5 The overall dynamics of vacuum layers and «vacuum electrostatics»

In this chapter, the overall dynamics of vacuum layers is considered, in particular "vacuum electrostatics". The rotation of the vacuum layers within the core of the stable vacuum formation (in particular the inside cores of the «electron» and «positron») is investigated. The foundations for studying the "rakya" (boundary) separating the core of stable vacuum formation from its outer shell are laid.

5.1 Stratification of «vacuum»

The subject of the study of Algebra of Signatures (Alsigna) is a volume of the "vacuum", i.e. a local portion of the 3 - dimensional void *(see Definitions 1.1.1, 1.12.5)*.

In the framework of the Algebra of Signatures, the "vacuum" is stratified into an infinite number of nested $\lambda_{m,n}$-vacuums (Figure 5.1.1 *or 1.5.1*), which are detected in the void by using monochromatic beams of light with wavelengths $\lambda_{m,n}$ from different ranges given by $\Delta\lambda = 10^m - 10^n$ cm, where $n = m + 1$ (*see §§ 1.1* through *1.4*).

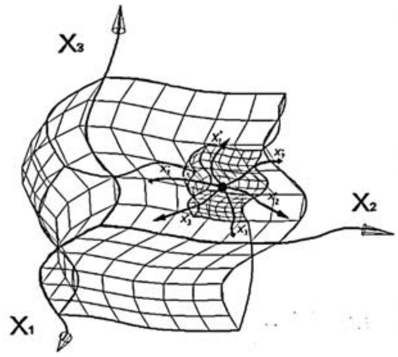


Fig. 5.1.1. $\lambda_{m,n}$-vacuum is nested in $\lambda_{f,d}$-vacuum, where $\lambda_{f,d} > \lambda_{m,n}$

In this a Chapter, we dwell on the geodesics of the curved portion of only one of $\lambda_{m,n}$-vacuums (i.e., one transverse 3-dimensional vacuum layer, Figure 5.1.1). The geodesics of the remaining $\lambda_{m,n}$-vacuums are described similarly.

Recall that, within the framework of the Algebra of Signatures, the simplest is the uncurved section of the 8-dimensional 2^3-$\lambda_{m,n}$-vacuum region (*see § 1.21*), which is described by a system of two metrics with mutually opposite signatures {*see (1.7.3) and (1.7.4)*}

$$\begin{cases} ds^{(-)2} = \ \ c^2dt^2 - dx^2 - dy^2 - dz^2 = \ \ dx_0^2 - dx_1^2 - dx_2^2 - dx_3^2 = 0 \ \text{ with signature } (+---); & (5.1.1) \\ ds^{(+)2} = -c^2dt^2 + dx^2 + dy^2 + dz^2 = -dx_0^2 + dx_1^2 + dx_2^2 + dx_3^2 = 0 \ \text{ with signature } (-+++), & (5.1.2) \end{cases}$$

satisfying the vacuum condition

$$ds^{(\pm)2} = ½(ds^{(-)2} + ds^{(+)2}) = ½\,[(c^2dt^2 - dx^2 - dy^2 - dz^2) + (-c^2dt^2 + dx^2 + dy^2 + dz^2)] =$$
$$= 0\cdot c^2dt^2 + 0\cdot dx^2 + 0\cdot dy^2 + 0\cdot dz^2 = \Theta, \qquad (5.1.3)$$

where Θ is the true zero (*see Definitions 1.4.1, 1.12.4*).

The metric-dynamical state of the same, but curved section of the 2^3-$\lambda_{m,n}$-vacuum region is described by the averaged metric (*§1.21 and §1.22*)

$$ds^{(\pm)2} = ½(ds^{(-)2} + ds_0^{(+)2}) = ½(g_{ij}^{(-)} - g_{ij0}^{(+)})dx^idx^j, \qquad (5.1.4)$$

where

$$ds^{(-)2} = ds^{(+---)2} = g_{ij}^{(-)}dx^idx^j \ \text{ with signature } (+---), \qquad (5.1.5)$$

$$g_{ij}^{(-)} = \begin{pmatrix} g_{00}^{(-)} & g_{10}^{(-)} & g_{20}^{(-)} & g_{30}^{(-)} \\ g_{01}^{(-)} & g_{11}^{(-)} & g_{21}^{(-)} & g_{31}^{(-)} \\ g_{02}^{(-)} & g_{12}^{(-)} & g_{22}^{(-)} & g_{31}^{(-)} \\ g_{03}^{(-)} & g_{13}^{(-)} & g_{23}^{(-)} & g_{33}^{(-)} \end{pmatrix} \quad (5.1.6)$$

is the metric tensor of the "outer" side of the 2^3-$\lambda_{m,n}$-vacuum region *(or subcont – see Definition 1.7.4)*;

$$ds^{(+)2} = ds^{(-+++)2} = g_{ij}{}^{(+)}dx^i dx^j \quad \text{with signature } (-+++), \quad (5.1.7)$$

$$g_{ij}^{(+)} = \begin{pmatrix} g_{00}^{(+)} & g_{10}^{(+)} & g_{20}^{(+)} & g_{30}^{(+)} \\ g_{01}^{(+)} & g_{11}^{(+)} & g_{21}^{(+)} & g_{31}^{(+)} \\ g_{02}^{(+)} & g_{12}^{(+)} & g_{22}^{(+)} & g_{31}^{(+)} \\ g_{03}^{(+)} & g_{13}^{(+)} & g_{23}^{(+)} & g_{33}^{(+)} \end{pmatrix} \quad (5.1.8)$$

is the metric tensor of the "inner" side of the 2^3-$\lambda_{m,n}$-vacuum region (*or antisubcont – see Definition 1.7.5*).

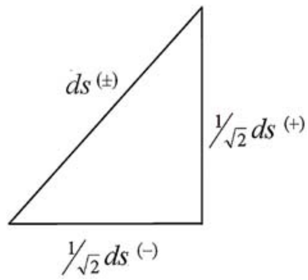


Fig. 5.1.2. Relationship between the segments $ds^{(-)}$ and $ds^{(+)}$

Fig. 5.1.3 If you project the lines of a regular double helix onto a plane, then at the point of intersection they are mutually perpendicular to each other

It is important to note that the expression (5.1.4)

$$ds^{(\pm)2} = \tfrac{1}{2}\, ds^{(-)2} + \tfrac{1}{2}\, ds^{(+)2} \quad (5.1.9)$$

is, in fact, the Pythagorean theorem $c^2 = a^2 + b^2$ (*see § 1.22*). This means that the line segments $(½)^{1/2}ds^{(-)}$ and $(½)^{1/2}ds^{(+)}$ are always mutually perpendicular to each other: $ds^{(-)} \perp ds^{(+)}$ (Figure 5.1.2), and two lines directed in the same direction can always be mutually perpendicular only when they form a regular double helix (Figure 5.1.3).

Thus, the average metric (5.1.9) corresponds to the segment 2-"braid" (*Definition 1.22.1*), consisting of two interwoven spirals $s^{(-)}$ and $s^{(+)}$, which can be described by a complex number

$$ds^{(\pm)} = \tfrac{1}{\sqrt{2}}\,(ds^{(-)} + i ds^{(+)}), \quad (5.1.10)$$

the square of the module of which is equal to (5.1.4). Here *i is* the imaginary unit $\sqrt{-1}$, fulfilling the function of a unit vector, giving the direction to the linear element $ds^{(+)}$ which is perpendicular to the direction of the linear element $ds^{(-)}$.

5.2 The equation of the geodesic line in a two-sided 2^3-$\lambda_{m,n}$-vacuum region

The shortest distance between two infinitely close points p_1 and p_2 in a curved 2^3-$\lambda_{m,n}$-vacuum region, i.e. the minimal length of the 2-helix (5.1.10), is defined as the extremal of the functional

$$S = \int ds^{(\pm)} = \tfrac{1}{\sqrt{2}} \int (ds^{(-)} + i ds^{(+)}), \quad (5.2.1)$$

where the limits of integration are the points p_1 and p_2 .

We find the equation of this extremal, based on the condition that the first variation is equal to zero.

$$\delta S = \frac{1}{\sqrt{2}}\,\delta\int(ds^{(-)} + i ds^{(+)}) = 0. \qquad (5.2.2)$$

Both parts of the expression (5.2.2) can be multiplied by $\sqrt{2}$; then we have

$$\delta S = \delta\int ds^{(-)} + i\delta\int ds^{(+)} = 0, \qquad (5.2.3)$$

or, taking into account (5.1.5) and (5.1.7)

$$\delta S = \delta\int\sqrt{g_{ij}^{(-)}dx^i dx^j} + i\delta\int\sqrt{g_{ij}^{(+)}dx^i dx^j} = 0. \qquad (5.2.4)$$

Variations in the expression (5.2.4) can be considered separately

$$\delta\int\sqrt{g_{ij}^{(-)}dx^i dx^j} = 0, \qquad \delta\int\sqrt{g_{ij}^{(+)}dx^i dx^j} = 0. \qquad (5.2.5)$$

Extremal of the functionals (5.2.5) are defined identically; therefore we consider the general case [34]

$$S = \int_{p_1}^{p_2} ds, \qquad (5.2.6)$$

where

$$ds = \sqrt{g_{ij}dx^i dx^j} \qquad (5.2.7)$$

is the element of the 4-dimensional line with any of the 16 possible signatures (1.10.13).

Consider the first variation of the functional (5.2.7)

$$\delta S = \delta\int ds = \delta\int\sqrt{g_{ij}dx^i dx^j} = 0, \qquad (5.2.8)$$

provided that at the ends of the *line* under consideration (i.e., at the points p_1 and p_2), the variations are equal to zero

$$\delta ds_{(p_1)} = \delta ds_{(p_2)} = \delta x_{(p_1)} = \delta x_{(p_2)} = 0\,. \qquad (5.2.9)$$

We use the expression [34]

$$\delta ds^2 = 2ds\,\delta ds \qquad (5.2.10)$$

from which follows

$$\delta ds = \frac{1}{2ds}\delta g_{ij}dx^i dx^j = \frac{1}{2ds}\left[\frac{\partial g_{ij}}{\partial x^\mu}\delta x^\mu dx^i dx^j + g_{ij}dx^j d\delta x^i + g_{ij}dx^i d\delta x^j)\right], \qquad (5.2.11)$$

where we use the commutativity of the operations of variation and differentiation, $\delta(dx^i) = d(\delta x^i)$.

Substituting the expression (5.2.11) into the integral (5.2.8) and dividing and multiplying by *ds,* we obtain [34]

$$\delta S = \frac{1}{2}\int_{p_1}^{p_2}\left\{\frac{\partial g_{ij}}{\partial x^\mu}\frac{dx^i}{ds}\frac{dx^j}{ds}\delta x^\mu + \left(g_{\mu j}\frac{dx^j}{ds} + g_{i\mu}\frac{dx^i}{ds}\right)\frac{d(\delta x^\mu)}{ds}\right\}ds = 0\,. \qquad (5.2.12)$$

We integrate the expression in parentheses by parts:

$$\frac{1}{2}\int_{p_1}^{p_2}\left(g_{\mu j}\frac{dx^j}{ds}+g_{i\mu}\frac{dx^i}{ds}\right)\frac{d(\delta x^\mu)}{ds}ds=\frac{1}{2}\left(g_{\mu k}\frac{dx^k}{ds}+g_{i\mu}\frac{dx^i}{ds}\right)\delta x^\mu\Bigg|_{p_1}^{p_2}-$$
$$-\frac{1}{2}\int_{p_1}^{p_2}\delta x^\mu\frac{d}{ds}\left(g_{\mu j}\frac{dx^j}{ds}+g_{i\mu}\frac{dx^i}{ds}\right)ds. \tag{5.2.13}$$

Due to (5.2.9), the first term in this expression vanishes. Substituting the remainder of (5.2.13) in (5.2.12), and differentiating, we arrive at the expression [34]

$$\delta S=\frac{1}{2}\int_{p_1}^{p_2}\left\{\left(\frac{\partial g_{ij}}{\partial x^\mu}-\frac{\partial g_{\mu j}}{\partial x^i}-\frac{\partial g_{i\mu}}{\partial x^j}\right)\frac{dx^i}{ds}\frac{dx^j}{ds}+2g_{\mu j}\frac{d^2x^j}{ds^2}\right\}ds\delta x^\mu=0. \tag{5.2.14}$$

From the fact that the integral (5.2.14) vanishes for any variation δx^μ, the expression, enclosed in brackets goes to zero. Whence, taking into account the relation $g_{\mu j}\, g^{\mu j} = 4$, after simple calculations we obtain [34]

$$\frac{d^2x^l}{ds^2}+\Gamma^l_{ij}\frac{dx^i}{ds}\frac{dx^j}{ds}=0, \qquad \text{or} \qquad \frac{d^2x^l}{ds^2}=-\Gamma^l_{ij}\frac{dx^i}{ds}\frac{dx^j}{ds}, \tag{5.2.15}$$

where

$$\Gamma^l_{ij}=\frac{1}{2}g^{l\mu}\left(\frac{\partial g_{\mu i}}{\partial x^j}+\frac{\partial g_{\mu j}}{\partial x^i}-\frac{\partial g_{ij}}{\partial x^\mu}\right) \text{ are the Christoffel symbols.} \tag{5.2.16}$$

Making similar calculations for the variations (5.2.5), we obtain the two equations

$$\frac{d^2x^l}{ds^2}+\Gamma^{l(-)}_{ij}\frac{dx^i}{ds}\frac{dx^j}{ds}=0, \tag{5.2.17}$$

$$\frac{d^2x^l}{ds^2}+\Gamma^{l(+)}_{ij}\frac{dx^i}{ds}\frac{dx^j}{ds}=0, \tag{5.2.18}$$

where, respectively

$$\Gamma^{l(-)}_{ij}=\frac{1}{2}g^{l\mu}\left(\frac{\partial g^{(-)}_{\mu i}}{\partial x^j}+\frac{\partial g^{(-)}_{\mu j}}{\partial x^i}-\frac{\partial g^{(-)}_{ij}}{\partial x^\mu}\right) \text{ are the Christoffel symbols of the } \textit{ubcont}; \tag{5.2.19}$$

$$\Gamma^{l(+)}_{ij}=\frac{1}{2}g^{l\mu}\left(\frac{\partial g^{(+)}_{\mu i}}{\partial x^j}+\frac{\partial g^{(+)}_{\mu j}}{\partial x^i}-\frac{\partial g^{(+)}_{ij}}{\partial x^\mu}\right) \text{ are the Christoffel symbols of the } \textit{antisubcont}. \tag{5.2.20}$$

When considering the variation (5.2.4), and considering the resulting Christoffel symbols (5.2.19) and (5.2.20), we find that the desired extremal functional (5.2.1) is defined by the following equation of the geodesic in the curved bilateral 2^3-$\lambda_{m,n}$-vacuum region

$$\frac{d^2x^l}{ds^2}+(\Gamma_{ij}^{l(-)}+i\Gamma_{ij}^{l(+)})\frac{dx^i}{ds}\frac{dx^j}{ds}=0\,, \qquad (5.2.21)$$

or

$$\frac{d^2x^l}{ds^2}=-(\Gamma_{ij}^{l(-)}+i\Gamma_{ij}^{l(+)})\frac{dx^i}{ds}\frac{dx^j}{ds}\,. \qquad (5.2.22)$$

Fig. 5.2.1. With an accelerated fall, the water jet is twisted into a spiral

Within the Algebra of Signatures (Alsigna), the expression (5.2.22) determines the accelerated motion of the local bilateral portion of the 2^3-$\lambda_{m,n}$-vacuum region, in a 2-braid. Further, it will be shown that this expression also contains information about the dynamics of the curved 3-dimensional layer of the "vacuum", whose dimensions of irregularities are commensurable with $100\cdot\lambda_{m,n}$.

5.3 Eight-sided consideration

More accurate and harmonious is not a 2-sided but an 8-sided consideration of a local portion of a 2^6-$\lambda_{m,n}$-vacuum region (*see Chapter 1*). In this case, we consider not the two 4-dimensional sides of one "sheet", (*Figure 1.21.1*), but rather the eight "sides" of the vacuum cube (*Figure 1.6.2*). Therefore, at this level of consideration, the curved state of the 2^6-$\lambda_{m,n}$-vacuum region is not described by a superposition of two 4-metrics, as in the previous paragraphs, but rather sixteen 4-metrics {*see (1.20.5)*}

$$\begin{aligned} ds_{(16)}^2=\sum_{q=1}^{16} g_{ij}^{(q)}dx_idx_j = {} & g_{ij}^{(1)}dx^idx^j+g_{ij}^{(2)}dx^idx^j+g_{ij}^{(3)}dx^idx^j+g_{ij}^{(4)}dx^idx^j+ \\ & +g_{ij}^{(5)}dx^idx^j+g_{ij}^{(6)}dx^idx^j+g_{ij}^{(7)}dx^idx^j+g_{ij}^{(8)}dx^idx^j+ \\ & +g_{ij}^{(9)}dx^idx^j+g_{ij}^{(10)}dx^idx^j+g_{ij}^{(11)}dx^idx^j+g_{ij}^{(12)}dx^idx^j+ \\ & +g_{ij}^{(13)}dx^idx^j+g_{ij}^{(14)}dx^idx^j+g_{ij}^{(15)}dx^idx^j+g_{ij}^{(16)}dx^idx^j=0\,, \end{aligned} \qquad (5.3.1)$$

where

$$g_{ij}^{(q)}=\begin{pmatrix} g_{00}^{(q)} & g_{10}^{(q)} & g_{20}^{(q)} & g_{30}^{(q)} \\ g_{01}^{(q)} & g_{11}^{(q)} & g_{21}^{(q)} & g_{31}^{(q)} \\ g_{02}^{(q)} & g_{12}^{(q)} & g_{22}^{(q)} & g_{32}^{(q)} \\ g_{03}^{(q)} & g_{13}^{(q)} & g_{23}^{(p)} & g_{33}^{(q)} \end{pmatrix} \qquad (5.3.2)$$

are the components of the metric tensor of the q^{th} metric space with the corresponding signature

$$sign\left(g_{ij}^{(q)}\right) = \begin{matrix} (++++)^1 & (+++-)^5 & (-++-)^9 & (++-+)^{13} \\ (---+)^2 & (-+++)^6 & (--++)^{10} & (-+-+)^{14} \\ (+--+)^3 & (++--)^7 & (+---)^{11} & (+-++)^{15} \\ (--+-)^4 & (+-+-)^8 & (-+--)^{12} & (----)^{16}. \end{matrix} \qquad (5.3.3)$$

Within the framework of the Algebra of Signatures, the expression (5.3.1) describes a 16-braid, formed in an additive manner (weave) of sixteen 4-dimensional metric spaces *(see §§ 1.17 through 1.22*). In this case, a segment of a 16-helix, consisting of the 16 interlaced segments $ds_{(q)}$, is described by the expression {*see (1.22.31)*}

$$\begin{aligned} ds_{(16)} = {} & \eta_1\, ds^{(+---)} + \eta_2\, ds^{(++++)} + \eta_3\, ds^{(---+)} + \eta_4\, ds^{(+--+)} + \\ & + \eta_5\, ds^{(--+-)} + \eta_6\, ds^{(++--)} + \eta_7\, ds^{(-+--)} + \eta_8\, ds^{(+-+-)} + \\ & + \eta_9\, ds^{(-+++)} + \eta_{10}\, ds^{(----)} + \eta_{11}\, ds^{(+++-)} + \eta_{12}\, ds^{(-++-)} + \\ & + \eta_{13}\, ds^{(++-+)} + \eta_{14}\, ds^{(--++)} + \eta_{15}\, ds^{(+-++)} + \eta_{16}\, ds^{(-+-+)}, \end{aligned} \qquad (5.3.4)$$

where η_m (m = 1, 2, 3, ..., 16) is an orthonormal basis of objects (similar to an imaginary unit) that satisfy the anticommutation relation of a Clifford algebra

$$\eta_m\eta_n + \eta_n\eta_m = 2\delta_{mn}\,, \qquad (5.3.5)$$

where δ_{nm} is the 16×16 identity matrix.

The section of the 16-braid (5.3.4) can be written as the sum of two complex conjugate 8-braids (octonions)

$$ds_{(16)} = ds_{(8)}{}^{(-)} + ds_{(8)}{}^{(+)}\,, \qquad (5.3.6)$$

where

$$\begin{aligned} ds_{(8)}{}^{(-)} = {} & \zeta_1\, ds^{(++++)} + \zeta_2 ds^{(+---)} + \zeta_3 ds^{(---+)} + \zeta_4 ds^{(+--+)} + \zeta_5 ds^{(--+-)} + \\ & + \zeta_6\, ds^{(++--)} + \zeta_7\, ds^{(-+--)} + \zeta_8 ds^{(+-+-)} = 0, \end{aligned} \qquad (5.3.7)$$

$$\begin{aligned} ds_{(8)}{}^{(+)} = {} & \zeta_1\, ds^{(----)} + \zeta_2\, ds^{(-+++)} + \zeta_3\, ds^{(+++-)} + \zeta_4\, ds^{(-++-)} + \zeta_5\, ds^{(++-+)} + \\ & + \zeta_6\, ds^{(--++)} + \zeta_7\, ds^{(+-++)} + \zeta_8\, ds^{(-+-+)}. \end{aligned} \qquad (5.3.8)$$

Here the eight objects ζ_r (where r =1, 2, 3, ... 8) satisfy the anticommutative relationship of a Clifford algebra:

$$\zeta_m\,\zeta_k + \zeta_k\,\zeta_m = 2\delta_{km}\,, \qquad (5.3.9)$$

where δ_{km} is the Kronecker symbol ($\delta_{km} = 0$ for $m \neq k$ and $\delta_{km} = 1$ for $m = k$).

These requirements are satisfied, for example, by a set of 8×8-matrices such as:

$$
\begin{gathered}
\zeta_1 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}
\qquad
\zeta_5 = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 \end{pmatrix}
\\
\zeta_2 = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 \end{pmatrix}
\qquad
\zeta_6 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}
\\
\zeta_3 = \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}
\qquad
\zeta_7 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}
\\
\zeta_4 = \begin{pmatrix} 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}
\qquad
\zeta_8 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}
\end{gathered}
\tag{5.3.10}
$$

In this case, δ_{km} is the identity 8×8-matrix:

$$
\delta_{km} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}
\tag{5.3.11}
$$

Consider the functional

$$
S = \int_{p_1}^{p_2} ds_{(16)}, \tag{5.3.12}
$$

where $ds_{(16)}$ is the segment of the 16-braid (5.3.4).

Analogously to what was done in § 5.2, we equate the first variation of the given functional to zero

$$\begin{aligned}\delta S = {} & \eta_1\delta\int ds^{(+---)} + \eta_2\delta\int ds^{(++++)} + \eta_3\delta\int ds^{(---+)} + \eta_4\delta\int ds^{(+--+)} + \\ & + \eta_5\delta\int ds^{(--+-)} + \eta_6\,\delta\int ds^{(++--)} + \eta_7\,\delta\int ds^{(-+--)} + \eta_8\delta\int ds^{(+-+-)} + \\ & + \eta_9\delta\int ds^{(-+++)} + \eta_{10}\delta\int ds^{(----)} + \eta_{11}\delta\int ds^{(+++-)} + \eta_{12}\delta\int ds^{(-++-)} + \\ & + \eta_{13}\delta\int ds^{(++-+)} + \eta_{14}\delta\int ds^{(--++)} + \eta_{15}\delta\int ds^{(+-++)} + \eta_{16}\delta\int ds^{(-+-+)} = 0,\end{aligned} \qquad (5.3.13)$$

and perform operations of the type (5.2.6) through (5.2.22), thereby obtaining the equation for the extremal (that is, the averaged geodesic) in the curved 2^6-$\lambda_{m,n}$-vacuum region

$$\frac{d^2x^l}{ds^2} + \left(\eta_1\Gamma^{l(1)}_{ij} + \eta_2\Gamma^{l(2)}_{ij} + \eta_3\Gamma^{l(3)}_{ij} + \ldots + \eta_{15}\Gamma^{l(15)}_{ij} + \eta_{16}\Gamma^{l(16)}_{ij}\right)\frac{dx^i}{ds}\frac{dx^j}{ds} = 0, \qquad (5.3.14)$$

or

$$\frac{d^2x^l}{ds^2} = -\left(\sum_{q=1}^{16}\eta_q\Gamma^{l(q)}_{ij}\right)\frac{dx^i}{ds}\frac{dx^j}{ds}, \qquad (5.3.15)$$

where

$$\Gamma^{l(q)}_{ij} = \frac{1}{2}g^{l\mu}\left(\frac{\partial g^{(q)}_{\mu i}}{\partial x^j} + \frac{\partial g^{(q)}_{\mu j}}{\partial x^i} - \frac{\partial g^{(q)}_{ij}}{\partial x^\mu}\right) \qquad (5.3.16)$$

are Christoffel symbols for the q^{th} metric space with components of the metric tensor

$$g^{(q)}_{ij} = \begin{pmatrix} g^{(q)}_{00} & g^{(q)}_{10} & g^{(q)}_{20} & g^{(q)}_{30} \\ g^{(q)}_{01} & g^{(q)}_{11} & g^{(q)}_{21} & g^{(q)}_{31} \\ g^{(q)}_{02} & g^{(q)}_{12} & g^{(q)}_{22} & g^{(q)}_{32} \\ g^{(q)}_{03} & g^{(q)}_{13} & g^{(p)}_{23} & g^{(q)}_{33} \end{pmatrix} \qquad (5.3.17)$$

and the corresponding signature

$$sign\left(g^{(q)}_{ij}\right) = \begin{matrix} (++++)^1 & (+++-)^5 & (-++-)^9 & (++-+)^{13} \\ (---+)^2 & (-+++)^6 & (--++)^{10} & (-+-+)^{14} \\ (+--+)^3 & (++--)^7 & (+---)^{11} & (+-++)^{15} \\ (--+-)^4 & (+-+-)^8 & (-+--)^{12} & (----)^{16}. \end{matrix} \qquad (5.3.18)$$

Expression (5.3.14) shows that at this level of consideration, the curved section of the 2^6-$\lambda_{m,n}$ -vacuum region represents complex "braids" and "knots", composed of 16 intertwined accelerated intra-vacuum currents (Figure 5.3.1).

Fig. 5.3.1. Fractal illustration of intertwined intra-vacuum currents

A further level of consideration deals with the a 2^{10}-$\lambda_{m,n}$-vacuum region (*see § 1.16*). Its dynamics are similar to the dynamics of a 2^{6}-$\lambda_{m,n}$-vacuum region, but in this case not 16 accelerated intra-vacuum currents are intertwined, but rather 256.

There can be an infinite number of more sophisticated levels of investigation of the "vacuum" (*see § 1.16*). In such a case, each time the dynamics of the subsequent cross-level "vacuum" would be the result of averaging (desensitization) of dynamics of the previous one, a significantly subtler and more gracefully constructed level.

5.4 Hidden dynamics of the transverse vacuum layer

In *§ 1.18* it was shown that the metric of the local section of a curved 4-dimensional subspace

$$ds^{(q)2} = g_{ij}^{(q)} dx^i dx^j, \qquad (5.4.1)$$

with any of the 16 possible signatures (5.3.3) may be represented as a scalar product of the two vectors specified in the distorted affine spaces with the corresponding stignatures {*see (1.18.3)*}

$$ds^{(q)2} = d\mathbf{s}^{(a)} d\mathbf{s}^{(b)} = \beta^{pm(a)} \mathbf{e}_m^{(a)} \alpha_{pi}^{(a)} \beta^{ln(b)} \mathbf{e}_n^{(b)} \alpha_{lj}^{(b)} dx^i dx^j = g_{ij}^{(q)} dx^i dx^j, \qquad (5.4.2)$$

where

$$d\mathbf{s}^{(a)} = \beta^{pm(a)} \mathbf{e}_m^{(a)} \alpha_{pi}^{(a)} dx^i, \qquad (5.4.3)$$

$$d\mathbf{s}^{(b)} = \beta^{ln(b)} \mathbf{e}_n^{(b)} \alpha_{lj}^{(b)} dx^j \qquad (5.4.4)$$

are vectors given respectively in the a^{th} and b^{th} curved affine space with a corresponding stignature (*see §§ 1.17 through 1.18*) .

Here, in turn,

$$\alpha_{ij}^{(d)} = dx'^{i(d)}/dx^{j(d)} \qquad (5.4.5)$$

are components of the tensor which effects the elongation of axes of the curved section of the d^{th} affine space with the corresponding stignature from the matrix *(1.10.13)*;

$$\beta^{pm(d)} = (\mathbf{e}'_p{}^{(d)} \cdot \mathbf{e}_m^{(d)}) = \cos\,(\mathbf{e}'_p{}^{(d)}\,{}^\wedge\,\mathbf{e}_m^{(d)}) \qquad (5.4.6)$$

are the direction cosines between the axes of the curved section of the d^{th} affine space with the same stignature;

$\mathbf{e}_m^{(d)}$ is the basis vector specifying the direction of the m^{th} axis of the d^{th} affine space;

$dx^{j(d)}$ is the infinitesimal segment along the j^{th} axis of the $d^{\text{ th}}$ affine space.

Let us return to the simplest level of consideration of a curved bilateral 2^3-$\lambda_{m,n}$-vacuum region. In this case, instead of the metric system (5.1.1) through (5.1.2), the outer and inner sides of the curved portion of the 2^3-$\lambda_{m,n}$-vacuum region of the vacuum are described by conjugates metrics

$$\begin{cases} ds^{(-)2} = g_{ij}^{(-)} dx^i dx^j \ \text{ with signature } (+\,-\,-\,-); & (5.4.7) \\ ds^{(+)2} = g_{ij}^{(+)} dx^i dx^j \ \text{ with signature } (-\,+\,+\,+), & (5.4.8) \end{cases}$$

which, according to (5.4.1) through (5.4.6), can be written as

$$\begin{cases} ds^{(-)2} = d\mathbf{s}^{(a)} d\mathbf{s}^{(b)} \text{ with signature } (+\,-\,-\,-); & (5.4.9) \\ ds^{(+)2} = d\mathbf{s}^{(c)} d\mathbf{s}^{(d)} \ \text{ with signature } (-\,+\,+\,+), & (5.4.10) \end{cases}$$

where

I $\quad d\boldsymbol{s}^{(a)} = \beta^{pm(a)}\mathbf{e}_m{}^{(a)}\alpha_{pi}{}^{(a)}dx^i$ with signature $\{- - - -\}$ (5.4.11)

H $\quad d\boldsymbol{s}^{(b)} = \beta^{ln(b)}\mathbf{e}_n{}^{(b)}\alpha_{lj}{}^{(b)}dx^j$ with signature $\{- + + +\}$ (5.4.12)

V $\quad d\boldsymbol{s}^{(c)} = \beta^{pm(c)}\mathbf{e}_m{}^{(c)}\alpha_{pi}{}^{(c)}dx^i$ with signature $\{+ + + +\}$ (5.4.13)

H' $\quad d\boldsymbol{s}^{(d)} = \beta^{ln(d)}\mathbf{e}_n{}^{(d)}\alpha_{lj}{}^{(d)}dx^j$ with signature $\{- + + +\}$. (5.4.14)

Let's find variations of all possible binary scalar products of the vectors (5.4.11) through (5.4.14)

$\delta(d\boldsymbol{s}^{(a)}d\boldsymbol{s}^{(b)}) = \delta(d\boldsymbol{s}^{(a)})d\boldsymbol{s}^{(b)} + d\boldsymbol{s}^{(a)}\delta(d\boldsymbol{s}^{(b)})$ with signature $(+ - - -)$ (5.4.15)

$\delta(d\boldsymbol{s}^{(c)}d\boldsymbol{s}^{(d)}) = \delta(d\boldsymbol{s}^{(c)})d\boldsymbol{s}^{(d)} + d\boldsymbol{s}^{(c)}\delta(d\boldsymbol{s}^{(d)})$ with signature $(- + + +)$ (5.4.16)

$\delta(d\boldsymbol{s}^{(a)}d\boldsymbol{s}^{(c)}) = \delta(d\boldsymbol{s}^{(a)})d\boldsymbol{s}^{(c)} + d\boldsymbol{s}^{(a)}\delta(d\boldsymbol{s}^{(c)})$ with signature $(- - - -)$ (5.4.17)

$\delta(d\boldsymbol{s}^{(c)}d\boldsymbol{s}^{(b)}) = \delta(d\boldsymbol{s}^{(c)})d\boldsymbol{s}^{(b)} + d\boldsymbol{s}^{(c)}\delta(d\boldsymbol{s}^{(b)})$ with signature $(- + + +)$ (5.4.18)

$\delta(d\boldsymbol{s}^{(a)}d\boldsymbol{s}^{(d)}) = \delta(d\boldsymbol{s}^{(a)})d\boldsymbol{s}^{(d)} + d\boldsymbol{s}^{(a)}\delta(d\boldsymbol{s}^{(d)})$ with signature $(+ - - -)$ (5.4.19)

$\delta(d\boldsymbol{s}^{(d)}d\boldsymbol{s}^{(b)}) = \delta(d\boldsymbol{s}^{(d)})d\boldsymbol{s}^{(b)} + d\boldsymbol{s}^{(d)}\delta(d\boldsymbol{s}^{(b)})$ with signature $(+ + + +)$. (5.4.20)

Among them, only four variations with different signatures are different

I $\quad \delta(d\boldsymbol{s}^{(c)}d\boldsymbol{s}^{(d)}) = \delta(d\boldsymbol{s}^{(c)})d\boldsymbol{s}^{(d)} + d\boldsymbol{s}^{(c)}\delta(d\boldsymbol{s}^{(d)})$ with signature $(- + + +)$ (5.4.21)

H $\quad \delta(d\boldsymbol{s}^{(d)}d\boldsymbol{s}^{(b)}) = \delta(d\boldsymbol{s}^{(d)})d\boldsymbol{s}^{(b)} + d\boldsymbol{s}^{(d)}\delta(d\boldsymbol{s}^{(b)})$ with signature $(+ + + +)$ (5.4.22)

V $\quad \delta(d\boldsymbol{s}^{(a)}d\boldsymbol{s}^{(b)}) = \delta(d\boldsymbol{s}^{(a)})d\boldsymbol{s}^{(b)} + d\boldsymbol{s}^{(a)}\delta(d\boldsymbol{s}^{(b)})$ with signature $(+ - - -)$ (5.4.23)

H' $\quad \delta(d\boldsymbol{s}^{(a)}d\boldsymbol{s}^{(c)}) = \delta(d\boldsymbol{s}^{(a)})d\boldsymbol{s}^{(c)} + d\boldsymbol{s}^{(a)}\delta(d\boldsymbol{s}^{(c)})$ with signature $(- - - -)$. (5.4.24)

The physical meaning of metric layers with signatures $(- - - -)$ and $(+ + + +)$ is found in consideration of infinitesimal thickness 2^3-$\lambda_{m,n}$-vacuum region between metric layers with signatures $(+ - - -)$ and $(- + + +)$.

We define a set of "pseudo-force fields", i.e. fields associated with accelerations of a local area of the "vacuum" of various types, resulting from the vanishing of the first variations of the four possible functionals in

$$\delta\int d\boldsymbol{s}^{(a)}=\int\{\delta\beta^{pm(a)}\mathbf{e}_m{}^{(a)}\alpha_{pi}{}^{(a)}dx^i+\beta^{pm(a)}\delta\mathbf{e}_m{}^{(a)}\alpha_{pi}{}^{(a)}dx^i+\beta^{pm(a)}\mathbf{e}_m{}^{(a)}\delta\alpha_{pi}{}^{(a)}dx^i+\beta^{pm(a)}\mathbf{e}_m{}^{(a)}\alpha_{pi}{}^{(a)}\delta dx^i\}=0,$$

$$\delta\int d\boldsymbol{s}^{(b)}=\int\{\delta\beta^{ln(b)}\mathbf{e}_n{}^{(b)}\alpha_{lj}{}^{(b)}dx^j+\beta^{ln(b)}\delta\mathbf{e}_n{}^{(b)}\alpha_{lj}{}^{(b)}dx^j+\beta^{ln(b)}\mathbf{e}_n{}^{(b)}\delta\alpha_{lj}{}^{(b)}dx^j+\beta^{ln(b)}\mathbf{e}_n{}^{(b)}\alpha_{lj}{}^{(b)}\delta dx^j\} = 0,$$

$$\delta\int d\boldsymbol{s}^{(c)}=\int\{\delta\beta^{pm(c)}\mathbf{e}_m{}^{(c)}\alpha_{pi}{}^{(c)}dx^i+\beta^{pm(c)}\delta\mathbf{e}_m{}^{(c)}\alpha_{pi}{}^{(c)}dx^i+\beta^{pm(c)}\mathbf{e}_m{}^{(c)}\delta\alpha_{pi}{}^{(c)}dx^i+\beta^{pm(c)}\mathbf{e}_m{}^{(c)}\alpha_{pi}{}^{(c)}\delta dx^i\} = 0,$$

$$\delta\int d\boldsymbol{s}^{(d)}=\int\{\delta\beta^{ln(d)}\mathbf{e}_n{}^{(d)}\alpha_{lj}{}^{(d)}dx^j+\beta^{ln(d)}\delta\mathbf{e}_n{}^{(d)}\alpha_{lj}{}^{(d)}dx^j+\beta^{ln(d)}\mathbf{e}_n{}^{(d)}\delta\alpha_{lj}{}^{(d)}dx^j+\beta^{ln(d)}\mathbf{e}_n{}^{(d)}\alpha_{lj}{}^{(d)}\delta dx^j\} = 0, \quad (5.4.24)$$

which decompose into variations of 16-sub-functionals.

H’ V H I i

$$\delta\int d\mathbf{s}^{(a)} = \int \delta\beta^{pm(a)}\mathbf{e}_m{}^{(a)}\alpha_{pi}{}^{(a)}dx^i + \int\beta^{pm(a)}\delta\mathbf{e}_m{}^{(a)}\alpha_{pi}{}^{(a)}dx^i + \int\beta^{pm(a)}\mathbf{e}_m{}^{(a)}\delta\alpha_{pi}{}^{(a)}dx^i + \int\beta^{pm(a)}\mathbf{e}_m{}^{(a)}\alpha_{pi}{}^{(a)}\delta dx^i = 0,$$

$$\delta\int d\mathbf{s}^{(b)} = \int \delta\beta^{ln(b)}\mathbf{e}_n{}^{(b)}\alpha_{lj}{}^{(b)}dx^j + \int\beta^{ln(b)}\delta\mathbf{e}_n{}^{(b)}\alpha_{lj}{}^{(b)}dx^j + \int\beta^{ln(b)}\mathbf{e}_n{}^{(b)}\delta\alpha_{lj}{}^{(b)}dx^j + \int\beta^{ln(b)}\mathbf{e}_n{}^{(b)}\alpha_{lj}{}^{(b)}\delta dx^j = 0,$$

$$\delta\int d\mathbf{s}^{(c)} = \int \delta\beta^{pm(c)}\mathbf{e}_m{}^{(c)}\alpha_{pi}{}^{(c)}dx^i + \int\beta^{pm(c)}\delta\mathbf{e}_m{}^{(c)}\alpha_{pi}{}^{(c)}dx^i + \int\beta^{pm(c)}\mathbf{e}_m{}^{(c)}\delta\alpha_{pi}{}^{(c)}dx^i + \int\beta^{pm(c)}\mathbf{e}_m{}^{(c)}\alpha_{pi}{}^{(c)}\delta dx^i = 0,$$

$$\delta\int d\mathbf{s}^{(d)} = \int \delta\beta^{ln(d)}\mathbf{e}_n{}^{(d)}\alpha_{lj}{}^{(d)}dx^j + \int\beta^{ln(d)}\delta\mathbf{e}_n{}^{(d)}\alpha_{lj}{}^{(d)}dx^j + \int\beta^{ln(d)}\mathbf{e}_n{}^{(d)}\delta\alpha_{lj}{}^{(d)}dx^j + \int\beta^{ln(d)}\mathbf{e}_n{}^{(d)}\alpha_{lj}{}^{(d)}\delta dx^j\} = 0. \quad (5.4.25)$$

Substituting the variations (5.4.25) into the expressions (5.4.21) through (5.4.24), we obtain 32 types of different fields corresponding to the acceleration of local sections of a 2^3-$\lambda_{m,n}$-vacuum region, i.e. pseudo-force fields of the void (Figure 5.4.1).

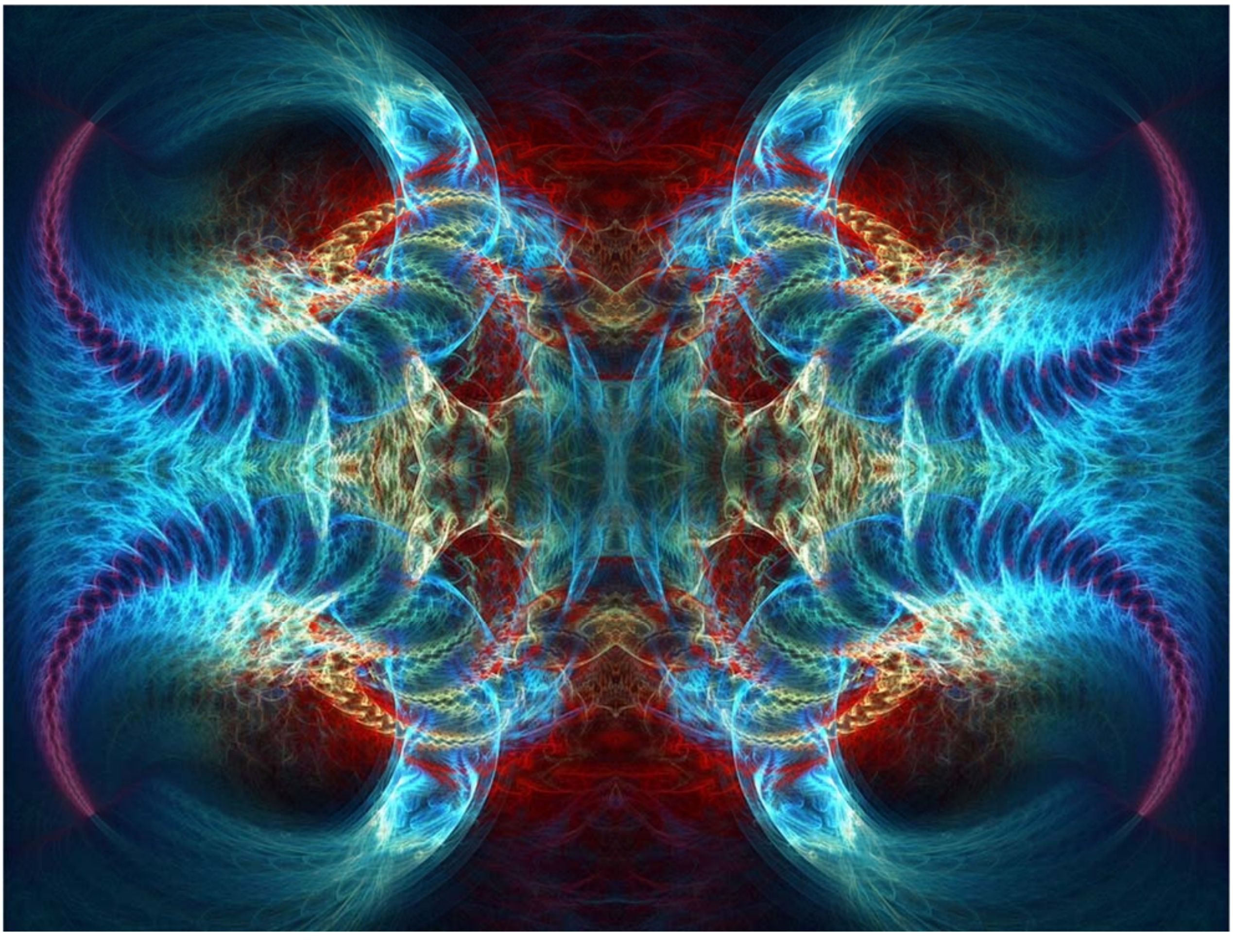


Fig. 5.4.1. Fractal illustration of accelerated intra-vacuum currents, which determine the manifestations of various fields of acceleration of the local area of the "vacuum"

As part of the development of the general dynamics of vacuum layers, a series of other possibilities should be considered that may prove useful for solving a number of geometric-dynamic problems. In particular:

1). In *§ 1.14*, from a diagonal quadratic form, for example, with the signature $(+---)$

$$ds^{(-)2} = g_{00}dx^0dx^0 - g_{11}dx^1dx^1 - g_{22}dx^2dx^2 - g_{33}dx^3dx^3 = \begin{pmatrix} q_0dx^0 + q_3dx^3 & q_1dx^1 + iq_2dx^2 \\ q_1dx^1 - iq_2dx^2 & q_0dx^0 - q_3dx^3 \end{pmatrix}_{\det} \quad (5.4.26)$$

(where $q_i = \sqrt{g_{ii}}$), a linear form was obtained in the form of an A_4-matrix

$$A_4^{(+---)} = \begin{pmatrix} q_0dx^0 + q_3dx^3 & q_1dx^1 + iq_2dx^2 \\ q_1dx^1 - iq_2dx^2 & q_0dx^0 - q_3dx^3 \end{pmatrix} = q_0dx^0\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - q_1dx^1\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} - q_2dx^2\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} - q_3dx^3\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, \quad (5.4.27)$$

In this case, the dynamics of the vacuum layer with the signature $(+---)$ is determined by the vanishing of the first variation of the functional of the form

$$\delta\int A_4^{(+---)} = \delta\int(q_0dx^0\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - q_1dx^1\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} - q_2dx^2\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} - q_3dx^3\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}) = 0. \quad (5.4.28)$$

Similarly, the dynamics of all other vacuum layers of the form *(1.14.6)* with all possible signatures *(1.11.5)*.

2). In *§ 1.15* one regards the Dirac representation of a diagonal quadratic form, for example, with the signature $(++++)$

$$ds^2 = g_{00}dx^0dx^0 + g_{11}dx^1dx^1 + g_{22}dx^2dx^2 + g_{33}dx^3dx^3 \quad (5.4.29)$$

in the form of a product of two affine (linear) forms

$ds^2 = ds'ds'' = (\gamma_0q_0dx^{0\prime} + \gamma_1q_1dx^{1\prime} + \gamma_2q_2dx^{2\prime} + \gamma_3q_3dx^{2\prime})\cdot(\gamma_0q_0dx^{0\prime\prime} + \gamma_1q_1dx^{1\prime\prime} + \gamma_2q_2dx^{2\prime\prime} + \gamma_3q_3dx^{2\prime\prime})$

where $q_i = \sqrt{g_{ii}}$; (5.4.30)

γ_μ represents the objects that satisfy the anticommutative relation of the Clifford algebra

$$\gamma_\mu\gamma_\eta + \gamma_\eta\gamma_\mu = 2\delta_{\mu\eta}, \quad (5.4.31)$$

The condition (5.4.31) is satisfied, for example, by the following set of Dirac 4×4-matrices:

$$\gamma_0 = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix}, \quad \gamma_1 = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}, \quad \gamma_2 = \begin{pmatrix} 0 & 0 & 0 & -i \\ 0 & 0 & i & 0 \\ 0 & -i & 0 & 0 \\ i & 0 & 0 & 0 \end{pmatrix}, \quad \gamma_3 = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 \\ 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \end{pmatrix}, \quad \delta_{\mu\eta} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix},$$

(5.4.32)

A variation of the product of two linear forms (5.4.27) is equal to

$$\delta(ds'ds'') = \delta(ds')ds'' + ds'\delta(ds''). \quad (5.4.33)$$

In this case, the dynamics of a vacuum layer with the signature $(++++)$ is determined by the expressions

$$\delta\int ds' = \delta\int(\gamma_0q_0dx^{0\prime} + \gamma_1q_1dx^{1\prime} + \gamma_2q_2dx^{2\prime} + \gamma_3q_3dx^{3\prime}) = 0, \quad (5.4.34)$$

$$\delta\int ds'' = \delta\int(\gamma_0q_0dx^{0\prime\prime} + \gamma_1q_1dx^{1\prime\prime} + \gamma_2q_2dx^{2\prime\prime} + \gamma_3q_3dx^{3\prime\prime}) = 0. \quad (5.4.35)$$

Similarly, the dynamics of all other vacuum layers with all possible signatures (5.3.18) is determined.

The further development of these directions of vacuum dynamics is left for mathematicians, with the certainty that they will be then utilized by physicists.

5.5 Overall dynamics of the metric space with constant curvature [34]

Consider the generalized metric

$$ds^2 = g_{ij} dx^i dx^j, \qquad (5.5.1)$$

with any signature whose components of the metric tensor are independent of time

$$g_{ij} = const\,. \qquad (5.5.2)$$

We rewrite the quadratic form (5.5.1), selecting the components with zero indices:

$$ds^2 = c^2 g_{00}\, dt^2 + 2cg_{0\alpha}\, dx^\alpha dt + g_{\alpha\beta} dx^\alpha dx^\beta, \qquad (5.5.3)$$

where $\alpha, \beta = 1, 2, 3$; $dx^0 = dt$.

To the right-hand side of (5.5.3) we add and subtract the square of the quantity

$$\frac{g_{0\alpha} dx^\alpha}{\sqrt{g_{00}}}. \qquad (5.5.4)$$

As a result, we obtain [34]

$$ds^2 = c^2 \left[\sqrt{g_{00}}\, dt + \frac{g_{0\alpha} dx^\alpha}{c\sqrt{g_{00}}} \right]^2 - \left[-g_{\alpha\beta} + \frac{g_{0\alpha} g_{0\beta}}{g_{00}} \right] dx^\alpha dx^\beta, \qquad (5.5.5)$$

whence for an curved area of a 4-dimensional space we have an analog of proper time [34]

$$d\tau = \sqrt{g_{00}}\, dt + \frac{g_{0\alpha} dx^\alpha}{c\sqrt{g_{00}}} \quad \text{или} \quad d\tau = \frac{\sqrt{g_{00}}}{c} \left(dx^0 + \frac{g_{0\alpha}}{g_{00}} dx^\alpha \right). \qquad (5.5.6)$$

The second term in (5.5.5) is the square of the distance between two points in a 3-dimensional metric space

$$dl^2 = -\left(g_{\alpha\beta} - \frac{g_{0\alpha} g_{0\beta}}{g_{00}}\right) dx^\alpha dx^\beta \quad \text{or} \quad dl^2 = \gamma_{\alpha\beta} dx^\alpha dx^\beta, \qquad (5.5.7)$$

where a 3-dimensional metric tensor

$$\gamma_{\alpha\beta} = -g_{\alpha\beta} + \frac{g_{0\alpha} g_{0\beta}}{g_{00}}. \qquad (5.5.8)$$

The expression (5.5.5) with allowance for (5.5.6) and (5.5.7) takes the invariant form

$$ds^2 = c^2 d\tau^2 - dl^2, \qquad (5.5.9)$$

corresponding to a reference system in which the local region under investigation of one of the sides of the vacuum region is at rest.

Now we can introduce the 3-dimensional velocity of the local region of the vacuum layer, whose metric-dynamic properties are given by the components of the metric tensor (5.5.2) [34]

$$v=\frac{dl}{d\tau}=\frac{cdl}{\sqrt{g_{00}}\left(x^{0}+\frac{g_{0\alpha}}{g_{00}}dx^{\alpha}\right)}=\frac{c\left(-g_{\alpha\beta}+\frac{g_{0\alpha}g_{0\beta}}{g_{00}}\right)dx^{\alpha}dx^{\beta}}{\sqrt{g_{00}}\left(x^{0}+\frac{g_{0\alpha}}{g_{00}}dx^{\alpha}\right)}. \tag{5.5.10}$$

Covariant components of the velocity vector v_α are determined by the expressions [34]

$$v_\alpha = g_{\alpha\beta} v^\beta, \qquad v^2 = v_\alpha v^\alpha. \tag{5.5.11}$$

Taking into account (5.5.10), the stationary metric (5.5.3) can be represented in the form

$$ds^2 = g_{00}(dx^0 - g_\alpha dx^\alpha)^2(1 - v^2/c^2), \tag{5.5.12}$$

where a 3-dimensional vector has been introduced

$$g_\alpha = -\frac{g_{0\alpha}}{g_{00}}. \tag{5.5.13}$$

The components of the 4-velocity $u^i=dx^i/ds$, taking into account (5.5.12), are equal to [34]

$$u^0=\frac{1}{\sqrt{g_{00}}\sqrt{1-\frac{v^2}{c^2}}}+\frac{g_\alpha v^\alpha}{c\sqrt{1-\frac{v^2}{c^2}}}, \qquad u^\alpha=\frac{v^\alpha}{c\sqrt{1-\frac{v^2}{c^2}}}. \tag{5.5.14}$$

To determine the acceleration of the local portion of the vacuum layer, we use the equation of the geodesic (5.2.15).

We find the Christoffel symbols (5.2.16) for the case under consideration [34]

$$\Gamma^{\alpha}{}_{00} = \tfrac{1}{2}\, g_{00}{}^{;\alpha} \tag{5.5.15}$$

$$\Gamma^{\alpha}{}_{0\beta} = \tfrac{1}{2}\, g_{00}\,(g^{\alpha}{}_{;\beta} - g_{;}{}^{\alpha}{}_{\beta}) - \tfrac{1}{2}\, g_\beta\, g_{00}{}^{;\alpha} \tag{5.5.16}$$

$$\Gamma^{\alpha}{}_{\beta\gamma} = \lambda^{\alpha}{}_{\beta\gamma} + \tfrac{1}{2}\, g_{00}[g_\beta(g_{;}{}^{\alpha}{}_{\gamma} - g^{\alpha}{}_{;\gamma}) + g_\gamma(g_{;}{}^{\alpha}{}_{\beta} - g^{\alpha}{}_{;\beta})] + \tfrac{1}{2}\, g_\beta\, g_\gamma\, g_{00}{}^{;\alpha}, \tag{5.5.17}$$

where

$g^{\alpha}{}_{;\gamma}$ indicates a covariant derivative, which in this case coincides with the usual partial derivative [34]

$$g^{\alpha}_{;\gamma}=\frac{\partial g^{\alpha}}{\partial x^{\gamma}}+\Gamma^{\alpha}_{k\gamma}g^{k}=\frac{\partial g^{\alpha}}{\partial x^{\gamma}}; \tag{5.5.18}$$

$\lambda^{\alpha}{}_{\beta\gamma}$ is a 3-dimensional Christoffel symbol composed of the components of the metric tensor $g_{\alpha\beta}$ just as $\Gamma^{i}{}_{kl}$ is composed of the components of g_{ik}.

In these expressions, all tensor actions (covariant differentiations, raising and lowering indices) are performed in a 3-dimensional space with the metric $g_{\alpha\beta}$ over the 3-dimensional vector g^α and the scalar g_{00}.

Substituting expressions (5.5.15) through (5.5.17) into the equation (5.2.5), we obtain [34]

$$du^\alpha/ds = -\Gamma_{00}{}^{\alpha}(u^0)^2 - 2\,\Gamma_{0\beta}{}^{\alpha}u^0u^\beta - \Gamma_{\beta\gamma}{}^{\alpha}u^\beta u^\gamma \tag{5.5.19}$$

and, using the expressions (5.5.14) for the components of 4-velocity, after the transformations we have

$$\frac{du^a}{ds}=\frac{d}{ds}\frac{v^\alpha}{c\sqrt{1-\frac{v^2}{c^2}}}=-\frac{g_{00}^{;\alpha}}{2g_{00}\left(1-\frac{v^2}{c^2}\right)}-\frac{\sqrt{g_{00}}(g_{;\beta}^{\alpha}-g_{\beta}^{;\alpha})v^\beta}{c\left(1-\frac{v^2}{c^2}\right)}-\frac{\lambda_{\beta\gamma}^{\alpha}v^\beta v^\gamma}{c^2\left(1-\frac{v^2}{c^2}\right)}. \tag{5.5.20}$$

The acceleration is the derivative of 3-dimensional velocity at the proper time, determined by means of three-dimensional covariant differentiation [34]

$$a^\alpha=c\sqrt{1-\frac{v^2}{c^2}}\frac{Dv^\alpha}{ds}=c\sqrt{1-\frac{v^2}{c^2}}\frac{d}{ds}\frac{v^\alpha}{\sqrt{1-\frac{v^2}{c^2}}}+\frac{\lambda_{\beta\gamma}^{\alpha}v^\beta v^\gamma}{\sqrt{1-\frac{v^2}{c^2}}}. \tag{5.5.21}$$

Taking into account (5.5.17) for the 3-dimensional acceleration of the local stationary section of the vacuum layer with the metric (5.5.1) and the components of the metric tensor (5.5.2), and omitting the index α for convenience, we finally have [34]

$$a_\alpha=\frac{c^2}{\sqrt{1-\frac{v^2}{c^2}}}\left\{-\frac{\partial\ln\sqrt{g_{00}}}{\partial x^a}+\sqrt{g_{00}}\left(\frac{\partial g_\beta}{\partial x^a}-\frac{\partial g_\alpha}{\partial x^\beta}\right)\frac{v^\beta}{c}\right\}, \tag{5.5.22}$$

or in the vector form [34]

$$\vec{a}=\frac{c^2}{\sqrt{1-\frac{v^2}{c^2}}}\left\{-grad\,(\ln\sqrt{g_{00}})+\sqrt{g_{00}}\left[\frac{\vec{v}}{c}\times rot\,\vec{g}\right]\right\}, \tag{5.5.23}$$

where $\vec{g}\ (g_1,g_2,g_3)$ is the three-dimensional vector with components $g_\alpha=-\frac{g_{0\alpha}}{g_{00}}$; (5.5.24)

$$\vec{v}=\frac{d\vec{l}}{d\tau}=\frac{cd\vec{l}}{\sqrt{g_{00}}\left(x^0+\frac{g_{0\alpha}}{g_{00}}dx^\alpha\right)} \tag{5.5.25}$$

is the vector of 3-dimensional velocity of the local section of the vacuum layer.

We note once again that the acceleration vector (5.5.23) with the components (5.5.22) was obtained under the condition that the component of the metric tensor g_{ij} is stationary (i.e., not depending on time $x^0 = t$) {see (5.5.2)}.

5.6 The vectors of the field strength and induction of the vacuum layer

Consider the vector expression (5.5.23)

$$\vec{a} = \frac{c^2}{\sqrt{1-\frac{v^2}{c^2}}}\left\{-grad\,(\ln\sqrt{g_{00}}) + \frac{1}{c}\left[\vec{v}\times\sqrt{g_{00}}rot\,\vec{g}\right]\right\}. \qquad (5.6.1)$$

We introduce the notation

$$\mathbf{E}_v = -\,\gamma\, grad\ \varphi, \qquad \mathbf{B}_v = \gamma\sqrt{g_{00}}rot\,\vec{A}/c\,, \qquad (5.6.2)$$

where

$$\gamma = \frac{c^2}{\sqrt{1-\frac{v^2}{c^2}}}, \qquad \varphi = \ln\sqrt{g_{00}}, \qquad \vec{A} = \vec{g}\,. \qquad (5.6.3)$$

In this case, the acceleration vector (5.6.1) becomes

$$\mathbf{a} = \mathbf{E}_v + [\mathbf{v}\times\mathbf{B}_v], \qquad (5.6.4)$$

Let us compare the acceleration vector with the Lorentz force

$$\mathbf{F}_l = q\mathbf{E} + q[\mathbf{v}\times\mathbf{B}],$$

or

$$\mathbf{F}_l/q = \mathbf{E} + [\mathbf{v}\times\mathbf{B}], \qquad (5.6.5)$$

where

E is the electric field strength vector;

B is the induction vector of the magnetic field;

q is the charge of the particle.

In an obvious analogy, expressions (5.6.4) and (5.6.5) allow us to consider the vectors (5.6.2) in the following way:

$\mathbf{E}_v$ is the vector of the field strength of a vacuum layer with components

$$E_{v1} = \gamma\frac{\partial\ln\sqrt{g_{00}}}{\partial x^1}, \qquad E_{v2} = \gamma\frac{\partial\ln\sqrt{g_{00}}}{\partial x^2}, \qquad E_{v3} = \gamma\frac{\partial\ln\sqrt{g_{00}}}{\partial x^3}. \qquad (5.6.6)$$

$\mathbf{B}_v$ is the induction vector of a vacuum layer with components

$$B_{v1} = \gamma\sqrt{g_{00}}\left(\frac{\partial g_3}{\partial x^2}-\frac{\partial g_2}{\partial x^3}\right), \quad B_{v2} = \gamma\sqrt{g_{00}}\left(\frac{\partial g_1}{\partial x^3}-\frac{\partial g_3}{\partial x^1}\right), \quad B_{v3} = \gamma\sqrt{g_{00}}\left(\frac{\partial g_2}{\partial x^1}-\frac{\partial g_1}{\partial x^2}\right). \qquad (5.6.7)$$

where $g_1 = -\frac{g_{01}}{g_{00}}, \quad g_2 = -\frac{g_{02}}{g_{00}}, \quad g_3 = -\frac{g_{03}}{g_{00}}.$

Vectors $\mathbf{E}_v$ and $\mathbf{B}_v$ describe the dynamic steady state of the local area of the vacuum layer whose metric-dynamic characteristics are determined by the metric (5.5.1) with the stationary components of the metric tensor (5.5.2).

To clarify the physical meaning of the vectors $\mathbf{E}_v$ and $\mathbf{B}_v$, we consider an arbitrary motion of an affine space (i.e., the reference frame) $K'(t',x',y',z')$ with respect to the affine space (i.e., the reference frame) $K(t,x,y,z)$ at rest (Figure 5.6.1) .

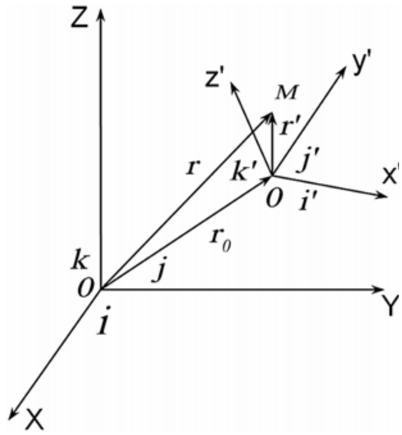


Fig. 5.6.1 The motion of the reference frame K' with relative to the stationary reference frame K [6]

It is evident from Figure 6.1 that the radius vectors $\mathbf{r}$ and $\mathbf{r}'$ defining the position of the point M in the systems K and K', respectively, are connected by the relation

$$\mathbf{r} = \mathbf{r}_0 + \mathbf{r}' \qquad (5.6.8)$$

or
$$\mathbf{i}x + \mathbf{j}y + \mathbf{k}z = \mathbf{r}_0 + \mathbf{i}'x' + \mathbf{j}'y' + \mathbf{k}'z', \qquad (5.6.9)$$

where $\mathbf{i}$, $\mathbf{j}$, $\mathbf{k}$ are the orthogonal unit vectors defining the directions of the axes of the motionless affine space K with stignature $\{+ + + +\}$;

$\mathbf{i}'$, $\mathbf{j}'$, $\mathbf{k}'$ are the orthogonal unit vectors defining the directions of the axes of the mobile affine space K' with stignature $\{+ + + +\}$.

The velocity of the point M (belonging to an affine space K') with respect to the system K for $t' = t$ is obtained by differentiating both sides of (5.6.8) [25]

$$\mathbf{v}_a = d\mathbf{r}/dt = d\mathbf{r}_0/dt + d\mathbf{r}'/dt\,, \qquad (5.6.10)$$

while taking (5.6.9) into account we have

$$\mathbf{v}_a = \mathbf{v}_0 + (x'd\mathbf{i}'/dt + y'd\mathbf{j}'/dt + z'd\mathbf{k}'/dt) + (\mathbf{i}'dx'/dt + \mathbf{j}'dy'/dt + \mathbf{k}'dz'/dt). \qquad (5.6.11)$$

The unit vectors $\mathbf{i}'$, $\mathbf{j}'$, $\mathbf{k}'$ belonging to the mobile affine space K' may change with relative to the affine space K only due to its rotation around the point O' with angular velocity $\boldsymbol{\Omega}$**.** Therefore, the derivatives with respect to time of $\mathbf{i}'$, $\mathbf{j}'$, $\mathbf{k}'$ are equal to the linear velocities of the endpoints of these vectors under rotation of the system K' [25]

$$d\mathbf{i}'/dt = [\boldsymbol{\Omega} \times \mathbf{i}'], \quad d\mathbf{j}'/dt = [\boldsymbol{\Omega} \times \mathbf{j}'], \quad d\mathbf{k}'/dt = [\boldsymbol{\Omega} \times \mathbf{k}']. \qquad (5.6.12)$$

Substituting (5.6.12) into (5.6.11), we obtain

$$\mathbf{v}_a = \mathbf{v}_0 + [\boldsymbol{\Omega} \times \mathbf{r}'] + (\mathbf{i}'dx'/dt + \mathbf{j}'dy'/dt + \mathbf{k}'dz'/dt). \qquad (5.6.13)$$

The acceleration of M relative to the frame K at $t' = t$ is equal to [25]

$$\mathbf{a} = d\mathbf{v}_a/dt = \mathbf{a}_r + \mathbf{a}_e + \mathbf{a}_k\,, \qquad (5.6.14)$$

where

$$\mathbf{a}_r = (\mathbf{i}'d^2x'/dt^2 + \mathbf{j}'d^2y'/dt^2 + \mathbf{k}'d^2z'/dt^2) \qquad (5.6.15)$$

is the relative acceleration;

$$\mathbf{a}_e = d\mathbf{v}_0/dt + [d\mathbf{\Omega}/dt \times \mathbf{r}'] + [\mathbf{\Omega} \times [\mathbf{\Omega} \times \mathbf{r}']] \quad (5.6.16)$$

is the proper acceleration.

$$\mathbf{a}_k = 2[\mathbf{\Omega} \times \mathbf{v}_r] \quad (5.6.17)$$

is the Coriolis acceleration.

We rewrite expression (5.6.14) for the stationary case $d\mathbf{v}_0/dt = 0$ and $[d\mathbf{\Omega}/dt \times \mathbf{r}'] = 0$ in the following form:

$$\mathbf{a} = \mathbf{a}_{pc} + 2[\mathbf{\Omega} \times \mathbf{v}_r], \quad (5.6.18)$$

where

$$a_{pc} = (\mathbf{i}'d^2x'/dt^2 + \mathbf{j}'d^2y'/dt^2 + \mathbf{k}'d^2z'/dt^2) + [\mathbf{\Omega} \times [\mathbf{\Omega} \times \mathbf{r}']] \quad (5.6.19)$$

is the stationary relative proper acceleration of a mobile affine space.

Taking into account the relation known in analytic geometry, the expression (5.6.18) can be represented in the form

$$[\mathbf{\Omega} \times \mathbf{v}_r] = -[\mathbf{v}_r \times \mathbf{\Omega}], \quad (5.6.20)$$

Equation (5.6.18) can be expressed in the form

$$\mathbf{a} = \mathbf{a}_{pc} - 2[\mathbf{v}_r \times \mathbf{\Omega}]. \quad (5.6.21)$$

Comparing the acceleration of the affine space K′ in the neighborhood of the point M (5.6.21) with the acceleration (5.6.4) $\mathbf{a} = \mathbf{E}_v + [\mathbf{v} \times \mathbf{B}_v]$, the following analogy is found:

$$\mathbf{E}_v \equiv \mathbf{a}_{pc}, \quad \mathbf{B}_v \equiv -2\mathbf{\Omega}, \quad \mathbf{v} \equiv \mathbf{v}_r. \quad (5.6.22)$$

Thus, it turns out that with respect to the affine space at rest (i.e., the reference frame) K (x,y,z):

- the vector of the strength of the vacuum layer $\mathbf{E}_v$ is identical to the proper acceleration with torsion $\mathbf{a}_{pc}$ of the local part of the mobile affine space K' in a neighborhood of the point M ;
- the vector of the induction of the vacuum layer $\mathbf{B}_v$ is identical to the double of the stationary angular velocity of the rotation $\mathbf{\Omega}$ of the same region of the mobile affine space K';
- the velocity vector $\mathbf{v}$ corresponds to the speed of a constant moving $\mathbf{v}_r$ of the same section of the affine space K' with respect to the affine space K.

Within the framework of the Algebra of Signatures, each of the reference systems $K'(t', x', y', z')$ and $K(t, x, y, z)$ can have any of the 16 possible stignatures *{see (1.8.2)}*

$$stign\left(e_i^{(a)}\right) = \begin{pmatrix} \{++++\}^{00} & \{+++-\}^{10} & \{-++-\}^{20} & \{++-+\}^{30} \\ \{---+\}^{01} & \{-+++\}^{11} & \{--++\}^{21} & \{-+-+\}^{31} \\ \{+--+\}^{02} & \{++--\}^{12} & \{+---\}^{22} & \{+-++\}^{32} \\ \{--+-\}^{03} & \{+-+-\}^{13} & \{-+--\}^{23} & \{----\}^{33} \end{pmatrix}, \quad (5.6.23)$$

therefore there are 256 possible variants of motion of two affine layers relative to one another.

5.7 The vectors of tension and induction of a 2^k-$\lambda_{m,n}$-vacuum region

In point 5.5 we give information well known to field theory specialists [34]. We now consider 2^3-$\lambda_{m,n}$-vacuum regions within the framework of the Algebra of Signatures.

We rewrite the expression (5.2.22) in the form

$$\frac{d^2x^l}{ds^2} = -\Gamma_{ij}^{l(-)}\frac{dx^i}{ds}\frac{dx^j}{ds} + i\Gamma_{ij}^{l(+)}\frac{dx^i}{ds}\frac{dx^j}{ds}, \qquad (5.7.1)$$

where a consideration of the previous paragraph shows that, for the simplest level in Alsigna, the acceleration of the steady state bilateral curved 2^3-$\lambda_{m,n}$-vacuum region has the form

$$\mathbf{a}^{(\pm)} = \mathbf{a}^{(-)} + i\mathbf{a}^{(+)} \qquad (5.7.2)$$

where

$\mathbf{a}^{(-)}$ is the acceleration vector (5.5.23) into which the corresponding components of the metric tensor of subcont $g_{ij}^{(-)}$ are substituted (5.1.6);

$\mathbf{a}^{(+)}$ is the acceleration vector (5.5.23) into which the components of the antisubcont metric tensor $g_{ij}^{(+)}$ are substituted (5.1.8).

The complex numbers of the expression (5.7.2) indicate that the vectors $\mathbf{a}^{(-)}$ and $\mathbf{a}^{(+)}$ are mutually perpendicular.

For the stationary case, the vector expression (5.7.2), taking (5.6.4) into account, takes the form

$$\mathbf{a}^{(\pm)} = \mathbf{E}_v{}^{(-)} + [\mathbf{v}^{(-)} \times \mathbf{B}_v{}^{(-)}] + i(\mathbf{E}_v{}^{(+)} + [\mathbf{v}^{(+)} \times \mathbf{B}_v{}^{(+)}]), \qquad (5.7.3)$$

or

$$\mathbf{a}^{(\pm)} = (\mathbf{E}_v{}^{(-)} + i\mathbf{E}_v{}^{(+)}) + ([\mathbf{v}^{(-)} \times \mathbf{B}_v{}^{(-)}] + i[\mathbf{v}^{(+)} \times \mathbf{B}_o{}^{(+)}]).$$

Similarly, considering the level of the 2^6-$\lambda_{m,n}$-vacuum region based on (5.3.14), we obtain

$$\begin{aligned}\mathbf{a}_{(16)} = {} & \eta_1\mathbf{a}^{(1)} + \eta_2\mathbf{a}^{(2)} + \eta_3\mathbf{a}^{(3)} + \eta_4\mathbf{a}^{(4)} + \\ & + \eta_5\mathbf{a}^{(5)} + \eta_6\mathbf{a}^{(6)} + \eta_7\mathbf{a}^{(7)} + \eta_8\mathbf{a}^{(8)} + \\ & + \eta_9\mathbf{a}^{(9)} + \eta_{10}\mathbf{a}^{(10)} + \eta_{11}\mathbf{a}^{(11)} + \eta_{12}\mathbf{a}^{(12)} + \\ & + \eta_{13}\mathbf{a}^{(13)} + \eta_{14}\mathbf{a}^{(14)} + \eta_{15}\mathbf{a}^{(15)} + \eta_{16}\mathbf{a}^{(16)},\end{aligned} \qquad (5.7.4)$$

where

$\mathbf{a}^{(q)}$ is the acceleration vector (5.5.23) into which the corresponding components of the metric tensor $g_{ij}^{(q)}$ (5.3.2), with the corresponding signature from the matrix (5.3.3), are substituted.

For the stationary case, the vector expression (5.7.4) with allowance for (5.6.4) can be represented in the form

$$\vec{a}_{(16)} = \sum_{q=1}^{16}\eta_q(\vec{E}_v^{(q)} + [\vec{v}^{(q)} \times \vec{B}_v^{(q)}]). \qquad (5.7.5)$$

The total dynamics of the following stationary 2^{10}-$\lambda_{m,n}$-vacuum region and the dynamics of all subsequent deeper polyhedral vacuum layers off to infinity {*see § 1.16*} can be developed analogously.

5.8 Metric-dynamic models of the «electron» and the «positron»

From the development of the overall dynamics of vacuum layers, we turn to the study of particular cases of various interactions between vacuum formations.

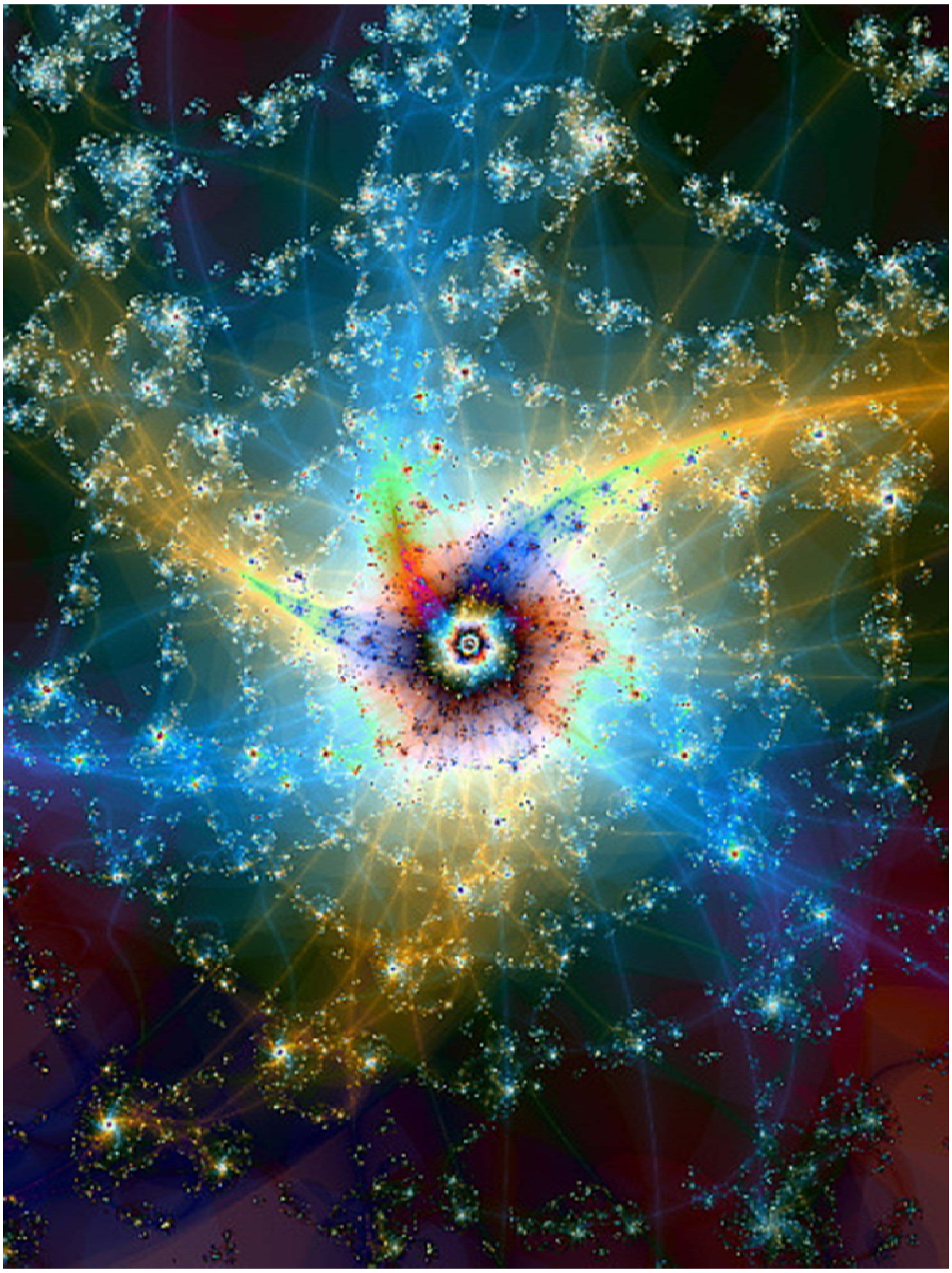


Fig. 5.8.0. Fractal illustration of a local vacuum formation

First of all, consider the «electron» - «positron» and «electron» - «electron» interaction. To this end, we recall {*see* § 2.6} that within the framework of the light-geometry of a vacuum based on the principles of the Algebra of Signatures, the resting «electron» is a stationary (stable) spherically symmetric (convex) vacuum formation, which at the level of consideration of a 2^3-$\lambda_{m,n}$-vacuum region is approximately described by a set of 10 metrics with the signature $(+ - - -)$:

«Electron» (5.8.2)

Stable vacuum formation with signature

$(+\,-\,-\,-)$

consisting of the following parts and curved vacuum layers {see (2.6.22)}:

The outer shell of the «electron»

in the interval [r_6, r_3] (Figure 5.8.1)

$$ds_1^{(+---)2} = \left(1 - \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.2)$$

$$ds_2^{(+---)2} = \left(1 + \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.3)$$

$$ds_3^{(+---)2} = \left(1 - \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.4)$$

$$ds_4^{(+---)2} = \left(1 + \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right); \quad (5.8.5)$$

The core of the «electron»

in the interval [r_7, r_6] (Figure 5.8.1)

$$ds_1^{(+---)2} = \left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.6)$$

$$ds_2^{(+---)2} = \left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.7)$$

$$ds_3^{(+---)2} = \left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.8)$$

$$ds_4^{(+---)2} = \left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right); \quad (5.8.9)$$

Scope of the «electron»

in the interval [0, ∞)

$$ds_5^{(+---)2} = c^2dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.10)$$

where

$r_3 \sim 4{\cdot}10^{18}$ cm is the radius commensurable with the radius of the core of the «galaxy», inside which is the core of the «electron»; if the core of the «electron» is within a biological cell, then the metric r_3 in (5.8.2) through (5.8.9) must be replaced by $r_5 \sim 4.9{\cdot}10^{-3}$ cm {*see (2.6.20)*}; if the core of the «electron» is inside the «planet» core, then for r_3 in the metrics (5.8.2) through (5.8.9) it is necessary to substitute $r_4 \sim 1.4{\cdot}10^{8}$ cm, etc. {*see Figures 2.6.1 through 2.6.3*};

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

$r_7 \sim 5.8{\cdot}10^{-24}$ cm is the radius of the particelle (*inner nucleolus*) located inside the core of the «electron».

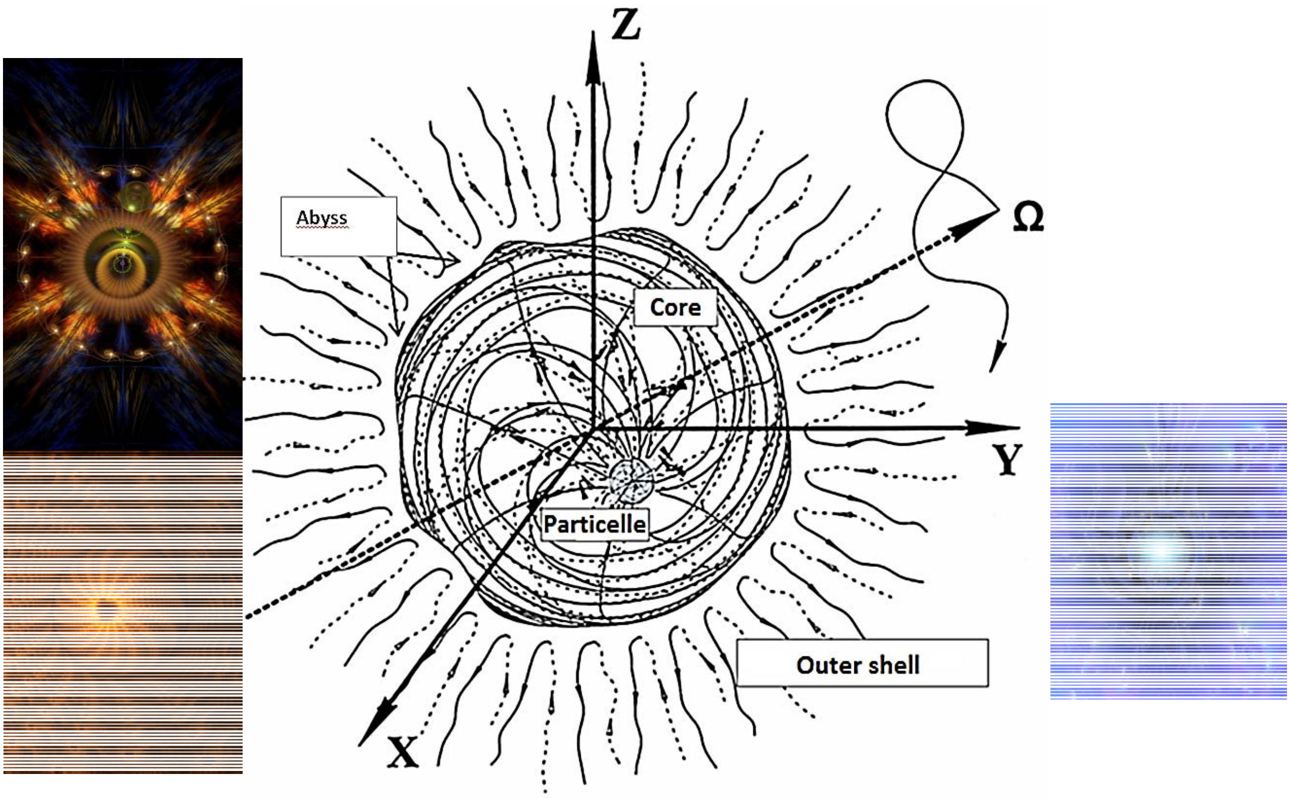


Fig. 5.8.1. Outer shell, abyss (*rakya*), core, particelle (*inner nucleolus*) and scope of a spherical vacuum formation

Definition 5.8.1 *The* ***abyss*** *(rakya) is a multi-layered spherical boundary (shell) between the core and the outer shell of any spherical vacuum formation (Figures 5.8.1 and 5.10.5 through 5.10.8).*

Definition 5.8.2 *The* ***scope*** *is a kind of memory of the undeformed state of the spherical area of the vacuum region under consideration.*

The resting «positron» is a stationary (stable) spherically symmetric vacuum formation that is negative (concave) with respect to the «electron», which, at the level of consideration of the 2^3-$\lambda_{m,n}$-vacuum region, is described by a set of 10 metrics with the signature $(-\,+\,+\,+)$:

«Positron» (5.8.11)

Stable vacuum formation with signature $(-+++)$
consisting of the following parts and curved vacuum layers:

Outer shell of the «positron»

in the interval $[r_6, r_3]$ (Figure 5.8.1)

$$ds_1^{(-+++)2} = -\left(1 - \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.12)$$

$$ds_2^{(-+++)2} = -\left(1 + \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.13)$$

$$ds_3^{(-+++)2} = -\left(1 - \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_6}{r} - \frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.14)$$

$$ds_4^{(-+++)2} = -\left(1 + \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_6}{r} + \frac{r^2}{r_3^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right); \quad (5.8.15)$$

The core of the «positron»

in the interval $[r_7, r_6]$ (Figure 5.8.1)

$$ds_1^{(-+++)2} = -\left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.16)$$

$$ds_2^{(-+++)2} = -\left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.17)$$

$$ds_3^{(-+++)2} = -\left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_7}{r} - \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.18)$$

$$ds_4^{(-+++)2} = -\left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right); \quad (5.8.19)$$

Scope of the «positron»

in the interval $[0, \infty)$

$$ds_5^{(-+++)2} = c^2dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \quad (5.8.20)$$

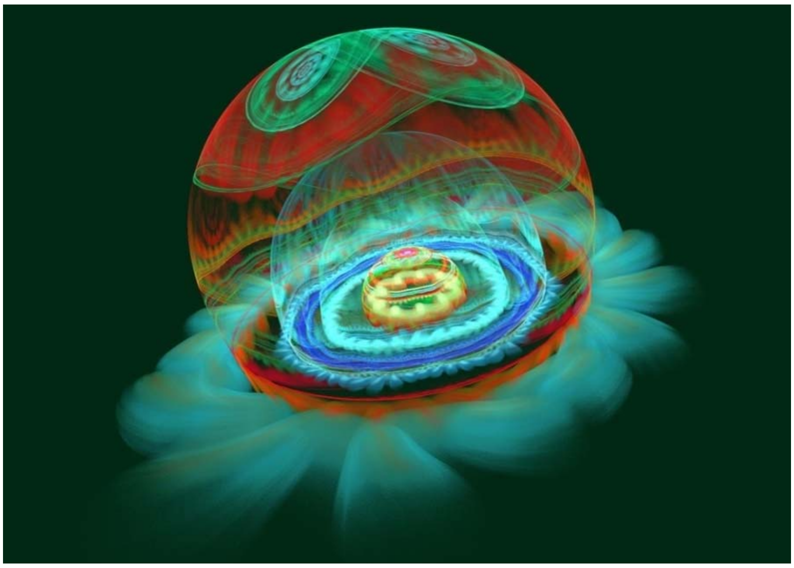
where

$r_3 \sim 4\cdot10^{18}$ cm is the radius commensurable with the radius of the core of the «galaxy», inside which is the core of the «positron»; if the core of the «positron» is within a biological cell, then the metric r_3 in (5.8.12) through (5.8.19) must be replaced by $r_5 \sim 4.9\cdot10^{-3}$ cm {*see (2.6.20)*}; if the core of the «positron» is inside the «planet» core, then for r_3 in the metrics (5.8.12) through (5.8.19) it is necessary to substitute $r_4 \sim 1.4 \cdot 10^8$ cm, etc. {*see Figures 2.6.1* through *2.6.3*};

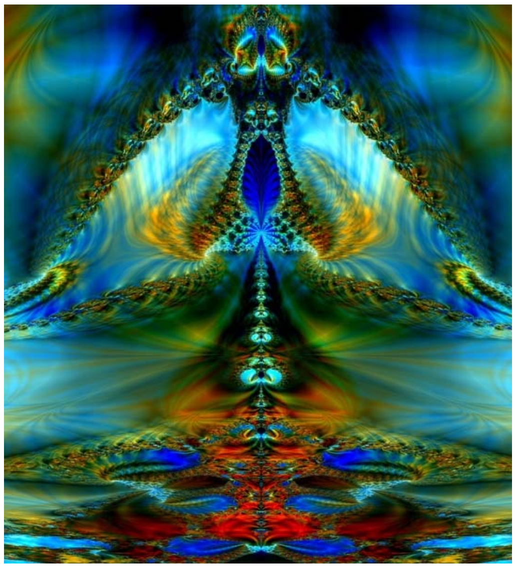
$r_6 \sim 1.7 \cdot 10^{-13}$ cm is the radius of core the of the « positron»;

$r_7 \sim 5.8 \cdot 10^{-24}$ cm is the radius of the particelle (*inner nucleolus*) located inside the core of the «positron».

Within Alsigna, the «electron» and the «positron» may be inserted into the hierarchical set of spherical vacuum formations nested like matruschka (Russian nested dolls) (Figures 5.8.2 *a* and 5.8.3) {*See §§ 2.5 through 2.6 and Figure 2.6.2*}. But, in order to simplify, we consider the vacuum formation consisting of a sequence of only three of them.



a)



b)

Fig. 5.8.2. *a*) Fractal illustration of the sequence of spherical formations nested inside each other; *b*) Fractal illustration of the hierarchy of local vacuum formations

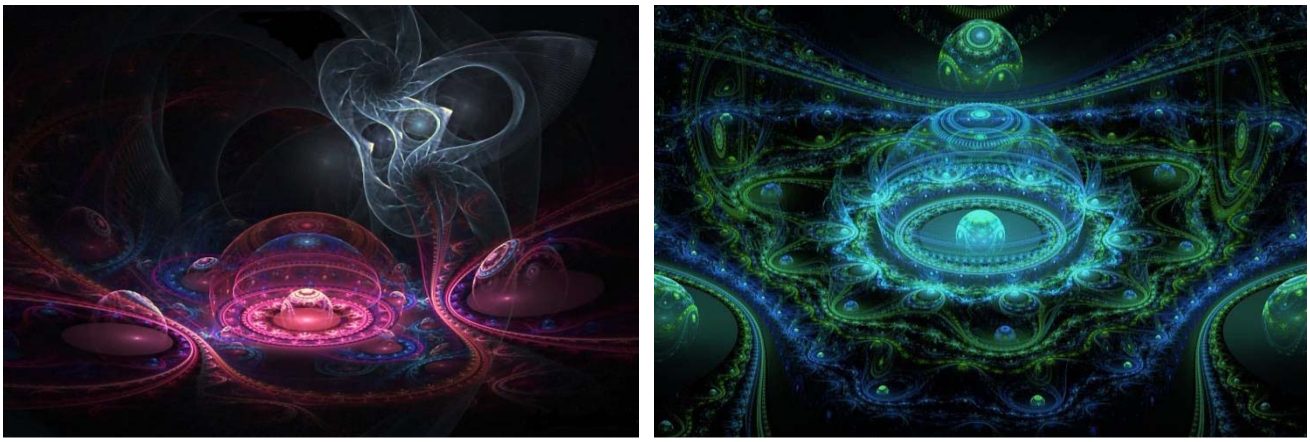


Fig. 5.8.3. Fractal illustrations of a sequence of spherical formations nested in each other

5.9 The outer shell of the «electron» and «positron»

Consider the outer shell of the «electron» (Figure 5.8.1), located inside the nucleus of the «galaxy» with a radius $r_3 \sim 4{\cdot}10^{18}$ cm.

Near the core of the «electron» $r_3 \gg r \approx r_3 \sim 4{\cdot}10^{18}$ cm; therefore, in metrics in (5.8.2) through (5.8.5), the terms r/r_3 can be neglected. In this case, the core of the «electron» can be considered practically free, and its outer shell can be described with a high accuracy (at the level of consideration of a 2^3-$\lambda_{m,n}$-vacuum region) by a set of metrics

The outer shell of the «electron»

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

in the interval [~$2.3{\cdot}10^{-13}$ cm, ~10^{18} cm] (Figure 5.8.1)

$$ds_1^{(+---)2} = \left(1-\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.9.1}$$

$$ds_2^{(+---)2} = \left(1+\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.9.2}$$

$$ds_3^{(+---)2} = \left(1-\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.9.3}$$

$$ds_4^{(+---)2} = \left(1+\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.9.4}$$

We average the metrics (5.9.1) and (5.9.3), and also (5.9.2) and (5.9.4)

$$\tfrac{1}{2}\left(ds_1^{(+---)2} + ds_3^{(+---)2}\right); \quad \tfrac{1}{2}\left(ds_2^{(+---)2} + ds_4^{(+---)2}\right), \tag{5.9.5}$$

As a result, to describe the outer shell of the «electron» we obtain the following set of two metrics

The outer shell of the «electron»

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

in the interval [~$2,3{\cdot}10^{-13}$ cm, ~10^{18} cm] (Figure 5.8.1)

$$ds_1^{(+---)2} = ds_1^{(-a)2} = \left(1-\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.9.6}$$

$$ds_2^{(+---)2} = ds_1^{(-b)2} = \left(1+\frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.9.7}$$

Similarly, to describe the outer shell of a free «positron» we have

The outer shell of the «positron»
with signature (– + + +)
in the interval [~2,3·10^{-13} cm, ~10^{18} cm] (Figure 5.8.1)

$$ds_1^{(-+++)2} = ds_1^{(+a)2} = -\left(1-\frac{r_6}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (5.9.8)$$

$$ds_2^{(-+++)2} = ds_1^{(+b)2} = -\left(1+\frac{r_6}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_6}{r}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (5.9.9)$$

We note that the averaging procedure for two metrics of the type (5.9.5) corresponds to finding the square of the modulus of a complex number of the form (5.1.10) $ds^{(\pm)} = \frac{1}{\sqrt{2}}(ds_1 + ids_2)$.

Recall also that, for the convenience of describing the intra-vacuum processes in Alsigna, the following neologisms are introduced {*see Table 2.1.1*}:

a-subcont is the region, described by the metric (5.9.6) with the signature (+ – – –); (5.9.10)

b-subcont is the region described by the metric (5.9.7) with the signature (+ – – –); (5.9.11)

a-antisubcont is the region described by the metric (5.9.8) with the signature (– + + +); (5.9.19)

b-antisubcont is the region described by the metric (5.9.9) with the signature (– + + +). (5.9.13)

5.10 Vacuum electrostatics of «electron» and «positron»

The metrics (5.9.6) through (5.9.7) and (5.9.8) through (5.9.9) are stationary, so we use equations (5.5.22) and (5.6.1) through (5.6.7) to study the accelerated currents of the intra-vacuum layers (5.9.10) through (5.9.13) in the outer shells of the «electron» and of the «positron».

In the metrics (5.9.6) through (5.9.9), all the mixed components of the metric tensor are zero.

$$g_{0\alpha}{}^{(-a)} = 0, \quad g_{0\alpha}{}^{(-b)} = 0, \quad g_{0\alpha}{}^{(+a)} = 0, \quad g_{0\alpha}{}^{(+b)} = 0. \qquad (5.10.1)$$

Therefore, for the case under consideration, equation (5.5.22) takes on the simplified form:

$$a_\alpha^{(-a)} = E_{v\alpha}^{(-a)} = -\frac{c^2}{\sqrt{1-\frac{v^{(-a)2}}{c^2}}}\frac{\partial \ln\sqrt{g_{00}^{(-a)}}}{\partial x^a} = -\frac{c^2}{\sqrt{1+\frac{r_6}{r}}}\frac{\partial \ln\sqrt{g_{00}^{(-a)}}}{\partial x^a} \qquad (5.10.2)$$

is the acceleration of the *a-subcont* ;

$$a_\alpha^{(-b)} = E_{v\alpha}^{(-b)} = -\frac{c^2}{\sqrt{1-\frac{v^{(-b)2}}{c^2}}}\frac{\partial \ln\sqrt{g_{00}^{(-b)}}}{\partial x^a} = -\frac{c^2}{\sqrt{1-\frac{r_6}{r}}}\frac{\partial \ln\sqrt{g_{00}^{(-b)}}}{\partial x^a} \qquad (5.10.3)$$

is the acceleration of the *b-subcont*;

$$a_{\alpha}^{(+a)} = E_{v\alpha}^{(+a)} = -\frac{c^2}{\sqrt{1-\frac{v^{(+a)2}}{c^2}}}\frac{\partial \ln\sqrt{g_{00}^{(+a)}}}{\partial x^a} = -\frac{c^2}{\sqrt{1+\frac{r_6}{r}}}\frac{\partial \ln\sqrt{g_{00}^{(+a)}}}{\partial x^a} \tag{5.10.4}$$

is the acceleration of the *a-antisubcont*;

$$a_{\alpha}^{(-b)} = E_{v\alpha}^{(+b)} = -\frac{c^2}{\sqrt{1-\frac{v^{(+b)2}}{c^2}}}\frac{\partial \ln\sqrt{g_{00}^{(+b)}}}{\partial x^a} = -\frac{c^2}{\sqrt{1-\frac{r_6}{r}}}\frac{\partial \ln\sqrt{g_{00}^{(+b)}}}{\partial x^a} \tag{5.10.5}$$

is the acceleration of the *b-antisubcont*,

where it is taken into account that, according to *(2.1.48)* through *(2.1.51)*,

$$v^{(-a)2}/c^2 = v_r^{(-a)2}/c^2 = -r_6/r\,, \qquad v^{(-b)2}/c^2 = v_r^{(-b)2}/c^2 = r_6/r\,, \tag{5.10.6}$$
$$v^{(+a)2}/c^2 = v_r^{(+a)2}/c^2 = -\,r_6/r, \qquad v^{(+b)2}/c^2 = v_r^{(+b)2}/c^2 = r_6/r\,.$$

Substituting the zero components of the metric tensors from the metrics (5.9.6) through (5.9.9)

$$g_{00}^{(-a)} = 1 - r_6/r \quad \text{and} \quad g_{00}^{(-b)} = 1 + r_6/r\,, \tag{5.10.7}$$

$$g_{00}^{(+a)} = -1 + r_6/r \quad \text{and} \quad g_{00}^{(+b)} = -1 - r_6/r \tag{5.10.8}$$

into the corresponding expressions (5.10.2) through (5.10.5), in spherical coordinates we obtain:

- the components of the vector of the *a-subcont* tension (i.e., of the vector of the acceleration of the *a-subcont*):

$$a_r^{(-a)} = E_{vr}^{(-a)} = -\frac{c^2}{\sqrt{1+\frac{r_6}{r}}}\frac{\partial \ln\sqrt{1-r_6/r}}{\partial r^*} = \frac{c^2 r_6}{2r^2\sqrt{1-\frac{r_6}{r}}},$$
$$a_{\theta}^{(-a)} = E_{v\theta}^{(-a)} = 0, \tag{5.10.9}$$
$$a_{\varphi}^{(-a)} = E_{v\varphi}^{(-a)} = 0.$$

where $$\frac{\partial}{\partial r^*} = g^{11\,(-a)}\frac{\partial}{\partial r} = -\left(1-\frac{r_6}{r}\right)\frac{\partial}{\partial r};$$

- the components of the vector of the *b-subcont* tension (i.e., of the vector of the acceleration of the *b-subcont*):

$$a_r^{(-b)} = E_{vr}^{(-b)} = -\frac{c^2}{\sqrt{1-\frac{r_6}{r}}}\frac{\partial \ln\sqrt{1+r_6/r}}{\partial r^*} = -\frac{c^2 r_6}{2r^2\sqrt{1+\frac{r_6}{r}}},$$
$$a_{\theta}^{(-b)} = E_{v\theta}^{(-b)} = 0, \tag{5.10.10}$$
$$a_{\varphi}^{(-b)} = E_{v\varphi}^{(-b)} = 0.$$

where $$\frac{\partial}{\partial r^*} = g^{11\,(-b)}\frac{\partial}{\partial r} = -\left(1+\frac{r_6}{r}\right)\frac{\partial}{\partial r};$$

- the components of the vector of the *a-antisubcont* tension (i.e., of the vector of the acceleration of the *a-antisubcont*):

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

$$a_\theta^{(+a)} = E_{v\theta}^{(+a)} = 0, \quad (5.10.11)$$

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

where $$\frac{\partial}{\partial r^*} = g^{11(+a)}\frac{\partial}{\partial r} = \left(1-\frac{r_6}{r}\right)\frac{\partial}{\partial r};$$

- the components of the vector of the *b-antisubcont* tension (i.e., of the vector of the acceleration of the *b-antisubcont*):

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

$$a_\theta^{(+b)} = E_{v\theta}^{(+b)} = 0, \quad (5.10.12)$$

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

where $$\frac{\partial}{\partial r^*} = g^{11(+b)}\frac{\partial}{\partial r} = \left(1+\frac{r_6}{r}\right)\frac{\partial}{\partial r}.$$

We define the acceleration vector of the subcont in the outer shell of the «electron» in the same manner as the vectors (5.7.2) – (5.7.3)

$$\mathbf{a}^{(-)} = \mathbf{a}^{(-a)} + i\mathbf{a}^{(-b)} = \mathbf{E}_v^{(-a)} + i\mathbf{E}_v^{(-b)}. \quad (5.10.13)$$

Taking into account (5.10.9) and (5.10.10), the components of the given vector are equal to

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

$$a_\theta^{(-)} = 0, \quad (5.10.14)$$

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

Similarly, the acceleration vector of the antisubcont in the outer shell of the «positron» is equal to

$$\mathbf{a}^{(+)} = \mathbf{a}^{(+a)} + i\mathbf{a}^{(+b)} = \mathbf{E}_v^{(+a)} + i\mathbf{E}_v^{(+b)}. \quad (5.10.15)$$

Taking into account (5.10.11) and (5.10.12), the components of the given vector are equal to

$$a_r^{(+)} = E_{vr}^{(+)} = \sqrt{E_{vr}^{(+a)2} + E_{vr}^{(+b)2}} = \frac{c^2 r_6 \sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}},$$
$$a_\theta^{(+)} = 0, \quad (5.10.16)$$
$$a_\varphi^{(+)} = 0.$$

When $r >> r_6$, the acceleration (5.10.14) assumes the approximate form

$$a_\alpha^{(-)} = E_{vr}^{(-)} \approx \frac{\sqrt{2}}{2}\frac{c^2 r_6}{r^2}. \quad (5.10.17)$$

Whereas in classical electrostatics, the electric field strength of a point-like electron in a vacuum is determined by the expression:

$$E_r = \frac{e}{4\pi\varepsilon_0 r^2}, \quad (5.10.18)$$

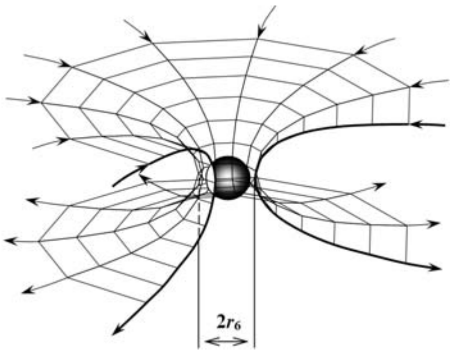
where $e = -1.60219 \cdot 10^{-19}$ C is the electron charge, and $\varepsilon_0 = 8.85419 \cdot 10^{-12}$ F/m is the vacuum permittivity.

Comparing (5.10.17) and (5.10.18), we find the correspondence

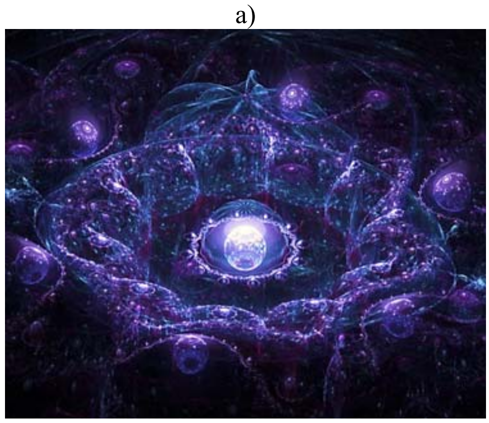
$$\frac{e}{4\pi\varepsilon_0} \leftrightarrow \frac{\sqrt{2}}{2}c^2 r_6, \quad (5.10.19)$$

where it is seen that the meaning of the electron charge e corresponds to the radius of the neck with a radius of $r_6 \sim 2.8 \cdot 10^{-13}$ cm. (Figures 5.8.1 and 5.10.1), from which the *a-subcont* flows to all directions with deceleration (5.10.9), and to which the *b-subcont* flows from all directions with acceleration (5.10.10).

Let's summarize the interim result. Alsigna introduced the concept of mobile continuous pseudo-media: *a-subcont, b-subcont, a-antisubcont and b-antisubcont*. Do these pseudo-media have a physical existence? Alsigna is so far silent on this point. But if acceleration is mathematically determined, for example in (5.10.9), then inevitably there arise the questions: "acceleration of what?" and "with respect to what is the acceleration?"



а)



б)

Fig. 5.10.1. a) A schematic illustration of the flow of the *a-subcont* into the abyss (*rakya*), surrounding the core of the «electron», and the flow of the *b-subcont* away from it
b) Fractal illustration of the abyss (*rakya*), surrounding the core of the «electron»

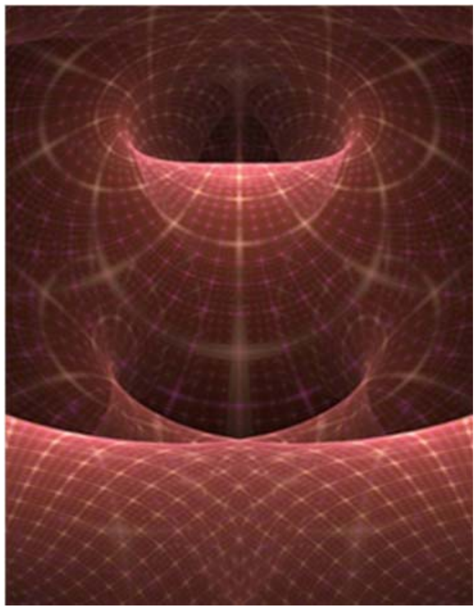


Fig 5.10.2. Illustration of the light landscape, the geodesic lines of which are curved rays of light in a curved «vacuum»

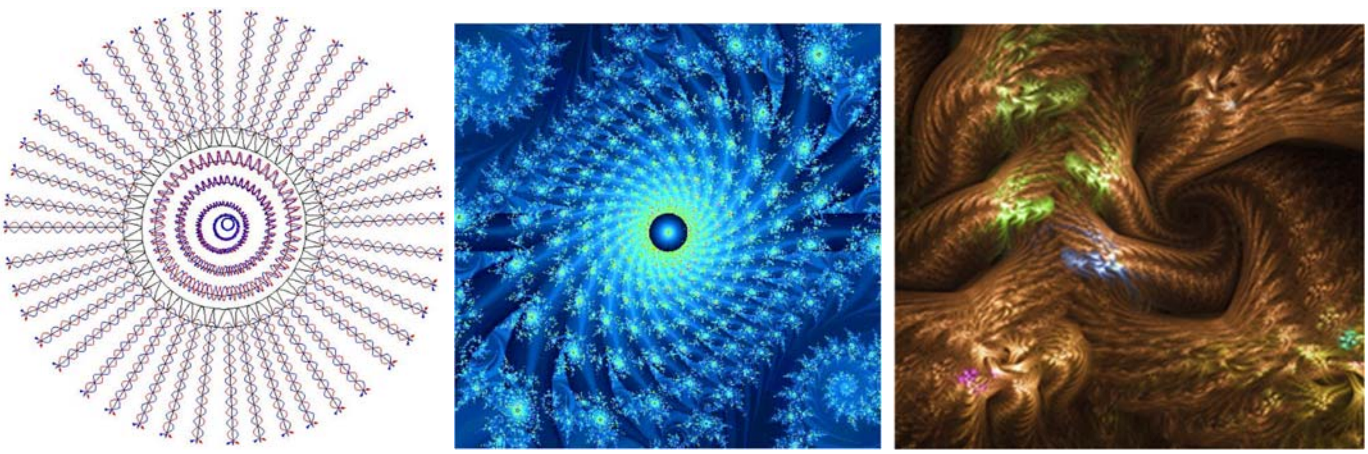
Alsigna tends to indicate that the interlacing of mobile intra-vacuum layers (pseudo-media) is only an illusory effect, similar to how we represent, for example, the seaside. Different types of entities are deemed substantial for purely technical purposes, but when considering the philosophical questions of ontological and epistemological nature about spatially extended Being, it is possible to disregard such burdensome data, since Alsigna does not see anything except the curved light-geometric pattern of the void.

So, considering the level of a 2^3-$\lambda_{m,n}$-vacuum region, the above mathematical apparatus allows us to create the following visual interpretation of intra-vacuum processes in terms of continuous pseudo-media.

In the outer shell surrounding the core of the «electron» with a radius $r_6 \sim 2.8 \cdot 10^{-13}$ cm, there are two opposing radial currents:

- the *a-subcont* flowing in all directions away from the nucleus [with a deceleration (5.10.9)], and
- the *b-subcont* incoming from all sides towards the core [with acceleration (5.10.10)].

Along each radial direction, these opposing currents (intra-vacuum currents) form a two-sided helix (Figure 5.10.3).



a) b) c)

Fig. 5.10.3. a) Spirals consisting of flowing inbound *a*-subcont and outbound *b*-subcont currents in the outer shell of the «electron»; b, c) Fractal illustrations of intertwined currents around a spherical object (in particular, around the core of an «electron» or the core of a «positron»)

Definition 5.10.1. *The intra-vacuum current is a local current of the pseudo-medium (a-subcont and/or b-subcont and/or a-antisubcont and/or b-antisubcont) which spirals around one of the radial directions.*

A suitable analogy of such a spiral is a multi-twisted ribbon (Figure 5.10.4), on one side of which the *b-subcont* flows towards the core of the «electron» with an acceleration, and on the other side of the same ribbon the *a-subcont* flows *away* with a deceleration in opposite direction.

Fig. 5.10.4. Multi-twisted ribbons, on one side of which the *b-subcont* accelerates, and on the other side in the opposite direction, a *a-subcont* decelerates

In this case, according to (5.10.6), the *b-subcont* that comes towards the abyss (*rakya*) at each point at a distance r from the center of the core of the «electron» has a radial velocity component

$$v_r^{(-b)} = -\,(c^2 r_6/r)^{½}, \tag{5.10.20}$$

and the *a-subcont* flowing from the *abyss* (*rakya*) at the same points has a velocity

$$v_r^{(-a)} = (c^2 r_6/r)^{½}. \tag{5.10.21}$$

These speeds compensate each other on the average

$$v_r^{(-b)} + v_r^{(-a)} = -\,(c^2 r_6/r)^{½} + (c^2 r_6/r)^{½} = 0, \tag{5.10.22}$$

however, the joint acceleration of twisted *a-subcont* and *b-subcont* intra-vacuum currents is (5.10.14)

$$a_r^{(-)} = \frac{c^2 r_6\sqrt{2}}{2r^2\sqrt{1-\dfrac{r_6^2}{r^2}}}. \tag{5.10.23}$$

We note the following aspects and consequences arising from the above mathematical model:

1. The velocities (5.10.20) and (5.10.21) and the acceleration (5.10.23) are determined with respect to the resting *scope* of the «electron», whose metric-dynamic properties are given by the quadratic form (5.8.10). The change in the «electron» *scope* (for example, by transition to another coordinate system) can lead to instability of the vacuum formation.

2. In classical quantum electrodynamics, the effect of polarization of a physical vacuum around a point charge is taken into account, which allows quantum theorists to introduce concepts of an effective electric charge

$$e_{eff} \approx \frac{e}{\left(1-\frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_e}\right)^{\frac{1}{2}}}, \tag{5.10.24}$$

where m_e is the electron mass and $\hbar$ is the Planck constant.
The electric field strength around the effective charge acquires the form

$$E_r = \frac{e}{4\pi\varepsilon_0 r^2\left(1-\frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_e}\right)^{\frac{1}{2}}}. \tag{5.10.25}$$

In comparing expressions (5.10.23) and (5.10.25), taking into account (5.10.16), we again find an obvious analogy

$$\frac{1}{\left(1-\frac{e^2}{6\pi^2}\ln\frac{\hbar}{4rm_e}\right)^{\frac{1}{2}}} \leftrightarrow \frac{1}{\left(1-\frac{r_6^2}{r^2}\right)^{\frac{1}{2}}}, \tag{5.10.26}$$

which allows us to state that the fully geometricized vacuum electrostatics of Alsigna permits us to more harmoniously substantiate the logical constructions of quantum electrodynamics.

3. At $r \approx r_6$ (i.e., in the region of the outer side of the *abyss* (*rakya*) of the «electron», *Figure* 5.8.1), the velocities of the flows of the *a-subcont* (5.10.20) and of the *b-subcont* (5.10.21) tend to the speed of light *c*. It follows that the speed of light is the limiting velocity of the flow of intra-vacuum layers. It will be further shown that an attempt to further increase the speed of movement of local sections of intra-vacuum layers only leads to a topological rearrangement of this «vacuum» region.
4. The acceleration of the subcont (5.10.23) in the same area at $r \approx r_6$ tends to infinity. Recall that according to *(2.1.14) through (2.1.33)*, the relative elongation of the subcont in the outer shell of the resting «electron» is equal to *(2.1.33)*:

$$l_r^{(-)} = \sqrt{\frac{r^2}{r^2 - r_6^2} - 1}\,, \quad l_\theta^{(-)} = 0\,, \quad l_\varphi^{(-)} = 0\,, \tag{5.10.27}$$

from which it can be seen that in the region of the *abyss* (*rakya*) ($r \approx r_6$), the radial component $l_r^{(-)}$ also tends to infinity. Together, expressions (5.10.23) and (5.10.27) show that in the approximation under consideration the core of the «electron» is surrounded by a practically impenetrable (i.e., extremely compressed and resistive shell) *abyss* (*rakya*) (Figure 5.10.5).

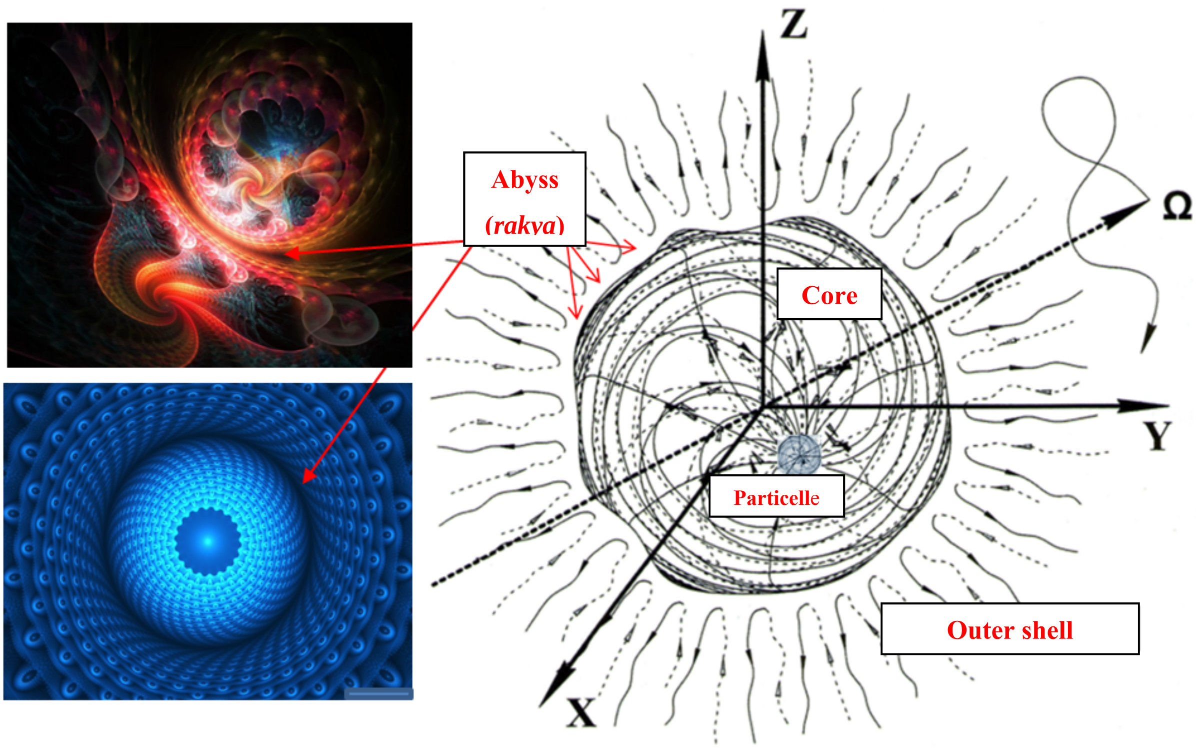


Fig. 5.10.5. Outer shell, multilayered abyss (*rakya*), core and particelle (internal nucleolus) of a spherical vacuum formation (in particular, of an «electron» or a «positron») and its fractal illustrations

However, on closer examination it turns out that the *abyss* (*rakya*) is a much more complex, multi-layered, flexible and permeable region enveloping the core of the «electron». A deeper analysis shows that the *abyss* (*rakya*) of an «electron» is similar to the membrane of a biological cell, or to the surface of a planet, or to the surface of a star (Figures 5.10.5).

5. In classical electrostatics electric field potential around a charge q_e with strength (5.10.18) is given by

$$\varphi_e = -\int E_r dr = -\int \frac{q_e}{4\pi\varepsilon_0 r^2} dr = -\frac{q_e}{4\pi\varepsilon_0} \int \frac{dr}{r^2} = \frac{q_e}{4\pi\varepsilon_0 r} \tag{5.10.28}$$

and the potential energy between two spheres with radii r_1 and r_2, equal

$$U_e = \int_0^{2\pi}\int_0^{2\pi}\int_{r_1}^{r_2} \varphi_e dr\, d\theta\, d\varphi = 4\pi^2 \int_{r_1}^{r_2} \frac{q_e}{4\pi\varepsilon_0 r} dr = \frac{\pi q_e}{\varepsilon_0} \int_{r_1}^{r_2} \frac{1}{r} dr = \frac{\pi q_e}{\varepsilon_0} (\ln r_2 - \ln r_1) = \frac{\pi q_e}{\varepsilon_0} \ln \frac{r_2}{r_1}. \tag{5.10.29}$$

In Alsigna the role of the electric field performs the acceleration, so by analogy with (5.10.28) we define the potential *subcont* tension

$$\varphi^{(-)} = -\int E_{vr}^{(-)} dr = -\int a_r^{(-)} dr \qquad (5.10.30)$$

Thus, taking into account (5.10.14) the potential subcont tension in the outer shell of the «electron» equal

$$\varphi_{во}^{(-)} = -\int a_{r\,во}^{(-)} dr = -\int \frac{c^2 r_6\sqrt{2}}{2r^2\sqrt{1-\frac{r_6^2}{r^2}}} dr = -\frac{c^2 r_6\sqrt{2}}{2}\int \frac{1}{r\sqrt{r^2-r_6^2}} dr = -\frac{c^2 r_6\sqrt{2}}{2} arc\sec\frac{r}{r_6} + C, \quad (5.10.31)$$

where we have used the tabulated integral

$$\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a} arc\sec\frac{x}{a} + C = \frac{1}{a}\arccos\frac{a}{x} + C. \qquad (5.10.32)$$

The graph of the function (5.10.31) is shown in Figure 5.10.6.

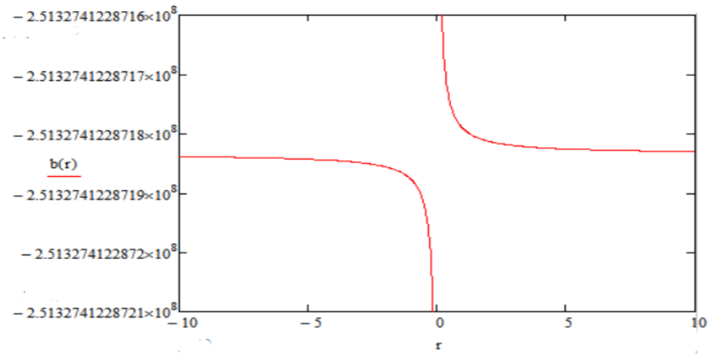


Fig. 5.10.6. Graph of potential subcont tension (5.10.31)
The calculations are performed using the MathCad software,
when $r_6 = 2{,}7\cdot 10^{-13}$ cm, $c = 2{,}9\cdot 10^{10}$ см/с, $C = 0$

Potential subcont tension inside the core of the «electron» (discussed in the following § 5.11), with account of (5.11.32) equal to

$$\varphi_{я}^{(-)} = -\int a_{r\,я}^{(-)} dr = -\int \frac{2c^2 r}{r_6^2\sqrt{1-\frac{r^4}{r_6^4}}} dr = -2c^2\int \frac{r}{\sqrt{r_6^4-r^4}} dr = -c^2\arcsin\frac{r^2}{r_6^2} + C \quad (5.10.33)$$

where we have used the well-known integral

$$\int \frac{x}{\sqrt{a-x^4}} dx = \left| \begin{matrix} t = x^2 \\ dt = 2xdx \end{matrix} \right| = \frac{1}{2}\int \frac{dt}{\sqrt{(\sqrt{a})^2 - t^2}} = \begin{cases} \frac{1}{2}\arcsin\frac{t}{\sqrt{a}} + C \\ -\frac{1}{2}\arcos\frac{t}{\sqrt{a}} + C \end{cases} = \begin{cases} \frac{1}{2}\arcsin\frac{x^2}{\sqrt{a}} + C \\ -\frac{1}{2}\arcos\frac{x^2}{\sqrt{a}} + C \end{cases}$$

The graph of the function (5.10.33) is shown in Figure 5.10.7.

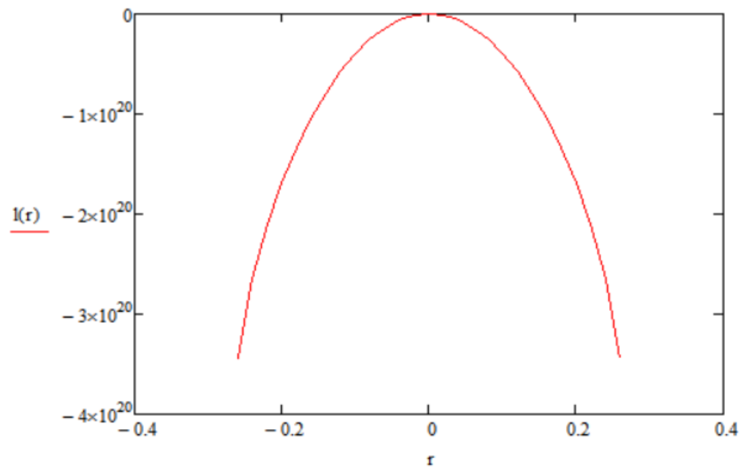
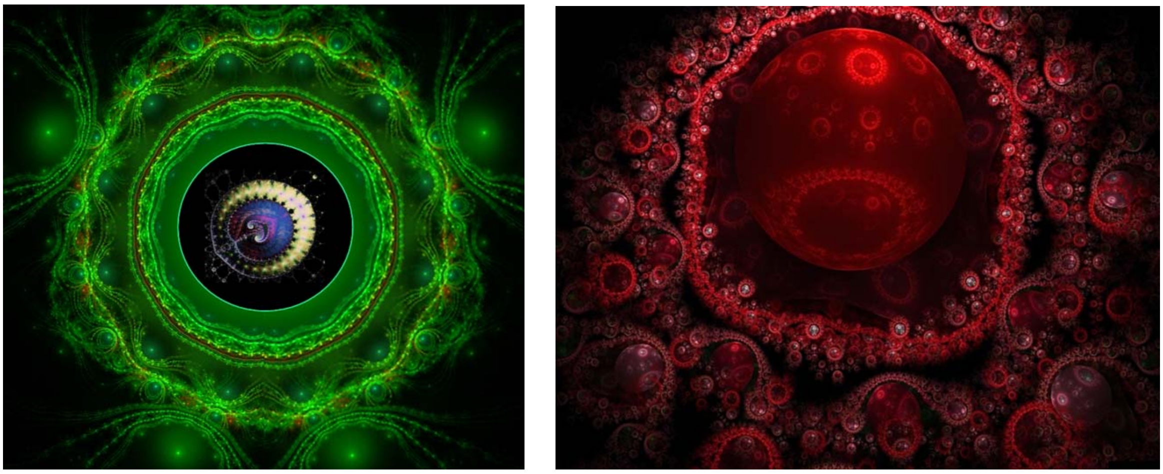


Fig. 5.10.7. Graph of potential subcont tension (5.10.33)
The calculations are performed using the MathCad software
when $r_6 = 0.27$ cm, $c = 2.9\cdot10^{10}$ см/с, $C = 0$

6. A similar analysis of the metrics (5.8.12) through (5.8.15) and (5.9.8) through (5.9.9), taking into account the accelerations (5.10.4) through (5.10.5) and the velocities (5.10.6), shows that the «positron» is a negative copy of the «electron». If the free «electron» is conventionally called a stable convexity in the vacuum region with the signature (+ – – –), then the «positron» is a similar concavity with the opposite signature (– + + +).
7. If, in the equations (5.8.1) through (5.10.27) instead of the triplet of radii r_3, r_6, r_7 {*see the hierarchy of radii (2.6.20)*}, one substitutes any other triple of radii from the same hierarchy, for example, r_4, r_6, r_8 or r_2, r_6, r_7 or r_1, r_6, r_8 or r_2, r_6, r_9 etc., then one obtains the metric-dynamic models of various types of «electrons» («electrons»$_{468}$, «electrons»$_{267}$, «electrons»$_{168}$, «electrons»$_{269}$, ...) and «positrons» («positrons»$_{468}$, «positrons»$_{267}$, «positrons»$_{168}$, «positrons»$_{269}$, ...), which differ in the structure of the abyss (*rakya*).
8. If, in the equations (5.8.1) through (5.10.27) instead of the triplet of radii r_3, r_6, r_7, one substitutes any other triple of radii from the *hierarchy of radii (2.6.20)*, for example, r_2, r_4, r_5 or r_1, r_3, r_5 or r_1, r_4, r_6 or r_4, r_5, r_7 etc., one obtains similar «electron» and «positron» metric-dynamic models respectively of a *naked* (see Definition 5.10.2): «planet», «galaxy», «star», «biological cell» and so forth.

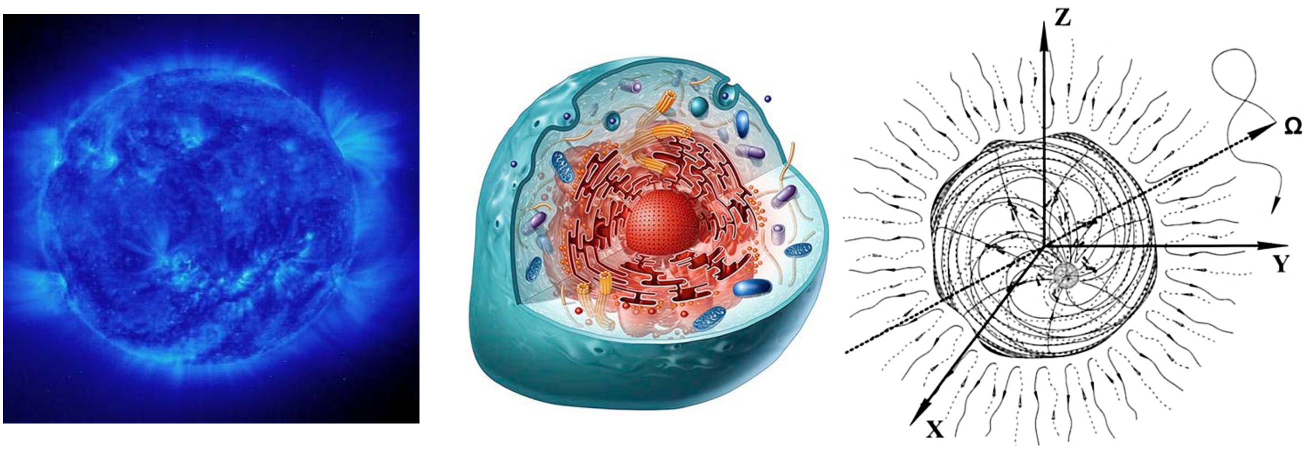
Definition 5.10.2. *A **naked** vacuum formation is a stable curvature of the vacuum region of any scale («electron», «biological cell», «planet», «star», «galaxy», etc.) whose metric-dynamic model is determined by a set of metrics of the type (5.8.1) through (5.8.20) as is shown in Figure 5.8.1. Many smaller vacuum formations can be attracted to a naked vacuum formation. For example, many small «particles» can be attracted to the nucleus of a **naked** «planet»: «biological cells», «atoms», «elementary particles», etc. (Figure 5.10.8 b).*



a) *b*)

Fig. 5.10.8. *a*) Fractal illustration of the multilayered abyss (*rakya*) surrounding the core of vacuum formation; *b*) Fractal illustration of the set of local vacuum formations around the core of a larger naked stable vacuum formation

9. The mathematical apparatus developed here is suitable for describing any stable *naked* vacuum formations with different sizes (Figure 5.10.9). Therefore, studying one of the local vacuum formations, for example, an «electron» - «positron» pair, we simultaneously obtain information about: the metric-dynamic properties of a pair of male and female «biological cells», a *naked* «star»-«planetary» system, etc. Conversely, by studying, for example, the metric-dynamic properties of a *naked* «planet», we also know the properties of the «electron» or the «positron» (see Figures 5.10.9 and 5.10.10).



a) *b*) *c*)

Fig. 5.10.9. Shells: *a*) stars; *b*) a biological cell; *c*) «electron».
Upon closer examination through the pores in the *abysses* (*rakyas*), a mutual correspondence is found between the core and the outer shell of any stable vacuum formation

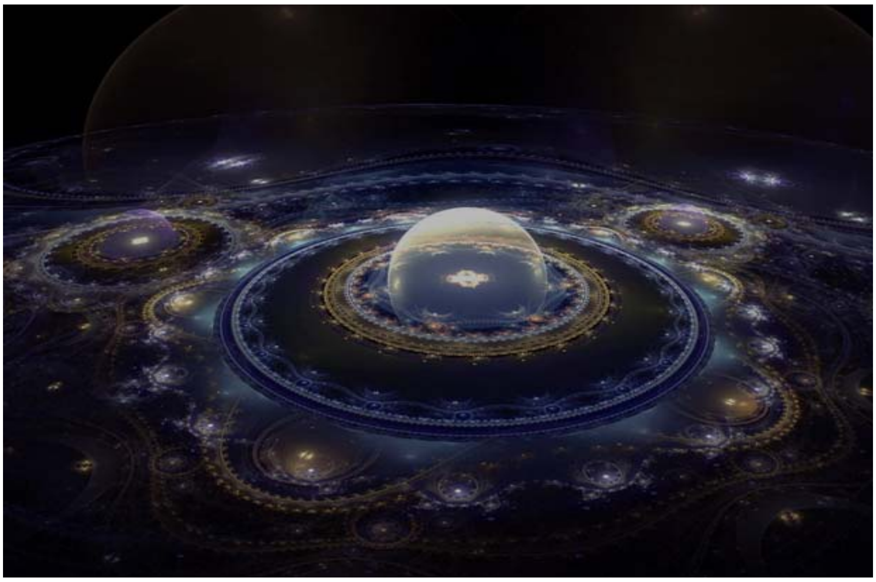


Fig. 5.10.10. Fractals often surprisingly accurately reflect a speculative picture of the world which is inaccessible to sensual human perception.

5.11 The core of the «electron» and «positron» at rest

We consider the metrics (5.8.6) through (5.8.10), describing the metric-dynamic state of the core of the «electron», turning our attention to the 2^3-$\lambda_{m,n}$-vacuum region

The core of the «electron»

in the interval [r_7, r_6] (Figure 5.8.1)

i I H V H'

I $$ds^{(-a)2} = \left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2d\theta^2 + r^2\sin^2\theta\, d\varphi^2 \quad -a\text{-subcont}, \tag{5.11.1}$$

H $$ds^{(-b)2} = \left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)} - r^2d\theta^2 + r^2\sin^2\theta\, d\varphi^2 \quad -b\text{-subcont}, \tag{5.11.2}$$

V $$ds^{(-c)2} = \left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)} - r^2d\theta^2 + r^2\sin^2\theta\, d\varphi^2 \quad -c\text{-subcont}, \tag{5.11.3}$$

H' $$ds^{(-d)2} = \left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2d\theta^2 + r^2\sin^2\theta\, d\varphi^2 \quad -d\text{-subcont}; \tag{5.11.4}$$

Scope of the «electron»

in the interval [0, ∞)

i $$ds_5^{(+---)2} = c^2dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.11.5}$$

where $r_6 \sim 1.7\cdot10^{-13}$ cm is the radius of core the of the «electron»; $r_7 \sim 5.8\cdot10^{-24}$ cm is the radius of the particelle (*inner nucleolus*) located inside the core of the «electron».

First, taking into account the inequality $r_6 >> r_7$ we neglect the terms r_7/r; under this condition, the metrics (5.11.1) through (5.11.4) are reduced to two de Sitter metrics:

$$ds^{(-a)2} = \left(1+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1+\dfrac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.11.6}$$

$$ds^{(-b)2} = \left(1-\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\dfrac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right). \tag{5.11.7}$$

The arithmetic mean of these metrics forms a 2-braid {*see (2.2.24)*}:

$$ds^{(-ab)2} = c^2dt^2 - \frac{dr^2}{\left(1-\dfrac{r^4}{r_6^4}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right). \tag{5.11.9}$$

and (2.2.24) through (2.2.25)}, we find the relative elongation of the subcont within the core of the «electron»

$$l_i^{(-)} = \sqrt{1 + \frac{g_{ii}^{(-)} - g_{ii}^{0(-)}}{g_{ii}^{0(-)}}} - 1\,, \tag{5.11.9}$$

where the averaged components of the metric tensor $g_{ii}^{(-)}$ are taken from the 2-braid (5.11.8)

$$g_{11}^{(-)} = \frac{1}{2}\left(g_{11}^{(-a)} + g_{11}^{(-b)}\right) = -\frac{r_6^4}{r_6^4 - r^4}\,, \tag{5.11.11}$$

$$g_{22}^{(-)} = \frac{1}{2}\left(g_{22}^{(-a)} + g_{22}^{(-b)}\right) = -r^2, \quad g_{33}^{(-)} = \frac{1}{2}\left(g_{33}^{(-a)} + g_{33}^{(-b)}\right) = -r^2\sin^2\theta,$$

$$g_{11}^{0(-)} = -1, \quad g_{22}^{0(-)} = -r^2, \quad g_{33}^{0(-)} = -r^2\sin^2\theta.$$

Substituting the components (5.11.10) and (5.11.11) into (5.11.9), we obtain

$$l_r^{(-)} = \sqrt{\frac{r_6^4}{r_6^4 - r^4}} - 1\,, \tag{5.11.12}$$

$$l_\theta^{(-)} = 0\,, \tag{5.11.13}$$

$$l_\varphi^{(-)} = 0\,. \tag{5.11.14}$$

The graph of the function (5.11.12) is shown in Figure 5.11.1, from which follows that the subcont on the periphery of the core of the «electron» is strongly stretched, whereas in the middle of the core the stretching of the subcont is virtually absent.

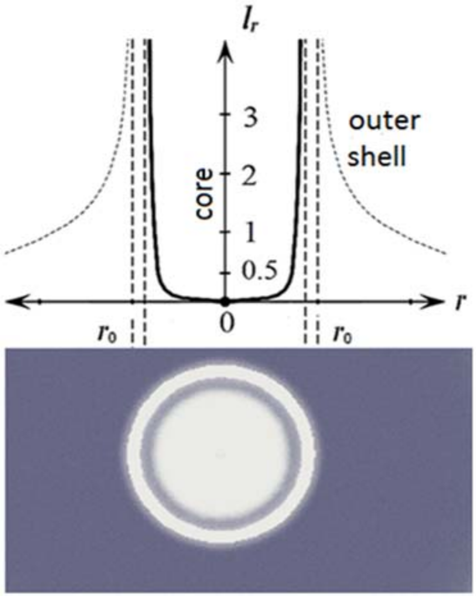


Fig. 5.11.1 The graph of the relative lengthening of the subcont (5.11.12) inside the core of the «electron»

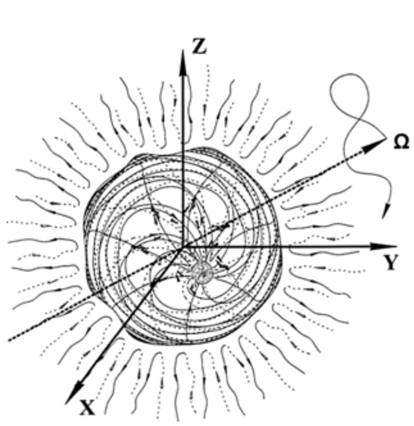


Fig. 5.11.2 Rotating core of a vacuum formation

According to the expressions (2.2.27) through (2.2.28), the velocities of the flow of the *a*-subcont and *b*-subcont are equal, respectively, to

$$v_r^{(-a)} = cr/r_6\,, \tag{5.11.15}$$

$$v_r^{(-b)} = -\,cr/r_6\,. \tag{5.11.16}$$

The given velocities in the center of the core of the «electron» (i.e., when $r = 0$, Figure 5.11.2) are zero, and on the periphery of the core with the radius $r \approx r_6$, they are near the speed of light c. More precisely, the periphery of the core is rotated in a complex manner at the speed of light; therefore the radial lines of the *a-subcont* and of the *b-subcont* currents for an outside observer look like spiral arms (Figure 5.11.2 and 5.11.5).

We bring into consideration the metrics (5.11.1) – (5.11.4). Averaging the data of the metric

$$ds^{(-abcd)2} = \frac{1}{4}\left(ds^{(-a)2} + ds^{(-b)2} + ds^{(-c)2} + ds^{(-d)2}\right), \tag{5.11.17}$$

we obtain the 4-braid

$$ds^{(-abcd)2} = c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)\left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)\left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)\left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2d\theta^2 - r^2\sin^2\theta\, d\varphi^2\,. \tag{5.11.18}$$

Substituting the components of the metric tensor from the 4-braid (5.11.18) and the scope (5.11.5) into the expressions (5.11.9), we find in this case a relative lengthening of the subcont within the core of the «electron»

$$l_r^{(-)} = \sqrt{1+\frac{g_{11}^{(-)}-g_{11}^{0(-)}}{g_{11}^{0(-)}}} - 1 = \sqrt{\frac{1}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)\left(1+\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)\left(1-\frac{r_7}{r}-\frac{r^2}{r_6^2}\right)\left(1+\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}} - 1, \tag{5.11.19}$$

$$l_\theta^{(-)} = \sqrt{1+\frac{g_{22}^{(-)}-g_{22}^{0(-)}}{g_{22}^{0(-)}}} - 1 = 0, \tag{5.11.20}$$

$$l_\varphi^{(-)} = \sqrt{1+\frac{g_{33}^{(-)}-g_{33}^{0(-)}}{g_{33}^{0(-)}}} - 1 = 0. \tag{5.11.21}$$

The graph of the function (5.11.19) is shown in Figure 5.11.3. From this graph it can be seen that the subcont is strongly stretched not only on the periphery, but also in the center of the core of the «electron» (Figure 5.11.2), where its particelle (*inner nucleolus*) {*i.e.* the *"proto-e⁻ quark"*} is found.

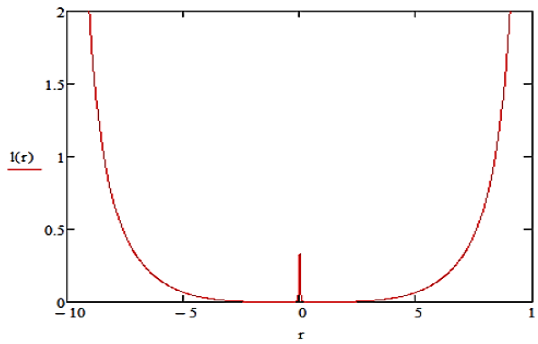


Fig. 5.11.3 The graph of the relative lengthening of the subcont (5.11.19) inside the core of the "electron". The calculations were performed using MathCad 14 software with $r_6 = 10$ and $r_7 = 0.01$. At $r_6 = 2\cdot10^{-13}$ and $r_7 = 6\cdot10^{-24}$, the resulting graph will be similar, but the wavelet in the middle will be barely noticeable.

We obtain, analogously, the velocities of the intra-vacuum layers inside the «electron's» core {see *(2.1.48) through (2.1.51)*}

I для a-субконта (5.11.1) $1-r_7/r+r^2/r_6^2=1-v_r^{(-a)2}/c^2 \rightarrow v_r^{(-a)}=c(-r_7/r+r^2/r_6^2)^{1/2}$ (5.11.22)

Н для b-субконта (5.11.2) $1+r_7/r-r^2/r_6^2=1-v_r^{(-b2}/c^2 \rightarrow v_r^{(-b)}=c(r_7/r-r^2/r_6^2)^{1/2}$ (5.11.23)

V для c-субконта (5.11.3) $1-r_7/r-r^2/r_6^2=1-v_r^{(-c)2}/c^2 \rightarrow v_r^{(-c)}=c(-r_7/r-r^2/r_6^2)^{1/2}$ (5.11.24)

Н для d-субконта (5.11.4) $1+r_7/r+r^2/r_6^2=1-v_r^{(-d)2}/c^2 \rightarrow v_r^{(-d)}=c(r_7/r+r^2/r_6^2)^{1/2}$ (5.11.25)

When $r \approx r_6$ (i.e., around the periphery of the core of the «electron»), all velocities (5.11.22) through (5.11.25) tend to the speed of light c. Similarly, at $r \approx r_7$ (i.e., in the area of the abyss (*rakya*) of the particelle (*inner nucleolus*), all velocities (5.11.22) through (5.11.25) tend to the speed of light c too.

Thus, on the level of the 2^3-$\lambda_{m,n}$ -vacuum region inside the core of the «electron», on each radial direction four intra-vacuum flows (currents) are coiled.

Two of these helical currents (the *b-subcont* current and the *c-subcont* current) flow from the periphery of the core of the «electron» initially at a speed close to that of light, then slowing down, and then nearby *the abyss (rakya)* of the internal particelle (*inner nucleolus*) again accelerating to the speed of light.

Two other oncoming helical currents (the *a*-subcont current and the *d*-subcont current) flow from the *abyss (rakya)* of the internal particelle (*inner nucleolus*), first at a speed close to the speed of light, then slowing down, and then at the periphery of the «electron's» core again accelerating to a speed close to the speed of light (Figure 5.11.5).

Fig. 5.11.4 A multiply-twisted quadrilateral, on one side of which an *a*-subcont is accelerating, on the other side a *b*-subcont flows, on the third side a c-subcont flows, and on the fourth side a *d*-subcont flows

In § 5.10 it was noted that, for clarity, it is convenient to assume that the oncoming *a*-subcont and *b*-subcont currents flow along the two sides of the same twisted ribbon (Figure 5.10.4). Having the 4-braid composed of the four intra-vacuum currents, we can continue the comparison with the ribbon, and we may assume that the given four currents flow on four sides of a repeatedly twisted parallelepiped (Figure 5.11.4).

However, for an outside observer, the periphery of the core of the «electron» and its inner periphery of its particelle (*inner nucleolus*) rotate at a speed close to the speed of light in a complex manner (Figures 5.11.2 and 5.11.5).

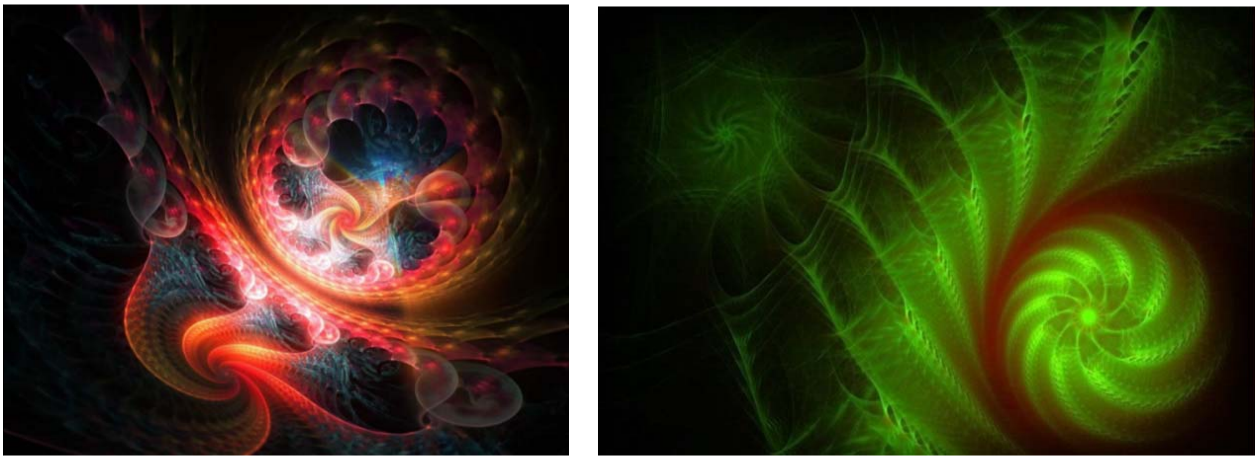


Fig. 5.11.5 Fractal illustration of interwoven intra-vacuum currents around a radial direction both inside as well as outside the rotating core of the «electron»

We define the radial components of acceleration vectors in intra-vacuum layers of the core of the «electron» with the help of equations (5.10.2)

$$a_1^{(-m)} = -\frac{c^2}{\sqrt{1-\frac{v^{(-m)2}}{c^2}}}\frac{\partial \ln\sqrt{g_{00}^{(-m)}}}{\partial x^1} \tag{5.11.26}$$

or

$$a_r^{(-m)} = -\frac{c^2}{\sqrt{1-\frac{v_r^{(-m)2}}{c^2}}}\frac{1}{g_{11}^{(-m)}}\frac{\partial \ln\sqrt{g_{00}^{(-m)}}}{\partial r} \tag{5.11.27}$$

The remaining components of these vectors are equal to zero, similar to (5.10.9) through (5.10.12).

Substituting into equation (5.11.27) the corresponding components of the metric tensors $g_{11}^{(-m)}$ from the metrics (5.11.1) through (5.11.4) and the radial velocity components (5.11.22) through (5.11.25), we obtain

$$a_r^{(-a)} = c^2\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}\frac{\partial \ln\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}{\partial r} = \frac{c^2\left(\frac{r_7}{r^2}+\frac{2r}{r_6^2}\right)}{2\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}$$ – acceleration of the *a*-subcont,

$$a_r^{(-b)} = c^2\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}\frac{\partial \ln\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}}{\partial r} = -\frac{c^2\left(\frac{r_7}{r^2}+\frac{2r}{r_6^2}\right)}{2\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}}$$ – acceleration of the *b*-subcont,

$$a_r^{(-c)} = c^2\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}\frac{\partial \ln\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}}{\partial r} = \frac{c^2\left(\frac{r_7}{r^2}-\frac{2r}{r_6^2}\right)}{2\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}}$$ – acceleration of the *c*-subcont,

$$a_r^{(-d)} = -c^2\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}\frac{\partial \ln\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}}{\partial r} = -\frac{c^2\left(\frac{r_7}{r^2}-\frac{2r}{r_6^2}\right)}{2\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}}$$ – acceleration of the *d*-subcont.

(5.11.28)

In this case, the total radial acceleration of the subcont between the periphery of the core of the «electron» and the abyss (*rakya) of* its internal particelle (*inner nucleolus*) is given by the quaternion (*see* § 5.7)

$$\mathbf{a}^{(-)} = \mathbf{a}^{(-a)} + i\mathbf{a}^{(-b)} + j\mathbf{a}^{(-c)} + k\mathbf{a}^{(-d)} = a_r^{(-a)} + i\,a_r^{(-b)} + j\,a_r^{(-c)} + k\,a_r^{(-d)}, \qquad (5.11.29)$$

which describes the interweaving of 4 intra-vacuum currents around each radial direction (Figures 5.11.5, 5.11.5 and 5.11.7).

The module of the vector of the total radial acceleration of subcost equal

$$a_r^{(-)} = \sqrt{a_r^{(-a)2} + a_r^{(-b)2} + a_r^{(-c)2} + a_r^{(-d)2}}. \qquad (5.11.30)$$

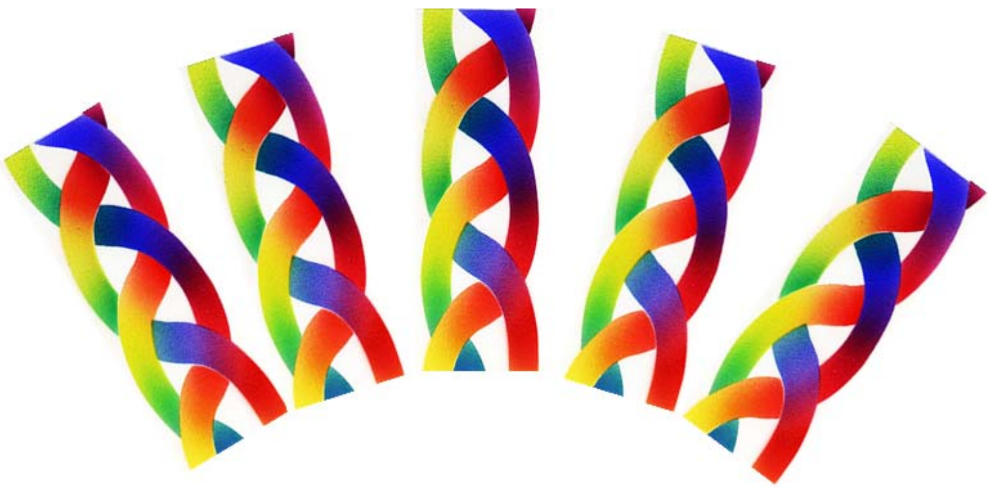


Fig. 5.11.6 Illustration of interlacing of accelerated intra-vacuum currents wound around one radial direction

Fig. 5.11.7 Fractal illustrations of various aspects of a representation of a spherically symmetrical local vacuum formation

If in expressions (5.11.28) to neglect the terms the r_7/r, we obtain:

$$a_r^{(-a)} = \frac{c^2 r}{r_6^2\sqrt{1+\frac{r^2}{r_6^2}}} \quad \text{– acceleration of the } a\text{-subcont,}$$

$$a_r^{(-b)} = -\frac{c^2 r}{r_6^2\sqrt{1-\frac{r^2}{r_6^2}}} \quad \text{– acceleration of the } b\text{-subcont,}$$

$$a_r^{(-c)} = \frac{c^2 r}{r_6^2\sqrt{1-\frac{r^2}{r_6^2}}} \quad \text{– acceleration of the } c\text{-subcont,}$$

$$a_r^{(-d)} = -\frac{c^2 r}{r_6^2\sqrt{1+\frac{r^2}{r_6^2}}} \quad \text{– acceleration of the } d\text{-subcont.} \qquad (5.11.31)$$

The total acceleration of subconts in the core «electrons» in this case is equal to

$$a_r^{(-)} = \sqrt{a_r^{(-a)2} + a_r^{(-b)2} + a_r^{(-c)2} + a_r^{(-d)2}} = \frac{c^2 r}{r_6^2}\sqrt{\frac{1}{1+\frac{r^2}{r_6^2}} + \frac{1}{1-\frac{r^2}{r_6^2}} + \frac{1}{1+\frac{r^2}{r_6^2}} + \frac{1}{1-\frac{r^2}{r_6^2}}} = \frac{2c^2 r}{r_6^2\sqrt{1-\frac{r^4}{r_6^4}}} = \frac{2c^2 r}{\sqrt{r_6^4 - r^4}}.$$

(5.11.32)

The core of the «positron» at rest, at the level of the 2^3-$\lambda_{m,n}$-vacuum region that we are considering, is a negative copy of the core of the «electron», as is easily verified by performing a similar analysis with the use of metrics (5.8.16) through (5.8.20) and expressions of the type (5.11.6) through (5.11.32).

In the study of the core of the «electron» at the level of consideration of a 2^6-$\lambda_{m,n}$-vacuum region, each metric (5.11.1) through (5.11.5) can be represented as a sum of seven metrics with signatures from the left rank *(1.13.1)* or (5.11.33)

$$\begin{array}{c} (+\ +\ +\ +) \\ (-\ -\ -\ +) \\ (+\ -\ -\ +) \\ (-\ -\ +\ -) \\ (+\ +\ -\ -) \\ (-\ +\ -\ -) \\ \underline{(+\ -\ +\ -)} \\ (+\ -\ -\ -)_+ \end{array} \quad (5.11.33) \qquad \begin{array}{c} (-\ -\ -\ -) \\ (+\ +\ +\ -) \\ (-\ +\ +\ -) \\ (+\ +\ -\ +) \\ (-\ -\ +\ +) \\ (+\ -\ +\ +) \\ \underline{(-\ +\ -\ +)} \\ (-\ +\ +\ +)_+ \end{array} \quad (5.11.34)$$

For example, the metric (5.11.1) with the signature (+ – – –)

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

is represented as the sum of seven analogous sub-metrics with the signatures (5.11.33):

$$ds^{(-a)2} = \left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} + r^2 d\theta^2 + r^2\sin^2\theta\, d\varphi^2 - \qquad -\ a_1\text{-subcont}$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2 d\theta^2 + r^2\sin^2\theta\, d\varphi^2 + \qquad -\ a_2\text{-subcont}$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2 d\theta^2 + r^2\sin^2\theta\, d\varphi^2 - \qquad -\ a_3\text{-subcont}$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}+r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2+ \qquad -a_4\text{-subcont}$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2- \qquad -a_5\text{-subcont}$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2+ \qquad -a_6\text{-subcont}$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}+r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2\ . \qquad -a_7\text{-subcont.} \quad (5.11.35)$$

In the study of the "positron" core at the level of consideration of the 2^6-$\lambda_{m,n}$-vacuum region each metric (5.8.16) through (5.8.20) is represented as the sum of seven analogous metrics with signatures from the right rank *(1.13.1)* or (5.11.34).

For example, the metric (5.8.16) with the signature (– + + +)

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

is represented as the sum of seven sub-metrics with the signatures (5.11.34)

$$ds^{(+a)2}=-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2+ \qquad -a_1\text{-antisubcont}$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}+r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2- \qquad -a_2\text{-antisubcont}$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}+r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2+ \qquad -a_3\text{-antisubcont}$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2d\theta^2+r^2\sin^2\theta\, d\varphi^2- \qquad -a_4\text{-antisubcont}$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}+r^2d\theta^2+r^2\sin^2\theta\, d\varphi^2+ \qquad -a_5\text{-antisubcont}$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}+r^2d\theta^2+r^2\sin^2\theta\, d\varphi^2- \qquad -a_6\text{-antisubcont}$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2d\theta^2+r^2\sin^2\theta\, d\varphi^2 \qquad -a_7\text{-antisubcont.}$$

(5.11.36)

Mathematical techniques for the analysis of metrics of the type (5.11.35) or (5.11.36) at the level of consideration of a 2^6-$\lambda_{m,n}$ -vacuum region remains the same as on the level of consideration of the 2^3-$\lambda_{m,n}$-vacuum region. However, in this case we have much more subtle and intricately woven intra-vacuum currents (Figure 5.11.8), the number of which is increased by 7 times.

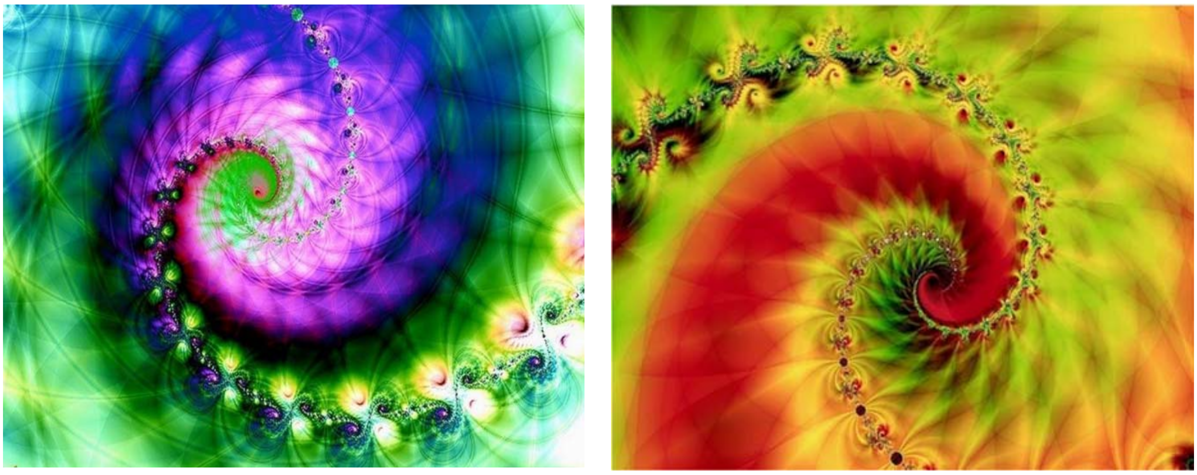


Fig. 5.11.8. Fractal illustrations of the interweaving of intra-vacuum currents at the level of consideration of a 2^6-$\lambda_{m,n}$-vacuum region

At the level of consideration of a 2^{10}-$\lambda_{m,n}$-vacuum region each of the seven metrics (5.11.35) or (5.11.36) can be represented as a sum of seven other metrics with the respective signatures, etc. (*see § 1.16*). Thus, subject to the following paragraph, the Algebra of Signatures (Alsigna) offers a mathematical apparatus that allows one to look into the depth of a vacuum.

Fig. 5.11.9. Alsigna provides the ability to dive into Infinity with the use of mathematical apparatus, which is consistent with the Doctrine of the Sefirot Tree and other fundamental principles of Lurianic Kabbalah (i.e., the Internal TORAH)

5.12 Isospin of the cores of the «electron» and «positron» at rest

We recall that a quadratic form with any of the possible signatures of ranks (5.11.33) through (5.11.34), represented in diagonal form [for example, metrics (5.11.35) and (5.11.36)], can in many ways be written as the determinant of a second-rank spin tensor (*see § 1.14*).

For example, the diagonalized quadratic form with signature

$$ds^2 = g_{00}dx^0dx^0 - g_{11}dx^1dx^1 - g_{22}dx^2dx^2 - g_{33}dx^3dx^3 \quad (5.12.1)$$

is the determinant of one of the 2×2 Hermitian matrices (spin tensors)

$$ds^{(-)2} = g_{00}dx^0dx^0 - g_{11}dx^1dx^1 - g_{22}dx^2dx^2 - g_{33}dx^3dx^3 = \begin{pmatrix} y_0dx^0 + y_3dx^3 & y_1dx^1 + iy_2dx^2 \\ y_1dx^1 - iy_2dx^2 & y_0dx^0 - y_3dx^3 \end{pmatrix}_{\det} \quad (5.12.2)$$

which can be represented as an A_4 -matrix

$$A_4^{(-)} = \begin{pmatrix} y_0dx^0 + y_3dx^0 & y_1dx^1 + iy_2dx^2 \\ y_1dx^1 - iy_2dx^2 & y_0dx^0 - y_3dx^3 \end{pmatrix} = y_0dx^0\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - y_1dx^1\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} - y_2dx^2\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} - y_3dx^3\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, \quad (5.12.3)$$

where

$$\sigma_0^{(+---)} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \sigma_1^{(+---)} = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \quad \sigma_2^{(+---)} = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \quad \sigma_3^{(+---)} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} \quad (5.12.4)$$

is the set of Pauli matrices.

Similarly, for a diagonalized quadratic form with inverted signature (– + + +), we have one of the variants of its representation in the form of an A_4-matrix:

$$ds^{(+)2} = -g_{00}dx^0dx^0 + g_{11}dx^1dx^1 + g_{22}dx^2dx^2 + g_{33}dx^3dx^3 = \begin{pmatrix} y_0dx^0 + y_3dx^0 & iy_1\,dx^1 + y_2dx^2 \\ iy_1\,dx^1 - y_0dx^0 & -y_0dx^0 + y_3dx^3 \end{pmatrix}_{\det} \quad (5.12.5)$$

$$A_4^{(+)} = \begin{pmatrix} y_0dx^0 + y_3dx^0 & iy_1\,dx^1 + y_2dx^2 \\ iy_1\,dx^1 - y_2dx^2 & -y_0dx^0 + y_3dx^3 \end{pmatrix} = -y_0dx^0\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} + y_1\,dx^1\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix} + y_2dx^2\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} + y_3dx^3\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \quad (5.12.6)$$

где

$$\sigma_0^{(+---)} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}; \quad \sigma_1^{(+---)} = \begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}; \quad \sigma_2^{(+---)} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}; \quad \sigma_3^{(+---)} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (5.12.7)$$

is the set of Cayley matrices.

Suppose that all elements of length dx^i are equal to one ($dx^i = 1$), then the A_4-matrices (5.12 3) and (5.12.6) take the form

$$A_4^{(-)} = \begin{pmatrix} y_0 + y_3 & y_1 + iy_2 \\ y_1 - iy_2 & y_0 - y_3 \end{pmatrix} = \begin{pmatrix} y_0 & 0 \\ 0 & y_0 \end{pmatrix} - \begin{pmatrix} 0 & -y_1 \\ -y_1 & 0 \end{pmatrix} - \begin{pmatrix} 0 & -iy_2 \\ iy_2 & 0 \end{pmatrix} - \begin{pmatrix} -y_3 & 0 \\ 0 & y_3 \end{pmatrix}, \quad (5.12.8)$$

$$A_4^{(+)} = \begin{pmatrix} y_0 + y_3 & iy_1 + y_2 \\ iy_1 - y_2 & -y_0 + y_3 \end{pmatrix} = -\begin{pmatrix} -y_0 & 0 \\ 0 & y_0 \end{pmatrix} + \begin{pmatrix} 0 & iy_1 \\ iy_1 & 0 \end{pmatrix} + \begin{pmatrix} 0 & y_2 \\ -y_2 & 0 \end{pmatrix} + \begin{pmatrix} y_3 & 0 \\ 0 & y_3 \end{pmatrix}, \quad (5.12.9)$$

For example, let us represent the metric (5.11.1) in the form of the determinant of a spin tensor of the type (5.12.5)

$$\begin{pmatrix} I & H \\ H' & V \end{pmatrix} = \begin{pmatrix} \sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}}\,cdt - r\sin\theta d\varphi & -\frac{1}{\sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}}}dr - ird\theta \\ -\frac{1}{\sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}}}dr + ird\theta & \sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}}\,cdt + r\sin\theta d\varphi \end{pmatrix}_{\det}$$

We write down this spin tensor, taking into consideration that $dx^i = 1$:

$$\begin{pmatrix} \sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}} - r\sin\theta & -\frac{1}{\sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}}} - ir \\ -\frac{1}{\sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}}} + ir & \sqrt{1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}}\,cdt + r\sin\theta \end{pmatrix}. \quad (5.12.10)$$

We also note that any binary event with the probability of its outcome being ½ (e.g., the rotation of a ball clockwise or counterclockwise, coins landing on heads or tails) may be described as spinors. For example, the clockwise rotation is formally described by spinors (i.e., "bra" and "ket" vectors)

$$|Z+\rangle=\sqrt{\frac{1}{2}}\begin{pmatrix}1\\0\end{pmatrix}\quad \text{и} \quad |Z+\rangle^{*}=\langle Z+|=\sqrt{\frac{1}{2}}(1\ 0) \tag{5.12.11}$$

such that

$$\langle Z+|Z+\rangle=\frac{1}{2}(1\ 0)\begin{pmatrix}1\\0\end{pmatrix}=\frac{1}{2}.$$

In this counter-clockwise rotation is formally defined by spinors

$$|Z-\rangle=\sqrt{\frac{1}{2}}\begin{pmatrix}0\\1\end{pmatrix}\quad \text{и} \quad |Z-\rangle^{*}=\langle Z-|=\sqrt{\frac{1}{2}}(0\ 1) \tag{5.12.12}$$

such that

$$\langle Z-|Z-\rangle=\frac{1}{2}(0\ 1)\begin{pmatrix}0\\1\end{pmatrix}=\frac{1}{2},\quad \langle Z-|Z+\rangle=\frac{1}{2}(0\ 1)\begin{pmatrix}1\\0\end{pmatrix}=0\ .$$

At the level of consideration of a 2^3-$\lambda_{m,n}$-vacuum region inside the core of the «electron», there are four intra-vacuum layers (5.11.1) through (5.11.4). Therefore, to study their isotopic rotation (isospin) we use the following spinors

$$|Z+\rangle=\sqrt{\frac{1}{4}}\begin{pmatrix}1\\0\end{pmatrix}\quad \text{и} \quad |Z+\rangle^{*}=\langle Z+|=\sqrt{\frac{1}{4}}(1\ 0), \tag{5.12.13}$$

$$|Z-\rangle=\sqrt{\frac{1}{4}}\begin{pmatrix}0\\1\end{pmatrix}\quad \text{и} \quad |Z-\rangle^{*}=\langle Z-|=\sqrt{\frac{1}{4}}(0\ 1). \tag{5.12.14}$$

Using the spin tensor (5.12.10) and the spinors (5.12.13), let us define the 4-vector of the isospin of the a-subcont

$$\langle s^{(-a)}\rangle=\sqrt{\frac{1}{4}}(1\quad 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}-r\sin\theta & -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}-ir\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}+ir & \sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}+r\sin\theta\end{pmatrix}\sqrt{\frac{1}{4}}\begin{pmatrix}1\\0\end{pmatrix}= \tag{5.12.15}$$

$$=\frac{1}{4}(1\ \ 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}$$

with components

$$s_t^{(-a)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=\frac{1}{4}\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}\ , \tag{5.12.16}$$

$$s_r^{(-a)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=0\,, \tag{5.12.17}$$

$$s_\theta^{(-a)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=\ 0, \tag{5.12.18}$$

$$s_\varphi^{(-a)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=-\frac{1}{2}r\sin\theta. \tag{5.12.19}$$

Similarly, the isospin of the *b*-subcont [i.e. metric (5.11.2)] is determined by the 4-vector

$$\left\langle s^{(-b)}\right\rangle=\sqrt{\frac{1}{4}}(0\ \ 1)\begin{pmatrix}\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}-r\sin\theta & -\frac{1}{\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}}-ir\\ -\frac{1}{\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}}+ir & \sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}+r\sin\theta\end{pmatrix}\sqrt{\frac{1}{4}}\begin{pmatrix}0\\1\end{pmatrix}= \tag{5.12.20}$$

$$=\frac{1}{4}(0\quad 1)\begin{pmatrix}\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}+\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -\frac{1}{\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}+\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}+\frac{1}{4}(0\quad 1)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}$$

with components

$$s_t^{(-b)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=\frac{1}{4}\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}\,, \tag{5.12.21}$$

$$s_r^{(-b)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -\frac{1}{\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=0\,, \tag{5.12.22}$$

$$s_\theta^{(-b)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=0\,, \tag{5.12.23}$$

$$s_\varphi^{(-b)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=\frac{1}{4}r\sin\theta\,. \tag{5.12.24}$$

The 4-vector of the anti-isospin of a c-subcont [i.e., the metric (5.11.3)] can be defined using spinors (5.12.14)

$$\left\langle s^{(-c)}\right\rangle=\sqrt{\frac{1}{4}}(1\quad 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}-r\sin\theta & -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}}-ir\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}}+ir & \sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}+r\sin\theta\end{pmatrix}\sqrt{\frac{1}{4}}\begin{pmatrix}1\\0\end{pmatrix}= \tag{5.12.25}$$

$$
=\frac{1}{4}(1\ \ 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}
$$

with components

$$
s_t^{(-c)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=\frac{1}{4}\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}\,, \tag{5.12.26}
$$

$$
s_r^{(-c)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=0\,, \tag{5.12.27}
$$

$$
s_\theta^{(-c)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=0\,, \tag{5.12.28}
$$

$$
s_\varphi^{(-c)}=\frac{1}{4}(1\ \ 0)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=-\frac{1}{2}r\sin\theta. \tag{5.12.29}
$$

We can define the 4-vector of the anti-isospin of the *d*-subcont [e.g. metrics (5.11.4)] in a similar way

$$\left\langle s^{(-d)}\right\rangle=\sqrt{\frac{1}{4}}(0\quad 1)\begin{pmatrix}\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}-r\sin\theta & -\frac{1}{\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}}-ir \\ -\frac{1}{\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}}+ir & \sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}+r\sin\theta\end{pmatrix}\sqrt{\frac{1}{4}}\begin{pmatrix}0\\1\end{pmatrix}= \qquad (5.12.30)$$

$$=\frac{1}{4}(0\quad 1)\begin{pmatrix}\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}+\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -\frac{1}{\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}+\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}+\frac{1}{4}(0\quad 1)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}$$

with components

$$s_t^{(-d)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=\frac{1}{4}\sqrt{1+\frac{r_7}{r}-\frac{r^2}{r_6^2}}\,, \qquad (5.12.31)$$

$$s_r^{(-d)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -\frac{1}{\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1+\frac{r_7}{r}+\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=0, \qquad (5.12.32)$$

$$s_\theta^{(-d)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=0, \qquad (5.12.33)$$

$$s_\varphi^{(-d)}=\frac{1}{4}(0\quad 1)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}=\frac{1}{2}r\sin\theta. \qquad (5.12.34)$$

We set the components of the general vector of the isospin of the subcont of the core of the «electron» equal to

$$s_t^{(-)}=\sqrt{s_t^{(-a)2}+s_t^{(-b)2}+s_t^{(-c)2}+s_t^{(-d)2}}=\frac{1}{4}\sqrt{(1-\frac{r_7}{r}+\frac{r^2}{r_6^2})+(1+\frac{r_7}{r}-\frac{r^2}{r_6^2})+(1-\frac{r_7}{r}-\frac{r^2}{r_6^2})+(1+\frac{r_7}{r}+\frac{r^2}{r_6^2})}=\frac{\sqrt{4}}{4}=\frac{1}{2},$$

$$s_r^{(-)}=0, \qquad (5.12.35)$$

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

$$s_\varphi^{(-)}=\sqrt{s_\varphi^{(-a)2}+s_\varphi^{(-b)2}+s_\varphi^{(-c)2}+s_\varphi^{(-d)2}}=\frac{1}{4}\sqrt{r^2\sin^2\theta+r^2\sin^2\theta+r^2\sin^2\theta+r^2\sin^2\theta}=\frac{1}{2}r\sin\theta.$$

There is another type of isotopic rotation, which is formally defined by complex spinors

$$|Y+\rangle=\sqrt{\frac{1}{4}}\begin{pmatrix} i \\ 0\end{pmatrix} \quad \text{и} \quad |Y+\rangle^*=\langle Y+|=\sqrt{\frac{1}{4}}\begin{pmatrix} i & 0\end{pmatrix} \qquad (5.12.36)$$

such that

$$\langle Y+|Y+\rangle=\frac{1}{4}\begin{pmatrix} i & 0\end{pmatrix}\begin{pmatrix} i \\ 0\end{pmatrix}=-\frac{1}{4}.$$

as well as the complex spinors

$$|Y-\rangle=\sqrt{\frac{1}{4}}\begin{pmatrix} 0 \\ i\end{pmatrix} \quad \text{и} \quad |Y-\rangle^*=\langle Y-|=\sqrt{\frac{1}{4}}\begin{pmatrix} 0 & i\end{pmatrix} \qquad (5.12.37)$$

such that

$$\langle Y-|Y-\rangle=\frac{1}{4}\begin{pmatrix} 0 & i\end{pmatrix}\begin{pmatrix} 0 \\ i\end{pmatrix}=-\frac{1}{4}, \quad \langle Y-|Y+\rangle=\frac{1}{4}\begin{pmatrix} 0 & i\end{pmatrix}\begin{pmatrix} i \\ 0\end{pmatrix}=0.$$

We substitute into the expressions (5.12.15) through (5.12.34) the complex spinors (5.12.36) through (5.12.37) in place of the spinors (5.12.13) through (5.12.14). As a result, we obtain opposite values for the components of the 4-vectors of the isospins of the *a*-subcont and the *b*-subcont, as well as those of the anti-isospin of the *c*-subcont and the *d*-subcont. Let us show this by the example of the isospin properties of the *a*-subcont

$$\langle s^{(-a)}\rangle=\sqrt{\frac{1}{4}}\begin{pmatrix} i & 0\end{pmatrix}\begin{pmatrix} \sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}-r\sin\theta & -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}-ir \\ -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}+ir & \sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}+r\sin\theta \end{pmatrix}\sqrt{\frac{1}{4}}\begin{pmatrix} i \\ 0\end{pmatrix}= \qquad (5.12.38)$$

$$
=\frac{1}{4}(i\quad 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}i\\0\end{pmatrix}+\frac{1}{4}(i\quad 0)\begin{pmatrix}0 & -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}i\\0\end{pmatrix}+\frac{1}{4}(i\quad 0)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}i\\0\end{pmatrix}+\frac{1}{4}(i\quad 0)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}i\\0\end{pmatrix}
$$

It is clear from this that, in this case, the components of the 4-vector of the isospin for the *a*-subcont have opposite values to those of their respective components in (5.12.16) through (5.12.19)

$$
s_t^{(-c)}=\frac{1}{4}(i\quad 0)\begin{pmatrix}\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}} & 0\\ 0 & \sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}i\\0\end{pmatrix}=-\frac{1}{4}\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}\ , \tag{5.12.39}
$$

$$
s_r^{(-c)}=\frac{1}{4}(1\quad 0)\begin{pmatrix}0 & -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}}\\ -\frac{1}{\sqrt{1-\frac{r_7}{r}-\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=0\ , \tag{5.12.40}
$$

$$
s_\theta^{(-c)}=\frac{1}{4}(1\quad 0)\begin{pmatrix}0 & -ir\\ ir & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}=0\ , \tag{5.12.41}
$$

$$
s_\varphi^{(-c)}=\frac{1}{4}(i\quad 0)\begin{pmatrix}-r\sin\theta & 0\\ 0 & r\sin\theta\end{pmatrix}\begin{pmatrix}i\\0\end{pmatrix}=\frac{1}{2}r\sin\theta. \tag{5.12.42}
$$

Therefore, the components of the general vector of the isospin of such an «electron» core should also be assumed to be opposite

$$
\begin{aligned}
s_t^{(-)}&=-\sqrt{s_t^{(-a)2}+s_t^{(-b)2}+s_t^{(-c)2}+s_t^{(-d)2}}=-\frac{1}{4}\sqrt{(1-\frac{r_7}{r}+\frac{r^2}{r_6^2})+(1+\frac{r_7}{r}-\frac{r^2}{r_6^2})+(1-\frac{r_7}{r}-\frac{r^2}{r_6^2})+(1+\frac{r_7}{r}+\frac{r^2}{r_6^2})}=-\frac{\sqrt{4}}{4}=-\frac{1}{2},\\
s_r^{(-)}&=0,\\
s_\theta^{(-)}&=0,\\
s_\varphi^{(-)}&=-\sqrt{s_\varphi^{(-a)2}+s_\varphi^{(-b)2}+s_\varphi^{(-c)2}+s_\varphi^{(-d)2}}=-\frac{1}{4}\sqrt{r^2\sin^2\theta+r^2\sin^2\theta+r^2\sin^2\theta+r^2\sin^2\theta}=-\frac{1}{2}r\sin\theta.
\end{aligned} \tag{5.12.43}
$$

The results (5.12.35) and (5.12. 43) appear analogous to the spin quantum number of classical quantum mechanics $s = \pm ½$.

Let's sum up what we have learned so far:

1. In this section we give only initial information on the isospin properties of diagonal quadratic forms. In view of what was said in *§§ 1.14 through 1.15*, the research data can be continued until many non-trivial results are obtained.
2. From the assumption that within the core of the «electron» at rest two intra-vacuum layers [for example, (5.11.1) and (5.11.3)] have isospins with the same direction, whereas the other two layers [e.g. (5.11.2) and (5.11.4)] have isospins with the opposite direction, the conclusion is reached that the given isospins, on the average, completely compensate each other's representations. However the general isospin of the core of the «electron» is analogous to the electron spin quantum number in classical quantum mechanics.

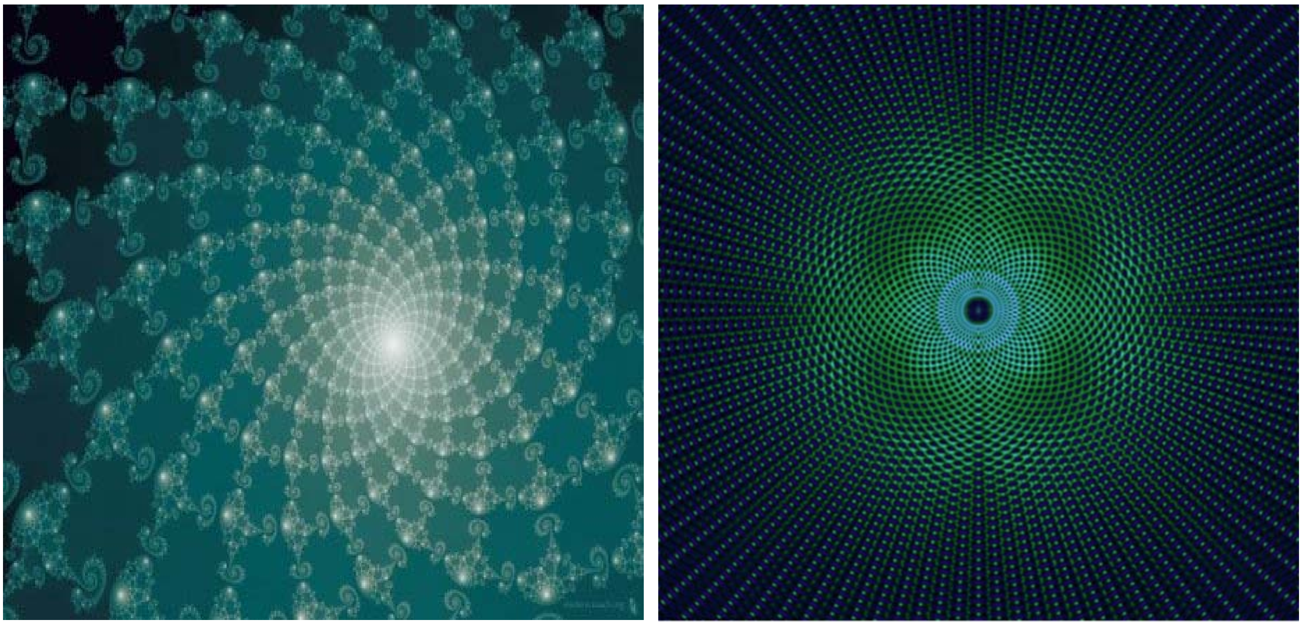


Fig. 5.12.1 Fractal illustration of the intercrossing isospin processes occurring inside the core of a spherical vacuum formation

3. Investigations of the isospin properties of the metrics (5.8.16) through (5.8.19) describing the core of the "positron" lead to similar results. For example, the 4-vector of the isospin of the *a*- antisubcont can be specified using the spin tensor obtained from the metric (5.8.16):

$$\left\langle s^{(+a)}\right\rangle=\sqrt{\frac{1}{4}}\begin{pmatrix}1 & 0\end{pmatrix}\begin{pmatrix}-\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}+r\sin\theta & \frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}+ir \\ \frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}-ir & -\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}-r\sin\theta\end{pmatrix}\sqrt{\frac{1}{4}}\begin{pmatrix}1\\0\end{pmatrix}= \qquad (5.12.44)$$

$$=\frac{1}{4}(1\ \ 0)\begin{pmatrix}-\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}} & 0\\ 0 & -\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & \frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}}\\ \frac{1}{\sqrt{1-\frac{r_7}{r}+\frac{r^2}{r_6^2}}} & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}0 & ir\\ -ir & 0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}+\frac{1}{4}(1\ \ 0)\begin{pmatrix}r\sin\theta & 0\\ 0 & -r\sin\theta\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}$$

and the components of the general vector of the isospin of such a "positron's" core are also equal to

$$\begin{aligned}
&s_t^{(+)}=\sqrt{s_t^{(+a)2}+s_t^{(+b)2}+s_t^{(+c)2}+s_t^{(+d)2}}=\frac{1}{4}\sqrt{(1-\frac{r_7}{r}+\frac{r^2}{r_6^2})+(1+\frac{r_7}{r}-\frac{r^2}{r_6^2})+(1-\frac{r_7}{r}-\frac{r^2}{r_6^2})+(1+\frac{r_7}{r}+\frac{r^2}{r_6^2})}=\frac{\sqrt{4}}{4}=\frac{1}{2},\\
&s_r^{(+)}=0,\\
&s_\theta^{(+)}=0,\\
&s_\varphi^{(+)}=\sqrt{s_\varphi^{(+a)2}+s_\varphi^{(+b)2}+s_\varphi^{(+c)2}+s_\varphi^{(+d)2}}=\frac{1}{4}\sqrt{r^2\sin^2\theta+r^2\sin^2\theta+r^2\sin^2\theta+r^2\sin^2\theta}=\frac{1}{2}r\sin\theta.
\end{aligned}\tag{5.12.45}$$

4. Investigations of the isospin properties of the cores of the «electron» and of the «positron» at the level of the 2^6-$\lambda_{m,n}$-vacuum region can, for example, by using metrics (5.11.35), lead to much more complicated but harmonious results.
5. If in equations (5.11.1) through (5.12.45) instead of the two radii r_6, r_7 substitute any other two radii from the hierarchy of radii (2.6.20), for example, r_2, r_3 or r_1, r_5 or r_4, r_6, etc., we obtain similar metric-dynamic models of core and their isospins respectively naked: «planet», «galaxy», «stars», «biological cells», etc. (*see Definition № 9.2.1*).

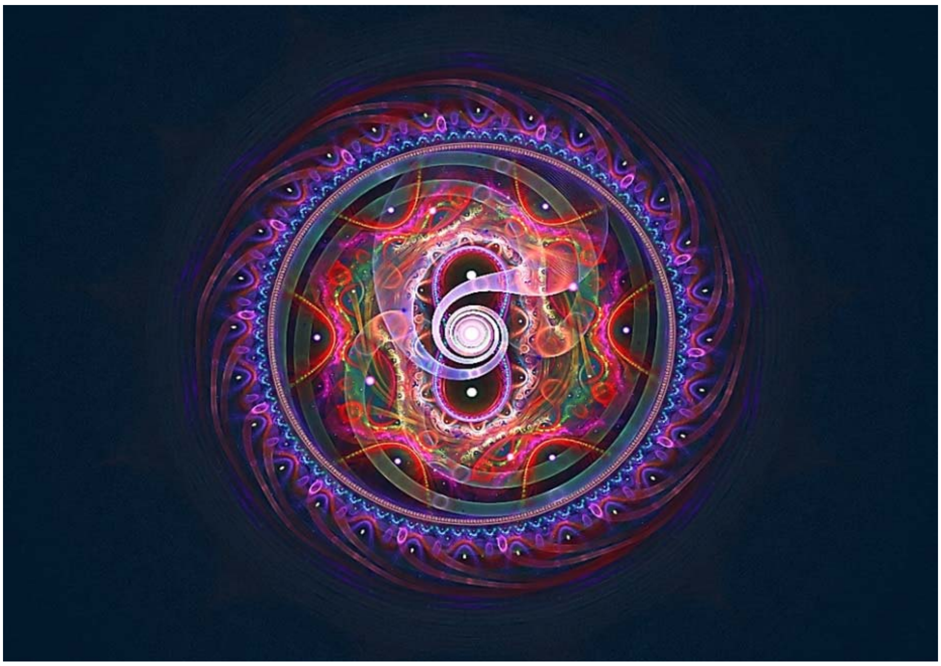


Fig. 5.12.2. The text of the TORAH contains 5845 verses. At the time of writing these lines in the Jewish calendar 5779 year from the birth of Adam HaRishon (the First Man). Our planet is left to do 5845 – 5779 = 66 revolutions around its axis until Gadol Erev Shabbat (the evening before the Great Sabbath)

5.13 Probabilistic description

Because of many external and internal influences the core of the «electron» (like the core of any other naked stable vacuum formation) is constantly fluctuating and distorted like a spherical jelly (Figures 5.10.5 and 5.13.1). At the same time, the *particelle* (inner nucleolus) inside the «electron's» core (Figure 5.13.1 or *Figure 3.1*) constantly wanders chaotically in the vicinity of the center of this vacuum formation.

Chaotic motion of the particelle (internal nucleolus) is investigated in detail in Chapters 3 and 4. In this paragraph let's consider one of variants of the description of fluctuations of subcont in the «electron's» core and antisubcont inside the core of the "positron".

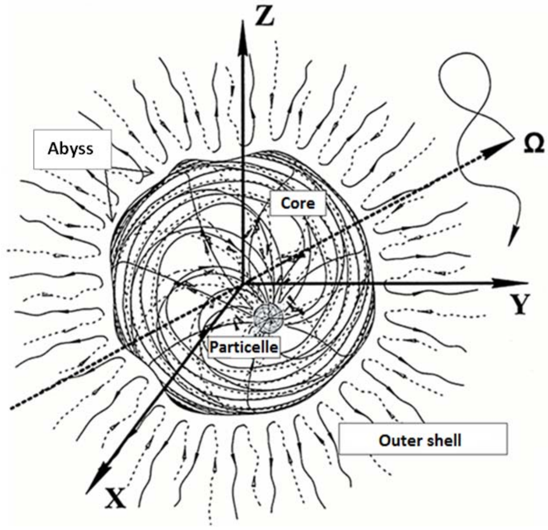


Fig. 5.13.1. The core of any naked stable vacuum formation (including the "electron's" core) constantly varies and is curved, and the *particelle* (inner nucleolus) constantly wanders chaotically in the vicinity of the center of this vacuum formation

As an example of changeable distortion of the intra-vacuum layers, consider the description of fluctuations an *a*-subcont (5.11.1)

$$ds^{(-a)2} = \left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right) \quad - a\text{-subcont,} \qquad (5.13.1)$$

Such fluctuations of the other three intra-vacuum layers with metrics (5.11.2) through (5.11.4) are described similarly.

Recall that the metric (5.13.1) can be represented as the sum of seven sub-metrics (5.11.35) with signature (5.11.33):

$$ds^{(-a)2} = \left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} + r^2d\theta^2 + r^2\sin^2\theta\, d\varphi^2 - \quad - a_1\text{-subcont} \qquad (5.13.2)$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2d\theta^2 + r^2\sin^2\theta\, d\varphi^2 + \quad - a_2\text{-subcont} \qquad (5.13.3)$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} - r^2d\theta^2 + r^2\sin^2\theta\, d\varphi^2 - \quad - a_3\text{-subcont} \qquad (5.13.4)$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)} + r^2d\theta^2 - r^2\sin^2\theta\, d\varphi^2 + \quad - a_4\text{-subcont} \qquad (5.13.5)$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2\ - \qquad - a_5\text{-subcont} \qquad (5.13.6)$$

$$-\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2+\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}-r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2\ + \qquad - a_6\text{-subcont} \qquad (5.13.7)$$

$$+\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2-\frac{dr^2}{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}+r^2d\theta^2-r^2\sin^2\theta\, d\varphi^2\,. \qquad - a_7\text{-subcont.} \qquad (5.13.8)$$

Consider only one of the seven summands in this expression, for example, (5.13.5) with signature (– – + –) (the other terms are described similarly).

As was shown in § 5.12, the sub-metric (5.13.5) (species $s^{(--+-)2}=-y_0^2-y_1^2+y_2^2-y_3^2$) can be represented in the form of one of the determinants of *n* $A_4^{i(--+-)}$, which are matrices of the form (5.12.8):

$$\begin{pmatrix}-y_0+iy_3 & y_1+y_2\\ -y_1+y_2 & y_0+iy_3\end{pmatrix}\ \begin{pmatrix}y_0+iy_3 & y_1+y_2\\ -y_1+y_2 & -y_0+iy_3\end{pmatrix}\ \begin{pmatrix}-y_0+iy_3 & -y_1+y_2\\ y_1+y_2 & y_0+iy_3\end{pmatrix}\ \begin{pmatrix}y_0+iy_3 & -y_1+y_2\\ y_1+y_2 & -y_0+iy_3\end{pmatrix}$$

$$\begin{pmatrix}y_1+y_2 & -y_0+iy_3\\ y_0+iy_3 & -y_1+y_2\end{pmatrix}\ \begin{pmatrix}y_1+y_2 & y_0+iy_3\\ -y_0+iy_3 & -y_1+y_2\end{pmatrix}\ \begin{pmatrix}-y_1+y_2 & -y_0+iy_3\\ y_0+iy_3 & y_1+y_2\end{pmatrix}\ \begin{pmatrix}-y_1+y_2 & y_0+iy_3\\ -y_0+iy_3 & y_1+y_2\end{pmatrix}$$

$$\begin{pmatrix}-y_0+iy_1 & y_3+y_2\\ -y_3+y_2 & y_0+iy_1\end{pmatrix}\ \begin{pmatrix}y_0+iy_1 & y_3+y_2\\ -y_3+y_2 & -y_0+iy_1\end{pmatrix}\ \begin{pmatrix}-y_0+iy_1 & -y_3+y_2\\ y_3+y_2 & y_0+iy_1\end{pmatrix}\ \begin{pmatrix}y_0+iy_1 & -y_3+y_2\\ y_3+y_2 & -y_0+iy_1\end{pmatrix}$$

$$\begin{pmatrix}y_3+y_2 & -y_0+iy_1\\ y_0+iy_1 & -y_3+y_2\end{pmatrix}\ \begin{pmatrix}y_3+y_2 & y_0+iy_1\\ -y_0+iy_1 & -y_3+y_2\end{pmatrix}\ \begin{pmatrix}-y_3+y_2 & -y_0+iy_1\\ y_0+iy_1 & y_3+y_2\end{pmatrix}\ \begin{pmatrix}-y_3+y_2 & y_0+iy_1\\ -y_0+iy_1 & y_3+y_2\end{pmatrix}$$

$$\dots \qquad \dots \qquad \dots \qquad \dots$$

$$\begin{pmatrix}y_0+y_2 & -y_1+iy_3\\ y_1+iy_3 & -y_0+y_2\end{pmatrix}\ \begin{pmatrix}y_0+y_2 & y_1+iy_3\\ -y_1+iy_3 & -y_0+y_2\end{pmatrix}\ \begin{pmatrix}-y_0+y_2 & -y_1+iy_3\\ y_1+iy_3 & y_0+y_2\end{pmatrix}\ \begin{pmatrix}-y_0+y_2 & y_1+iy_3\\ -y_1+iy_3 & y_0+y_2\end{pmatrix}$$

(5.13.9)

where

$$y_0=\sqrt{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}cdt,\qquad y_1=\frac{dr}{\sqrt{\left(1-\frac{r_7}{r}+\frac{r^2}{r_6^2}\right)}},\qquad y_2=rd\theta,\qquad y_3=r\sin\theta d\varphi. \qquad (5.13.10)$$

If we assume that each of the $A_4^{i(--+-)}$-matrices of (5.13.9) is implemented with some probability $c_i^2(t)$ (which may vary with time *t*), the middle $A_4^{(--+-)}$-matrix can be represented in the form

$$A_4^{(--+-)}=c_1^2(t)A_4^{1(--+-)}+c_2^2(t)A_4^{2(--+-)}+c_3^2(t)A_4^{3(--+-)}+\ldots+c_n^2(t)A_4^{n(--+-)} \qquad (5.13.11)$$

or $$A_4^{(--+-)} = \sum_{i=1}^{n} c_i^2(t) A_4^{i(--+-)} \quad (5.13.12)$$

where $$\sum_{i=1}^{n} c_i^2(t) = 1 \,. \quad (5.13.13)$$

In the simplest case, when all $c_i^2 = 1/n$, the expression (5.13.12) takes the form

$$A_4^{(--+-)} = \frac{1}{n} \sum_{i=1}^{n} A_4^{i(--+-)}. \quad (5.13.14)$$

Part of the characteristics of the considered random processes can be obtained on the basis of the spin tensor analysis

$$S_4^{(--+-)} = \langle \psi_1 | A_4^{1(--+-)} | \psi_1 \rangle + \langle \psi_2 | A_4^{2(--+-)} | \psi_2 \rangle + \langle \psi_3 | A_4^{3(--+-)} | \psi_3 \rangle + ... + \langle \psi_m | A_4^{n(--+-)} | \psi_m \rangle, \quad (5.13.15)$$

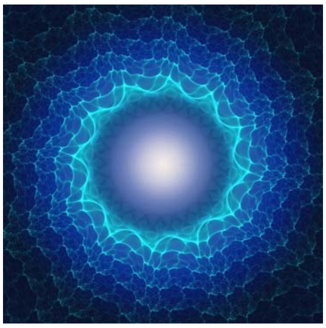
where «bra» and «ket» vectors have the form

$$\langle \psi_i | = (\bar{c}_i(t), 0) = \bar{c}_i(t)(1,0) \qquad | \psi_i \rangle = \begin{pmatrix} c_i(t) \\ 0 \end{pmatrix} = c_i(t) \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \quad (5.3.16)$$

and / or

$$\langle \psi_i | = (i\bar{c}_i(t), 0) = \bar{c}_i(t)(i,0) \qquad | \psi_i \rangle = \begin{pmatrix} ic_i(t) \\ 0 \end{pmatrix} = c_i(t) \begin{pmatrix} i \\ 0 \end{pmatrix}. \quad (5.13.17)$$

Similar descriptions can be formulated for the chaotic fluctuations of all sub-layers (5.13.2) through (5.13.8) and the layers (5.11.2) through (5.11.4) of the subcont in the «electron's» core.



Use of metrics (5.8.16) through (5.8.19) and (5.11.36) can be described by fluctuations of the layers and sub-layers of antisubcont inside the core of the «positron».

The probabilistic description of intra-vacuum fluctuations should be the subject of a separate study, which would be beyond the scope of this work. However, we note that all the metrics and linear forms with which the Algebra of Signatures operates in the present study are only the result of averaging extremely complex and intricate overlays of intra-vacuum layers, sub-layers and sub-layers ... and plexuses of the subcont's and / or antisubcont's flows (currents) (Fig. 5.13.2 and 5.13.3).

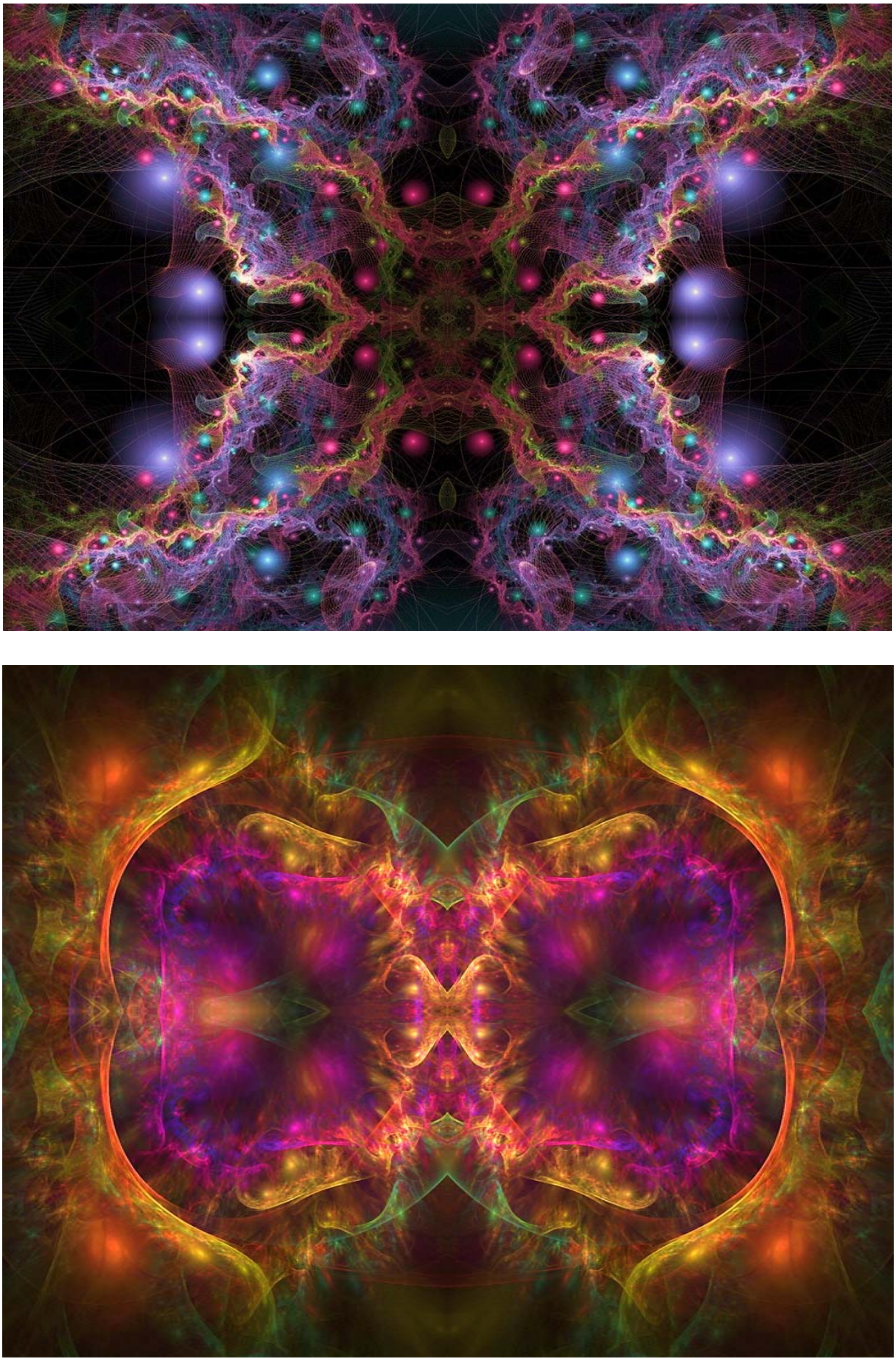


Fig. 5.13.2. Fractal illustration of the vacuum fluctuations

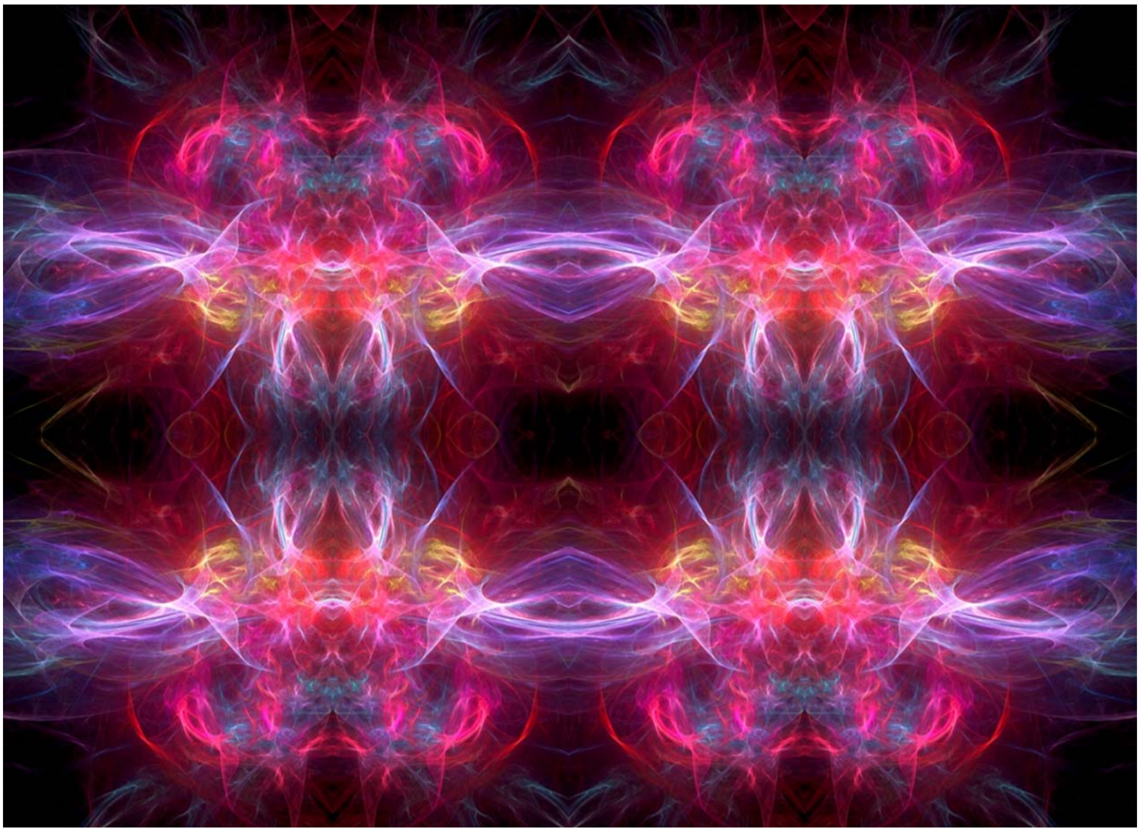
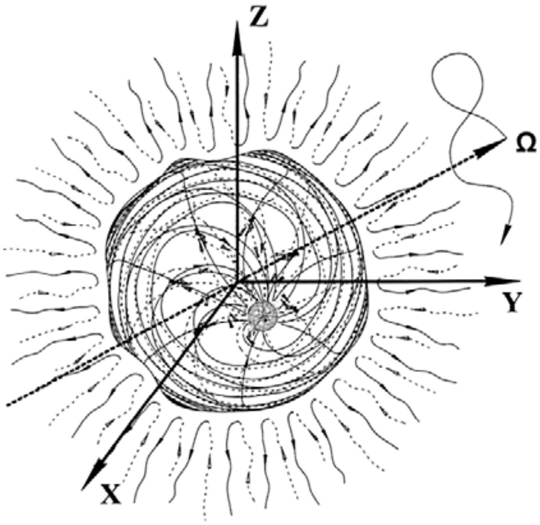


Fig. 5.13.3. Fractal illustration of various aspects of the complex and intricate intertwining of the intra-vacuum layers and weaves of the subcont's or antisubcont's flows (currents)

5.14 The rotation core of the «electron» and «positron»

The core of any naked stable vacuum formation, including the core of the «electron» and «positron», rotates relative to an outside observer (i.e. an observer located in its outer shell); see Figures 5.11.5 and 5.14.1.



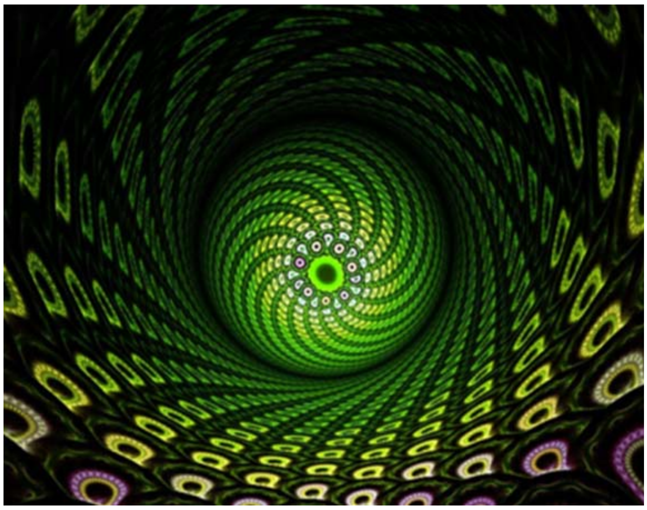


Fig. 5.14.1. Rotation of the «electron's» core has two components:
1) rotation around the instantaneous axis, and 2) the chaotic change of the direction of its axis of rotation

However, as noted in *§ 2.3*, for an observer located inside the rotating core of any vacuum formation, this rotation can be practically not manifested. In this case, the condition *(2.3.14)* should be satisfied; in particular

$$Y_{\mu\nu} + \Phi_{\mu\nu} = 0 \quad \text{или} \quad \begin{cases} Y_{\mu\nu} = 0, \\ \Phi_{\mu\nu} = 0. \end{cases} \tag{5.14.1}$$

where

$$Y_{\mu\nu} = K_\mu K_\nu + K_{\mu\alpha\beta} K_\nu^{\alpha\beta} + K_{\alpha\mu\beta} K_\nu^{\beta\alpha} + K_{\alpha\beta\mu} K_\nu^{\alpha\beta} - \tfrac{1}{2} g_{\mu\nu} \left(K_\lambda K^\lambda + K_{\lambda\mu\nu} K^{\lambda\mu\nu} \right) \tag{5.14.2}$$

is the Cartan-Schouten tensor *(2.3.5)*;

$$\Phi_{jm} = 2\left\{ \nabla_{[i} \Phi^{i}_{|j|m]} + \Phi^{i}_{s[i} \Phi^{s}_{|j|m]} - \frac{1}{2} g_{jm} g^{pn} (\nabla_{[i} \Phi^{i}_{|p|n]} + \Phi^{i}_{s[i} \Phi^{s}_{|p|n]}) \right\} \tag{5.14.3}$$

is the Vaytsenbek -Vitali - Shipov tensor *(2.3.8)*.

The rotation core of the naked stable vacuum formation (in particular, the «electron's» core) is an extremely complex phenomenon that requires a separate extensive research. In this work we note only possible directions of this research on the example of a qualitative review of core rotation of the «electron» (or «positron»).

First of all, note that, as mentioned in § 5.11, each point of the periphery of the «electron's» core has to move with a linear velocity close to the speed of light $v_r^{(-)} \approx c$ [see (5.11.22) through (5.11.25)]. This is the condition for the existence of a subcont on the border between the core and the outer shell of «electron» (Figures 5.8.1 and 5.14.1). Such rotational movement of the periphery of the core can be described as follows.

If the surface of the «electron's» core rotates like a solid sphere, the velocity of points lying on its equator $v_e^{(-)}$,would be maximal, i.e. close to the speed of light ($v_e^{(-)} \approx c$), and the velocity of other points on this area would be significantly less ($v^{(-)} < c$) (Figure 5.14.2).

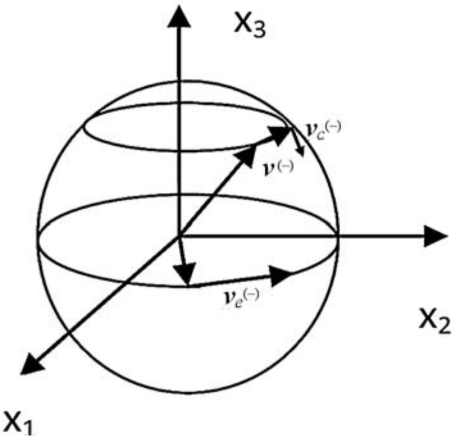


Fig. 5.14.2. The linear velocity of points on a rotating sphere

The speed of non-equatorial points on the surface of the core would also be close to the speed of light, as they must still participate in the surface rotational movements (cyclone and/or anticyclone, see Figure 5.14.3), with additional speed $v_c^{(-)}$, so that $v^{(-)} + v_c^{(-)} \approx c$.

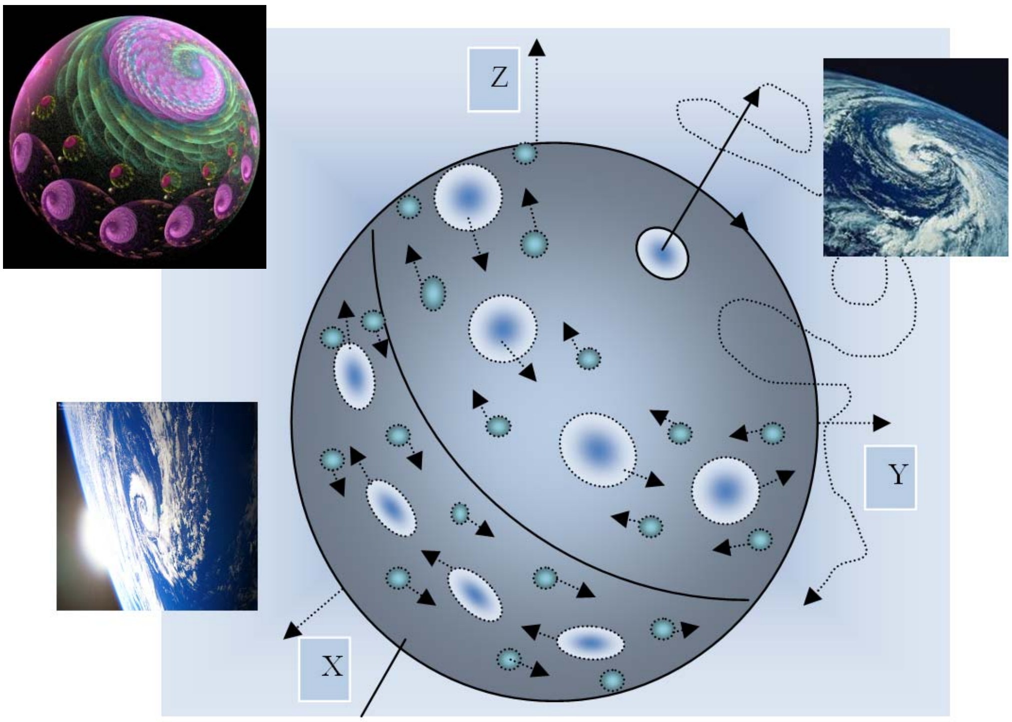


Fig. 5.14.3. Cyclones and anticyclones at the surface of the rotating core of the vacuum formation (in particular the «electron's» core), like circulation of air on the surface of a planet

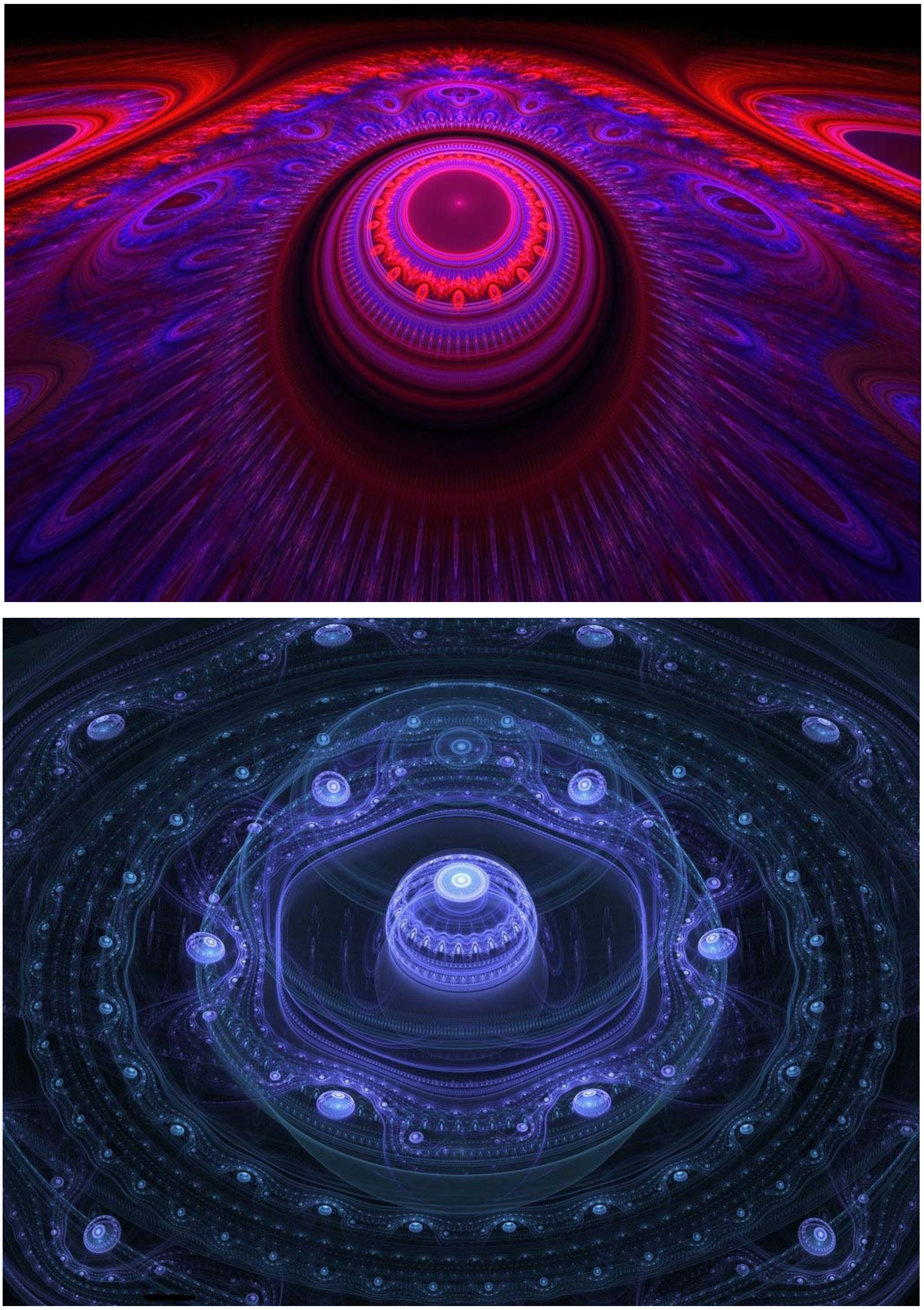
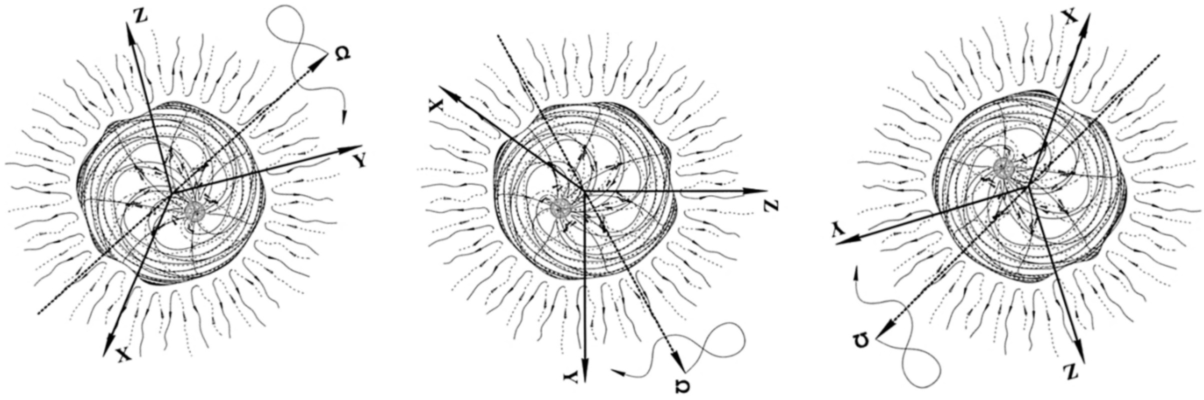


Fig. 5.14.4. Fractal illustration of different zones on the surface of the rotating core of the naked stable vacuum formation (in particular, the core of the «electron»)

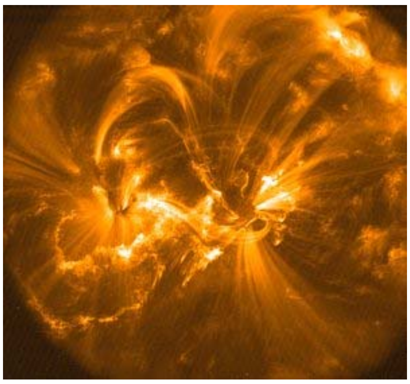
On the surface of the considered sphere (Figure 5.14.2, 5.14.4) still remain two points at the "North" and "South" poles which do not participate in the rotational motion. But they are due to the boundary conditions; these points also need to move with a speed close to the speed of light. Therefore, the axis of rotation of the «electron's» core passing through the pole should move with the speed of light in the direction perpendicular to the equator (Figure 5.14.1 and 5.14.3).

The result of superposition of several of the above reasons, the points that are in the peripheral layer of the «electron's» core should participate in an extremely complex perfunctory movement. Thus the instantaneous axis of rotation of the whole core as a whole should move along almost a chaotic trajectory (Figures 5.14.5 and 5.14.6).

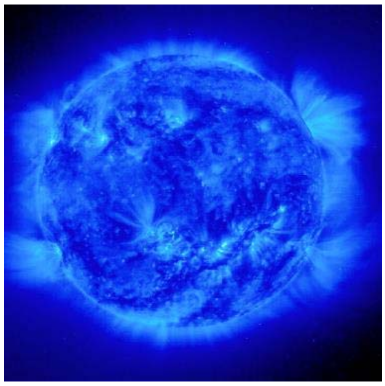


t_1 t_2 t_3

Fig. 5.14.5. The chaotic change of direction of the axis of the rotation core of the vacuum formation (in particular the «electron's» core) over time relative to an outside observer



Photograph of the Sun with unit Trace



The sun in the infrared spectrum

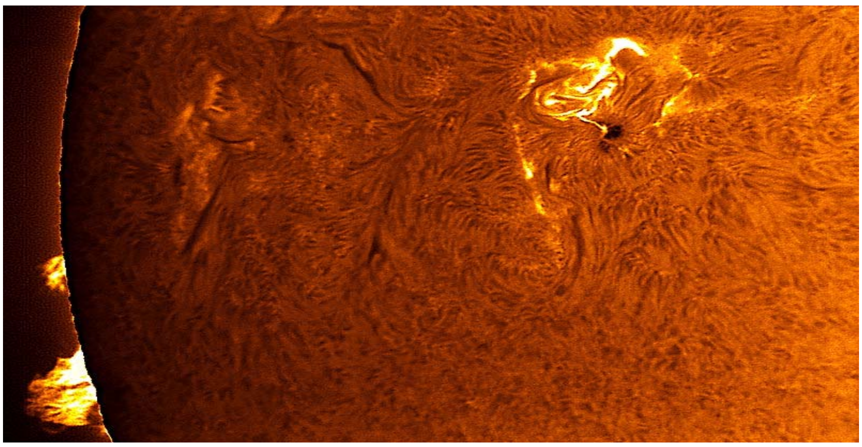


Fig. 5.14.6. On the surface of the Sun is seen many whirling currents (spicules), moving at a speed close to 50 000 km/h. It is possible that movements on the surface of the core of any naked stable vacuum formation (including at the periphery of the «electron's» core) are similar to vortex intra-vacuum currents, but with others speeds

Initially it is unknown which way to rotate the core of the «electron», but we know that these opportunities are only two: "clockwise" and "counterclockwise", and the probability of any of these directions of rotations is equal to ½.

Because of the chaotic precession of the axis of rotation of the core of the «electron», for any given direction in a forward direction, it coincides with this direction part of the time, and the other equal part of the time this axis is opposite to it. Therefore, the core of a free resting «electron» has its own moment of rotation for any direction, on average, equal to zero.

Different longitudinal and transverse layers of the «electron's» core are moving with a different velocities (5.11.22) through (5.11.25) depending on the distance from the center *r*. At the periphery of the core, all four of the cross-layers of the subcont, move on average almost exclusively at the surface of a sphere with a radius r_6; the layers out of the four intertwined layers of subcont which are closer to the particelle (inner nucleolus) become more and more radial (Figures 5.11.5 and 5.14.1). However, near the inner nucleolus their velocities are again primarily directed along a sphere with a radius r_7 (Figures 5.14.7 and 5.14.8).

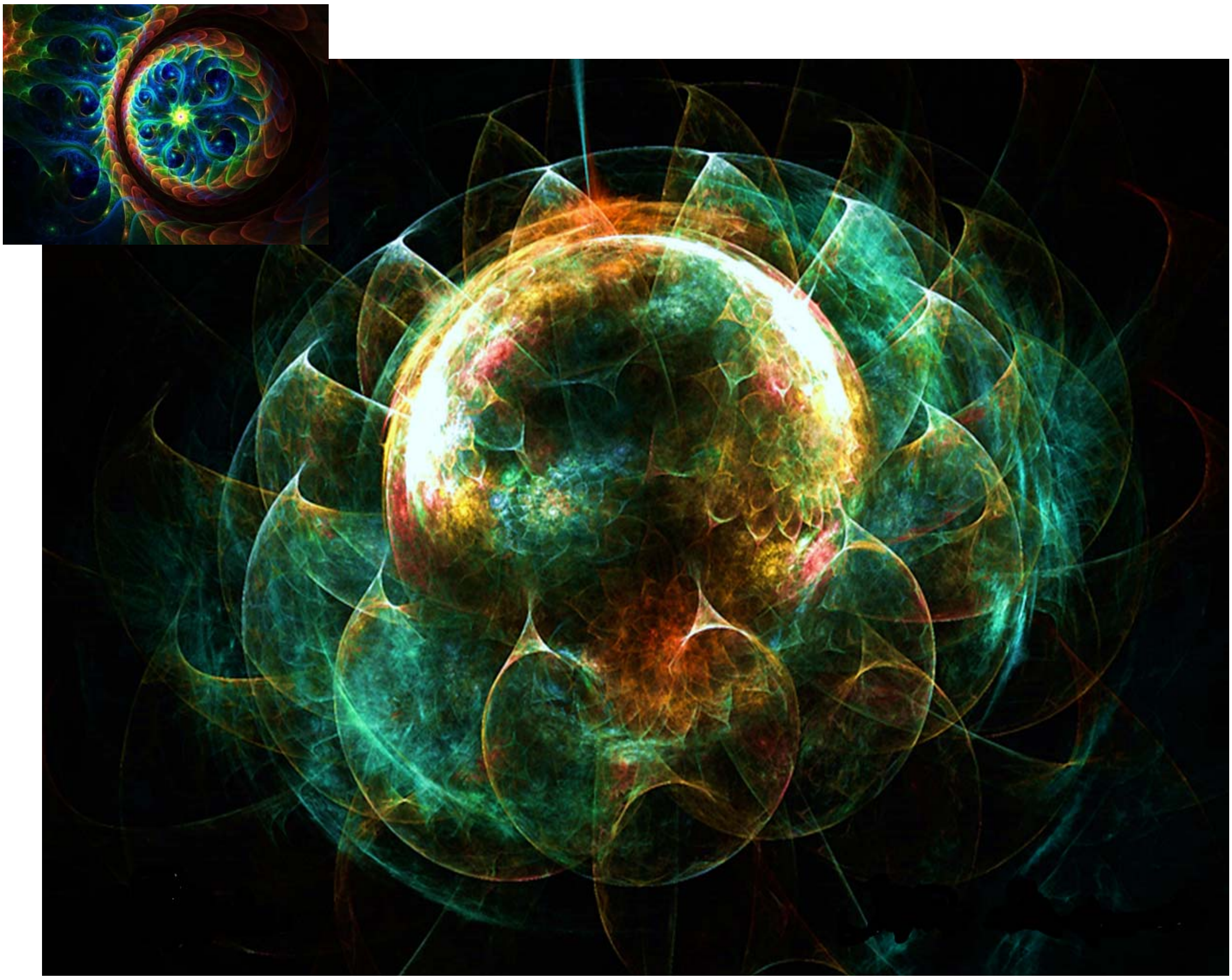


Fig. 5.14.7. Near the particelle (inner nucleolus) with a radius r_7, subcont speed again increases, and increases its tangential component

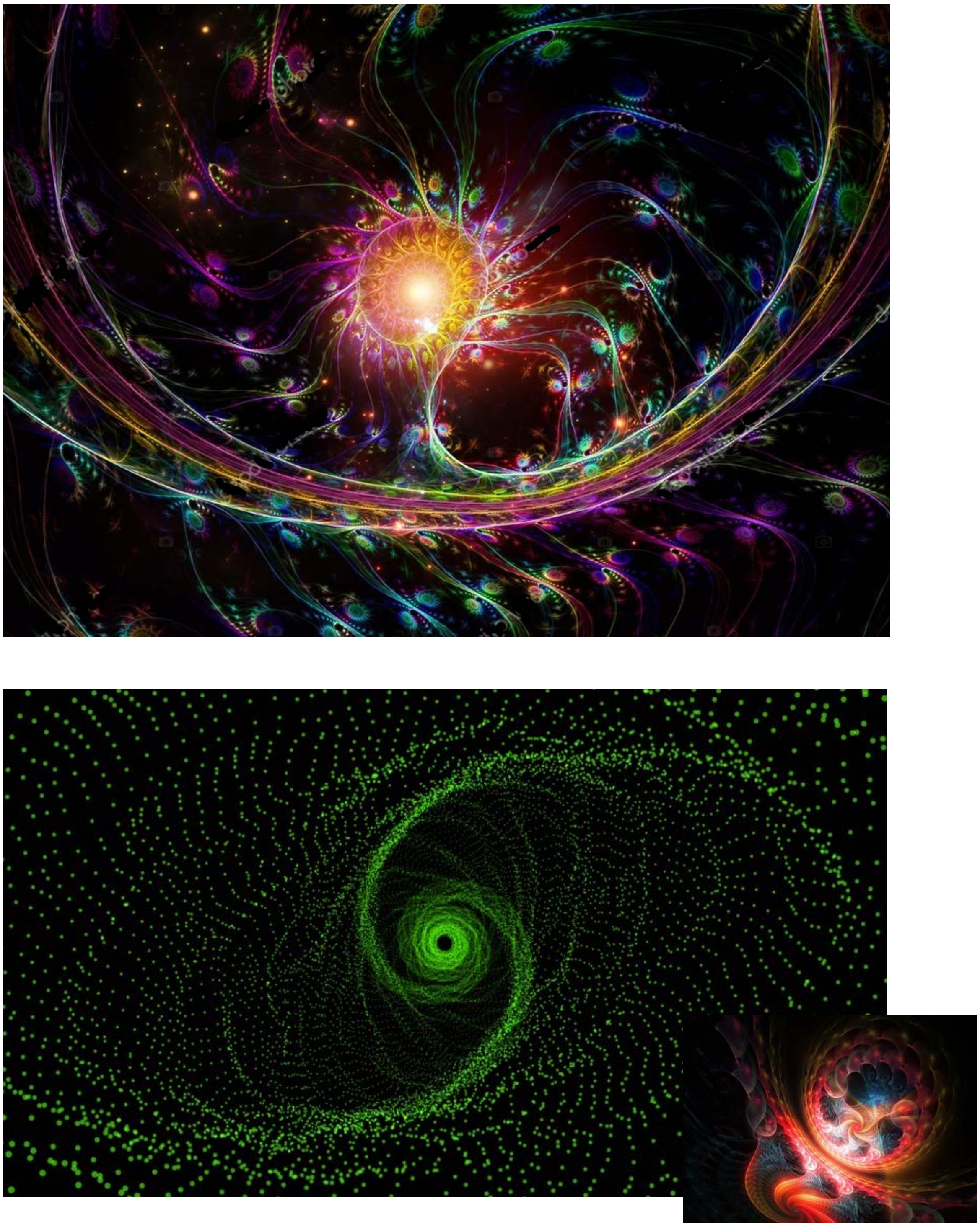


Fig. 5.14.8. On the periphery of the «electron's» core with a radius r_6 and near its particelle (inner nucleolus) with a radius r_7 the speed of the subcont on average has a tangential component, and between the periphery of the «electron's» core and *rakya* of its internal nucleolus is dominated by the radial component of velocity of the subcont.

Therefore, the projection of the velocities of transverse layers of subcont on the surface of spheres with different radii $r_6 > r > r_7$ are different. Because of this, longitudinal layers of the «electron's» core (Figure 5.14.9) are different.

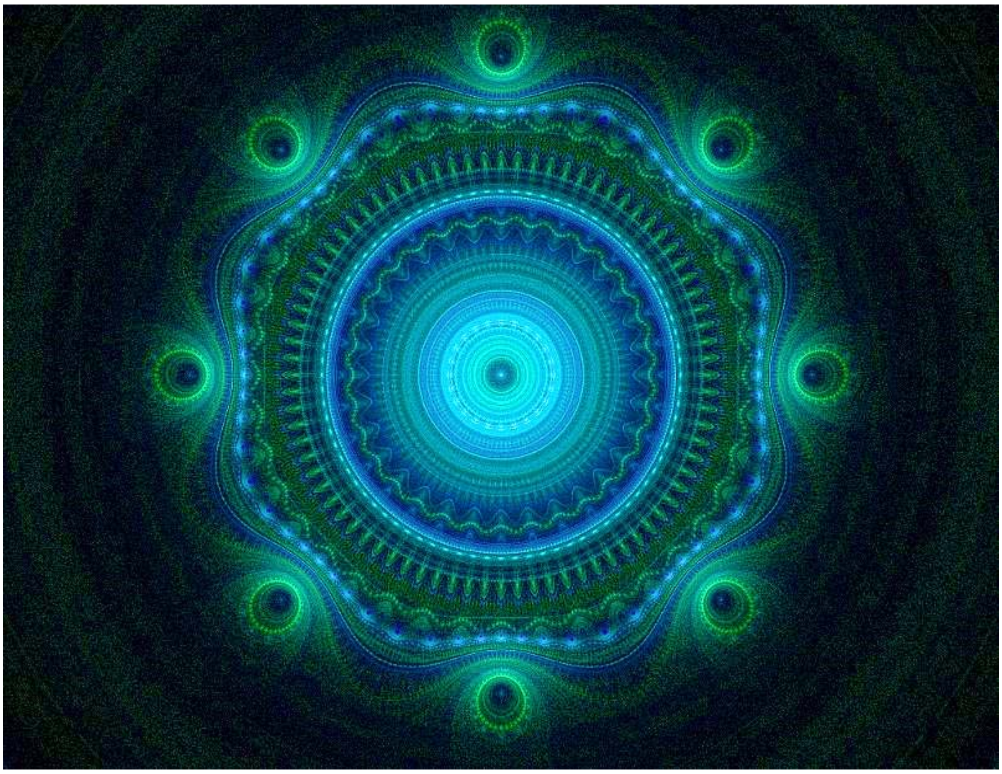


Fig. 5.14.9. Fractal illustration of a state longitudinal layers inside the core of the «electron»

Let's consider some aspects regarding the complex rotation process of subcont and antisubcont in the core of the vacuum formations, in particular in the «electron's» core and the «position's» core.

Let the point M be located at a distance r from the center of the core of the «electron» ($r_6 > r > r_7$) as it moves around the instantaneous axis of rotation with a linear velocity (Figure 5.14.10) [48]

$$\mathbf{v} = \boldsymbol{\omega}\times\mathbf{r}, \qquad (5.14.4)$$

where

$$\boldsymbol{\omega} = \mathbf{e}\; d\varphi/dt \qquad (5.14.5)$$

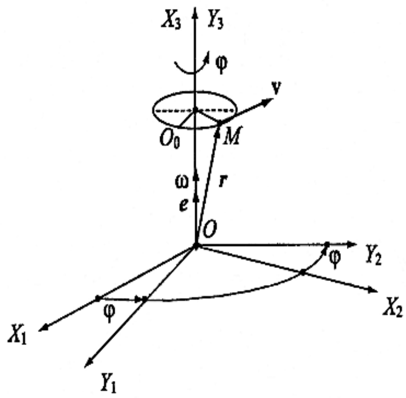


Fig. 5.14.10. The definition of angular speed [48]

is the angular velocity of rotation of the core ($\mathbf{e}$ is a unit vector directed along the instantaneous axis of rotation).

Let the supporting system of reference x_1, x_2, x_3 (Figure 5.14.10), remains stationary, and the system y_1, y_2, y_3 chaotically precesses together with the instantaneous axis of rotation of the core.

The coordinate axes of the reference and shifting reference systems in this case are interconnected by a system of three linear equations

$$y_\alpha = \beta_{\alpha 1}(t)\, x_1 + \beta_{\alpha 2}(t)\, x_2 + \beta_{\alpha 3}(t)\, x_3\,, \qquad (5.14.6)$$

where $\beta_{\alpha k}(t)$ (α,k =1,2,3) are the direction cosines, which are random functions of time.

Referring to equations (5.14.6) [48], we differentiate

$$\frac{dy_a}{dt} = \sum_{k=1}^{3} \frac{d\beta_{ak}(t)}{dt} x_k = \omega(t) \times y_a = \begin{pmatrix} x_1 & x_2 & x_3 \\ \omega_1(t) & \omega_2(t) & \omega_3(t) \\ \beta_{a1}(t) & \beta_{a2}(t) & \beta_{a3}(t) \end{pmatrix}, \tag{5.14.7}$$

where $\omega_\alpha(t)$ is the instantaneous projection of the angular velocity vector $\omega(t)$ on the reference axis of the reference system x_1, x_2, x_3 at time t.

Equating coefficients of the unit vectors x_k, from equation (5.14.7), we obtain the system of equations for speeds of change of the direction cosines

$$d\beta_{\alpha 1}/dt = \beta_{\alpha 1}{}^{\bullet} = \omega_2\beta_{\alpha 3} - \omega_3\beta_{\alpha 2}, \tag{5.14.8}$$

$$d\beta_{\alpha 2}/dt = \beta_{\alpha\beta}{}^{\bullet} = \omega_3\beta_{\alpha 1} - \omega_1\beta_{\alpha 3}, \tag{5.14.9}$$

$$d\beta_{\alpha 3}/dt = \beta_{\alpha 3}{}^{\bullet} = \omega_1\beta_{\alpha\beta} - \omega_2\beta_{\alpha 1}, \tag{5.14.10}$$

which can be written in matrix form [48]

$$\begin{pmatrix} \beta^{\bullet}_{\alpha 1} \\ \beta^{\bullet}_{\alpha 2} \\ \beta^{\bullet}_{\alpha 3} \end{pmatrix} = \begin{pmatrix} 0 & -\omega_3 & \omega_2 \\ \omega_3 & 0 & -\omega_1 \\ -\omega_2 & \omega_1 & 0 \end{pmatrix} \begin{pmatrix} \beta_{\alpha 1} \\ \beta_{\alpha 2} \\ \beta_{\alpha 3} \end{pmatrix}. \tag{5.14.11}$$

Combining the three matrix equations into one will get a matrix of kinematic Poisson equation [48]

$$\begin{pmatrix} \beta^{\bullet}_{11} & \beta^{\bullet}_{21} & \beta^{\bullet}_{31} \\ \beta^{\bullet}_{12} & \beta^{\bullet}_{22} & \beta^{\bullet}_{32} \\ \beta^{\bullet}_{13} & \beta^{\bullet}_{23} & \beta^{\bullet}_{33} \end{pmatrix} = \begin{pmatrix} 0 & -\omega_3(t) & \omega_2(t) \\ \omega_3(t) & 0 & -\omega_1(t) \\ -\omega_2(t) & \omega_1(t) & 0 \end{pmatrix} \begin{pmatrix} \beta_{11} & \beta_{21} & \beta_{31} \\ \beta_{12} & \beta_{22} & \beta_{32} \\ \beta_{13} & \beta_{23} & \beta_{33} \end{pmatrix}. \tag{5.14.12}$$

which determines the displacement of a point M on a sphere with radius r.

According to (5.11.22) through (5.11.25), the velocity of intra-vacuum layers in the core of the «electron» relative to the observer inside the core equals

$v_r^{(-a)}(r) = c(-r_7/r + r^2/r_6^2)^{1/2}$ – velocity of the *a*-subcont; (5.14.13)
$v_r^{(-b)}(r) = c(r_7/r - r^2/r_6^2)^{1/2}$ – velocity of the *b*-subcont; (5.14.14)
$v_r^{(-c)}(r) = c(-r_7/r - r^2/r_6^2)^{1/2}$ – velocity of the *c*-subcont; (5.14.15)
$v_r^{(-d)}(r) = c(r_7/r + r^2/r_6^2)^{1/2}$ – velocity of the *d*-subcont. (5.14.16)

However, relative to the observer outside the rotating core of the «electron», these speeds are decomposed into radial $v_{rr}{}^{(-m)}(r)$ and tangential components of $v_{rt}{}^{(-m)}(r)$

$$v_r^{(-a)}(r) = v_{rr}{}^{(-a)}(r) + v_{rt}{}^{(-a)}(r); \tag{5.14.17}$$

$$v_r^{(-b)}(r) = v_{rr}{}^{(-b)}(r) + v_{rt}{}^{(-b)}(r); \tag{5.14.18}$$

$$v_r^{(-c)}(r) = v_{rr}{}^{(-c)}(r) + v_{rt}{}^{(-c)}(r); \tag{5.14.19}$$

$$v_r^{(-c)}(r) = v_{rr}{}^{(-c)}(r) + v_{rt}{}^{(-c)}(r). \tag{5.14.20}$$

whereby the tangential velocity component of each intra-vacuum layer can be estimated by the expression

$$v_{r\tau}{}^{(-m)}(r) \approx \boldsymbol{\omega}(t) \times \mathbf{s}^{(-m)}, \tag{5.14.21}$$

where $\mathbf{s}^{(-m)}$ is the dimensional vector of isospin of the *m*-th intra-vacuum layer.

For example, the vector of the tangential speed of subcont inside the «electron's» core approximately equals

$$v_{r\tau}{}^{(-a)}(r) \approx \boldsymbol{\omega}(t)\times\mathbf{s}^{(-a)}\ , \qquad (5.14.22)$$

where $\mathbf{s}^{(-m)}$ is the dimensional vector and isospin of the *a*-subcont with components (5.12.17) through (5.12.19):

From the expression (5.14.19), taking into account the component (5.14.23), we estimate the module of the instantaneous value of the tangential speed of subcont between the two abysses (*rakyas*) of the «electron's» core ($r_6 > r > r_7$)

$$|v_{rt}{}^{(-a)}(r)| \approx \ ½\ r\ sin\theta\ [\omega_1(t)^2 + \omega_2(t)^2]^{½}. \qquad (5.14.23)$$

provided that on the periphery of the core with a radius r_6

$$|v_{rt}{}^{(-a)}(r_6)| \approx \ ½\ r_6\ sin\ \theta\ [\omega_1(t)^2 + \omega_2(t)^2]^{½} = c, \qquad (5.14.24)$$

and in the area of abyss (*rakya*) *particelle* (inner nucleolus) with a radius r_7 , the following condition is fulfilled

$$|v_{rt}{}^{(-a)}(r_7)| \approx \ ½\ r_7\ sin\ \theta\ [\omega_1(t)^2 + \omega_2(t)^2]^{½} = c. \qquad (5.14.25)$$

From the expression (5.14.17) it follows that the radial component of *a*-subcont velocity inside the «electron's» core approximately equals

$$v_{rr}{}^{(-a\,)}(r) \approx v_r{}^{(-a)}(r) - v_{rt}{}^{(-a)}(r) \approx c(-\,r_7/r + r^2/r_6{}^2)^{1/2} - ½r\ sin\ \theta\ [\omega_1(t)^2 + \omega_2(t)^2]^{½}. \quad (5.14.26)$$

On the basis of analysis of the expressions (5.14.18) through (5.14.20), the tangential and radial components of: *b*-subcont velocity, *c*-subcont velocity and *d*-subcont velocity in the «electron's» core) can be obtained.

This is similar to the described rotational processes inside the core of the "proton" when you use metric (5.8.16) through (5.8.20) with the opposite signature (– – – +).

In all the equations of this paragraph, if, instead of the radii r_6, r_7, one substitutes any other pair of radii of the hierarchy *(2.6.20)* (for example, r_4, r_2 or r_6, r_9 or r_5, r_7, etc.), then one gets the description of rotational processes within any other naked vacuum formation, for example, the core of the naked “galaxy", the core of the naked «planet», the nuclei of naked biological «cells», etc.

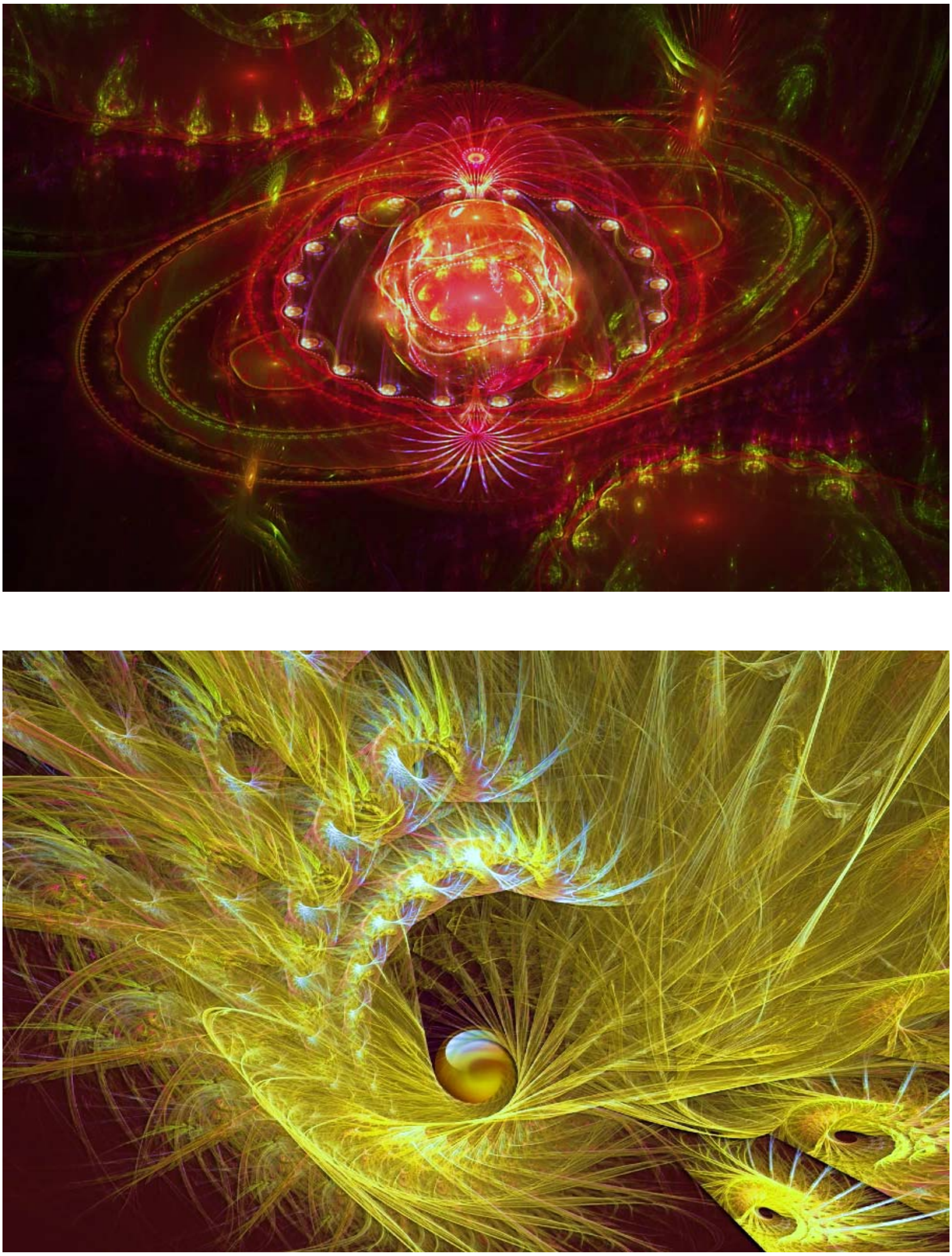


Fig. 5.14.11. Fractal illustration of a complex multi-layered rotational processes, occurring in the core of the naked stable vacuum formations (in particular in the «electron's» core)

At this point we note again that no complete solutions to the assigned tasks exist. In this paper are indicated only ways of describing the rotation of the various layers of cores of the naked stable vacuum formations (in particular the cores of the «electron» and «positron»).

5.15 *Rakya* (abyss) around the cores of «electrons» and «positrons»

Let's return to the consideration of metrics *(2.6.9)* through *(2.6.12)* with signature (+ – – –). Let's write down the given metrics taking into account *(2.6.5)* through *(2.6.8)*

$$ds_1^{(-)2} = \left\{1 - \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} + \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\} c^2 dt^2 -$$
$$- \left\{1 - \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} + \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\}^{-1} dr^2 -$$
$$- r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.15.1}$$

$$ds_2^{(-)2} = \left\{1 + \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} - \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\} c^2 dt^2 -$$
$$- \left\{1 + \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} - \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\}^{-1} dr^2 -$$
$$- r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.15.2}$$

$$ds_3^{(-)2} = \left\{1 - \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} - \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\} c^2 dt^2 -$$
$$- \left\{1 - \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} - \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\}^{-1} dr^2 -$$
$$- r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.15.3}$$

$$ds_4^{(-)2} = \left\{1 + \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} + \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\} c^2 dt^2 -$$
$$- \left\{1 + \frac{r_1 + r_2 + r_3 + r_4 + r_5 + r_6 + r_7 + r_8 + r_9 + r_{10}}{r} + \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} + \frac{1}{r_6^2} + \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}\right) r^2 \right\}^{-1} dr^2 -$$
$$- r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.15.4}$$

$$ds_5^{(-)2} = c^2 dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.15.5}$$

where according to hierarchy *(2.6.20)*:

$r_1 \sim 3.4\cdot10^{39}$ cm – characteristic radius of the closed «Universe»; (5.15.5a)

$r_2 \sim 1.2\cdot10^{29}$ cm – characteristic radius of the «metagalaxy» core;

$r_3 \sim 4\cdot10^{18}$ cm – characteristic radius of the «galaxy» core;

$r_4 \sim 1.4\cdot10^{8}$ cm – characteristic radius of the «star's» (or «planet's») core;

$r_5 \sim 4.9\cdot10^{-3}$ cm – characteristic radius of the biological «cell»;

$r_6 \sim 1.7\cdot10^{-13}$ cm – characteristic radius of the «elementary particle's» core;

$r_7 \sim 5.8\cdot10^{-24}$ cm – characteristic radius of the «protoquark's» core;

$r_8 \sim 2.1\cdot10^{-34}$ cm – characteristic radius of the «plankton's » core;

$r_9 \sim 7{\cdot}10^{-45}$ cm – characteristic radius of the «phytoplankton's » core;

$r_{10} \sim 2.4{\cdot}10^{-55}$ cm – characteristic radius of the «instanton's » core.

We rewrite the metric (5.15.1) through (5.15.5)

$$ds_1^{(-)2} = \left\{1 - \frac{r_B + r_6 + r_L}{r} + \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\} c^2 dt^2 - \left\{1 - \frac{r_B + r_6 + r_L}{r} + \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\}^{-1} dr^2 - r^2\left(d\theta^2 + \sin^2\theta d\varphi^2\right) \quad (5.15.6)$$

$$ds_2^{(-)2} = \left\{1 + \frac{r_B + r_6 + r_L}{r} - \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\} c^2 dt^2 - \left\{1 + \frac{r_B + r_6 + r_L}{r} - \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\}^{-1} dr^2 - r^2\left(d\theta^2 + \sin^2\theta d\varphi^2\right) \quad (5.15.7)$$

$$ds_3^{(-)2} = \left\{1 - \frac{r_B + r_6 + r_L}{r} - \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\} c^2 dt^2 - \left\{1 - \frac{r_B + r_6 + r_L}{r} - \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\}^{-1} dr^2 - r^2\left(d\theta^2 + \sin^2\theta d\varphi^2\right) \quad (5.15.8)$$

$$ds_4^{(-)2} = \left\{1 + \frac{r_B + r_6 + r_L}{r} + \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\} c^2 dt^2 - \left\{1 + \frac{r_B + r_6 + r_L}{r} + \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right)\right\}^{-1} dr^2 - r^2\left(d\theta^2 + \sin^2\theta d\varphi^2\right) \quad (5.15.9)$$

$$ds_5^{(-)2} = c^2 dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right). \quad (5.15.10)$$

where
$$r_B = r_1 + r_2 + r_3 + r_4 + r_5; \quad (5.15.11)$$

$$r_L = r_7 + r_8 + r_9 + r_{10}; \quad (5.15.12)$$

$$\frac{1}{r_I^2} = \frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2}; \quad (5.15.13)$$

$$\frac{1}{r_Y^2} = \frac{1}{r_7^2} + \frac{1}{r_8^2} + \frac{1}{r_9^2} + \frac{1}{r_{10}^2}. \quad (5.15.14)$$

In relation to the implementation of equality

$$1 - \frac{r_B + r_6 + r_L}{r} + \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right) = \left(1 - \frac{r_L}{r} + \frac{r^2}{r_6^2}\right) - \left(1 + \frac{r_6}{r} - \frac{r^2}{r_I^2}\right) + \left(1 - \frac{r_B}{r} + \frac{r^2}{r_Y^2}\right) \quad (5.15.15)$$

$$1 + \frac{r_B + r_6 + r_L}{r} - \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right) = \left(1 + \frac{r_L}{r} - \frac{r^2}{r_6^2}\right) - \left(1 - \frac{r_6}{r} + \frac{r^2}{r_I^2}\right) + \left(1 + \frac{r_B}{r} - \frac{r^2}{r_Y^2}\right) \quad (5.15.16)$$

$$1 - \frac{r_B + r_6 + r_L}{r} - \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right) = \left(1 - \frac{r_L}{r} - \frac{r^2}{r_6^2}\right) - \left(1 + \frac{r_6}{r} + \frac{r^2}{r_I^2}\right) + \left(1 - \frac{r_B}{r} - \frac{r^2}{r_Y^2}\right) \quad (5.15.17)$$

$$1 + \frac{r_B + r_6 + r_L}{r} + \left(\frac{r^2}{r_I^2} + \frac{r^2}{r_6^2} + \frac{r^2}{r_Y^2}\right) = \left(1 + \frac{r_L}{r} + \frac{r^2}{r_6^2}\right) - \left(1 - \frac{r_6}{r} - \frac{r^2}{r_I^2}\right) + \left(1 + \frac{r_B}{r} + \frac{r^2}{r_Y^2}\right) \quad (5.15.18)$$

metrics (5.15.6) through (5.15.10) can take the form of

$$ds_1^{(-)2}=\left\{\left(1-\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)-\left(1+\frac{r_6}{r}-\frac{r^2}{r_I^2}\right)+\left(1-\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\right\}c^2dt^2-\left\{\left(1-\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)-\left(1+\frac{r_6}{r}-\frac{r^2}{r_I^2}\right)+\left(1-\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\right\}^{-1}dr^2-$$
$$-r^2\left(d\theta^2+\sin^2\theta d\varphi^2\right) \quad (5.15.19)$$

$$ds_2^{(-)2}=\left\{\left(1+\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)-\left(1-\frac{r_6}{r}+\frac{r^2}{r_I^2}\right)+\left(1+\frac{r_B}{r}-\frac{r^2}{r_Y^2}\right)\right\}c^2dt^2-\left\{\left(1+\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)-\left(1-\frac{r_6}{r}+\frac{r^2}{r_I^2}\right)+\left(1+\frac{r_B}{r}-\frac{r^2}{r_Y^2}\right)\right\}^{-1}dr^2-$$
$$-r^2\left(d\theta^2+\sin^2\theta d\varphi^2\right) \quad (5.15.20)$$

$$ds_3^{(-)2}=\left\{\left(1-\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)-\left(1+\frac{r_6}{r}+\frac{r^2}{r_I^2}\right)+\left(1-\frac{r_B}{r}-\frac{r^2}{r_Y^2}\right)\right\}c^2dt^2-\left\{\left(1-\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)-\left(1+\frac{r_6}{r}+\frac{r^2}{r_I^2}\right)+\left(1-\frac{r_B}{r}-\frac{r^2}{r_Y^2}\right)\right\}^{-1}dr^2-$$
$$-r^2\left(d\theta^2+\sin^2\theta d\varphi^2\right) \quad (5.15.21)$$

$$ds_4^{(-)2}=\left\{\left(1+\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)-\left(1-\frac{r_6}{r}-\frac{r^2}{r_I^2}\right)+\left(1+\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\right\}c^2dt^2-\left\{\left(1+\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)-\left(1-\frac{r_6}{r}-\frac{r^2}{r_I^2}\right)+\left(1+\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\right\}^{-1}dr^2-$$
$$-r^2\left(d\theta^2+\sin^2\theta d\varphi^2\right) \quad (5.15.22)$$

$$ds_5^{(-)2}=c^2dt^2-dr^2-r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right). \quad (5.15.23)$$

In the vicinity of the «electron's» core with a radius of about $r_6 \sim 1{,}7\cdot10^{-13}$ см {see hierarchy (5.15.5 a)} all third terms in the metric (5.15.19) through (5.15.22) (for example, $1 - r_B/r + r^2/r_Y^2$) can be considered as a permanent (constant) background. Since in the range of lengths from $r_5 \sim 4{,}9\cdot10^{-3}$ cm to $r_7 \sim 5{,}8\cdot10^{-24}$ cm they practically do not change

$$\left(1-\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\approx const,\quad \left(1-\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\approx const,\quad \left(1-\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\approx const,\quad \left(1-\frac{r_B}{r}+\frac{r^2}{r_Y^2}\right)\approx const, \quad (5.15.23a)$$

because in the area of the «electron's» core: $r_B/r_6 \sim 10^{53} \sim \infty$ and $r_6^2/r_Y^2 \sim 10^{84} \sim \infty$.

In addition, if you average all the third terms (15.23 a) in the metrics of the species (5.15.19) through (5.15.20) with signatures (+ – – –) and (– + + +), they fully compensate for each other according to the vacuum condition.

Taking into account the expressions (5.15.23 a), the stable "convex" formation (which we call «electron»), existing on a constant background, can be more accurately described by the following multilayer metric-dynamic model:

«Electron» (5.15.24)

"Convex" multilayer vacuum formation with signature

$(+---)$

consisting of:

The outer shell of the «electron»

in the interval [r_1, r_6] (Figure 8.1 or 15.1)

$$ds_1^{(+---)2} = \left(1 - \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - a\text{-subcont}, \tag{5.15.25}$$

$$ds_2^{(+---)2} = \left(1 + \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - b\text{-subcont}, \tag{5.15.26}$$

$$ds_3^{(+---)2} = \left(1 - \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - c\text{-subcont}, \tag{5.15.27}$$

$$ds_4^{(+---)2} = \left(1 + \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - d\text{-subcont}; \tag{5.15.28}$$

The core of the «electron»

in the interval [r_6, r_{10}] (Figure 5.8.1 or 5.15.1)

$$ds_1^{(+---)2} = \left(1 - \frac{r_L}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_L}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - a\text{-subcont}, \tag{5.15.29}$$

$$ds_2^{(+---)2} = \left(1 + \frac{r_L}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_L}{r} - \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - b\text{-subcont}, \tag{5.15.30}$$

$$ds_3^{(+---)2} = \left(1 - \frac{r_L}{r} - \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_L}{r} - \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - c\text{-subcont}, \tag{5.15.31}$$

$$ds_4^{(+---)2} = \left(1 + \frac{r_L}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r_L}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - d\text{-subcont}; \tag{5.15.32}$$

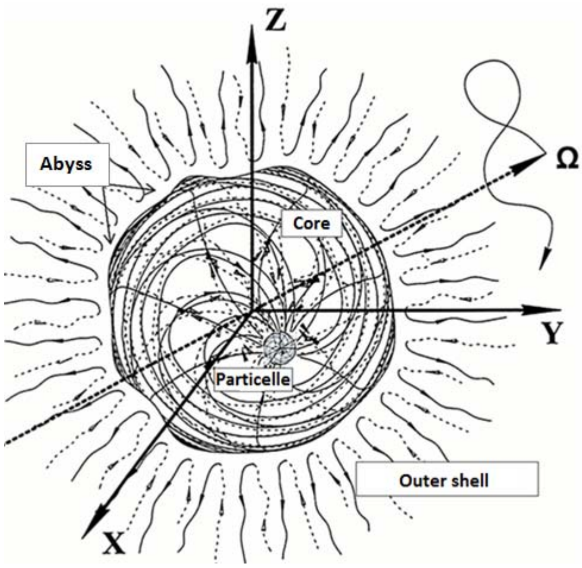
The scope of the «electron»

in the interval [0, ∞]

$$ds_5^{(+---)2} = c^2dt^2 - dr^2 - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.15.33}$$

where
$$r_L = r_7 + r_8 + r_9 + r_{10}\,; \tag{5.15.34}$$

$$\frac{1}{r_I^2} = \frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} \tag{5.15.35}$$



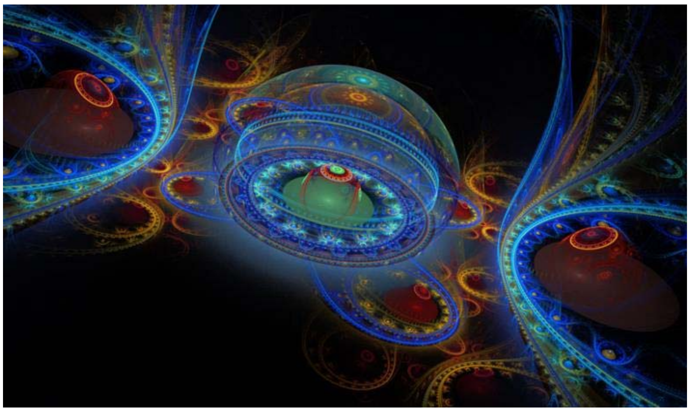


Fig. 5.15.1. Visualized metric-dynamic model of stable multilayer vacuum formation (in particular, «electron» or «positron»), consisting of: outer shell, abyss (*rakya*), core and internal particelle, and its fractal illustration

Performing a similar action with the metric *(2.6.14) through (2.6.18)*, we get the following refinement of the metric-dynamic model of a «positron» (i.e. the model is an exact negative copy of an «electron»):

«Positron» (5.15.36)

"Concave" multilayer vacuum formation with signature

(– + + +)

consisting of:

The outer shell of the «positron»

in the interval [r_1, r_6] (Figure 5.8.1 or 5.15.1)

$$ds_1^{(+---)2} = -\left(1 - \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - a\text{-antisubcont}, \qquad (5.15.37)$$

$$ds_2^{(+---)2} = -\left(1 + \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) - b\text{-antisubcont}, \qquad (5.15.38)$$

$$ds_3^{(+---)2} = -\left(1 - \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 - \frac{r_6}{r} - \frac{r^2}{r_I^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - c\text{-antisubcont}, \qquad (5.15.39)$$

$$ds_4^{(+---)2} = -\left(1 + \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)c^2dt^2 + \frac{dr^2}{\left(1 + \frac{r_6}{r} + \frac{r^2}{r_I^2}\right)} + r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad - d\text{-antisubcont}; \quad (5.15.40)$$

The core of the «positron»

in the interval [r_6, r_{10}] (Figure 5.8.1 or 5.15.1)

$$ds_1^{(+---)2} = -\left(1-\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right) \ - a\text{-antisubcont}, \qquad (5.15.41)$$

$$ds_2^{(+---)2} = -\left(1+\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right) \ - b\text{-antisubcont}, \qquad (5.15.42)$$

$$ds_3^{(+---)2} = -\left(1-\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_L}{r}-\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right) \ - c\text{-antisubcont}, \qquad (5.15.43)$$

$$ds_4^{(+---)2} = -\left(1+\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 + \frac{dr^2}{\left(1+\frac{r_L}{r}+\frac{r^2}{r_6^2}\right)} + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right) \ - d\text{-antisubcont}; \qquad (5.15.44)$$

The scope of the «positron»

in the interval [0, ∞]

$$ds_5^{(-+++)2} = -c^2dt^2 + dr^2 + r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \qquad (5.15.45)$$

where
$$r_L = r_7 + r_8 + r_9 + r_{10}\,; \qquad (5.15.45a)$$
$$\frac{1}{r_I^2} = \frac{1}{r_1^2}+\frac{1}{r_2^2}+\frac{1}{r_3^2}+\frac{1}{r_4^2}+\frac{1}{r_5^2}. \qquad (5.15.45b)$$

For the effect of additional terms on the metric-dynamic state of the outer shell and the core of the «electron» (or «positron»), consider the example of an a-subcont. We write the metrics (5.15.25) and (5.15.29) subject to the equations (5.15.45a) and (5.15.45b):

– for an a-subcont in the outer shell of «electron»

$$ds_{1s}^{(+---)2} = \left(1-\frac{r_6}{r}+\frac{r^2}{r_1^2}+\frac{r^2}{r_2^2}+\frac{r^2}{r_3^2}+\frac{r^2}{r_4^2}+\frac{r^2}{r_5^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_6}{r}+\frac{r^2}{r_1^2}+\frac{r^2}{r_2^2}+\frac{r^2}{r_3^2}+\frac{r^2}{r_4^2}+\frac{r^2}{r_5^2}\right)} - r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right), \qquad (5.15.46)$$

– for an a-subcont in the «electron's» core

$$ds_{1c}^{(+---)2} = \left(1-\frac{r_7}{r}-\frac{r_8}{r}-\frac{r_9}{r}-\frac{r_{10}}{r}+\frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1-\frac{r_7}{r}-\frac{r_8}{r}-\frac{r_9}{r}-\frac{r_{10}}{r}+\frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2+\sin^2\theta\, d\varphi^2\right) \qquad (5.15.47)$$

According to the hierarchy (5.15.5 a), the radii of vacuum formations differ of many times from each other $r_1 >> r_2 >> r_3 >> r_4 >> r_5 >> \mathbf{r_6} >> r_7 >> r_8 >> r_9 >> r_{10}$. Therefore, apart from the terms containing the radius of the core of the «electron» r_6, the greatest impact in the metric (5.15.46) are the components of r^2/r_5^2, as in the metric (5.15.47), which dominate the components of r_7/r in the metric. If we exclude all other additional terms, we will return to the metric-dynamic model of the «electron» *(2.6.23) through (2.6.31)*.

However, at the boundary between the «electron's» core and its outer shell (Figure 5.10.5), which in this paper is called *rakya* (or *abyss:* Figure 5.15.1), additional terms have a tangible impact. To explain this circumstance, let us first consider the roughest (first) approximation, on the example of simplification of metrics (5.15.46) and (5.15.47):

- for an *a*-subcont in the outer shell of «electron»

$$ds_{1s}^{(+---)2} = \left(1 - \frac{r_6}{r}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \qquad (5.15.48)$$

- for an *a*-subcont in the «electron's» core

$$ds_{1c}^{(+---)2} = \left(1 + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \qquad (5.15.49)$$

In fact, the Schwarzschild radius is the radius of the spherical boundary (*rakya*) between the «electron's» core and its outer shell (Figure 5.15.2). This corresponds to the distance r_s from the center of the vacuum formation at which the zero component g_{00} of the metric tensor is equal to zero [34]. For example, for metrics (5.15.48) and (5.15.49), the Schwarzschild radius is defined by the expressions

$$g_{00s}^{(-)} = 1 - \frac{r_6}{r_{ss}} = 0, \quad g_{00c}^{(-)} = 1 + \frac{r_{sc}^2}{r_6^2} = 0, \quad (5.15.50)$$

from which follows: $r_{ss} = r_6$ and $r_{sc} = ir_6$.

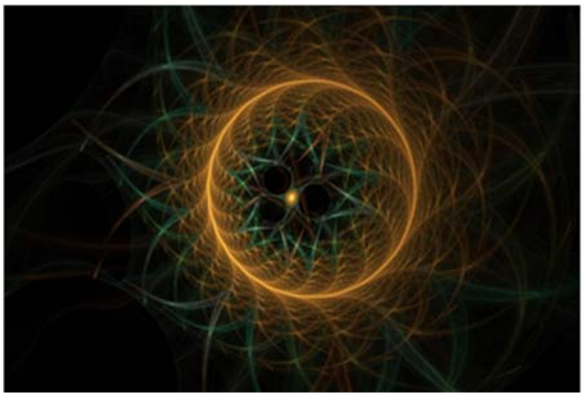


Fig. 5.15.2. Fractal illustration of the Schwarzschild sphere separating the «electron's» core from its outer shell

Thus, at the roughest (first) approximation, a clear boundary is revealed between the «electron's» core and its outer shell. This explicit boundary (i.e. *rakya*) is a sphere with radius r_6 (Figure 5.15.2).

With a more detailed (second) approximation, metrics (5.15.46) through (5.15.47) acquire the following form:

– for an *a*-subcont in the outer shell of the «electron»

$$ds_{1s}^{(+---)2} = \left(1 - \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{r_5^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right); \tag{5.15.51}$$

– for an *a*-subcont in the «electron's» core

$$ds_{1c}^{(+---)2} = \left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_7}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right). \tag{5.15.52}$$

In this case, by analogy with (5.15.50), the *rakya* (that is, the sphere determined by the Schwarzschild radius, hereafter denoted the "Schwarzschild horizons") is expressed:

$$g_{00s}^{(-)} = 1 - \frac{r_6}{r} + \frac{r^2}{r_5^2} = 0, \qquad g_{00c}^{(-)} = 1 - \frac{r_7}{r} + \frac{r^2}{r_6^2} = 0, \tag{5.15.53}$$

which are converted to cubic equations

$$g_{00s}^{(-)} = r^3 + r_5^2 r - r_5^2 r_6 = 0, \tag{5.15.54}$$

$$g_{00c}^{(-)} = r^3 + r_6^2 r - r_6^2 r_7 = 0, \tag{5.15.55}$$

where, according to the hierarchy (5.15.5a):

$r_5 \sim 4.9\cdot10^{-3}$ cm – characteristic radius of the biological «cell»; (5.15.56)

$r_6 \sim 1.7\cdot10^{-13}$ cm – characteristic radius of the «elementary particle's» core;

$r_7 \sim 5.8\cdot10^{-24}$ cm – characteristic radius of the «protoquark's» core.

As is known, the three roots of the cubic equation of the form are determined by Cardano formulas [52]

$$y_1 = \alpha + \beta; \qquad y_{2,3} = \frac{\alpha+\beta}{2} \pm i\frac{\alpha-\beta}{2}\sqrt{3} = 0, \tag{5.15.57}$$

where $$\alpha = \sqrt[3]{-\frac{q_k}{2} + \sqrt{Q}}; \qquad \beta = \sqrt[3]{-\frac{q_k}{2} - \sqrt{Q}}, \tag{5.15.58}$$

$$Q = \left(\frac{p_k}{3}\right)^3 + \left(\frac{q_k}{2}\right)^2. \tag{5.15.59}$$

In the particular case of the equation (5.15.54):

$$p_k = p_s = r_5^2, \qquad q_k = q_s = -r_5^2 r_6, \tag{5.15.60}$$

and in the case of equation (5.15.55):

$$p_k = p_c = r_6^2, \qquad q_k = q_c = -r_6^2 r_7. \tag{5.15.61}$$

Substituting the value of (5.15.60) into (5.15.58), we have

$$\alpha = \sqrt[3]{\frac{r_5^2 r_6}{2} + \sqrt{\left(\frac{r_5^2}{3}\right)^3 + \left(\frac{-r_5^2 r_6}{2}\right)^2}}, \qquad \beta = \sqrt[3]{\frac{r_5^2 r_6}{2} - \sqrt{\left(\frac{r_5^2}{3}\right)^3 + \left(\frac{-r_5^2 r_6}{2}\right)^2}}. \tag{5.15.62}$$

Then on the basis of (5.15.56), (5.15.57) and (5.15.62) we obtain three roots of the equation (5.15.54)

$$r_{ss1} \approx 2.1x10^{-3} + i\,2.1x10^{-3}, \tag{5.15.63}$$

$$r_{ss2} \approx \frac{2.1x10^{-3} + i2.1x10^{-3}}{2} + i\frac{2.1x10^{-3} - i\,2.1x10^{-3}}{2}\sqrt{3}, \tag{5.15.64}$$

$$r_{ss3} \approx \frac{2.1x10^{-3} + i2.1x10^{-3}}{2} - i\frac{2.1x10^{-3} - i2.1x10^{-3}}{2}\sqrt{3}. \tag{5.15.65}$$

Similarly, substituting values (5.15.61) in (5.15.58), we have

$$\alpha = \sqrt[3]{\frac{r_6^2 r_7}{2} + \sqrt{\left(\frac{r_6^2}{3}\right)^3 + \left(\frac{-r_6^2 r_7}{2}\right)^2}}, \quad \beta = \sqrt[3]{\frac{r_6^2 r_7}{2} - \sqrt{\left(\frac{r_6^2}{3}\right)^3 + \left(\frac{-r_6^2 r_7}{2}\right)^2}}. \tag{5.15.66}$$

Then on the basis of (5.15.56), (5.15.57) and (5.15.66) we obtain three roots of the equation (5.15.55)

$$r_{ss1} \approx 0.99\times10^{-13} + i0.99\times10^{-13}, \tag{5.15.67}$$

$$r_{ss2} \approx \frac{0.99\times10^{-13} + i0,99\times10^{-13}}{2} + i\frac{0.99\times10^{-13} + i\,0.99\times10^{-13}}{2}\sqrt{3}, \tag{5.15.68}$$

$$r_{ss13} \approx \frac{0.99\times10^{-13} + i0.99\times10^{-13}}{2} - i\frac{0.99\times10^{-13} + i\,0.99\div10^{-13}}{2}\sqrt{3}. \tag{5.15.69}$$

It is obvious that the radii (5.15.63) through (5.15.65) are associated with the splitting and expansion of *rakya* (i.e. the Schwarzschild horizons) around the *a*-subcont shell of the biological cell. While the radii (5.15.67) through (5.15.69) are associated with the splitting and extension of the *a*-subcont *rakya* (i.e. the Schwarzschild horizons) around the «electron's» core.

A similar examination of all metrics (5.15.25) through (5.15.32) allows us to obtain eight cubic equations:

	I	$g_{00s1}^{(-)} = r^3 + r_5^2 r - r_5^2 r_6 = 0$	(5.15.70)
I	H	$g_{00s2}^{(-)} = r^3 - r_5^2 r - r_5^2 r_6 = 0$	(5.15.71)
	V	$g_{00s3}^{(-)} = r^3 - r_5^2 r + r_5^2 r_6 = 0$	(5.15.72)
	H'	$g_{00s4}^{(-)} = r^3 + r_5^2 r + r_5^2 r_6 = 0$	(5.15.74)
	I	$g_{00c1}^{(-)} = r^3 + r_6^2 r - r_6^2 r_7 = 0$	(5.15.75)
H	H	$g_{00c2}^{(-)} = r^3 - r_6^2 r - r_6^2 r_7 = 0$	(5.15.76)
	V	$g_{00c3}^{(-)} = r^3 - r_6^2 r + r_6^2 r_7 = 0$	(5.15.77)
	H'	$g_{00c4}^{(-)} = r^3 + r_6^2 r + r_6^2 r_7 = 0.$	(5.15.78)

which determine the splitting and extension (second-level representation) of the *rakyas* of the all four of the *a, b, c, d* - subconts around the two cores (in this case, the biological cell and the «electron's» core) which are nested into each other (see Figures 5.15.3, 5.15.4).

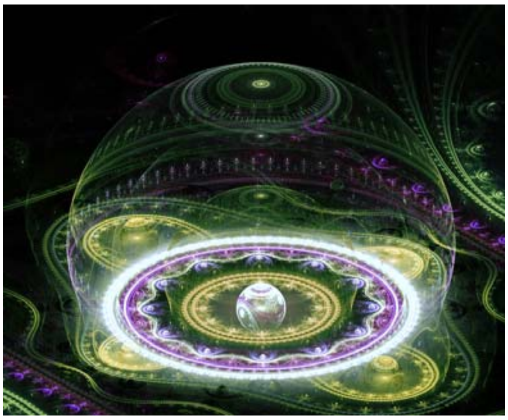


Fig. 5.15.3. Fractal illustration of *rakya*, i.e. the multi-layered boundary between the core of the «electron» and its outer shell

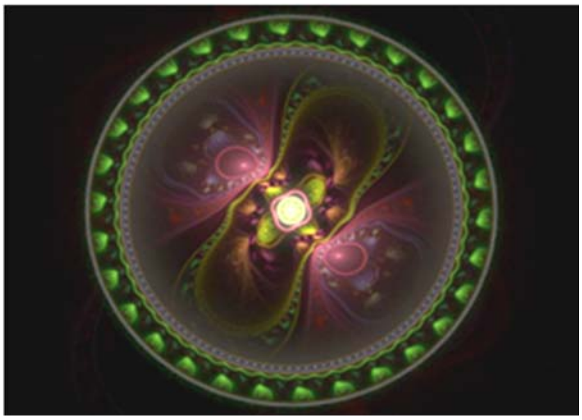


Fig. 5.15.4. Fractal illustration of the splitting and expansion of *rakya* (i.e. the Schwarzschild spherical horizons) around the core of a stable vacuum formation (including around the «electron's» core»)

Taking into account the zero components g_{00} of the metrics (5.15.25) through (5.15.32) at the third level of representation, we have eight cubic equations:

	I	$g_{00s1}^{(-)} = r^3 + r_I^2 r - r_I^2 r_6 = 0$	(5.15.79)
I	H	$g_{00s2}^{(-)} = r^3 - r_I^2 r - r_I^2 r_6 = 0$	(5.15.80)
	V	$g_{00s3}^{(-)} = r^3 - r_I^2 r + r_I^2 r_6 = 0$	(5.15.81)
	H'	$g_{00s4}^{(-)} = r^3 + r_I^2 r + r_I^2 r_6 = 0$	(5.15.82)
	I	$g_{00c1}^{(-)} = r^3 + r_6^2 r - r_6^2 r_L = 0$	(5.15.83)
H	H	$g_{00c2}^{(-)} = r^3 - r_6^2 r - r_6^2 r_L = 0$	(5.15.84)
	V	$g_{00c3}^{(-)} = r^3 - r_6^2 r + r_6^2 r_L = 0$	(5.15.85)
	H'	$g_{00c4}^{(-)} = r^3 + r_6^2 r + r_6^2 r_L = 0$,	(5.15.86)

where, according to (5.15.34) and (5.15.35):

$$r_L = r_7 + r_8 + r_9 + r_{10}\,; \tag{5.15.87}$$

$$r_I = \left(\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2} \right)^{-\frac{1}{2}}. \tag{5.15.88}$$

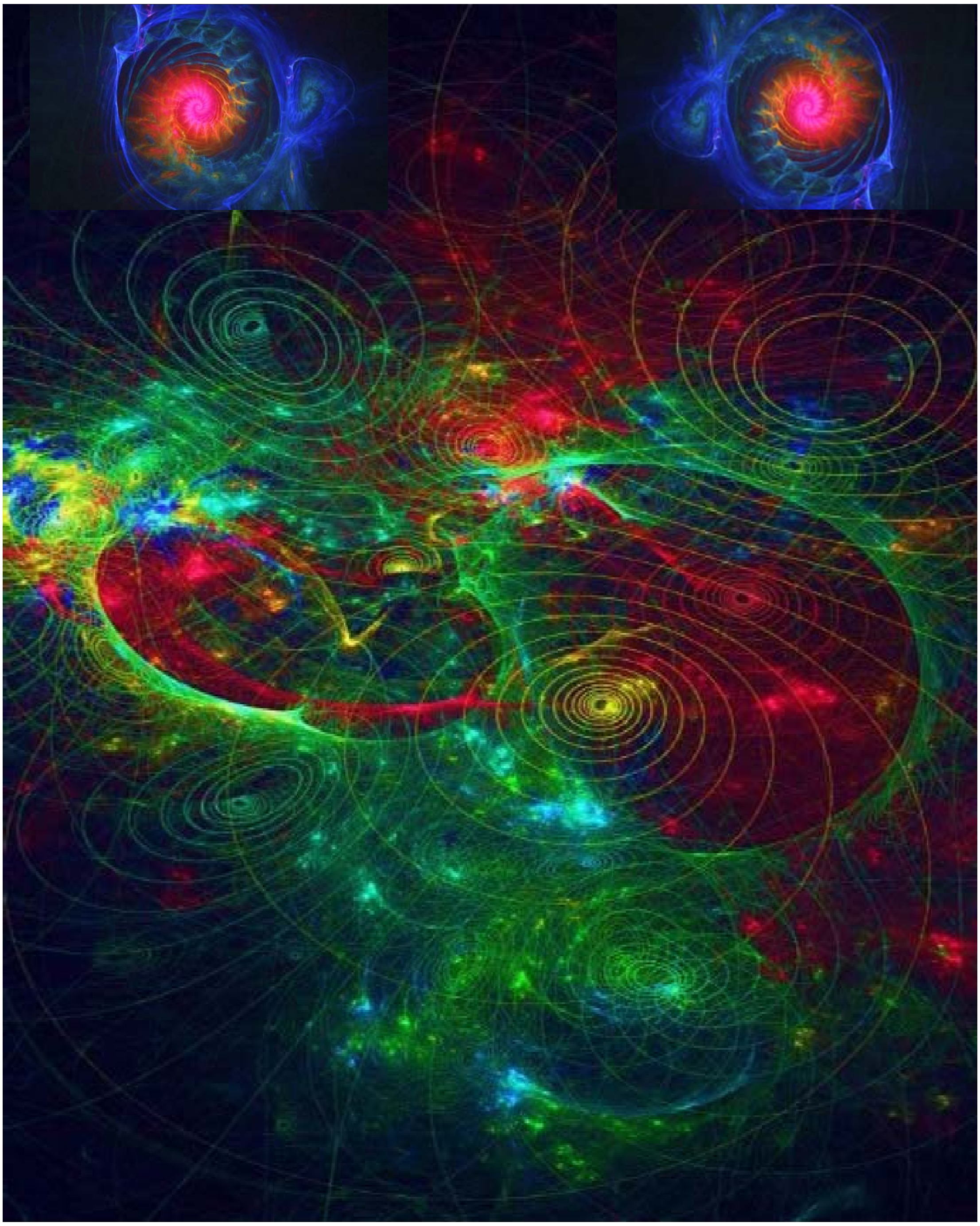
These equations describe the multilayer structure of *rakyas* (spherical Schwarzschild horizons) around the cores of the vacuum formations under consideration.

One needs to devote a further and more extensive investigation of the *rakyas* surrounding the cores of stable vacuum formations (e.g., «electron's» core); this may lead to a revision of our relationship to the universe.

But now, a combination of the equations (5.15.79) through (5.15.86) shows that the *rakya* is an extremely complex multilayered shell of the core (Figure 5.15.5, 5.15.6). The formation of the structure of each *rakya* is influenced by all spherical vacuum formations with the radii (5.15.5 a).

For example, in the «electron's» *rakya* there is a sub-layer connected to the Universe; another sub-layer is connected to the galaxy; the third sub-layer is connected to the planet in which it is located, etc.

Thus, we find that all spherical vacuum formations nested within each other (regardless of scale) affect each other. Changing the *rakya* of one of them inevitably affects the *rakya* of all other members of the hierarchy. This rule is consistent with the "principle of Space Responsibility".



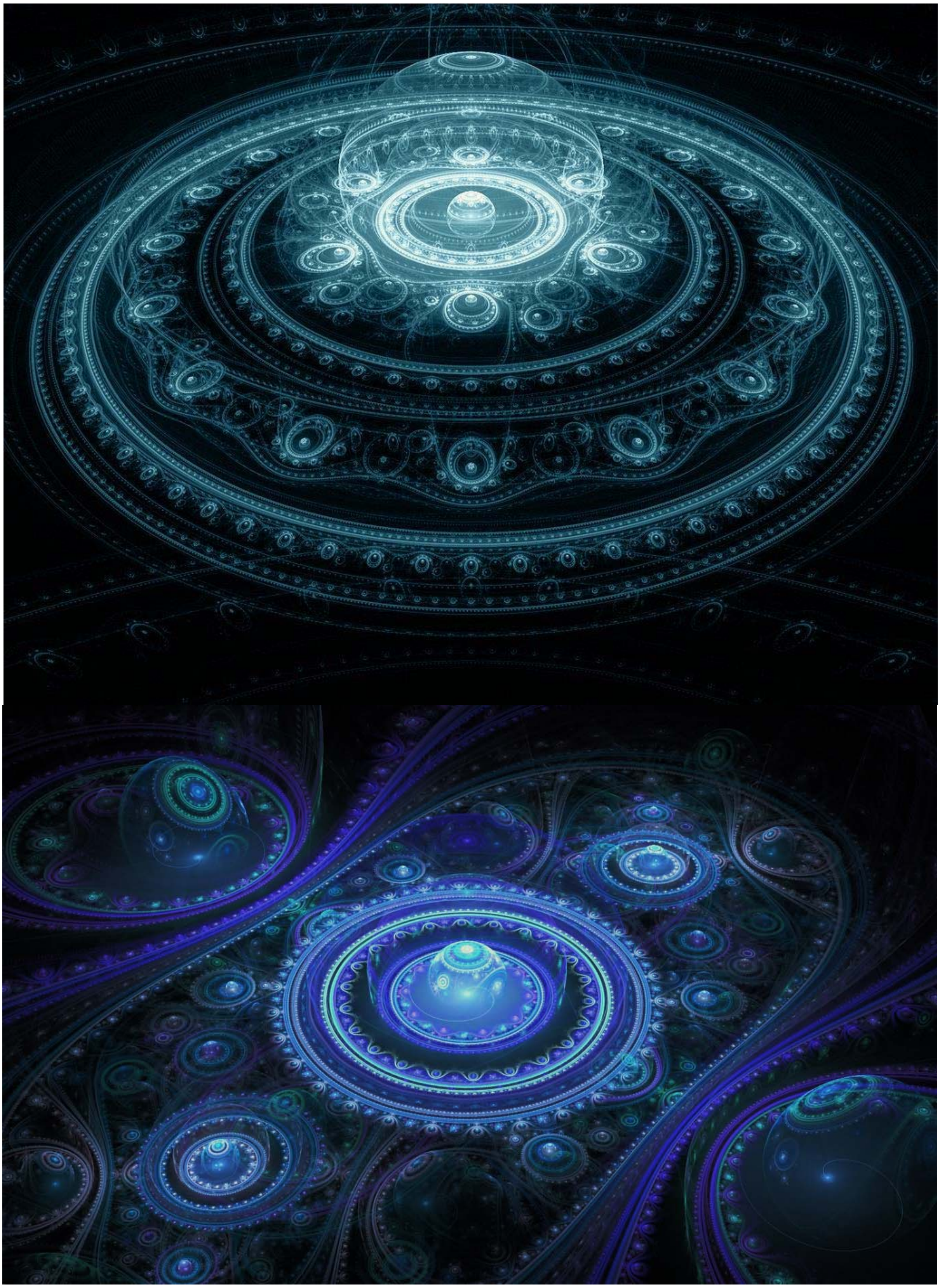


Fig. 5.15.5. Fractal illustrations of complex and multi-layered *rakya* (i.e., the shell or spherical Schwarzschild belt) surrounding the cores of stable vacuum formation (in particular, the core of the «electron»).
Under-layers of *rakya* associated with the respective radii of hierarchy (5.15.5 a):
rakyas Universe, Metagalaxy, galaxy, planet, cell,..., proto-quark, instanton

Fig. 5.15.6. Fractal illustrations of *rakya* - multilayer boundary between the core of a stable vacuum formation (in particular, the core of an "electron") and its outer shell, in which there are core - satellites similar to the satellites of stars

According to the representations of Alsigna the skin of the living entity (Figure 5.15.7) has many interrelated layers, each of which has its own function, and has a connection with the corresponding cosmic and atomic molecular structures.

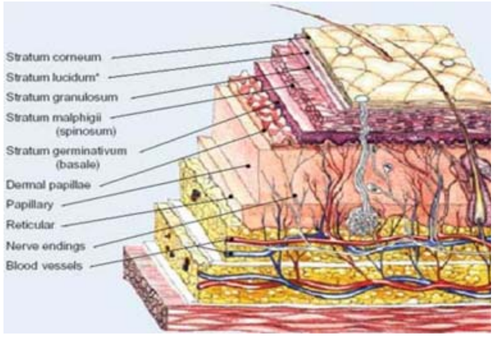


Fig. 5.15.7. Multilayer leather cover of the animal's body

In this paper, we will not go into the study of rakyas of stable vacuum formations. But for the beginning of the study of the effect of macro - and microscopic structures on the «electron's» rakya, we recommend putting forward a metric, for example, the metric (5.15.25):

$$ds_1^{(+---)2} = \left(1 - \frac{r_6}{r} + \frac{r^2}{\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2}}\right) c^2 dt^2 - \frac{dr^2}{\left(1 - \frac{r_6}{r} + \frac{r^2}{\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r_4^2} + \frac{1}{r_5^2}}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \tag{5.15.89}$$

as a set of five separate metrics:

$$ds_{1,1}^{(+---)2} \approx \left(1 - \frac{r_{6,1}}{r} + \frac{r^2}{r_1^2}\right) c^2 dt^2 - \frac{dr^2}{\left(1 - \frac{r_{6,1}}{r} + \frac{r^2}{r_1^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right), \tag{5.15.90}$$

$$ds_{1,2}^{(+---)2} \approx \left(1 - \frac{r_{6,2}}{r} + \frac{r^2}{r_2^2}\right) c^2 dt^2 - \frac{dr^2}{\left(1 - \frac{r_{6,2}}{r} + \frac{r^2}{r_2^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right),$$

$$ds_{1,3}^{(+---)2} \approx \left(1 - \frac{r_{6,3}}{r} + \frac{r^2}{r_3^2}\right) c^2 dt^2 - \frac{dr^2}{\left(1 - \frac{r_{6,3}}{r} + \frac{r^2}{r_3^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right),$$

$$ds_{1,3}^{(+---)2} \approx \left(1 - \frac{r_{6,4}}{r} + \frac{r^2}{r_4^2}\right) c^2 dt^2 - \frac{dr^2}{\left(1 - \frac{r_{6,3}}{r} + \frac{r^2}{r_4^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right),$$

$$ds_{1,5}^{(+---)2} \approx \left(1 - \frac{r_{6,5}}{r} + \frac{r^2}{r_5^2}\right) c^2 dt^2 - \frac{dr^2}{\left(1 - \frac{r_{6,5}}{r} + \frac{r^2}{r_5^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right).$$

Also metric (5.15.29)

$$ds_1^{(+---)2} = \left(1 - \frac{r_7 + r_8 + r_9 + r_{10}}{r} + \frac{r^2}{r_6^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_7 + r_8 + r_9 + r_{10}}{r} + \frac{r^2}{r_6^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta d\varphi^2\right) \quad (5.15.91)$$

in the same approximation can be represented as four separate metrics:

$$ds_{1,9}^{(+---)2} \approx \left(1 - \frac{r_7}{r} + \frac{r^2}{r_{6,7}^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_7}{r} + \frac{r^2}{r_{6,7}^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right)$$

$$ds_{1,8}^{(+---)2} \approx \left(1 - \frac{r_8}{r} + \frac{r^2}{r_{6,8}^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_8}{r} + \frac{r^2}{r_{6,8}^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right) \quad (5.15.92)$$

$$ds_{1,9}^{(+---)2} \approx \left(1 - \frac{r_9}{r} + \frac{r^2}{r_{6,9}^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_9}{r} + \frac{r^2}{r_{6,9}^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right)$$

$$ds_{1,10}^{(+---)2} \approx \left(1 - \frac{r_{10}}{r} + \frac{r^2}{r_{6,10}^2}\right)c^2dt^2 - \frac{dr^2}{\left(1 - \frac{r_{10}}{r} + \frac{r^2}{r_{6,10}^2}\right)} - r^2\left(d\theta^2 + \sin^2\theta\, d\varphi^2\right).$$

After examining these metrics individually, can define rules for combining the results, such as averaging and the superposition.

Similar actions can be taken with all other metrics (5.15.24) through (5.15.36).

If the cores and the outer shells of all stable spherical vacuum formations are on average similar to each other, then their rakya are unique, since the environment of the cores depends not only in what nuclei they are inside, and what cores are inside them, but also on their position in the Universe.

Further studies of *rakya* of vacuum formations in the axiomatic framework of the Algebra of Signatures can lead to the development of a powerful mathematical apparatus, which, in conjunction with a fractal visualization, would allow us to expand our understanding of the fine structure of vacuum formations.

Once again, let's emphasize the amazing ability of fractals to visualize various aspects of the manifestation of vacuum structures. One can try to describe in detail the contours of visual sensations, that are induced by the mathematical apparatus of the Algebra of Signatures (Alsigna), but sometimes it is enough to admire the view of a single fractal (e.g., Figure 5.15.8), to render extensive verbal descriptions unnecessary. Mathematics, consistent with fractal plots, acquires shades of solidity, and the logical constructions of the Alsigna find support in fractals in the form of tangible contact with reality.

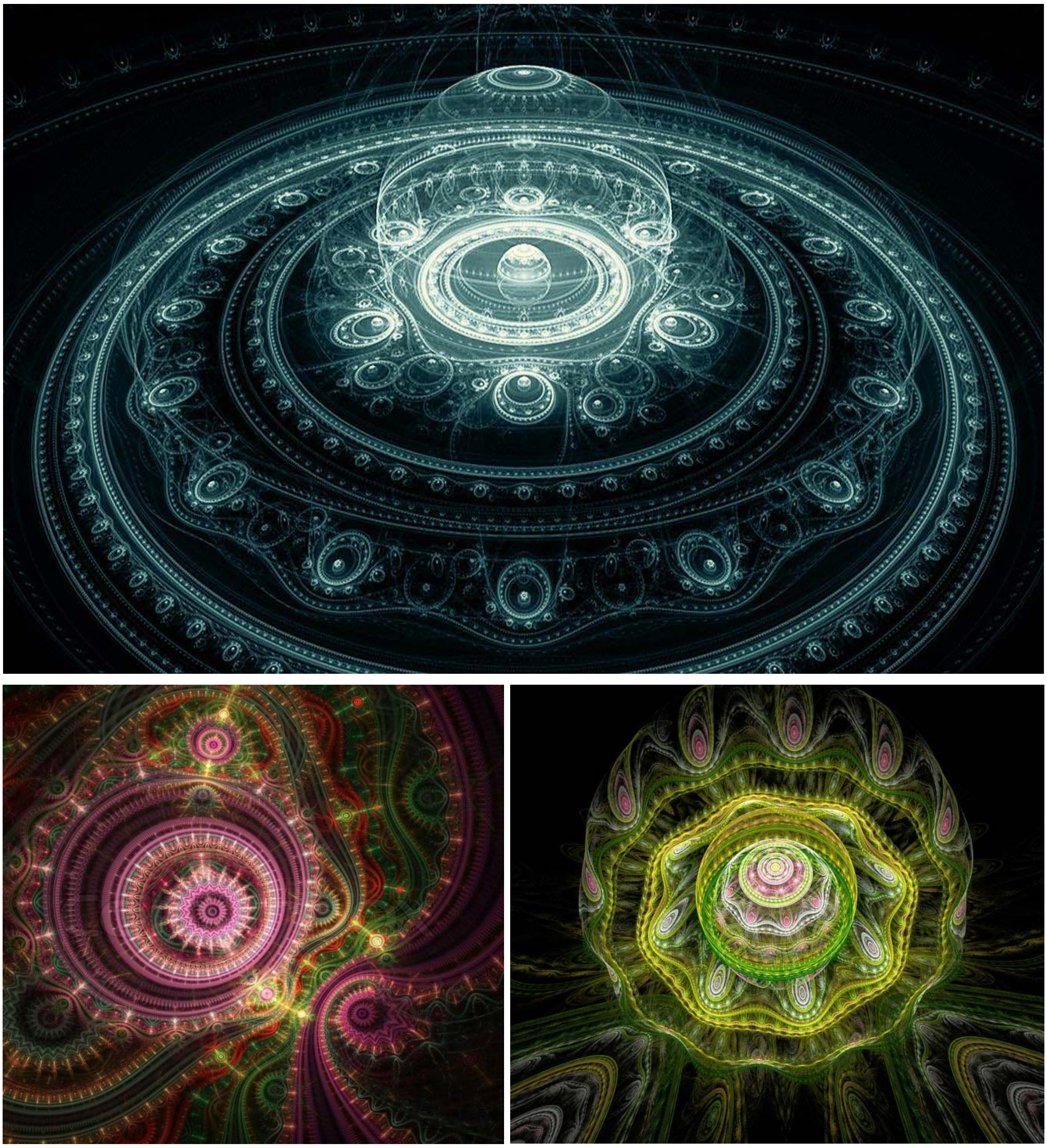


Fig. 5.15.8. Fractals are an amazing way to visualize the geometric essence of vacuum formations and of vacuum processes. Often the fractal contains such a huge volume of figurative information, the description of which would require dozens of pages of text, but such a detailed text would not have the exhaustive harmony of the fractal image

5.16 Summary of Chapter 5

In this chapter:

- the basics of the general dynamics of intra-vacuum layers and a particular case of geometrized vacuum electrodynamics are presented;

- the metric-dynamic model of the core of stable vacuum formations the example of the core~~s~~ of the «electron» and the «positron» is studied»;

- variants of the development of a dynamic model of rotation of different longitudinal and transverse layers of vacuum extent inside the core of a stable vacuum formation (in particular, the core of the «electron» and the core of the « positron»).

- the foundations for the study of the *rakya* (the sphere determined by the Schwarzschild radius, here labeled the “Schwarzschild horizons”) separating the core of stable vacuum formation from its outer shell (in particular, the *rakya* of the «electron» and the *rakya* of the «positron») are laid.