

Unified Model of Bivacuum, Wave-Corpuscle Duality, Fields & Time

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Unified Model (UM) represents the next stage of our efforts for unification of vacuum, matter, fields and time from few ground postulates.

New concept of Bivacuum is introduced, as a dynamic cell-type matrix of the Universe with superfluid and nonlocal properties, composed from non mixing *microscopic* sub-quantum particles of the opposite energies. The collective quantum excitations of sub-quantum particles and antiparticles form the correlated pairs [*actual* rotor (V^+) + *complementary* antirotor (V^-)], representing *mesoscopic double cells-dipoles*. The *macroscopic* structure of Bivacuum is formed by the infinitive number of these cells-dipoles, unified in form of virtual Bose condensate (VirBC) with nonlocal properties. The rotor (V^+) and antirotor (V^-) of cell-dipoles have the opposite quantized energy, virtual mass, spin, charge and magnetic moments.

In symmetric *primordial* Bivacuum, i.e. in the absence of matter and fields, the absolute values of all these parameters in each dipole are equal. The radiuses of *primordial* rotor and antirotor are equal to Compton radius vortex: $[L^+ = L^- = L_0 = \hbar/m_0c]_{1,2,3}^i$, where m_0^i is the rest mass of the electrons of three leptons generation ($i = e, \mu, \tau$).

Such a cells-dipoles are named Bivacuum fermions ($BVF^\uparrow = \mathbf{V}^+ \uparrow\uparrow \mathbf{V}^-$) and Bivacuum antifermions ($BVF^\downarrow = \mathbf{V}^+ \downarrow\downarrow \mathbf{V}^-$). Their opposite half integer spins $S = \pm \frac{1}{2}\hbar$, notated as (\uparrow and \downarrow), depend on direction of clockwise or anticlockwise rotation of pairs of [rotor (\mathbf{V}^+) + antirotor (\mathbf{V}^-)], forming them. Bivacuum bosons ($BVB^\pm = \mathbf{V}^+ \uparrow\downarrow \mathbf{V}^-$) represent the intermediate state between BVF^\uparrow and BVF^\downarrow .

The dynamic spin equilibrium [$BVF^\uparrow \rightleftharpoons BVF^\downarrow$] is very sensitive to magnetic fields. The oscillation of this equilibrium represent *virtual spin waves (VSW)*, transmitting the information in Bivacuum without change/transmission of momentum and energy. A standing nonlocal [$VSW_S \bowtie VSW_R$] may be responsible for creation of Psi channel between Sender [S] and Receiver [R] along with standing Bivacuum symmetry waves [$BvSW_S \bowtie BvSW_R$], also nonlocal in the volume of VirBC.

In *secondary* Bivacuum, in presence of matter and fields, the properties of rotors and antirotors do not compensate each other and BVF^\downarrow and BVB^\pm turns to asymmetric. The charge and mass of (\mathbf{V}^+) and (\mathbf{V}^-) became non equal by absolute value: $|\mathbf{V}^+| \lesseqgtr |\mathbf{V}^-|$.

Virtual particles and antiparticles in our model are the result of certain combinations of virtual clouds ($\mathbf{VC}_{j,k}^+$) and anticlouds ($\mathbf{VC}_{j,k}^-$), composed from sub-quantum particles. Virtual clouds and anticlouds emission/absorption represents a correlated transitions between different excitation states (j, k) of rotors ($V_{j,k}^+$) and antirotors ($V_{j,k}^-$) of Bivacuum dipoles [BVF^\uparrow]^{*i*} and [BVB^\pm]^{*i*}, corresponding to three lepton generation ($i = e, \mu, \tau$), from higher to lower levels ($j \rightarrow k$). The process of [*creation* \rightleftharpoons *annihilation*] of virtual clouds is accompanied by oscillation of *virtual pressure (VP $^\pm$) in form of positive and negative virtual pressure waves (VPW⁺ and VPW⁻)*, forming in certain conditions the autowaves in Bivacuum with properties of active medium. In primordial Bivacuum the virtual pressure waves: VPW⁺ and VPW⁻ totally compensate each other. However, in asymmetric secondary Bivacuum, in presence of matter and fields such compensation is absent and the resulting pressure of virtual particles or antiparticles becomes nonzero. This displays, for example, in Casimir effect. In contrast to real particles, the virtual ones may exist only in the wave [W] phase, but not in corpuscular [C] phase (see Section 3). It is a reason, why [VPW $^\pm$] and their superposition in form of the virtual autowaves do not obey the laws of relativist mechanics and causality principle.

The sub-elementary particles: *fermions and antifermions* (\mathbf{F}_\uparrow^\pm and $\mathbf{F}_\downarrow^\pm$) of the opposite charge (+/-) and energy, composing the matter, emerge due to stable symmetry violation between the *actual* (V^+) and *complementary* (V^-) rotors of BVF^\dagger cells-dipoles: $[BVF^\dagger \rightarrow \mathbf{F}_\uparrow^\pm]$. The spatial image of [C] phase of sub-elementary particle represents the [actual rotor + complementary vortex] dipole, corresponding to the [actual mass (m_C^+) + complementary mass (m_C^-)] dipole. The spatial image of [W] phase in form of cumulative virtual cloud (CVC) of sub-quantum particles is a parted hyperboloid.

Asymmetric double cells in form of [actual vortex + complementary rotor] dipoles, representing sub-elementary particles, get the ability to move as respect to symmetric ones with external group velocity $v_{gr}^{ext} > 0$. The pulsation between such asymmetric (excited) and former symmetric (ground) shape of double cells represents, in accordance to our Unified model, the [corpuscle (C) \rightleftharpoons wave (W)] transitions. These transitions are accompanied by jump-way propagation in space the triplets of asymmetric dipoles in certain combinations, representing elementary particles.

Two conservation rules for $(BVF^\dagger)^i$ and $(\mathbf{F}_\uparrow^\pm)^i$ are postulated in UM:

I. Conservation rule of the actual and complementary internal kinetic energies of vortex and antivortex: V^+ and V^- of $BVF^\dagger = [V^+ \updownarrow V^-]^i$ and their asymmetric vortex and rotor states of $F_\uparrow^\pm = [V^+ \updownarrow V^-]^{i*}$, correspondingly, in form of equality of modules of the internal actual $|2T_{kin}^+|^{in}$ and complementary $|-2T_{kin}^-|^{in}$ kinetic energies to the rest mass energy (m_0c^2) of corresponding electron's generation:

$$\left[|2T_{kin}^+|^{in} = |m_C^+|(v_{gr}^{in})^2 = |-2T_{kin}^-|^{in} = |-m_C^-|(v_{ph}^{in})^2 = m_0c^2 = const \right]^i \quad 1$$

where the product of *internal* group (v_{gr}^{in}) and phase (v_{ph}^{in}) velocities is equal to product of *external* group ($v_{gr} \equiv v_{gr}^{ext}$) and phase ($v_{ph} \equiv v_{ph}^{ext}$) velocities of sub-elementary particle in composition of elementary particle:

$$v_{gr}^{in}v_{ph}^{in} = v_{gr}v_{ph} = c^2 \quad 2$$

II. Conservation of the absolute values of the internal actual (μ_+) and complementary (μ_-) magnetic moments of vortex and antivortex: V^+ and V^- of Bivacuum fermions: $BVF^\dagger = [V^+ \updownarrow V^-]^i$ and their asymmetric states: vortex and rotor of sub-elementary particles: $F_\uparrow^\pm = [V^+ \updownarrow V^-]^{i*}$, correspondingly, in form of the equality of their modules to the Bohr magneton (μ_B^\pm):

$$|\pm\mu_+| \equiv \frac{1}{2}|e_+|\frac{|\pm\hbar|}{|m_C^+|v_{gr}^{in}} = |\pm\mu_-| \equiv \frac{1}{2}|-e_-|\frac{|\pm\hbar|}{|-m_C^-|v_{ph}^{in}} = \mu_B \equiv \frac{1}{2}|e|\frac{\hbar}{m_0c} = const \quad 3$$

where: the actual mass (m_C^+) has the regular relativist dependence on the external group velocity ($v_{gr}^{ext} \equiv v$):

$$m_C^+ = \frac{m_0}{\pm[1 - (v/c)^2]} \quad 3b$$

the complementary mass (m_C^-) has the opposite dependence on the external group velocity:

$$m_C^- = \pm m_0[1 - (v/c)^2] \quad 3c$$

It is easy to see from 3b and 3c, that the rest mass squared (m_0^2) and the the energy of quantum beats between the actual and complementary states, equal to energy of [of sub-elementary particles are:

$$|m_C^+ m_C^-| = m_0^2 \quad 4$$

$$and : E_{C \rightleftharpoons W} = |m_C^+ - m_C^-|c^2 = m_C^+v^2 \quad 4a$$

e_+ and e_- are the *internal* electric charges of actual vortex and complementary rotor, correspondingly;

$|e|$ is a module of the resulting charge of the electron or positron.

The parameters: $|e_{\pm}|$, $|m_C^{\pm}|$ and v_{gr}^{in} are not permanent, in contrast to magnetic moments: $|\pm\mu_+| = |\pm\mu_-| = \mu_B$ and ratios:

$$\frac{|e_+|}{|m_C^+|v_{gr}^{in}} = \frac{|-e_-|}{|-m_C^-|v_{ph}^{in}} = const \quad 4$$

Such a difference between the variable electric and permanent magnetic charges of Bivacuum explains the absence of MONOPOLE in Nature, as far the external measurable parameters in our theory are determined by the *difference* between the actual and complementary parameters of sub-elementary particles.

For the case of symmetric *primordial Bivacuum* (in the absence of matter and fields), when $v = v^{ext} = 0$ and $v_{gr}^{in} = v_{ph}^{in} = c$, we have for BVF † :

$$|m_C^+| = |-m_C^-| = m_0 \quad 5$$

$$|e_+| = |e_-| = e \quad 5a$$

$$v_{gr}^{in} = v_{ph}^{in} = c \quad 5b$$

$$|\pm\mu_+| = |\pm\mu_-| = \mu_B = const \quad 5c$$

In slightly asymmetric *secondary Bivacuum* in presence of matter and fields, the equalities (5 - 5b) for are broken, however 5c remains unchanged.

The \mathbf{F}_\dagger^+ and \mathbf{F}_\dagger^- and their complexes are stable at the equality of their *internal and external* group and phase velocities, corresponding to Golden mean condition, coinciding in turn with condition of resonant virtual energy exchange with Bivacuum in a course of the asymmetric dipoles [Corpuscle (C) \rightleftharpoons Wave (W)] pulsation. The **rest mass** of sub-elementary particles (fermions) and their **charge** are determined by the difference between the actual and complementary mass and between the actual and complementary charges of sub-elementary fermions/antifermions ($\mathbf{F}_\dagger^-/\mathbf{F}_\dagger^+$) at conditions of Golden mean. Corresponding differences are relativist effects, provided by inequality of spinning velocity of the *actual vortex* and *complementary rotor*, forming asymmetric dipoles of \mathbf{F}_\dagger^+ or \mathbf{F}_\dagger^- . The difference between the actual and complementary energies of \mathbf{F}_\dagger^+ or \mathbf{F}_\dagger^- , corresponding to Golden mean (ϕ) conditions, determines the carrying frequency of their [C \rightleftharpoons W] pulsation:

$$[\omega_{C \rightleftharpoons W} = |m_C^+ - m_C^-| \phi c^2 / \hbar = m_0 c^2 / \hbar = \omega_0]^i.$$

Sub-elementary particles (\mathbf{F}_\dagger^\pm) i , like primordial Bivacuum fermions (BVF †) i , can be of three modes, corresponding to three lepton generation: $i = e, \mu, \tau$. The square root of product of radiuses of the actual vortex ($L^+ = \hbar/m_C^+ c$) i and complementary rotor ($L^- = \hbar/m_C^- c$) i of sub-elementary particles (the resulting radius) is equal to *Compton radius vorticity of the electron* of corresponding generation: $L_0^i = (L^+ L^-)^{1/2} = \hbar/m_0^i c$, as far $[m_C^+ m_C^- = m_0^2]^i$.

The coherent triplets, formed by pair: sub-elementary fermions + sub-elementary antifermion: $[\mathbf{F}_\dagger^- \times \mathbf{F}_\dagger^+]$ and one sub-elementary fermion \mathbf{F}_\dagger^- : $\langle [\mathbf{F}_\dagger^+ \times \mathbf{F}_\dagger^-] + \mathbf{F}_\dagger^- \rangle$ or one sub-elementary antifermion \mathbf{F}_\dagger^+ : $\langle [\mathbf{F}_\dagger^- \times \mathbf{F}_\dagger^+] + \mathbf{F}_\dagger^+ \rangle$ represent the electrons and positrons, correspondingly. The absolute values of energy of sub-elementary particles/antiparticles in triplets are equal and determined by energy of *uncompensated* $[\mathbf{F}_\dagger^\pm]$. Certain combinations of such triplets form quarks and photons. In latter case of elementary bosons, all the properties, except spins, of three sub-elementary particles are compensated by properties of three sub-elementary antiparticles. The structure of triplets is stabilized by exchange of virtual clouds of sub-quantum particles between two sub-elementary fermions or antifermions of the opposite spins: $[\mathbf{F}_\dagger^+]$ and \mathbf{F}_\dagger^+ or $[\mathbf{F}_\dagger^-]$ and \mathbf{F}_\dagger^- in a course of their *counterphase* pulsation. Stabilization of pair of sub-elementary fermion and antifermion $[\mathbf{F}_\dagger^- \times \mathbf{F}_\dagger^+]$, pulsing in-phase, occur because of minimization of local Bivacuum energy/symmetry shift. The orientation of sub-elementary particles/antiparticles in

triplets is normal to each other (x,y,z). This determines three dimensions (3D) of space.

Two corresponding modulation frequencies (ω_{\parallel} and ω_{\perp}) of the carrying frequency: $\omega_0 = m_0 c^2 / \hbar$ ($\omega_0 > \omega_{\parallel} \gg \omega_{\perp}$) of $[C \rightleftharpoons W]$ pulsation of particles, characterize the electromagnetic and gravitational fields.

The physical nature of electromagnetic potential of elementary particles can be related to non local equilibrium shifts between rotors and antirotors ($\mathbf{V}^+ \uparrow \uparrow \mathbf{V}^-$) of infinitive number of BVF † of Bivacuum, compensating the local symmetry shift, induced by *longitudinal vibrations* (ω_{\parallel}), accompanied the $[C \rightleftharpoons W]$ pulsation of uncompensated $[\mathbf{F}_{\uparrow}^{\pm}]$ and corresponding instant momentum oscillation, coinciding with vector of particle's external momentum.

The gravitational potential of triplets is a result of similar kind of non local Bivacuum symmetry compensation of local transversal vibrations (ω_{\perp}), generated by oscillation of resulting momentum of quasi-symmetric pairs of sub-elementary particles and antiparticles $[\mathbf{F}_{\downarrow}^+ \bowtie \mathbf{F}_{\downarrow}^-]$ of triplets. This very small momentum is due to their in-phase $[C - W]$ pulsation, compensating each other almost totally.

The excessive pressure of virtual pressure waves: $\Delta VP \sim |VPW^+ - VPW^-|$ is responsible for hydrodynamic Bjorkness force, attracting or repulsing of interacting particles, depending on the phase shift between the resulting virtual pressure waves, radiating by two or more interacting particles.

By analogy with Bjorkness mechanism, we suppose, that $[C \rightleftharpoons W]$ pulsation of pairs: $[\mathbf{F}_{\uparrow}^- \bowtie \mathbf{F}_{\uparrow}^+]$ are decreasing the excessive virtual quanta pressure between particles ($\Delta \varepsilon_G^{\pm}$) more than outside of them. This provides the gravitational attraction between particles.

In accordance to theory, the Bjorkness force has a reverse square distance dependence between pulsing bodies in liquid, as $(1/r^2)$, like gravitational force. *It is important, that this force could be positive and negative, depending on difference of phase of pulsations.* In turn, this phase shift is dependent on relation of distance between bodies to acoustic (or gravitational in our case) wave length. If the length of acoustic (gravitational) waves, excited by pulsing bodies, is less than the distance between bodies, the Bjorkness (gravitational) force is attractive. If the distance is much bigger than wave length, then the attraction turns to repulsion. This effect means antigravitation.

The large-scale honey-comb structure of the Universe, its huge voids, could be explained by the interplay of gravitational attraction and repulsion between clusters of galactics, depending on the distance between them.

Recently a strong experimental evidence appears, pointing to acceleration of the Universe expansion. This phenomena could be explained by increasing the antigravitation factor with increasing the distance between galactics. It confirms our hydrodynamic model of mechanism of gravitation.

The in-phase pulsation of pairs $[\mathbf{F}_{\uparrow}^- \bowtie \mathbf{F}_{\uparrow}^+]$ are mediating the dynamic exchange interaction of triplets of sub-elementary particles, atoms and molecules with Bivacuum. They generate also the Virtual Pressure Waves (VPW^{\pm}), participating in quantum entanglement between particles and modulated by $[C \rightleftharpoons W]$ pulsation of uncompensated $[\mathbf{F}_{\uparrow}^{\pm}]$. The latter is responsible for nonlocal component of quantum entanglement between coherent particles.

The nonlocal $[BVF^{\uparrow} \rightleftharpoons BVF^{\downarrow}]$ dynamic equilibrium shifts, compensated the local symmetry shifts, induced by different spinning velocity of the vortex and rotor of sub-elementary particles is responsible for the *spin field* potential origination.

The coherent formula, unifying the pace of translational (tr) kinetic energy change $(dT_k/T_k)_{tr}$ of any closed system with its electromagnetic (E_{el}), gravitational (E_G) energies and temporal field (dt/t) relative changes, has been obtained:

$$[d \ln t = -d \ln(E_{el} + E_G) = -d \ln[(T_k)_{\parallel tr} + (T_k)_{\perp tr}]_{x,y,z} \quad 6$$

The spatial anisotropy of all of these parameters are determined by anisotropy of translational momentum and kinetic energy distribution: $[\vec{T}_k = \vec{p}^2/2m]_{x,y,z}$.

The new compensation principle of Bivacuum symmetry shifts, induced by matter and fields, has been formulated as follows: *the spatially localized Bivacuum symmetry shifts, induced by contributions of longitudinal (\parallel) and transversal (\perp) vibrations to kinetic energy of charged particles, are compensated by non local symmetry shifts of Bivacuum rotors and antirotors [V^+ and V^-], responsible for electromagnetic and gravitational potentials, correspondingly.*

It is shown, that Principle of least action is a consequence of introduced in UM "Harmonization energy (HaE) and force (HaF)" of asymmetric Bivacuum. This new force, acting on particles by the mechanism of induced resonance, drives the matter on all hierarchical levels to Golden mean conditions. The HaF could be responsible for directed evolution of microscopic, mesoscopic and macroscopic systems (inorganic and biological ones) to states, optimal for interaction with Bivacuum.

The [$C \rightleftharpoons W$] quantum beats of sub-elementary particles, forming triplets $\langle [\mathbf{F}_{\uparrow}^- \otimes \mathbf{F}_{\downarrow}^+] + \mathbf{F}_{\uparrow}^{\pm} \rangle$ are followed by the energy exchange between the negative and positive realms of secondary Bivacuum and kinetic energy of particles. Corresponding [Bivacuum - matter] interaction can be the source of energy for self-acceleration of rotating magnets in Searl effect. This happens after overcoming of certain angular velocity of rotation, necessary for sufficient synchronization of [$C \rightleftharpoons W$] pulsation of particles of matter. The accompanied decreasing or increasing of weight of magnets, dependent on clockwise or anticlockwise rotation, is a result of the additional local Bivacuum symmetry shift, induced by rotating magnets and their magnetic field influence.

The superfluous energy of space, extracted by Motionless Electromagnetic Generators (MEG), constructed and patented in US by Patrick, Bearden, Hayes, Moore and Kenny (2002), also is a result of additional local Bivacuum energy symmetry shift, induced by permanent magnets. This additional energy of Bivacuum is converted to additional kinetic energy of the electrons in 'collectors', increasing the electrons actual charge and their coherency in short - living nonequilibrium states, realized in MEG.

Bivacuum has a properties of the active medium with ability to self-organization, as a result of interaction with matter. The asymmetric double cells-dipoles, pulsing between [C] and [W] phase, serve as the active elements of medium. The existence of different 3D structures of virtual autowaves, formed by VPW^{\pm} , modulated by external EM, gravitational fields and matter dynamics, are also the important feature of secondary Bivacuum. The notion of Virtual Replica (VR) of condensed matter is introduced, as a multidimensional standing VPW^{\pm} , forming the autowaves in Bivacuum under the influence of hierarchy of matter quantum and molecular dynamics.

References:

A. Kaivarainen: series of papers in the Archives of Los-Alamos
http://arXiv.org/find/physics/1/au:+Kaivarainen_A/0/1/0/all/0/1 :

- Unified model of Bivacuum, [Corpuscle (C) \rightleftharpoons Wave (W)] duality of particles, Electromagnetism, Gravitation & Time. The Superfluous Energy of Asymmetric Bivacuum (<http://arXiv.org/abs/physics/0207027>);

-New Hierarchic theory of liquids and solids, verified on examples of water and ice by computer simulations (<http://arXiv.org/abs/physics/0102086>);

-New Hierarchic model of elementary act of consciousness, based on exchange interaction between microtubules of distant neurons by means of coherent IR photons, inducing the reversible [gel \rightleftharpoons sol] transition in cytoplasm of neuron's body and synaptic reorganization (<http://arXiv.org/abs/physics/0003045>);

-The concept of Virtual Replica (VR) of matter and living organisms in Bivacuum, as a consequence of Unified model (UM) (<http://arXiv.org/abs/physics/0103031>);