \cdot m^{-1} \cdot s^{-2}]$  – the module of shift of the **environment**. We can determine density:  $p = \frac{b_{cross} e_o^2}{\eta^2 \Phi^2}$  . It is necessary to find out the module of shift. This is determined from the maximum force for stretching the **environment** at the limiting value:

$$f_{\max} = b_{\text{cross}} r_e (\Delta r_{\max}) = \xi \frac{e_o^2}{r_e^2} \varphi = 117.888954 \cdot \varphi$$

*Newton.*

The angle  $\varphi$  is determined by the inclination of a quarter of a sinusoid of a maximum “*red boudoir*”

$$\varphi = \frac{2\Delta r_{\max}}{\alpha^{-1} r_e} = 1.0650271 \cdot 10^{-4}$$

wave. *Radian.* From here we receive the module of shift:

$$b_{\text{cross}} = 8.79591 \cdot 10^{29}$$

Density of the *environment* of space:

$p = 9.786769 \cdot 10^{12} \text{ kg.m}^{-3}$ . This density of "dark" matter does not correspond to our representations about density of substance. It is possible to define it as an **analogue** of density of substance whose **inertia** limits the speed of light in a free space.

The literature and sources (in Russian)

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