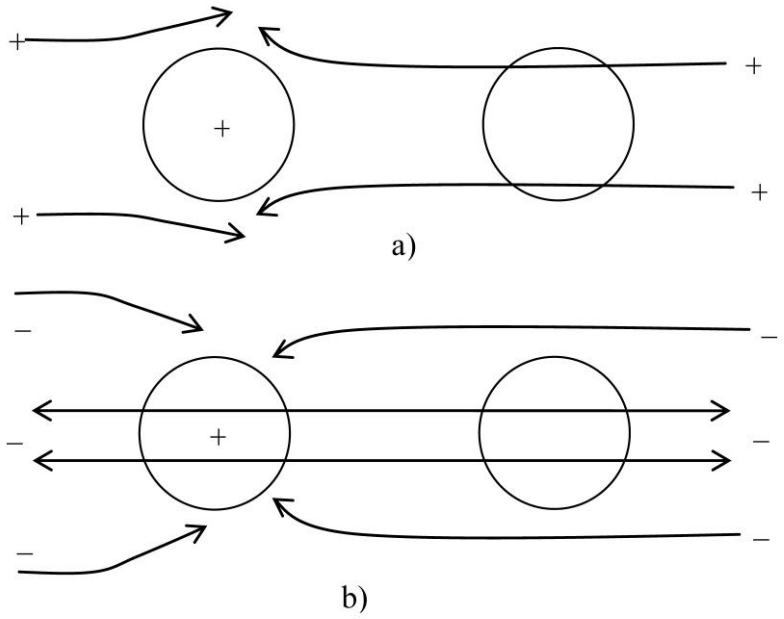

Fig. 1. The lines of motion of the small particles of the vacuum field, which are a) positively charged, b) negatively charged, near two bodies one of which is neutral and the other is positively charged.

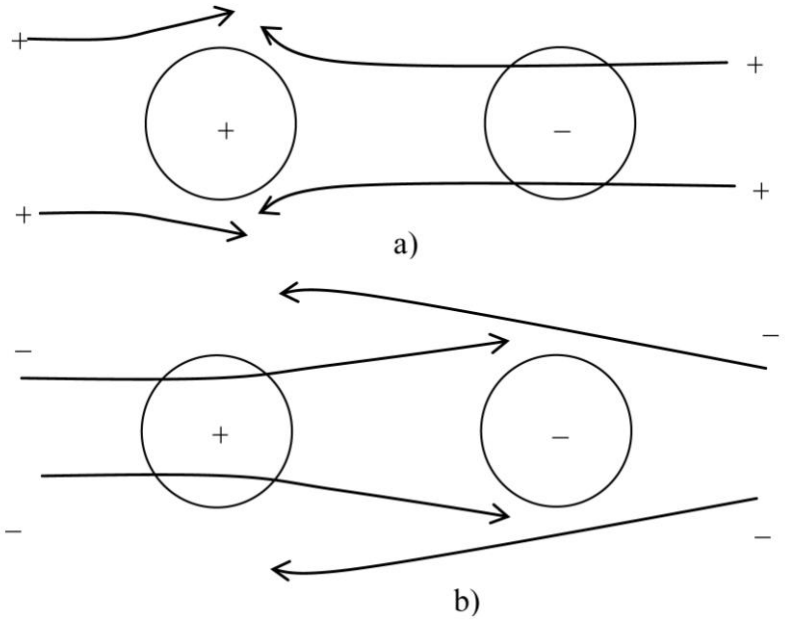

Fig. 2. The lines of motion of the small particles of the vacuum field which are a) positively charged, b) negatively charged, near two bodies, one of which is negatively charged and the other is positively charged.

Figure 3 shows the lines of motion of the negative particles of the vacuum field near two positively charged bodies. Both bodies attract the negative particles and obtain an additional momentum from them, which leads to repulsion of bodies. The motion of the positive particles of the vacuum field in Figure 3 is not shown. It is assumed that they are repelled from the bodies and therefore their interaction with them is weak.

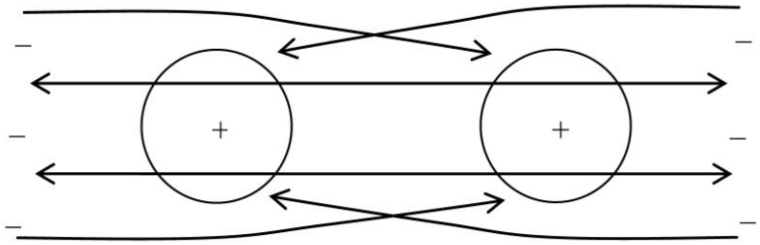

Fig. 3. The lines of motion of the small particles of the vacuum field, which are negatively charged, near two positively charged bodies.

For two negatively charged bodies the interaction is similar to the one shown in Figure 3, only it is necessary to replace the signs of all charges. This results in the repulsion of similarly charged bodies. The picture described above can be found in [10]. The common in all the Figures is the fact that depending on the sign of the charge of two bodies the number of charged particles falling on the bodies changes so that after calculating the momentum transferred by these particles the electric force in necessary direction arises.

Thus, we reduce the interaction between the charges at a distance to the interaction by means of the charged particles of the vacuum field.

Let us compare the Coulomb's law and the Newton's law:

$$F_C = \frac{q_1 q_2}{4\pi\varepsilon_0 R^2}, \qquad F_N = \frac{G m_1 m_2}{R^2}.$$

For the charged particles the relation must hold for the fluence attenuation of charged particles in the matter similarly to (2), with substitution of the concentration of nucleons n with the concentration of the electric charge η inside the body. Instead of the body mass $m = nM_n$ the absolute value of body charge should be used $|q| = \eta e$, where e is the elementary charge. As a result, instead of (3-4) we arrive at the approximate expression for the vacuum permittivity:

$$\varepsilon_0 = \frac{e^2}{6 p_q D_{0q} \vartheta^2} = \frac{e^2}{\varepsilon_q \vartheta^2}, \qquad (7)$$

where p_q is the average momentum of a charged particle, D_{0q} is the fluence rate of the charged particles of the vacuum field, ϑ is the cross-section of interaction of the charged particles with the matter of charged bodies, ε_q is the energy density of the charged particles in space.

As it was shown in [4], the ratio of the energy density of strong gravitation to the electromagnetic energy density of the proton is equal to the ratio of the proton mass to the electron mass $\frac{M_p}{M_e}$. Indeed, for the field energies and their relations with regard to definition of strong gravitational constant $\Gamma = \frac{e^2}{4\pi\varepsilon_0 M_p M_e}$, we have: $E_g = \frac{k\Gamma M_p^2}{R}$, $E_e = \frac{k e^2}{4\pi\varepsilon_0 R}$, $\frac{E_g}{E_e} = \frac{4\pi\varepsilon_0 \Gamma M_p^2}{e^2} = \frac{M_p}{M_e}$. We believe that the same relationship holds for the energy density of neutral and charged particles in the vacuum field that allows us to estimate the energy density of charged particles and their cross-section of interaction:

$$\varepsilon_q = \varepsilon_c \frac{M_e}{M_p} = 4\cdot 10^{32}\ \text{J/m}^3,$$

$$\vartheta = \frac{e}{\sqrt{\varepsilon_0 \varepsilon_q}} = 2.67\cdot 10^{-30}\ \text{m}^2.$$

This cross-section has the value, which is comparable with the cross-section of nucleon and exceeds the cross-section of gravitons $\sigma = 5.6\cdot 10^{-50}\ \text{m}^2$.

If the described picture is true, then from the Coulomb force we can easily move to the field strength of the electric field around a point charge and then to the scalar field potential. After that, dividing the scalar potential by the square of the speed of light and multiplying by the 4-velocity we

obtain the 4-potential of the particle. Then use of the procedure in [11] allows us to find all of the electromagnetic field properties and to derive all the field equations, including the Maxwell equations.

4 Conclusion

After a brief analysis of the models of ether and quantum vacuum and after enumerating the problems existing in these models, we presented the force vacuum field as some alternative. If we assume that the vacuum field consists of such particles as neutrinos, photons and charged high-energy particles, generated at the lowest levels of matter, it helps to explain the high penetrating ability of the particles. The fluxes of gravitons and charged particles of the vacuum field due to the small cross-section of interaction with the matter penetrate all the objects and transfer their momentum to them. Only such dense objects as neutron stars have the ability to appreciably absorb and dissipate the fluxes of gravitons.

According to the estimates in [6], it is necessary to put into a line three neutron stars for significant absorption of the fluxes of gravitons passing through them. Taking into account the fact that the analogues of neutron stars at the atomic level are nucleons and the assumption that the strong gravitation is acting between the nucleons instead of the ordinary gravitation, in [10] and [12] we can explain the effect of saturation of the nuclear forces binding the atomic nuclei. The essence of the explanation lies in the fact that as the number of nucleons increases, the specific energy of strong gravitation per nucleon, which is proportional to the specific nuclear binding energy, stops increasing linearly, as the gravitational field potential usually increases with increasing of the mass. Saturation becomes noticeable in the nuclei, containing about 20 nucleons or more. In these nuclei, due to almost complete absorption of gravitons by nucleons, addition of a new nucleon brings into the system almost the same binding energy, and therefore the dependence of the specific nuclei binding on the atomic number has the saturation effect.

In the presented model the vacuum field is responsible for both gravitational and electromagnetic forces. In contrast to the models of ether and quantum vacuum, in which there is some static substance with certain properties, the vacuum field is a multi-component and dynamic field, consisting of particles moving at about the speed of light. Electromagnetic and gravitational waves in this case must be the waves transferred by the particles of the vacuum field. In particular, in [13] we have presented the model of a photon, which consists of charged particles.

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