Unified Model of Shadow-Gravity and the Exploding Electron

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A model of the shadow-gravity unified with electricity is developed. Basic problems owing to which old Fatio-Lesage's idea of gravitation has not been recognized, and problems of the electron structure are solved. A mechanism of transforming of fations (which Lesage called ultra-mundane corpuscles) into electricity is suggested. The *new* formula for shadow-gravity interaction of two fundamental sub-particles of mater for any distances between sub-particles, including very short ones, is derived. Numerical evaluations of the fations gas energy density ($\varepsilon_G = 4.7\times10^{107}$ J/m^3), of gravitational cross-section of the electron ($\sigma^*_{eGa} = 3.4\times10^{-68}$ m^2), of the Earth ($\sigma_{GEarth} \sim 10^{-14}$ m^2), of the Universe and many other parameters of the model are made. It is shown that a usual substance absorbs fations very weakly.

Keywords: Fatio-Lesage's shadow-gravity, exploding electron, link between gravity and electricity, hypothetical sub-particles.

1. Introduction.

Neither Newton's phenomenological theory of gravitation nor Einstein's general relativity (GR) have any physical interpretation. According to GR, nature of gravity is the curved space-time. The area, at which from the physical point of view, there is a gravitational field, is the area of the curved space-time from the geometrical point of view. Many unsuccessful attempts to find a more evident physical mechanism of gravity action have been undertaken in the past, and these attempts is also continued by physicists in our time. A survey of such ideas can be found, for example, in [1]. Fatio-Lesage's hypothesis is, of course, the most verisimilar among such ideas. A freely available source about Fatio-Lesage's hypothesis is Wikipedia [2]. But this idea was also not recognized because a satisfactory solution of some difficulties had not been found. Nicolas Fatio Duillier originally proposed this hypothesis of shadow-gravity in 1690. Later (1748) Georges-Louis Le Sage somewhat developed this idea. Fatio reported on his idea to the Royal Society in London, but did not publish it in his lifetime. Therefore this hypothesis is far-famed as Lesage's theory. Fatio assumed that the Space is filled with microscopic unseen particles, moving in all directions with large velocities, and weakly absorbed by bodies. Lesage has named them as ultra-mundane corpuscles.

These corpuscles, bombarding bodies from all sides, exert a pressure on bodies. As a consequence, both the density of Fatio-Lesage's corpuscles in areas between bodies and the pressure on bodies are reduced, resulting in attractive forces on the bodies. To be more exact, bodies are pushed towards each other.

These corpuscles have been called *lesagons* in the work [3], in which an attempt to develop Fatio-Lesage's idea was also made. The name graviton would be more suitable for these corpuscles, but this name has already been used for another hypothetical particle in quantum gravity and has some different meaning. Therefore, taking into account that Fatio originally proposed this idea, we will use the name *fations*.

Neither Lesage nor others considered question about charge of fations, although notion about electric charge was already known in Lesage's time. Only Lorentz touched upon this in 1900 when he discussed comparison of fations with Röntgen rays. I proceed from notion that fations have no charge because the gravity acts on all bodies and particles, neutral and charged, equally.

As far back as Fatio considered the flows of fations as rarefied gas. Free fations interact very weakly with each other in the sense that their mean free path in the fation gas must be very large.

Fatio assumed that fations bombard bodies non-elastically. Darwin [4] showed mathematically that shadow-gravity would be equal to zero if collisions were fully elastic.

As above noted, originally Fatio came to this conclusion. But in the case of non-elastic collisions the body temperature, in consequence of the energy absorption, must rapidly rise to a high level. This is one of basic reasons owing to which Maxwell, Poincare and others rejected this idea [5]. There are also other objections against this idea. Further we will consider these problems and their possible solutions in greater detail.

On the other hand, there is also the old problem of the electron structure, which *turns out to be connected with gravitation*. The electron, despite of its more than a centenarian history, still remains a riddle for physicists. The basic difficulty of the classical Abraham–

Lorentz model is that the nature of the forces, which hold together equally charged parts of the electron, has no explanation.

In the modern standard theory the electron is considered simply as a material point. But at the same time the existence of the angular momentum of the electron becomes not clear. Furthermore the self-energy of such electron becomes infinite. Both the mechanism of creating the electric field by the electron and the nature of the electric field are also unknown. In quantum theory electric interaction is considered as a process of exchange by a continuous stream of virtual photons. But photons are considered as neutral particles. In this connection it is not clear how photon distinguishes positive and negative charges.

Recently I have tried to solve both the above-mentioned problems (gravity and electricity) on the basis of Fatio-Lesage's old idea and new ideas concerning the exploding electron [6]. Here these ideas substantially were developed and made more exact. As a distinguished from previous work basic attention is focused on the gravity here.

I have decided that the electron indeed is not stable, it explodes, but in such a way that some its very small core remains stable by pressure of the bombardment of fations. Further, for short, the electron core will be named as E-core and the positron core as P-core. In section 7 it will be shown that the E-core radius, $r_c < 5.1\times10^{-46}$ m. It is introduced the notion about *fundamental sub-particles* (FSP) from which electron and all substance consist. I suggest to consider as fundamental such sub-particles, which are *absolutely impenetrable* for fations. Seemingly FSP, to a certain extent, can be associated with known sub-leptons: preons, which are hypothetical constituents of the electron, quarks and another leptons.

The electron frees itself from the absorbed energy by means of explosions. In doing so we solve both problems: freeing matter from the absorbed fation energy, that is the basic problem of Fatio-Lesage's model, and the electron stability problem. In the work [6] it was introduced a notion about the *asymmetry factor* δ, which is the ratio of the part of fation energy absorbed by FSP to the all energy of the fations bombarding the FSP. As proposed constructions are based on a new, unexplored sub-electronic level of matter, I am forced to use many heuristic assumptions. However, as far as possible, I avoided arbitrary speculations.

2. New formula for shadow-gravity force

In the work [6] was found the formula for FSPs having equal radii and for macroscopic conditions. Here it will be derived new precise formula for two FSPs having different radii and for any, including short, distances.

Let us consider the gravitational interaction between two FSPs without regard for electric forces acting between them. For convenience, the FSP that gives rise to a gravitational field (shadowing from fations) will be here referred to as the active FSP (FSP*a*), and the FSP to which the gravitational force is attached (shadowed from fations) will be referred to as the passive one (FSP*p*).

The gravitational force is proportional to the total area of the shadow falling on the cross-section of the passive FSP from the active one. Let us name it as *Gravitational Cross-section* (*GCr-S*) as distinguished from *Geometrical Cross-section* limited to external borders of a body or a particle. GCr-Ss of bodies and composite particles (for example nucleons), which are to a great extent penetrable for fations, are less than their Geometrical Cross-sections.

Thus, it will be found a formula for a force of gravitational interaction of two FSPs: passive *p* and active *a* (Figure 1). The passive FSP*p* is shadowed, from the right, by the active FSP*a* (Figure 1(a)), from the flows of fations 2 directed within the limits of the solid angle element $d\Omega$ of the solid angle Ω (unidirectional flows having energy density ε_G^*). Therefore only the flows 3, reflected from FSP*a*, fall on the FSP*p* under the plane angle Ω_p, from the right side. These flows have energy density $\varepsilon_G^*(1-\delta_a)$, because FSP*a* absorbed a part of fations proportionally to the factor asymmetry δ_a, therefore these flows act on the FSP*p* with the force proportional to $\varepsilon_G^*(1-\delta_a)(2-\delta_p)$ from the right side. (It is introduced here different indexes *p* and *a* at δ, because passive and active FSP can have different value of asymmetry factors.) Along this line, in opposite direction, flows 4 also act (from the left side) with force proportional to $\varepsilon_G^*(2-\delta_p)$. Thus, resultant force, being proportional to $\varepsilon_G^*[(2-\delta_p)-(2-\delta_p)(1-\delta_a)]=(2-\delta_p)\delta_a$, acts on the FSP*p* in direction to FSP*a*. Inasmuch as $\delta_p << 2$ (for example for E-sub-core, $\delta_{sc} \sim 10^{-41}$, see below), this resultant is equal to $2\varepsilon_G^*\delta_a$ with a very high accuracy. Thus, the gravitational effect is practically independent from the factor δ_p. It follows from this that the gravitation constant *G* is connected only with active gravitation mass in Newton's formula for gravity.

As was noted above, gravitational effect is proportional to the shadow, which falls on the passive FSP*p* from the active FSP*a*. Actions of all other fations, that bombard the FSP*p* from the right side, are equilibrated by action of the corresponding fations that bombard it from the left side. I do not lose sight the fact that not all fations, which arrive from the left side, fall on the FSP*a* and then, being reflected from FSP*a*, fall on the FSP*p*, inasmuch as FSP*p* screens some part of them. This feature will be considered in further calculations.

Thus, the cross-section element σ (in Figure 1(b) it is shaded), is shadowed from the fations directed within the limits of the element $d\Omega$ of the solid angle Ω. The vertex of the angle Ω is in the center A of the active FSP*a*. Total area of the shadow is equal to sum of the elements σ, when the center C_s of the shadow (figure 1) circumscribes the circle with radius $a\cos\Omega_p$ and the plane angle Ω_p goes through the values from 0 (a=0) to $\Omega_{p\max}$, when $a = r_1 + r_2$ (Figure 1(a)). In doing so the solid angle Ω goes through the values from 0 to $\Omega_{\max}$. Then, the force acting on the total shadow area in the direction to FSP*a* is equal to

$$F_{Gff} = (2-\delta_p)\,\varepsilon_G^*\,\delta_a \int_0^{\Omega_{\max}} \sigma\cos\Omega_p\, d\Omega\,, \tag{1}$$

where ε_G^* is the energy density of fation flows, directed within the limits of $d\Omega$. Next from trigonometrical relations (Figure 1(b)) we find

$$r_p \sin(\varphi_p/2) = r_a \sin(\varphi_a/2)\,, \tag{2}$$

and

$$\sigma = \frac{r_p^2}{2}\left\{2\arcsin(\gamma_a\sin\varphi_a) + \gamma_a^2\varphi_a - 2\gamma_a\sin\left(\frac{\varphi_a}{2}\right)\left[1-\gamma_a^2\sin^2\left(\frac{\varphi_a}{2}\right)\right]^{1/2} - \gamma_a^2\sin\varphi_a\right\} = \frac{r_p^2}{2} f_1(\varphi_a)\,, \tag{3}$$

where and further $\gamma_a = r_a / r_p$, r_p and r_a are radii of the FSP*p* and FSP*a* respectively, $r_a \le r_p$. The expression in curly brackets is denoted by $f_1(\varphi_a)$. It will be used further.

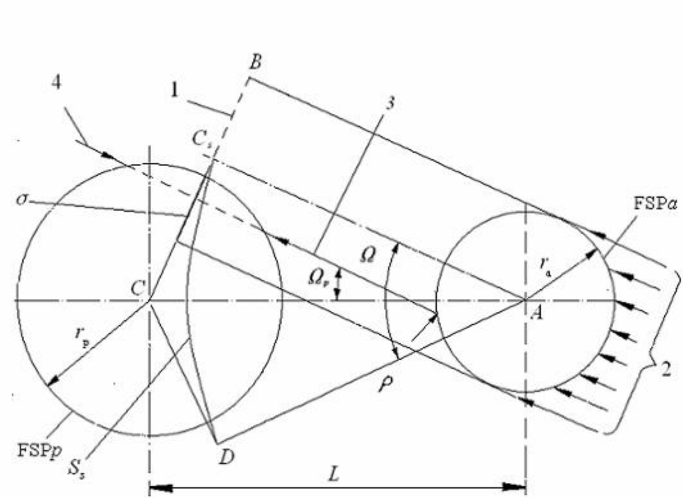

Figure 1(a). Scheme for calculation of the shadow-gravity force, affecting the FSP*p*. The passive FSP*p* is shadowed, from the right side, by the active FSP*a* from the flows of fations 2 directed within the limits of the solid angle element $d\Omega$ of the solid angle Ω (unidirectional flows having energy density ε_G^*). Only the flows 3, reflected from FSP*a*, fall on the FSP*p* under a plane angle Ω_p, from the right side. Along this line, in opposite direction, flows 4 also act with force proportional to $\varepsilon_G^*(2-\delta_p)$. 1 is projection of FSP*a* on the cross-section BC, r_a and r_p are radii of active and passive FSPs, respectively.

Solid angle Ω is equal to ratio of the spherical segment area, S_s, having footing the circle with radius $a\cos\Omega_p$, where $a = CC_s$ (Fig. 1a), to the $\rho^2 = L^2 - a^2$, L is the distance between FSPs. After geometrical derivations we obtain

$$\Omega=\frac{S_s}{\rho^2}=\pi\left\{\left(\frac{a}{\rho}\right)^2\left[1-\left(\frac{a}{L}\right)^2\right]+2-2\left[1-\left(\frac{a}{L}\right)^2\right]^{1/2}-\left(\frac{a}{L}\right)^2\right\}.\qquad(4)$$
$$=2\pi\left\{1-\left[1-\left(\frac{a}{L}\right)^2\right]^{1/2}\right\}$$

By differentiating this relationship with respect to *a*, we obtain

$$d\Omega=\frac{2\pi a}{L^2\left[1-(a/L)^2\right]^{1/2}}da.\qquad(5)$$

From simple trigonometric relations (Figure 1(b)), taking into account also (2), we obtain

$$a=r_p\cos(\varphi_p/2)+r_a\cos(\varphi_a/2)$$
$$=r_a\left\{\gamma_p\left[1-\gamma_a^2\sin^2(\varphi_a/2)\right]^{1/2}+\cos(\varphi_a/2)\right\}=r_a a^*,\qquad(6)$$

where $\gamma_p=r_p/r_a=1/\gamma_a$. The expression in curly brackets is denoted by a^*.

By differentiating (6) with respect to φ_a, we obtain

$$da=-\frac{r_a}{2}\left\{\frac{\gamma_a\sin\varphi_a}{2\left[1-\gamma_a^2\sin^2(\varphi_a/2)\right]^{1/2}}+\sin(\varphi_a/2)\right\}d\varphi_a,\qquad(7)$$
$$=-\frac{r_a}{2}f_2(\varphi_a)d\varphi_a$$

where expression in curly brackets is denoted by $f_2(\varphi_a)$.

It is obvious that

$$\cos\Omega_p = \left[1 - \left(\frac{a}{L}\right)^2\right]^{1/2}. \tag{8}$$

Now, substituting (3), (5) and (8) into (1), we obtain formula for the shadow-gravity interaction between two fundamental sub-particles (FSP) for macroscopic cases as

$$F_{Gff}^{\infty} = \frac{(2-\delta_p)\pi\ r_p^2\, r_a^2\, \varepsilon_G\, \delta_a}{4L^2}(Int1 + Int2), \tag{9}$$

where $\varepsilon_G = 4\pi\varepsilon_G^*$ is the volume energy density of omnidirectional flows of fations, *Int1* and *Int2* are integrals, which will be calculated by using expressions for two limits of integrating. The first of them is equal to $2\pi, 0$, for the variable φ_a that corresponds to positions of the shadow in the limits: $r_p - r_a \le a \le r_p + r_a$. The second limits are $0 \le a \le r_p - r_a$, for the variable a and $\sigma = \pi r_a^2$ instead of (3). Then, substituting (3), (5), (6), (7) and (8) into (1), we find

$$Int1 + Int2 = \int_{2\pi}^{0} \frac{a * f_1(\varphi_a)[-f_2(\varphi_a)]}{2\pi}\, d\varphi_a + \frac{2}{r_p^2}\int_0^{r_p - r_a} a\, da = 1, \tag{10}$$

where radius of the active FSP (FSP*a*) is less than or is equal to the passive one, as has been shown on the Figure 1. Thus, formula (9), with taking into account (10), becomes as

$$F_{Gff}^{\infty} = \frac{(2-\delta_p)\pi\ r_p^2\, r_a^2\, \varepsilon_G\, \delta_a}{4L^2}. \tag{11}$$

But in the last formula the above-mentioned effect of partial screening of FSP*a* by FSP*p* is not taken into account. In consequence of this effect not all fations, falling from the left side on the FSP*a*, are reflected from FSP*a* and then fall on FSP*p* from the right side. The shadow-force will be partially increased in $1/\delta_a$ times when this feature is considered. To account for this feature let be introduced the correction factor $k(L)$, which can be found from approximate notion that the averaged relative screening the FSP*a* by the FSP*p* is equal to

$$(1/\alpha_s)\int_0^{\alpha_s}[\cos(\alpha_s-\varphi)-\cos(\alpha_s)]d\varphi=(1/\alpha_s)\sin(\alpha_s)-\cos(\alpha_s), \qquad (12)$$

where $\alpha_s=\arcsin(r_p/L)$ is the half of the angle under which FSP*p* is seen from the center A of the FSP*a* (Figure 1(a)), $0\le\varphi\le\alpha_s$ is a variable angle. As a result the formula for the shadow gravity for any distances $L\ge r_p+r_a$ takes the form

$$F_{Gff}\cong F_{Gff}^{\infty}\left\{1+\left[\frac{r_p}{L}\left[\arcsin\left(\frac{r_p}{L}\right)\right]^{-1}-\left(1-\frac{r_p^2}{L^2}\right)^{1/2}\right]\left(\frac{1}{\delta_a}-1\right)\right\}=F_{Gff}^{\infty}k(L), \qquad (13)$$

where $k(L)$, in fact, is *the coefficient of deviation of the gravitational force from Newton's law of gravity*, if to assume that F_{Gff}^{∞} equivalent to *Newton's law*. For macroscopic conditions, provided that $r_p<<L$, $k(L)\approx 1+(1/2\,\delta_a)(r_p/L)^2$.

The obtained formula (12) is approximately *valid for any distances between* FSPs, except $L<r_p+r_a$, when FSPs penetrate into each other. In these cases the force is equal to $(1/3)\pi\, r_a^2\varepsilon_G$, because all fations are shielded by active and passive FSPs from the right and left sides and any fation cannot be reflected from the FSP*a* from the left side. This *is exactly the force by which the pressure of the fation gas keeps FSPs in the stable state.*

In the case when radius of the passive FSP*p* is less than that of the active one (FSP*a*), we will obtain the same result if we pass from variable φ_a to the variable φ_p using (2).

In Figure 2 the diagram of dependence of *k(L)* from the ratio L/r_p for the sub-core, $\delta_a = \delta_{sc} \sim 10^{-41}$ and the core, $\delta_a = \delta_c \sim 10^{-19}$ is shown. Thus, from Fig. 2 it is seen that *gravitation becomes "strong"* at some small distances. If to base on the core numerical value $r_c \sim 10^{-46}$ m, then, in absolute values, the "strong gravitation" starts from distances $L < 10^{-35}$ m.

Unfortunately, for the present we cannot evaluate a situation for the sub-cores, as we cannot find here numerical value of the sub-core radius, r_{sc}, without arbitrary assumptions. If to use value $r_{sc} \sim 10^{-66}$ m, which was found in [6], then Newton's law is valid for distances $L > 10^{-44}$ m. But the value $r_{sc} \sim 10^{-66}$ m is uncertain. If to assume that Planck length, ~10^{-35} m is limit for *L*, then $r_{sc} \sim 10^{-57}$ m. Note that diagram of *k(L)* for $\delta_c = 10^{-19}$ is a low limit inasmuch as actually $\delta_c < 10^{-19}$, and it is possible that $\delta_c << 10^{-19}$.

Seemingly the new obtained formula for gravity at small distances will play an important role in the particle physics. For example, the strong interaction between nucleons can be directly connected with the "strong gravitation" according to formula (13).

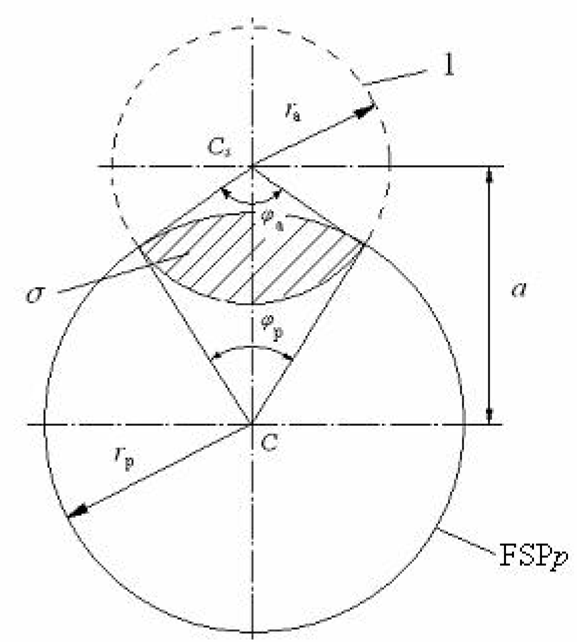

Figure 1(b). Cross-section on BCD (figure 1a). The force element is proportional, in modulo, to the area of the shadow element, σ, that falls on the cross-section BC of the passive FSP*p* from the active FSP*a* (Figure (1a)). 1 is projection of FSP*a* on the cross-section BC (figure 1a), C_s is the shadow center; r_a and r_p are radii of active and passive FSPs.

Darwin obtained, by some another (as it seems to me, by less obvious) method [4], expression for the shadow-gravity force as

$$\frac{1}{4}\pi\rho\frac{\mathrm{v}^2 a^2 b^2}{R^2}, \tag{14}$$

where (in original denotation) ρ is a mass density of the fations gas, v is the fation velocity, a and b are radii of spherical particles of interacting bodies, R is distance between them. I introduce notion of energy density ε_G of the fation gas in (11) and further instead of Darwin's product $\rho \mathrm{v}^2$. Darwin's result corresponds only to the case of macroscopic conditions and when all fations impact substance fully inelastically. In our denotations it corresponds to $L/r_{sc} > 10^{22}$ and $\delta_a = \delta_p = 1$, that is far from actual values ($\delta_{sc} \sim 10^{-41}$ and $\delta_c < 10^{-19}$.), see (48) and (49).

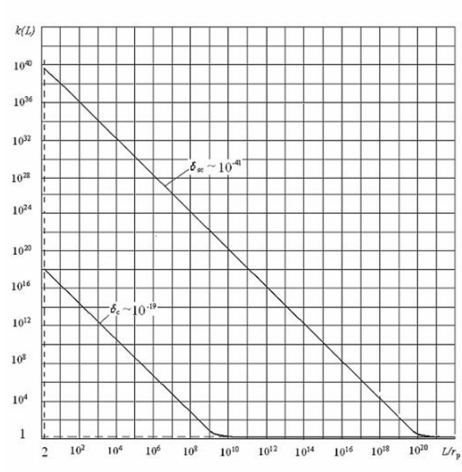

Figure 2. Diagram of dependence of the factor *k(L)* of deviation from the inverse square law from the ratio L/r_p for the sub-core, $\delta_a = \delta_{sc} \sim 10^{-41}$ and the core, $\delta_a = \delta_c \sim 10^{-19}$.

3.The exploding electron

Fations bombard E-core continuously. Energy of some its small part accumulates on the E-core surface during a certain time interval T. At the end of the period T the explosion is accomplished. The electron explosion has two stages. The explosion corona, in the course of the first stage, expands similarly to a compressed matter. Corona consists of sub-cores, which we will name as E-sub-cores, and FSPs of next more deeper level, which we will name as FS-2. Hereafter the first stage of the explosion will be referred to (for short) as the E-corona.

At the instant when the radius of the E-corona is increased to value R_m (Figure 3) it disintegrates into separate sub-particles. This is the beginning of the second stage.

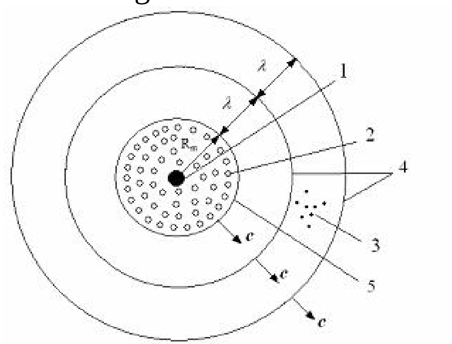

Figure 3. A cross-section of the E-corona explosion (at its disintegration instant, t = 0) and periodical flows of EFS, radiated by the electron. Only two λ layers of these flows are shown. λ is width of the λ layer; $R_m \cong \lambda$ is the E-corona radius; c is the speed of light; 1 is E-core; 2 are E-sub-cores; 3 are EFS; 4 are boundaries of λ layers; 5 is E-corona.

One after another, flows of these new sub-particles produce spherical λ layers radiated with velocity of light c (like the classical electric field). The thickness of each moving λ layer is constant and is given by

$$\lambda = cT\,. \tag{15}$$

I set $R_m \approx cT = \lambda$, here and in all subsequent calculations, inasmuch as the E-core radius $r_c << \lambda$. I consider that the E-corona front and

λ layers expand with the velocity of light in vacuum, **c**, inasmuch as that new sub-particles, which are created in the result of the explosion, have extremely small masses. In the work [6] it was showed that these new sub-particles can be identified with the electrostatic field and named them as *electrical field sub-particles* (EFS). The components from which the E-corona consists are bound in the E-corona (before its disintegration) and differ from EFS. Further, in section 4, these questions will be considered in more detail.

The moment of the E-corona disintegration and the instant of the next explosion are simultaneous; therefore the outer surface of the E-corona forms the upper boundary of the moving λ layer and the outer surface of the E-corona of the next explosion forms its lower boundary, which also becomes the upper boundary of the next λ layer, and so forth. The E-corona and boundaries of λ layers have spherical shapes, as the explosions take place symmetrically, and they expand with the maximal possible velocity *c*. As distinguished from the classical theory, according to which electron mass is equal to the energy of electric field in entire infinity space surrounding electron, the E-corona, in our model, contains basic mass of the electron. In the previous work [6] it was considered the structure of the E-corona and EFS, energy density of the EFS, and connection the model with Coulomb's law.

As has been noted above, the E-corona contains E-sub-cores, which also create sub-particles of the second level, FS-2. E-sub-cores interact with one another electrically by means of FS-2. From the logical point of view, one can conclude that this hierarchy is infinite, but we can restrict ourselves to level FS-2; furthermore, I believe that FS-2, being too small sub-particles, do not absorb the fations energy, do not explode and thus do not create sub-particles of the next level.

Fations bombard the FS-2 fully elastically, keeping thus them in stable state. After disintegrating of the E-corona, FS-2 become components of the EFS, which also do not absorb fations, do not explode and do not create sub-particles of the next level. In the opposite case the energy of electrostatic field would increase continuously and the Coulomb's law (inverse square law) would not be satisfied, whereas in the experiments for testing Coulomb's law [7], upper limit of $|q| \leq 1.3\times10^{-13}$, if to assume that the force between charges varies as $r^{(2+q)}$. We may take FS-2 and EFS to be identical entities.

4. Possible scenario of accumulating fation energy at the E-core and of the explosions

We now return to the beginning of the process and consider it in greater detail. We will proceed from notion that fations have no charge because gravity acts on all bodies and particles neutral and charged equally. As above noted, free fations interact very weakly with each other. Nevertheless, the E-core and E-sub-cores detain fations because the energy density in the E-core and in E-sub-cores is higher than that of the fation gas, ε_G. Neutrinos are an analogous example for this. In spite of their huge penetrability (stars, for example, are entirely transparent for them), neutrinos react with the atom nucleus when a central collision occurs. E-sub-cores and seemingly E-cores are absolutely impenetrable for fations, and in this sense these sub-particles *are fundamental*. FSPs are conserved in all elastic collision basically by pressure of the fation gas. If energy of collisions of oppositely charged particles exceeds some limit, FSP is excited and from produced thus fireball new cores are created. In doing so the fation gas pressure plays a calibrating role. E-cores and

P-cores, like quarks, *cannot exist in free states without their E-coronas and P-coronas*, respectively. As a matter of fact the quarks are not observed separately from particles for the same cause.

It is reasonable to consider that the electron E-core and all other components of the electron are negatively charged and the respective positron components are positively charged. Such assumption gives to us possibilities to explain interactions of charged particles by natural way. Although the E-corona (its E-sub-cores) also absorbs fations, it is sufficiently penetrable for them (further it will be shown that only ~ 10^{-84}-th part of fations is adsorbed by the E-corona); therefore fations practically freely reach the E-core.

Some part of bombarding fations is disintegrated on negatively and positively charged components at the E-core surface (figure 4a, note 3). This phenomenon seems to be similar to well-known process of disintegrations of gamma quanta on electrons and positrons at the strong electric field of the atomic nucleus. Analogous Hawking's mechanism of the disintegration of particles at black holes [8] is also known.

Next, we must make the fundamental assumption. In this process some asymmetry take place: some excess of negatively charged components as against positive ones are created with very small probability at the E-core. Analogously, respective excess of positive charged components is created at the positron core, *P-core*. Undoubtedly, this is associated with differences in properties of the electron and positron cores: they are oppositely charged. Of course, such a process of creating charged components, without the concomitant creation of oppositely charged ones, contradicts the law of conservation of charge, which is considered as exact for ordinary particles, but some analogies can be used to support our assumption.

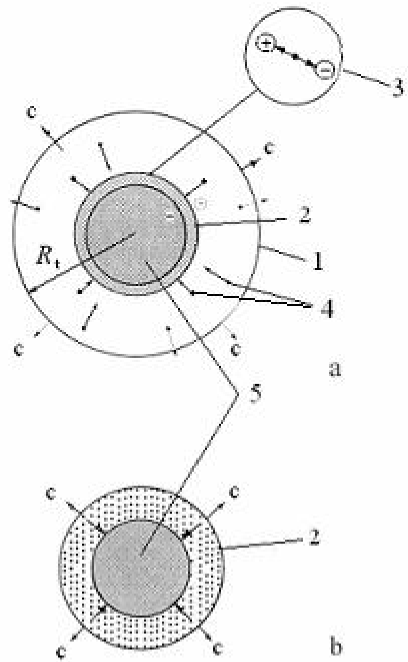

Figure 4. Analysis of possible mechanism of creating of E-corona components out of fations: *a* is the event corresponding to a moment $t < T$ and to the radius E-corona $R_t < \lambda$, i.e., to a process of E-corona 1 expansion; *b* is the moment of the beginning of the explosion (beginning of the decay of the layer 2), at $t = T$ and $R_t = R_m \cong \lambda$. The foregoing E-corona is not shown in Fig. 4(b). 3 is note about a decay of a fation; 4 are fations; 5 is E-core. See also main text.

This process seems to have a remote likeness with the big bang, when all matter was created without the concomitant creation of antimatter [9]. It is also well known that, in result of CP violation, K^0 mesons (neutral mesons) decay on particles and antiparticles with asymmetry in experiments on the level of ordinary matter [10, 11]. All this can be some basis for the conjecture of the existence of a violation of the charge conservation law on the sub-electron level. The total charge in the Universe, in any case, is conserved, because there are equal quantities of positively and negatively charged cores (E-cores and P-cores), which, in the final analysis, create equal quantities of positively and negatively charged EFS.

Fations, which do not decay and those that are once again recombined, are reflected from E-core surface and emitted in the surrounding space. In Figure 4(a) these fations have arrows directed out of the E-core. As we saw in section 2, this part of fations was not taking part in making the gravitational force, it was only compressing the E-core. The negatively charged components, which are produced in consequence of the above-mentioned asymmetry, are retained on the E-core surface in the form of compressed layer 2 basically by the pressure of bombardment of the fations. Here we assume that the layer 2 is also impenetrable for fations, and all above process of creating E-corona components, in fact, is performed on the surface of the layer 2. The negatively charged E-corona matter exerts on layer 2 the additional pressure needed for its existence in the stable state during the time T.

The E-corona energy density and its pressure on the layer 2, in the course of expanding the E-corona, are reduced and become minimal in the disintegration instant. Therefore, from this time on, layer 2 is expanded under an action of repulsive forces of the E-sub-core charge, becomes more rarefied and more penetrable for fations (figure 4b). As a result fations almost freely pierce through the rare layer 2, and bombard each component of the layer 2 (new E-sub-cores) separately almost from all sides. The entire surface area and intensity of the process of absorbing and transforming fations by new E-sub-cores into FS-2 abruptly increase, as a result repulsive electrical forces become considerably higher than the shadow-gravity force

(13), and thus an explosion occurs. At the first instant of explosion the new layer 2 begins being created at the E-core surface.

Bombardments of fations and pressure of gas of FS-2 keep E-sub-cores in stable states, but only during the time T of the E-corona expansion. At the end of the expansion the pressure of the FS-2 gas on E-sub-cores is ceased, in consequence of that E-sub-cores disintegrate on EFS. As was mentioned above, FS-2 and EFS have too small charges to disintegrate fations therefore they do not absorb energy of the fations gas and do not explode. They are being kept in stable state only by elastic bombardment of fations.

Perhaps the question arises: why does the stage “corona” exist? Why is continuous emission impossible at once as rarefied flows of EFS? But de Broglie’s internal periodical process in the electron, the wave-corpuscle duality and all others quantum events would be absent in this case.

Next, we can consider that in accordance with the model of the exploding electron all the E-corona energy must be equal to the fations energy that was absorbed by the E-core and E-sub-cores of the E-corona during the time period T. In Figure 5 an approximate structural diagram of components of the electron mass (not in scale) is shown. According to the described above scenario, masses of components of FS-2 and layer 2 vary with time from 0 to M_F and m_2 respectively. Mass of E-sub-cores, $N_{sc}m_{sc}$, and E-core mass, m_c, remain invariable during explosion period T. Recall that the N_{sc} of E-sub-cores are created in result of decay of the layer 2, which, in its turn, is created in the process of the previous explosion by absorbing of the fation gas energy.

At the explosion end (t=T) the mass of the electron is equal to

$$m_e = m_c + N_{sc} m_{sc} + m_2 + M_F \,. \tag{16}$$

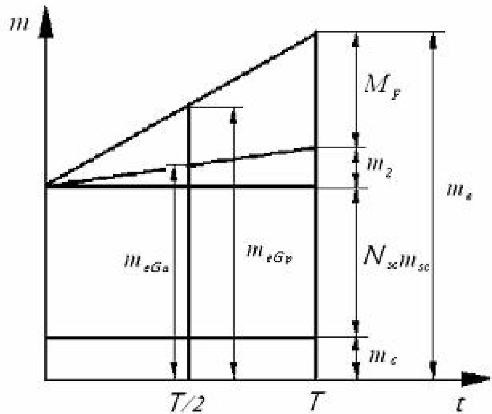

Figure 5. An approximate structural diagram of E-corona mass components of the electron (not in scale). Masses of components of FS-2 and layer 2 are varying with time from 0 to M_F and m_2 respectively. Mass of E-sub-cores, $N_{sc}m_{sc}$ and E-core mass, m_c, remain invariable during explosion period T. N_{sc} is number of E-sub-cores in the corona, m_{sc}; m_{eGa} and m_{eGp} are active and passive masses of the electron respectively; m_e is observed inertial mass of the electron.

We can assume that m_e is the inertial electron mass observed by mass spectrometer. The mean value, m_{eGp}, is the passive gravitational mass. The active gravitational mass, m_{eGa}, does not contain M_F, which take part only in fully elastic collision with fations. Actually m_2 depends on time nonlinearly; however taking it into account gives small rise of precisions but complicates calculations.

All components of the passive electron interact with all components (except FS-2) of the active one. Note that FS-2s do not interact with one other gravitationally, because they take part only in elastic collisions with fations. But FS-2s of the passive electron interact with the E-core and E-sub-cores of active ones. Fations reflected from E-cores and E-sub-cores of the active electron not compensate the shadow effect in these cases. EFS also do not take part in creating gravitational field, but the gravitational field acts on the EFS. These features are disregarded in the literature. Furthermore, in accordance with GR electrostatic field is a source of gravitational field, because it carries energy.

Thus, the equivalence principle is violated for the electron. This can be verified experimentally for freely falling electrons. Some experiment for freely falling electrons carried out by Witteborn and Fairbank [12], from which follows that deviation of the gravitational force was shown to be less than 0.09*mg*" (*g* is the acceleration of the earth). It is the only one cited in literature. Problem of the equivalence principle is widely discussed in theoretical literature, and there are asserted that equivalence principle can be violated on the level of particles. For example, in the work [13] it was found theoretically that the ratio of the relative deviation of the gravitation constant for the electron, G_e, from that the proton, G_p, is equal to $\left(G_p - G_e\right)/G = 3\times10^{-2}$. Authors said: "It follows from here: electron interacts with gravitational field weaker than proton" But such difference in accelerations of proton and electron cannot be obtained in Galilean experiment, because gravitation constant is connected with *active* mass, i.e. with mass of the Earth in Galilean experiment, rather than with the proton and the electron. Seemingly, this result can be interpreted to take the ratio of the passive gravitation mass of the electron, m_{eGp} to its inertial mass, m_e, m_{eGp}/m_e, to be lesser than that for the proton, m_{pGp}/m_p.

It is well known that the Weak Equivalence Principle is experimentally confirmed for neutral bulk matter with an accuracy of 10^{-12}-10^{-13} [14, 15]. But in all experiments only equivalence of an *inertial mass to a passive* gravitational mass is tested. Equivalence of the *active* gravitational mass to the inertial mass is not tested, whereas, as it was shown in the section 2, the asymmetry factors δ_c, δ_{sc}, and hence the gravitational constant G in Newton's formula, are associated *just with an active mass*.

As it will be shown below, the described self-consistent version of the scenario (which we chose from huge number of versions) enables us to obtain verisimilar quantitative results.

Thus, the electron, in the proposed model, as against the static Abraham–Lorentz electron, *is the dynamic object transforming the gravitational field energy into the energy of the electric field*, and periodically exploding up. Its mass is almost entirely located in its E-corona, which is renewed with each period of time T (period of the electron explosion). It is reasonable to suppose that, since the P-core has positive charge, a surplus of positive components is created on its surface. In other respects the scenario is the same. The core charge sign must play a decisive role in the asymmetry direction of producing E-corona components and EFS with the corresponding sign of the charge.

The conclusion that gravitation can act on an electrostatic field (EFS), but EFS does not create gravitational field, differs from GR, according to which all forms of energy are sources of gravitational field. This problem can be solved only experimentally. Fortunately such possibility exists. In works [6, 16] have been shown that energy density of electrostatic field actually is considerably higher than that of classical one, $\varepsilon_{cl} = \varepsilon_0 E^2 / 2$, where E is the intensity of electrostatic field and ε_o is the electric constant. It was found that the actual energy density of electrostatic field $\varepsilon_a = Ee/2\lambda\lambda_C\alpha$, where e is the elementary charge, α is the fine-structure constant, λ_C is Compton wavelength constant, λ is the maximal radius of the E-corona of the electron. Inasmuch as $\varepsilon_a >> \varepsilon_{cl}$, it is possible to measure an energy value contained between plates of a *stationary* charged capacitor by means of a torsion balance and to compare the result with a simple weighing it by means of a precise weighing machine. If our conclusion is true, then we will observe a measurable gravitational effect in the second case, and it will be absent in the first case.

Despite the obviousness of the described mechanism, the problem of explaining a nature of asymmetry in decays of fations on charged components differently on electron and positron cores requires additional analysis and substantiation. Therefore the existence of such process is postulated here, *as a basic presumption* in the hope that further investigations will shed more light on this problem.

5. Energy density of the fation gas

Analogously to (11) we can find the total gravitational force, F_{Gee}, for two electrons without regard for electric force acting between them. We will consider cases when a distance between electrons is sufficiently large not to take into account factor $k(L)$ (13). If to assume that electron consists of one E-core, N_{sc} E-sub-cores and FS-2, and to compare thus obtained expression for F_{Gee} with Newton's law, we find

$$F_{Gee} = \frac{m^*_{eGa} m_{eGp} G_{sc}}{L^2} = \frac{\bar{\sigma}^*_{eGa} \bar{\sigma}_{eGp} \varepsilon_G \, \delta_{sc}}{2\pi \, L^2}, \qquad (17)$$

where

$$\overline{\sigma}^*_{eGa} = \pi\left(\overline{r_2^2}\delta_c^* + N_{sc}r_{sc}^2\right) \tag{18}$$

is the gravitational cross-section of the active electron corrected with taking into account difference in the asymmetry factors for the E-core, δ_c, and for the E-sub-core, δ_{sc}; $\overline{r}_2$ is the mean radius of the core with the layer 2; r_{sc} is the radius of the sub-core; $\overline{\sigma}_{eGp} = \pi\overline{r_2^2} + N_{sc}\pi r_{sc}^2 + \overline{\sigma}_F$ is the mean GCr-S of the passive electron; G_{sc} is the gravitational constant for E-sub-cores; $\overline{\sigma}_F$ is the mean GCr-S of the total FS-2,

$$m^*_{eGa} = N_{sc}m_{sc} + (m_2/2 + m_c)(G_c/G_{sc}) = N_{sc}m_{sc} + (m_2/2 + m_c)\delta_c^* \tag{19}$$

is the corrected gravitational mass of the active electron and $m_{eGp} = N_{sc}m_{sc} + M_F/2 + m_2/2 + m_c$ is the gravitational mass of the passive electron, where G_c and G_{sc} are gravitational constants for the E-core and the E-sub-core respectively; $\delta_c^* = \delta_c/\delta_{sc} = G_c/G_{sc}$, where asymmetry factor δ_c for the E-core and layer 2, seemingly, differs from that for the E-sub-core, δ_{sc}. In this connection the gravitational constant G_c for the E-core also differs from that for the E-sub-core, G_{sc}, but there is a connection between these quantities. For finding this connection let us consider two cases: first when E-core belongs to the active electron and E-sub-core to the passive one, equation has the form

$$(m_2 + 2m_c)m_{sc}G_c = \pi\overline{r_2^2}r_{sc}^2\varepsilon_G\delta_c, \tag{20}$$

and second when the E-core belongs to the passive electron and E-sub-core belongs to the active one

$$(m_2 + 2m_c)m_{sc}G_{sc} = \pi\overline{r_2^2}r_{sc}^2\varepsilon_G\delta_{sc}, \tag{21}$$

where r_{sc} is the E-sub-core radius, r_2 is the total radius of the E-core with the layer 2. In (20) and (21) the mean gravitational mass of the layer 2, $m_2/2$, is used. This will be used also in the further.

Combining these equations together yields

$$\frac{G_c}{G_{sc}} = \frac{\delta_c}{\delta_{sc}}. \tag{22}$$

This relation has been already used in (19).

It is obvious that all fation energy absorbed by electron during the time T is finally transformed into the self-energy of its E-corona, which consists of energy of E-sub-cores and FS-2 as mentioned above. Then, if Einstein formula is usable for the sub-electron level, we can obtain the equation

$$\varepsilon_G \delta_{sc} \lambda \overline{\sigma}^{*}_{eGa} C^{*}_{G} = \left(N_{sc} m_{sc} + M_F\right) c^2 = N_{sc} m_{sc} c^2 \left(1 + 2B\right), \tag{23}$$

where $C^{*}_{G} = c_G / c$, c_G is the speed of gravitation propagation, which may differ from the speed of light (below we will come back to this question once more),

$$B = \frac{M_F}{2 N_{sc} m_{sc}}. \tag{24}$$

In order to derive expression for $\delta^{*}_{c} = \delta_c / \delta_{sc}$ we can use the fact that all energy of fations accumulated at the E-core surface in form of the layer 2 finally is equal to the self-energy of N_{sc} E-sub-cores in accordance with equation

$$\pi \overline{r_2^2} \varepsilon_G \delta_{sc} \delta^{*}_{c} \lambda C^{*}_{G} = N_{sc} m_{sc} c^2. \tag{25}$$

From comparing the expression for the shadow gravity force acting between two E-sub-cores with Newton's law we obtain

$$r_{sc}^2 = \frac{\sqrt{2} m_{sc} G_{sc}^{1/2}}{\sqrt{\pi} \left(\varepsilon_G \, \delta_{sc}\right)^{1/2}} . \tag{26}$$

Analogous expression for the layer 2 including the E-core has the form

$$\overline{r_2^2} = \frac{(m_2 + 2m_c) G_{sc}^{1/2}}{\sqrt{2\pi} \left(\varepsilon_G \, \delta_{sc}\right)^{1/2}} . \tag{27}$$

Solving equations (18), (23), (25) and (26) together, we can obtain the equation for the energy density of the fation gas that takes part in the shadow-gravity as

$$\varepsilon_G \delta_{sc} = \frac{2 B^2 c^4}{\pi G_{sc} \; \lambda^2 C_G^{*2}} . \tag{28}$$

We also can find from (25) with taking into account (27) and (28) the relative asymmetry factor as

$$\delta_c^* = \frac{N_{sc} m_{sc}}{B\left(m_2 + 2m_c\right)} = \frac{m_e}{B\left(1 + 2\,B\right)\left(m_2 + 2m_c\right)} , \tag{29}$$

where

$$N_{sc} m_{sc} = m_e / (1 + 2B) , \tag{30}$$

which was found from (16), with taking into account (24) and assumed that $m_2 + m_c << N_{sc} m_{sc}$.

Finally from (18) with due regard for (25), (26), (28) and (30) the expression for GCr-S of the electron can be obtained as

$$\overline{\sigma}_{eGa}^* = \frac{\pi N_{sc} m_{sc} G_{sc} \lambda \, c_G^* \left(1 + 2B\right)}{2B^2 c^2} = \frac{\pi m_e G_{sc} \lambda c_G^*}{2B^2 c^2} . \tag{31}$$

Before further analysis we need the values ε_G and δ_{sc} separately. For this purpose, let us consider the condition for the stability of the E-sub-core by the pressure of the fations gas, which equilibrates repulsive electric force of charged E-sub-core. I shall not take into account a pressure of the gas of FS-2 as it is considerably less than that of fation gas. Indeed, mean energy density of the gas of FS-2 equals about $3M_F c^2 \big/ (4\pi\lambda^3) \sim 10^{24}$ J/m^3 at the end of the first stage of explosion, where $M_F = 1.6\times10^{-31}$ kg (see below (51)), whereas according to (47) $\varepsilon_G = 4.7\times10^{107}$ J/m^3.

The exploding electron, in accordance with the model, absorbs fations gas energy and emits it in the form of the electric field (EFS); therefore we can interpret a *charge as ability to absorb fations and generate energy of EFS*. This energy is proportional to the total surface area of the FSPs, which constitute the electron. This surface area equal to $4\overline{\sigma}^*_{eGa}$, hence the electron charge e is also proportional to $4\overline{\sigma}^*_{eGa}$. Respectively the E-sub-core charge, q_{sc}, is proportional to $4\pi r_{sc}^2$.

Let the E-sub-core charge be uniformly distributed on its surface, then the repulsive force from the E-sub-core charge q_{sc} acts on any element ΔS of the E-sub-core surface in accordance with Coulomb's law. This force is equilibrated by the force that is proportional to energy density of the fations gas, ε_G, in accordance with the equation

$$\frac{q_{\Delta S}\, q_{sc}}{4\pi\varepsilon_0 r_{sc}^2} = (1/3)\varepsilon_G \Delta S\,, \tag{32}$$

where ε_0 is the electric constant. Then from simple proportionality we find the charge of the element ΔS as

$$q_{\Delta S} = \frac{q_{sc}\Delta S}{4\pi r_{sc}^2}. \quad (33)$$

Analogously the charge of E-sub-core is equal to

$$q_{sc} = \frac{e\pi r_{sc}^2}{\sigma_{eGa}^*}. \quad (34)$$

Solving (31), (32), (33) and (34) together, we obtain

$$\varepsilon_G = \frac{3e^2}{16\varepsilon_0 \bar{\sigma}_{eGa}^{*2}} = \frac{3}{\varepsilon_0}\left(\frac{B^2c^2e}{2\pi m_e G_{sc}\lambda C_G^*}\right)^2. \quad (35)$$

Now, substituting last formula into (28), we obtain expression for the asymmetry factor for E-sub-cores as

$$\delta_{sc} = \frac{8\pi\varepsilon_0 G_{sc} m_e^2}{3B^2e^2}. \quad (36)$$

6. Other parameters of sub-particles and gravitational cross-sections.

Nucleons have more complicate structure than that of the electron. As it was shown above, electron consists of 3 types of fundamental negatively charged sub-particles: E-core, E-sub-core and FS-2. Many are of the opinion that quarks and gluons, from which nucleons consist, are composite (see, for example, ref. [10, 11, 17]). In accordance with Harari's model [17] the quarks and leptons are composite of two types of fundamental objects: one charged 1/3 and one neutral. He named them "rishons'. Actually "rishons" (at least the neutral) must be also composite, even because any neutral object consist of + and - components. It is reasonable to assume that nucleons and therefore all usual matter consist of the same types of fundamental sub-particles as the electron and positron, but in another numbers and combinations. Seemingly this assumption can be conformed to Pati-Salam model of Grand Unification [18]. It is possible that FS-2 amounts to a negligible part in the nucleon owing to that the equivalence principle is valid, at the macroscopic level, with high accuracy for nucleons. In addition nucleons, as a distinguished from the electron, have opposite charged cores (E-cores and P-cores), which generate opposite charged sub-cores (E-sub-cores and P-sub-cores), which annihilate and thus have lifetime less than *T*. Having all these in mind, we can, analogously to (17), write formula for gravitational interaction of two nucleons in the form

$$F_{Gnn} = \frac{m^*_{nGa} m_{nGp} G_{sc}}{L^2} = \frac{\overline{\sigma}^*_{nGa} \overline{\sigma}_{nGp} \varepsilon_G \, \delta_{sc}}{2\pi \, L^2}, \tag{37}$$

where, analogously to expression (18) for the electron,

$$\overline{\sigma}^*_{nGa} = \pi \left(N^{\pm}_{nc} \overline{r^2_{n2}} \delta^*_c + N^{\pm}_{nsc} r^2_{sc} \right) \tag{38}$$

is the gravitational cross-section of the active nucleon corrected with taking into account difference in the asymmetry factors for E-core, δ_c, and for E-sub-core, δ_{sc},

$$\overline{\sigma}_{nGp} = N^{\pm}_{nc} \pi \overline{r^2_{n2}} + N^{\pm}_{nsc} \pi r^2_{sc} + \sigma_{nF} \tag{39}$$

is the mean GCr-S of the passive nucleon;

$$\begin{aligned} m^*_{nGa} &= N^{\pm}_{nsc} m_{sc} + N^{\pm}_{nc} \left(m_{n2}/2 + m_c \right) \left(G_c / G_{sc} \right) \\ &= N^{\pm}_{nsc} m_{sc} + N^{\pm}_{nc} \left(m_{n2}/2 + m_c \right) \delta^*_c \end{aligned} \tag{40}$$

is the corrected gravitational mass of the active nucleon, and

$$m_{nGp} = N^{\pm}_{nsc} m_{sc} + M^{\pm}_{nF} / 2 + N^{\pm}_{nc} \left(m_{n2}/2 + m_c \right) \tag{41}$$

is the gravitational mass of the passive nucleon; $N_{nc}^{\pm}$ and $N_{nsc}^{\pm}$ are numbers of cores and sub-cores (+ and - charged) in the nucleon respectively; m_{n2} is mass of the layer 2; r_{n2} is radius of the layer 2 including core. They can be differ from m_2 and r_2 for the electron, inasmuch as E-cores and P-cores are bound with each other in current quarks and in the sea of quark anti-quark pairs.

From (38) with due regard for (26), (28), (40) and by analogy with (27), in respect to $\overline{r_{n2}^2}$, we find

$$\overline{\sigma}_{nGa}^{*} = \frac{\pi m_{nGa}^{*} G_{sc} \lambda c_G^{*}}{Bc^2}. \tag{42}$$

7. Approximate numerical analysis

Obtained in the previous sections relations contain, except known fundamental constants, new unknown parameters: λ, m_c, m_2, B, G_{sc} and c_G^{*}, which require evaluating and justifications. We, so far, cannot estimate number of cores, $N_{nc}^{\pm}$, and sub-cores $N_{nsc}^{\pm}$, in the nucleon and number E-sub-cores N_{sc} in the electron.

The E-corona radius, λ, is associated with known evaluations of possible value of the electron radius, inasmuch as a force of electrostatic interaction of the electron with EFS is proportional to the cross-section of the interaction [6, 16]. McGregor gives some analysis of this question [19]. In accordance with his analysis an electron radius, by different estimations, is within the limits $10^{-18}...6.7\times10^{-13}$ m. The lower limit corresponds to scattering properties of the electron and the upper one corresponds to Compton's wavelength of the electron with some corrections. If to associate electron explosions with de Broglie's periodical process in an electron [20] and to take into account the fact that the frequency of de Broglie's periodical process is $\nu = m_e c^2 / h$ (h is Planck's constant), then we can derive $T = h / \left(m_e c^2 \right) \sim 10^{-20}$ s, and having considered (15), we find $\lambda \geq \lambda_C$, where $\lambda_C = h / m_e c$ is Compton's wavelength.

Finally, I showed, in the next work, that exact value is $\lambda = \lambda_C / 2\pi = 3.86159 \times 10^{-13}$ m, which will be used here in all numerical calculations. This value conforms also to Heisenberg uncertainty principle, according to which $m_e c^2 T \geq \eta$, whence $\lambda = cT \geq \eta / m_e c = \lambda_C / 2\pi$.

For estimating E-core mass, m_c, we have following evidences. It is well known that gamma quantum decays on electron and positron near atomic nucleus. This fact can be interpreted that gamma quantum consists of cores of electron and positron (E-core and P-core) being bound by means of annihilating E-corona and P-corona at small distance. A reverse process of recombination of the electron and the positron, where gamma-quantum arise, is also well known. Experimentally it was evaluated that photon mass is $< 10^{-52}$ kg [21]. From this we may assume that the E-core mass

$$m_c < 10^{-52} \text{ kg.} \tag{43}$$

There is also some problem connected with the speed of gravity. In accordance with GR theory, $C_G^* = c_G / c = 1$. Unfortunately, we do not have direct measurements of the gravity propagation speed. For explanation of absence of a resistance, which the fation streams exert on moving bodies ("contrary wind"), Fatio assumed that the fation speed v (in his denotations) is sufficiently higher than a body velocity u because the resistance in Fatio's model is proportional to

$\rho u\,\mathrm{v}$, but gravity (i.e. the fation stream pressure) is proportional to $\rho\,\mathrm{v}^2$, where ρ is mass density. Laplace, calculated a gravity propagation speed no less than $10^7 c$ [5]. Recently Van Flandern [22] has argued that the observed absence of gravitational aberration requires that gravity propagates at a speed $c_G > 2\times10^{10} c$. But Carlip [23] showed that aberration in GR is almost exactly cancelled by velocity-dependent interactions, permitting $c_G = c$. We have no reason to doubt about correctness of the conclusion of GR under this question, therefore hereinafter it will be consider $C_G^* = 1$ in all numerical calculations, although parameter C_G^* is conserved in algebraic equations.

We so far cannot find analytically the parameter *B*, which enters into formulae obtained in the previous sections. Therefore let us use some experimentally data [12], according to which gravitational force acting on a free falling electron is less than 0,09 $m_e g$, where m_e is inertial mass of the electron, *g* is terrestrial acceleration. If to consider it, in a first approximation, as a possible deviation of the gravitation mass of the electron from its inertial one and to denote $\Delta = \left(m_e - m_{eGp}\right)/m_e = 0.09$, then we obtain

$$B = \frac{M_F}{2N_{sc}m_{sc}} = \frac{\Delta}{(1-2\Delta)} = 0.11\,. \tag{44}$$

We also have a problem with estimation of the actual value of the gravitation constant G_{sc}. The point is that two probe-mass (active and passive), in the Cavendish method experiment, were measured by weighing, where active mass was equal to mass of the Earth, and both probe-mass, thus, were passive. But one of mass becomes active in the Cavendish experiment. Thus, when gravitational constant was calculated, on the results of the experiment, both values of passive probe mass were used, whereas of one of them must be active. This mistake was not discovered up till now because in all gravitation calculations and experiments only products $m_a G$ are used. Thus, there is some ambiguities in values of G_{sc} and m^*_{nGa}. Therefore, taking into account the above statement, we would make some simplified calculation here. For numerical analysis of GCr-Ss it is assumed, as a first approximation, that $m^*_{nGa} G_{sc} \approx m_n G$, where m_n and G are the known experimental values of the nucleon mass and the gravitation constant, respectively. Then from (42) we find

$$\overline{\sigma}^*_{nGa} = \frac{\pi m_n G \lambda c^*_G}{Bc^2}. \tag{45}$$

For all bodies and cosmic objects, since they basically consist of protons and neutrons, the formulae have forms analogous to (45), differing only by value of masses. For all others calculations it will be taken the value $G_{sc} \approx G = 6.67 \times 10^{-11}$ m^3/(kgc^2).

Using (28) and (44), we can calculate the value of the energy density of the fations gas, which takes part in creating gravitational force as

$$\varepsilon_G \delta_{sc} = 6.3 \times 10^{66} \text{ J/m}^3. \tag{46}$$

From (35) and (44) we find the energy density of the fation gas as

$$\varepsilon_G = 4.7 \times 10^{107} \text{ J/m}^3, \tag{47}$$

and then from last two equations we obtain

$$\delta_{sc} = 1.3 \times 10^{-41}. \tag{48}$$

From (29), taking into account (43), (44) and that $m_2>0$, we can estimate the value $\delta_c^* = \delta_c / \delta_{sc} < 10^{22}$, whence after substituting (48) we obtain

$$\delta_c < 10^{-19}. \tag{49}$$

From (30) and (44) we can calculate mass of E-sub-cores as

$$N_{sc} m_{sc} = 7.5 \times 10^{-31} \text{ kg}. \tag{50}$$

and from (24), (44) and (50) the mass of FS-2 in the electron can be found as

$$M_F = 2 N_{sc} m_{sc} B = 2 m_e B / (1 + 2B) = 0.18 m_e = 1.6 \times 10^{-31} \text{ kg}. \tag{51}$$

Here it is not take into account mass of the E-core, which is $<10^{-52}$ kg, and mass of the layer 2. Although we cannot calculate it without arbitrary assumptions, but it can be assumed that it is also very small.

Analogously to (26) with due regard to (43) and (46) we can calculate the E-core radius as

$$r_c = \left(\frac{2 m_c^2 G_{sc}}{\pi \varepsilon_G \, \delta_{sc}} \right)^{1/4} < 5.1 \times 10^{-46} \text{ m}. \tag{52}$$

Gravitational cross-section of the electron, from (31) with due regard for (44), equals

$$\overline{\sigma}_{eGa}^* = 3.4 \times 10^{-68} \text{ m}^2, \tag{53}$$

that is approximately equal to Planck's area. Mean geometrical cross-section of the E-corona equals

$$\overline{\sigma}_{egeom} = \pi \lambda^2 / 3 = 1.6 \times 10^{-25} \text{m}^2. \tag{54}$$

Thus the electron absorbs only $\sigma^*_{eGa}\,\delta_{sc}/\sigma_{egeom} \sim 10^{-84}$ part of the fation gas energy. It is practically transparent for the fations gas. Therefore fations, practically freely, reach the E-core and bombard it from all sides.

According to (45) gravitational cross-section of the nucleon is equal to

$$\overline{\sigma}^*_{nGa} \sim 10^{-65}\ \text{m}^2, \tag{55}$$

whereas the geometrical cross-section of the nucleon, having radius $r_n \sim 10^{-15}$ m, equals

$$\sigma_{ngeom} = \pi r_n^2 = 10^{-30}\quad \text{m}^2. \tag{56}$$

Only $\sigma^*_{nGa}\,\delta_{sc}\big/\sigma_{ngeom} \sim 10^{-76}$ part of the fations gas energy is absorbed by the nucleon. It is also practically transparent for the fations gas.

Analogously, for the Earth ($M_{Earth} = 6\times 10^{24}$ kg):

$$\overline{\sigma}^*_{GEarth} = \frac{M_{Earth}\sigma^*_{nGa}}{m_n} \sim 10^{-14}\ \text{m}^2, \tag{57}$$

and the geometrical cross-section of the Earth equals

$$\sigma_{Earthgeom} = \pi R_{Earth}^2 \sim 10^{14}\ \text{m}^2, \tag{58}$$

where $R_{Earth} = 6.4\times 10^6$ m. Thus the Earth absorbs less than $\overline{\sigma}_{GEarth}\delta_{sc}\big/\sigma_{Egeom} =\sim 10^{-69}$ part of the fations gas energy.

Finally, for the seen part of the Universe GCr-S is

$$\overline{\sigma}^*_{Universe\,G} = \frac{M_{Universe}\overline{\sigma}^*_{nGa}}{m_n} \sim 10^{16}\quad \text{m}^2, \tag{59}$$

where $M_{Universe} = 3.5\times10^{54}$ kg (without regard for dark matter).

Geometrical cross-section of the Universe, for its radius $R_{Universe} = 4.4\times10^{26}$ m, is equal to

$$\sigma_{Universegeom} = 6.1\times10^{53}\ \mathrm{m}^2. \quad (60)$$

Thus, at most $\sigma_{GUniverse}\delta_{sc}/\sigma_{Universegeom}$ ~10^{-79} part of the fations gas is absorbed as a result of its passage through the Universe. From this it follows that, even if fation gas absorbed by all matter and converted into EFS, finally is converted into another form of matter thinner than that of fations (in consequence of annihilating of EFS^+ with EFS^-), its energy density is decreased on the insignificant part since time of the big band. This makes groundless the objections about attenuation of the fations gas density as result of its absorption by matter [1, 2]. It also follows from this that known assumptions about decreasing gravitational constant with time have no sense.

In all above calculations it was neglected by a hardly probable shielding each other of fundamental sub-particles in connection with their extreme rarefaction and small value of GCr-S. Indeed, it is not difficult to show that for example, for a neutron star, having mass ~10^{30} kg and radius ~ 10^4 m, a shielding probability is equals about 10^{-52}. Owing to this gravitation acts on front and back sides of planets equally. Therefore, respective criticism of shadow-gravity on this question [1,2] becomes groundless.

8. Conclusion

A self-consistent Unified Model of Shadow-Gravity and the Exploding Electron have been developed.

The obtained numerical results showed that known objections against shadow-gravity model become groundless.

The obtained new formula for shadow-gravity force for any, including *short, distances* can be important for the particle physics theory.

It is shown that active mass is not equal to that of passive, hence the known gravitation constant G is not equal to the actual one.

Shadow-gravity model is closely associated with electricity. This link enables us to solve the old problem of electron stability.

It is possible, that the idea of shadow-gravity is verified by Podkletnov's experiments [24] with taking into account of our interpretation of his results [25].

The proposed here model gives a physical picture of gravity and electricity. It can play a heuristic role in physics. For example, it follows from the model that search of free quarks has no sense, inasmuch as they, consisting from cores of electrons and positrons, cannot exist without their coronas of explosions.

The violation of equivalence principle for the electron discovered here deserves attention and an experimental test.

Inevitably the question arises: what happens eventually to the EFS, which are generated by E-cores and E-sub-cores continuously? The answer is obvious. There are equal numbers negatively and positively charged E-cores and E-sub-cores in the Universe, which create equal quantity of the corresponding EFS, which are annihilated into matter, which is thinner than fations, i.e. it has more penetrability.

We show that the reduction of the fations gas energy density in result of absorbing it by substance is equal to less than $\sim 10^{-79}$ part of the all fation gas during the time from the big bang. Therefore supposed change of the gravitational constant with time is unobservable small.

The problem of the “contrary wind” still remains without a final explanation.

References

[1] M. R. Edwards ed., *Pushing Gravity: New Perspectives on Le Sage's Theory of Gravitation*, Montreal: C. Roy Keys. (2002) 320 pp.

[2] Le Sage's theory of gravitation. http://en.wikipedia.org/wiki/Le_Sage's_theory_of_gravitation

[3] V. Demidenko, “Ether – zigzags of the way”, *Tehnika molodegy* No 5, (1979) 25-29. (In Russian)

[4] G. H. Darwin, “The Analogy between Lesage's Theory of Gravitation and the Repulsion of Light”, *Proceedings of the Royal Society of London* Series A, Vol. 76, No. 511 (1905,) 387-410.

[5] H. Poincaré, “La Dinamique de l’électron”, *Revue Gén. Sci. Pures Appl.* **19** (1908) 386-402.

[6] N. Dibrov On Working out a New Model of the Electron, Phys. Essays. **16** (2003) 4-25.

[7] D. F. Bartlett, Goldhaden P. E. and Phillips E. A., “Experimental Test of Coulomb's Law”, *Phys. Rev*. D 2 (1970) 483-487.

[8] Stephen W. Hawking, *A Brief History of Time, From the Big Bang to Black Holes*, Toronto, New York, London, Sydney, Auckland: Bantam Books (1988) 159 pp.

[9] P. Davies, *Superforce*, New York: Simon & Schuster (1985) 259 pp.

[10] L. B. Okun, *Physics of elementary particles*, Moscow: Nauka (1984) 272 pp. (in Russian).

[11] F. Halzen and A. D. Martin, Quarks and Leptons: An Introductory Course in Modern Particle Physics, New York: Wiley & Sons (1984)

[12] F. C. Witteborn, W. M. Fairbank, “Experimental comparison of the gravitational force on freely falling electrons and metallic electrons”, *Phys. Rev. Lett.* **19** No 18 (1967)1049-1052.

[13] M.J.F. Cabbolet, S.S. Sannikov-Proskurov, “Galilean Experiment at the Elementary Particle Level”, *Problem of Atomic science and Technology*, № 6, (2001) 88-90.

[14] G. Braginsky and V. I. Panov, "Verification of the equivalence of inertial and gravitational mass", *Sov. Phys. JETP* **34** (1972) 463 p.

[15] S. Schlamminger at al., "Test of the Equivalence Principle Using a Rotating Torsion Balance", *Physical Review Letters* **100** (2008) 041101-1.

[16] N. Dibrov, On actual value of electrostatic field energy density, Phys. Essays. **18** (2005) 538-540.

[17] H. Harari, A Schematic Model of Quarks and Leptons, Phys. Lett. B **86** No 1 (1979) 83-86.

[18] J. C. Pati and A. Salam, "Lepton number as the forth "color"", *Phys. Rev.* **D10** No 1 (1974,) 275-289.

[19] M. H. MacGregor, *The Enigmatic Electron*, Dordrecht, Boston, London: Klawer Academic Publishers (1992,) 232 pp.

[20] L. de Broglie, Compt. Rendues **177** (1923) 507 p.

[21] S. Eidelman at al., (Particle Data Group) "Gauge and Higgs Boson", *Phys. Lett.* B. **592.** 1 (2004).

[22] T. Van Flandern, "The Speed of Gravity-What the Experiment, Say" *Phys. Lett.* A **250** (1998) 1-11.

[23] S. Carlip, "Aberration and the Speed of Gravity", *Phys.Lett.* A **267** (2000) 81-87.

[24] E. Podkletnov, Weak gravitation shielding properties of composite bulk YBa2Cu3O7-x superconductor below 70K under e. m. field, **arXiv:cond-mat/9701074 v3 16 Sep 1997** (1997) 23 pp.

[25] Nikolay Dibrov, "An explanation of the "Antigravity" Effect Observed in Podkletnov's Experiments", *Journal of Vectorial Relativity*, Vol. 5, No. 3 (2010) L1-L4.