The photoeffect, (vacuum analogue of the photoelectric effect,) is used to study the structure of the physical vacuum, the outcome of which is the basis for an hypothesis on the nature of gravitation and inertia. The source of gravitation is the vacuum which has a weak massless elementary electrical dipole (+/-) charge. Inertia is the result of the elastic force of the vacuum in opposition to the accelerated motion of material objects. The vacuum is seen as the source of attraction for all bodies according to the law of induction.

The nature of gravitation remains one of the central problems of science and the discovery of its true basis will introduce major changes to our understanding of the physical laws. The following hypothesis is a departure from commonly accepted physical theories. Newton presented the laws of gravitation and inertia and shows acceleration as absolute in ambient space. Einstein’s General Theory represents gravitation as the curvature of space near gravitating masses, and inertia is seen as equivalent to gravitation. In consideration of the absolute or relative character of acceleration, Einstein adopted Mach’s theory, in which the property of inertia is seen as the gravitational attraction of all masses in the Universe. This is despite the paradox that an isolated rotating object should not experience centrifugal forces. It is commonly acknowledged in physics, that the curvature of space-time is sufficient, and gravitation is not required. However this concept is not convincing even from a philosophical point of view. The physics of the past century has continued the methodology of prior centuries which is to search for answers to problems of HOW? and not WHY?, considering the latter approach to be religious rather than physical. For example, the Big Bang generates the whole substance of the Universe from a mathematical point, presumably under no influence other than God. The theories view the physical vacuum as playing an exclusive role in all interactions except gravitation. Exchange forces are implemented in the vacuum with the help of virtual particles: photons in electromagnetic interaction, mesons in nuclear forces and gluons in nucleons. Gravitons as exchange field quanta, have not received sufficient development in the quantum theory of gravitation although a similar approach to the above is indicated. The nature of gravitation is here presented as the vacuum composed of massless charge dipoles, one component having a small charge superiority over the other. In this manner, it is
possible to represent a primitive scheme of universal gravity and antigravity:

\[(\text{body1} +) (- + - - - \text{vacuum} - + - -) (+ \text{body2})\]

- The Coulomb attraction (gravity) in the presence of material bodies,

\[(- - - \text{vacuum} - - -)\]

- The Coulomb self-repulsion (antigravity) in the absence of material bodies or bodies separated by large distances in space. An inequality zero of the sum of charges is shown visually: \[((-) \text{ is numerically greater than } (+).]\] The ratio of gravitation and repulsion in the universe forms the numerical equality of \(\Lambda\)-member in Einstein’s theory [1, P. Davis, 1985].

At first we’ll remove a blunder of physics presented by Coulomb’s formula. It lies in the fact that parameters of vacuum were put to the denominator of formulas for electric and magnetic forces. We’ll introduce inverse values:

\[\eta = \frac{1}{\mu} = 1.0000000028 \cdot 10^7 [a^2 kg^{-1}m^{-1}s^2] - \text{is a magnetic constant of vacuum equal to inverse value of magnetic permeability.}\]

\[\xi = \frac{1}{\epsilon} = 8.98755179 \cdot 10^9 [a^{-2} m^3 kg^{-1}s^{-4}] - \text{is a dielectric constant of vacuum equal to inverse value of dielectric permittivity.}\]

Newton’s and Coulomb’s formulas get an identical view. Speed of light gets more logical idea \(c = \sqrt{\eta \xi}\).

Experimental physics presents necessary data for the study of vacuum. We mean the data on photoeffects in vacuum, on nuclei and nucleons [2, Karjakin N.I. and others, 1964]. Let’s remind the values of gamma-quanta energies: 1, 137, 1836, 3672 MeV \((2m_e c^2, 137 \cdot 2m_e c^2, 1836 \cdot 2m_e c^2, 1836 \cdot 4m_e c^2)\). This series of energy gives a valuable information for the physical ideas about the structure of vacuum and matter [3, Rykov A.V., 2001].

Gamma-quantum of \(\nu\) frequency deforms the structure of cosmic vacuum. Being within the size of \(r_e\) between its elements, gamma-quantum creates a deformation \(\Delta r_e\). The deformation energy will be \(e_o E \Delta r_e\), where \(e_o\) is an elementary charge, \(E\) - is electrical intensity of the structure. To avoid a well known experimental noise at real birth of electron+positron pair by gamma-quantum we shall take the equation of the energy in pure case:

\[h\nu = e_o E \Delta r_e (1),\]

where \(h\) - is a Plank’s constant. Deformation is function of time

\[\Delta r_e = \Delta [r_e \sin(2\pi \nu t)] = 2\pi \nu r_e \Delta t \cos(2\pi \nu t) (2).\]
Let’s define the intensity of electrical field, where N is some coefficient of proportionality:

\[ E = N\xi e^o \] (3).

Let’s put the obtained expressions, amplitude from (2) and intensity from (3) to (1):

\[ h = 2\pi Ne^2o\xi e^{r_e/\Delta t} \] (4).

We can assume quite naturally that \( r_e/\Delta t = c \) - is speed of light. Let’s find an unknown quantity:

\[ N = \frac{h}{2\pi e^2o r_q} = 137.035990905 = \alpha^{-1} \] (5),

where \( r_q = \sqrt{\xi/\eta} \). We have got a well known formula of Plank’s constant:

\[ h = 2\pi e^2o\alpha^{-1}\sqrt{\xi/\eta} = 6.6260755(40) \cdot 10^{-34} \] (6).

On this stage we should clear a situation with a choice of numerical values for \( h \) or \( \alpha^{-1} \). All next values are calculated on the base of \( h \). But the \( \alpha^{-1} \) is in reality more fundamental then \( h \), because the last one is derivative from \( e, \alpha^{-1}, \xi, \eta \) - vacuum parameters. The choice made here is based upon this quite new study of vacuum.

Gamma–quantum of energy \( w \geq 1 \) MeV interacting with vacuum changes a ”virtual” electron-positron pair to the real ones. The energy equation of this change is:

\[ w = h\nu_{rb} = \xi e^2o r_e \] (7),

where \( r_e \) - distance between charges (+) and (-) of vacuum structure, \( \nu_{rb} = 2.4892126289 \cdot 10^{20} \) Hz - ”red border” for frequency of gamma-quantum. The last exact value is determined below. Let’s find \( r_e \):

\[ r_e = \frac{\xi e^2}{2\pi e^2o \nu_{rb}} = \frac{\xi c}{2\pi \nu_{rb}} = 1.398763188 \cdot 10^{-15} m \] (8).

We have from (2) \( \Delta r_e = 2\pi \nu_{rb} r_e \Delta t = \frac{2\pi \nu_{rb} r_e}{c} = \alpha \cdot r_e \) under assumption \( r_e/\Delta t = c \). In other words, it is the limit of the vacuum deformation above what a rupture of structure ties occurred:
\[ \Delta r_e = \alpha \cdot r_e = 1.020726874 \cdot 10^{-17} m \quad (9). \]

The exact value for \( \nu_{rb} = \frac{c}{2\pi r_e \alpha - 1} = 2.48921263 \cdot 10^{20} Hz \). Deformation of structure lower than the given value has electroelastic character. Let’s find the coefficient of elasticity \( b \) from a next equation:

\[ f = b \Delta r_{rb} = \xi \frac{e^2}{r_e^2}, \quad b = 1.155219829 \cdot 10^{19}[kg \cdot s^{-2}] \quad (10). \]

Dipoles can be polarized and the polarization will be next:

\[ \sigma_{\Delta r} = \alpha^{-2} \frac{e_o}{4\pi r_e^2} (\Delta r)^2 = S (\Delta r)^2, \]

where

\[ S = \alpha^{-2} \frac{e_o}{4\pi r_e^2} = 6.254509137 \cdot 10^{43}[Q \cdot m^{-4}] \quad (11). \]

Another useful parameter of vacuum will be:

\[ E_o = \sqrt{\gamma \xi} = 0.77440463 \quad [a^{-1} m^3 s^{-3}] \quad (12). \]

The names for this parameters are not yet known.

To that stage we get the main parameters of the vacuum structure. Massless vacuum structure follows the fact that energy required for creation pair of electron+positron defines by energy equation

\[ w = 2m_o c^2 + 2m_o c^2 / 137.036, \] where \( 2m_o c^2 \) went on birth of two particle masses and \( 2m_o c^2 / 137.036 \) went to break the dipole tie.

Dielectric vacuum media has a tied charges. The moving charge generates a Maxwell’s displacement current \( j \). This current generates magnetic strength \( \overrightarrow{dH} = \frac{1}{c} \overrightarrow{j} \) where \( \overrightarrow{j} = \frac{1}{4\pi} \frac{d\overrightarrow{E}}{dt} \). The \( \overrightarrow{H} \) is necessary magnetic component to the \( \overrightarrow{E} \) for the Electromagnetic wave (light). The vacuum structure is natural media for light excitation and propagation in space. Thus, the connected charges - dipoles - are re-translators of an electromagnetic wave. Light reaching the observer is not the initial phenomenon of a photon emitted at source, but must be viewed as a multiply-relayed signal.

It is natural to assume that the longitudinal polarization of the dipoles of space involves gravitational phenomena. Gravitation is explained by the electrostatic "field", which is transmitted in vacuo as a longitudinal signal. The longitudinal motion of the polarized front between connected charges is not accompanied by the appearance of a parallel magnetic field moving in one direction, and of identical sign. The magnetic strength should in this case surround the displacement current of moving charges similar to a current in a conductor. As an electrostatics or gravitation act as central and frequently
spherical forces, the total magnetic strength of displacement currents appears equal to zero for gravitating objects or those charged by static electricity. The outcome is minimal damping. This infers an extremely large and almost instantaneous speed of propagation of longitudinal waves in the vacuum. The universe appears to be an interconnected system in which any part ”feels” in full unity with the whole. It is only in this way that it is capable of existence and development. In essence, cosmology cannot manage without ”instantaneous” gravitational transfer.

The laws of Newton and Coulomb can be united next way.

\[ f = G \frac{m_1 m_2}{R^2} = \xi \frac{q_1 q_2}{R^2} \text{ and } \rho = \sqrt{\frac{\xi}{\varepsilon_0}} = 8.6164135164 \cdot 10^{-11}[Q \cdot kg^{-1}] \] - the electrical charge of one kg of any mass. The same value may be presented by a micro parameters - \( \rho = e_0 \sqrt{\frac{2\pi G}{\varepsilon_0}} = 8.6164135 \cdot 10^{-11} \). Gravitational constant is defined by parameters of vacuum \( G = \xi \frac{e_0^2}{m_\xi} = 6.67259049725 \cdot 10^{-11}[kg^{-1}m^3s^{-2}] \) where \( m_\xi = m_{Pl} \sqrt{\alpha} = 1.8594480544 \cdot 10^{-9}kg, m_{Pl} \) - Plank mass. It is indirect evidence of electrical nature of gravitation.

It is necessary to state that it is impossible to formally transfer accepted physical concepts regarding material substance on the structured vacuum as here indicated. Strength \( E = \xi \frac{q}{R^2} \) and potential \( U = \xi \frac{q}{R} \). For example, the calculation of acceleration of gravity for the earth in terms of electrical forces gives \( g = \sqrt{G\xi \frac{4M}{R^2}} \). For instance, The Earth has \( g = 9,82 \text{ m/c}^2 \) and electrical strength \( E = 1.1402 \cdot 10^{10} \text{ V/m in vacuum} \). This is nonsense from the usual point of view. However, it is not surprising that the electrical strength of an electron is \( 1.8367 \cdot 10^{20} \text{ V/m} \) and proton \( 6.399 \cdot 10^{26} \text{ V/m} \). This is the medium in which ” the microparticles exist ”, and of which the macro bodies consist. Distances between the constituents of atoms on 3-4 order exceed the indicated distance. The vacuum penetrates everywhere, whether it is a dielectric or a conductor. Therefore it must be realized that customary concepts of shielding or electrical voltage are here completely unsuitable. It is impossible for example, to arrange a conductor between gravitating bodies to shield the operation of gravity. It is impossible to arrange electrodes in space to remove and use the electrical voltage of the vacuum. The carriers of electricity in a substance and in the vacuum are completely different. The interaction of bodies with the vacuum is implemented at the level of electrons and nucleons of substances. Gravitation also begins at the same level, finally being integrated in macroscopic masses.

We state that the force of elastic electrical deformation will be defined as

\[ f = b \Delta r_{eb} = \xi \frac{q^2}{R^2} \text{ and } b = 1.155065 \cdot 10^{19}[kg/s^2]. \] (13)
Where $b$ is the factor of electrical elasticity. Charge polarization -

$$\sigma = Q/4\pi R^2 \ [Q/m^2](14).$$

Using formula (11), (14) and $g = GM/R^2$ for the acceleration of gravity we have:

$$g = 4\pi \sqrt{G\xi S} (\Delta r) g^2 \ m/s^2. \ (15)$$

The longitudinal deformation of the vacuum dipoles by a gravitating object determines the acceleration of gravity and alternately, the acceleration of gravity determines the deformation of the vacuum structure. We calculate the maximum acceleration on (15) and (9):

$$g_{\text{max}} = 6.3409 \cdot 10^{10} \ m/s^2. \ (16)$$

The force of electroelastic deformation from (9) will be defined by the maximum acceleration of an unknown mass $m_x$:

$$b\Delta r_{rb} = g_{\text{max}}m_x. \ (17)$$

The unknown mass is determined from the equation (17)

$$m_x = \sqrt{\alpha m_{Pl}} = 1.859459 \cdot 10^{-9} \ kg, \text{ where } m_{Pl} - \text{ Planck's mass!}$$

This gives $Q = \rho m_x = 1.602177 \cdot 10^{-19}$ - the value of the charge of an electron (!), inadvertently identifying a surprising connection of values $\rho, \alpha, m_x, m_{Pl}$, and that indirectly supports the gravitational theory.

Mass provides the ability to determine the gear of gravitation through the availability of a gravitational charge. We now calculate the number of pairs of electrons and positrons forming vacuum dipoles in this mass: $n = m_x/m_o = 2.0412553^{21}$ pieces. From this, the value of the charge is determined $\Delta e_o = e_o/n = 7.848981^{-41}$ Q, where the charge of an electron exceeds the positron charge by: $7.848981^{-41}$ Q. For instance, the excess of negative charges over positive by a factor of 21 is the basis for gravitation. It corresponds to a minimum gravitational charge of the mass of an electron or positron, i.e. $q_g = \rho m_o = 7.848981^{-41}$ Q. We get there another very vivid coincidence and thus additional prove of validity of description of nature gravity.

Summary.
For centuries the nature of gravity is being unknown. The gravity was and is up to now the most mysterious forth of the Nature. It is difficult to make references to many-many published attempts to solve the problem of gravity. It seems to author that he find a realystic and physicaly based theory of non-geometric gravitation. Above there are remarkable and unexpected coincidences that serves as source of author hope that this article has sense. Any new theory should expect new knowledge about The Nature.

1) The velocity of gravity is expected almost to be infinitiv. Experiment on solar tide data in comparison with local sun time should give the estimated velocity of gravity.

2) There are possibilities to control the deformation of vacuum structure by electrical and magnetic forces, by gamma-quanta radiation etc. Thus the gravity and inertia may be controled as the russian scientists Roschin V.V. and Godin S.M. shows [4, Roschin, Godin, 2000]. There is a tale about wonderful discs after John R.R.Searl which was taken by the mentioned scientists for construction of their device.

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