

Elements of classical structure of physical vacuum

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With the help of interaction a photon with physical vacuum on the basis of classical representations is established, that there are tied charges, composed by electron and positron. On the basis of the energy equation of photon and deformation the distance between charges in the tied charge is received. The limiting deformation of the tied charge for red border of photon frequency is determined. The dependence of polarization of physical vacuum on deformation of the tied charge is deduced and some energy ratios are considered. Is established, that a key role in all ratios plays of the constant thin structure of radiation

As classical structure of physical vacuum (PV) we shall understand some structural formations deduced, basically, with the help of classical physics operation on the help of the Coulomb and Newton laws. It means, that the consideration of the problem does not involve relativity (speeds compared to speed of light), quantum mechanics etc. modern physical theories. The author is far from opposition of classical and modern representations and uses the classical approach as the simplified method of a task with the sole purpose - to receive some simple approach to a complex and difficult problem.

For penetration into PV structure the phenomenon of «photoeffect» is used, though there are also other ways in the given direction, for example, task after Lamb for thin structure of radiation (1947). Let's consider a photon interaction with PV. For the decision of a task we shall accept, that PV has some structure.

Photon, having frequency « ν », deforms PV structure. Being in structure of PV with the size between its elements « r », photons deforms structure on distance dr . Thus the energy of deformation will be $qEdr$, where q - electron charge, E - intensity of an electrical field of structure. The photon energy is equal to energy of deformation:

$$h\nu = qEdr \quad (1)$$

The deformation depends on time (photon \Leftrightarrow electromagnetic phenomenon with amplitude $r \sin(2\pi\nu t)$):

$$dr = d[r \sin(2\pi\nu t)] = 2\pi\nu r dt \cos(2\pi\nu t) \quad (2)$$

Let's define intensity of an electrical field, where N - uncertain factor of proportionality:

$$E = N \xi \frac{q}{r^2} \quad (3)$$

Let's substitute the received expressions (amplitude from 2 and intensity from 3 in 1):

$$h = 2\pi N q^2 \xi \frac{1}{r / dt} \quad (4)$$

It is natural to assume $r / dt = c = \sqrt{\nu \xi}$ - speed of light. Let's define unknown number:

$$N = \frac{h}{2\pi q^2 r_q} = 137,0360 = \alpha^{-1}, \quad (5)$$

where $r_q = \sqrt{\xi/\nu}$, $\nu = \frac{1}{\mu} = 1,00000031 \cdot 10^7 [a^2 \kappa z^{-1} M^{-1} c^2]$ - vacuum magnetic constant,

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$\xi = \frac{1}{\epsilon} = 8,987551 \cdot 10^9 [a^{-2} m^3 \kappa_2 c^{-4}]$ - vacuum electrical constant.

In result we have value of return size of thin structure constant. Have received from (5) the known formula for a Plank constant:

$$h = 2\pi q^2 r_q \alpha^{-1} \quad (6)$$

The done operation and its result - first certificate about not of hopelessness of the put task. The following stage will be the reference to the «photoeffect» for PV. It is known, that photon with energy $w \geq 1 MeV = 1,6 \cdot 10^{-13} dg$ turns to a pair of electron+positron. From classical point of view, probably, it is necessary to tell, that photon «beats out» from PV structure the specified pair of particles (photoeffect in the pure state). It is not far from the fact, known in physics, of realization under influence of photon with of the necessary frequency (energy) of pair from virtual particles of PV. A deliberate arbitrariness in a choice of exact size of red border for photon frequency $\nu_{rb} \geq \frac{w}{h} = 2,4891 \cdot 10^{20} Hz$ is allowable for our case. Is clear, that actually this frequency can be insignificant less or on much greater. For definition « r » we shall take advantage of the equation of energy under the Coulomb law and photon energy $h\nu$:

$$w = \xi \frac{q^2}{r} = 2\pi\alpha^{-1} q^2 r_q \nu_{rb} = 1,6493 \cdot 10^{-13} \text{ Дж} \quad (7)$$

From (7) we find the value of a structural element of PV:

$$r = \frac{\alpha^{-1} \xi}{2\pi r_q \nu_{rb}} = 1,398826 \cdot 10^{-15} \text{ м} \quad (8)$$

We have distance between virtual charges of electron and positron, forming the certain tied charge of PV, which in 2,014504 times is less than classical radius. Limiting deformation of the tied PV charge, which is border of its «destruction» at photoeffect is defined from:

$$dr_{rb} = \frac{h\nu_{rb} r^2 \alpha}{q^2 \xi} = 1,020772 \cdot 10^{-17} \text{ м}, \quad (9)$$

The deformation in PV is less than the given size should carry electroelastic character and at the greater size deformation to result in destruction of the tied charge, to birth of pair free electron and positron with zero speed of outcome at exact performance of equality (7). The little bit large photon energy with its frequency for giving unzero speed of outcome of pair of particles is required. A remarkable consequence from the formula (9) -

$$dr_{rb} = 1,020772 \cdot 10^{-17} = \alpha \cdot r. \quad (10)$$

It indirectly testifies, that the put problem is solved in physical (scientific) frameworks.

Under the given formula the connection of strength in PV deformation through constant of thin structure and distance in tied pair of electron+positron is carried out. Let's define the deformation of PV from an electron through the equation of energy of a electrical field of electron and energy of deformation:

$$\xi \frac{q^2}{r_e} = \xi q^2 \alpha^{-1} \frac{dr}{r^2} \quad dr = \alpha \frac{r^2}{r_e} = 5,067116 \cdot 10^{-18} \text{ м} \quad (12)$$

The deformation of PV from electron as well as a ratio of classical radius and size of the tied charge is less in 2,0145 times. As in PV the certain tied charge is found out, it will be natural fair to speak about polarization of physical vacuum. The similar judgements about its polarization can be found out and in other authors. Let's establish connection of PV polarization from a electron charge on its surface and on distance of Boor radius:

$$\sigma_e = \frac{q}{4\pi r_e^2} = 1,6056 \cdot 10^9, \quad dr_e = 5,067116 \cdot 10^{-18}, \quad \sigma_{be} = \frac{q}{4\pi r_{be}^2} = 4,5530, \quad dr_{be} = 2,6983 \cdot 10^{-22} \quad (13)$$

The polarization decreases on 9 orders at distance from a positive elementary charge up to the first orbit of atom of hydrogen. Let's notice, that $\sqrt{dr_e / dr_{be}} = 137,0362 = \alpha^{-1}$ and $\sigma_e / \sigma_{be} = \alpha^{-4} = (137,0365)^4$. From here is received connection of polarization and deformation for elementary charges.

$$\frac{\sigma_{be}}{\sigma_e} = \left(\frac{dr_{be}}{dr_e}\right)^2 = \alpha^4 \quad \sigma_x = \sigma_e \left(\frac{dr_x}{dr_e}\right)^2 \quad \frac{\sigma_x}{\sigma_e} = \left(\frac{dr_x}{dr_e}\right)^2 = Const = \alpha^4 \quad (14)$$

$$\sigma_{dr} = \alpha^{-2} \frac{q}{4\pi r^4} (dr)^2 = 6,253387 \cdot 10^{43} (dr)^2 \quad \text{where} \quad r = 1,398826 \cdot 10^{-15}.$$

As in (14) the structural PV elements are used only, the account of polarization can be executed for any deformations of PV from any physical reasons influencing on PV.

For example, account of PV deformation from gravity acceleration of the Earth:

$$dr_g = \sqrt{\frac{g}{4\pi E_\sigma \cdot 6,253387 \cdot 10^{43}}} = 1,2703 \cdot 10^{-22} \text{ m} \quad (15)$$

Where $E_\sigma = \sqrt{\gamma \xi} = 0,7744 [a^{-1} \text{ m}^3 \text{ s}^{-2}]$ and $\gamma = 6,67259 \cdot 10^{-11} [\text{m}^3 \text{ kg}^{-1} \text{ s}^{-2}]$ - constant gravitation.

Return account of polarization of the tied charges of PV on its deformation from gravity acceleration of Earth:

$$\sigma_g = 6,253387 \cdot 10^{43} (dr_g)^2 = 1,0091 [K \text{ L} \text{ M}^{-2}] \quad (16)$$

For the Sun the PV deformation on an orbit of the Earth on the average, designed on $g_{se} = 0,0059 \text{ M/c}^2$, will be:

$$dr_g = \sqrt{\frac{g_{se}}{4\pi E_\sigma \cdot 6,253387 \cdot 10^{43}}} = 3,1137 \cdot 10^{-24} \text{ m} \quad \text{and the accordingly polarization of PV is equal}$$

$\sigma_{gs} = 6,0627 \cdot 10^{-4} \text{ M}$. For the control we shall calculate force of an attraction of the Earth on the part of the Sun by

two ways: $F = \xi(4\pi R_{erth})^2 \sigma_g \sigma_{gs} = 3,5265 \cdot 10^{22} \text{ N}$, $F = \gamma \frac{M_s m_{erth}}{R^2} = 3,5458 \cdot 10^{22} \text{ N}$. The diver-

gence in results occurs only at the expense of existing limits of accuracy of definition entrance sizes $\xi, \gamma, R_{erth}, R, M_s, m_{erth}$.

If at electromagnetic disturbances the polarization of PV occurs in a cross direction to propagation, at a static electricity and at gravitational influences the polarization of PV occurs in a longitudinal direction [Рыков А.В. The law of Newton - Coulomb // UIPE RAS, M, 1999, 28 p.]. The size of relative deformation defines speed of light near to powerful

sources of gravitation: $c_{dr} = c \sqrt{1 - \frac{1}{\alpha} \frac{dr_g}{r}}$. For example, the corner of refraction of light which is taking place con-

cerning to a surface the Sun will be $\varphi = \text{arcSin}(1 - \sqrt{1 - \frac{1}{\alpha} \frac{dr_{sg}}{r}}) = 1,9094''$, that practically is confirmed on experience.

Let's address to power ratio at a photoeffect. The energy $w = 1,6493 \cdot 10^{-13} \text{ Dg}$ (formula 7) goes on break of ties electron+positron in the tied charge of PV and formation of free pair of electron and positron with energy $w = 1,6374 \cdot 10^{-13}$, i.e. $w = 1,6493 \cdot 10^{-13} = 1,6374 \cdot 10^{-13} + 1,1949 \cdot 10^{-15} \text{ Dg}$, where the energy of break is designed agrees

$$r + dr_{rb} = 1,3988 \cdot 10^{-15} + 1,0207 \cdot 10^{-17} = 1,409034 \cdot 10^{-15} \text{ M and} \quad (17)$$

$$\Delta w = w - \xi \frac{q^2}{r + dr_{rb}} = 1,1949 \cdot 10^{-15} \text{ Dg.} \quad (18)$$

Let's notice, that the relation of energy of connection to energy of pair of electron and proton is equal $\frac{\Delta w}{w_{ep}} = \frac{1,1949 \cdot 10^{-15}}{1,6374 \cdot 10^{-13}} = 0,0072975 = \alpha$. Thus, constant of thin structure is equal to the relation of energy of con-

nection of the tied PV charge to energy of pair electron and positron at free condition of rest $w_{ep} = 2m_e c^2$.

Continuing the classical approach to structure of PV, we shall notice, that force of elastic deformation

$$f = b dr_{rb} = \xi \frac{e_0^2}{r^2} \quad b = \xi \frac{e_0^2}{dr_{rb} r^2} = 1,155065 \cdot 10^{19} \text{ kg/s}^2. \quad (19)$$

Let's check up correctness of accounts. Energy of deformation $w_{rb} = f r = b r dr_{rb} = 1,649347 \cdot 10^{-13}$ Dg. Coincides with complete energy of a photoeffect in PV.

Let's write the linear differential equation of the tied charge in the scalar form:

$$2m_e \cdot x'' + s \cdot x' + b \cdot x = F(x) \quad x'' + \frac{s}{2m_e} x' + \frac{b}{2m_e} x = \frac{1}{2m_e} F(x) \quad (20)$$

Let's receive linear frequency of own fluctuations of charges in the tied charge. Frequency $\nu_{pv} = 4,0074 \cdot 10^{23}$ Hz

From expression for cyclic frequency of the equation (20) $\sqrt{b/2m_e} = 2\pi\nu_{pv} = 2,5179 \cdot 10^{24}$.

RESULTS

Attempt to define structure of physical vacuum with the help of interaction of photon with PV has resulted in the following:

1. In the first approach structure of PV includes the tied charges from pairs electron+positron.
2. Distance from centre to centre in the tied charge is equal $r = 1,398826 \cdot 10^{-15}$ m.
3. The deformation of the tied charge for red border $dr_{rb} = 1,020772 \cdot 10^{-17}$ m = $\alpha \cdot r$, that corresponds to border of «durability» of PV.
4. The polarization of PV is defined through deformation under the formula $\sigma_{dr} = S \cdot (dr)^2 [Kl M^{-2}]$, $S = 6,253387 \cdot 10^{43} [Kl M^{-4}]$ And back, the deformation is defined through polarization. The formula deduced from photon or electron interaction, with physical vacuum, appears fair and for gravitational interaction. In this sense deformation of the tied charges (polarization) of PV has a universal nature for electromagnetism, electrostatics and gravitation. The difference consists in a direction of polarization concerning distribution of interaction - longitudinal for an electrostatics and gravitation, cross for the electromagnetic phenomena.
5. The existence of medium with the tied charges, which are capable to polarization, reminds the theory of an ether, which existence was in the seen contradiction with results of Maikelson experiences. The described above properties were not known in times of Maikelsons, namely, ability of an ether to electrical polarization near to gravitating object and its electrical attraction to the Earth. The Earth is strongly electrically connected to physical vacuum, which is motionless concerning a surface of the Earth and consequently the experience of Maikelson has positive result establishing connection of PV with a surface of the Earth. Under the law of a square of distance the polarization decreases at distance from a surface of the Earth, as it was marked in experiences of Maikelson at rise his instrument on a height.

The problem of «structure» of physical vacuum is even very far from the decision. Obviously, the quantum approach is necessary for deeper and detailed study of PV on micro level, and at about light speeds of movements of material bodies and particles in PV the account relativity of effects is necessary.