6 «Electron» motion. «Vacuum electrodynamics»

In this chapter the motion of stable vacuum formations in the «vacuum» (i.e. in the continuous "medium", of which they themselves consist) is considered the development of the fully geometrized "vacuum electrodynamics" is continued.

6.1 Introduction

In the previous Chapters 1 through 5 we've considered the metric-dynamic models of practically all of the basic «particles» and «antiparticles» form the Standard model (besides «neutrino» and Higgs bosons). In particular, the proposed metric-dynamic models: of the «electrons» and «positrons», «protons» and «antiprotons», «neutrons» and «antineutrons», «quarks» and «antiquarians» of all kinds and generations, etc.

The names of «particles» are in brackets, since in the framework of the Algebra of Signatures (Alsigna) each elementary «particle» occupies the whole Universe. But each of these «particles» can be divided into four main parts: 1) outer shell, 2) *rakya*, 3) core, and 4) particelle (*inner nucleolus*) (*see Figure 5.10.5*).

All of the above «particles» were considered in Chapters 1 through 5 as stable or unstable spherical-symmetric deformations of «vacuum», which are at relative to this «vacuum» (i.e. empty continuous 3-dimensional extent).

In this paper, we investigate the rectilinear and uniform motion of «electron» and «positron» in «vacuum» (i.e. in "3-dimensional empty extent", the stable curvatures of which they are). This lays the foundations not only for the dynamics of the cores of these «particles», but also of the dynamics of intra-vacuum currents in the outer shell surrounding these cores.

6.2 Outer shell of resting «electron» or «positron»

Recall that the simplest metric-dynamic model of the outer shell of an «electron» resting relative to the «vacuum» (the deformation of which it is), in Alsigna is determined by a set of four metrics *(5.8.2) through (5.8.5)*:

The outer shell of resting «electron»

in the interval [$r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm] with signature $(- + + +)$

$$ds_1^{(+--)2} = \left(1 - \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (6.2.1)$$

$$ds_2^{(+--)2} = \left(1 + \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (6.2.2)$$

$$ds_3^{(+--)2} = \left(1 - \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (6.2.3)$$

$$ds_4^{(+---)2} = \left(1+\frac{r_6}{r}+\frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_6}{r}+\frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right). \qquad (6.2.4)$$

Similarly, the outer shell of a resting «positron» is characterized by a set of four metrics *(5.8.12) through (5.8.15)*:

The outer shell of resting «positron»

in the interval [$r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm] with signature (– + + +)

$$ds_1^{(-+++)2} = -\left(1-\frac{r_6}{r}+\frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_6}{r}+\frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \qquad (6.2.5)$$

$$ds_2^{(-+++)2} = -\left(1+\frac{r_6}{r}-\frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_6}{r}-\frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \qquad (6.2.6)$$

$$ds_3^{(-+++)2} = -\left(1-\frac{r_6}{r}-\frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_6}{r}-\frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \qquad (6.2.7)$$

$$ds_4^{(-+++)2} = -\left(1+\frac{r_6}{r}+\frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_6}{r}+\frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right). \qquad (6.2.8)$$

In the vicinity of the «electron's» core (or «positron's» core) $r_6/r_3 \sim 10^{-13}/10^{18} \sim 10^{-31}$, therefore the terms r^2/r_3^2 in metric sets (6.2.1) through (6.2.4) and (6.2.5) through (6.2.8) can be ignored. As a result, we obtain more simplified metric-dynamic models of the outer shell of the resting «electron» and resting «positron» {*see (5.9.6) through (5.9.9)* and *(5.9.8) through (5.9.9)*}

The outer shell of resting «electron»

in the interval [$r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm] with signature (– + + +)

$$ds_1^{(+---)2} = ds_1^{(-a)2} = \left(1-\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} - r^2d\theta^2 - r^2\sin^2\theta\, d\varphi^2 \quad \textit{a-subcont}; \qquad (6.2.9)$$

$$ds_2^{(+---)2} = ds_2^{(-b)2} = \left(1+\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} - r^2d\theta^2 - r^2\sin^2\theta\, d\varphi^2 \quad \textit{b-subcont}. \qquad (6.2.10)$$

The outer shell of resting «positron»

in the interval [$r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm] with signature (– + + +)

$$ds_1^{(-+++)2} = ds_1^{(+a)2} = -\left(1-\frac{r_6}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad \textit{a-antisubcont;} \qquad (6.2.11)$$

$$ds_2^{(-+++)2} = ds_2^{(+b)2} = -\left(1+\frac{r_6}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad \textit{b-antisubcont.} \qquad (6.2.12)$$

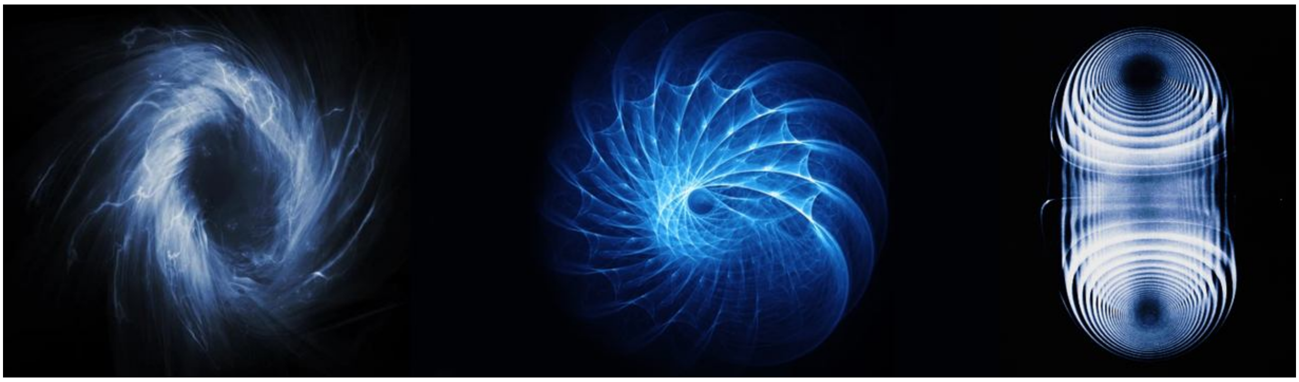
Recall the previously defined legend {*see table 2.1.1*}:

Table 6.2.1

Layer of the 2^3-$\lambda_{m,n}$-vacuum	**Code name**	**Metric with the signature**	**Formulae**
The outer side of the external side of the 2^3-$\lambda_{m,n}$-vacuum region	*a*-subcont	$ds^{(-a)2}$ (+ – – –)	(6.2.9)
The inner side of the external side of the 2^3-$\lambda_{m,n}$-vacuum region	*b*-subcont	$ds^{(-b)2}$ (+ – – –)	(6.2.10)
The outer side of the internal side of the 2^3-$\lambda_{m,n}$-vacuum region	*a*-antisubcont	$ds^{(+a)2}$ (– + + +)	(6.2.11)
The inner side of the internal side of the 2^3-$\lambda_{m,n}$-vacuum region	*b*-antisubcont	$ds^{(+b)2}$ (– + + +)	(6.2.12)

Also recall that in Alsigna we consider 16 types of metric spaces described by metrics *(5.11.35) and (5.11.36)* with signatures *(5.11.33)* through *(5.11.34)*. So the next, more subtle level of consideration should take into account the interweaving not of four, but of 16 × 4= 64 2^6-$\lambda_{m,n}$-vacuum underlayers. In this case, the concepts of the model of intra-vacuum processes look much more complex (Figure 6.2.1).

Fig. 6.2.1. Fractal illustration of complex sub-vacuum processes at the level of 2^6-$\lambda_{m,n}$-vacuum region (*see Definition 1.7.1*)



6.3 Outer shell of a moving «electron» or positron»

The experience of studying the translational motion of stable local disturbances in continuous media suggests that the outer shell of a moving «electron» should rotate like a toroidal vortex in a gas or in a liquid (Figure 6.3.1).

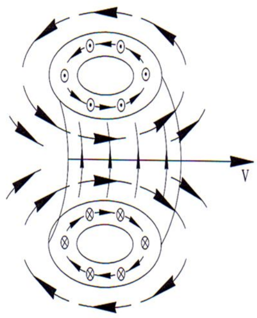


Fig. 6.3.1. The translational motion of the toroidal vortex in a gaseous or liquid medium

Therefore, in the considered approximation (6.2.9) through (6.2.10) and (6.2.11) through (6.2.12), the rotation of the outer shells of the «electron» and «positron» is described by the following generalized Kerr metrics:

The outer shell of the moving «electron» (6.3.1)

in the interval [$r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm] with signature (– + + +)

$$ds_1^{(-a)2} = \left(1 - \frac{r_6 r}{\rho^2}\right)c^2dt^2 - \frac{\rho^2 dr^2}{r^2 - r_6 r + a^2} - \rho^2 d\theta^2 - \left(r^2 + a^2 + \frac{r_6 r a^2}{\rho^2}\sin^2\theta\right)\sin^2\theta d\varphi^2 + \frac{2r_6 ra}{\rho^2}\sin^2\theta d\varphi c dt$$

– a-subcont; (6.3.2)

$$ds_2^{(-b)2} = \left(1 + \frac{r_6 r}{\rho^2}\right)c^2dt^2 - \frac{\rho^2 dr^2}{r^2 + r_6 r + a^2} - \rho^2 d\theta^2 - \left(r^2 + a^2 - \frac{r_6 r a^2}{\rho^2}\sin^2\theta\right)\sin^2\theta d\varphi^2 + \frac{2r_6 ra}{\rho^2}\sin^2\theta d\varphi c dt$$

– b-subcont. (6.3.3)

The outer shell of the moving «positron» (6.3.4)

the interval [$r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm] with signature (– + + +)

$$ds_1^{(-a)2} = \left(1 - \frac{r_6 r}{\rho^2}\right)c^2dt^2 - \frac{\rho^2 dr^2}{r^2 - r_6 r + a^2} - \rho^2 d\theta^2 - \left(r^2 + a^2 + \frac{r_6 r a^2}{\rho^2}\sin^2\theta\right)\sin^2\theta d\varphi^2 + \frac{2r_6 ra}{\rho^2}\sin^2\theta d\varphi c dt$$

– a-antisubcont; (6.3.5)

$$ds_2^{(-b)2} = \left(1 + \frac{r_6 r}{\rho^2}\right)c^2dt^2 - \frac{\rho^2 dr^2}{r^2 + r_6 r + a^2} - \rho^2 d\theta^2 - \left(r^2 + a^2 - \frac{r_6 r a^2}{\rho^2}\sin^2\theta\right)\sin^2\theta d\varphi^2 + \frac{2r_6 ra}{\rho^2}\sin^2\theta d\varphi c dt$$

– b-antisubcont, (6.3.6)

were

$$\rho^2 = r^2 + a^2\cos^2\theta, \tag{6.3.7}$$

$$a = r_6 \frac{V_z}{2c} \tag{6.3.8}$$

– the ellipticity parameter of a «particle» («electron» or «positron») , moving at a constant speed V_z (in the direction of the axis z) as a single vacuum formation relative to the vacuum from which it consists.

The solution of the Einstein vacuum equation *(2.1.6)* for a rotating body was discovered by Kerr in 1963. However, the Kerr metric in the form of (6.3.2) was first given by Boyer and Lindquist in 1967. As far as the author knows, there is no correct output of this metric in the literature. However, the correct values are obtained by substitution of the metric tensor components from metrics (6.3.2) through (6.3.3) and (6.3.5) through (6.3.6) into the Einstein vacuum equation *(2.1.6)*. Metrics (6.3.3) and (6.3.6) are obtained by replacing all r_6 in metrics (6.3.2) and (6.2.5) with $-r_6$.

Vacuum formations, metric-dynamic models of which are given by metrics (6.2.2) through (6.2.3) and (6.2.7) through (6.2.8), fully compensate each other's manifestations, as the sum of these four metrics is zero, i.e. the "vacuum condition" is observed.

In the absence of translational motion «electron» or «positron» (i.e., $V_z = 0$ and therefore $a = 0$) metrics (6.3.2) through (6.3.3) and (6.3.5) through (6.3.6) are reduced respectively to metrics (6.2.9) through (6.2.10) and (6.2.11) through (6.2.12).

6.4 The shape of the cores of a moving «electron» or «positron»

Let's define the shape of the core of the uniformly and rectilinearly moving «electron» based on the form of *rakya* (i.e., the boundary or horizon of Schwarzschild, which separates the core from its outer shell).

Similarly to *(5.15.50)*, the form of a *rakya* of a moving «electron» can be found by equating the components of the metric tensor g_{00} from metrics (6.3.2) and (6.3.3) to zero

$$g_{00s}^{(-a)} = 1 - \frac{r_6 r}{\rho^2} = 1 - \frac{r_6 r}{r^2 + a^2\cos^2\theta} = 0 \quad \text{– for } \textit{rakya} \text{ (border) } a\text{-subcont;} \tag{6.4.1}$$

$$g_{00s}^{(-b)} = 1 + \frac{r_6 r}{\rho^2} = 1 - \frac{r_6 r}{r^2 + a^2\cos^2\theta} = 0 \quad \text{– for } \textit{rakya} \text{ (border) } b\text{-subcont.} \tag{6.4.2}$$

First, consider the equation (6.4.1), which can be represented as a quadratic trinomial

$$r^2 - r_6 r + a^2\cos^2\theta = 0 \tag{6.4.3}$$

with roots

$$r_{s1,2}^{(-a)} = \frac{r_6}{2} \pm \sqrt{\left(\frac{r_6}{2}\right)^2 - a^2\cos^2\theta}\,, \tag{6.4.4}$$

or, taking into account (6.3.8)

$$r_{s1,2}^{(-a)} = \frac{r_6}{2} \pm \sqrt{\left(\frac{r_6}{2}\right)^2 - \left(\frac{r_6 V_z}{2c}\right)^2 \cos^2\theta}\,. \tag{6.4.5}$$

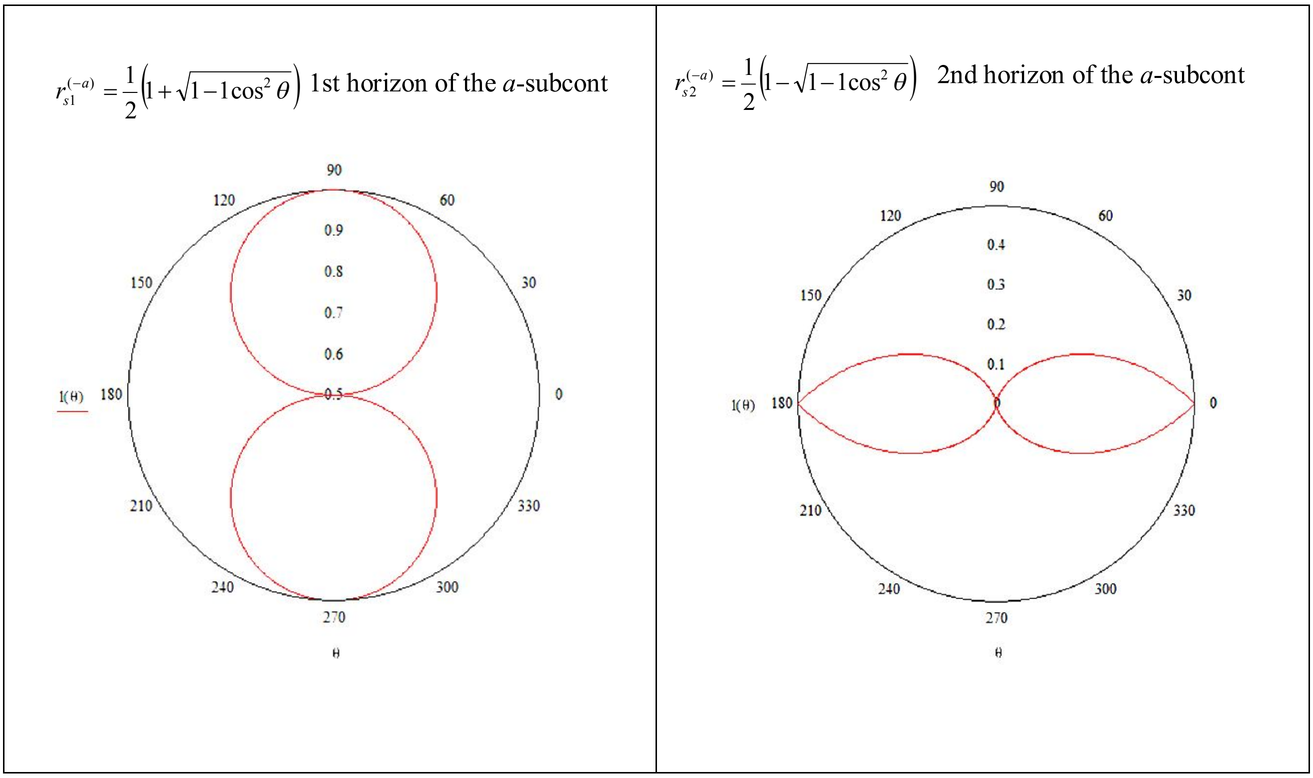
Hence the desired expression to determine the shape of the two horizons of *rakya* (border) between the core of the moving «electron» and its *a*-subcont outer shell

$$r_{s1,2}^{(-a)} = \frac{r_6}{2}\left(1 \pm \sqrt{1 - \frac{V_z^2}{c^2}\cos^2\theta}\right). \tag{6.4.6}$$

Similarly, there are the roots of the equation (6.4.2), which determine the forms of the two rakya horizons between the core of the same «electron» and its *b*-subcont outer shell

$$r_{s1,2}^{(-b)} = \frac{r_6}{2}\left(-1 \pm \sqrt{1 - \frac{V_z^2}{c^2}\cos^2\theta}\right). \tag{6.4.7}$$

Graphs of functions (6.4.6) and (6.4.7) (with $V_z/c = 1$ and $r_6 = 1$) depending on the change of the angle θ shown in Figure 6.4.1.



$r_{s1}^{(-b)} = \frac{1}{2}\left(-1+\sqrt{1-1\cos^2\theta}\right)$ 1st horizon of the b-subcont

$r_{s2}^{(-b)} = \frac{1}{2}\left(-1-\sqrt{1-1\cos^2\theta}\right)$ 2nd horizon of the b-subcont

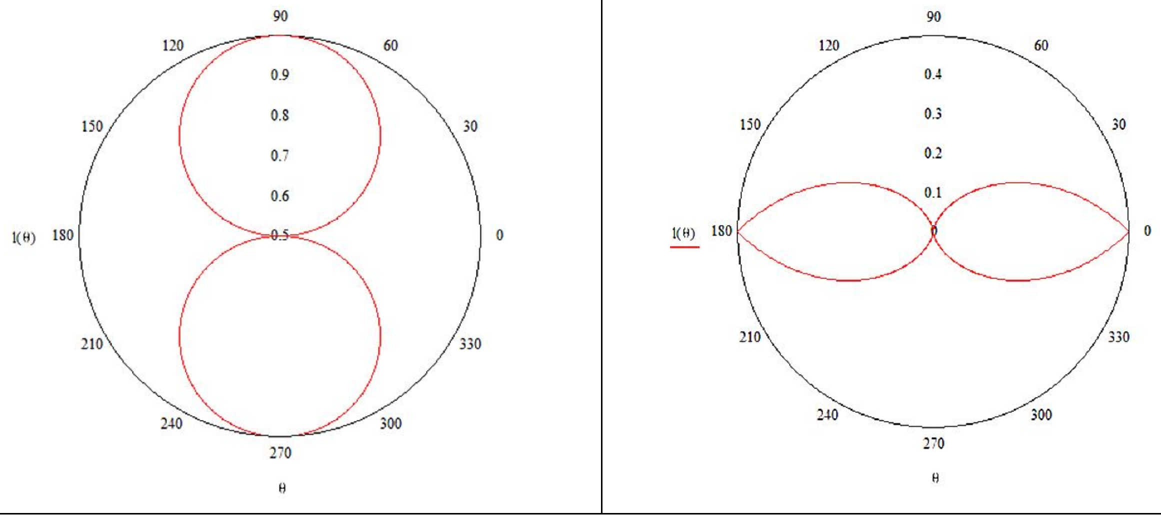


Fig. 6.4.1. Changing the shape of the 4 horizons of *rakya* surrounding the core of a moving «electron». The calculations are performed in $V_z/c = 1$ and $r_6 = 1$ using the MathCad software

From the expressions (6.4.6) and (6.4.7) can be seen:

– at low speed of the «electron» (i.e. $V_z/c \approx 0$), the spherical form of the *rakya*, surrounding the core (and thus the core itself), almost no change;

– at a large speed of the «electron» (i.e. $V_z/c \approx 1$), the *rakya* is separated into four horizons, having the form of ellipsoids of revolution. Two of these ellipsoidal horizons are flattened in the direction of motion of the «electron» (i.e. along the axis z), and the other two horizons are flattened in the perpendicular directions (Figure 6.4.2).

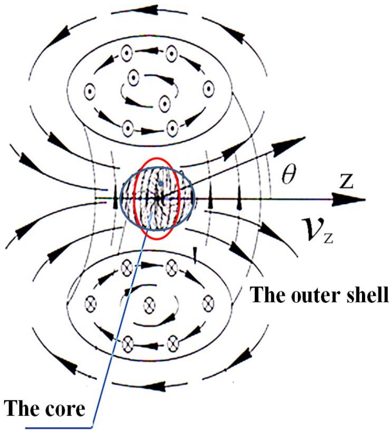


Fig. 6.4.2. Tapered horizons of the «electron's» (or «positron's») rakya, moving at a constant speed V_z in the direction of the axis z

The shape of the «positron's» core can be investigated by found the zero components of the metric tensor g_{00} from metrics (6.3.5) and (6.3.6)

$$g_{00s}^{(+a)} = -1 + \frac{r_6 r}{\rho^2} = -1 + \frac{r_6 r}{r^2 + a^2\cos^2\theta} = 0 \quad \text{– for } rakya \text{ (border) } a\text{-antisubcont;} \qquad (6.4.8)$$

$$g_{00s}^{(+b)} = -1 - \frac{r_6 r}{\rho^2} = -1 - \frac{r_6 r}{r^2 + a^2\cos^2\theta} = 0 \quad \text{– for } rakya \text{ (border) } b\text{-antisubcont.} \qquad (6.4.9)$$

Analyzing the expressions (6.4.8) through (6.4.9) we find the similar results as in the case of the «electron's» core (Figure 6.4.2), but shifted in phase by 90^0.

6.5 The scope of the a moving «electron» and «positron»

When $r_6 = 0$, metrics (6.3.2) and (6.3.3) and (6.3.5) and (6.3.6) become Galilean:

$$ds^{(-)2} = c^2dt^2 - \frac{\rho^2 dr^2}{r^2 + a^2} - \rho^2 d\theta^2 - \left(r^2 + a^2\right)\sin^2\theta\, d\varphi^2, \qquad (6.5.1)$$

$$ds^{(+)2} = -c^2dt^2 + \frac{\rho^2 dr^2}{r^2 + a^2} + \rho^2 d\theta^2 + \left(r^2 + a^2\right)\sin^2\theta\, d\varphi^2. \qquad (6.5.2)$$

Indeed, the introduction of coordinates

$$\begin{aligned} x &= \sqrt{r^2 + a^2}\,\sin\theta\cos\varphi\,, \\ y &= \sqrt{r^2 + a^2}\,\sin\theta\sin\varphi\,, \\ z &= r\cos\theta \end{aligned} \qquad (6.5.3)$$

leads metrics (6.5.1) and (6.5.2) to pseudo-Euclidean form

$$ds^{(-)2} = \quad c^2dt^2 - dx^2 - dy^2 - dz^2, \qquad (6.5.4)$$

$$ds^{(+)2} = -\,c^2dt^2 + dx^2 + dy^2 + dz^2. \qquad (6.5.5)$$

Thus the surface r = const represents the ellipsoids of rotation described by the equations

$$\frac{x^2}{r^2 \pm a^2} + \frac{y^2}{r^2 \pm a^2} + \frac{z^2}{r^2} = 1, \qquad (6.5.6)$$

or

$$\frac{x^2}{r^2} + \frac{y^2}{r^2} + \frac{z^2}{r^2 \mp a^2} = 1, \qquad (6.5.7)$$

therefore, the value a is called "ellipticity parameter".

Thus, the «scope» of linearly and uniformly moving «electron» and «positron» are given by the metrics:

The scope of the a moving «electron»

moving at a constant speed V_z, $r \in [0, \infty]$, with the signature $(+\,-\,-\,-)$

$$ds_5^{(-)2} = c^2dt^2 - \frac{\rho^2 dr^2}{r^2 + a^2} - \rho^2 d\theta^2 - \left(r^2 + a^2\right)\sin^2\theta\, d\varphi^2. \qquad (6.5.8)$$

The scope of the a moving «positron»

moving at a constant speed V_z, $r \in [0, \infty]$, with the signature $(-\,+\,+\,+)$

$$ds_5^{(+)2} = -c^2dt^2 + \frac{\rho^2 dr^2}{r^2 + a^2} + \rho^2 d\theta^2 + \left(r^2 + a^2\right)\sin^2\theta\, d\varphi^2. \qquad (6.5.9)$$

6.6 Deformations of the outer shell of a moving «electron» and «positron»

We will evaluate the deformation of the outer shell of the «electron» moving at a constant speed V_z in the direction of the z axis by the relative elongation of the local areas of the outer side of the 2^3-$\lambda_{-11\div-16}$-vacuum region {*see (2.1.32)*}

$$l_i^{(-)} = \sqrt{1+\frac{g_{ii}^{(-)} - g_{ii}^{0(-)}}{g_{ii}^{0(-)}}} - 1 = \sqrt{\frac{g_{ii}^{(-)}}{g_{ii}^{0(-)}}} - 1. \qquad (6.6.1)$$

First, just like in *§ 2.2.1*{*see expressions (2.1.23) through (2.1.36)*}, we find the arithmetic mean of the metric tensor components from metrics (6.3.2) and (6.3.3)

$$g_{ii}^{(-)} = \frac{1}{2}\left(g_{ii}^{(-a)} + g_{ii}^{(-b)}\right). \qquad (6.6.2)$$

As a result of calculations by the formula (6.6.2) we obtain

$$g_{00}^{(-)} = \frac{1}{2}\left(g_{00}^{(-a)} + g_{00}^{(-b)}\right) = \frac{1}{2}\left(1-\frac{r_6 r}{\rho^2}+1+\frac{r_6 r}{\rho^2}\right) = 1\,,$$

$$g_{11}^{(-)} = \frac{1}{2}\left(g_{11}^{(-a)} + g_{11}^{(-b)}\right) = -\frac{1}{2}\left(\frac{\rho^2}{(r^2-r_6 r+a^2)}+\frac{\rho^2}{(r^2+r_6 r+a^2)}\right) = -\frac{\rho^2\left(r^2+a^2\right)}{(r^2-r_6 r+a^2)(r^2+r_6 r+a^2)}\,,$$

$$g_{22}^{(-)} = \frac{1}{2}\left(g_{22}^{(-a)} + g_{22}^{(-b)}\right) = -\frac{1}{2}\left(\rho^2+\rho^2\right) = -\rho^2\,,$$

$$g_{33}^{(-)} = \frac{1}{2}\left(g_{33}^{(-a)} + g_{33}^{(-b)}\right) = -\frac{1}{2}\left[\left(r^2+a^2+\frac{r_6 r a^2\sin^2\theta}{\rho^2}\right)+\left(r^2+a^2-\frac{r_6 r a^2\sin^2\theta}{\rho^2}\right)\right]\sin^2\theta = -\left(r^2+a^2\right)\sin^2\theta,$$

$$g_{03}^{(-)} = \frac{1}{2}\left(g_{03}^{(-a)} + g_{03}^{(-b)}\right) = \frac{1}{2}\left(\frac{2r_6 r a}{\rho^2}+\frac{2r_6 r a}{\rho^2}\right)\sin^2\theta = \frac{2r_6 r a}{\rho^2}\sin^2\theta,$$

$$(6.6.3)$$

the remaining $g_{ij}^{(-)} = 0$.

The components of the metric tensor $g_{ij}^{0(-)}$ describing the not curved (initial) state of the area in question of the outer side of the 2^3-$\lambda_{m,n}$-vacuum region comes from the metric of the scope (6.5.8):

$$g_{11}^{0(-)} = -\frac{\rho^2}{r^2+a^2}, \qquad g_{22}^{0(-)} = -\rho^2, \qquad g_{33}^{0(-)} = -\left(r^2+a^2\right)\sin^2\theta. \qquad (6.6.4)$$

Substituting the components (6.6.3) and (6.6.4) into the expression for the relative lengthening of the outer side 2^3-$\lambda_{-11,-16}$-vacuum region (6.6.1), we obtain

$$l_r^{(-)} = \sqrt{\frac{(r^2+a^2)^2}{(r^2-r_6r+a^2)(r^2+r_6r+a^2)}} - 1, \qquad (6.6.5)$$

$$l_\theta^{(-)} = 0,$$

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

The graph of the function (6.6.5) at r_6 = 1 and V_z/c = 0.007 is shown in Figure 6.6.1.

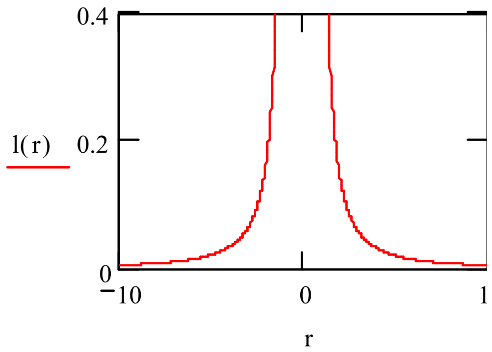


Fig. 6.6.1. The graph of the function (6.6.5) with r_6 = 1 and V_z/c = 0.007. The calculations are performed using the MathCad software

From other graphs of the same function (6.6.5) shown in Figure 6.6.2, we see that with an increase in the speed of movement of the «electron» V_z, the radius of its *rakya* (hence the size of its core) decreases.

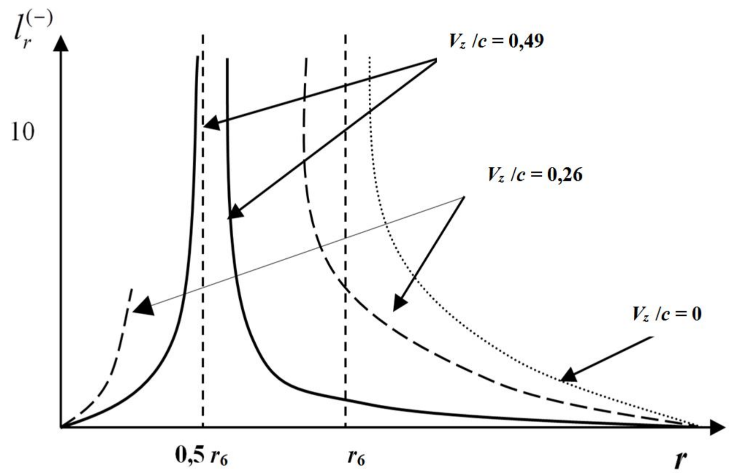


Fig. 6.6.2. Graphs of the function (6.6.5), i.e., the relative lengthening of the local sections of the outer side 2^3-$\lambda_{-11\div-16}$-vacuum region in the outer shell of the «electron» moving at a constant speed V_z at r_6 = 1 and various values of the ratio $a = V_z/c$

Deformations of the «positron's» outer shell, which moves at a constant speed V_z in the direction of the z axis, are determined by substituting the components of metric tensor $g_{ij}^{(+a)}$, $g_{ij}^{(+b)}$ and $g_{ij}^{0(+)}$ of the metric (6.3.5) through (6.3.6) and (6.5.9) in expressions of the form (6.6.1) and (6.6.2). Calculations using these formulas lead to similar relative lengthening of the inner side of the same 2^3-$\lambda_{-11,-16}$-vacuum region (Figure 6.6.2).

6.7 Simplified metric-dynamic model of the moving «electron» and the moving «positron»

Recall that in the framework of Alsigna «electron» is a stable "convex" deformation of the outer side of the 2^3-$\lambda_{-11,-16}$-vacuum region (i.e. subcont, see Definition *1.7.4* and table 6.2.1), a stationary metric-dynamic state of which is described by a set of metrics *(5.8.2) through (5.8.10)*.

In turn, the «positron» is stable "concave" deformation of the inner side 2^3-$\lambda_{-11,-16}$-vacuum region (i.e. antisubcont, see Definition *1.7.5* and table. 6.2.1), a stationary metric-dynamic state of which is described by a set of metrics *(5.8.12) through (5.8.20)*.

Taking into account the assumptions made in §§ 6.2 and 6.3, a simplified metric-dynamic model of an «electron» moving at a constant speed V_z in the direction of the z axis as a single vacuum formation with respect to the vacuum extent from which it consists itself is described by a set of metrics:

A moving «electron» (6.7.1)

with signature $(+\,-\,-\,-)$

The outer shell of a moving «electron»

in the interval [$r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm]

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

– a-subcont; (6.7.2)

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

– b-subcont. (6.7.3)

The core of a moving «electron»

in the interval [$r_6 \sim 10^{-24}$ cm, $r_3 \sim 10^{13}$ cm]

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

– a-subcont; (6.7.4)

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

– b-subcont. (6.7.5)

The scope of a moving «electron»

in the interval [0, ∞]

]

$$ds_5^{(-)2} = c^2 dt^2 - \frac{\rho^2 dr^2}{r^2 + a^2} - \rho^2 d\theta^2 - \left(r^2 + a^2\right)\sin^2\theta\, d\varphi^2. \quad (6.7.6)$$

where $\rho^2 = r^2 + a^2\cos^2\theta$; $a = r_6 \dfrac{V_z}{2c}$ – the parameter of ellipticity; (6.7.7)

$r_6 \sim 1.7 \cdot 10^{-13}$ cm is the radius of the core of the «electron»;

$r_7 \sim 5.8 \cdot 10^{-24}$ cm is the radius of the internal particelle (i.e., the core of proto-quark) inside the «electron's» core.

In this case, a simplified metric-dynamic model of «positron» moving at a constant speed V_z in the direction of the z axis as a single vacuum formation with respect to the “vacuum” from which it consists itself is described by a set of metrics:

A moving «positron» (6.7.8)

with signature $(-+++)$

The outer shell of a moving «positron»

in the interval $[r_6 \sim 10^{-13}$ cm, $r_3 \sim 10^{18}$ cm$]$

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

– a-antisubcont; (6.7.9)

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

– b-antisubcont. (6.7.10)

The core of a moving «positron»

in the interval $[r_6 \sim 10^{-24}$ cm, $r_3 \sim 10^{13}$ cm$]$

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

– a-antisubcont; (6.7.11)

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

– b-antisubcont. (6.7.12)

The scope of a moving «positron»

in the interval $[0, \infty]$

$$ds_5^{(+)2} = -c^2dt^2 + \frac{\rho^2 dr^2}{r^2 + a^2} + \rho^2 d\theta^2 + \left(r^2 + a^2\right)\sin^2\theta\, d\varphi^2. \qquad (6.7.13)$$

where $\rho^2 = r^2 + a^2\cos^2\theta$; $a = r_6 \dfrac{V_z}{2c}$ – the parameter of ellipticity; (6.7.14)

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

$r_7 \sim 5.8\cdot 10^{-24}$ cm is the radius of the internal particelle (i.e., the antiproto-quark nucleus) inside the «positron’s» core.

On the one hand, the ellipticity parameter a depends on the velocity of the «particle» as a single vacuum formation moving relative to the "vacuum" from which it consists. On the other hand, distortion (more precisely-flattening) of the spherical shape of the «particle» core by the value a inevitably leads to the averaged rotation of the core around the selected direction (in particular with respect to the z axis) (see § 6.12).

6.8 Accelerated movement of the vacuum layer

Let's consider the accelerated movement of the local areas of various layers of the 2^3-$\lambda_{-11,-16}$-vacuum region in the vicinity of the core of a moving «particle» at the example of the moving «electron».

Constantly, uniformly and rectilinearly moving «electron» is a stationary object. That is, the components of a metric tensor in metrics (6.7.2) through (6.7.7) describing its metric-dynamic state do not change over time. Therefore, the acceleration vector *(5.6.1)*

$$\vec{a} = \frac{c^2}{\sqrt{1-\frac{v^2}{c^2}}}\left\{-grad\,(\ln\sqrt{g_{00}}) + \frac{1}{c}\left[\vec{v}\times\sqrt{g_{00}}\,rot\,\vec{g}\right]\right\} \tag{6.8.1}$$

is suitable to describe the dynamics of each vacuum layer in the vicinity of the core of the moving «electron».

This vector has components of *(5.5.22)*

$$a_\alpha = \frac{c^2}{\sqrt{1-\frac{v^2}{c^2}}}\left\{-\frac{\partial \ln\sqrt{g_{00}}}{\partial x^a} + \sqrt{g_{00}}\left(\frac{\partial g_\beta}{\partial x^a} - \frac{\partial g_\alpha}{\partial x^\beta}\right)\frac{v^\beta}{c}\right\}, \tag{6.8.2}$$

To use these expressions we will need the following information:

1. The gradient of any scalar function $G\,(x,y,z)$

$$grad\ G = \frac{\partial G}{\partial x}i + \frac{\partial G}{\partial y}j + \frac{\partial G}{\partial z}k \tag{6.8.3}$$

in the curved coordinates of the Riemann space has the form [31]

$$\nabla G = e_i g^{ji}\frac{\partial G}{\partial x^j}, \tag{6.8.4}$$

where e_i are the components of the unit vector (i, j, k);

g^{ij} is the contravariant components of the metric tensor, which is defined by the expression [31]

$$g^{ij} = \frac{\Delta_{ij}}{g}, \tag{6.8.5}$$

where
$$g = \|g_{ij}\| = -\left(r^2 + a^2\cos^2\theta\right)^2\sin^2\theta \tag{6.8.6}$$

– the determinant; Δ_{ij} is the cofactor of the corresponding element of the matrix (g_{ij}).

2. The rotor of any vector **F**

$$rot\vec{F} = \left(\frac{\partial F_z}{\partial y} - \frac{\partial F_y}{\partial z}\right)i + \left(\frac{\partial F_x}{\partial z} - \frac{\partial F_z}{\partial x}\right)j + \left(\frac{\partial F_y}{\partial x} - \frac{\partial F_x}{\partial y}\right)k \tag{6.8.7}$$

in curved coordinates it looks like [31]

$$\frac{1}{\sqrt{|g|}}\frac{DF_j}{\partial x^i}e^{ijk} = \frac{1}{2\sqrt{|g|}}\left(\frac{\partial F_j}{\partial x^i} - \frac{\partial F_i}{\partial x^j}\right)e^{ijk}, \qquad (6.8.8)$$

where e^{ijk} after summation become e^k – components of the unit vector (i, j, k).

6.9 Accelerated currents of *a*-subcont in the outer shell of a moving «electron». Basics of vacuum electrodynamics

Let's apply a vector of the form (6.8.1) to determine the acceleration of an a-subcont in the outer shell of a moving «electron»

$$\vec{a}^{(-a)} = \frac{c^2}{\sqrt{1-\frac{v^{(-a)2}}{c^2}}}\left\{-grad\,(\ln\sqrt{g_{00}^{(-a)}}) + \frac{1}{c}\left[\vec{v}\times\sqrt{g_{00}^{(-a)}}\,rot\,\vec{g}^{(-a)}\right]\right\} \qquad (6.9.1)$$

with components

$$a_\alpha^{(-a)} = \frac{c^2}{\sqrt{1-\frac{v^{(-a)2}}{c^2}}}\left\{-\frac{\partial\ln\sqrt{g_{00}^{(-a)}}}{\partial x^a} + \sqrt{g_{00}^{(-a)}}\left(\frac{\partial g_\beta^{(-a)}}{\partial x^a} - \frac{\partial g_\alpha^{(-a)}}{\partial x^\beta}\right)\frac{v^{(-a)\beta}}{c}\right\}, \qquad (6.9.2)$$

where,
$$g_\alpha^{(-a)} = -\frac{g_{0\alpha}^{(-a)}}{g_{00}^{(-a)}} \qquad (6.9.3)$$

$$v^{(-a)\beta} = \frac{dx^\beta}{d\tau^{(-a)}} = \frac{dx^\beta}{\frac{\sqrt{g_{00}^{(-a)}}}{c}\left(dx^0 + \frac{g_{0\alpha}^{(-a)}}{g_{00}^{(-a)}}dx^\alpha\right)}. \qquad (6.9.4)$$

– components of the 3-dimensional velocity vector of a local section of a-subcont;

$v^{(-a)}$ – velocity, which is determined similarly to (2.1.48) through (2.1.51) or (2.2.27) through (2.2.28) by means of equating component g_{00} from metric (2.1.45) with component $g_{00}^{(-a)}$ from metric (6.8.9)

$$\left(1-\frac{v_r^{(-a)2}}{c^2}\right) = \left(1-\frac{r_6 r}{r^2+a^2\cos^2\theta}\right) \qquad (6.9.5)$$

whence it follows that

$$v^{(-a)} = -c\sqrt{\frac{r_6 r}{r^2+a^2\cos^2\theta}}\,. \qquad (6.9.6)$$

The vector (6.8.1) can be represented as follows {*see (5.6.1 through 5.6.7)*}

$$\mathbf{a}^{(-\alpha)} = \mathbf{E}_o^{(-\alpha)} + [\mathrm{v}^{(-\alpha)}\times\mathbf{B}_o^{(-\alpha)}], \qquad (6.9.7)$$

where

$$\mathbf{a}_{\mathrm{E}}^{(-\alpha)} = \mathbf{E}_o^{(-\alpha)} = -\gamma\,grad\left(\ln\sqrt{g_{00}^{(-a)}}\right) \qquad (6.9.8)$$

– the vector of laminar (straight-line) acceleration of the a-subcont (or the vector of a-subcont intensity $\mathbf{E}_o{}^{(-\alpha)}$);

$$\mathbf{a}_{\mathrm{B}}{}^{(-\alpha)} = [\mathbf{v}\times \mathbf{B}_o{}^{(-\alpha)}] = \gamma\sqrt{g_{00}^{(-a)}}\,\left(\frac{\partial g_{\beta}^{(-a)}}{\partial x^{a}}-\frac{\partial g_{\alpha}^{(-a)}}{\partial x^{\beta}}\right)\frac{v^{(-a)\beta}}{c} \tag{6.9.9}$$

– the vector of turbulent (rotational) acceleration of the a-subcont (or the vector of a-subcont induction $\mathbf{B}_o{}^{(-\alpha)}$), and

$$\gamma = \frac{c^2}{\sqrt{1-\frac{v^{(-a)2}}{c^2}}}. \tag{6.9.10}$$

Vector components (6.9.8), taking into account (6.8.4), have the following form {*see (5.6.6)*}

$$a_{Er}^{(-a)} = E_{or}^{(-a)} = -\gamma\frac{\partial\ln\sqrt{g_{00}^{(-a)}}}{\partial r*},$$

$$a_{E\theta}^{(-a)} = E_{o\theta}^{(-a)} = -\gamma\frac{\partial\ln\sqrt{g_{00}^{(-a)}}}{\partial \theta*}, \tag{6.9.11}$$

$$a_{E\varphi}^{(-a)} = E_{o\varphi}^{(-a)} = -\gamma\frac{\partial\ln\sqrt{g_{00}^{(-a)}}}{\partial \varphi*},$$

where
$$\frac{\partial}{\partial r*} = g^{11(-a)}\frac{\partial}{\partial r},\qquad \frac{\partial}{\partial \theta*} = g^{22(-a)}\frac{\partial}{\partial \theta},\qquad \frac{\partial}{\partial \varphi*} = g^{33(-a)}\frac{\partial}{\partial \varphi}. \tag{6.9.12}$$

The components of the vector (6.9.9) with account (6.8.8) have the following form {*see (5.6.7)*}:

$$a_{Br}^{(-a)} = \left(v^{\theta}B_{0\varphi}^{(-a)} - v^{\varphi}B_{0\theta}^{(-a)}\right) = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{c}\left\{v^{\theta}\left(\frac{\partial g_{\theta}^{(-a)}}{\partial r^{+}}-\frac{\partial g_{r}^{(-a)}}{\partial \theta^{+}}\right)-v^{\varphi}\left(\frac{\partial g_{r}^{(-a)}}{\partial \varphi^{+}}-\frac{\partial g_{\varphi}^{(-a)}}{\partial r^{+}}\right)\right\},$$

$$a_{B\theta}^{(-a)} = \left(v^{\varphi}B_{0r}^{(-a)} - v^{r}B_{0\varphi}^{(-a)}\right) = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{c}\left\{v^{\varphi}\left(\frac{\partial g_{\varphi}^{(-a)}}{\partial \theta^{+}}-\frac{\partial g_{\theta}^{(-a)}}{\partial \varphi^{+}}\right)-v^{r}\left(\frac{\partial g_{\theta}^{(-a)}}{\partial r^{+}}-\frac{\partial g_{r}^{(-a)}}{\partial \theta^{+}}\right)\right\}, \tag{6.9.13}$$

$$a_{B\varphi}^{(-a)} = \left(v^{r}B_{0\theta}^{(-a)} - v^{\theta}B_{0r}^{(-a)}\right) = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{c}\left\{v^{r}\left(\frac{\partial g_{r}^{(-a)}}{\partial \varphi^{+}}-\frac{\partial g_{\varphi}^{(-a)}}{\partial r^{+}}\right)-v^{\theta}\left(\frac{\partial g_{\varphi}^{(-a)}}{\partial \theta^{+}}-\frac{\partial g_{\theta}^{(-a)}}{\partial \varphi^{+}}\right)\right\},$$

where
$$\frac{\partial}{\partial r^{+}} = \frac{1}{2\sqrt{|g|}}\frac{\partial}{\partial r},\qquad \frac{\partial}{\partial \theta^{+}} = \frac{1}{2\sqrt{|g|}}\frac{\partial}{\partial \theta},\qquad \frac{\partial}{\partial \varphi^{+}} = \frac{1}{2\sqrt{|g|}}\frac{\partial}{\partial \varphi}. \tag{6.9.14}$$

Recall that the expression (6.9.7) is similar to the Lorentz force in classical electrodynamics {*see (5.6.4)* through *(5.6.5)*}. But within Alsigna this expression describes not the motion of a charged particle in some abstract electromagnetic field. In the case it describes the accelerated laminar and turbulent flow (current) of subcont and antisubcont of the 2^3-$\lambda_{m,n}$-vacuum region, which may induce movement of the local vacuum formation just as the river carries the boat.

Let us write the components of the vector of a-subcont intensity $\mathbf{E}_o^{(-\alpha)}$ and the components of the vector of a-subcont induction $\mathbf{B}_o^{(-\alpha)}$

$$E_{or}^{(-a)} = -\gamma \frac{\partial \ln \sqrt{g_{00}^{(-a)}}}{\partial r^*}, \qquad E_{o\theta}^{(-a)} = -\gamma \frac{\partial \ln \sqrt{g_{00}^{(-a)}}}{\partial \theta^*}, \qquad E_{o\varphi}^{(-a)} = -\gamma \frac{\partial \ln \sqrt{g_{00}^{(-a)}}}{\partial \varphi^*}; \tag{6.9.15}$$

$$B_{or}^{(-a)} = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{c}\left(\frac{\partial g_{\varphi}^{(-a)}}{\partial \theta^+} - \frac{\partial g_{\theta}^{(-a)}}{\partial \varphi^+}\right), \qquad B_{o\theta}^{(-a)} = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{c}\left(\frac{\partial g_{r}^{(-a)}}{\partial \varphi^+} - \frac{\partial g_{\varphi}^{(-a)}}{\partial r^+}\right), \qquad B_{o\varphi}^{(-a)} = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{c}\left(\frac{\partial g_{\theta}^{(-a)}}{\partial r^+} - \frac{\partial g_{r}^{(-a)}}{\partial \theta^+}\right). \tag{6.9.16}$$

We define the components of $\mathbf{E}_o^{(-\alpha)}$ and $\mathbf{B}_o^{(-\alpha)}$ vectors in the outer shell of an «electron», which is moving at a constant speed V_z. To do this, we write a generalized Kerr metric (in Boyer – Lindquist coordinates) (6.7.2) describing the metric-dynamic state of the a-subcont in the outer shell of the moving «electron» in expanded form

$$\begin{aligned} ds_1^{(-a)2} = &\left(1 - \frac{r_6 r}{r^2 + a^2\cos^2\theta}\right)c^2dt^2 - \frac{r^2 + a^2\cos^2\theta}{r^2 + a^2 - rr_e}dr^2 - \left(r^2 + a^2\cos^2\theta\right)d\theta^2 - \\ &- \left(r^2 + a^2 + \frac{r_6 ra^2\sin^2\theta}{r^2 + a^2\cos^2\theta}\right)\sin^2\theta\, d\varphi^2 + \frac{2r_6 ra}{r^2 + a^2\cos^2\theta}\sin^2\theta\; d\varphi\; cdt. \end{aligned} \tag{6.9.17}$$

Substituting the components of the metric tensor $g_{ij}^{(-a)}$ from the metric (6.9.17) into the expression (6.8.5) and (6.8.6), we obtain contravariant components

$$g^{ij(-a)} = \begin{pmatrix} \frac{(r^2+a^2)(r^2+a^2\cos^2\theta)+r_6 ra^2\sin^2\theta}{(r^2+a^2-rr_6)(r^2+a^2\cos^2\theta)} & 0 & 0 & \frac{r_6 ra}{(r^2+a^2-rr_6)(r^2+a^2\cos^2\theta)} \\ 0 & \frac{-(r^2+a^2-rr_6)}{r^2+a^2\cos^2\theta} & 0 & 0 \\ 0 & 0 & \frac{-1}{r^2+a^2\cos^2\theta} & 0 \\ \frac{r_6 ra}{(r^2+a^2-rr_6)(r^2+a^2\cos^2\theta)} & 0 & 0 & \frac{-(r^2+a^2\cos^2\theta-rr_6)}{(r^2+a^2-rr_6)(r^2+a^2\cos^2\theta)\sin^2\theta} \end{pmatrix} \tag{6.9.18}$$

Zero components of the metric tensor from the metric (6.9.17) are

$$g_{00}^{(-\alpha)}=1-\frac{r_6 r}{r^2+a^2\cos^2\theta},\qquad g_{01}^{(-\alpha)}=g_{02}^{(-\alpha)}=0,\qquad g_{03}^{(-\alpha)}=\frac{2r_6 ra\sin^2\theta}{r^2+a^2\cos^2\theta}\ . \tag{6.9.19}$$

Herewith, according to (6.9.3), we have

$$g_r^{(-a)}=-\frac{g_{01}^{(-a)}}{g_{00}^{(-a)}}=0,\qquad g_\theta^{(-a)}=-\frac{g_{02}^{(-a)}}{g_{00}^{(-a)}}=0,\qquad g_\varphi^{(-a)}=-\frac{g_{03}^{(-a)}}{g_{00}^{(-a)}}=-\frac{2r_6 ra\sin^2\theta}{r^2+a^2\cos^2\theta-r_6 r} \tag{6.9.20}$$

and, according to (6.9.5)

$$\gamma=\frac{c^2}{\sqrt{1-\frac{v^{(-a)2}}{c^2}}}=\frac{c^2}{\sqrt{1-\frac{r_6 r}{\rho^2}}}=\frac{c^2}{\sqrt{g_{00}^{(-\alpha)}}} \tag{6.9.21}$$

Substitute the covariant components of the metric tensor (6.9.19) and contravariant components of the metric tensor (6.9.18) into expressions for the components of the vectors of a-subcont intensity $\mathbf{E}_o^{(-\alpha)}$ (6.9.15) and a-subcont induction $\mathbf{B}_o^{(-\alpha)}$ (6.9.16).

As a result of calculations for the components of the vector a-subcont intensity $\mathbf{E}_o^{(-\alpha)}$ (6.9.15), taking into account (6.9.10) and (6.9.12), we obtain

$$a_{Er}^{(-a)}=E_{or}^{(-a)}=-\gamma\frac{\partial\ln\sqrt{g_{00}^{(-\alpha)}}}{\partial r^*}=-\frac{c^2 r_6\left(a^2\cos^2\theta-r^2\right)\left(r^2+a^2-rr_6\right)}{2\left(1-\frac{r_6 r}{r^2+a^2\cos^2\theta}\right)^{\frac{3}{2}}\left(r^2+a^2\cos^2\theta\right)^3}, \tag{6.9.22}$$

$$a_{E\theta}^{(-a)}=E_{o\theta}^{(-a)}=-\gamma\frac{\partial\ln\sqrt{g_{00}^{(-a)}}}{\partial\theta^*}=\frac{c^2 rr_6 a^2\sin 2\theta}{2\left(1-\frac{r_6 r}{r^2+a^2\cos^2\theta}\right)^{\frac{3}{2}}\left(r^2+a^2\cos^2\theta\right)^3}, \tag{6.9.23}$$

$$a_{E\varphi}^{(-a)}=E_{o\varphi}^{(-a)}=-\gamma\frac{\partial\ln\sqrt{g_{00}^{(-a)}}}{\partial\varphi^*}=0. \tag{6.9.24}$$

Attention! *The dimension of the component (6.9.23) is 1/sec^2, different from the dimension of the component (6.9.22) m/sec^2.*

Graphs of functions (6.9.22) and (6.9.23) when $r\sim 10^{-11}$ cm and V_z/c = 0.00098 shown in Figure 6.9.1.

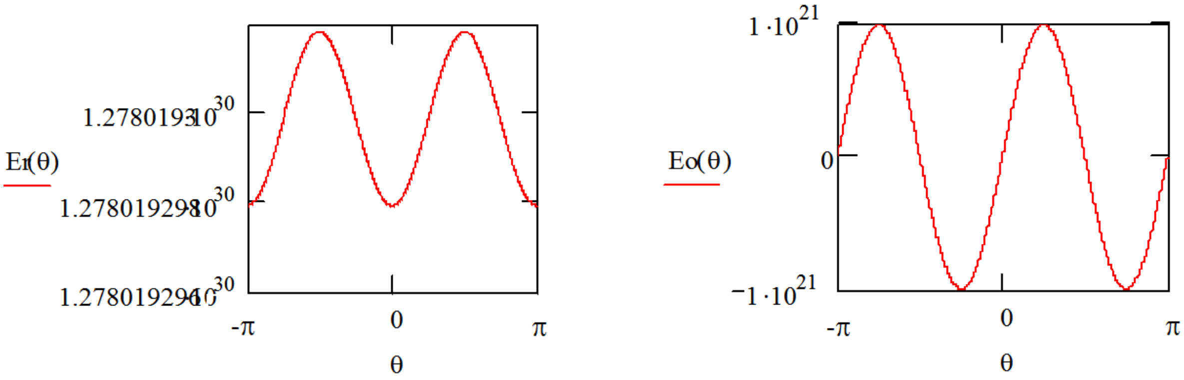


Fig. 6.9.1. Graphs of functions (6.9.22) and (6.9.33) with $r \sim 10^{-11}$ cm and $Vz/c = 0.00098$. The calculations are done using the MathCad software

At $a = 0$, the expressions (6.9.22) through (6.9.24) coincide with the expressions *(5.10.9)* specifying the components of the vector of a-subcont intensity in the outer shell of the resting «electron».

When substituting (6.9.19) through (6.9.21) in (6.9.16) taking into account (6.8.6) and (6.8.8) for the components of the vector a-subcont induction $\mathbf{B}_o^{(-a)}$ in the outer shell of the moving «electron» we obtain:

$$B_{or}^{(-a)} = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{2c\sqrt{|g|}}\left(\frac{\partial g_{\varphi}^{(-a)}}{\partial\theta} - \frac{\partial g_{\theta}^{(-a)}}{\partial\varphi}\right) = -\frac{2\,c\,r r_6\,a\cos\theta\left(r^2 + a^2 - r_6 r\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2}, \tag{6.9.25}$$

$$B_{o\theta}^{(-a)} = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{2c\sqrt{|g|}}\left(\frac{\partial g_{r}^{(-a)}}{\partial\varphi} - \frac{\partial g_{\varphi}^{(-a)}}{\partial r}\right) = \frac{c\,r_6 a\,\sin\theta\left(a^2\cos^2\theta - r^2\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2}, \tag{6.9.26}$$

$$B_{o\varphi}^{(-a)} = \frac{\gamma\sqrt{g_{00}^{(-a)}}}{2c\sqrt{|g|}}\left(\frac{\partial g_{\theta}^{(-a)}}{\partial r} - \frac{\partial g_{r}^{(-a)}}{\partial\theta}\right) = 0. \tag{6.9.27}$$

Attention! *The dimension of the component (6.9.25) is m/sec, whereas the dimension of the component (6.9.26) is 1/sec.*

Substituting the components of the vector a-subcont induction $\mathbf{B}_o^{(-a)}$ (6.9.25) through (6.9.27) into the expression for the component of the turbulent acceleration of an a-subcont in the outer shell of the moving «electron» (6.9.13), we obtain

$$a_{Br}^{(-a)} = \left(-v^{(-a)\varphi} B_{o\theta}^{(-a)}\right) = -\frac{v^{(-a)\varphi} c\, r_6 a \sin\theta \left(a^2\cos^2\theta - r^2\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2}$$

$$a_{B\theta}^{(-a)} = \left(v^{(-a)\varphi} B_{or}^{(-a)}\right) = -\frac{v^{(-a)\varphi}\, 2c\, r_6\, a\cos\theta \left(r^2 + a^2 - r_6 r\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2} \qquad (6.9.28)$$

$$a_{B\varphi}^{(-a)} = \left(v^{(-a)r} B_{o\theta}^{(-a)} - v^{\theta(-a)} B_{or}^{(-a)}\right) = \frac{v^{(-a)r} c\, r_6 a \sin\theta \left(a^2\cos^2\theta - r^2\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2} +$$

$$+\frac{v^{(-a)\theta}\, 2c\, r_6\, a\cos\theta \left(r^2 + a^2 - r_6 r\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2},$$

where $v^{(-a)\beta}$ is defined by the expression of the form (6.9.4).

The graph of the second component (6.9.28) is given in Figure 6.9.2.

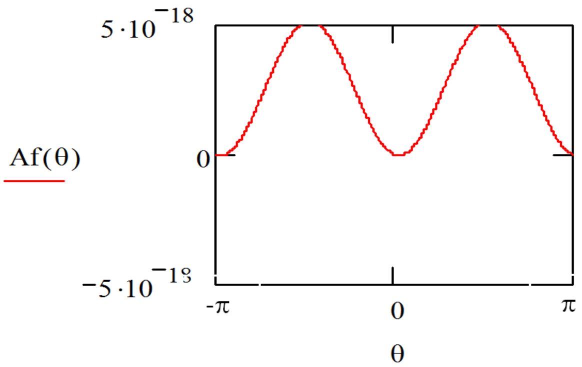


Fig. 6.9.2. Schedule the second components of (9.28) with $r \sim 9$ cm, $V_z/c = 0.087$ and $v^{\beta} = 1$ m/s. The calculations are performed using MathCad software

Together, the expressions (6.9.22) through (6.9.28) define the vector field of laminar and turbulent accelerations of the a-subcont in the outer shell of the «electron» moving with the speed V_z in the direction of the *z*-axis.

However, these expressions define the basis of "*a*-subcont electrodynamics", in which the intensity and induction of the vacuum layer is a set of vector fields that determine the direction of accelerated currents of *a*-subcont (i.e., the outer side of the external side of the 2^3-$\lambda_{m,n}$-vacuum region, see table 6.2.1) in the outer shell of the moving «electron».

6.10 Accelerated currents of the *b*-subcont in the outer shell of a moving «electron»

The behavior of *b*-subcont (i.e., the inner side of the external side of 2^3-$\lambda_{m,n}$-vacuum region, see table. 6.2.1) in the outer shell of the moving «electron» is described by the second generalized Kerr metric (6.3.3)

$$ds_1^{(-b)2} = \left(1+\frac{r_6 r}{r^2+a^2\cos^2\theta}\right)c^2dt^2 - \frac{r^2+a^2\cos^2\theta}{r^2+a^2+rr_6}dr^2 - \left(r^2+a^2\cos^2\theta\right)d\theta^2 -$$
$$-\left(r^2+a^2-\frac{r_6 ra^2\sin^2\theta}{r^2+a^2\cos^2\theta}\right)\sin^2\theta\, d\varphi^2 + \frac{2r_6 ra}{r^2+a^2\cos^2\theta}\sin^2\theta\; d\varphi\; cdt. \qquad (6.10.1)$$

In this case, the zero components $g_{0i}^{(-b)}$ of the metric tensor have the form

$$g_{00}^{(-b)} = 1+\frac{r_6 r}{r^2+a^2\cos^2\theta}, \quad g_{01}^{(-b)} = g_{02}^{(-b)} = 0, \quad g_{03}^{(-b)} = \frac{2r_6 ra\sin^2\theta}{r^2+a^2\cos^2\theta}. \qquad (6.10.2)$$

Herewith

$$g_r^{(-b)} = -\frac{g_{01}^{(-b)}}{g_{00}^{(-b)}} = 0, \quad g_\theta^{(-b)} = -\frac{g_{02}^{(-b)}}{g_{00}^{(-b)}} = 0, \quad g_\varphi^{(-b)} = -\frac{g_{03}^{(-b)}}{g_{00}^{(-b)}} = -\frac{2r_6 ra\sin^2\theta}{r^2+a^2\cos^2\theta+r_6 r}. \qquad (6.10.3)$$

$$\gamma = \frac{c^2}{\sqrt{1-\frac{v_r^{(-b)2}}{c^2}}} = \frac{c^2}{\sqrt{1+\frac{r_6 r}{\rho^2}}} = \frac{c^2}{\sqrt{g_{00}^{(-b)}}} \qquad (6.10.4)$$

Contravariant components of the metric tensor in this case have the form

$$g^{ij(-b)} = \begin{pmatrix} \frac{(r^2+a^2)(r^2+a^2\cos^2\theta)-r_6 ra^2\sin^2\theta}{(r^2+a^2+rr_6)(r^2+a^2\cos^2\theta)} & 0 & 0 & \frac{r_6 ra}{(r^2+a^2+rr_6)(r^2+a^2\cos^2\theta)} \\ 0 & \frac{-(r^2+a^2+rr_6)}{r^2+a^2\cos^2\theta} & 0 & 0 \\ 0 & 0 & \frac{-1}{r^2+a^2\cos^2\theta} & 0 \\ \frac{r_6 ra}{(r^2+a^2+rr_6)(r^2+a^2\cos^2\theta)} & 0 & 0 & \frac{-(r^2+a^2\cos^2\theta+rr_6)}{(r^2+a^2+rr_6)(r^2+a^2\cos^2\theta)\sin^2\theta} \end{pmatrix}$$

(6.10.5)

Similar to the previous paragraph, we use expressions (6.10.2) through (6.10.5) to define the components of the $\mathbf{E}_o^{(-b)}$ and $\mathbf{B}_o^{(-b)}$ vectors.

As a result of calculations for the outer shell of a moving «electron», we obtain:
– components of the vector *b*-subcont of the intensity $\mathbf{E}_o^{(-b)}$:

$$a_{Er}^{(-b)} = E_{or}^{(-b)} = -\gamma \frac{\partial \ln \sqrt{g_{00}{}^{(-b)}}}{\partial r*} = \frac{c^2 r_6 \left(a^2 \cos^2\theta - r^2\right)\left(r^2 + a^2 + rr_6\right)}{2\left(1 + \frac{r_6 r}{r^2 + a^2\cos^2\theta}\right)^{\frac{3}{2}} \left(r^2 + a^2\cos^2\theta\right)^3}, \tag{6.10.6}$$

$$a_{E\theta}^{(-b)} = E_{o\theta}^{(-b)} = -\gamma \frac{\partial \ln \sqrt{g_{00}^{(-b)}}}{\partial \theta^*} = -\frac{c^2 r r_6 a^2 \sin 2\theta}{2\left(1 + \frac{r_6 r}{r^2 + a^2\cos^2\theta}\right)^{\frac{3}{2}} \left(r^2 + a^2\cos^2\theta\right)^3}, \tag{6.10.7}$$

$$a_{E\varphi}^{(-b)} = E_{o\varphi}^{(-b)} = -\gamma \frac{\partial \ln \sqrt{g_{00}^{(-b)}}}{\partial \varphi^*} = 0; \tag{6.10.8}$$

– components of the vector b-subcont of the induction $\mathbf{B}_o{}^{(-b)}$:

$$B_{or}^{(-b)} = \frac{\gamma \sqrt{g_{00}^{(-b)}}}{2c\sqrt{|g|}} \left(\frac{\partial g_\varphi^{(-b)}}{\partial \theta} - \frac{\partial g_\theta^{(-b)}}{\partial \varphi} \right) = -\frac{2crr_6\, a\cos\theta\left(r^2 + a^2 + r_6 r\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta + r_6 r\right)^2}, \tag{6.10.9}$$

$$B_{o\theta}^{(-b)} = \frac{\gamma \sqrt{g_{00}^{(-b)}}}{2c\sqrt{|g|}} \left(\frac{\partial g_r^{(-b)}}{\partial \varphi} - \frac{\partial g_\varphi^{(-b)}}{\partial r} \right) = \frac{c r_6 a \sin\theta\left(a^2\cos^2\theta - r^2\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta + r_6 r\right)^2}, \tag{6.10.10}$$

$$B_{o\varphi}^{(-b)} = \frac{\gamma \sqrt{g_{00}^{(-b)}}}{2c\sqrt{|g|}} \left(\frac{\partial g_\theta^{(-b)}}{\partial r} - \frac{\partial g_r^{(-b)}}{\partial \theta} \right) = 0. \tag{6.10.11}$$

Let's substitute the components of the vector of the b-subcont induction $\mathbf{B}_o{}^{(-b)}$ (6.10.9) through (6.10.11) into the expressions for the components of turbulent (rotational) acceleration of the b-subcont

$$a_{Br}^{(-b)} = \left(v^\theta B_{o\varphi}^{(-b)} - v^\varphi B_{o\theta}^{(-b)}\right) = \frac{\gamma\sqrt{g_{00}^{(-b)}}}{c} \left\{ v^\theta \left(\frac{\partial g_\theta^{(-b)}}{\partial r^+} - \frac{\partial g_r^{(-b)}}{\partial \theta^+} \right) - v^\varphi \left(\frac{\partial g_r^{(-b)}}{\partial \varphi^+} - \frac{\partial g_\varphi^{(-b)}}{\partial r^+} \right) \right\},$$

$$a_{B\theta}^{(-b)} = \left(v^\varphi B_{or}^{(-b)} - v^r B_{o\varphi}^{(-b)}\right) = \frac{\gamma\sqrt{g_{00}^{(-b)}}}{c} \left\{ v^\varphi \left(\frac{\partial g_\varphi^{(-b)}}{\partial \theta^+} - \frac{\partial g_\theta^{(-b)}}{\partial \varphi^+} \right) - v^r \left(\frac{\partial g_\theta^{(-b)}}{\partial r^+} - \frac{\partial g_r^{(-b)}}{\partial \theta^+} \right) \right\}, \tag{6.10.12}$$

$$a_{B\varphi}^{(-b)} = \left(v^r B_{o\theta}^{(-b)} - v^\theta B_{or}^{(-b)}\right) = \frac{\gamma\sqrt{g_{00}^{(-b)}}}{c} \left\{ v^r \left(\frac{\partial g_r^{(-b)}{}_r}{\partial \varphi^+} - \frac{\partial g_\varphi^{(-b)}}{\partial r^+} \right) - v^\theta \left(\frac{\partial g_\varphi^{(-b)}}{\partial \theta^+} - \frac{\partial g_\theta^{(-b)}}{\partial \varphi^+} \right) \right\},$$

As a result we have:

$$a_{Br}^{(-b)}=\left(-v^{(-b)\varphi}B_{o\theta}^{(-b)}\right)=-\frac{v^{(-b)\varphi}c\,r_6 a\,\sin\theta\left(a^2\cos^2\theta-r^2\right)}{\left(r^2+a^2\cos^2\theta\right)^{1/2}\left(r^2+a^2\cos^2\theta+r_6 r\right)^2},$$

$$a_{B\theta}^{(-b)}=\left(v^{(-b)\varphi}B_{or}^{(-b)}\right)=-\frac{v^{(-b)\varphi}2c\,rr_6\,a\cos\theta\left(r^2+a^2+r_6 r\right)}{\left(r^2+a^2\cos^2\theta\right)^{1/2}\left(r^2+a^2\cos^2\theta+r_6 r\right)^2}, \tag{6.10.13}$$

$$a_{B\varphi}^{(-b)}=\left(v^{(-b)r}B_{o\theta}^{(-a)}-v^{\theta(-b)}B_{or}^{(-b)}\right)=\frac{v^{(-b)r}c\,r_6 a\,\sin\theta\left(a^2\cos^2\theta-r^2\right)}{\left(r^2+a^2\cos^2\theta\right)^{1/2}\left(r^2+a^2\cos^2\theta+r_6 r\right)^2}+$$

$$+\frac{v^{(-a)\theta}2c\,rr_6\,a\cos\theta\left(r^2+a^2+r_6 r\right)}{\left(r^2+a^2\cos^2\theta\right)^{1/2}\left(r^2+a^2\cos^2\theta+r_6 r\right)^2}.$$

The second component $a_{B\theta}^{(-a)}$ of the graph (6.10.13) is shown in Figure 6.10.1.

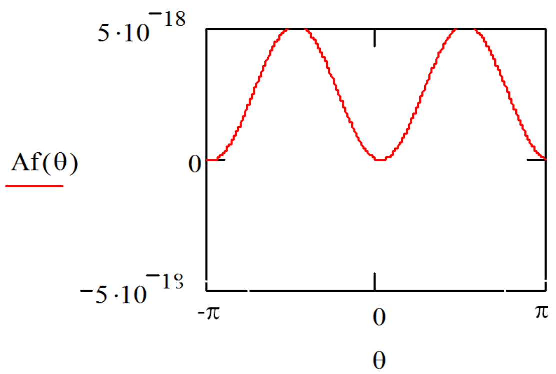


Fig. 6.10.1. Graph of the second components of (6.10.13) with $r \sim 9$ cm, $V_z/c = 0.087$ and $v^{\beta} = 1$ m/s. The calculations are done using MathCad software

This graph almost completely coincides with the graph in Figure 6.9.2. This suggests that at a sufficiently large distance from the core of the moving «electron» (i.e. at $r > r_6$), the induction (turbulent) components of the accelerated motion of a-subcont and b-subcont in the outer shell of the moving «electron» behave almost equally.

Indeed, when $r >> r_6$, expressions (6.9.22) through (6.9.27) and (6.10.6) through (6.10.11) are taking a simplified form

$$E_{or}^{(-a)} \approx \frac{c^2 r_6}{2r^2},\qquad E_{o\theta}^{(-a)} \approx \frac{c^2 r_6 a^2 \sin 2\theta}{2r^5},\qquad E_{o\varphi}^{(-a)} = 0. \tag{6.10.14}$$

$$B_{or}^{(-a)} \approx -\frac{2c r_6\, a \cos\theta}{r^2} \approx -\frac{r_6^2 V_z \cos\theta}{r^2},\qquad B_{o\theta}^{(-a)} \approx -\frac{c r_6 a \sin\theta}{r^3} \approx -\frac{r_6^2 V_z \sin\theta}{2r^3},\qquad B_{o\varphi}^{(-a)} = 0. \tag{6.10.15}$$

$$E_{or}^{(-b)} \approx -\frac{c^2 r_6}{2r^2},\qquad E_{o\theta}^{(-b)} \approx -\frac{c^2 r_6 a^2 \sin 2\theta}{2r^5},\qquad E_{o\varphi}^{(-b)} = 0. \tag{6.10.16}$$

$$B_{or}^{(-b)} \approx -\frac{2c r_6\, a \cos\theta}{r^2} \approx -\frac{r_6^2 V_z \cos\theta}{r^2},\qquad B_{o\theta}^{(-b)} \approx -\frac{c r_6 a \sin\theta}{r^3} \approx -\frac{r_6^2 V_z \sin\theta}{2r^3},\qquad B_{o\varphi}^{(-b)} = 0. \tag{6.10.17}$$

So we see that at a large distance from the core of a moving «electron» laminar (straight-line) acceleration of the *a*-subcont and *b*-subcont mutually oppose to each other, and the turbulent (rotational) of acceleration a of *a*-subcont and *b*-subcont {with (6.9.28) and (6.10.13)} flow in the same direction.

6.11 Accelerated vacuum currents in the outer shell of a moving "electron". Vacuum electrodynamics

Fig. 6.11.1. Fractal illustration of the twisted intra-vacuum accelerated currents of *a*-subcont and *b*-subcont

The total vector field of the accelerated *a*-subcont and *b*-subcont (intra-vacuum) currents in the outer shell of a moving «electron», according to the geometrized vacuum electrodynamics of the Alsigna {*see §§ 5.1 through 5.7*}, is determined by the expression *(5.7.2)*

$$\mathbf{a}_\Sigma = \mathbf{a}^{(-a)} + i\mathbf{a}^{(-b)}, \tag{6.11.1}$$

where

$$\mathbf{a}^{(-a)} = \mathbf{E}_o^{(-a)} + [\mathbf{v}^{(-a)} \times \mathbf{B}_o^{(-a)}] \tag{6.11.2}$$

- acceleration of the *a*-subcont in the outer shell of a moving «electron»;

$$\mathbf{a}^{(-b)} = \mathbf{E}_o^{(-b)} + [\mathbf{v}^{(-b)} \times \mathbf{B}_o^{(-b)}] \tag{6.11.3}$$

- acceleration of the *b*-subcont in the same outer shell of a moving «electron».

The expression (6.11.1), subject to (6.11.2) and (6.11.3), may be presented as

$$\mathbf{a}_\Sigma^{(-)} = (\mathbf{E}_o^{(-a)} + i\mathbf{E}_o^{(-b)}) + ([\mathbf{v}^{(-a)} \times \mathbf{B}_o^{(-a)}] + i[\mathbf{v}^{(-b)} \times \mathbf{B}_o^{(-b)}]). \tag{6.11.4}$$

This type of representation for the General vector field of intra-vacuum accelerations is due to the fact that the current lines of accelerated a-subcont and b-subcont are always mutually perpendicular. In other words, these intra-vacuum currents are twisted into bundles around the direction of general motion (see Figure 6.11.1 and *Figure 5.11.5 through 5.11.6*).

Analysis of the expressions (6.9.22) through (6.9.24), (6.9.28) and (6.10.6) through (6.10.8), (6.10.12) with taking into account (6.11.1) through (6.11.4) leads to the following conclusions:

– a vector field subcont intensity $\mathbf{E}_o^{(-)}$ (more precisely, a vector field of laminar acceleration of subcont)

$$\mathbf{a}_E^{(-)} = \mathbf{E}_o^{(-)} = \mathbf{E}_o^{(-a)} + i\mathbf{E}_o^{(-b)} \qquad (6.11.5)$$

in the outer shell of the moving «electron» flattens (see Figure 6.11.2). This fully coincides with the conclusions of classical electrodynamics;

– a vector field of turbulent acceleration of subcont $\mathbf{a}_B^{(-)} = [\mathbf{v}^{(-a)} \times \mathbf{B}_o^{(-a)}] + i[\mathbf{v}^{(-b)} \times \mathbf{B}_o^{(-b)}]$ is a toroidal-helical $a{\times}b$-subcont vortex formed around the moving core of the «electron» (Figure 6.11.3).

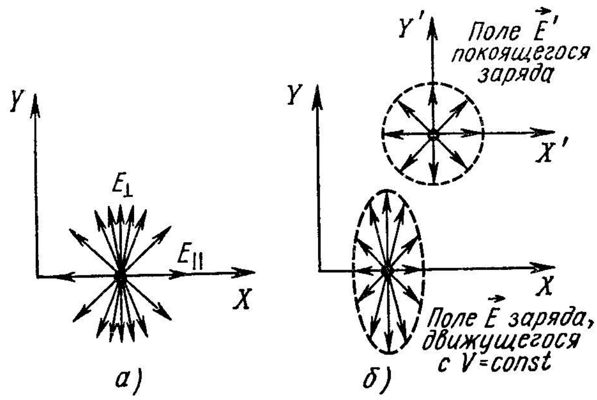


Fig. 6.11.2. Vector field of the subcont tension $\mathbf{E}_o^{(-)}$ (i.e., laminar accelerations of the $a{\times}b$-subcont) in the outer shell of the «electron» moving with constant speed V_z

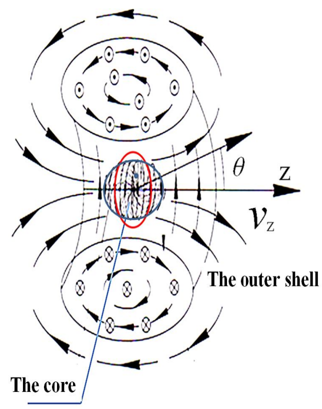
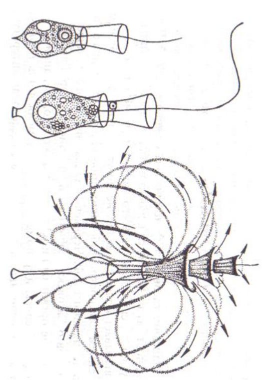


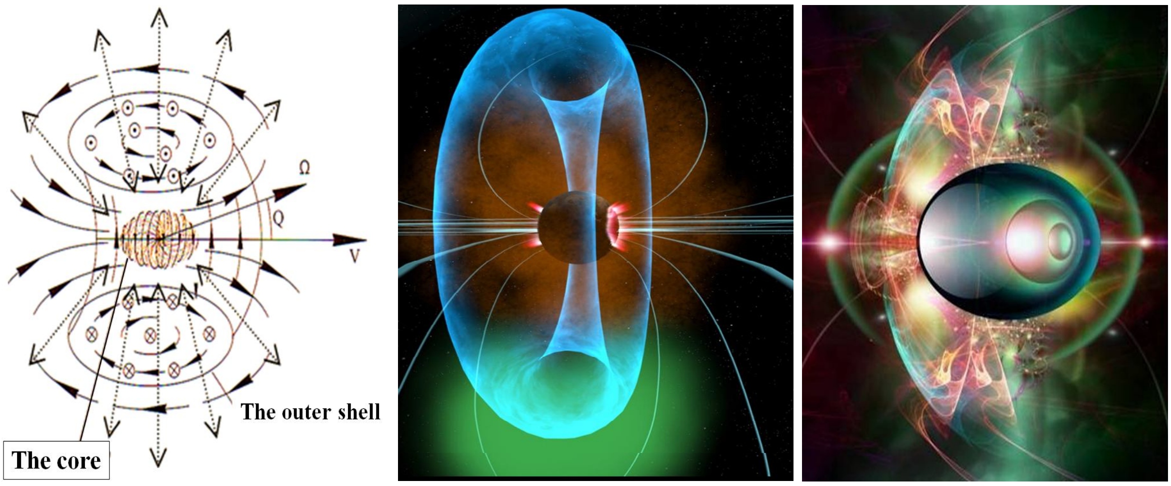
Fig. 6.11.3. The field of the vector of turbulent accelerations of the $a{\times}b$-subcont is a toroidal-helical vortex in the outer shell of an «electron» moving at a constant speed Vz

For Figure 6.11.4a an attempt is presented to combine laminar and turbulent components of vector fields describing the interweaving of accelerated $a{\times}b$-subcont flows (currents) in the outer shell of an «electron» moving at a constant velocity V_z.



In Nature, there are many analogues for the moving vacuum formation shown in Figure 6.11.4. For example, the movement of the collar flagellate (an aqueous unicellular organism) causes a similar toroidal-helical flow of water.

This metric-dynamic (fully geometrized) model of an «electron» moving at a constant velocity V_z in the «vacuum» from which it consists, contains a possible answer to the question about the nature of inertia of stable local vacuum formations.



a) б)

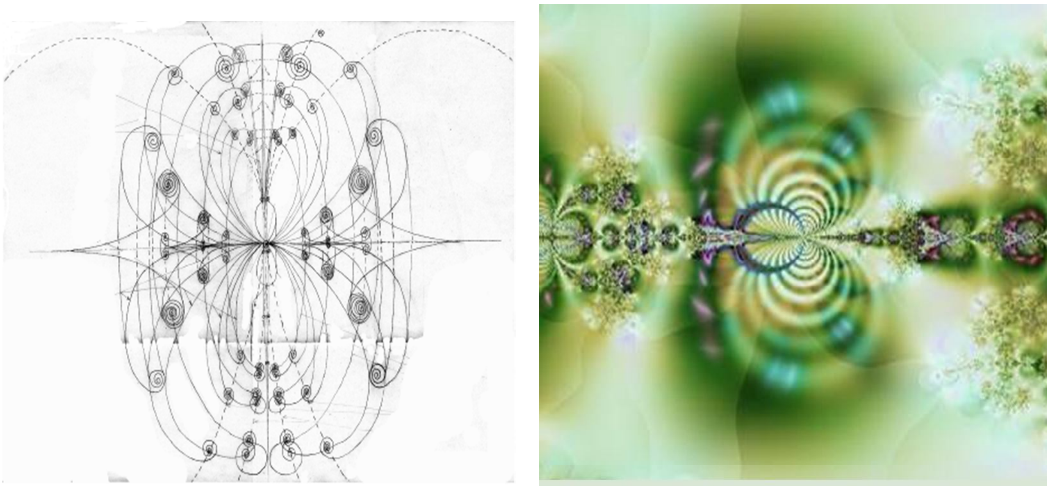
Fig. 6.11.4. a) Accelerated laminar and turbulent $a \times b$-subcont currents in the external shell of an «electron» moving at a constant speed V_z; *b*) Fractal illustration of a stable vacuum formation moving in the "medium" from which it itself consists

The motion of a stable vacuum formation inevitably leads to the appearance of a toroidal-helical vortex in its outer shell (i.e. around its moving core), and to the compactification and flattening of the core (Figure 6.11.4 a). The faster this «particle» moves, the greater the speed and acceleration of an $a \times b$-subcont in toroidal-helical vortex. Accordingly, in such a vortex there is more stored energeticity (i.e. mobility). Therefore, the moving «particle» is more difficult to disperse and more difficult to change the direction of its movement due to the gyroscopic effect.

On the other hand, if accelerate the «electron» to a certain speed V_z, then it will constantly move in a «vacuum» (i.e., in the absence of other «particles») with this speed and in the initially given direction.

The inert properties of local vacuum formations are due to the inertia of the vacuum itself, which is expressed in the finiteness of the velocity of propagation of vacuum disturbances (i.e., the velocity of light). Thus, in the Algebra of Signature (Alsigna) there is no need to introduce additional entities like Higgs bosons to explain the inert properties of the moving stable vacuum formations.

In this chapter Alsigna considers the easiest way to weave two intra-vacuum currents: *a*-subcont and *b*-subcont with the same signature (+ – – –). However, it should be remembered that each metric length with metrics (6.2.9) and (6.2.10), which we conditionally call *a*-subcont and *b*-subcont, can be represented as a superposition of seven metric sub-lengths with signatures *(5.11.33)* similar to *(5.11.35)*. Therefore, at the next, deeper level of consideration, vacuum processes in the outer shell of the moving «electron» look much more complex and multicolored (in the sense of the colors of vacuum chromodynamics) (Figure 6.11.5).



a) Drawing of V. A. Lebedev b) Fractal illustration of a toroidal vortex

Fig. 6.11.5. Illustrations of the outer shell of a moving «electron» at the level of 2^6-$\lambda_{m,n}$-vacuum region

Recall that at the level of the 2^6-$\lambda_{m,n}$-vacuum region, the fabric of Existence is woven not from two 4-sided "threads "(black and white), but from 16-and multi-colored 4-sided "thread" (*see §§ 1.11 through 1.13*): 7 colors of thread + 1 white thread + 7 colors of anti-threads + 1 thread black = 16.

Within the framework of the Algebra of Signatures, each 4-face "thread" is the result of intertwining of seven "sub-threads", and this may continue indefinitely long. The deeper the level of consideration, the more elegant the local vacuum formations look (Figure 6.11.7).

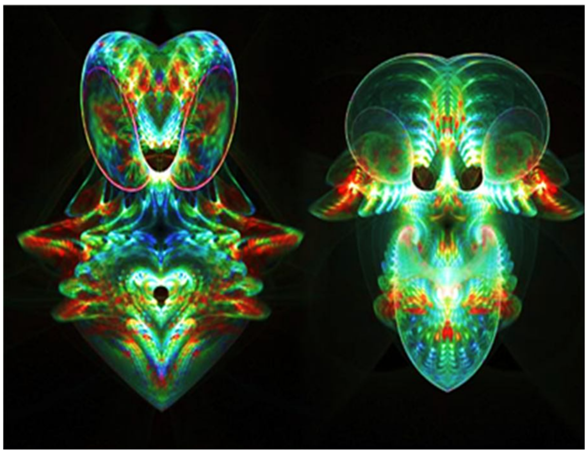


Fig. 6.11.6. Illustration of the local vacuum units on the level of consideration 2^6-$\lambda_{m,n}$-vacuum region

6.12 Precession of the axis of rotation of the core of a moving «electron»

The spin of the core of a moving «electron» is an extremely complex phenomenon, the study of which should be held in a separate extensive study. Here Alsigna considers only some superficial aspects of this process.

As shown in Figure 6.12.1 and Figure 6.12.2 the core of a moving «electron» is located at the neck of a toroidal-helical vortex under the influence of a practically rectilinearly and constantly flowing $a{\times}b$-subcont, described by the vector of subcont induction $\mathbf{B}_o^{(-)}$ with components (0, 0, $B_{oz}^{(-)}$).

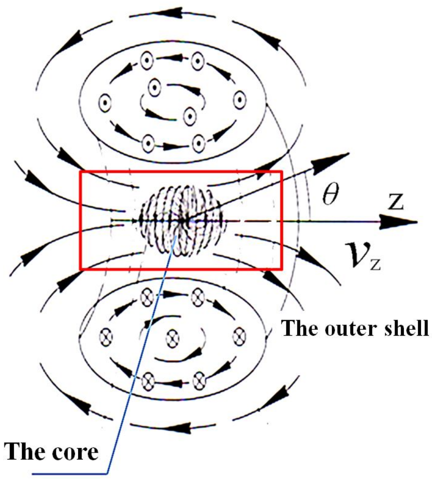


Fig. 6.12.1. The core of the moving "electron" is located in the neck of the toroidal - helical vacuum vortex, where there is a virtually constant and uniform field of the vacuum induction vector $\mathbf{B}_o$ (0, 0, B_{oz})

Recall that the spinor properties, e.g., a-subcont on the periphery of the «electron's» core, are described by a simplified spin-tensor (*see §§ 5.12 through 5.14*)

$$\begin{pmatrix} \sqrt{1-\frac{r^2}{r_6^2}}+r\sin\theta & \frac{1}{\sqrt{1-\frac{r^2}{r_e^2}}}+ir \\ \frac{1}{\sqrt{1-\frac{r^2}{r_6^2}}}-ir & \sqrt{1-\frac{r^2}{r_e^2}}-r\sin\theta \end{pmatrix} = \begin{pmatrix} \sqrt{1-\frac{r^2}{r_6^2}} & 0 \\ 0 & \sqrt{1-\frac{r^2}{r_e^2}} \end{pmatrix} + \begin{pmatrix} 0 & \frac{1}{\sqrt{1-\frac{r^2}{r_e^2}}} \\ \frac{1}{\sqrt{1-\frac{r^2}{r_n^2}}} & 0 \end{pmatrix} + \begin{pmatrix} 0 & ir \\ -ir & 0 \end{pmatrix} + \begin{pmatrix} r\sin\theta & 0 \\ 0 & -r\sin\theta \end{pmatrix}, \tag{6.12.1}$$

determinant of which is reduced to the generalized de Sitter metric *(2.2.19)*.

The last three terms on the right side of the expression (6.12.1) are the components of the spatial spin-vector $\boldsymbol{\sigma}$ (σ_r, σ_θ, σ_φ):

$$\sigma_r = \begin{pmatrix} 0 & \frac{1}{\sqrt{1-\frac{r^2}{r_6^2}}} \\ \frac{1}{\sqrt{1-\frac{r^2}{r_6^2}}} & 0 \end{pmatrix}, \quad \sigma_\theta = \begin{pmatrix} 0 & ir \\ -ir & 0 \end{pmatrix}, \quad \sigma_\varphi = \begin{pmatrix} r\sin\theta & 0 \\ 0 & -r\sin\theta \end{pmatrix}, \tag{6.12.2}$$

Chaotic rotation inside the core of the «electron», located in a constant vector field of the subcont induction $\mathbf{B}_o^{(-)}$, is described by a two-component spinor

$$|\Psi(t)\rangle = \begin{pmatrix} r\,e^{-i\lambda(r)B_{oz}^{(-)}t} \\ r\,e^{i\lambda(r)B_{oz}^{(-)}t} \end{pmatrix}, \qquad |\Psi(t)\rangle^+ = \langle\Psi(t)| = \left(r\,e^{-i\lambda(r)B_{oz}^{(-)}t}, r\,e^{i\lambda(r)B_{oz}^{(-)}t}\right) \tag{6.12.3}$$

where $\lambda(r)$ is the moment of inertia of the «electron's» core layer located at a distance r from its center.

Substitute bra and ket vectors (6.12.3) to the left and to the right of spin-tensor (6.12.2)

$$\left(r\,e^{-i\lambda(r)B_{oz}^{(-)}t}, r\,e^{i\lambda(r)B_{oz}^{(-)}t}\right) \begin{pmatrix} \sqrt{1-\frac{r^2}{r_e^2}}+r\sin\theta & \frac{1}{\sqrt{1-\frac{r^2}{r_e^2}}}+ir \\ \frac{1}{\sqrt{1-\frac{r^2}{r_e^2}}}-ir & \sqrt{1-\frac{r^2}{r_e^2}}-r\sin\theta \end{pmatrix} \begin{pmatrix} r\,e^{-i\lambda(r)B_{oz}^{(-)}t} \\ r\,e^{i\lambda(r)B_{oz}^{(-)}t} \end{pmatrix}. \tag{6.12.4}$$

As a result of simple transformations of the matrix structure (6.12.4), taking into account (6.12.1) and (6.12.2), we obtain the following projections of the averaged 3-dimensional spin vector

<s> of the peripheral core layer of the moving «electron» located at the neck of $a\times b$-subcont toroidal-helical vortex:

$$\langle s_z \rangle = \frac{2z^2}{\sqrt{1-\dfrac{r^2}{r_6^2}}}\left(|z|^2-|z|^2\right)=0\,, \qquad (6.12.5)$$

$$\langle s_x \rangle = \frac{2x^2}{\sqrt{1-\dfrac{r^2}{r_6^2}}}\cos\left[2\lambda(r)B_{oz}^{(-)}\,t\right], \qquad (6.12.6)$$

$$\langle s_y \rangle = \frac{2y^2}{\sqrt{1-\dfrac{r^2}{r_6^2}}}\sin\left[2\lambda(r)B_{oz}^{(-)}\,t\right]. \qquad (6.12.7)$$

From expressions (6.12.5) through (6.12.7) we see that the axis of rotation of the peripheral layer of the «electron's» core is chaotically changing, but on average it precesses around the axis z, or rather around the direction of the vector of the a - subcont induction $\mathbf{B}_o^{(-)}$ (0, 0, $B_{oz}^{(-)}$) in the sector and with a frequency depending on the magnitude of the z - component of the vector of the a-subcont induction $B_{oz}^{(-)}$ (Figure 6.12.2), which in its turn depends on the speed of the «electron» V_Z {see (6.10.15)}.

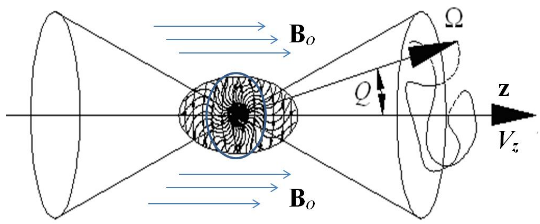


Fig. 6.12.**2.** Averaged precession of the axis of rotation of the core of a moving «electron» around the direction of the vector of vacuum induction $\mathbf{B}_o$ (0,0,B_{oz}) in the neck of the toroidal-helical vortex

Once again, we note that this paragraph only outlines the direction associated with the rotation of the core of the moving «electron». A separate study should be devoted to the analysis of the complex process of rotation of the core of moving local vacuum formations.

6.13 Straight-line and uniform movement of a «positron»

Within the Alsigna, the metric-dynamic model of the «positron» moving at a constant speed V_z (in the direction of the z-axis) is a negative copy of the «electron's» metric-dynamic model (6.7.1) through (6.7.7), and is described by the same generalized Kerr metrics (6.7.9) through (6.7.14), but with the opposite signature (– + + +).

Doing the similar actions with the components of the metric tensor $g_{ij}^{(+a)}$ and $g_{ij}^{0(+b)}$ from the metric (6.7.9) and (6.7.10) we receive for the outer shell of the «positron»:

- components of the vector of a-antisubcont intensity $\mathbf{E}_o^{(+a)}$ and the components of the vector of a - antisubcont induction $\mathbf{B}_o^{(+a)}$:

$$E_{or}^{(+a)} = \frac{c^2 r_6 \left(a^2 \cos^2\theta - r^2\right)\left(r^2 + a^2 - r r_6\right)}{2\left(1 - \dfrac{r_6 r}{r^2 + a^2\cos^2\theta}\right)^{\frac{3}{2}} \left(r^2 + a^2\cos^2\theta\right)^3},$$

$$E_{o\theta}^{(+a)} = -\frac{c^2 r r_6 a^2 \sin 2\theta}{2\left(1 - \dfrac{r_6 r}{r^2 + a^2\cos^2\theta}\right)^{\frac{3}{2}} \left(r^2 + a^2\cos^2\theta\right)^3},$$

$$E_{o\varphi}^{(+a)} = 0. \qquad (6.13.1)$$

$$B_{or}^{(+a)} = \frac{2 c r r_6 a \cos\theta \left(r^2 + a^2 - r_6 r\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2},$$

$$B_{o\theta}^{(+a)} = -\frac{c r_6 a \sin\theta \left(a^2\cos^2\theta - r^2\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta - r_6 r\right)^2},$$

$$B_{o\varphi}^{(+a)} = 0. \qquad (6.13.2)$$

- components of the vector of b-antisubcont intensity $\mathbf{E}_o^{(+b)}$ and the components of the vector of b-antisubcont induction $\mathbf{B}_o^{(+b)}$:

$$E_{or}^{(+b)} = -\frac{c^2 r_6 \left(a^2 \cos^2\theta - r^2\right)\left(r^2 + a^2 + r r_6\right)}{2\left(1 + \dfrac{r_6 r}{r^2 + a^2\cos^2\theta}\right)^{\frac{3}{2}} \left(r^2 + a^2\cos^2\theta\right)^3},$$

$$E_{o\theta}^{(+b)} = \frac{c^2 r r_6 a^2 \sin 2\theta}{2\left(1 + \dfrac{r_6 r}{r^2 + a^2\cos^2\theta}\right)^{\frac{3}{2}} \left(r^2 + a^2\cos^2\theta\right)^3},$$

$$E_{o\varphi}^{(+b)} = 0; \qquad (6.13.3)$$

$$B_{or}^{(+b)} = \frac{2 c r r_6 a \cos\theta \left(r^2 + a^2 + r_6 r\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta + r_6 r\right)^2},$$

$$B_{o\theta}^{(+b)} = -\frac{c r_6 a \sin\theta \left(a^2\cos^2\theta - r^2\right)}{\left(r^2 + a^2\cos^2\theta\right)^{1/2}\left(r^2 + a^2\cos^2\theta + r_6 r\right)^2},$$

$$B_{o\varphi}^{(-b)} = 0. \qquad (6.13.4)$$

Fig. 6.13.1. Fractal illustration of twisted threads of subcont and antisubcont

Comparing expressions (6.13.1) through (6.13.4) with corresponding expressions for the outer shell of the «electron» (6.9.22) through (6.9.24), (6.9.25) through (6.9.27), (6.10.6) through (6.10.8), (6.10.9) through (6.10.11), we find that they fully compensate for each other's manifestations on average:

$$\mathbf{E}_o^{(-a)} - \mathbf{E}_o^{(+a)} = 0, \quad \mathbf{B}_o^{(-a)} - \mathbf{B}_o^{(+a)} = 0; \qquad (6.13.5)$$

$$\mathbf{E}_o^{(-b)} - \mathbf{E}_o^{(+b)} = 0, \quad \mathbf{B}_o^{(-b)} - \mathbf{B}_o^{(+b)} = 0. \qquad (6.13.6)$$

Thus, each accelerated movement of the subcont in the outer shell of the «electron» corresponds to the opposite accelerated movement of the antisubcont in the outer shell of the positron, which fully meets the vacuum condition (*see Definition 1.12.4*).

6.14 2^3-$\lambda_{-11,-16}$-vacuum dynamics

Expressions (6.9.22) through (6.9.24), (6.9.25) through (6.9.27), (6.10.6) through (6.10.8), (6.10.9) through (6.10.11), (6.13.1) through (6.13.4) in their total describe the acceleration of different sides (layers) of the same 2^3-$\lambda_{-11,-16}$-vacuum region.

The general field of accelerations in each local area of 2^3-$\lambda_{-11,-16}$-vacuum region is described by the vector quaternion

$$\mathbf{a}_\Sigma = \mathbf{a}^{(-a)} + i\mathbf{a}^{(-b)} + j\mathbf{a}^{(+a)} + k\mathbf{a}^{(+b)}, \qquad (6.14.1)$$

where

$$\mathbf{a}^{(-a)} = \mathbf{E}_o^{(-a)} + [\mathbf{v}^{(-a)} \times \mathbf{B}_o^{(-a)}] \qquad (6.14.2)$$

– the vector of acceleration of a-subcont in the outer shell of the «electron» (I);

$$\mathbf{a}^{(-b)} = \mathbf{E}_o^{(-b)} + [\mathbf{v}^{(-b)} \times \mathbf{B}_o^{(-b)}] \qquad (6.14.3)$$

– the acceleration vector of the b-subcont in the same outer shell of the «electron» (H);

$$\mathbf{a}^{(+a)} = \mathbf{E}_o^{(-a)} + [\mathbf{v}^{(-a)} \times \mathbf{B}_o^{(-a)}] \qquad (6.14.4)$$

– the acceleration vector a-antisubcont in the outer shell of the «positron» (V);

$$\mathbf{a}^{(+b)} = \mathbf{E}_o^{(-b)} + [\mathbf{v}^{(-b)} \times \mathbf{B}_o^{(-b)}] \qquad (6.14.5)$$

– the acceleration vector of b-antisubcont in the outer shell of the «positron» (H').

The joint action of all 4 mutually perpendicular vector fields (6.14.2) through (6.14.5) leads to the creation of multi-layer 2^3-$\lambda_{-11,-16}$-vacuum dynamics, which, upon averaging of the intertwined subcont currents in many aspects reduces itself to the classical electrodynamics. This fact was partly addressed in [20, 22], and it is assumed that it will be studied in more detail in the future.

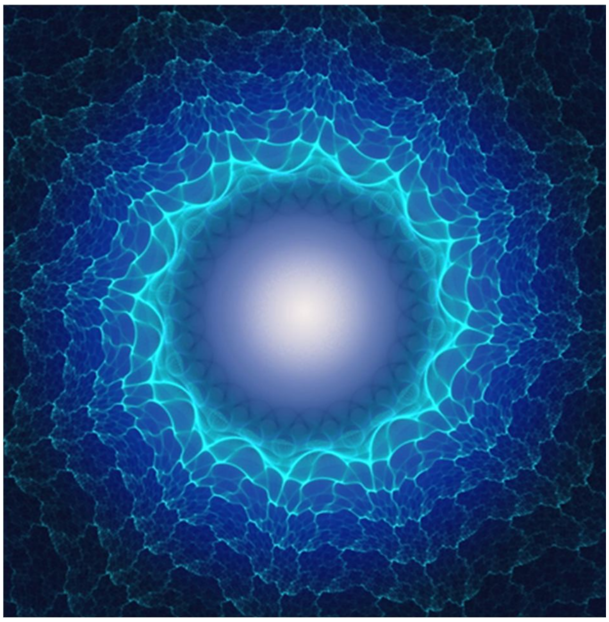


Fig. 6.14.1. Fractal illustration of a core of a vacuum formation on a cosmic scale

We also note that the multi-layered 2^3-$\lambda_{-11,-16}$-vacuum dynamics vacuum, proposed here, is universal. If in all of the equations of this chapter instead of the radius of the core's «electrons» or «positrons» $r_6 \sim 1.7 \cdot 10^{-13}$ cm we substitute any other radius from the hierarchy *(2.6.20)*, we get the same subcont-antisubcont dynamics, but on a different scale. For example, substituting in all equations the characteristic $r_3 \sim 4 \cdot 10^{18}$ cm, commensurate with the radius of the core of the galaxy, we obtain a 2^3-$\lambda_{16,20}$-vacuum dynamics (see Figure 6.14.1, 6.14.2).

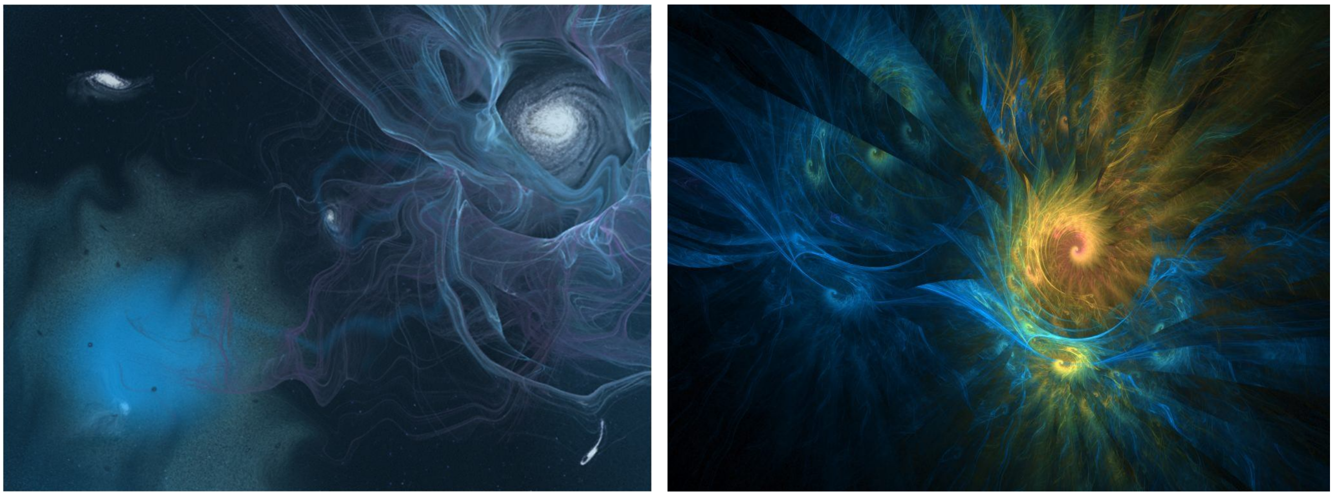


Fig. 6.14.2. Fractal illustration 2^3-$\lambda_{16,20}$-vacuum dynamics