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

In the previous chapters metric-dynamic models of all elementary «particles» and «antiparticles» (both fermions and bosons, with the exception of the Higgs boson) that are part of the Standard model were proposed. In this chapter, a metric-dynamic model of vacuum electrostatics is laid out, taking as an example the interaction of stationary or slowly moving (compared to the speed of light) «particles» and «antiparticles».

8.1 Simplified models stationary «electron» and motionless «positron»

The issues related to vacuum electrostatics of «particles» and «antiparticles» have already been addressed in *§ 5.10*, but that paragraph has only considered single charged stable vacuum formations by the example of «electron» or «positron». In this chapter, electrostatic interactions between two or more stable vacuum formations are considered. But first, we write down the necessary information from the previously obtained results.

Within the Algebra of Signature, «particles» are embedded in the vertical hierarchy of spherical vacuum formations *(2.6.20)* (*see § 2.5 and § 2.6*). 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 *(2.6.23) through (2.6.31) and (2.6.33) through (2.6.41)*.

«ELECTRON» (8.1.1)

Stationary "convex" multilayer vacuum formation (Figure 2.6.3) with signature

$(+---)$

consisting of:

The outer shell of resting «electron»

in the interval $[r_5, r_6]$

$$ds_1^{(+---)2} = \left(1 - \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.2}$$

$$ds_2^{(+---)2} = \left(1 + \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.3}$$

$$ds_3^{(+---)2} = \left(1 - \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.4}$$

$$ds_4^{(+---)2} = \left(1 + \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.5}$$

The core of the «electron»

in the interval $[r_6, r_7]$

$$ds_1^{(+---)2} = \left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.6}$$

$$ds_2^{(+---)2} = \left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.7}$$

$$ds_3^{(+---)2} = \left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.8}$$

$$ds_4^{(+---)2} = \left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.9}$$

The scope of the «electron»

in the interval $[0, \infty]$

$$ds_5^{(+---)2} = c^2dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right). \tag{8.1.10}$$

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» (8.1.11)

Stationary "concave" formation of the vacuum with the signature $(-+++)$ consisting of:

The outer shell of resting «positron»

in the interval $[r_5, r_6]$

$$ds_1^{(-+++)2} = -\left(1 - \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.12}$$

$$ds_2^{(-+++)2} = -\left(1 + \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.13}$$

$$ds_3^{(-+++)2} = -\left(1 - \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_6}{r} - \frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.14}$$

$$ds_4^{(-+++)2} = -\left(1 + \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{8.1.15}$$

The core of the «positron»

in the interval $[r_6, r_7]$

$$ds_1^{(-+++)2} = -\left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (8.1.16)$$

$$ds_2^{(-+++)2} = -\left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (8.1.17)$$

$$ds_3^{(-+++)2} = -\left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (8.1.18)$$

$$ds_4^{(-+++)2} = -\left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (8.1.19)$$

The scope of the «positron»

in the interval $[0, \infty]$

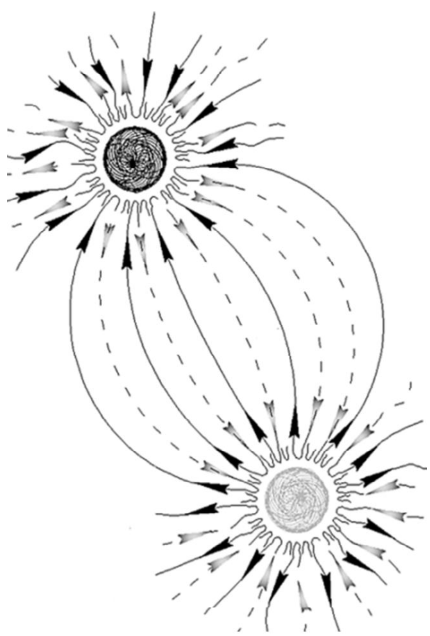
$$ds_5^{(-+++)2} = c^2dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right). \quad (8.1.20)$$

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 «positron»;

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



The interactions (repulsion or attraction) of «particles» and «antiparticles» occurring during their fast motion are described using metric-dynamic models, which are given in Chapter 6. However, in this chapter 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» $r_3 >> r \approx r_6 \sim 1.7\cdot10^{-13}$ cm, so in metrics (8.1.2) *through* (8.1.5) the terms r/r_3 can be neglected. The metrics (8.1.2) through (8.1.5) are reduced to the following two simplified metrics *(2.9.6) through (2.9.7)* and *(2.9.8) through (2.9.9)*:

The outer shell of resting «electron»

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

$$ds_1^{(+---)2} = ds_1^{(-a)2} = \left(1-\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - a\text{-subcont}, \quad (8.1.21)$$

$$ds_2^{(+---)2} = ds_2^{(-b)2} = \left(1+\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - b\text{-subcont}. \quad (8.1.22)$$

The outer shell of resting «positron»

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

$$ds_1^{(-+++)2} = ds_1^{(+a)2} = -\left(1-\frac{r_6}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - a\text{-antisubcont}, \quad (8.1.23)$$

$$ds_2^{(-+++)2} = ds_2^{(+b)2} = -\left(1+\frac{r_6}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - b\text{-antisubcont}. \quad (8.1.24)$$

The names of the vacuum layers (*a* or *b*-subcont and *a* or *b*-antisubcont) described by the metrics (8.1.21) through (8.1.22) and (8.1.23) through (8.1.24) are given in *Table 2.1.1* and in § 5.11.

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 $r \in [r_6, \infty]$.

8.2 Interaction of «particles» and «antiparticles»

In the Algebra of Signatures (Alsigna), it is admissible to consider the metric-dynamic properties of individual «particles» in the framework of simplified model representations, as was done. However, from the "vacuum condition" (*see Definition 1.12.4*), 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 *rakyas* of «particles» and «antiparticles» the intra-vacuum flow (subcont - antisubcont currents) are constantly circulating (see Figures 8.2.1 and 8.3.1).

Thus, the laminar subcont-antisubcont currents, which are present in the model representations of the outer shell of the «electron» (8.1.21) through (8.1.22) and the outer shell of the «positron» (8.1.23) through (8.1.24), do not go to infinity, but are closed on each other's *rakyas* (Figure 8.2.1).

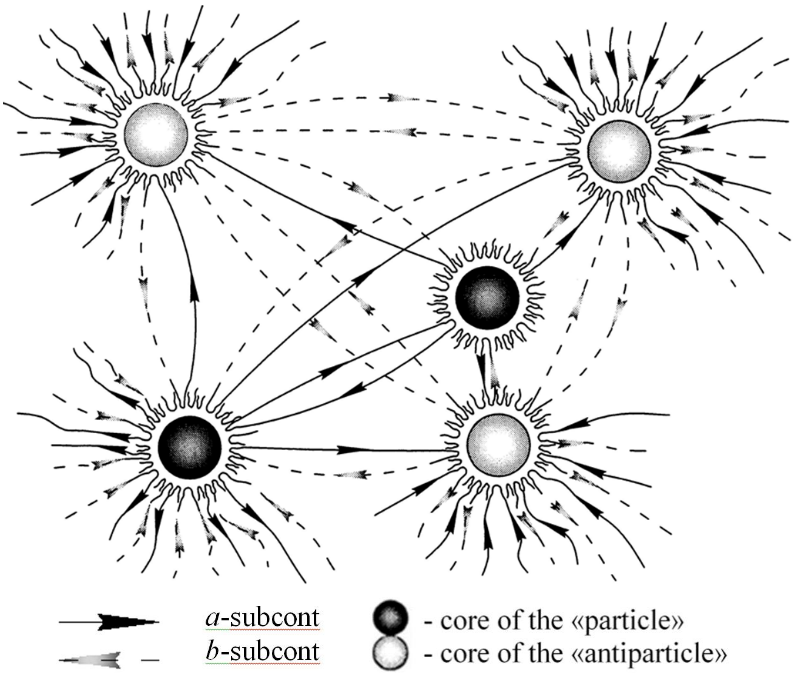


Fig. 8.2.1. External *subcont - antisubcont* currents circulate between *rakyas* of «particles» and «antiparticles»

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 § 5.15. Along with that, a rakya of «particles», in particular of «electron», is a 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.

8.3 Static «electron» - «positron» interaction

In *§ 5.10* during study of metrics (8.1.21) through (8.1.24) {*more precisely, metrics (5.9.6)* through *(5.9.9)*} 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») *(5.10.9)*:

$$\mathbf{I} \qquad \begin{aligned} a_r^{(-a)} &= E_{vr}^{(-a)} = \frac{c^2 r_6}{2r^2\sqrt{1-\frac{r_6}{r}}}, \\ a_\theta^{(-a)} &= E_{v\theta}^{(-a)} = 0, \\ a_\varphi^{(-a)} &= E_{v\varphi}^{(-a)} = 0, \end{aligned} \qquad (8.3.1)$$

- components of the vector *b*-subcont intensity (i.e. acceleration vector of *b*-subcont in the outer shell of the «electron») *(5.10.10)*:

H

$$a_r^{(-b)} = E_{vr}^{(-b)} = -\frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}},$$
$$a_\theta^{(-b)} = E_{v\theta}^{(-b)} = 0, \qquad (8.3.2)$$
$$a_\varphi^{(-b)} = E_{v\varphi}^{(-b)} = 0,$$

- components of the vector a-antisubcont intensity (i.e. the acceleration vector of a-antisubcont in the outer shell «positron») *(5.10.11)*:

V

$$a_r^{(+a)} = E_{vr}^{(+a)} = -\frac{c^2 r_6}{2r^2\sqrt{1-\frac{r_6}{r}}},$$
$$a_\theta^{(+a)} = E_{v\theta}^{(+a)} = 0, \qquad (8.3.3)$$
$$a_\varphi^{(+a)} = E_{v\varphi}^{(+a)} = 0,$$

- components of the vector b-antisubcont intensity (i.e. the acceleration vector of b-antisubcont in the outer shell «positron») *(5.10.12)*:

H′

$$a_r^{(+b)} = E_{vr}^{(+b)} = \frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}},$$
$$a_\theta^{(+b)} = E_{v\theta}^{(+b)} = 0, \qquad (8.3.4)$$
$$a_\varphi^{(+b)} = E_{v\varphi}^{(+b)} = 0\,.$$

The total acceleration vector of the subcont in the outer shell of the «electron» is calculated by the formula *(5.10.13)*

$$\mathbf{a}^{(-)} = \mathbf{a}^{(-a)} + i\mathbf{a}^{(-b)} = \mathbf{E}_v^{(-a)} + i\mathbf{E}_v^{(-b)}. \qquad (8.3.5)$$

The components of this vector, taking into account (8.3.1) and (8.3.2) are *(5.10.14)*

$$a_r^{(-)} = E_{vr}^{(-)} = \sqrt{E_{vr}^{(-a)2} + E_{vr}^{(-b)2}} = \frac{c^2 r_6\sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}},$$
$$a_\theta^{(-)} = 0, \qquad (8.3.6)$$
$$a_\varphi^{(-)} = 0.$$

Similarly, the acceleration vector of the antisubcont in the outer shell of the resting «positron» is calculated by the formula *(5.10.15)*

$$\mathbf{a}^{(+)} = \mathbf{a}^{(+a)} + i\mathbf{a}^{(+b)} = \mathbf{E}_v^{(+a)} + i\mathbf{E}_v^{(+b)}. \qquad (8.3.7)$$

The components of this vector taking into account (8.3.3) and (8.3.4) are *(5.10.16)*

$$a_r^{(+)} = E_{vr}^{(+)} = \sqrt{E_{vr}^{(+a)2} + E_{vr}^{(+b)2}} = \frac{c^2 r_6 \sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}},$$
$$a_\theta^{(+)} = 0, \qquad (8.3.8)$$
$$a_\varphi^{(+)} = 0.$$

Within Alsigna we study the following stationary model of the interaction of resting «electron» and resting «positron». The subcont flows into a rakya of the «electron» with acceleration (8.3.6), this accelerated course carries the core of the «positron» to the core of the «electron» (Figure 8.3.1).

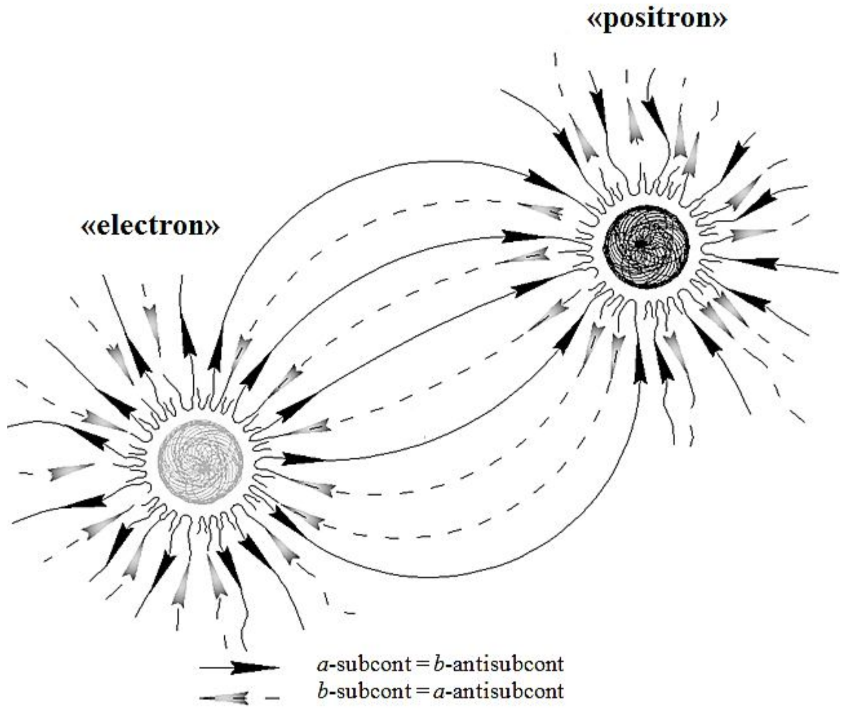


Fig. 8.3.1. Stationary interaction of «electron» and «positron» by circulation subcont-antisubcont currents between their rakyas

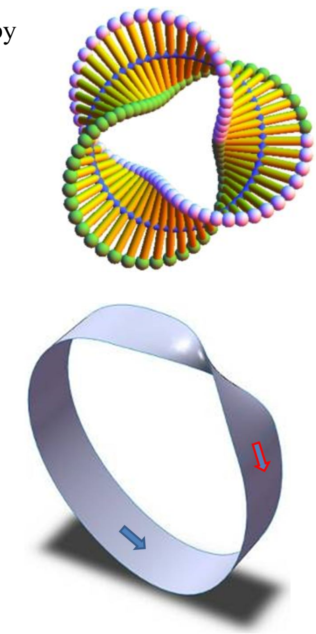


Fig. 8.3.2. Mobius strip

On the other hand, the antisubcont flows into the rakya of the «positron» with the acceleration of (8.3.8); this accelerated course carries the core of the «electron» to the core of the «positron» (Figure 8.3.1).

In the framework of the above model representation, a rakya of the «electron» absorbs a subcont and exudes an antisubcont, which returns to a rakya of the «positron», where it turns back into a subcont, which again goes to a rakya of the «electron». At the same time, according to the ideas developed in the *§§ 5.7 and 5.10*, the current of the subcont intertwines with the current of the antisubcont in a double helix.

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 Möbius strip (Figure 8.3.2). Let's assume that the subcont flows along the outer side of the Möbius strip, and the antisubcont moves in the opposite direction along its inner side. If such a Möbius strip is twisted into a harness (Figure 8.3.3), then such a double helix will be a good model representation of one closed 4-braid of the subcont - antisubcont current circulating between the rakyas, for example, between an «electron» and a «positron» (Figure 8.3.3 and 8.3.4).

Fig. 8.3.3. Within the framework of model representations of Alsigna, between the rakya of the «electron» and the rakya of the «positron» circulate two subcont and two antisubcont currents with accelerations (8.3.1) through (8.3.4). To better envision intra-vacuum processes, it can be assumed that the pairwise counter currents flow on both sides of the Möbius strip twisted into a harness. In the rakya of an «electron», the anticubcont becomes a subcont, and in the rakya of a «positron», the subcont becomes an antisubcont. In addition, the accelerated subcont-antisubcont currents entrain the core of the «electron» and the core of the «positron» in the respective directions towards the other

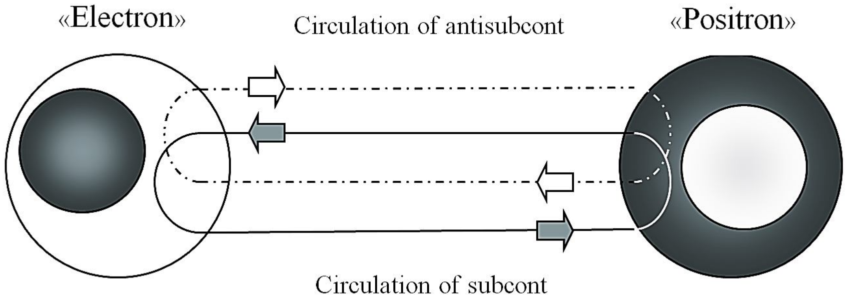


Fig. 8.3.4. The circulation of subcost and antisubcont currents between the rakya of the «electron» and the rakya of the «positron»

In this model, the accelerated intra-vacuum currents with general acceleration {*see the expression (5.11.30)*}

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

influence the cores of the «electron» and «positron», thus tending to bring together the cores.

Taking into account (8.3.6) and (8.3.8), we obtain

$$a_r^{(e+\bar{e})} = \sqrt{a_r^{(+)2} + a_r^{(-)2}} = \sqrt{\left(\frac{c^2 r_6 \sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}}\right)^2 + \left(\frac{c^2 r_6 \sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}}\right)^2} = \frac{c^2 r_6}{r^2\sqrt{1-\frac{r_6^2}{r^2}}}. \qquad (8.3.9)$$

In this case, r is the distance between the centers of the cores of «electron» and «positron». The graph of the function (8.3.9) is shown in Figure 8.3.5.

When $r >> r_6$ equation (8.3.9) is simplified and takes the form

$$a_r^{(e+\bar{e})} = \frac{c^2 r_6}{r^2}, \qquad (8.3.10)$$

similar to the Coulomb interaction force in classical electrostatics

$$F_{кл} = \frac{e^2}{4\pi\varepsilon_0 r^2}. \qquad (8.3.11)$$

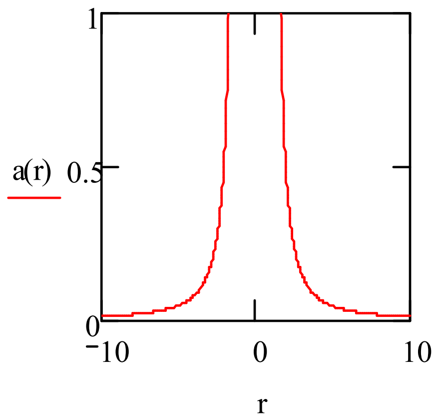


Fig. 8.3.5. Graph of the function (8.3.9) for $c = r_6 = 1$

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 [49]:

$$W_Э = \frac{1}{8\pi}\int E^2 dV = \frac{1}{8\pi}\int_a^\infty \frac{e^2}{r^4} 4\pi r^2 dr = -\frac{e^2}{2r}\Big|_a^\infty = \frac{e^2}{2a}. \qquad (8.3.12)$$

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 be oriented 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

$$a_e = e^2/(4\pi) \qquad (8.3.13)$$

turns out to be an effective function of the distance [28]:

$$a_{eff}(r) = \frac{e_{eff}^2}{4\pi} = \frac{\frac{e^2}{4\pi}}{1 - \frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_e}}, \tag{8.3.14}$$

where m_e is the mass of the electron.

This fitting procedure is called renormalization of the constant of electromagnetic interaction. Substituting the expression (8.3.14) into Coulomb's law (8.3.11), we obtain {*see (5.10.24)* through *(5.10.26)*}:

$$F_{кл\ eff} \approx \frac{e^2}{4\pi\varepsilon_0 r^2 (1 - \frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_0})}. \tag{8.3.15}$$

Comparing (8.3.9) with (8.3.14), we find the following correspondence

$$\frac{e^2}{4\pi\varepsilon_0} \quad \leftrightarrow \quad c^2 r_6 \tag{8.3.16}$$

and

$$\frac{1}{(1 - \frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_0})} \quad \leftrightarrow \quad \frac{1}{\sqrt{1 - \frac{r_6^2}{r^2}}}. \tag{8.3.17}$$

From (8.3.16) it is seen that in fully geometrized vacuum electrodynamics of Alsigna the role charge plays value

$$e \leftrightarrow \sqrt{c^2 r_6} = \sqrt{(3\cdot 10^8)^2 \cdot 1{,}7\cdot 10^{-15}} \approx \sqrt{153} \approx 12{,}4\ \frac{м^{3/2}}{сек}, \tag{8.3.18}$$

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

From the correspondence (8.3.17) it is seen that the representations of Alsigna do not contradict the conclusions of modern theories. While the vacuum electrostatics of the Alsigna is completely geometrized in the framework of the axiomatic light-geometry of «vacuum», presented in Chapters 1&2.

From the expression (8.3.17) we see that Alsigna does not contradict modern theories. In this case, the vacuum electrostatics of Alsigna is completely geometrized within the axiomatics of the light geometry of the "vacuum" presented in Chapters 1 and 2.

8.4 Static «electron» - «electron» interaction

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

As shown in Figures 8.4.1 and 8.4.2, the *b*-subcont flows from the rakya of each «electron» to the rakyas of the nearest «positrons» (or other positively charged «particles»). At the same time, a b-subcont flowing from the rakya of an «electron» strives to entrap all the cores of other «electrons» (or other negatively charged «particles») that are in its path. From the outside, it looks as if the cores of «electrons» are repelled from each other (Figure 8.4.1).

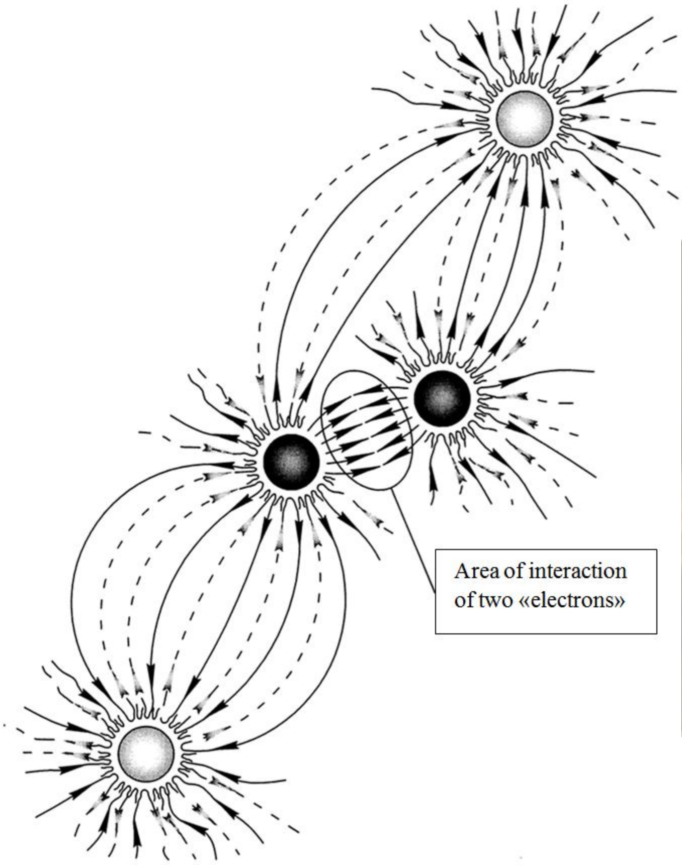


Fig. 8.4.1. External subcont-antisubcont currents between rakyas surrounding the cores of «electrons» and «positrons». Currents of b-subcont, flowing from the rakyas of two «electrons», result in the repulsion of their cores from each other

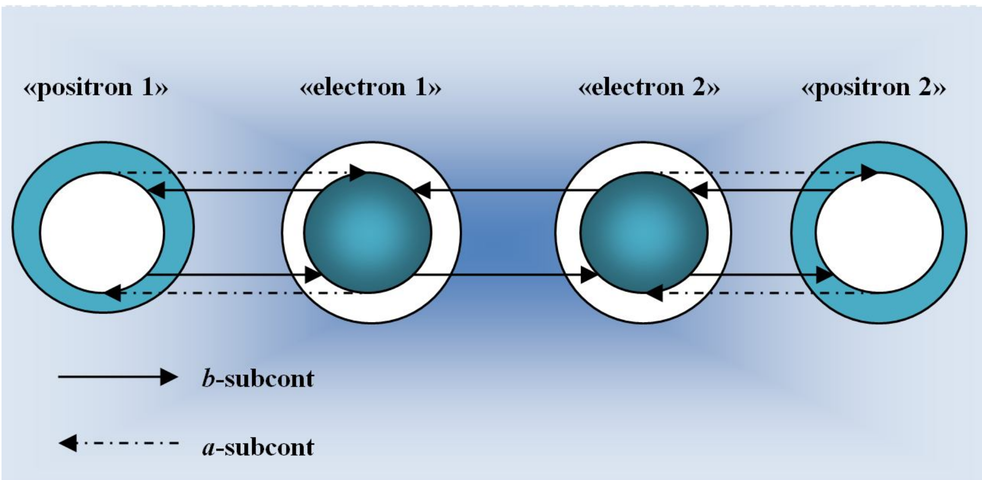


Fig. 8.4.2. Schematic representation of the subcont-antisubcont currents between *rakyas* of «electrons» and «positrons»

According to the above model (Figure 8.4.1 and 8.4.2), 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»

$$a_r^{(e1)} = a_r^{(-b1)} = -\frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}; \tag{8.4.1}$$

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

$$a_r^{(e2)} = a_r^{(-b2)} = \frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}. \tag{8.4.2}$$

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

$$a_r^{(e_1+e_2)}(r) = \sqrt{a_r^{(e_1)2} + a_r^{(e_2)2}} = \frac{\sqrt{2}c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}, \tag{8.4.3}$$

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

When $r >> r_6$ equation (8.4.3) becomes simplified

$$a_r^{(e1+e2)} = \frac{\sqrt{2}}{2}\frac{c^2 r_6}{r^2} \approx \frac{0{,}7c^2 r_6}{r^2}, \tag{8.4.4}$$

similar to Coulomb's law (8.3.11) for two similarly charged particles in vacuum.

Comparing accelerations (8.3.9) and (8.4.3), i.e.

$$a_r^{(e+\bar{e})} = = \frac{c^2 r_6}{r^2\sqrt{1-\frac{r_6^2}{r^2}}},$$

$$a_r^{(e_1+e_2)} = \frac{\sqrt{2}c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}}, \tag{8.4.5}$$

in the framework of the Alsigna, we find that the «electron» - «positron» interaction at $r \approx r_6$ is slightly different from the «electron» - «electron» interaction, but at $r >> r_6$ these interactions become practically equal, resulting in

$$a_r^{(e+\bar{e})} = \frac{c^2 r_6}{r^2}, \qquad a_r^{(e1+e2)} = \frac{0{,}7c^2 r_6}{r^2}. \tag{8.4.6}$$

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

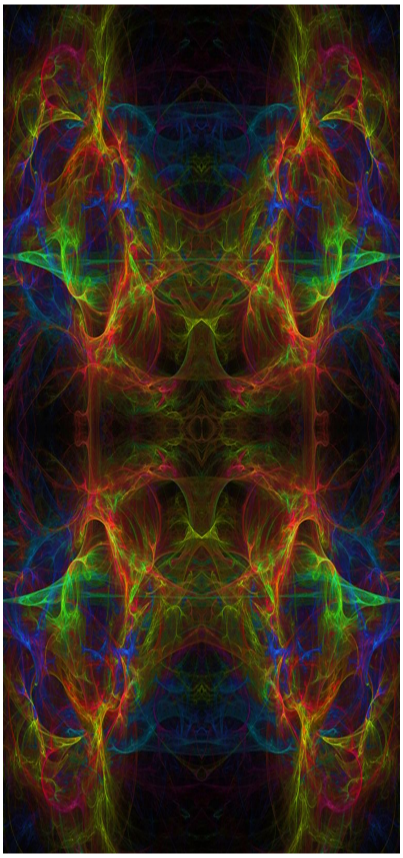
8.5 Chapter 8 conclusions

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 *Table 2.12.1*.

Here we consider only the simplest case: a 4-braid «electron» - «positron» interaction and a 2-braid «electron» - «electron» interaction. Alsigna allows for the representation of each "string" of these *k*-braids in the superposition of seven "strands", as shown in *§ 5.11 {see the expression (5.11.33) through (5.11.36)}*. At the same time, deeper intra-vacuum exchange processes can be identified and investigated.

Fig. 8.5.1. In a «vacuum», any action or vacuum manifestation is accompanied by a similar anti-action or anti - manifestation. This property of the "vacuum" is reflected in a "vacuum balance" (see Definitions 1.12.4 and 1.12.3)



Also, we note again that the mathematical apparatus and model representations of Alsigna are versatile in regards to stable vacuum formations at 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 *(2.6.20)*.

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 8.2.1), and between the «particles» and «antiparticles» of different levels of existence (*see Figure 2.6.2*).

That is, on the one hand, each level of existence is a closed world, balanced in respect of any vacuum manifestations and antimanifestations (Figure 8.5.1); on the other hand, different levels of existence (worlds) exchange subcont - antisubcont flows and together to form a Closed Universe.

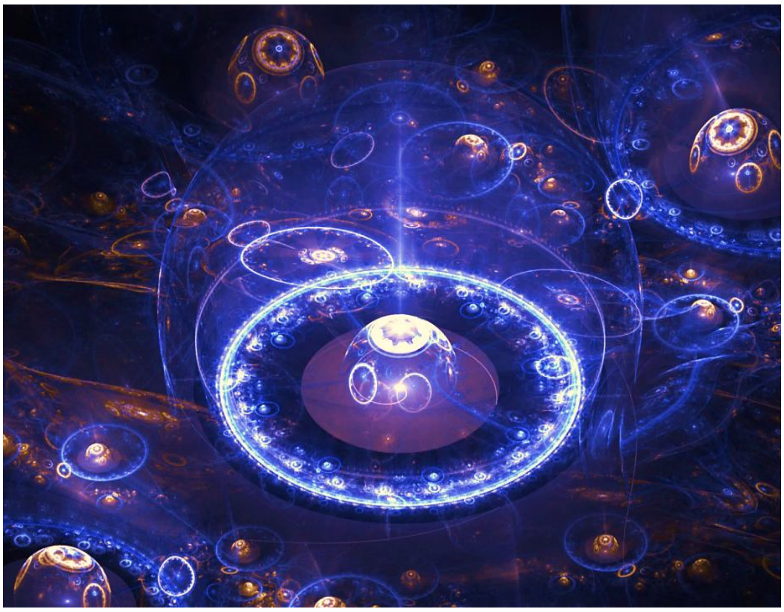
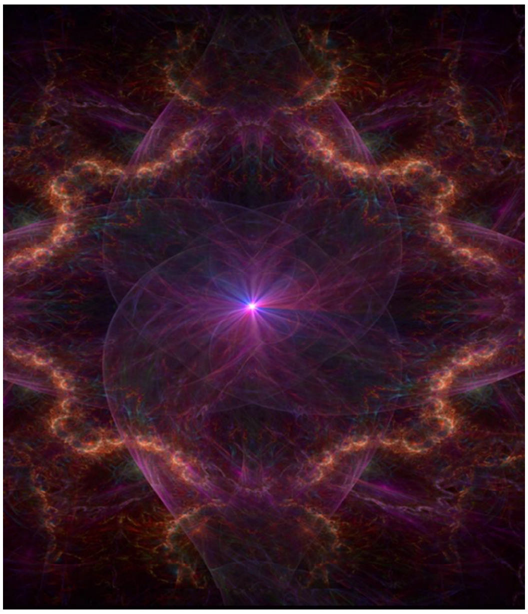



Fig. 8.5.2. All levels of existence are interconnected

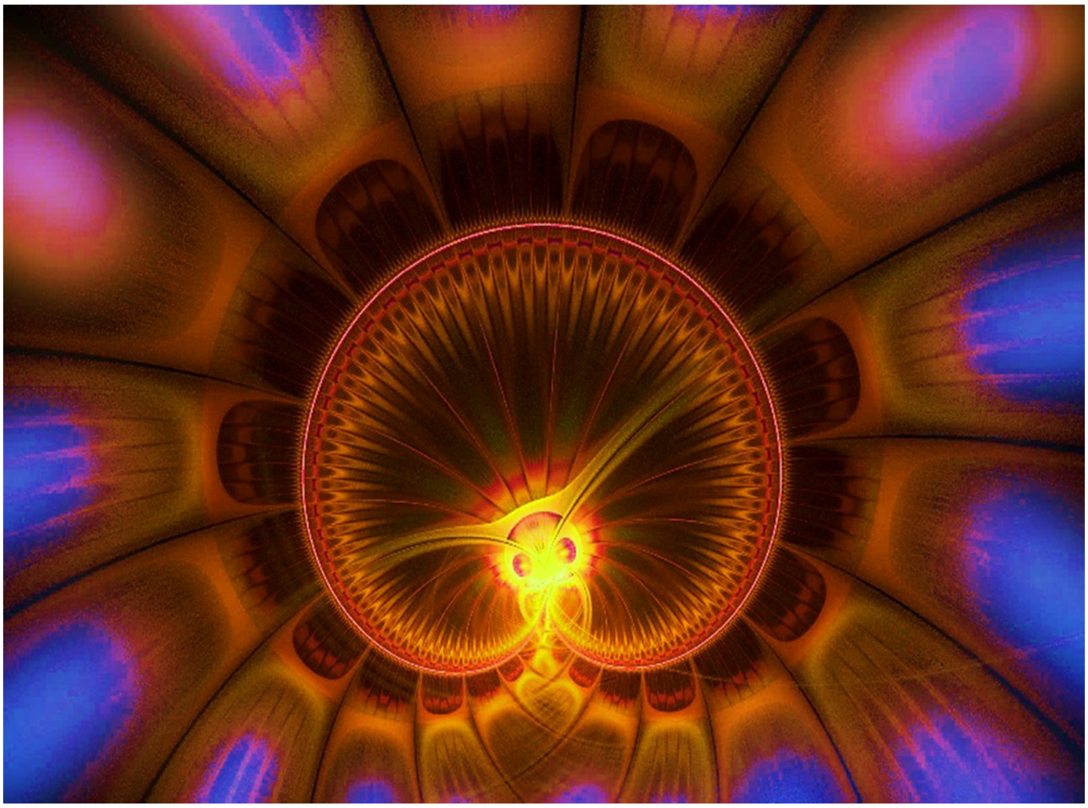


Fig. 8.5.3. A closed Universe is a Mother's Womb in which the cosmic Embryo grows