Vacuum electrostatics in the framework of the Algebra of signatures. Interaction of stationary «particles» and «antiparticles»

Mikhail Batanov[1], Ph.D., Associate Professor,
Department 207, Moscow Aviation Institute
Moscow, Russia

Abstract: This work is a continuation of a series of articles [1 – 7] devoted to the development of fully geometrized physics based on the axiomatics of the Algebra of signature. To reduce the Algebra of signature is often called "Alsigna".

In previous articles [1 – 7], metric-dynamic models of all elementary «particles» and «antiparticles» (fermions and bosons) that are part of the Standard model (for the elimination of Higgs bosons) were proposed. In this article, model concepts of vacuum electrostatics are laid, i.e. the interaction of stationary or slowly moving (in comparison with the speed of light) «particles» and «antiparticles» with each other.

Keywords: vacuum, local vacuum formation, interaction of particles.

1. Simplified models stationary «electron» and motionless «positron»

The issues related to vacuum electrostatics of «particles» and «antiparticles» have already been addressed in *§ 10 in* [5], but that paragraph has only considered single charged stable vacuum formations by the example of «electron» and «positron». In this article, electrostatic interactions between two or more stable vacuum formations are considered. But first, we write down the necessary information from the previously obtained results.

In previous articles of the Algebra of signature (Alsigna) [1,2,7], metric-dynamic models of almost all individual stationary «particles» included in the Standard model were obtained on the basis of the complete set of irreducible solutions of the vacuum Einstein equation *(1.6) or (5.3) in* [2]. These solutions, which are called quarks, are summarized in *table 12.1 in* [2].

Within the Algebra of signature, «particles» are embedded in the vertical hierarchy of spherical vacuum formations *(6.20) in* [2] (*see § 5 and §6 in* [2]). However, simplified consideration of individual «particles» is allowed.

In particular, the metric-dynamic models of a separate resting «electron» and a separate resting «positron» are given by the sets of metrics *(6.22) – (6.31) and (6.32) – (6.41) in* [2].

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[1] alsignat@yandex.ru

«ELECTRON» (1.1)

Stationary "convex" multilayer vacuum formation (Figure 6.3 in [2]) with signature

$(+---)$

consisting of:

The outer shell of resting «electron»

in the interval $[r_5, r_6]$

$$ds_1^{(+---)2}=\left(1-\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.2}$$

$$ds_2^{(+---)2}=\left(1+\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)c^2dt^2-\frac{dr^2}{\left(1+\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.3}$$

$$ds_3^{(+---)2}=\left(1-\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.4}$$

$$ds_4^{(+---)2}=\left(1+\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)c^2dt^2-\frac{dr^2}{\left(1+\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.5}$$

The core of the «electron»

in the interval $[r_6, r_7]$

$$ds_1^{(+---)2}=\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.6}$$

$$ds_2^{(+---)2}=\left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.7}$$

$$ds_3^{(+---)2}=\left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.8}$$

$$ds_4^{(+---)2}=\left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \tag{1.9}$$

The scope of the «electron»

in the interval $[0, \infty]$

$$ds_5^{(+---)2}=c^2dt^2-dr^2-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right). \tag{1.10}$$

where

$r_5 \sim 4.9\cdot10^{-3}$ cm: ~ radius of biological «cage»;

$r_6 \sim 1.7\cdot10^{-13}$ cm: ~ radius of core of «electron»;

$r_7 \sim 5.8\cdot10^{-24}$ cm: ~ radius of the core of «protoquark».

«POSITRON» (1.11)

Stationary "concave" formation of the vacuum with the signature

$(-+++)$

consisting of:

The outer shell of resting «positron»

in the interval $[r_5, r_6]$

$$ds_1^{(-+++)2} = -\left(1-\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.12)$$

$$ds_2^{(-+++)2} = -\left(1+\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.13)$$

$$ds_3^{(-+++)2} = -\left(1-\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_6}{r}-\frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.14)$$

$$ds_4^{(-+++)2} = -\left(1+\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_6}{r}+\frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.15)$$

The core of the «positron»

in the interval $[r_6, r_7]$

$$ds_1^{(-+++)2} = -\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.16)$$

$$ds_2^{(-+++)2} = -\left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.17)$$

$$ds_3^{(-+++)2} = -\left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.18)$$

$$ds_4^{(-+++)2} = -\left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (1.19)$$

The scope of the «positron»

in the interval $[0, \infty]$

$$ds_5^{(-+++)2} = c^2dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right). \qquad (1.20)$$

where

$r_5 \sim 4.9\cdot 10^{-3}$ cm: ~ radius of biological «cage»;

$r_6 \sim 1.7\cdot 10^{-13}$ cm: ~ radius of core of «positron»;

$r_7 \sim 5.8\cdot 10^{-24}$ cm: ~ radius of the core of «antiprotoquark».

This paper examines the interaction between stationary or slow moving (compared to the speed of light) «particles» and «antiparticles». Therefore, we will be interested only in the outer shells of these stable vacuum formations, through which the interaction between their cores is carried out.

The interactions (repulsion or attraction) of «particles» and «antiparticles» occurring during their fast motion are described using metric-dynamic models, which are given in [2].

However, in this work it is assumed that the speed of motion of the interacting «particles» and «antiparticles» are small in comparison with the speed of light, so only metric-dynamic models of stable fixed vacuum formations are considered for the reduction.

Near the core of the «electron» or «positron» $r_3 >> r \approx r_6 \sim 1.7 \cdot 10^{-13}$ cm, so in metrics (1.2) – (1.5) the terms r/r_3 can be neglected. The metrics (1.2) – (1.5) are reduced to the following two simplified metrics *(9.6) – (9.7) in* [2]:

The outer shell of resting «electron»

with signature (+ – – –), in the interval [~10^{-13} cm, ∞]

$$ds_1^{(+---)2} = ds_1^{(-a)2} = \left(1 - \frac{r_6}{r}\right)c^2 dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - a\text{-subcont}, \quad (1.21)$$

$$ds_2^{(+---)2} = ds_2^{(-b)2} = \left(1 + \frac{r_6}{r}\right)c^2 dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - b\text{-subcont}. \quad (1.22)$$

Similarly, to describe the outer shell of a free stationary «positron», we have two simplified metrics (9.8) – (9.9) in [2]:

The outer shell of resting «positron»

with signature (– + + +), in the interval [~10^{-13} см, ∞]

$$ds_1^{(-+++)2} = ds_1^{(+a)2} = -\left(1 - \frac{r_6}{r}\right)c^2 dt^2 + \frac{dr^2}{\left(1 - \frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - a\text{-antisubcont}, \quad (1.23)$$

$$ds_2^{(-+++)2} = ds_2^{(+b)2} = -\left(1 + \frac{r_6}{r}\right)c^2 dt^2 + \frac{dr^2}{\left(1 + \frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - b\text{-antisubcont}. \quad (1.24)$$

The names of the vacuum layers (*k*-subcont and *k*-antisubcont) described by the metrics (1.21) – (1.22) and (1.23) – (1.24) are given in the table. 1.1 in [2] and in §11 in [5].

In this case, «electron» and «positron» can be considered like free «particles», but each of them occupies almost the entire Universe, because their outer shells extends to infinity $r \in [r_6, \infty]$.

2. Interaction of «particles» and «antiparticles»

In the Algebra of signature (Alsigna) is admissible to consider, the metric-dynamic properties of individual «particles» in the framework of simplified model representations, as was done, for example, in § 8.7 in [2]. However, from the "vacuum condition" (*see definition 12.4 in* [1]), it appears that only mutually opposite entities arise from the «vacuum», in particular, «particles» and «antiparticles».

If «particles» and «antiparticles» are in different points in space, within the concept of Alsigna, the relationship between them does not cease. Between a rakyas of «particles» and «antiparticles» constantly circulating the intra-vacuum flow (subcont - antisubcont currents) (see Figures 2.1 and 3.1).

Thus, the laminar subcontact-antisubcont currents, which are present in the model representations of the outer shell of the «electron» (1.21) – (1.22) and the outer shell of the «positron» (1.23) – (1.24), do not go to infinity, but are closed on the rakyas each other's (Figure 2.1).

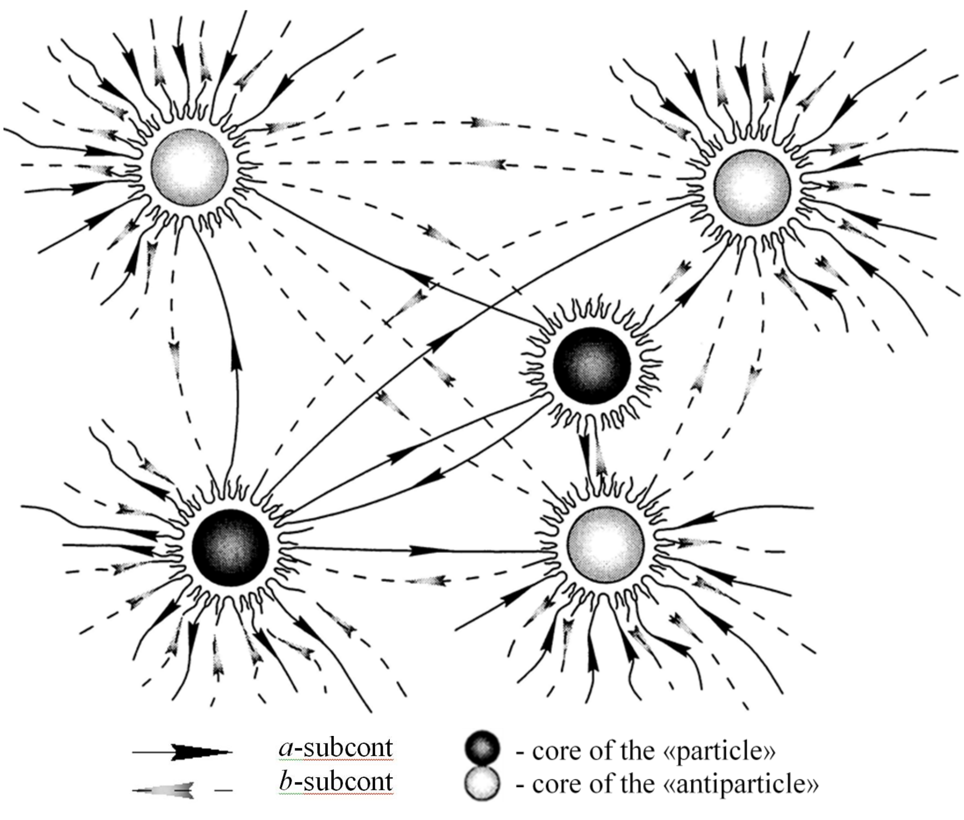

Fig. 2.1. Subcont - antisubcont currents circulate between rakyas «particles» and «antiparticles»

Recall that the rakya is a multilayer shell surrounding the core of the «particle» or «antiparticle». The concept of "rakya" is discussed in detail in § 15 in [5]. Along with that, a rakya of «particles», in particular of «electron», is subcont drain and the source of antisubcont; and conversely, a rakya of «antiparticles», in particular of the «positron», is a drain of antisubcont and the source of subcont.

3. Static «electron» - «positron» interaction

In *§ 10 in* [5] during study of metrics (1.21) – (1.24) (*more precisely, metrics (9.6) – (9.9) in* [5]) describing the outer shells of the resting «electron» and the resting «positron», we obtained:

- components of the vector a-subcont intensity (i.e. acceleration vector of a-subcont in the outer shell of the «electron») *(10.9) in* [5]:

I

$$a_r^{(-a)} = E_{vr}^{(-a)} = \frac{c^2 r_6}{2r^2\sqrt{1-\frac{r_6}{r}}},$$
$$a_\theta^{(-a)} = E_{v\theta}^{(-a)} = 0, \tag{3.1}$$
$$a_\varphi^{(-a)} = E_{v\varphi}^{(-a)} = 0,$$

- components of the vector b-subcont intensity (i.e. acceleration vector of b-subcont in the outer shell of the «electron») *(10.10) in* [5]:

H

$$a_r^{(-b)} = E_{vr}^{(-b)} = -\frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}},$$
$$a_\theta^{(-b)} = E_{v\theta}^{(-b)} = 0, \tag{3.2}$$
$$a_\varphi^{(-b)} = E_{v\varphi}^{(-b)} = 0,$$

- components of the vector a-antisubcont tension (i.e. the acceleration vector a of a-antisubcont in the outer shell «positron») *(10.11) in* [5]:

V

$$a_r^{(+a)} = E_{vr}^{(+a)} = -\frac{c^2 r_6}{2r^2\sqrt{1-\frac{r_6}{r}}},$$
$$a_\theta^{(+a)} = E_{v\theta}^{(+a)} = 0, \tag{3.3}$$
$$a_\varphi^{(+a)} = E_{v\varphi}^{(+a)} = 0,$$

- components of the vector b-antisubcont tension (i.e. the acceleration vector of b - antisubcont in the outer shell «positron») *(10.12) in* [5]:

H′

$$a_r^{(+b)} = E_{vr}^{(+b)} = \frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}},$$
$$a_\theta^{(+b)} = E_{v\theta}^{(+b)} = 0, \tag{3.4}$$
$$a_\varphi^{(+b)} = E_{v\varphi}^{(+b)} = 0.$$

The total acceleration vector of the subcont in the outer shell of the «electron» is listed by the formula *(10.13) in* [5]

$$\mathbf{a}^{(-)} = \mathbf{a}^{(-a)} + i\mathbf{a}^{(-b)} = \mathbf{E}_v{}^{(-a)} + i\mathbf{E}_v{}^{(-b)}. \tag{3.5}$$

The components of this vector, taking into account (3.1) and (3.2) are *(10.14) in* [5]

$$a_r^{(-)} = E_{vr}^{(-)} = \sqrt{E_{vr}^{(-a)2} + E_{vr}^{(-b)2}} = \frac{c^2 r_6 \sqrt{2}}{2r^2 \sqrt{1 - \frac{r_6^2}{r^2}}},$$

$$a_\theta^{(-)} = 0, \qquad (3.6)$$

$$a_\varphi^{(-)} = 0.$$

Similarly, the acceleration vector of antisubcont in the outer shell of the resting «positron» is calculated by the formula *(10.15) in* [5]

$$\mathbf{a}^{(+)} = \mathbf{a}^{(+a)} + i\mathbf{a}^{(+b)} = \mathbf{E}_v^{(+a)} + i\mathbf{E}_v^{(+b)}. \qquad (3.7)$$

The components of this vector taking into account (3.3) and (3.4) are *(10.16) in* [5]

$$a_r^{(+)} = E_{vr}^{(+)} = \sqrt{E_{vr}^{(+a)2} + E_{vr}^{(+b)2}} = \frac{c^2 r_6 \sqrt{2}}{2r^2 \sqrt{1 - \frac{r_6^2}{r^2}}},$$

$$a_\theta^{(+)} = 0, \qquad (3.8)$$

$$a_\varphi^{(+)} = 0.$$

Within Alsigna we study the following stationary model of the interaction of resting «electron» and resting «positron». Subcont flows into a rakya of the «electron» with acceleration (3.6), this accelerated course carries the core of the «positron» to the core of the «electron» (Figure 3.1).

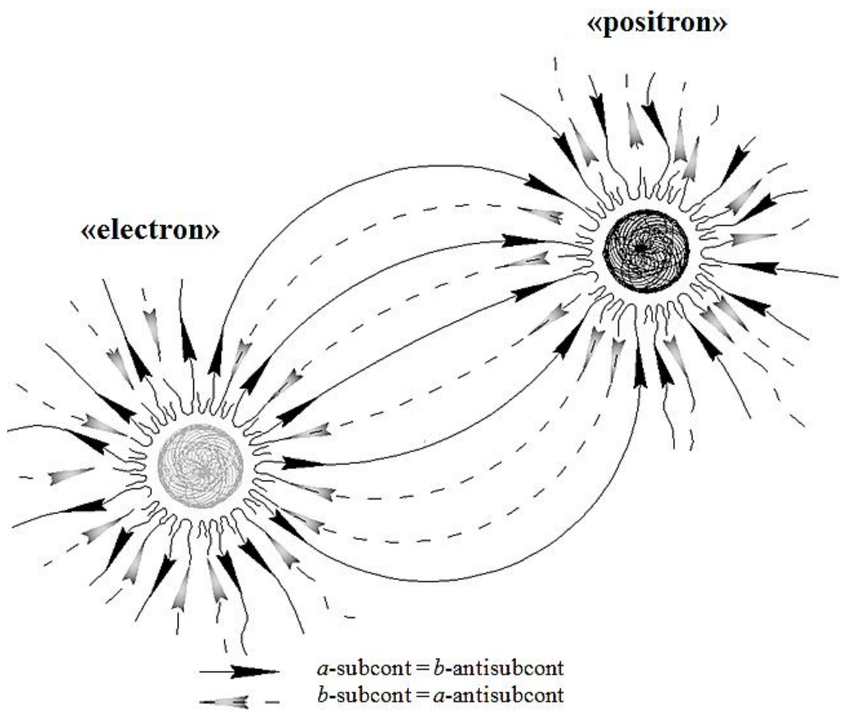

Fig. 3.1. Stationary interaction of «electron» and «positron» by circulation subcont-antisubcont currents between their rakyas

On the other hand, antisubcont flows into rakya of the «positron» with the acceleration of (3.8), this accelerated course carries the core of the «electron» to the core of the «positron» (Figure 3.1).

In the framework of the above model representation a rakya of the «electron» absorbs subcont and exudes antisubcont, returned to a rakya of the «positron», where it turns back into subcont, which again goes out to a rakya of the «electron». At the same time, according to the ideas developed in the *§§ 7 and 10 in* [5], the line current of subcont intertwined with the line current antisubcont in a double helix.

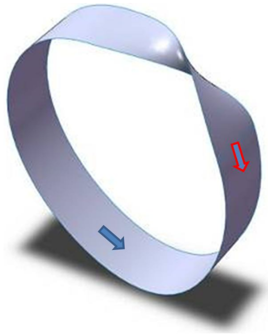

Fig. 3.2. Mobius strip

A closed helical structure of subcont-antisubcont currents circulating between a rakya of the conditionally stationary «particles» and a rakya of the stationary «antiparticle» can be explained with the help of a Mobius strip (Figure 3.2). Let's assume that the subcont flows along the outer side of the Mobius strip, and the antisubcont moves in the opposite direction along its inner side. If such a Mobius strip twist into a harness (Figure 3.3), then such a double helix will be a good model representation of one closed 4-braid of the subcont - antisubcont current circulating between of the rakyas, for example, «electron» and «positron» (Figure 3.3 and 3.4).

Fig. 3.3. Within the framework of model representations of Alsigna, between rakya of the «electron» and rakya of the «positron» circulate two subcont and two antisubcontact currents with accelerations (3.1) – (3.4). For the convenience of perception of intra-vacuum processes, it can be assumed that the in pairs counter currents flow on both sides of the Mobius strip twisted into a harness. In rakya of «electron» anticubcont becomes subcont, and in rakya of «positron» subcont becomes antisubcont. In addition, the accelerated subcont-antisubcont currents entrain core of the «electron» and core of the «positron» in the direction towards each other

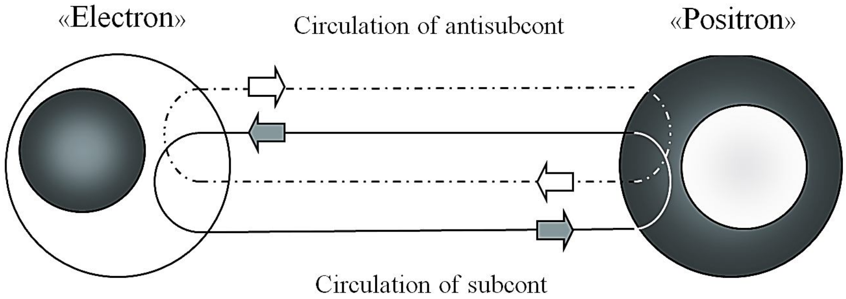

Fig. 3.4. The circulation of subcost and antisubcont between rakya of the «electron» and rakya of the «positron»

In this model representations on the cores of the «electron» and «positron» influence accelerated intra-vacuum currents with general acceleration {*see the expression (11.30) in* [5]}

$$a_r^{(e+\bar{e})} = \sqrt{a_r^{(+a)2} + a_r^{(-a)2} + a_r^{(+b)2} + a_r^{(-b)2}} = \sqrt{a_r^{(+)2} + a_r^{(-)2}} \ ,$$

which strive to bring together the cores with each other.

Taking into account (3.6) and (3.8), we obtain

$$a_r^{(e+\bar{e})} = \sqrt{a_r^{(+)2} + a_r^{(-)2}} = \sqrt{\left(\frac{c^2 r_6 \sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}}\right)^2 + \left(\frac{c^2 r_6 \sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}}\right)^2} = \frac{c^2 r_6}{r^2\sqrt{1-\frac{r_6^2}{r^2}}}. \qquad (3.9)$$

In this case, r is the distance between the centers of the cores of «electron» and «positron». The graph of the function (3.9) is shown in Figure 3.5.

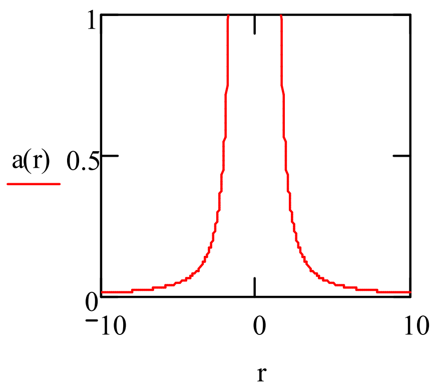

Fig. 3.5. Graph of the function (3.9) for $c = r_6 = 1$

When $r >> r_6$ equation (3.9) is simplified and takes the form

$$a_r^{(e+\bar{e})} = \frac{c^2 r_6}{r^2}, \qquad (3.10)$$

similar to the Coulomb interaction force in classical electrostatics

$$F_{кл} = \frac{e^2}{4\pi\varepsilon_0 r^2}. \qquad (3.11)$$

From the point of view of physics of the 19th century, if the charged electron had at least some spatial size, it could not exist, because its eponymously charged parts would inevitably fly apart in different directions under the influence of a huge electrostatic force, which is inversely proportional to the square of the distance between these parts. Therefore, for a number of other reasons, in all modern physical theories, the elementary charge along with the rest mass and spin is a kind of internal characteristic of the material point.

Ideas about the lack of size of elementary particles contradict common sense, and lead to logical paradoxes. For example, let us calculate the total energy of the electrostatic field of the electron *W*э, the radius of which we will take equal to a [7]:

$$W_Э = \frac{1}{8\pi}\int E^2 dV = \frac{1}{8\pi}\int_a^\infty \frac{e^2}{r^4} 4\pi r^2 dr = -\frac{e^2}{2r}\Big|_a^\infty = \frac{e^2}{2a}. \qquad (3.12)$$

Obviously, when $a \to 0$ the energy tends to infinity.

To get away from this kind of divergence quantum physics is based on the calibration theory, the mathematical apparatus which allows the renormalization procedure. In the case of electrostatics of a single point charge, part of the renormalization effect is to account for the so-called polarization of the physical vacuum. This effect, as quantum physics believes, is due to the fact that virtual electron-positron pairs are constantly born from the vacuum and immediately disappear in it, but in a short time of their existence they have time to Orient in such a way as to weaken the impact of the "naked" point charge. Therefore, in the framework of quantum electrodynamics (QED), the constant of electromagnetic interaction

$$a_e = e^2/(4\pi) \tag{3.13}$$

it turns out to be an effective function of the distance of the form [8]:

$$a_{eff}(r) = \frac{e_{eff}^2}{4\pi} = \frac{\frac{e^2}{4\pi}}{1 - \frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_e}}, \tag{3.14}$$

where m_e is the mass of the electron.

This fitting procedure is called renormalization of the constant of electromagnetic interaction. Substituting the expression (3.14) into Coulomb's law (3.11), we obtain

$$F_{кл\ eff} \approx \frac{e^2}{4\pi\varepsilon_0 r^2 (1 - \frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_0})}. \tag{3.15}$$

Comparing (3.9) with (3.14), we find the following correspondence

$$\frac{e^2}{4\pi\varepsilon_0} \quad \leftrightarrow \quad c^2 r_6 \tag{3.16}$$

and

$$\frac{1}{(1 - \frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_0})} \quad \leftrightarrow \quad \frac{1}{\sqrt{1 - \frac{r_6^2}{r^2}}}. \tag{3.17}$$

From (3.16) it is seen that in fully geometrized vacuum electrodynamics of Alsigna the role charge plays value

$$e \leftrightarrow \sqrt{c^2 r_6} = \sqrt{(3\cdot 10^8)^2 \cdot 1{,}7 \cdot 10^{-15}} \approx \sqrt{153} \approx 12{,}4\ \frac{м^{3/2}}{сек}, \tag{3.18}$$

which characterizes the intensity of the drain - source twisted subcont - antisubcont current surrounding the core of the «electron».

From the correspondence (3.17) it is seen that the representations of Alsigna do not contradict the conclusions of modern theories. While the vacuum electrostatics of the Asigna is completely geometrized in the framework of the axiomatic light-geometry of «vacuum», presented in [1, 2].

4. Static «electron» - «electron» interaction

Within the concept Alsigna between the cores of two «electrons» are no subcont - antisubcont metabolic processes.

As shown in Figures 4.1 and 4.2, the *b*-subcont flows from the rakya of each «electron» to the rakya of the nearest «positrons» (or other positively charged «particles»). At the same time, *b*-subcont flowing from the rakya of «electron», to strive to entrap all the cores of other «electrons» (or other negatively charged «particles») that have fallen in its path. From the outside, it looks as if the cores of two «electrons» to push off from each other (Figure 4.1).

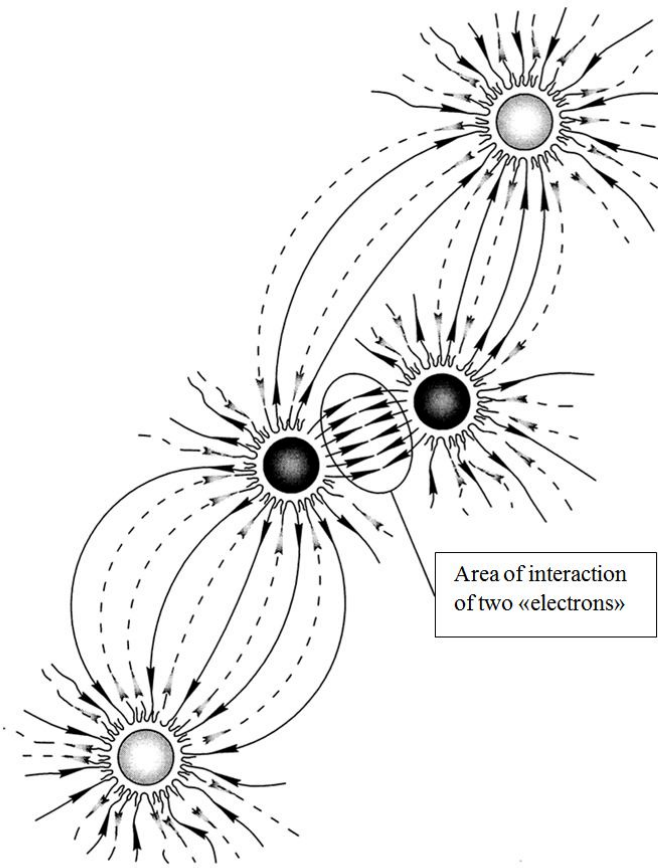

Fig. 4.1. Subcont-antisubcont currents between rakyas surrounding the cores «electrons» and «positrons». Currents of *b*-subcont, flowing from the rakyas of two «electrons», repel their cores from each other

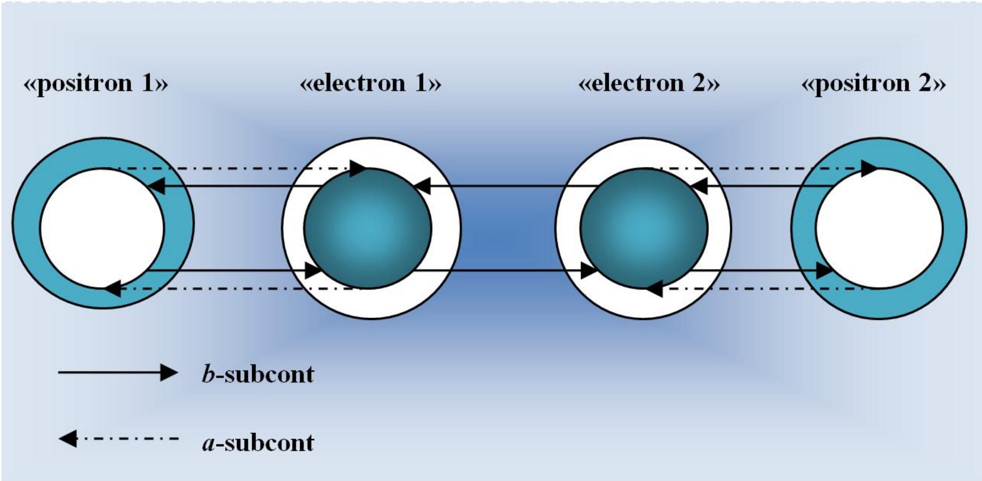

Fig. 4.2. Schematic representation of the subcont-antisubcont currents between rakyas «electrons» and «positrons»

According to the above model representation (Figure 4.1 and 4.2), between the rakyas of the two nearest «electrons» there are only two *b*-subcont currents that move in the radial direction from the cores of the two «electrons» towards each other with accelerations:

- acceleration of the *b*-subcont in the outer shell of «electron 1»

$$a_r^{(e1)} = a_r^{(-b1)} = -\frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}; \qquad (4.1)$$

- acceleration of the *b*-subcont in the outer shell of «electron 2»

$$a_r^{(e2)} = a_r^{(-b2)} = \frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}. \qquad (4.2)$$

These two counter *b*-subcont current bound in a 2-braid, so the total acceleration, tending to alienate the core of the «electron 1» from the core of the «electron 2», is given by expression (assuming $r > r_6$):

$$a_r^{(e_1+e_2)}(r) = \sqrt{a_r^{(e_1)2} + a_r^{(e_2)2}} = \frac{\sqrt{2}c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}, \qquad (4.3)$$

where r is the distance between the centers of the cores of «electron 1» and «electron 2».

When $r >> r_6$ equation (4.3) becomes simplified

$$a_r^{(e1+e2)} = \frac{\sqrt{2}}{2}\frac{c^2 r_6}{r^2} \approx \frac{0{,}7c^2 r_6}{r^2}, \qquad (4.4)$$

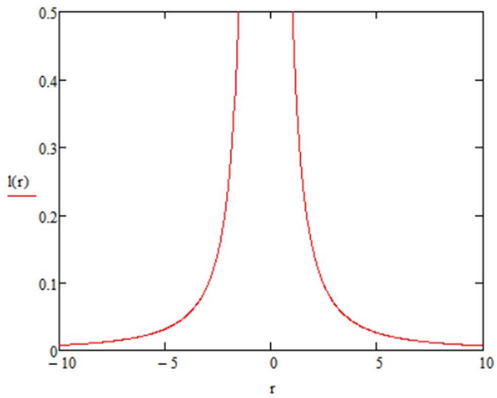

Fig. 4.3. Function graph (4.3) for $c = r_6 = 1$

similar to Coulomb's law (3.11) for two similarly charged particles in vacuum.

Comparing accelerations (3.9) and (4.3), i.e.

$$a_r^{(e+\bar{e})} = = \frac{c^2 r_6}{r^2\sqrt{1-\frac{r_6^2}{r^2}}} \quad \text{и} \quad a_r^{(e_1+e_2)} = \frac{\sqrt{2}c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}, \tag{4.5}$$

we find that in the framework of the Alsigna at $r \approx r_6$ «electron» - «positron» interaction is slightly different from the «electron» - «electron» interaction, but at $r >> r_6$ the data of interaction are practically compared

$$a_r^{(e+\bar{e})} = \frac{c^2 r_6}{r^2}, \qquad a_r^{(e1+e2)} = \frac{0,7c^2 r_6}{r^2}. \tag{4.6}$$

It is possible that the above difference between the two types of interactions can be found experimentally.

Fig. 5.1. In «vacuum» any action or vacuum manifestation is accompanied by a similar anti-action or anti-manifestation. This property of the "vacuum" is reflected in the «vacuum» and "vacuum balanced" Alsigna (see definition No. 12.4 and No. 12.3 in [1])

5. Summary

Within the framework of light-geometry of the Alsigna, it is possible to develop ideas about fully geometrized vacuum electrostatics, which is consistent with the concepts of classical electrostatics and quantum electrodynamics.

The metric-dynamic models of the static interaction of «electrons» and «positrons» presented here can be extended to the description of the mutual influence of other charged «particles» and «antiparticles» composed of «quarks» and «antiquark» shown in the *table. 12.1 in* [2].

Here we consider only the simplest: a 4-braid «electron» - «positron» interaction and 2-braid «electron» - «electron» interaction. Alsigna allows for the representation of each "string" of these *k*-braid in the superposition of seven "strands", as shown in *§ 11 in* [5] {*see the expression (11.33) and (11.36) from* [5]}. At the same time, deeper intra-vacuum exchange processes can be identified and investigated.

Also, we note again that the mathematical apparatus and model representations of Alsigna versatile in regards to a stable vacuum formations any other scale. To describe similar processes at other levels of existence in all the metrics and equations of this work, instead of r_6, one should substitute r_k from the hierarchy *(6.20) in* [2].

At the same time, the "vacuum balance" between «particles» and «antiparticles» entails the requirement that at each level of existence the lines of subcont - antisubcont (intra-vacuum) currents are closed between the «particles» and «antiparticles» of the same level (Figure 2.1), and between the «particles» and «antiparticles» of different levels of existence (see Figure 6.2 in [2]).

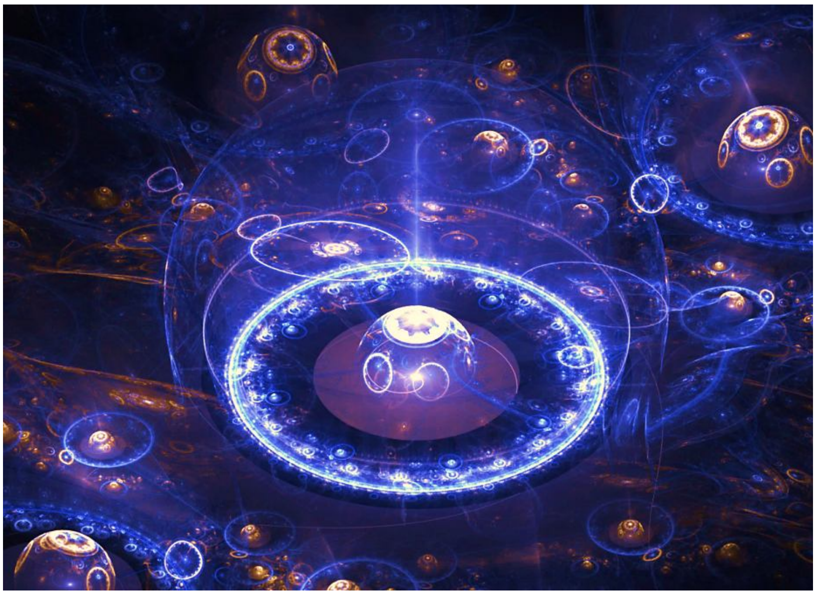

Fig. 5.2. All levels of existence are interconnected

Fig. 5.3. A closed Universe is a Mother's Womb in which the cosmic Embryo Grows

That is, on the one hand, each level of existence is a closed world, balanced in respect of any vacuum manifestations and antimanifestations (Fig. 5.1); on the other hand, different levels of existence (worlds) exchange subcont - antisubcont flows and together to form a Closed Universe.

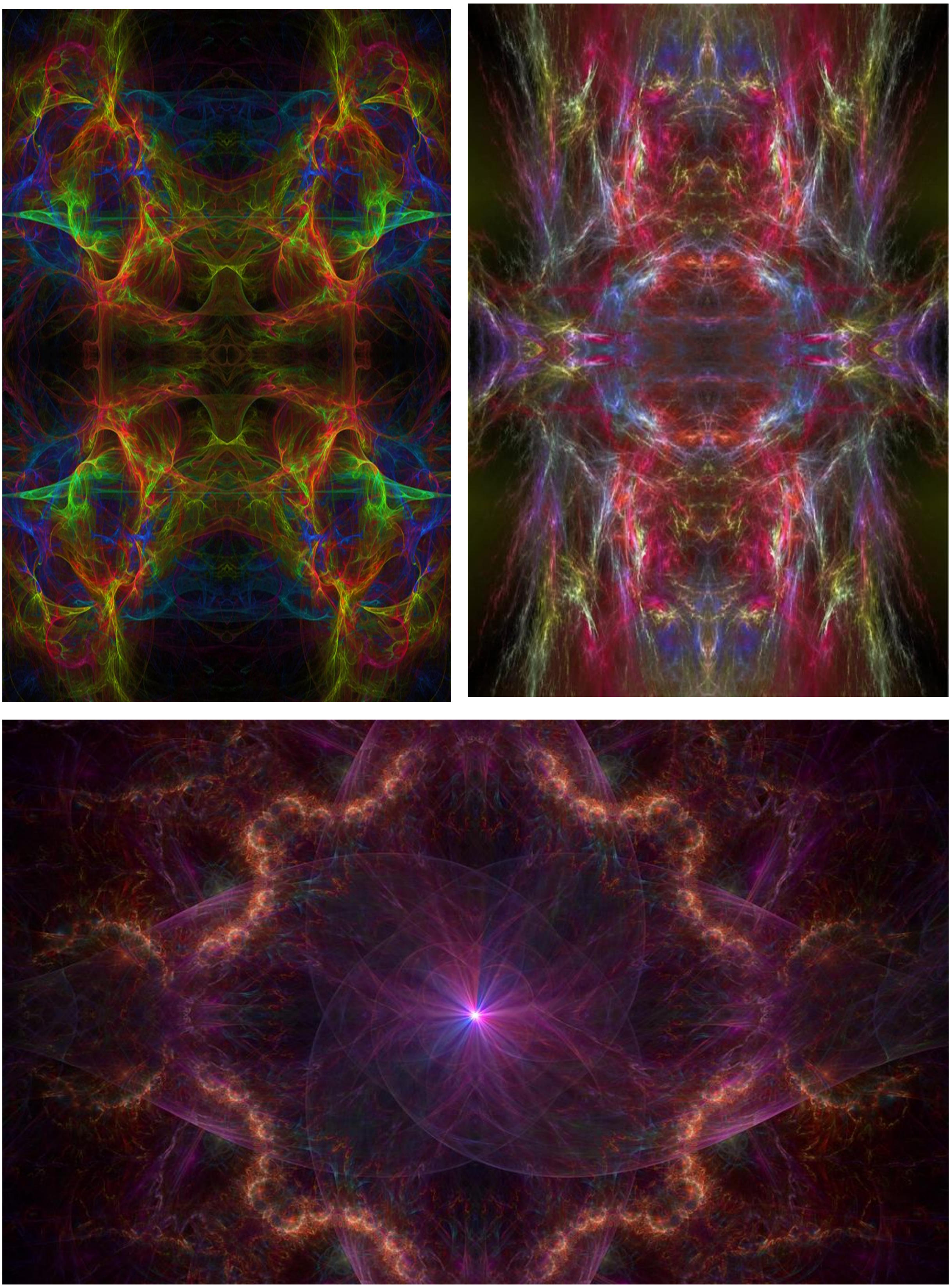

Fig. 5.4. Fractal illustration of a balanced inside-vacuum processes

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