

NEW MODELS OF BI-VACUUM, CORPUSCLE - WAVE DUALITY AND SUPERUNIFICATION

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Abstract. The new Dynamic Model of Corpuscle -Wave [$C \rightleftharpoons W$] Duality elaborated, is based on the new notion of BI-VACUUM. The hypothesis of bi-vacuum assumes the existence of POSITIVE and NEGATIVE vacuum as two non mixing 'oceans' of superfluid quantum liquid from virtual quanta of the opposite energies. Bi-vacuum is composed from meta-stable pairs of virtual excitations, termed Bi-Vacuum Bosons (BVB). **In terms of string theory, applied by R.Kiehn (1997) in his description of Falaco soliton, BVB may be considered as a pair of topological 2-dimensional rotational defects in a surface of discontinuity, connected and stabilized by 1-dimensional string.** In accordance to our model, the rotors in such pairs are separated and isolated from each other by energetic gap, equal to difference between ground zero-point energy or higher, but symmetric to zero-point energies of positive and negative vacuum. The unified systems, termed BI-VACUUM, is assumed as an infinitive source of bi-vacuum bosons (BVB^\pm), as a pairs of **contra-rotating [rotor + antirrotor] or [circle + anticircle] of two polarization and broad spectra of radiuses and energetic gaps.** Our BVB^\pm , as Falaco topological defect, responsible for spin pairing mechanism, could appear in any density and scale from microscopic to cosmic scale (R. Kiehn, 1997).

The [*origination* \rightleftharpoons *annihilation*] of pairs of virtual particles and antiparticles, accompanied by fluctuation of bi-vacuum density and pressure around equilibrium, are the result of sub-quantum transitions between metastable BVB^\pm with different energetic gaps and radiuses. Such pairs of short-living states, related to virtual particles and antiparticles, are termed Virtual Transitions (VT^\pm). The energy of VT^\pm is converted to vacuum amplitude waves (VAW) in form of bi-vacuum energetic gap symmetric oscillations. Then the energy of VAW can be converted back to excitation of ground bi-vacuum boson: $(BVB^\pm)^* = BVB^\pm + A_{VAW}$. Decreasing of probability of VT^\pm between conducting plates due to coherency of Corpuscle \rightleftharpoons Wave: [$C \rightleftharpoons W$] pulsation of their electrons, explains the Casimir attractive (positive) effect. **In contrast to that, it looks that open cones, pyramids, etc. with geometry, following Golden mean, increase the probability of VT^\pm anisotropically in such cavities (negative Casimir effect) and produce maximum gradient of virtual pairs density and virtual pressure. Such constructions are in fact Virtual Jet Generators (VJG) and may be used for extraction of free energy from bi-vacuum. Rotation (spinning) of such structures may increase the nonequilibrium virtual effects in bi-vacuum and virtual pressure gradients.**

Excitation of nonresonant VAW in bi-vacuum virtual Bose condensate, unable to excite BVB^\pm to next metastable state, may be nondissipative and nonlocal.

It is shown in our work, using the Virial theorem, that conditions of macroscopic Bose condensation (BC), as the real BC in condensed matter and virtual BC in bi-vacuum - coincide with condition of nonlocality.

At conditions of ultra low density of matter and corresponding decreasing of bi-vacuum gap, the breakdown of bi-vacuum and collective 'annihilation' of virtual particles and antiparticles occurs. This analog of Big Bang is a source of energy for the fusion of elementary particles, atoms, etc. from triplets of sub-elementary particles and antiparticles.

The sub-elementary particles in Corpuscular phase represent the asymmetrically excited BVB^\pm in form of [real (m_C^+) + mirror (m_C^-)] mass-dipole. The spatial image of sub-particle in [C]-PHASE is a correlated pair [real vortex + mirror rotor]. The real inertial mass, in accordance to our model, is a result of bi-vacuum symmetry shift, accompanied a

sub-elementary particle origination.

The Corpuscular and Wave phases of sub-elementary particles are considered in our model as two alternative phase of de Broglie wave (wave B), which are in dynamic equilibrium [$C \rightleftharpoons W$].

The frequency of [$C \rightleftharpoons W$] pulsation is equal to frequency of quantum beats between real and mirror corpuscular states. It is shown, that at conditions of Golden Mean, meaning the equality of internal (hidden) and external group and phase velocities, this frequency is determined by relativist energy of the rest mass of elementary particle: $\omega_0 = m_0 c^2 / \hbar$.

The wave [W]- PHASE in form of cumulative virtual cloud (CVC) originates as a result of quantum beats between the excited - real ($m_C^+ \cdot c^2$) and mirror ($m_C^- \cdot c^2$) states of corpuscular [C] phase of sub-elementary particles, building elementary particles.

The spatial image of CVC is a parted hyperboloid. The CVC is composed from virtual density waves (VDW), responsible for electric component (i) of elementary electromagnetic charge and from virtual symmetry waves (VSW), related to magnetic component (η) of resulting charge. The product of two components is equal to resulting charge squared ($i \cdot \eta = e^2$).

It leads from equations obtained, that small part of energy of particle in [W] phase, equal to CVC energy, with fine structure constant as a factor, is responsible for electromagnetism and much smaller part of - for gravitation.

The restoration of [C]-PHASE in form of [real+mirror] mass-dipole is a result of binding of CVC to BVB in ground state, accompanied by **asymmetric** excitation of BVB. This [$W \rightarrow C$] transition is opposite to the previous one [$C \rightarrow W$].

The energy and impulse of particle in phase [C], determined by doubled kinetic energy of particle ($m_C^+ v^2$) are equal to energy and impulse of [W] phase, determined by the energy of cumulative virtual cloud (CVC): $(m_C^+ - m_C^-) \cdot c^2$.

Propagation of fermion in bi-vacuum is a jump-way process (kangaroo effect), because the [W] phase is luminal in contrast to [C] phase. **Our model unifies electromagnetic and gravitational potentials of elementary charge (electron) with its real kinetic energy and bi-vacuum symmetry shift in very clear way.**

The inertial property of real mass (m_C^+) of [C] phase in our model is a consequence of bi-vacuum reaction and corresponding increasing of CVC, as [W] phase, necessary to keep [$C \rightleftharpoons W$] equilibrium. This equilibrium is shifted by change of energy of particle in [C] phase under external force.

Such tendency to keep dynamic [$C \rightleftharpoons W$] equilibrium of sub-elementary particles, in spite of external perturbation of this equilibrium, we termed generalized principle of Le Chatelier.

The described kind of bi-vacuum symmetry resistance to perturbation is a distant, but not nonlocal effect. In contrast to nonlocal Mach's principle, our theory explains the existence of inertial mass even in the empty Universe. We do not need to apply to mass producing Higgs-like fields also.

The new duality model elucidates the quantum background of non-locality, principle of least action and Golden mean, unifies the quantum and relativist theories. We got evidence, that the Nature in its way of matter creation and evolution follows the **principle of Golden mean**. It is shown also that the pace of time - changes with opposite sign with pace of kinetic energy for each selected closed system. **The TEMPORAL field oscillations, in turn, are directly related with that of electromagnetic and gravitational fields. It is shown, that self-organization and evolution correspond to positive pace of time and negative entropy.**

The notion of three kind of Vibro-Gravitational Replica (VR): local, distant and nonlocal - in form of corresponding superposition of the electromagnetic, gravitational components of CVC and vacuum amplitude waves (VAW), is introduced. It reflects a result of coherent [$C \rightleftharpoons W$] transitions, modulated by internal molecular dynamics of condensed matter. The VR may be evaluated quantitatively by unifying of our Bi-Vacuum Duality

model and Hierarchic theory of matter (see: <http://arXiv.org/abs/physics/0003044>) and section 9-9.2. It is shown, that basically new approach, developed in this work, may serve as the effective way to Superunification.

Keywords: bi-vacuum, nonlocality, sub-elementary particles, wave-corpuscule duality, spatial images, golden mean, electromagnetism, gravitation, inertial mass, principle of least action, temporal field, Superunification.

Introduction

Einstein never accepted the Bohr's philosophy, that properties of particles cannot be analyzed without direct experimental control. Bohr's objection of EPR paradox was based on this point.

David Bohm was the first one, who made an attempt to explain wholeness of the Universe, without loosing the causality principle. Experimental discovery: "Aharonov-Bohm effect" (1950) pointing that electron is able to "feel" the presence of a magnetic field even in a regions where the probability of field existing is zero, was stimulating. For explanation of nonlocality Bohm introduced in 1952 the notion of quantum potential, which pervaded all of space. But unlike gravitational and electromagnetic fields, its influence did not decrease with distance. All the particles are interrelated by very sensitive to any perturbations quantum potential. This means that signal transmission between particles occurs instantaneously. The idea of quantum potential or active information is close to notion of pilot wave, proposed by de Broglie at the Solvay Congress in 1927. In our model instead quantum potential we introduced the notion of informational vacuum amplitude waves (VAW). These waves have a concrete interpretation in the framework of our model.

In fact Bohm develops the de Broglie idea of pilot wave, applying it for many-body system. In 1957 Bohm published a book: Causality and Chance in Modern Physics. Later he comes to conclusion, that Universe has a properties of giant, flowing hologram. Taking into account its dynamic nature, he prefer to use term: holomovement. In his book: Wholeness and the Implicate Order (1980) he develops an idea that our explicated unfolded reality is a product of enfolded (implicated) or hidden order of existence. He consider the manifestation of all forms in the universe as a result of enfolding and unfolding exchange between two orders, determined by super quantum potential.

According to Bohm, manifestation of corpuscule - wave duality of particle is dependent on the way, which observer interacts with a system. Both of this properties are always enfolded in a quantum system. It is a basic difference with our model, assuming that the wave and corpuscule phase are realized alternatively with high frequency during two different semiperiods of de Broglie wave (wave B).

Bohm, like Einstein, rejected the statement, that particles can not be considered until they are observed. In his last book, written with Basil Hiley: "THE UNDIVIDED UNIVERSE. An ontological interpretation of quantum theory" (1993), he considered the electron as a particle with well- defined position and momentum which are, however, under influence of special wave (quantum potential). Particle in accordance with this authors is a sequence of incoming and outgoing waves, which are very close to each other. However, particle itself does not have a wave nature after Bohm. Interference pattern in double slit experiment is a result of periodically "bunched" character of quantum potential in Bohm's view.

In accordance to our model (see next section), **one of two** standing sub-elementary particles, as excited bi-vacuum boson of negative polarization ($2V^-$) in the coherent triplet [$2V^- + V^+$], composing the electron as a correlated dynamic system, is always in the corpuscular [C] state in each of two semiperiods. The pair of standing V^- and V^+ are pulsing between Corpuscular [C] and Wave [W] states in-phase, compensating the influence of energy, spin and charge of each other on vacuum symmetry. The bunched character of the electron's trajectory can be a result of

impulses, produced by uncompensated sub-elementary particle in a course of its $[C \rightleftharpoons W]$ pulsations, accompanied by outgoing and incoming Cumulative Virtual Cloud (CVC). At this point our model has some similarity with idea of Bohm, related to quantum potential.

However, our duality model can explain the nonlocality and double slit experiment without using the notion of quantum potential or pilot-wave, but by the internal (hidden) dynamics of the components of elementary particles with alternating change of their properties.

The important point of Bohmian philosophy, coinciding with our theory, is that everything in the Universe is a part of dynamic continuum.

Neurophysiologist Karl Pribram made the next exciting step in the same direction as Bohm: "The brain is a hologram enfolded in a holographic Universe". The good popular description of Bohm and Pribram ideas are presented in books: "The Bell's theorem and the curious quest for quantum reality" (1990) by David Peat and "The Holographic Universe" (1992) by Michael Talbot.

Such original concepts are interesting and stimulating, indeed, but should be considered as a first attempts to transform intuitive perception of duality and quantum wholeness into clear geometrical and mathematical models.

In 1950 John Wheeler and Charles Misner published Geometrodynamics, a new description of space-time properties, based on topology. Topology is more general than Euclidean geometry and deeper than non-Euclidean, used by Einstein in his General theory of relativity. Topology does not deal with distances, angles and shapes. Drawn on a sheet of stretching rubber, a circle, triangle and square are indistinguishable. A ball, pyramid and a cube also can be transformed into the other. However, objects with holes in them can never be transformed by stretching and deforming into objects without holes.

For example black hole can be described in terms of topology. It means that massive rotating body behave as a space-time hole. Wheeler supposed that elementary particles, their spins, positive and negative charges can be presented as interconnected black and white holes. Positron and electron pair correspond to such model. The energy, directed to one of the hole, goes through the connecting tube - "handle" and reappears at the other.

The connecting tube exist in another space-time than holes itself. Such a tube is undetectable in normal space and the process of energy transmission looks as instantaneous. In conventional space-time two ends of tube, termed 'worm holes' can be a vast distant apart. It gives an explanation of quantum nonlocality. Like Bohm's quantum potential, the Wheeler's quantum topology remains fascinating but unproved hypothesis.

Serious attack on problem of quantum nonlocality was performed by Roger Penrose (1989) from Oxford University with his twister theory of space-time. In accordance with Penrose, quantum phenomena can generate space-time. The twistors, proposed by Penrose, are lines of infinite extent, resembling twisting light rays. Interception or conjunction of twistors lead to origination of particles. In such a way the local and nonlocal properties and particle-wave duality are interrelated in twistor geometry.

In our model the local properties are resulted from corpuscular [C] phase of elementary particles, generating real [mass-velocity-space-time]. Their nonlocal properties are the result of vacuum amplitude waves (VAW), exciting in a course of $[C \rightleftharpoons W]$ pulsation of these particles.

The analysis of main quantum paradoxes was presented by Asher Peres (1992) and Charles Bennett et. al., (1993).

One of the most important question is related with possibility of existing of **hidden parameters** in quantum system. Searching of hidden parameters was strongly discouraged by a theorem of Von Neumann (1955), claiming to show their to be unnecessary for explanation the known quantum phenomena (see also N. Mermin, 1990). Bohm proved his disagreement with such formal statistical interpretation of quantum theory and with conclusions of Von Neuman

(Bohm & Hiley, 1993). We assume in our model that hidden (internal) parameters of elementary particles are existing. It is shown that in corpuscular phase internal parameters are interrelated in definite way with external, experimentally detectable parameters.

It is important to note, that formalism and quite different approach for computational derivation of quantum relativist systems with forward-backward space-time shifts, developed by Daniel Dubois (1999), led to some important results, similar to ours (Kaivarainen, 1993, 1995, 2000). For example, introduced by Dubois the group and phase masses, related to internal group and phase velocities has analogy with our real and mirror masses. Like in my theory, the product of these masses is equal to the particle's rest mass squared.

The **discrete time interval**, used in Dubois approach, may correspond to **PERIOD of $[C \rightleftharpoons W]$ pulsation** of sub-elementary particles of our dynamic model of duality. The positive course of the internal time (positive time interval of Dubois theory) in accordance to my model corresponds to forward $C \rightarrow W$ transition and the negative one to the backward $W \rightarrow C$ transition.

The **anticipation of physical system**, discussed in his articles, is a result of principle of least action realization. Our approach also support this interesting phenomena, leading from interference between nonlocal vacuum amplitude waves (VAW), generated by $[C \rightleftharpoons W]$ pulsation of particles of closed system, and VAW, generated by surrounding medium. Feedback reaction between matter and its vibro-gravitational replica in bi-vacuum may be partially responsible for its self-organization and evolution.

In model of Haisch, Rueda and Puthoff (1994) it was proposed, that the inertia and mass is a reaction force, originating in interaction between the electromagnetic zero-point field (ZPF) of vacuum and charge of elementary particles.

In our approach, in contrast to mentioned above, the real (inertial) and mirror mass origination, pertinent for $[C]$ phase of particle is a PRIMARY phenomena, resulted from bi-vacuum bosons (BVB) symmetry breach. The resistance of particle to acceleration (i.e. inertia force), proportional to its mass (second Newton's law) is a consequence of resistance of bi-vacuum symmetry shift to change and compensate the change of energy of $[C]$ phase by corresponding change of $[W]$ phase energy in form of cumulative virtual cloud (CVC). So, inertia is a distant bi-vacuum effect, decreasing with the increasing of distance from particle, but not nonlocal, postulated by Mach's principle. **Consequently, the inertial property of mass is a consequence of bi-vacuum reluctance to change its symmetry shift and CVC, necessary to compensate the shift of $[C \rightleftharpoons W]$ equilibrium, induced by change real kinetic energy of particle (i.e. energy of $[C]$ phase of particle). The tendency to keep $[C \rightleftharpoons W]$ equilibrium unchanged we named a generalized principle of Le Chatelier. In contrast to nonlocal Mach's principle, our theory explains the existence of inertial mass even in the empty Universe.**

The charge and electromagnetism in my dynamic model of duality are the SECONDARY phenomena, related to $[W]$ -phase of particle (cumulative virtual cloud, CVC). The CVC emission is a result of quantum beats between bi-vacuum states of $[C]$ phase, corresponding to real and mirror masses, located at the opposite realms of bi-vacuum.

Statement, that the mass of particle, as a primary phenomena and its charge as a secondary, is more reliable, because the energy, related with mass ($E = mc^2$) is much bigger, than that related with charge (see 4.13).

In later version of their model Rueda and Haisch (1988), Rueda, Haisch and Puthoff (1998) consider the inertia, as a resistance of vacuum to acceleration of particle due to scattering of ZPF momentum flux by particle. It is shown, that non-zero ZPF momentum flux arises in accelerating coordinate frames from relativistic transformation of electromagnetic fields. They have used stochastic electrodynamics (SED) to study classical dynamics of hypothetical fundamental particle (like parton). Authors did not consider the details of interaction of vacuum with particles. Their theory does not explain the apparent mass of photons and Z^0 , W^+ , W^- bosons.

However, our approaches are partially unified by final conclusion, that inertia may be explained as a local vacuum - related phenomena, without applying to nonlocal Mach's principle and Higgs field.

1. BASIC NOTIONS OF NEW MODEL

The new Dynamic Model of Wave-Particle Duality elaborated, is based on the new notion of BI-VACUUM and selected excitations of virtual particles, termed bi-vacuum bosons (BVB).

The hypothesis of bi-vacuum assumes the existence of POSITIVE and NEGATIVE vacuum as two non mixing 'oceans' of superfluid quantum liquid from virtual quanta of the opposite energies. They are separated and isolated from each other by energetic gap, equal to difference between the energies of positive and negative vacuum zero-point oscillations. The unified systems, including both vacuums, termed BI-VACUUM, is an infinitive source of bi-vacuum bosons (BVB[±]) of two polarization.

The spatial image of BVB⁺ and BVB⁻ is a pair: [rotor + antirotor] or [circle + anticircle] of opposite direction of rotation in the energetic planes of positive and negative vacuum. The 'left' polarization of BVB⁺ corresponds to clockwise rotation of 'positive' rotor and the 'right' polarization of BVB⁻ to its opposite direction of rotation. The antirotors of BVB⁺ and BVB⁻ have the opposite direction of rotation relatively to that of rotors. The energetic BI-VACUUM GAP (BVG) between rotor and antirotor may vary strongly, depending on radius of selected BVB[±]. The radius of BVB may change from almost infinitive, pertinent for neutrino (ν , rotor/circle) and antineutrino ($\bar{\nu}$, antirotor/anticircle), till to Compton radius of the electron, muon or even Plank radius. Between the most probable radius of bi-vacuum bosons (L_0) and corresponding bi-vacuum energetic gap (BVG), defined as A_{BVB_0} , we have the following relation:

$$A_{BVB_0} = \frac{1}{2}\hbar\omega_0 - (-\frac{1}{2}\hbar\omega_0) = \hbar\omega_0 = m_0c^2 = \frac{\hbar c}{L_0} \quad 1.1$$

$$where : L_0 = \hbar/m_0c; \quad \frac{1}{2}\hbar\omega_0 = |m_{\nu}^+|_0 \cdot c^2; \quad -\frac{1}{2}\hbar\omega_0 = |m_{\bar{\nu}}^-|_0 \cdot c^2 \quad 1.1a$$

$$m_0 \text{ is the effective mass of rotor or antirotor of } BVB_0; \quad 1.1b$$

$$|m_{\nu}^+|_0 \text{ and } |m_{\bar{\nu}}^-|_0 \text{ are the effective mass of ground states} \quad 1.1c$$

of positive and negative vacuum

The increasing of A_{BVB_0} will accompanied by decreasing of L_0 and vice verse:

$$\Delta A_{BVB_0} = \Delta m_0c^2 = -\frac{\hbar c}{L_0^2} \Delta L_0 \quad 1.2$$

$$where : \Delta m_0c^2 = \Delta |m_{\nu}^+ - m_{\bar{\nu}}^-|_0 \cdot c^2 \quad 1.2a$$

Due to impulse and energy compensation there are no strict limitations for BVB[±] radius and corresponding energetic gap value between rotor and antirotor. The minimum radius of BVB may be of Plank's length order. Such small BVB[±] may serve as a "molecules" of bi-vacuum as a quantum superfluid liquid with maximum energetic gap between their rotor and antirotor. This gap determines the stability of BVB[±]. Just such a "molecules" may form the rotors and vortexes as a parts of sub-elementary particles.

Between BVB[±] and pair of 2-dimensional rotational topological defects on a surface of discontinuity a strong analogy exists. It is supposed, that the pair of contra-rotating uniform vortex cores are connected by 1-dimensional string. This structure has some common features with macroscopic Falaco soliton, described by R. Kiehn (1997). He wrote: "This spin pairing as a topological phenomenon, is independent from size and shape and could occur at both the microscopic and cosmic scales".

The nonlocal properties of BVB are the consequence of their zero resulting external impulse, responsible for their infinitive virtual wave B length ($\lambda^{ext} = h/P_{BVB}^{ext} \rightarrow \infty$) and corresponding scale of bi-vacuum Bose condensation (see section 6). Zero value of the external group velocity of BVB $^\pm$ has been proved in our theory as will be shown later. As a result of matter origination, the external impulse of BVB $^\pm$ becomes non zero. Consequently, the infinitive virtual Bose condensate 'dissociate' to huge superfluid bi-vacuum domains with dimension ($\lambda^{ext} = h/P_{BVB}^{ext} < \infty$). **The VIBRO-GRAVITATIONAL SIGNAL transmission between distant parts of virtual Bose condensate may be provided by modulated Vacuum Amplitude Waves (VAW) in form of bi-vacuum energetic slit oscillation (ΔA_{BVB}).**

The radiuses of rotor (L^+) and antirotor (L^-) of BVB $^\pm$ from principle of uncertainty in coherent form: $L^\pm \cdot P^\pm = \hbar/2$ may be expressed like:

$$L^+ = \frac{\hbar}{2P^+} \quad \text{and} \quad L^- = \frac{\hbar}{2P^-} \quad 1.3$$

In the case of symmetric BVB $^\pm$ with zero resulting momentum, we have $L^+ = L^-$ and $P^+ + P^- = 0$.

The values of most probable impulses may vary in range from $|P^+| = |P^-| = \frac{1}{2}m_0 \cdot c$ to $|P^+| = |P^-| = \frac{1}{2}M_{Pl} \cdot c$, where m_0 is a rest-mass of the electron and M_{Pl} is the Plank mass. The huge radiuses of BVB $^\pm$ circle and anticircle, corresponding to neutrino and antineutrino of all three generations (e, μ, τ) are possible also.

Judging from discreet values of mass of elementary particles, the "resonant" values of BVB $^\pm$ parameters: effective mass, impulse, radius, energetic gap - must exist. It means that a FRACTAL HIERARCHY of BVB $^\pm$ exists, which determines the complex properties of bi-vacuum virtual structure and that of elementary particles.

The general idea of subquantum particles, composing vacuum and elementary particles, is compatible with our model, if we assume that they represent the smallest BVB $^\pm$, which did not follow principle of uncertainty in traditional form. We suppose that principle of uncertainty for subquantum particles may have more 'flexible' shape:

$$\Delta x \cdot \Delta p \lesssim \hbar \quad 1.3a$$

The nonlocal vacuum amplitude waves (VAW) display themselves as the **nonresonant** oscillation of energetic slit ($A_{VAW} \neq n \cdot m_0 c^2 = A_{BVB}^n$) between positive and negative ground levels of bi-vacuum, equal to:

$$A_{VAW} = m_0 \cdot c^2 \quad 1.4$$

For the case of symmetric **resonant** BVB excitation we have:

$$\Delta m_V^+ = \Delta m_V^- = \frac{1}{2} \hbar \omega_0 / c^2 \quad 1.5$$

the corresponding energies of excited BVB $^\pm$ (E_n^{BVB}) are related directly to energy of resonant VAW quanta (A_{VAW}^n):

$$E_n^{BVB} = A_{VAW}^n = n \cdot A_{VAW}^0 = n \cdot m_0 c^2 \quad 1.6$$

It is simple to show, that for nonresonant VAW, which may be nonlocal:

$$d \ln A_{VAW} = \frac{1}{2} [d \ln m_C^+ + d \ln m_C^-] \cdot c^2 \quad 1.7$$

This formula points that acceleration of particles and corresponding relativistic change of real m_C^+ and mirror m_C^- masses should influence on the energy of vacuum amplitude waves (VAW).

In accordance to our model (see section 2, eqs. 2.2 and 2.3), the real and mirror masses - change with external group velocity ($v \equiv v_{gr}$) of particles in the counterphase manner:
 $m_C^+ = \pm m_0/[1 - (v/c)^2]^{1/2}$ and $m_C^- = \pm m_0 \cdot [1 - (v/c)^2]^{1/2}$.

1.1. FUSION OF ELEMENTARY PARTICLES FROM SUB-ELEMENTARY ONES

The sub-elementary particles in our model represent the local asymmetric excitations of bi-vacuum bosons of two possible polarization of $(\mathbf{BVB}^\pm)^*$ (see section: Spatial Images). It is assumed, that the **fusion of triplets** of sub-elementary particles and the coherent clusters of such triplets - form the elementary particles, like electron, positron, quarks, etc. For example, the electron and positron may be presented as:

electron's composition

$$\langle [\mathbf{BVB}^+ \bowtie \mathbf{BVB}^-]^* + (\mathbf{BVB}^-)^* \rangle \quad 1.12$$

$$\text{or : } \langle [\mathbf{V}^+ \bowtie \mathbf{V}^-] + \mathbf{V}^- \rangle = (\mathbf{V}^+ + 2\mathbf{V}^-) \sim e^- \quad 1.13$$

positron composition :

$$\langle [\mathbf{BVB}^+ \bowtie \mathbf{BVB}^-]^* + (\mathbf{BVB}^+)^* \rangle \quad 1.14$$

$$\text{or : } \langle [\mathbf{V}^+ \bowtie \mathbf{V}^-] + \mathbf{V}^+ \rangle = (2\mathbf{V}^+ + \mathbf{V}^-) \sim e^+ \quad 1.14a$$

The notions of sub-elementary particles and sub-elementary antiparticles we introduce as two opposite polarization of asymmetrically excited $(\mathbf{BVB}^\pm)^*$. The following abbreviations are convenient for future:

$$\mathbf{V}^+ \equiv [\mathbf{BVB}^+]^* \quad \text{is sub-elementary particle} \quad 1.15$$

$$\mathbf{V}^- \equiv [\mathbf{BVB}^-]^* \quad \text{is sub-elementary antiparticle} \quad 1.15a$$

The sign (\bowtie) means, that energy, impulse and other properties of sub-elementary particle (\mathbf{V}^+) and sub-elementary antiparticle (\mathbf{V}^-) in pairs $[\mathbf{V}^+ \bowtie \mathbf{V}^-]$, change in-phase and compensate each other in all kinds of elementary particles. The external properties of each triplet, like mass, spin, charge is determined by uncompensated sub-elementary particle (\mathbf{V}^+) or sub-elementary antiparticle (\mathbf{V}^-).

It will be shown in this paper, that the bigger is difference between real inertial (m_C^+) and 'mirror' (m_C^-) mass of sub-elementary particle in corpuscular [C] phase, the bigger is difference between effective mass of positive and negative vacuum, induced by this mass-dipole, termed vacuum symmetry shift (Δm_V^\pm):

$$\Delta m_V^+ = m_V^+ - m_V^- = \beta(m_C^+ - m_C^-) = \beta m_C^+ \cdot (v/c)^2 \quad \text{for sub - elementary particles} \quad 1.16$$

$$\Delta m_V^- = m_V^- - m_V^+ = \beta(m_C^- - m_C^+) = \beta m_C^- \cdot (v/c)^2 \quad \text{for sub - elementary antiparticles} \quad 1.16a$$

here: $\beta = (m_0/M_{Pl})^2$ is the gravitational fine structure constant (see section: Gravitation); v is the external group velocity of the particle.

In our model, the real: $m_C^+ = m_0/[1 - (v/c)^2]^{1/2}$ and mirror: $m_C^- = m_0 \cdot [1 - (v/c)^2]^{1/2}$ corpuscular masses are related to mass of rest (m_0) as follows:
 $m_C^+ \cdot m_C^- = m_0^2$.

It is easy to see, that at the external group velocity tending to zero: $v \rightarrow 0$, both values: Δm_V^+ and Δm_V^- are tending to zero and, consequently, the energetic gap of bi-vacuum.

The sum of contributions of bi-vacuum symmetry shifts (1.16) and (1.16a), produced by presence of coherent **pairs** of sub-elementary particles: $[\mathbf{V}^+ \bowtie \mathbf{V}^-]$, determines the value of

bi-vacuum energy gap in location of particle in [C] phase:

$$A_{\bar{V}}^{\pm} = (\Delta m_V^+ + \Delta m_{\bar{V}}^-) \cdot c^2 \quad 1.17$$

The instant energetic landscape of bi-vacuum gap may be very non smooth, corresponding to variation of kinetic energy distribution of particles and antiparticles, i.e. density, velocity and acceleration of 'molecules' of matter and antimatter, different degree of V^{\pm} excitation. Generation of standing VAW by such energetic landscape may produce the "Vibro-Gravitational Replica" of [C] phase of particles, responsible for this landscape.

The value of $A_{\bar{V}}^{\pm}$, generated in bi-vacuum in a course of $[C \rightleftharpoons W]$ pulsations is much bigger, than related with regular acceleration. It may be comparable with energy of resonant vacuum amplitude waves (A_{VAW}^n), discussed above and, consequently, be responsible for Casimir effect, indeed.

In accordance to our model, between the mass of two sub-elementary particles, forming **coherent pair**: $[V^+ \bowtie V^-]$ and the **third** sub-elementary particle (V^{\pm}) of **triplet**:

$$\langle [V^+ \bowtie V^-] + V^{\pm} \rangle_{e^-, e^+} \quad 1.18$$

the direct correlation should exist. Such correlation is a result of highly correlated dynamics of sub-elementary particles, composing particles. This means that the impulses, masses and kinetic energies of all of three sub-elementary standing waves, as well as the change of these parameters are equal. The mass, charge and other properties of elementary particle are determined by uncompensated sub-elementary particle (V^{\pm}) of triplet (1.18).

The u -quark is considered in our theory as a superposition of two positron- like structures (see 1.13 and 1.14):

$$\mathbf{u} \sim [e^+ + e^+]_u \quad 1.19$$

The d -quark can be composed from two electrons and one positron - like structures

$$\mathbf{d} \sim [2e^- + 1e^+]_d \quad 1.20$$

Each of excessive standing sub-elementary particle: V^+ **and** V^- in quark - has an electric charge, equal to +1/3 and -1/3 correspondingly.

In our model, the proton:

$$\mathbf{p} = [2\mathbf{u} + \mathbf{d}] \quad 1.21$$

contains more standing sub-elementary particles with positive polarization ($12V^+$), than that with negative polarization ($9V^-$). Each proton contains three excessive standing sub-elementary particles V^+ with their resulting spin and charge, equal and opposite to that of the electron.

The neutron:

$$\mathbf{n} = [\mathbf{d} + 2\mathbf{u}] \quad 1.22$$

is composed from the equal number of standing excited bi-vacuum bosons (sub-elementary particles) of both polarization: ($12V^+$) and ($12V^-$).

1.2. NEW SCENARIO OF DEATH AND BIRTH OF THE UNIVERSE

In accordance to our model, fusion of elementary particles needs BVB $^{\pm}$ asymmetric excitation and extremely high energy. The idea of bi-vacuum predicts that huge source of energy may be produced by breakdown of energetic gap between positive and negative vacuums, leading to collective annihilation of virtual particles and antiparticles of positive and negative vacuum. Such a process has similarity with dielectric breakdown of

condenser. It can be considered as a new Big Bang model.

The probability of breakdown of bi-vacuum gap is dependent on the value of this gap, its 'dielectric' properties and difference of energetic potentials between positive and negative vacuum.

We proceed from assumption that the main factor, affecting this probability, is a value of the average energetic gap of bi-vacuum A_{BV}^{\pm} with two other mentioned factors - more permanent. For general case formula (1.1) may be presented as:

$$A_{BV}^{\pm} = \frac{\hbar c}{L_{BV}^{\pm}} \quad 1.23$$

Taking into account, that the electromagnetic fine structure constant (α) is related to elementary charge squared as: $\alpha = e^2/\hbar c$, formula (1.23) turns to:

$$A_{BV}^{\pm} = \frac{e^2}{\alpha \cdot L_{BV}^{\pm}} \quad 1.24$$

It is easy to see from this formula, that increasing of the average radius of BVB: $L_{BV}^{\pm} = \hbar/(m_{BV}^{\pm}c) \rightarrow \infty$, will lead to decreasing of $A_{BV}^{\pm} \rightarrow 0$ and enhancement of probability of bi-vacuum breakdown (P_{br}):

$$P_{br} = \exp\left(-\frac{A_{BV}^{\pm}}{A_{V_0}}\right) \quad 1.25$$

Where the standard gap, defined as: $A_{V_0} = \hbar c/L_0 = m_0 \cdot c^2 = const$ corresponds to radius $L_0 = \hbar/m_0c$, equal to Compton radius of the electron with mass, equal to its mass of rest m_0 (see 1.1a).

Our theory define the **neutrino** (ν) and **antineutrino** ($\bar{\nu}$) as a rotor (+) and antirotor (-) of BVB^{\pm} with radius $L_{BVB} = \hbar/m_{\nu}c \rightarrow \infty$, as far the effective mass $m_{\nu} \rightarrow 0$. This means that the energetic gap A_{BV} (see 1.16 and 1.19) tends to zero. In a course of enough long time all the matter and antimatter of the universe will dissipate to neutrino and very low frequency photons. It leads from eq. (1.17), that at these conditions the probability of bi-vacuum gap breakdown tends to $P_{br} \rightarrow 1$.

We can see, that bi-vacuum model explains the source of energy for BIRTH of new Universe after the DEATH of old one as a result of its infinitive expansion and dissipation to neutrino and weak photons. It explains why this process should be cyclic.

Our new approach to problem of Universe origination is in accordance with recent findings, that the expansion of matter in our Universe is accelerating. Corresponding matter density and bi-vacuum gap is decreasing tending to conditions (1.21). Finally it will make possible the bi-vacuum breakdown and restarting of the new cycle of the Universe.

The gradient of difference of energetic gap between rotors and antirotors of BVB^{\pm} in their ground state, and the **gradient of difference** in concentration of BVB^+ and BVB^- in their excited states, originated under the influence of rotating atoms, molecules or macroscopic bodies - is responsible for so called TORSION field. In the framework of our model.

The transmission of signal in form of nonresonant vacuum amplitude waves (VAW), propagating in bi-vacuum without origination/annihilation of pairs of virtual particles and antiparticles is instant. The infinitive velocity of signal transmission is a result of nonlocal properties of any kind of Bose condensate: real or virtual. This important conclusion leads from combination of Virial theorem and condition of infinitive (macroscopic) Bose condensation (see section 6: 'Principle of least action' and <http://arXiv.org/abs/physics/0003045>).

Signals in form of VAW are not related with energy-impulse propagation. However, it may

be responsible for bi-vacuum replica (VR) origination as 3D or N-dimensional virtual hologram. The number of dimensions (N) of virtual standing waves, like VAW, is dependent on the number of independent virtual degrees of freedom of bi-vacuum bosons (BVB[±]), excited by VAW.

Corresponding Vacuum Replica (VR) may be generated by any condensed matter as result of VAW, generated by high-frequency [C \rightleftharpoons W] pulsation, modulated by low frequency vibro-gravitational waves (VAW). The latter are activated by coherent oscillations of molecules and atoms of condensed matter (see section 10).

2. NEW DYNAMIC MODEL OF CORPUSCLE-WAVE DUALITY

This work is devoted to analysis of the internal (hidden) parameters of elementary de Broglie waves termed waves B and their interrelation with external, observable ones, in the framework of new wave-particle duality model.

It is based on assumption of correlated pulsation of sub-elementary particles, between the corpuscular [C] and wave [W] phase, which are in dynamic equilibrium. Each of these alternating phase represents corresponding semiperiod of wave B of elementary particles.

The real and mirror mass origination, pertinent for corpuscular [C] phase of sub-elementary particles (V^+ and V^-) is assumed to be a result of BVB[±] symmetry breach. Corpuscle-Wave duality is supposed to be a result of high-frequency oscillations (quantum beats) between the real and mirror asymmetric corpuscular states of particles.

In the course of [C \rightleftharpoons W] pulsations the part of real and mirror corpuscular mass reversibly transforms to number of positive and negative virtual quanta, forming cumulative virtual cloud (CVC). This virtual cloud corresponds to [W] - phase of particle. It may excites the secondary virtual waves in bi-vacuum in accordance with Hugence principle.

We consider each of standing bi-vacuum excitations (V^+ and V^-), composing elementary particles in CORPUSCULAR [C] - phase as a Mass-Dipole, represented by real (m_C^+) and "mirror" (m_C^-) masses, corresponding to correlated excitation of positive and negative vacuum sublevels. It was postulated (Kaivarainen 1993, 1995), that the product of these mass is equal to mass of rest squared:

$$m_C^+ \cdot m_C^- = m_0^2 = const \quad 2.1$$

is always positive and equal to the electron's mass of rest (m_0) squared.

In accordance to relativist mechanics and (2.1), the real and mirror masses - change with external group velocity ($v \equiv v_{gr}$) of particles in the counterphase manner:

$$m_C^+ = \pm m_0 / [1 - (v/c)^2]^{1/2} \quad and \quad 2.2$$

$$m_C^- = \pm m_0 \cdot [1 - (v/c)^2]^{1/2} \quad 2.3$$

We do not need to introduce the notion of negative mass in our model of duality in contrast to notion of negative energy, pertinent for negative vacuum. It has the opposite - compensating values as respect to the energy of positive vacuum.

Dividing eq.(2.3) to (2.2), we get:

$$1 - \frac{m_C^-}{m_C^+} = (v/c)^2 \quad 2.4$$

$$or : \quad \frac{m_C^-}{m_C^+} = 1 - (v/c)^2 \quad 2.5$$

Eqs. (2.2) and (2.3) can be transformed to shape, close to that, obtained by Dirac

$$(E_C^+)^2 = (m_C^+)^2 c^4 = m_0^2 c^4 + (m_C^+ v)^2 c^2 \quad 2.6$$

$$(E_C^-)^2 = (m_C^-)^2 c^4 = m_0^2 c^4 - (m_0 v)^2 c^2 \quad 2.7$$

where: E_C^+ and E_C^- are the real and mirror energy of wave B.

Adding (2.6) and (2.7) we got the formulae for zero-point resulting energy, taking into account both real and mirror corpuscular masses of one of sub-elementary particle in composition of elementary particle, like electron:

$$\begin{aligned} 2E_0^2 &= 2m_0^2 c^4 = E_{tot}^2 - (P_C^\pm)^2 \cdot c^2 = \\ &= c^4 [(m_C^+)^2 + (m_C^-)^2] - c^2 v^2 [(m_C^+)^2 - m_0^2] \end{aligned} \quad 2.8$$

It is possible after some reorganizations of (2.8) and using (2.5), to get the formulae for the **resulting (hidden)** impulse of mass-dipole of sub-elementary particle (2.9). The resulting impulses of [C] and [W] phases are equal to each other and less than **real** impulse of sub-elementary particle (2.9a), detectable in experiment.

$$P_C^\pm = m_C^\pm \cdot (v^2/c) = (m_C^+ - m_C^-)c = P_W^\pm \quad 2.9$$

$$P_C^+ = P_W^+ = m_C^+ \cdot v \quad [P_C^+ > P_C^-] \quad 2.9a$$

Consequently, the real wave B length ($\lambda_C^+ = h/P_C^+$) is shorter, than that of mass-dipole ($\lambda_C^\pm = h/P_C^\pm$).

From (2.4) we can find out the difference between total energies of real and mirror states of [C] phase. It is equal to energy of quantum beats between these states, which determines the energy of wave B in both phase [C] and [W] and that of cumulative virtual cloud (CVC) [$E_B = E_C = E_W = E_{CVC}$]:

$$E_W = \hbar\omega_B = (m_C^+ - m_C^-) \cdot c^2 = m_C^+ \cdot v^2 = 2T_{kin}^+ = E_C \quad \text{or} : \quad 2.10$$

$$E_W = E_{CVC} = |m_C^+ - m_0| \cdot c^2 + |m_C^- - m_0| \cdot c^2 = E_{VDW}^+ + E_{VSW}^- \quad 2.10a$$

$$\text{where} : m_C^+ > m_0 > m_C^- \quad \text{and} \quad m_0^2 = m_C^+ \cdot m_C^- \quad 2.10b$$

We subdivide the total energy of [W] phase in form of CVC - to virtual Vacuum Density Waves (VDW) of positive vacuum and to virtual Vacuum Symmetry Waves (VSW) of negative vacuum. The mirror VSW are not related to the impulse-energy transmission and can be superluminal:

$$E_{VDW}^+ = |m_C^+ - m_0| \cdot c^2 \sim T_{kin}^+ \quad 2.11$$

$$E_{VSW}^- = |m_C^- - m_0| \cdot c^2 \sim V^- \quad 2.11a$$

The cumulative virtual cloud (CVC), corresponding to the Wave [W] phase, propagates in bi-vacuum with luminal velocity. The component of CVC, corresponding to VDW, propagates in the positive vacuum in the case of particles and in the negative vacuum in the case of antiparticles. The velocity of propagation of particle in real [C] phase is limited by particle's external group velocity and can be much lower than light velocity of CVC, corresponding to [W] phase. It means that propagation of particle in space in a course of its [$C \rightleftharpoons W$] pulsation has a jump-way character (kangaroo effect). The energies of both phase are equal and can be presented in a few forms:

$$E_W^\pm = c^2 [m_C^+ - m_C^-] = \hbar[\omega_C^+ - \omega_C^-] = \hbar\omega_B = m_C^+ \cdot v^2 = E_C^\pm \quad 2.12$$

$$\text{or} : E_C^\pm = |m_C^+ - m_0| \cdot c^2 + |m_C^- - m_0| \cdot c^2 = T_k^+ + V^- = E_W^\pm \quad 2.12a$$

$$\text{or} : E_W^\pm = \hbar[\omega_C^+ - \omega_0] + \hbar[\omega_C^- - \omega_0] = E_{VDW}^+ + E_{VSW}^- \quad 2.12b$$

The ratio of the effective mass of cumulative virtual quanta of [W]- phase ($m_C^+ - m_C^-$) to the real mass of [C]- phase (m_C^+) is equal to: $1 - m_C^-/m_C^+ = (v/c)^2$ (see also eq. 2.4).

The characteristic frequencies of real and mirror corpuscular states are defined as:

$$\omega_C^+ = \frac{m_C^+ \cdot c^2}{\hbar}; \quad \omega_C^- = \frac{m_C^- \cdot c^2}{\hbar}; \quad \omega_0 = \frac{m_0 \cdot c^2}{\hbar} \quad 2.13$$

The frequency of beats is equal to $\omega_W^\pm = [\omega_C^+ - \omega_C^-]$ and the resulting frequency of beats is equal to:

$$\omega_R = \frac{\omega_C^+ + \omega_C^-}{2} \quad 2.14$$

T_k^+ and V^- are the external kinetic and potential energy of CVC, correspondingly. The period of quantum beats is equal to:

$$T_B = 2\pi/\omega_B = 2\pi/[\omega_C^+ - \omega_C^-] \quad 2.14a$$

This phenomena reflects the pulsation of wave B in a course of its $[W \rightleftharpoons C]$ reversible transitions and energy exchange with bi-vacuum.

From the known formulae, interrelated the energy of the relativist wave B with its external group ($v = v_{gr}$) and phase (v_{ph}) velocities:

$$E_B = E_C = V + T_k = m_C^+ \cdot v^2 = m_C^+ \cdot v_{gr} v_{ph} \quad 2.14b$$

$$\text{and : } 2 \frac{v_{ph}}{v_{gr}} - 1 = \frac{V}{T_k}$$

one can see, that for CVC the condition under consideration: $2T_k = E_B = V + T_k$ corresponds to that of harmonic oscillator or standing wave:

$$V = T_k \quad \text{at} \quad v_{gr} = v_{ph} \quad 2.14c$$

The instant values of potential and kinetic energy $V = T_k$ may be equal, when the instant values of $v_{gr} = v_{ph}$ are equal. In general case (2.14b and 2.14c) are true for the average values of variables.

2.1. SPATIAL IMAGES

The spatial images of elementary wave B in [C] and [W] phase can be analyzed in terms of the wave numbers or energy distribution, if we transform the basic equations for real and mirror energy, squared (2.6 and 2.7) to forms:

$$\text{for real } [C^+] \text{ state : } \left(\frac{m_C^+ \cdot c}{\hbar} \right)^2 - \left(\frac{m_C^+ \cdot v}{\hbar} \right)^2 = \left(\frac{m_0 c}{\hbar} \right)^2 \quad 2.15$$

$$\text{for mirror } [C^-] \text{ state : } \left(\frac{m_C^- \cdot c}{\hbar} \right)^2 + \left(\frac{m_0 \cdot v}{\hbar} \right)^2 = \left(\frac{m_0 c}{\hbar} \right)^2 \quad 2.15a$$

The spatial image of energy distribution of real corpuscular state $[C^+]$, defined by equation (15), corresponds to equilateral hyperbola (Fig.1a):

$$[C^+] : X_+^2 - Y_+^2 = a^2 \quad 2.15b$$

where: $X_+ = (k_C^+)_{tot} = m_C^+ \cdot c/\hbar$; $Y_+ = m_C^+ \cdot v/\hbar$; $a = m_0 c/\hbar$

The spatial image of mirror $[C^-]$ state (2.15a) corresponds to circle (Fig. 1b), described by equation:

$$X_-^2 + Y_-^2 = R^2 \quad 2.15c$$

where: $X_- = (k_C^-)_{tot} = m_C^- \cdot c/\hbar$; $Y_- = (k_0)_{kin} = m_0 v/\hbar$.

The radius of mirror circle: $R = k_0 = m_0 c/\hbar$ is equal to the axe length of equilateral hyperbola: $R = a$ of real $[C^+]$ state. In fact this circle represents the half of bi-vacuum boson (BVB).

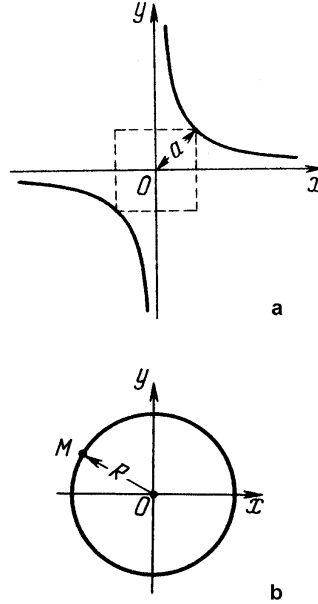


Fig. 1a. Equilateral hyperbola, describing the energy distribution for real corpuscular state $[C^+]$ of sub-elementary particle (positive region) and sub-elementary antiparticle (negative region). The rotation of equilateral hyperbola around common axe of symmetry leads to origination of parted hyperboloid or conjugated pair of paraboloids of revolution. The direction of this rotation as respect to vector of particle propagation in space may be responsible for spin. This excited state of bi-vacuum is responsible also for real mass and electric component of electromagnetic charge.

Fig. 1b. Circle, describing the energy distribution for the mirror (hidden) corpuscular state $[C^-]$. It is located near zero-point level of negative realm of bi-vacuum for sub-elementary particles and near zero-point level of positive region of bi-vacuum for corresponding antiparticles. Circulation of virtual quanta in the ground energetic planes is responsible for magnetic properties of elementary particle in accordance to our model. Such a rotor is a part of secondary bi-vacuum bosons (BVB) as a pair [rotor+antirrotor].

The $[W]$ phase in form of cumulative virtual cloud (CVC) originates as a result of quantum beats between real and mirror states of $[C]$ phase (see 2.12) of elementary wave B. Consequently, the spatial image of CVC energy distribution can be considered as a geometric difference between energetic surfaces of real $[C^+]$ state as an equilateral hyperbola and that of $[C^-]$ state as a mirror circle. After subtraction of left and right parts of (2.15b and 2.15c) and some reorganization, we get the energetic spatial image of $[W]$ phase or $[CVC]$ as a geometrical difference of equilateral hyperbola and circle:

$$\frac{(m_C^+)^2}{m_0^2} + \frac{(m_C^-)^2}{m_0^2} \frac{c^2}{v^2} - \frac{(m_C^+)^2}{m_0^2} \frac{c^2}{v^2} = -1 \quad 2.16$$

This equation in dimensionless form describes the parted (two-cavity) hyperboloid (Fig. 2):

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = -1 \quad 2.17$$

The (c) is a real semi-axe; a and b – the imaginary ones.

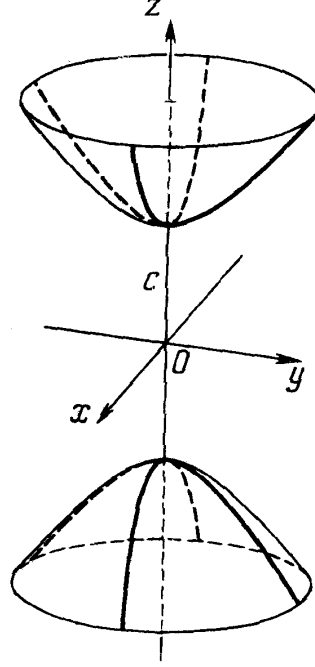


Fig. 2. The parted (two-cavity) hyperboloid (in arbitrary scale) is a spatial image of CVC, corresponding to [W] phase of elementary wave B. The positive half of this parted hyperboloid corresponds to CVC of [W] phase of elementary particle and the negative one - to CVC of antiparticle. The whole picture may characterize the twin CVC of positive and negative energy, produced by pair of sub-elementary [particle+antiparticle] or standing [neutrino+antineutrino] as a part of electron, positron, photon and quarks.

If we consider the real and the mirror states of [C] phase as a two rotors of different shape and resulting frequency, equal, correspondingly, to ω_C^+ and ω_C^- , then the difference of rotors of corresponding fields of velocities: $\vec{V}_C^+(r)$ and $\vec{V}_C^-(r)$ can be presented as doubled energy of CVC:

$$rot[\hbar\vec{V}_C^+(r)] - rot[\hbar\vec{V}_C^-(r)] = 2\vec{n} \cdot \hbar(\omega_C^+ - \omega_C^-) = 2\vec{n} \cdot \hbar\omega_{CVC} \quad 2.18$$

where: \vec{n} is the unit-vector, common for both states; $\omega_{CVC} = (\omega_C^+ - \omega_C^-)$ is frequency of beats between real and mirror rotors. All the virtual microparticles of bi-vacuum as a quantum liquid, forming each of rotors, should have the same angle frequency (ω_C^+ and ω_C^-).

The spatial image of BVB is a pair of [rotor + antirotor] with opposite circulation in the ground energetic planes of positive and negative vacuum, forming bi-vacuum. Their surfaces are equal, correspondingly to:

$$S_{BVB}^+ = \pi(L_0^+)^2 = \pi(\hbar/m_0^+c)^2; \quad S_{BVB}^- = \pi(L_0^-)^2 = \pi(\hbar/m_0^-c)^2 \quad 2.19$$

For the case of totally symmetric BVB: $S_{BVB}^+ = S_{BVB}^-$, the resulting surface of BVB is

$$S_{BVB} = S_{BVB}^+ + S_{BVB}^- = 2S_{BVB}^+ = 2S_{BVB}^- \quad 2.20$$

The oscillations of S_{BVB} as a result of symmetric oscillations of m_0^+ and m_0^- at condition

$(m_0^+ - m_0^-) = 0$, are related to excitations of vacuum amplitude waves VAW and torsion field. Restoration of [C] phase is a result of binding of CVC on BVB, serving as a anchor site.

Let us consider the elementary wave B as a quantum harmonic oscillator, corresponding to conditions (2.14c) with energy quantization in the realms of positive and negative bi-vacuum:

$$E_n = \hbar\omega_B = \pm\hbar\omega_0\left(n + \frac{1}{2}\right) \quad 2.21$$

where quantum number: $n = 0; 1; 2 \dots$ and $\hbar\omega_0 = m_0c^2$.

Two sublevels, with $n = 0$ are: $E_0^\pm = \pm\frac{1}{2}\hbar\omega_0$ correspond to positive and negative zero-point states of bi-vacuum. They are general for particles, antiparticles and bi-vacuum bosons (BVB).

The additional third sublevel of positive vacuum at $n = 1$: $E_1^+ = +\frac{3}{2}\hbar\omega_0$ characterize the asymmetry of energy distribution, accompanied the sub-elementary particle origination (Fig.3).

The additional sublevel of negative vacuum: $E_{-1}^- = -\frac{3}{2}\hbar\omega_0$ is pertinent for sub-elementary antiparticles origination. Particles and antiparticles have the opposite symmetry of energy distribution, however, with the same absolute values.

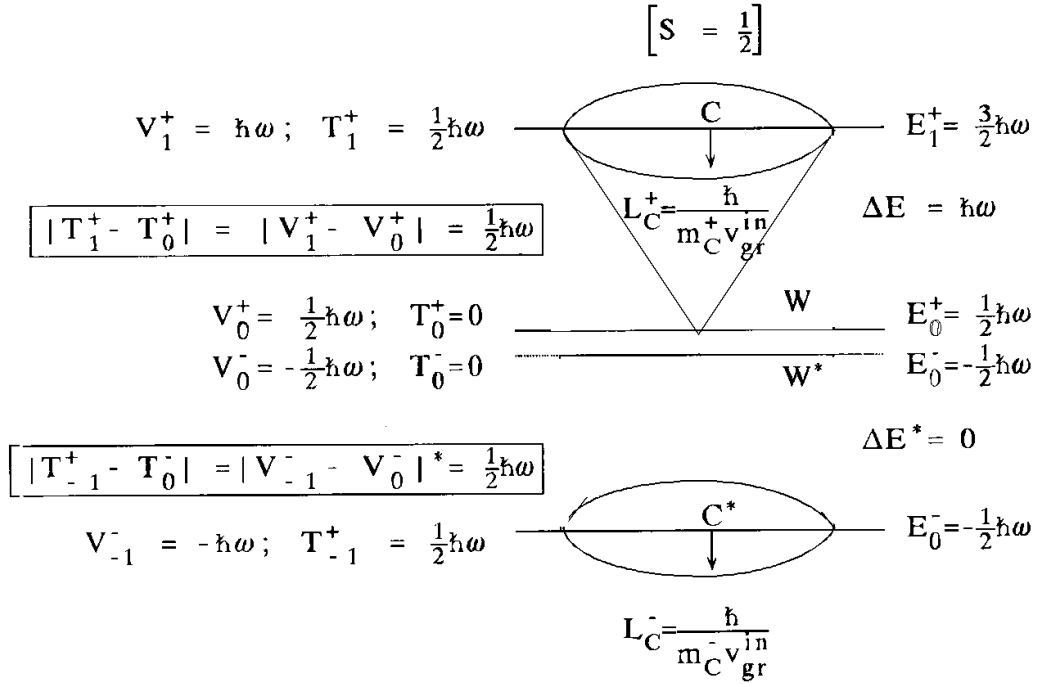


Fig.3. The spatial image of [C] phase of elementary wave B [real vortex+mirror rotor], corresponding to [real+mirror] mass-dipole.

The real total energy of wave B as quantum oscillator in [C] and [W] phases can be defined as:

$$E_C = \frac{3}{2}\hbar\omega_0 + (-\frac{1}{2}\hbar\omega_0) = \hbar\omega_0 \quad \text{total energy of [C] states: real and mirror} \quad 2.22$$

and $E_W = \frac{3}{2}\hbar\omega_0 - \frac{1}{2}\hbar\omega_0 = \hbar\omega_0$ energy of beats between [C] states,

equal to energy of CVC

The length of [real +mirror] mass-dipole, equal to that of CVC:

$$\vec{\lambda}^{\pm} = h/(m_C^+ v^2/c) = h/(m_C^+ - m_C^-)c \quad 2.23$$

of the fermions is determined by dynamic properties of "uncompensated" sub-elementary particle in form of [vortex+ rotor] dipole in composition of the electron's triplets.

2.2. Scenario of fermion propagation in vacuum in a course of its [C \rightleftharpoons W] pulsation

For the end of simplification we consider the behavior of sub-elementary particle with $\Delta m_C = (m_C^+ - m_C^-) > 0$ in Corpuscular [C] phase. Such sub-elementary particle can exist, in accordance to our model, only in composition of triplets, like the electron [$2V^- + V^+$] or positron [$2V^+ + V^-$].

We can subdivide the process of this particle dynamics in a course of propagation to following stages:

1. The particle (wave B) in [C] phase, representing mass-dipole, with real mass (m_C^+) and mirror mass (m_C^-) with linear dimension (λ^{\pm}) moves in vacuum with external group velocity ($v < c$), the resulting energy (E^{\pm}), resulting impulse (P^{\pm}), the external real impulse (P_C^{ext}) and corresponding external wave B length (λ_C^{ext}), equal correspondingly to:

$$E^{\pm} = m_C^{\pm} \cdot v^2 = (m_C^+ - m_C^-) \cdot c^2 \quad 2.24$$

$$P^{\pm} = [(m_C^{\pm}) \cdot (\vec{v}_{gr}^2/c)]_C = (m_C^+ - m_C^-)c \quad \text{and} \quad \lambda^{\pm} = h/P^{\pm} \quad 2.25$$

$$P_C^{ext} = [(m_C^{\pm}) \cdot v]_C \quad \text{and} \quad \lambda_C^{ext} = h/(m_C^+ \cdot v) < \lambda^{\pm} \quad 2.26$$

2. The [C] phase is unstable due to its specific asymmetric composition from elements of positive and negative vacuum: [real+mirror] mass - dipole, corresponding to spatial image of pair of [real vortex+ mirror rotor] dipole. This instability is a "driving force" of [C \rightleftharpoons W] pulsations in form of quantum beats between real and mirror states.

There are three interrelated consequences of the first semiperiod of these pulsations, corresponding to transition from Corpuscular to the Wave phase:

a) The excessive energy of real corpuscular state [C^+] as respect to mirror one [C^-] of corpuscular phase - turns to the energy of cumulative virtual cloud (CVC), corresponding to that of the [W] phase. The CVC propagates in bi-vacuum with light velocity. The energy of CVC can be subdivided to energy of Vacuum Density Waves (VDW) and Vacuum Symmetry Waves (VSW):

$$E_W = (m_C^+ - m_C^-) \cdot c^2 = m_C^+ \cdot v^2 = E_C \quad 2.27$$

$$\text{or} : E_{CVC} = E_{VDW} + E_{VSW} = E_W \quad 2.28$$

$$\text{where} : E_{VDW} = |m_C^+ - m_0| \cdot c^2; \quad E_{VSW} = |m_C^- - m_0| \cdot c^2$$

The hidden resulting impulse of CVC, composed from these two kinds of virtual quanta (P_{CVC}^{\pm}), determines the resulting radius of CVC (L_{CVC}^{\pm}), equal to that of corpuscular mass-dipole:

$$P_{CVC}^{\pm} = c(m_C^+ - m_C^-) = c\Delta m_C \quad \text{and} \quad L_{CVC}^{\pm} = \frac{\hbar}{(m_C^+ - m_C^-) \cdot c} \quad 2.29$$

The spatial image of CVC is a half of two-cavity parted hyperboloid (see eq. 2.16 and Fig.2), each of cavity, corresponding to positive for particles and negative for antiparticles components of CVC.

The resulting energy and the external impulse of secondary bi-vacuum boson (BVB) - turns to zero:

$$E_{BVB} = \frac{1}{2} \hbar \omega_0 + (-\frac{1}{2} \hbar \omega_0) = \frac{1}{2} (m_0^+ - m_0^-) \cdot c^2 \rightarrow 0 \quad 2.30$$

$$\text{and } P_{BVB} = \frac{1}{2} (m_0^+ - m_0^-) \cdot c \rightarrow 0 \quad \lambda_{BVB} = h/P_{BVB} \rightarrow \infty. \quad 2.31$$

The conditions (2.31) means that the bi-vacuum bosons (BVB), corresponding to [W] phase of coherently pulsating particles, may form nonlocal virtual Bose condensate with infinitive dimensions.

The secondary curved bi-vacuum, corresponding to [C] phase, displays nonlocality only in the volume of finite, but huge clusters in contrast to unperturbed flat primordial bi-vacuum, which nonlocality has no limitations.

The probability of BVB origination and their Bose condensation is very high for both: primordial and secondary vacuum.

3. At the next, the reverse stage of our scenario, the "ejected" in a course of [C → W] transition cumulative virtual cloud (CVC), representing [W] phase of particle - restores in bi-vacuum the asymmetric [real-mirror] mass dipole (C-phase) in form of [real vortex+mirror rotor] pair as a result of CVC absorption by one of BVB.

The most probable distance of restoration of [C] phase, i.e. [W → C] transition - from the point of previous [C → W] transition is determined by the external wave B length of the electron (2.26).

The in-phase [C ⇌ W] pulsations of symmetric pair of sub-elementary particle and sub-elementary antiparticle [V⁻ ⇌ V⁺] in composition of the electron [2V⁻ + V⁺] is also accompanied by [emission ⇌ absorption] of twin CVC in form of parted hyperboloid (Fig. 2). These correlated CVC of positive and negative vacuum - totally compensate each other and do not contribute to the impulse - energy of uncompensated sub-elementary particle of triplet. However, the periodic [emission ⇌ absorption] of CVC doublet may generate the nonlocal (instant) Vacuum Amplitude Waves (VAW), as oscillations of bi-vacuum zero-point energy slit.

Our model do not needs the Bohmian "quantum potential" or "pilot wave" for explanation of two-slit experiment. For the common case of ensembles of particles, the explanation can be based on interference of their [W] phase in form of cumulative virtual clouds (CVC). The ability of CVC to activate secondary virtual waves and wavefronts in bi-vacuum could be responsible for interference, produced even by single electron or photon. Scattering of photons on the free electrons will affect their impulse, mass, wave B length and, consequently, the interference picture. Only [C] phase of particle, but not its [W] phase can be registered by detectors of particles. Such a consequences of our dynamic duality model can explain all details of well known and still mysterious double slit experiment.

The absence of dissipation in the process of [C ⇌ W] transitions in bi-vacuum Bose condensate as in superfluid quantum liquid, makes them totally reversible.

Propagation of fermion in 3D space in a course of its [C ⇌ W] pulsation can be considered as a periodic jumping of particle in form of CVC of [W] phase with light velocity between wavefronts of bi-vacuum, corresponding to [C] phase, moving with group velocity lower than luminal one. The wavefronts of [C] and [W] phase are normal as respect to direction of particles propagation.

The separation between coherent wavefronts, generated by real [C] phase, is determined by real external wave B length (eq.2.26).

Such jump-way process may be termed KANGAROO EFFECT [KE]. The [KE] as elastic effect, is a consequence of total 'compensation' of energy of cumulative virtual cloud (CVC) - by energy of mass symmetry shift (real versus to mirror) and corresponding energy of bi-vacuum symmetry shift (see section 'Gravitation'), accompanied by binding of (CVC) to bi-vacuum boson (BVB) in corpuscular [C] - phase of photon. Only at this [C] - phase the impulse and energy of photon may be detected. For the other hand, the electric and magnetic properties of

photon are detectable only in [W] phase - as a part of CVC energy. **These consequences of dynamic duality model may be verified experimentally.** The source of coherent radio waves and corresponding set of detectors, equidistantly distributed along the wave penetration are necessary for such experiment. To demonstrate the different properties of photon in [C] and [W] phase, the distance between detectors should be less, than the coherent electromagnetic wavelength. It is anticipated, that the correlation between the spatial periodicity of the "kangaroo effect" value and the length of coherent EM waves should exist.

The energy (E_{CVC}) of cumulative virtual cloud (CVC) is determined by difference in energy of quantum beats: $\Delta m_C \cdot c^2 = (m_C^+ - m_C^-) \cdot c^2$ in a course of $[C \rightleftharpoons W]$ and energy of secondary bi-vacuum symmetry shift ($\Delta m_V \cdot c^2$):

$$E_{CVC} = (\Delta m_C - \Delta m_V) \cdot c^2 \quad 2.32$$

The total energy of wave B is a sum of CVC energy and energy of vacuum symmetry shift:

$$E_B = E_{CVC} + \Delta m_V \cdot c^2 = \Delta m_C \cdot c^2 = (m_C^+ - m_C^-) \cdot c^2 \quad 2.33$$

The nonlocal quantum interaction can occur between [C] phase particles via bi-vacuum Bose condensate. The nonlocal interaction between [C] phase of particles in the huge but limited volume of secondary bi-vacuum Bose condensate, may be realized as a coherent change of vacuum symmetry shift:

$$\Delta m_V = \frac{1}{2} |m_0^+ - m_0^-| = |m_V^+ - m_V^-| \quad 2.34$$

in the shell of secondary superfluid Bi-vacuum Bose condensate with the radius of curvature:

$$L_{BVC} = \hbar / (\Delta m_V \cdot c) \quad 2.35$$

The vacuum symmetry shift oscillation may be induced by the mass symmetry shift (Δm_C) oscillation, resulted from change of velocity in a coherent system of particles and in-phase $[C \rightleftharpoons W]$ pulsation (see "Gravitation"):

$$\Delta m_C = |m_C^+ - m_C^-| = \Delta m_V / \beta \quad 2.36$$

Such kind of nonlocal interaction display itself in oscillation of L_{BVC} . (2.35), i.e. radius of nonlocality.

The oscillation of real mass of uncompensated sub-elementary particle (V^-) of elementary particle due to its alternating acceleration - is accompanied by corresponding oscillations of real masses of pair $[V^- + V^+]$ in composition of the electrons $[2V^- + V^+]$, protons and neutrons. These symmetric oscillation of $[V^- + V^+]$, in turn, excite the nonlocal Vacuum Amplitude Waves (VAW), accompanied by oscillations of bi-vacuum Bose condensate (BC) energy slit (E_{BVB}), equal to that of BVB:

$$E_{BVB} + \Delta E_{BVB} = \frac{1}{2} [(m_0^+ + \Delta m_0^+) + (m_0^- + \Delta m_0^-)] \cdot c^2 = (m_0 + \Delta m_0) \cdot c^2 \quad 2.37$$

$$A_{VAW} = \Delta E_{BVB} = \Delta m_0^+ + \Delta m_0^- = \Delta m_0^\pm \quad 2.38$$

Such mechanism of nonlocal interaction via virtual BC can explain the instant interaction between coherent twin photons in experiments of Aspect et al and realization of principle of least action.

Our theory relates the pace of time for any selected closed system to the pace of the external real kinetic energy T_{kin} change (see section: 'Principle of least action and problem of time'). The notion of real time is existing only on realm of wavefronts, corresponding to [C] phase of wave B. The pace of real time is determined by the pace of real kinetic energy change. At the [W]

wavefronts and bi-vacuum energetic surface, the notion of real time is absent as far the notion of real kinetic energy is absent. However, the virtual time could coexist with change of virtual kinetic energy.

Spatial stability of complex systems: atoms, molecules and that of solids means that in these systems superposition of asymmetrical cumulative virtual clouds, representing [W] states of elementary particles - forms hologram - like 3D standing waves superposition with location of nodes, corresponding to the most probable positions of corpuscular phase of the nucleons, electrons, atoms and molecules in condensed matter. The binding of CVC by bi-vacuum bosons restore the [C] phase of particles in positions, close to the most probable ones in accordance with the value of corresponding wave function squared (see section 7).

3. THE EXTERNAL AND INTERNAL PARAMETERS OF DE BROGLIE WAVE.

Our model includes the notions of detectable in experiment - external and nondetectable internal (hidden) parameters. The generally accepted notions, valid for external parameters of wave B, are not the same for hidden ones.

We assume the (1): permanent values and (2): equality of internal kinetic energies of real and mirror corpuscular states of sub-elementary particle/antiparticle (V^+ or V^-). In accordance to introduced in our theory definition of time (see section 6 of <http://arXiv.org/abs/physics/0003001>), the 1st assumption is necessary for condition that the pace of time for internal states is zero and their life-time is infinitive (in contrast to external ones). The 2nd assumption is a result of symmetry demand between **real** internal dynamics of [C] phase and the **effective, mirror** one.

At the non equal real and mirror masses ($m_C^+ > m_C^-$), depending on the external group velocity (eqs. 2.2 and 2.3), such conditions can be achieved by the compensating difference of hidden velocities ($v_{in}^+ < v_{in}^-$):

$$(2T_k^+)^{in} = m_C^+(v_{in}^+)^2 = m_C^-(v_{in}^-)^2 = (2T_k^-)^{in} = const \quad 3.1$$

The mirror kinetic energy is a **virtual reflection** to 'balance' the real kinetic energy.

It is easy to show that the internal kinetic energies are equal to resulting one, determined by the mass of rest of the electron:

$$(T_k^+)^{in} = (T_k^-)^{in} = T_0 = \frac{1}{2}m_0 \cdot c^2 \quad 3.2$$

The relativist increasing of real inertial m_C^+ and decreasing of mirror, inertialess m_C^- with the enhancement of external group velocity (v) - is compensated by the opposite change of **hidden** group and phase velocities, defined as:

$$v_{in}^+ \equiv v_{gr}^{in} \quad \text{and} \quad v_{in}^- \equiv v_{ph}^{in} \quad 3.2a$$

By analogy for **external** group (v) and phase (v_{ph}) velocities, the product of **internal (hidden)** velocities is equal to the light velocity squared:

$$v_{gr}^{in} \cdot v_{ph}^{in} = v \cdot v_{ph} = c^2, \quad 3.3$$

however, in general case : $v_{gr}^{in} \neq v$ and $v_{ph}^{in} \neq v_{ph}$

The resulting hidden impulse of sub-elementary wave B squared is equal to

$$P_0^2 = P^+ \cdot P^- = (m_C^+ \cdot v_{gr}^{in}) \cdot (m_C^- \cdot v_{ph}^{in}) = m_0^2 \cdot c^2 = const \quad 3.4$$

From (3.1) and (2.4) we get the important relation between the internal and external

velocities:

$$\frac{m_C^-}{m_C^+} = \left(\frac{v_{gr}^{in}}{v_{ph}^{in}} \right)^2 = \left(\frac{v_{gr}^{in}}{c} \right)^4 = 1 - \left(\frac{v}{c} \right)^2 \quad 3.5$$

One of the most important characteristics of bi-vacuum bosons (BVB[±]) is the equality of their external impulse and group velocity to zero: $v_{gr}^{ext} \equiv v = 0$. From (3.5) we can see that at this condition:

$$m_C^+ = m_C^- \quad \text{and} \quad v_{gr}^{in} = v_{ph}^{in} = c \quad \text{for BVB}^\pm \quad 3.5a$$

So, we get here very important properties of bi-vacuum "bricks"- .BVB[±].

Taking into account (3.3), formula (3.5) can be transformed to:

$$\frac{v_{gr}^{in}}{v_{ph}^{in}} = \frac{(v_{gr}^{in})^2}{c^2} = \left[1 - \left(\frac{v}{c} \right)^2 \right]^{1/2} = \left[1 - \left(\frac{v}{v_{ph}} \right) \right]^{1/2} \quad 3.6$$

More convenient for further work shape of the above formula is:

$$\frac{c}{v_{gr}^{in}} = \frac{1}{\left[1 - (v/c)^2 \right]^{1/4}} \quad 3.6a$$

3.1.HIDDEN HARMONY AND GOLDEN MEAN

The reason of huge importance of Golden mean: $\phi \equiv S = 0.618$ in very different physical, chemical biological, etc. phenomena is entirely obscure. Let's try to elucidate it's physical nature, using fundamental eq.(3.6), interrelating the internal and external velocities of de Broglie wave.

For this end we introduce the important condition of **Hidden Harmony**: the equality of internal (hidden) and external group and phase velocities:

$$\left[\mathbf{v}_{gr}^{in} = \mathbf{v}_{gr}^{ext} \quad \text{and} \quad \mathbf{v}_{ph}^{in} = \mathbf{v}_{ph}^{ext} \right] \quad 3.7$$

Realization of this primary condition determines the definite ratio of group and phase velocities (internal and external):

$$\mathbf{S} = \frac{v_{gr}^{in}}{v_{ph}^{in}} = \left[\frac{v}{v_{ph}} \right]^{ext} = \left(\frac{v^2}{c^2} \right)^{ext, in} = \frac{A}{B} \quad 3.8$$

Using selective ratio (3.8), based on Hidden harmony condition (3.7), we get from (3.6) the key quadratic equation:

$$S^2 + S - 1 = 0 \quad 3.9$$

$$\text{or : } \frac{S}{(1-S)^{1/2}} = 1 \quad 3.10$$

The positive solution of (3.9) gives the numerical value of Golden mean:

$$S \equiv Phi = (A/B) = 0.618 \quad 3.11$$

From (3.8) and (3.11), we can find the ratio of external group velocity to the luminal velocity, corresponding to Golden mean realization:

$$[v/c]_S = 0.786$$

3.11a

It is anticipated that this ratio is characteristic for different dynamic processes on various hierarchical levels. It may be experimentally find out, for example, in the large scale dynamics of the Universe.

Golden mean is one of the most intriguing, important and universal number of Nature. Lot of very different natural phenomena - from ratio of parameters of planetary orbits to the law of multiplication of microbes and rabbits (Fibonacci row) follow Golden mean. Our intuitive perception of beauty and harmony also is related to Golden mean. This means that our consciousness is also "constructed" on the same principle.

The deep quantum roots of Golden mean, reflecting realization of conditions of Hidden Harmony (3.7), leading from our dynamic model of wave-particle duality, explain the universality of this number ($S = 0.618$).

We put forward a hypothesis, that any kind of selected system, enable to self-assembly, self-organization and evolution: from atoms to living organisms, galactics and the Universe - are tending to conditions of Hidden Harmony as a background of Golden Mean realization. The less is deviation of ratio of characteristic parameters of system from $[S \equiv Phi]$, the more advanced is evolution of this system.

We have to keep in mind that all forms of matter are composed from hierarchic system of de Broglie waves.

Our statement that tendency of any system (from elementary particle to the Universe) to Hidden Harmony is a driving force and final goal of evolution - can be confirmed on the lot of examples. One of them is evaluation of energy of wave B (i.e. electron), corresponding to Golden mean condition.

The formula (2.4) at condition $(v/c)^2 = S$, taking into account (3.10), can be easily driven to the following expression, meaning the equality of mass symmetry shift, produced by particle (Δm_C^S) to mass of rest of this particle (m_0):

$$\Delta m_C^S = (m_C^+ - m_C^-)^S = m_C^+ \cdot S = \frac{m_0 \cdot S}{(1 - S)^{1/2}} = m_0 \quad 3.12$$

The energy of wave B, equal to that of CVC, at condition of Hidden harmony and Golden mean, is equal to:

$$E_B^S = \Delta m_C^S \cdot c^2 = m_0 \cdot c^2 = m_0 \cdot v_{gr} v_{ph} = \hbar \omega_0 = T_k + V \quad 3.13$$

where the angle frequency of $[C \rightleftharpoons W]$ pulsations of "ideal" electron with external and internal group velocities, determined by condition (3.7) is equal to:

$$\omega_0 = m_0 c^2 / \hbar = 9.03 \cdot 10^{20} s^{-1} \quad 3.14$$

We can see, that at condition of Hidden Harmony, the total energy of wave B is described by Einstein's formula, unifying the energy and mass. This means that each cycle of $[C \rightleftharpoons W]$ pulsation is accompanied by reversible annihilation of each of sub-elementary particle (elementary wave B), composing elementary particles.

From the known relation between kinetic (T_k) and potential (V) energy of wave B and that of group and phase velocities (2.14b), at the condition of Golden mean: $S = [v_{gr}/v_{ph}]^{ext} = [v_{gr}/v_{ph}]^{in} = 0.618$, we get the ratios between different energy contributions of wave B:

$$\left[\frac{V}{T_k} \right]^S = \frac{2}{S} - 1 = 2.236 \quad \text{or} \quad S = \left[\frac{v_{gr}}{v_{ph}} \right]^S = \left[\frac{2T_k}{E_B} \right]^S = 0.618 \quad 3.15$$

$$\text{or : } \left[\frac{T_k}{E_B} \right]^S = 0.309 \quad 3.15a$$

We may introduce here the **”Dead mean”** conditions. At this conditions any system represents the number of **independent harmonic oscillators**, unable, consequently to self-organization:

$$\left[\frac{V}{T_k} \right]^D = 1 \quad \left[\frac{2T_k}{E_B} \right]^D = 1 \quad 3.16$$

$$\text{or : } [T_k = V]^D \quad 3.16a$$

In section: ”Electromagnetism” the important results will be presented, pointing that principles of hydrogen and other atoms/molecules assembly follow the rule of Golden mean, based on Hidden harmony.

It has been shown also that the famous Sri Yantra diagram contains the features, compatible with our model of duality.

4. ELECTROMAGNETISM

The fine structure constant ($\alpha = 7.29735 \cdot 10^{-3}$) in our model can be related to ratio of minimum zero-point external group velocity of the electron ($v = v_0$), to the light velocity as follows:

$$\alpha = \frac{e^2}{\hbar c} = \left(\frac{v_0}{c} \right)^2 \quad 4.1$$

The new notions of external and internal (hidden) electric (i ; i^{in}) and magnetic (η ; η^{in}) components of resulting electromagnetic charge (e) are interrelated with each other as

$$(i \cdot \eta) = (i^{in} \cdot \eta^{in}) = e^2 \quad 4.2$$

In accordance to our theory, the real and mirror states of [vortex+rotor] dipole of [C] phase - reflect the internal electric (i^{in}) and magnetic (η^{in}) components of electromagnetic charge, correspondingly.

It may be shown, that the ratio of Bohr magneton (μ_B) to internal magnetic moment of the electron (μ_η):

$$\mu_B = e \cdot (\hbar/2m_0c); \quad \mu_\eta^{in} = \eta^{in} \cdot (\hbar/2m_0c) \quad 4.3$$

at very low external group velocity, equal to that of zero-point: $v \rightarrow v_0$, when the eqs. (4.1 and 3.5) are valid, tends to:

$$\frac{\mu_\eta^{in}}{\mu_B} \rightarrow \left(\frac{\eta^{in}}{i^{in}} \right)_0^{1/2} = \left(\frac{v_{ph}^{in}}{v_{gr}^{in}} \right)_0^3 = \frac{1}{[1 - \alpha]^{1/6}} \quad 4.4$$

This value is very close to experimental one: $(\mu_e / \mu_B)_{\text{exp}} = 1.00115965221$

The notion of Dirac’s magnetic monopole is replaced in our model by the notion of internal magnetic component of electromagnetic charge (η^{in}).

The Lienor-Vihert’s vector (\vec{A}) and scalar (ϕ) potential, producing by moving elementary

charge with velocity (\vec{v}) (Landau and Lifshiz, 1988) are equal to:

$$\vec{A} = \frac{\mathbf{e}\vec{v}}{c\left(R - \frac{vR}{c}\right)} \quad 4.5$$

$$\text{and } \phi = \frac{\mathbf{e}}{\left(R - \frac{vR}{c}\right)} \quad 4.6$$

Dividing (4.5) to (4.6) and taking into account (3.5), we get:

$$\left(\frac{\vec{A}}{\phi}\right)^2 = \left(\frac{\vec{v}}{c}\right)^2 = 1 - \frac{m_C^-}{m_C^+} \quad 4.7$$

The electromagnetic energy, corresponding to maximum potential of the electron, is expressed in our model as an internal interaction energy between elementary internal electric (i^m) and magnetic (η^m) charges, separated by the radius (L^\pm) of [real+mirror] mass-dipole. This value is equal to radius of cumulative virtual cloud (CVC), produced by quantum beats between real and mirror states of the electron's ($2V^- + V^+$) uncompensated sub-elementary particle (V^-):

$$[E_{el}^{\max}]_e = \left(\frac{[i \cdot \eta]^m}{L^\pm} = \frac{\mathbf{e}^2}{L^\pm}\right)_e = \alpha|m_C^+ - m_C^-|_e \cdot c^2 = \alpha(m_C^+ \cdot v^2)_e \quad 4.8$$

$$\text{or : } [E_{el}^{\max}]_e = \alpha \cdot 2[T_{kin}]_e \quad 48a$$

where $\alpha = e^2/\hbar c = e^2/Q^2$ is a fine structure constant, which determines the isotropic component of CVC; $Q^2 = \hbar c$ is a total charge squared; v is the external group velocity of particle in [C] state.

The total electromagnetic potential of proton with positive charge, determined by fractional charges of three uncompensated antineutrinos of three quarks, is equal to that of the electron, but with opposite sign. It can be expressed in similar way:

$$[E_{el}^{\max}]_p = \left(\frac{i \cdot \eta}{L^\pm} = \frac{\mathbf{e}^2}{L^\pm}\right)_p = \alpha|m_C^+ - m_C^-|_p \cdot c^2 = \alpha(m_C^+ \cdot v^2)_p \quad 4.9$$

$$\text{or : } [E_{el}^{\max}]_p = \alpha \cdot 2[T_{kin}]_p \quad 4.9a$$

From eq.2.9 the electron's and proton's mass-dipole characteristic dimensions, equal to radius of their CVC, should be equal to each other:

$$[L^\pm = \hbar/P^\pm]_{e,p} = [\hbar/(m_C^+ - m_C^-)c = \hbar/(m_C^+ \cdot v^2/c)]_{e,p} \quad 4.10$$

$[L^\pm]_{e,p}$ characterizes the distance between real and mirror masses of mass-dipole and between magnetic and electric components of electromagnetic charge, distributed over CVC for electron and proton. As far the mass of proton is much bigger, than that of the electron: $m_p \gg m_e$, it leads from the right part of eq.4.10 that the external group velocity of proton should be much smaller than that of the electron.

The dependence of electromagnetic potential on distance (r) is like:

$$\left[E_{el}(r) = E_{el}^{\max} \cdot \frac{\vec{r}}{r} \right]_{e,p} \quad 4.11$$

where: \vec{r} is the unitary radius-vector.

From condition: $[E_{el}^{tot}]_e = [E_{el}^{tot}]_p$, and equality of real kinetic energies of the electron and proton (see 4.8 and 4.9) $2T_k^e = (m_C^+ \cdot v^2)_e = (m_C^+ \cdot v^2)_p = 2T_k^p$, we got the following interrelation between their real external impulses, masses and corresponding group velocities:

$$\frac{P_P^+}{P_e^+} = \left[\frac{(m_C^+)_P}{(m_C^+)_e} \right]^{1/2} = \frac{v_e}{v_P} \quad 4.12$$

At the conditions of Golden mean, when: $[\Delta m_C = m_C^+ - m_C^-]_e^S = m_0$ (see eq. 3.12), eqs. 4.8 and 4.11 turns to:

$$E_{el}^S(r) = E_{el}^{\max} \cdot \frac{\vec{r}}{r} = \frac{e^2}{L_0} \cdot \frac{\vec{r}}{r} = \alpha \cdot m_0 c^2 \cdot \frac{\vec{r}}{r} \quad 4.13$$

where : $L_0 = \hbar/m_0 c = 3.86 \times 10^{-13}$ m is a Compton radius of the electron

As far the Compton radius is in fact experimental parameter, obtained from analysis of scattering of photons on the electrons, we may conclude, that the Nature in its way of matter creation follows the principle of Hidden harmony or Golden mean, indeed.

The Compton radius of the electron is an averaged value of the real internal real (L^+) vortex and mirror (L^-) rotor radiuses, as it leads from our model:

$$L_0 = (L^+ \cdot L^-)^{1/2} = [\hbar/(m_C^+ \cdot v_{gr}^{in}) \cdot \hbar/(m_C^- \cdot v_{ph}^{in})]^{1/2} = \hbar/m_0 c \quad 4.14$$

equal to the radius of cumulative virtual cloud (CVC) and that of ground bi-vacuum bosons (BVB $^\pm$) at conditions of Hidden Harmony:

$$(L^\pm)^S = \hbar/(m_C^\pm - m_C^\mp)^S c = L_0 = \hbar/m_0 c \quad 4.15$$

\vec{r} is radius-vector; $r \geq |\vec{r}| = L_0$ is the distance from the electron.

The averaged hidden impulse of the electron is determined by product of internal real and mirror impulses: $P_{in}^+ = m_C^+ \cdot v_{gr}^{in}$ and $P_{in}^- := m_C^- \cdot v_{ph}^{in}$. Taking into account that $m_C^+ \cdot m_C^- = m_0^2$ and $v_{gr}^{in} \cdot v_{ph}^{in} = c^2$ we get:

$$P_0 = (P_{in}^+ \cdot P_{in}^-)^{1/2} = \pm m_0 c \quad 4.16$$

From the principle of uncertainty in coherent form:

$$L_0^2 \cdot P_0^2 = \left(\frac{\hbar}{2} \right)^2 \quad 4.17$$

we find out that the internal mechanic moment of the electron in the units of Plank constant, equal to its spin is:

$$s = \pm \frac{1}{2} \quad 4.18$$

Two possible projections of momentum of real vortex of [C^+] state in form of paraboloid of revolution, for particles and antiparticles to selected direction, determines the sign of spin of fermions, like electron or positron.

The total electromagnetic energy of the electron (E_{el}) can be considered as a part of total energy of wave B, equal to that of cumulative virtual cloud (CVC), determined by the fine structure constant ($\alpha = e^2/\hbar c$) as a factor. This means that the notion of the electric and magnetic components of virtual quanta, responsible for interaction between charged particles, looks to be pertinent for the wave [W] phase of particle only. However, the electric and magnetic components of charge are related to [real vortex + mirror rotor] dipole of corpuscular [C] phase, correspondingly.

The notions of spin, real mass and time also are pertinent only for [C] phase of particle only.

4.1. THE HYDROGEN ATOM

One more evidence in proof of our model is a finding that the Bohr radius of the Hydrogen atom is equal to radius of CVC of the electron and proton, at conditions of Golden mean [$L_0 = (L^\pm)^S$ at $(m_C^+ - m_C^-) = m_0$]:

$$a_B = \frac{\hbar}{\alpha \cdot m_0 c} = \frac{L_0}{\alpha} = 0.529177249 \times 10^{-10} \text{ m} \quad 4.19$$

Corresponding condition of the electron's standing wave with the electron's group velocity on the orbit, equal to: $v = \alpha c$ is:

$$\lambda_B = 2\pi \cdot a_B = \frac{h}{m_0(\alpha c)} \quad 4.20$$

One can see from (4.20), that the Bohr radius can be expressed also via total electromagnetic energy of the electron in "ideal condition" (eq.4.13) as:

$$a_B = \frac{\hbar c}{E_{el}^S} = \frac{Q^2}{E_{el}^S} \quad 4.21$$

where $Q^2 = \hbar c$ is a total charge of the electron, squared, related to the total energy of CVC (see 4.8).

The energy of electrostatic attraction between electron and proton at the hydrogen atom, compensated in Bohr's model by energy of centripetal energy, is proportional to the total electromagnetic energy of the electron at condition of hidden harmony:

$$E_H = \frac{e^2}{a_B} = \alpha \cdot \frac{e^2}{L_0} = \alpha^2 \cdot m_0 c^2 = \alpha \cdot E_{el}^S \quad 4.22$$

The biggest part of energy of cumulative virtual cloud (CVC = [vacuum density + vacuum symmetry waves] \equiv VDW + VSW), resulted from quantum beats of the electron's unpaired sub-elementary particle, is nonparticipating in electromagnetism and is responsible for realization of $[C \rightleftharpoons W]$ duality and stabilization of elementary particles. The part of energy of CVC of [W] phase of particle is characterized by radius: $L_0 = \hbar/m_0 c = \alpha \cdot a_B$.

The radius of component of CVC, responsible for interaction between electron and proton, is equal to the Bohr radius (4.19).

The part of CVC, nonparticipating in electromagnetism may be responsible for coherent exchange interaction between two standing neutrinos of the electron [$2V^- + V^+$] with opposite spins and counterphase $[C \rightleftharpoons W]$ pulsation. The energy of this part is equal to:

$$E_{CVC}^W = (E_{VDW} + E_{VSW}) - \alpha(E_{VDW} + E_{VSW}) = (E_{VDW} + E_{VSW}) \cdot (1 - \alpha) \quad 4.23$$

where: $E_{el}^{\max} = \alpha \cdot (E_{VDW} + E_{VSW}) \ll E_{VDW} + E_{VSW}$

The energy of vacuum density waves is $E_{VDW} = |m_C^+ - m_0| \cdot c^2$ and the energy of vacuum symmetry waves is: $E_{VSW} = |m_C^- - m_0| \cdot c^2$

The total CVC moment of the particle in [W] phase, introduced here, is the invariant:

$$d_{tot} = (m_C^+ - m_C^-) \cdot L^\pm = \frac{\hbar}{c} \quad 4.24$$

Using (2.13), the quantization rule for electromagnetic energy (4.8) can be expressed as:

$$nE_{el} = \alpha \cdot n\hbar[\omega_C^+ - \omega_C^-] \quad 4.25$$

At the Hidden harmony/Golden mean condition, we have for the electron's frequency of $[C \rightleftharpoons W]$ pulsation:

$$\omega_0 = [\omega_C^+ - \omega_C^-] = m_0 c^2 / \hbar = 9.03 \cdot 10^{20} \text{ s}^{-1} \quad 4.26$$

and

$$n(E_{el})_e = \alpha \cdot n \hbar \omega_0 = \alpha \cdot n m_0 c^2 = \alpha \cdot n |m_C^+ - m_C^-|_P \cdot c^2 = n(E_{el})_P \quad 4.27$$

where: $\omega_0 = [\omega_C^+ - \omega_C^-]_P = |m_C^+ - m_C^-|_P \cdot c^2 / \hbar$, and $|m_C^+ - m_C^-|_P \ll (m_0)_P$

From this formula one can see that the electromagnetic energy emergence is a result of quantum beats between real and mirror corpuscular states of one uncompensated [vortex+rotor] dipole of the electron and three of them in proton's quarks with fractional charge ($+\frac{1}{3}$).

The formula (4.25) and our presentation of elementary wave B as a dynamic system of [real vortex+mirror rotor] dipole get support from the known expression of vector analysis (4.28). We can express the divergency of Pointing vector: $P = (c/4\pi)[EH]$ via difference of contributions, related to real and mirror rotors:

$$\text{div}[EH] = \frac{4\pi}{c} \text{div}P = H \text{rot}E - E \text{rot}H \quad 4.28$$

where H and E are the magnetic and electric components of virtual photons, radiated by electron in course of quantum beats between real and mirror phase of uncompensated bi-vacuum excitation in a course of its $[C \rightleftharpoons W]$ pulsation.

The analogy between (4.25) and (4.28), illustrating the dynamics of [vortex+rotor] dipole background of (4.25), is evident.

4.2. THE MECHANISM OF ELECTROMAGNETIC INTERACTION

In accordance to model, the mechanism of electromagnetic repulsion and attraction between charged particles is a result of realization of principle of least action in our formulation. It means tendency of system to minimum of resulting density of energy of cumulative virtual cloud (CVC) (see eq.6.4), interrelated with vacuum symmetry shift ($\Delta m_V = |m_V^+ - m_V^-|$) and mass symmetry shift ($\Delta m_C = |m_C^+ - m_C^-|$) as one can see from eq. 5.8.

The repulsion is a consequence of streaming of two particle with similar charge to increase the distance between them, as far it minimize the density of energy of CVC of the same sign . The electromagnetic attraction is a consequence the same principle, because of two CVC of the opposite energy are tending to compensate the influence of each other, decreasing the resulting energy of CVC as a cluster of virtual photons. The closer are opposite charges to each other, the more symmetric becomes energy distribution and resulting vacuum and mass symmetry shift.

In the case of the electron and positron scattering, their opposite by energy cumulative virtual clouds: CVC^- and CVC^+ - transform to the high energy photon structure after overlapping, leading to annihilation of e^- and e^+ . The energy of such photon is:

$$h\nu_{ph} = [(m_C^+ - m_C^-)_{e^-} + (m_C^+ - m_C^-)_{e^+}]c^2 \quad 4.29$$

At the Golden mean condition this formula change to:

$$h\nu_{ph} = 2m_0c^2 \quad 4.30$$

In general case the energy of photon as a result of annihilation: $[e^- + e^+] \rightarrow [(2V^- + V^+) + ([2V^+ + V^-])]$ can be more than $2m_0c^2$, depending on velocity of their colliding. If the energy of photon is more than $2m_0c^2$, it can split to [electron+positron] pair again at certain conditions.

4.3. Alternative Corpuscle-Wave model of atom

Besides planetary model of hydrogen atom of Bohr-Sommerfeld, our duality approach allows to propose the new one. It is assumed that $[C \rightleftharpoons W]$ pulsations of the electrons and nuclear of atom are in-phase.

We suppose also, that the electrons in the $[C]$ phase has an ability for limited jumps along line tangent to orbit around the nuclear. The length of one jump (l_0) is determined by period of the electron $[C \rightleftharpoons W]$ pulsation: $T_0 = 2\pi \cdot \omega_0$ (4.26) at Golden mean condition and its external group velocity ($v = \alpha c$):

$$l_{lb} = T_0 \cdot v = \alpha \frac{h}{m_0 c} = \alpha L_0 \quad 4.31$$

This real $[C]$ - jump of the electron is much smaller than the length of Bohr's orbit (4.20). Their ratio is equal to fine structure constant squared:

$$l_{lb}/(2\pi a_B) = \alpha^2 \quad 4.32$$

The stage of the electron-proton interaction, corresponding to $[W]$ phase of atom, represents a superposition of part of their CVC with equal wave B length, determined by Bohr radius (4.19) in form of virtual 3D standing wave. Such 3D standing wave, reflecting $[W]$ phase of atom is not dissipating. It is formed by compensating each other virtual photons of opposite energy. The total absolute value of such energy of electromagnetic interaction in Hydrogen atom is:

$$E_{el}^H = 2\alpha^2 \cdot m_0 c^2 \quad 4.33$$

At the following semiperiod the atom returns to its $[C]$ phase and the electron makes its next corpuscular jump around nuclear. As far the real time in virtual $[W]$ phase is absent (see section: "The principle of least action and problem of time"), this phase is out of perception and it looks that the electron in $[C]$ phase is in the process of permanent rotation along the orbit.

The density of charge is oscillating in a course of $[W \rightleftharpoons C]$ pulsations of the [electron+proton] and its movement around nuclear. It means that the interpretation of Van-der-Waals interaction as a result of coherently flickering charge of atoms/molecules remains valid in our model.

In atoms, containing one or integer number of the electrons pairs with opposite spins of the electrons, their counterphase $[C-W]$ cycles of each selected [electron + proton] pair - are accompanied by 3D standing waves formation, which are more symmetric and stable, than in atoms with unpaired valent electrons.

Unification of atoms in a course of different reactions, accompanied by unification of unpaired valent electrons and creation of additional symmetric standing waves B, is energetically favorable. Molecules could be considered as a highly orchestrated dynamic systems, where the $[W \rightleftharpoons C]$ pulsations of all protons, neutrons and electrons are coherent with frequency (4.26), corresponding to Hidden harmony condition for the electron.

4.4. New interpretation of Coulomb interaction between macroscopic bodies.

Let us proceed from assumption, that the interaction (attraction or repulsion) between charged macroscopic bodies is a result of averaging of their electromagnetic potentials, depending on their average charge, squared ($q_{1,2}^2$) and the distance between centers of bodies ($r_{1,2}$):

$$q_{1,2}^2 = \pm(q_1 \cdot q_2) \quad 4.34$$

$$r_1 = r_2 = r_{1,2}$$

Consequently, the Coulomb interaction between these bodies, taking into account dielectric permeability (ϵ), can be expressed as:

$$E_C = -\frac{q_1 \cdot q_2}{\epsilon r_{1,2}} = -\frac{q_{1,2}^2}{\epsilon r_{1,2}} \quad 4.35$$

The analog of this formula, leading from our theory (see eq.4.8):

$$E_C^* = -\frac{\vec{r}}{r_{1,2}} [E_1 \cdot E_2]^{1/2} = -\frac{\vec{r}}{r_{1,2}} \alpha \cdot c^2 \left[\sum_{i=1}^{N_i} (m_C^+ - m_C^-)_i \cdot \sum_{j=1}^{N_j} (m_C^+ - m_C^-)_j \right]^{1/2} \quad 4.36$$

where N_i and N_j are the numbers of sub-elementary uncompensated charges in the volume of first and second body; (\vec{r}) is the unitary radius-vector.

If we denote the total mass symmetry shift (difference between real, inertial and mirror, inertialess mass) for each of bodies as a sum of contributions of all elementary charges in its volume:

$$\Delta m_1 = \sum_{i=1}^{N_i} (m_C^+ - m_C^-)_i \quad \text{and} \quad \Delta m_2 = \sum_{j=1}^{N_j} (m_C^+ - m_C^-)_j \quad 4.37$$

we get from (5.1):

$$E_C = -\frac{\vec{r}}{r_{1,2}} \alpha c^2 \cdot \Delta m_1^{1/2} \Delta m_2^{1/2} = -\frac{\vec{r}}{r_{1,2}} \alpha \Delta m_{1,2} \cdot c^2 \quad 4.38$$

where the averaged mass symmetry shift of uncompensated elementary charges of two bodies is: $\Delta m_{1,2} = \pm(\Delta m_1 \cdot \Delta m_2)^{1/2}$.

From the comparisons of 4.38 and 4.35, we find the expressions for total charges of two bodies in terms of our model:

$$q_1 = (\vec{r}\epsilon)^{1/2} \cdot \alpha^{1/2} \Delta m_1^{1/2} \cdot c \quad 4.39$$

$$q_1 = (\vec{r}\epsilon)^{1/2} \cdot \alpha^{1/2} \Delta m_2^{1/2} \cdot c \quad 4.40$$

The averaged resulting charge, squared of two interacting bodies is

$$q_{1,2}^2 = (\vec{r}\epsilon) \cdot \alpha \Delta m_{1,2} \cdot c^2 \quad 4.41$$

As far, in accordance to our theory (see eq. 4.8), the mass symmetry shift of elementary charge (Δm_C) is related to its kinetic energy as: $\Delta m_C \cdot c^2 = m_C^+ \cdot v^2$, the eq.(4.41) for resulting charge may transformed to:

$$q_{1,2}^2 = (\vec{r}\epsilon) \cdot \alpha m_{1,2}^+ \cdot v^2 \quad 4.42$$

where: $m_{1,2}^+ = (m_1^+ \cdot m_2^+)^{1/2}$ is the resulting/averaged real corpuscular mass of two charged bodies; v is the resulting group velocity of all elementary charges of bodies, depending on their coherent thermal oscillations and relative macroscopic movement of two bodies, without the change of distance between centurms of their mass ($r_{1,2}$). The simplest kind of such movement is the relative spinning/rotation of bodies.

The biggest contribution of resulting kinetic energy to (4.42) is mostly due to in-phase microscopic atomic/molecular oscillations in the volume of coherent clusters, resulting from high-temperature Bose condensation, in accordance to our Hierarchic theory of condensed matter (see: <http://arXiv.org/find/cond-mat,physics/1/au:+kaivarainen/0/1/0/past/0/1>). This contribution depends on temperature and the external fields tension, affecting the dynamics of lattice of bodies.

Substitution of 4.41 or 4.42 to 4.35, will lead to eq.4.43, unifying our approach and Coulomb interaction.

Taking into account that $q_{1,2}^2 = n^2 e^2$, where n is the integer number and $\alpha = e^2/\hbar c$, this formula can be driven to:

$$n^2 = \frac{q_{1,2}^2}{\hbar \alpha} = (\vec{r}\epsilon)_{x,y,z} \left(\frac{\Delta m_{1,2} \cdot c}{\hbar} \right)_{x,y,z} = (\vec{r}\epsilon)_{x,y,z} (k_{1,2})_{x,y,z} \quad 4.43$$

where $(\epsilon)_{x,y,z}$ is a tensor of dielectric permeability and $(k_{1,2})_{x,y,z} = (\Delta m_{1,2} \cdot c/\hbar)_{x,y,z}$ is a resulting for system of two bodies the Compton's wave number tensor, determined by the sum of their uncompensated elementary charges mass symmetry shift.

At the conditions of Golden mean, when: $|m_C^+ - m_C^-| = m_0$ we have:

$$m_1 = N_1 m_0; \quad \Delta m_2 = N_2 m_0 \quad \text{and} \quad \Delta m_{1,2} = m_0 (N_1 N_2)^{1/2} \quad 4.44$$

where N_1 and N_2 are the numbers of uncompensated elementary charges in the first and second bodies, correspondingly.

For the case of isotropic dielectric permeability, we get from 4.38:

$$[n^2/(\vec{r}\epsilon)]^3 = (c/\hbar)^3 \cdot (\Delta m_{1,2})_x \cdot (\Delta m_{1,2})_y \cdot (\Delta m_{1,2})_z = const \quad 4.45$$

For Newtonian gravitation we get the similar formulae, replacing α to $\beta = (m_0/M_{Pl})^2$. (see 5.2). This phenomena, responsible for electro-gravitational interaction, will be discussed at the next section.

The effect of spinning on electromagnetic and gravitational interaction

Using the relation between (4.41) and (4.42), we get from (4.45):

$$[n^2/(\vec{r}\epsilon)]^3 = c/\hbar^3 \cdot (mv_{1,2}^2)_x \cdot (mv_{1,2}^2)_y \cdot (mv_{1,2}^2)_z = const \quad 4.46$$

These formulae leads to important conclusion: the increasing of velocity of relative rotation of two charged bodies in plane (x,y), normal to (z, parallel to \vec{r}) will be accompanied by relativist enhancement of product $[(\Delta m_{1,2})_x \cdot (\Delta m_{1,2})_y] \sim [(mv_{1,2}^2)_x \cdot (mv_{1,2}^2)_y]$ and corresponding decreasing of $(\Delta m_{1,2})_z$ and $(mv_{1,2}^2)_z$. **This means decreasing of Coulomb and gravitational interaction between two rotating bodies.**

5. GRAVITATION

The total gravitational potential of particle is introduced in our model as the energy of gravitational attraction between real and mirror corpuscular masses, separated by wave B dipole length ($L^\pm = \hbar/P^\pm$ see eq. 4.10) of uncompensated sub-elementary particle in composition of triplets of particles. The vacuum symmetry shifts, produced by each of sub-elementary particle and sub-elementary antiparticle in coherent pairs [$V^+ \bowtie V^-$] compensate each other, increasing the value of energetic slit between positive and negative vacuum. However, the vacuum symmetry shift remains unchanged.

The formula obtained for gravitation, are very symmetric to those, obtained for electromagnetism (4.8 – 4.27). The maximum of gravitational potential, produced by one sub-elementary particle (V^+) or sub-elementary antiparticle (V^-):

$$E_G^{\max} = G \cdot \frac{m_C^+ \cdot m_C^-}{L^\pm} = G \cdot \frac{m_0^2}{L^\pm} = \beta \cdot |m_C^+ - m_C^-|_{v_0, \vec{v}_0} \cdot c^2 = \beta \cdot (m_C^+ \cdot v^2)_{v_0, \vec{v}_0} \quad 5.1$$

$$\text{or : } E_G^{\max} = \beta \cdot 2(T_{kin})_{v_0, \vec{v}_0} \quad 5.1a$$

$$\text{where } \beta = (m_0/M_{Pl})^2 \quad 5.2$$

is a new dimensionless Gravitational Fine Structure (β), introduced in our theory, containing the Plank mass squared $M_{Pl}^2 = \hbar c/G$;

$$E_B^\pm = |m_C^+ - m_C^-| \cdot c^2 = m_C^+ v^2 = 2T_k^{ext} \quad 5.2a$$

is a total energy of wave B as a quantum harmonic oscillator, equal to its doubled real kinetic energy ($E_B^\pm = 2T_k^{ext} = T_k^{ext} + V$).

The decreasing of maximum of gravitational potential with distance, like that of electromagnetic one, can be expressed as:

$$E_G(r) = E_G^{\max} \cdot \frac{\vec{r}}{r} \quad 5.3$$

where $|\vec{r}|$ is a unitary radius-vector of gravitating particle or body; $r \geq |\vec{r}|$ is a distance from the particle.

Using (2.13), the quantization rule of gravitational energy (5.1), resulted from beats between positive (m_V^+) and negative (m_V^-) ground states of secondary bi-vacuum, can be expressed as:

$$\begin{aligned} nE_G &= \beta \cdot n\hbar \cdot |\omega_C^+ - \omega_C^-|_{v_0, \vec{v}_0} = n \cdot |m_V^+ - m_V^-|_{v_0, \vec{v}_0} \cdot c^2 \\ &= n \cdot h\nu_G = n \cdot h(c/\lambda_G) \end{aligned} \quad 5.4$$

where: $n = 1, 2, 3, \dots$ is the integer number; ν_G is frequency of gravitational waves (GW), equal to frequency of quantum beats between positive and negative vacuum states;

$$\lambda_G = h/[|m_V^+ - m_V^-|_{v_0, \vec{v}_0} \cdot c] \quad 5.5$$

is the length of gravitational wave, produced by one elementary particle/antiparticle.

For particle the difference: $|\omega_C^+ - \omega_C^-| \sim |m_V^+ - m_V^-|$ is positive and for antiparticles it is negative. However, just the absolute value of this difference determines the frequency and energy of gravitational field. It means that particles and antiparticles with identical mass generate the equal gravitational potential.

From the right part of eqs. 4.9 and 5.1, it is easy to show after differentiation, that:

$$d \ln E_{el} = d \ln E_G = d \ln T_{kin} = d \ln m_C^+ + 2d \ln v \quad 5.6$$

It is convincing formula, demonstrating unification of electromagnetism and gravitation in the framework of our theory in very clear way.

At the conditions of Hidden harmony (3.7), necessary for Golden mean realization (3.8), when condition (3.12) is fulfilled, the eqs. (5.1-5.4) transforms to:

$$E_G^S(r) = n \cdot \beta \cdot m_0 c^2 \cdot \frac{\vec{r}}{r} = n \cdot \beta \cdot \hbar \omega_0 \cdot \frac{\vec{r}}{r} \quad 5.7$$

where zero-point frequency is defined from the mass of rest of the electron: $\omega_0 = m_0 c^2 / \hbar$, equal to frequency of quantum beats between real and mirror states of [C] phase at conditions of Hidden harmony.

The gravitational waves, could be considered as a result of quantum beats between positive and negative bi-vacuum ground states: m_V^+ and m_V^- , pertinent to [C] phase. We assume that asymmetry of real and mirror corpuscular masses of uncompensated standing neutrinos or antineutrinos of fermions - the mass symmetry shift: $\Delta m_C = |m_C^+ - m_C^-|$ induce corresponding bi-vacuum symmetry shift:

$$\Delta m_V = |m_V^+ - m_V^-| = \beta |m_C^+ - m_C^-| = \beta \cdot \Delta m_C \quad 5.8$$

where: $m_V^+ = |E_V^+/c^2| = \beta \cdot m_C^+$ and $m_V^- = |E_V^-/c^2| = \beta \cdot m_C^-$ are the absolute effective masses of positive and negative ground vacuum states correspondingly;

The new fundamental constant: Gravitational fine structure [by analogy with electromagnetic fine structure $\alpha = (e/Q)^2 = e^2/\hbar c$] is equal to:

$$\beta = \frac{\Delta m_V}{\Delta m_C} = \left(\frac{m_0}{M_{Pl}} \right)^2 = 1.7385 \cdot 10^{-45} \quad 5.9$$

where the Plank mass: $M_{Pl} = (\hbar c/G)^{1/2} = Q/G^{1/2}$ (Q is a total charge).

The Gravitational fine structure may be represented as a ratio of surfaces of bi-vacuum bosons (BVB), with Plank's ($S_{Pl} = \pi L_{Pl}^2 = \pi(\hbar/M_{Pl} \cdot c)^2$) and electron's Compton's ($S_0 = \pi L_0^2 = \pi(\hbar/m_0 \cdot c)^2$) radiuses:

$$\beta = \frac{S_{Pl}}{S_0} \quad 5.10$$

It follows from (5.9) that the sign and value of mass symmetry shift: $\Delta m_C = \pm(m_C^+ - m_C^-)$ for particle/antiparticle are interrelated with the sign and value of vacuum symmetry shift: $\Delta m_V = \pm(m_V^+ - m_V^-)$ in the point of particle localization.

At the Golden mean condition: $[\Delta m_C = |m_C^+ - m_C^-|]^S = m_0$, we get from (5.9) the vacuum symmetry shift:

$$[\Delta m_V]^S = \frac{m_0^3}{M_{Pl}^2} \quad 5.11$$

The corresponding to this condition curvature of bi-vacuum bosons (BVB) Bose condensate:

$$[L_{BVC}]^S = \frac{\hbar}{[\Delta m_V]^S \cdot c} = \frac{1}{\beta} \cdot \frac{\hbar}{m_0 c} = \frac{L_0}{\beta} = 2.22 \cdot 10^{32} \text{ m} \quad 5.12$$

The analogy is existing between the "polaron" - quantum excitation in ionic crystals and particle in [C] state. Polaron in condensed matter represents the mobile pair with dipole properties [electron + lattice polarization]. For the other hand, the sub-elementary particle of elementary particle in [C] phase we consider as a "mass - dipole" with resulting charge (Δm_C), coexisting with vacuum polarization, termed in our model - bi-vacuum symmetry shift (Δm_V).

The mass and mobility of system: [(C-phase) + vacuum symmetry shift] depends on the absolute value of vacuum polarization: Δm_V .

Equalizing the wave B dipole length, equal to radius of CVC, presented in form: $L_d = \hbar c/(m_C^+ v^2)$ and gravitational Schwarzschild radius: $r_g = 2Gm_C^+/c^2$, corresponding to radius of black hole, we get the condition of black hole emergency for relativist particle like electron, when $L_d \rightarrow r_g$:

$$m_C^+ v = m_0 v / [1 - (v/c)^2]^{1/2} = M_{Pl} \cdot c \quad 5.13$$

At this limit condition the de Broglie wave length of particle, i.e. electron, as a mini black hole is determined by the Plank's mass:

$$L_{Pl} = \hbar/(M_{Pl} \cdot c) = 1.61605 \times 10^{-35} \text{ m} \quad 5.14$$

Corresponding to black hole radius of secondary bi-vacuum Bose condensate curvature is:

$$[L_{BVC}]^g = \frac{\hbar}{\beta \cdot M_{Pl} \cdot c} = \frac{L_{Pl}}{\beta} \sim 10^9 \text{ m} \quad 5.15$$

It is still pretty big even under condition of mini-black hole origination.

5.1. POSSIBLE MECHANISM OF GRAVITATIONAL INTERACTION

It can be similar to hydrodynamic Bjorkness interaction between pulsing particles in liquids, radiating acoustic waves. We suppose that gravitational waves, resulted from quantum beats between positive and negative ground states of vacuum, decreasing the vacuum symmetry shift, are decreasing also the virtual quanta pressure between particles more than outside of them. This leads to excessive outside vacuum pressure, providing the gravitational attraction between bodies.

In accordance with the existing theory of Bjorkness force, it is dependent on distance between pulsing bodies or microbubbles in liquid - as $(1/r^2)$.

It is important that this force could be positive and negative, depending on difference of phase of pulsations, generating density waves. 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 bodies, is less or comparable with the distance between bodies, the Bjorkness (gravitational) force is attractive. If the distance is much bigger than wave length, then the attraction of bodies turns to repulsion. This mean origination of 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 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. This confirms our hydrodynamic model of mechanism of gravitation.

Like electromagnetic interaction, the gravitational one can be considered as a result of principle of least action realization (see eq. 6.4). For this end we have to assume, that the resulting vacuum symmetry shift, represented by sum of contributions of (Δm_V) between bodies and outside of them - decreases with decreasing the distance between them.

For the other hand, if the starting separation between bodies (L) is big enough:.

$$\mathbf{L} > L_{BVC} = \hbar/[\Delta m_V \cdot c] \quad 5.16$$

then the increasing of this separation minimize the resulting vacuum symmetry shift, i.e. we have a gravitational repulsion.

The gravitational interaction is related to the very low-energy virtual quanta pressure oscillation between positive and negative zero-point vacuum, which may be termed as under-zero-point virtual quanta $(-\frac{1}{2}\hbar\omega_0 < E_{SV} < +\frac{1}{2}\hbar\omega_0)$, in contrast to virtual quanta with energy, bigger than absolute value of zero-point energy: $|\pm\frac{1}{2}\hbar\omega_0|$.²

The gravitational interaction is displayed itself as a result of bi-vacuum symmetry shift and corresponding virtual pressure emergency:

$$\Pi_V \sim \Delta m_V \cdot c^2 \quad 5.17$$

The quantum beats between bi-vacuum sublevels, exciting the gravitational waves (GW) with frequency

$$\nu_{GW} = \frac{c^2}{h} \left(\left| m_V^+ - \frac{1}{2}m_0^+ \right| + \left| m_V^- - \frac{1}{2}m_0^- \right| \right) \quad 5.18$$

decreases the Δm_V and Π_V .

Consequently, the GW represents the density/pressure oscillations of the under zero-point virtual quanta, excited as a consequence of beats between positive and negative vacuum states, formed by bi-vacuum bosons Bose condensate. In another terms, GW can be considered as a result of interference between vacuum symmetry waves (VSW⁺ and VSW⁻). In the framework of our model there are no evidence, pointing to luminal limitation of gravitational waves propagation.

It contrast to gravitational field, the electromagnetic field is a result of quasi-real vacuum

density waves (VDW) interference, enable to impulse and energy transmission.

Comparing our formulae for total electromagnetic (4.8) and gravitational (5.1) energies, we get the relation between them:

$$\frac{E_{el-m}}{E_G} = \frac{\alpha}{\beta} = \frac{e^2}{Gm_0^2} = 4.1975 \cdot 10^{42} \quad 5.19$$

These results and ones, presented below point out, that our model may serve as very clear **background for Superunification**.

5.2. The interrelation of new model and general theory of relativity

It is possible to demonstrate a relation between Einstein's idea concerning curving the geometry of space in the presence of gravitating body and our vacuum symmetry shift parameter:

$$\Delta m_V = |m_V^+ - m_V^-| = \beta \cdot |m_C^+ - m_C^-| \quad 5.20$$

Einstein postulates that gravitation changes the trajectory of probe body from the right to geodesic one due to curving conventional two-dimensional surface in 3D space. For example, trajectories of planets round the sun corresponds to geodesic lines.

Instead Euclid geometry on flat surface, the Lobachevsky geometry on curved surface was used in Einstein's classic theory of gravitation. The criteria of surface curvature for sphere is a curvature radius (R), defined as:

$$R = \sqrt{\frac{S}{\Sigma - \pi}} \quad 5.21$$

where sum of angles in triangle on the flat surface is equal to $\pi = 180^0$, and that on curved surface:

$$\Sigma = \pi + S/R^2 \quad 5.22$$

where S is a square of triangle on the flat surface; R is a sphere radius.

When $(\Sigma - \pi) > 0$, the curvature ($R > 0$) is positive; when $(\Sigma - \pi) < 0$, the curvature R is imaginary and corresponding space is negative. If the space (surface) is flat, then $R = \infty$ and $\Sigma = \pi = 180^0$.

In our Wave - Corpuscle Duality Model of Gravitation instead space-time curvature R we introduce a Bi-Vacuum Symmetry Curvature, defined as:

$$\pm L_V = \pm \frac{\lambda_{vac}}{2\pi} = \frac{\hbar}{\pm \Delta m_V \cdot c} = \frac{\hbar}{\pm \beta \Delta m_C \cdot c} \quad 5.23$$

where: $\pm \Delta m_V = \pm (|m_V^+| - |m_V^-|) = \pm \beta \Delta m_C$ is a vacuum symmetry shift, positive for particles and negative for antiparticles, related directly to mass symmetry shift.

It is possible to calculate, using (2.9 and 5.23) that vacuum curvature, induced by particle with mass, equal to that of the electron at Golden mean condition (3.12)

($m_e = 9.1095 \cdot 10^{-31} kg$) is: $L_V^e = 3.2288 \cdot 10^{35} m$.

For the particle with mass of proton ($m_P = 1.6726 \cdot 10^{-27} kg$) we have: $L_V^P = 5.212 \cdot 10^{25} m$.

The maximum of gravitational potential, produced by one proton, calculated from (5.1) at condition (3.12) is equal to: $\epsilon_G^P = 8.8904 \cdot 10^{-52} J$.

The analogy between R and L_{vac} (5.22 and 5.23) is obvious. The more is energy of

gravitational field ϵ_G , the more is vacuum symmetry shift (Δm_V) and bi-vacuum curvature. The bigger is bi-vacuum curvature, the less is radius (L_V).

In condition of black hole origination, when $\Delta m_V \rightarrow \beta M_{Pl}$ the bi-vacuum curvature radius tends to that, determined by gravitational radius (r_g) of black hole and Plank length (see 5.15):

$$L_{Vac}^* = \frac{\hbar}{\beta M_{Pl} \cdot c} = r_g / 2\beta \quad 5.24$$

On the other hand, in the absence of gravitation, when the positive and negative vacuum ground states are in state of ideal symmetry and equilibrium:

$$| m_V^+ | = | m_V^- | = \frac{1}{2} m_0 = \frac{1}{2} m_C \quad 5.25$$

and $\Delta m_V = 0$, then the bi-vacuum is flat: $L_{Vac} = \infty$.

The photons trajectory reflects the bi-vacuum curvature in 3D space. It is a consequence of our model of photon as a superposition of three pairs of coherent pair [$V^+ + V^-$], moving in bi-vacuum without its symmetry perturbation.

The trajectory of photon follows the bi-vacuum Bose condensate radius and in general case deviate from the straight line, corresponding to "flat" primordial bi-vacuum in the absence of matter. Near the black holes it turns to the closed one as a result of corresponding bi-vacuum symmetry violation.

As well as General theory of relativity our theory can explain the red shift of photons in gravitational field. The RED, low-frequency shift:

$$\Delta \omega_p^{1,2} = \omega_p^{(1)} - \omega_p^{(2)} \quad 5.26$$

of photons in gravitation field is a result of deviation of their trajectory from the right line and is a consequence of increasing the vacuum symmetry curvature and corresponding length of its path.

In accordance to our model, red shift has a simple relation to difference of vacuum symmetry shifts at point of photon radiation: $\Delta m_V^1 = (| m_V^+ | - | m_V^- |)^1$ and at point of it registration $\Delta m_V^{(2)} = (| m_V^+ | - | m_V^- |)^{(2)}$:

$$\Delta \Delta m_V^{1,2} = \Delta m_V^{(1)} - \Delta m_V^{(2)} \quad 5.27$$

in a form:

$$\hbar \Delta \omega_p^{1,2} = \Delta \Delta m_V^{1,2} \cdot c^2 \quad or : \quad \Delta \omega_p^{1,2} = \frac{\Delta \Delta m_V^{1,2} \cdot c^2}{\hbar} \quad 5.28$$

It is easy to see that if $\Delta \Delta m_V^{1,2} = 0$, i.e. bi-vacuum is flat, then $\omega_p^{(1)} = \omega_p^{(2)}$ and red shift is absent.

We may conclude, that our Duality Model of Gravitation explains the same phenomena, as do the General theory of relativity, but in terms of vacuum symmetry shift with tensor properties, instead of curved space-time. The tensor properties of bi-vacuum symmetry shift is related directly to that of mass symmetry shift: $(\Delta m_V = \beta \Delta m_C)_{x,y,z}$, produced by asymmetry of relativist real mass dependence on the external group velocity in 3D space.

5.3. New interpretation of Newtonian interaction between macroscopic bodies.

Let's compare the formulae of Newtonian gravitational attraction between two macroscopic bodies and gravitational potentials of these bodies, leading from our theory (5.1, 5.3):

$$E_G = G \frac{m_1 \cdot m_2}{r_{1,2}} = G \frac{m_{1,2}^2}{r_{1,2}} \quad 5.29$$

$$E_G^{\max} = \frac{\vec{r}}{r_{1,2}} \beta \cdot \sum_{e,p,n}^{1,2} |m_C^+ - m_C^-|_{e,p,n} \cdot c^2 = \frac{\vec{r}}{r_{1,2}} \beta \cdot \sum_{e,p,n}^{1,2} (m_C^+ \cdot v^2)_{e,p,n} \quad 5.30$$

where : $r_{1,2}$ is the distance between centers of bodies;

$m_{1,2} = (m_1 m_2)^{1/2}$ is the averaged mass of two bodies; $\beta = (m_0/M_{Pl})^2$

Using the same considerations, as in section "Electromagnetism", eq. 5.29 turns to 5.30 at conditions:

$$m_1 = (\vec{r})^{1/2} \beta^{1/2} \Delta m_1^{1/2} \cdot c/G^{1/2} = (\vec{r})^{1/2} \beta^{1/2} \cdot (m_C^+)^{1/2} v_{1,2}/G^{1/2} \quad 5.31$$

$$m_2 = (\vec{r})^{1/2} \beta^{1/2} \Delta m_2^{1/2} \cdot c/G^{1/2} = (\vec{r})^{1/2} \beta^{1/2} \cdot (m_C^+)^{1/2} v_{1,2}/G^{1/2}$$

where : $v_{1,2} = (v_1 v_2)^{1/2}$ is the relative resulting velocity;

$$\Delta m_1 = \sum_{e,p,n}^1 |m_C^+ - m_C^-|_{e,p,n} \quad \Delta m_2 = \sum_{e,p,n}^2 |m_C^+ - m_C^-|_{e,p,n}$$

The masses of each body are the result of all elementary particles mass summation. In the Golden mean conditions, as was shown earlier: $|m_C^+ - m_C^-|_{e,p,n} = (m_0)_{e,p,n}$.

It looks, that the existing of such invariant as Avogadro number - confirms our hypothesis, that the elementary particles in composition of atoms and molecules and atoms/molecules itself in any phase of matter are tending to certain ratio (3.15), providing realization of Hidden harmony condition (3.7), as a background of Golden mean rule (3.8).

For the averaged mass, squared, we get from 5.31:

$$m_{1,2}^2 = (\vec{r}) \cdot (m_0/M_{Pl})^2 \cdot \Delta m_{1,2} \cdot c^2/G = (\vec{r}) \cdot (m_0/M_{Pl})^2 \cdot (m_C^+)_{1,2} \cdot v_{1,2}^2/G \quad 5.32$$

If we assume that $(m_{1,2}^2/m_0^2) = N^2$, then, taking into account that $G = \hbar c/M_{Pl}^2$, (5.32) may be transformed to important formula, meaning that the resulting volume in 3D energetic space is permanent:

$$\left(\frac{1}{\vec{r}} N^2 \cdot \hbar c \right)^3 = (\Delta m_{1,2} \cdot c^2)_{x,y,z}^3 = [(m_C^+)_{1,2} \cdot v_{1,2}^2]_{x,y,z}^3 = const \quad 5.33$$

One can see from this formula that if due to any external factors (electric or magnetic fields, relative rotation of interacting bodies, etc., the value of $(\Delta m_{1,2} \cdot c^2)_{x,y}^2 = [(m_C^+)_{1,2} \cdot v_{1,2}^2]_{x,y}^2$ is increasing, the "vertical" component of gravitational interaction $(\Delta m_{1,2} \cdot c^2)_z = [(m_C^+)_{1,2} \cdot v_{1,2}^2]_z$ should decrease. **Such effect corresponds to decreasing of gravitational attraction between bodies.**

The spinning and Biefeld-Brown effects

In the case of charged condensers, the mechanism described, may be responsible for Biefeld-Brown effect. The explanation of this effect is related to polarization of charge and mass of dielectric molecules in electric field in such a way, that massive positive nuclears are shifted towards negative plate of condenser and their oscillations become more anharmonic and asymmetric in 3D space.

In accordance to our Hierarchic theory of condensed matter, significant fraction of

atoms/molecules in solids are composition of coherent clusters, formed as a result of high-temperature Bose condensation (see my: "Hierarchic theory of condensed matter..." at: <http://arXiv.org/find/cond-mat,physics/1/au:+kaivarainen/0/1/0/past/0/1>)

This is an important factor, making the influence of external field on the atoms/molecules charge and mass polarization - cumulative. Correspondingly, the **virial coefficient (n)**, equal to ratio of the resulting doubled kinetic to the averaged potential energy of coherent fraction of positively charged nuclears of dielectric between plates, becomes more anisotropic

$$\left[n = \frac{2\overline{T_k}}{\overline{V}} \right]_{x,y,z}$$

$$\left[V(r) \sim r^n \right]_{x,y,z}$$

. For the other hand, in accordance to this theory, between tensors of mass symmetry shift, responsible for electromagnetism, and tensor of vacuum symmetry shift, responsible for gravitation, - the direct correlation exists: $(\Delta m_V = \beta \Delta m_C)_{x,y,z}$.

The decreasing of resulting component of tensor in direction of positively charged plate of condenser (+):

$$(\Delta m_{1,2} \cdot c^2)_z^+ = [(m_C^+)_{1,2} \cdot v_{1,2}^2]_z^+ = [2T_k]_z^+ \quad 5.34$$

corresponds to decreasing of gravitational attraction and electromagnetic interaction presumably in this direction (+z) as respect to directions, opposite (-z) and normal ($\pm x, \pm y$) to this one. This may explain the asymmetric Biefeld-Brown effect.

If both plates of condenser have the same charge, then independently of sign of charge, the amplitude and kinetic energy of [nuclears+electronic shells] oscillations will be more limited in direction normal to plates, than in directions of the same plane, decreasing selectively the normal component of gravitational interaction of mass of dielectric between plates with Earth.

Charging the dielectric disk positively or negatively with external source of charge - will lead to charge distribution near its surface due to Coulomb repulsion. In this case the effects will be the same, as in the case of unipolar condensers, described above. The electro-gravitational effect will increase with relative rotation of discs in accordance to mechanism proposed.

Our mechanism of Biefeld-Brown and related effects - explains their dependence on mass of dielectric between plates, dielectric permeability, as far it is related with polarizability and density of dielectric, the density of electromagnetic energy between plates, related to proximity of plates and voltage.

The mechanism predicts also, that the increasing of temperature, declining the coherence of anharmonic nuclears oscillations at the other permanent conditions (taking into account possible decreasing of dielectric permeability) should decrease the values of electro-gravity effects. It is a way for experimental verification of suggested mechanism, based on our model.

5.4. Inertia of mass as a consequence of the 'inertia' of bi-vacuum symmetry, supported by generalized principle of Le Chatelier

From eqs. 5.1 and 5.8 we get the following interrelation between real inertial mass (m_C^+) of particle, its external group velocity (v), mass shift: $\Delta m_C = m_C^+ - m_C^-$ and bi-vacuum symmetry shift: $\Delta m_V = m_V^+ - m_V^-$, where bi-vacuum shift and mass shift are interrelated as: $\Delta m_V = \beta \cdot \Delta m_C$. Then we have for real mass following expression:

$$m_C^+ = \Delta m_C \cdot \left(\frac{c}{v}\right)^2 = \frac{1}{\beta} \Delta m_V \cdot \left(\frac{c}{v}\right)^2 \quad 5.35$$

where the gravitational fine structure $\beta = \frac{\Delta m_V}{\Delta m_C} = \frac{m_0}{M_{Pl}}$ was introduced earlier (eqs. 5.7-5.9).

Formula (5.35) points to direct relation between real inertial mass and bi-vacuum symmetry shift (Δm_V). It can be transformed to:

$$m_C^+ v^2 = \frac{c^2}{\beta} \Delta m_V \quad 5.36$$

The second Newton's law ($F = ma = m \frac{dv}{dt}$) may be presented in a new form, leading from our theory. Taking a time derivative of (5.36), we came to:

$$\frac{dm_C^+}{dt} v^2 + 2m_C^+ v \frac{dv}{dt} = \frac{c^2}{\beta} \cdot \frac{d(\Delta m_V)}{dt} \quad 5.37$$

or after simple reorganization we came to 2nd Newton's law in form:

$$F = m_C^+ a = \frac{c^2}{2\beta v} \cdot \frac{d(\Delta m_V)}{dt} - \frac{1}{2} \frac{dm_C^+}{dt} v \quad 5.38$$

For acceleration ($a = dv/dt$) we get:

$$a = \frac{c^2}{\beta v} \cdot \frac{d(\Delta m_V)}{m_C^+ dt} - \frac{d \ln m_C^+}{dt} v \quad 5.39$$

Taking into account that real inertial mass is dependent on velocity:

$$m_C^+ = m_0 \cdot [1 - (v/c)^2]^{-1/2} = m_0/R^{1/2} \quad 5.39a$$

we can get from (5.39) the general expression for acceleration:

$$a = \frac{c^2}{\beta} \frac{d(\Delta m_V)/dt}{m_C^+ v \cdot [1/R + 1]} = c^2 \frac{d(\Delta m_C)/dt}{m_C^+ v \cdot [1/R + 1]} \quad 5.40$$

$$\text{or using (5.1) : } a = R \frac{v}{1+R} \cdot \frac{d \ln T_{kin}}{dt} = R \frac{v}{1+R} \cdot \frac{d \ln E_G^{\max}}{dt} \quad 5.40a$$

where:

$$\text{dimensionless relativistic factor: } R = 1 - (v/c)^2 \quad 5.41$$

$$\Delta m_V/\beta = \Delta m_C; \quad \Delta m_C \cdot c^2 = 2T_{kin} = m_C^+ v^2 \quad 5.41a$$

For inertial Newton's force we have from (5.40 and 5.40a), taking into account (5.39a):

$$F = m_C^+ \cdot a = \frac{c^2}{\beta} \frac{d(\Delta m_V)/dt}{v \cdot [1/R + 1]} = c^2 \frac{d(\Delta m_C)/dt}{v \cdot [1/R + 1]} \quad 5.42$$

$$F = R^{1/2} \frac{m_0 v}{1+R} \cdot \frac{d \ln T_{kin}}{dt} = R^{1/2} \frac{m_0 v}{1+R} \cdot \frac{d \ln E_G^{\max}}{dt} \quad 5.42a$$

It is interesting to note, that at $v \rightarrow c$ and $R \rightarrow 0$, the acceleration (5.40a) and force (5.42a) are tending to zero.

Eqs. (5.40-5.42) mean that applying a force to particle or body, leading to change of its acceleration and kinetic energy, is accompanied by corresponding change of bi-vacuum and mass symmetry shift ($\Delta m_V = \beta \Delta m_C = \beta \cdot m_C^+ v^2/c^2$), interrelated directly with gravitational (E_G^{\max}) potential:

$$E_G^{\max} = \Delta m_V \cdot c^2 = \beta \Delta m_C \cdot c^2 = 2\beta T_{kin} \quad 5.43$$

and electromagnetic potential

$$E_{el-m}^{\max} = (\alpha/\beta) \cdot E_G^{\max} = \alpha \Delta m_C \cdot c^2 = 2\alpha T_{kin} \quad 5.44$$

The corresponding inertial property of mass can be considered as a consequence of keeping of dynamic equilibrium between [C] and [W] phase of sub-elementary particle.

This equilibrium stability means tendency of system to keep the equality of corpuscular and wave phase energy in form of CVC:

$$[m_C^+ v^2]_C \rightleftharpoons [(m_C^+ - m_C^-) \cdot c^2]_W \quad 5.45$$

Such phenomenon may be considered as generalized principle of Le Chatelier. The differential of the left and right part of (5.45), gives:

$$\begin{aligned} \Delta(m_C^+ v^2) &= c^2 \Delta(m_C^+ - m_C^-) \\ \text{or : } \Delta(m_C^+ v^2) &= \frac{c}{\beta} \Delta(m_V^+ - m_V^-) \end{aligned} \quad 5.46$$

Generalized principle of Le Chatelier may be formulated as follows: "The action on corpuscular [C] phase, accompanied by change of its kinetic energy and instant shift of [C \rightleftharpoons W], is followed by compensating bi-vacuum symmetry shift and changing the energy of [W] in form of cumulative virtual cloud (CVC), restoring dynamic [C \rightleftharpoons W] equilibrium.

It looks, that not only the second, but also the first and third Newton's laws are the consequences of Generalized principle of Le Chatelier. Each of these laws is related with inertial properties of bi-vacuum symmetry and changing the energy of CVC.

The gravitational interaction between two or more bodies also may be related to generalized principle of Le Chatelier and that of Least action, minimizing the resulting bi-vacuum symmetry shift in system and primordial [C \rightleftharpoons W] equilibrium.

The advantage of our approach to explanation of inertia is that it is applicable not only for charged, but for neutral elementary particles also. We do not need to consider the special electromagnetic component of zero-point field of vacuum, generating resistance force to acceleration of elementary charges.

The formulae (5.40 - 5.44) are applicable also for averaged or most probable values of \bar{a} ; \bar{F} and \bar{E}_G^{\max} ; \bar{E}_{el-m}^{\max} , i.e. for atoms and molecules in composition of condensed matter. The interrelation between \bar{E}_G^{\max} , $\bar{\Delta m}_V$ and coherent dynamics of molecules - is very important for analyzing the possibility of Vibro-Gravitational Replica of condensed matter in bi-vacuum (see section 9).

6. THE PRINCIPLE OF LEAST ACTION AND PROBLEM OF TIME

It can be shown, that the Principle of Least Action is one, reflecting the nonlocal Wave - quality of the World and its feedback reaction with local Corpuscular - quality. After Lagrange, the action for particle, like electron could be expressed as:

$$S = \int_{t_1}^{t_2} 2T_k dt \quad 6.1$$

If T_{kin} is the averaged kinetic energy of particle (or system of particles) during the time interval: $t = t_2 - t_1$, we have from (6.1):

$$S = 2T_{kin} t \quad 6.2$$

Representing the time interval (t) as an integer number of [C \rightleftharpoons W] pulsation period (T_0) we

have:

$$t = nT_{C \Leftrightarrow W} = n \cdot h / [(m_C^+ - m_C^-)c^2], \quad \text{where : } n = 1, 2, 3, \dots \quad 6.3$$

At condition of Golden mean, when: $(m_C^+ - m_C^-) = m_0$, we get: $t = nT_0$. This means that time is a discrete parameter and can be quantized.

Using expression for doubled kinetic energy of particle in [C] and [W]-phase eq.(2.12), we get the following expressions for action:

$$S = m_C^+ v^2 \cdot t = (m_C^+ - m_C^-)c^2 \cdot t = [(m_V^+ - m_V^-)c^2 / \beta] \cdot t \quad 6.4$$

We can see from (6.4) that the fundamental principle of least action: $\delta S = 0$, leads to new formula, interrelating the positive pace of time for particle or body ($d \ln t = dt/t$) with the decreasing of its kinetic energy, including real mass of particle (body) and its velocity:

$$d \ln t = -d \ln T_{kin} = -[d \ln m_C^+ + 2d \ln v] \quad 6.5$$

The similar result we can get from principle of uncertainty in coherent form.

Condition (6.5) unify the pace of time for particle or system of particles with pace of this system's mass change ($d \ln m_C^+ = dm_C^+ / m_C^+$) and with pace of its velocity change ($d \ln v = dv/v$).

Another version of this formula interrelates the pace of time with particles mass - symmetry shift $\Delta m_C = (m_C^+ - m_C^-)$ and corresponding vacuum symmetry shift $\Delta m_V = m_V^+ - m_V^- = \beta \Delta m_C$:

$$\Delta \ln t = -d \ln(m_C^+ - m_C^-) = -d \ln(m_V^+ - m_V^-) \quad 6.6$$

$$\text{or : } \Delta \ln t = \Delta \ln E_{el} = \Delta \ln E_G = \Delta \ln T_{kin} \quad 6.6a$$

Comparisons of this formula with those, describing the electromagnetic (4.8) and gravitational (5.1) energy leads to important conclusion: **Oscillations of electromagnetic and gravitational fields, related with vibrations of particles, generating these fields, should be accompanied by the in-phase time oscillations. The latter represents a TEMPORAL WAVES & FIELD origination. Like electromagnetic and gravitational, the TEMPORAL waves may form a standing, hologram-like pattern.**

The TEMPORAL FIELD, consequently, is related directly to coherent oscillations of kinetic energy of system (internal and/or external) and may be influenced by electromagnetic and gravitational fields.

At the condition of Hidden Harmony and Golden mean, when $\Delta m_C = (m_C^+ - m_C^-) = m_0 = \text{const}$, the pace of time for such system is zero:

$$\Delta \ln t = -d \ln m_0 = 0 \quad 6.7$$

This condition means the achievement of top of evolution/self-organization of selected system. However, the existence of zero-point oscillations make condition true only for the averaged values of $\bar{m} = m_0$.

Our approach to problem of time, based on eq.(6.5) leads to definition: "Time for any closed nonequilibrium or oscillating physical system is a parameter, characterizing the pace of this system kinetic energy (mass and velocity) change".

In accordance to our model, the characteristic time for any closed system (t_i), including the Universe, is positive if the kinetic energy, including the real mass of this system M_i and its velocity is decreasing and negative in the opposite case:

$$t_i = -\frac{T_{kin}}{dT_{kin}/dt} = -\frac{1}{d \ln T_{kin}/dt} \quad 6.8$$

This relation, derived from eq. (6.5) between the time and pace of kinetic energy change is valid for any selected closed system. It is important to note, that the **entropy increasing**, as

usual, is accompanied by the increasing of kinetic energy of its components.

Consequently, in accordance to our approach, dissipation and disorganization of system mean negative course of time. For the other hand, decreasing of kinetic energy of particle, usually mean increasing of its potential energy of interaction with surrounding medium, leading to particles association and condensed matter formation.

In another words, we may conclude, that time is positive for selected condensed matter system, if this system is tending to self-organization and evolution, decreasing its internal kinetic energy and increasing potential one. In the opposite case time for this system is negative. In other words, decreasing of entropy means positive course of time and increasing - the negative course of time.

Comparison of (6.8) with (5.40a), leads to new simple formula, interrelating time and acceleration:

$$t_i = -R \frac{v/a}{1+R} \quad 6.8a$$

The negative acceleration of system: $a = dv/dt < 0$, for example due to interaction with medium, accompanied by decreasing of its kinetic energy: $dT_{kin}/dt < 0$ means a positive course of time. The increasing of velocity ($a < 0$) and kinetic energy means the negative course of time.

Oscillation of internal kinetic energy around equilibrium means oscillation of time for closed system, moving as a whole without acceleration.

The course of time for any system could be characterized by the time decrement, introduced as:

$$D_i = \exp\left(-\frac{t_i}{T_0}\right) \quad 6.9$$

where: $T_0 = 1/\nu_0 = h/(m_0c^2)$ is period of wave B [$C \rightleftharpoons W$] oscillations, corresponding to Hidden harmony condition.

Hierarchy of systems from atom to universe determines the corresponding hierarchy of time-scales.

If the decreasing of internal kinetic energy of system as a result of it cooling, ($kT \rightarrow 0$ and $v \rightarrow 0$) is irreversible, for example as a result of IR photons radiation, the time for this system is positive and irreversible also. This process corresponds to second law of thermodynamics.

The Principle of least action in form (6.6) for the minimum time interval ($\Delta t = \min$) means that charged and neutral particles "choose" the trajectory, corresponding to the minimum change of their kinetic energy and corresponding electromagnetic ($E_{el}^S \sim \Delta m_C \cdot c^2$, eq. 4.13) and gravitational ($E_G^S \sim \Delta m_V \cdot c^2$, eq. 5.4) potential.

Such ability of particles (including photons) to "seek out" such optimal trajectory can be only a consequence of feedback reaction between their nonlocal properties due to vacuum amplitude waves (VAW) and local properties of particles in a course of their [$C \rightleftharpoons W$] pulsations. This is a new quantum explanation of the fundamental Principle of Least Action. **The problem of 'anticipation', i.e. dependence of current trajectory of particles and its change for any isolated physical system on final result may be explained by nonlocal and time-independent feedback reaction between interference of VAW, generated by this system and its environment.** For interesting analysis of anticipation problem see works of Daniel Dubois (1999,

2000).

For the other hand, formula (6.6) in combination of eqs.(4.8 and 5.1) means that the pace of time and, consequently, the dynamics of different process should be in-phase with oscillations of gravitational and electromagnetic fields.

On macroscopic scale such oscillations can correspond to periods of:

- a) Earth rotation around its own axe;
- b) rotation of Earth around Sun;
- c) rotation of Moon around Earth.

The experimental evidence of macroscopic oscillations of very different dynamic processes (physical, chemical and biological) of the mentioned above periods has been obtained in long term systematic observations by team of S. Shnol from Moscow university.

6.1. Interrelation between nonlocality, Bose condensation and time

The Virial theorem in general form is correct not only for classical, but as well for quantum systems. It relates the averaged kinetic $\bar{T}_k(\vec{v}) = \sum_i \overline{m_i v_i^2/2}$ and potential $\bar{V}(r)$ energies of particles, composing these systems:

$$2\bar{T}_k(\vec{v}) = \sum_i \overline{m_i v_i^2} = \sum_i \overline{\vec{r}_i \partial V / \partial \vec{r}_i} \quad 6.10$$

If the potential energy $\bar{V}(r)$ is a homogeneous $n - order$ function like:

$$\bar{V}(r) \sim r^n \quad 6.11$$

then average kinetic and average potential energies are related as:

$$n = \frac{2\bar{T}_k}{\bar{V}(r)} \quad 6.12$$

For example, for a harmonic oscillator, when $\bar{T}_k = \bar{V}$, we have $n = 2$.

For Coulomb interaction: $n = -1$ and $\bar{T} = -\bar{V}/2$.

It is interesting to note, that at the average kinetic energy and impulse (\bar{p}) tending to zero:

$$\bar{T}_k = \bar{p}^2/2m \rightarrow 0 \quad 6.13$$

the interaction between particles of system becomes nonlocal, i.e. independent on distance between them:

$$V_w(r) \sim r^{(0)} = 1 = const \quad 6.14$$

We came to important conclusion, that conditions of nonlocality (6.13 and 6.14) mean condition of macroscopic or even infinitive Bose condensation:

$$\bar{\lambda}_B = (h/\bar{p}) \rightarrow \infty \quad at \quad \bar{p} \rightarrow 0 \quad 6.15$$

For the other hand, the notion of time (6.8) at condition (6.13) as well as pace of time ($dt/t = dT_{kin}/T_{kin}$), became uncertain.

7. NEW INTERPRETATION OF THE WAVE FUNCTION

Our dynamic duality model makes it possible to modify the interpretation of the wave B function of Schrödinger equation. We can present wave functions ψ and ψ^* in dimensionless form, using the effective mass of the electron $[2V^- + V^+]$, determined by uncompensated sub-elementary particle (V^-) :

$$\Psi^+ = \frac{|m_C^+ - m_0|}{m_0} \quad 7.1$$

$$\Psi^- = \frac{|m_C^- - m_0|}{m_0} \quad 7.2$$

On the microscopic level the wave function squared is dependent on the product of instant values of real and mirror corpuscular mass shifts: $(\Delta m^+ \cdot \Delta m^-)$, related to fraction of time (f_C^t), which particle spend in corpuscular phase:

$$|\Psi|^2 = \Psi^+ \cdot \Psi^- = \frac{|m_C^+ - m_0|}{m_0} \cdot \frac{|m_C^- - m_0|}{m_0} = \frac{(\Delta m^+ \cdot \Delta m^-)}{m_0^2} \quad 7.3$$

$$f_C^t = \frac{\tau_C}{\tau_C + \tau_W} = \frac{1}{1 + K_{[W \rightleftharpoons C]}} \quad 7.4$$

where: $m_0^t = (m_C^+ \cdot m_C^-)^{1/2}$ is the resulting zero-point corpuscular mass. The product of real and mirror mass symmetry shift: $[(\Delta m^+ \cdot \Delta m^-) > 0]_C$ in Corpuscular phase is positive. In the Wave phase, when $\Delta m^+ = \Delta m^- = 0$, it is zero.

One can see from (7.3), that the mass symmetry shifts - changes in-phase with probability of location of particle in [C] phase in the any given volume of space, equal to the wave function squared $|\Psi|^2$.

Our theory predicts that finding the way to shift the $[C \rightleftharpoons W]$ equilibrium could be a way to change the real mass of body. For example, the application of strong magnetic or electric fields, interacting with CVC of the charged particles - can influence the vacuum symmetry shift and change the real mass of body. This effect may be used also for propulsion of one matter throw another or big space-jumps.

The elementary particles of positive and negative charge, like electrons and protons have the opposite influence on the vacuum symmetry shift, i.e. gravitation. In accordance to our Alternative corpuscle-wave model of atom, at some conditions, the distance between their electron's and proton's can become very small as a result of violation of Golden mean condition: $(m_C^+ - m_C^-) > m_0$ (see eq.4.19). As conditions of strong overlapping of their cumulative virtual clouds (CVC), their opposite bi-vacuum shifts can totally or partially compensate each other without annihilation. Our gravitation theory predicts, that this effect should be accompanied by decreasing of the effective mass of such atoms and **their gravitational potential**.

8. INTERRELATION BETWEEN MICROSCOPIC [CORPUSCLE \rightleftharpoons WAVE] EQUILIBRIUM AND MACROSCOPIC [MATTER \rightleftharpoons VACUUM_S] EQUILIBRIUM

Physical vacuum in our theory is subdivided to Primordial BI-VACUUM, existing without matter, and Secondary one [VACUUM_S], coexisting with matter and fields, produced by matter.

Secondary vacuum reflects the interference of the vacuum amplitude waves (VAW), vacuum density waves (VDW) and vacuum symmetry waves (VSW) as a components of cumulative virtual cloud (CVC), resulted from $[C \rightleftharpoons W]$ pulsation of sub-elementary particles. Secondary vacuum is a result of perturbations of superfluid Primordial vacuum properties, like energy slit and symmetry, by huge number of particles.

It follows from our model, that coherent over the large-scale microscopic [Wave \rightleftharpoons Corpuscle] dynamic equilibrium of elementary particles - can lead to macroscopic [VACUUM_S \rightleftharpoons MATTER] dynamic equilibrium.

The asymmetrical state of the electron is related to semiperiod of wave B, when one (unpaired) sub-elementary particle (V^-) is in Corpuscular [C] phase and pair ($V^- \rightleftharpoons V^+$) is in the Wave [W] phase.

In contrast to symmetrical $[C \rightleftharpoons W]$ pulsation of $(V^- \bowtie V^+)$ pairs, the asymmetrical pulsation of uncompensated sub-elementary particle (V^-) is accompanied by energy (electromagnetic and gravitational) transfer, as far the resulting Pointing vector is nonzero.

Such kind of asymmetric VAW_{OFF} can not be superluminal or nonlocal. The same is true for bosons, like photons, composed from three pairs:

$$photon \equiv 3[V^+ \bowtie V^-]$$

because one $[V^+ \bowtie V^-]$ pair have nonzero resulting momentum and spin ($S = 1/2 + 1/2 = 1$).

At the 1st semiperiod of wave B, when pair $(V^+ \bowtie V^-)$ as a part of the electron ($2V^- + V^+$) or quark is in the [W] phase and corresponding pair of CVC form positive and negative virtual quanta of $(VACUUM_S)_{ON}$ with properties of bi-vacuum bosons (BVB), the uncompensated sub-elementary particle (V^-) of the electron is in Corpuscular [C] state and forms the **(MATTER)_{ON}**. This instant situation on macroscopic scale corresponds to our perceptible "ON"- World.

The bi-vacuum symmetry shift, corresponding to this semiperiod (I), induced by uncompensated sub-elementary particle in [C] phase:

$$\Delta m_V c^2(I) = \beta \cdot |m_C^+ - m_C^-| c^2 = \beta \cdot m_C^+ v^2 = \beta \cdot 2T_{kin} \quad 8.1$$

The total energy of symmetric cumulative virtual cloud (CVC), ejected in positive and negative vacuum in form of VAW, as a result of simultaneous $C \rightarrow W$ transitions of pair $(V^+ \bowtie V^-)$ is equal to

$$VAW(I) = 2CVC_{ON} = 2|m_C^+ - m_C^-| c^2 = 2m_C^+ v^2 = 4T_{kin} \quad 8.1a$$

At the 2nd semiperiod of wave B pulsation, when coherent pair $(V^+ \bowtie V^-)$ is in [C] phase and uncompensated sub-elementary particle in triplet is in [W] phase, the bi-vacuum symmetry shift two times bigger, than at 1st semiperiod:

$$2\Delta m_V c^2(II) = 2\beta \cdot |m_C^+ - m_C^-| c^2 = 2\beta \cdot m_C^+ v^2 = \beta \cdot 4T_{kin} \quad 8.2$$

The energy of asymmetric CVC, ejected by uncompensated sub-elementary particle is two time less, than (8.1a):

$$VAW(II) = CVC_{ON} = |m_C^+ - m_C^-| c^2 = m_C^+ v^2 = 2T_{kin} \quad 8.2a$$

At the second semiperiod our $(VACUUM_S)_{ON}$ collapses to hidden $(MATTER)_{OFF}$. Simultaneously our explicated Corpuscular "ON" World transforms to hidden implicated $(VACUUM_S)_{OFF}$. Such enfolded, $[VACUUM_S + MATTER]_{OFF}$ subsystem of the part of the UNIVERSE with in-phase $[C \rightleftharpoons W]$ pulsation - is alternative to unfolded $[MATTER + VACUUM_S]_{ON}$ subsystem.

The perception of World by bio-receptors and equipment normally is limited by [ON] in-phase subsystem, corresponding to the first of two described above semiperiods only and fields, resulting from $[ON \rightleftharpoons OFF]$ transitions. The dynamics of conversions between $[ON]$ and $[OFF]$ – Worlds due to their ultrahigh frequency can't be registered experimentally. The result of dynamic equilibrium between ON and OFF subsystems in form of fields is detectable only.

The feedback reaction between $[ON]$ and $[OFF]$ coherent Worlds subsystems as a consequence of nonlocality of VAW, responsible for realization of principle of least action, may be responsible for UNIVERSE self-organization.

The coherent molecular dynamics of real $MATTER_{ON}$, including living organisms, with coherent alternating acceleration and relativistic mass change of particles (m_C^+) should modulate the properties of CVC, including VDW, VSW, bi-vacuum symmetry shift (Δm_V) and value of gap between positive and negative vacuum (A_{VAW}).

9. Hierarchic theory of Vibro-Gravitational Replica (VGR) of condensed matter, imprinted in Bi-Vacuum

It leads from our Hierarchic theory of condensed matter (see <http://arXiv.org/abs/physics/0003044>) that each of 24 collective quantum excitations is characterized by specific coherent oscillations and corresponding kinetic energy (T_{kin}^i). Our Hierarchic theory of condensed matter in combination with Dynamic model of wave-corpucle duality allows quantitative evaluation of Vibro-Gravitational Replica (VGR) in bi-vacuum.

9.1. Extended Summary of Hierarchic theory of condensed matter (see: <http://arXiv.org/abs/physics/0003044>)

A basically new hierarchic quantitative theory, general for solids and liquids, has been developed. It is assumed, that anharmonic oscillations of particles in any condensed matter lead to emergence of three-dimensional (3D) superposition of standing de Broglie waves of molecules, electromagnetic and acoustic waves. Consequently, any condensed matter could be considered as a gas of 3D standing waves of corresponding nature. Our approach unifies and develops strongly the Einstein's and Debye's models.

Collective excitations in form of coherent clusters, representing at certain conditions the mesoscopic molecular Bose condensate, were analyzed, as a background of hierarchic model of condensed matter.

The most probable de Broglie wave (wave B) length is determined by the ratio of Plank constant to the most probable impulse of molecules or by ratio of its most probable phase velocity to frequency. The waves B are related to molecular translations (*tr*) and librations (*lb*).

As the quantum dynamics of condensed matter does not follow in general case the classical Maxwell-Boltzmann distribution, the real most probable de Broglie wave length can exceed the classical thermal de Broglie wave length and the distance between centers of molecules many times.

This makes possible the atomic and molecular partial Bose condensation in solids and liquids at temperatures, below boiling point. It is one of the most important results of new theory, which we have confirmed by computer simulations on examples of water and ice and the Virial theorem.

Four strongly interrelated new types of quasiparticles (collective excitations) were introduced in our hierarchic model:

1. *Effectons* (*tr* and *lb*), existing in "acoustic" (a) and "optic" (b) states represent the coherent clusters in general case;
2. *Convertons*, corresponding to interconversions between *tr* and *lb* types of the effectons (flickering clusters);
3. *Transitons* are the intermediate [$a \rightleftharpoons b$] transition states of the *tr* and *lb* effectons;
4. *Deformons* are the 3D superposition of IR electromagnetic or acoustic waves, activated by *transitons* and [$lb \rightleftharpoons tr$] *convertons*.

Primary effectons (*tr* and *lb*) are formed by 3D superposition of the most probable standing de Broglie waves of the oscillating ions, atoms or molecules. The volume of

effectons (tr and lb) may contain from less than one, to tens and even thousands of molecules. The first condition means validity of classical approximation in description of the subsystems of the effectons. The second one points to quantum properties of coherent clusters due to molecular Bose condensation.

It leads from our computer simulations, that liquids are semiclassical systems because their primary (tr) effectons contain less than one molecule and primary (lb) effectons - more than one molecule. The solids are quantum systems totally because both kind of their primary effectons (tr and lb) are molecular Bose condensates.

It is shown, that the 1st order [*gas* → *liquid*] transition is accompanied by strong decrease of librational (rotational) degrees of freedom due to emergence of primary (lb) effectons. In turn, the [*liquid* → *solid*] transition is followed by decreasing of translational degrees of freedom due to Bose-condensation of primary (tr) effectons.

In the general case the effecton can be approximated by parallelepiped with edges corresponding to de Broglie waves length in three selected directions (1, 2, 3), related to the symmetry of the molecular dynamics. In the case of isotropic molecular motion the effectons' shape may be approximated by cube.

The edge-length of primary effectons (tr and lb) can be considered as the "parameter of order".

The in-phase oscillations of molecules in the effectons correspond to the effecton's (a) - *acoustic* state and the counterphase oscillations correspond to their (b) - *optic* state. States (a) and (b) of the effectons differ in potential energy only, however, their kinetic energies, impulses and spatial dimensions - are the same. The *b*-state of the effectons has a common feature with **Frölich's polar mode.**

The (*a* → *b*) or (*b* → *a*) transition states of the primary effectons (tr and lb), defined as primary transistons, are accompanied by a change in molecule polarizability and dipole moment without density fluctuation. In this case the transitions lead to absorption or radiation of IR photons, respectively.

Superposition (interception) of three internal standing IR photons, penetrating in different directions (1,2,3) - forms primary electromagnetic deformons (tr and lb).

On the other hand, the [*lb* ⇌ *tr*] *convertions* and *secondary transistons* are accompanied by the density fluctuations, leading to *absorption or radiation of phonons.*

Superposition resulting from interception of standing phonons in three directions (1,2,3), forms secondary acoustic deformons (tr and lb).

*Correlated collective excitations of primary and secondary effectons and deformons (tr and lb), localized in the volume of primary *tr* and *lb* electromagnetic deformons, lead to origination of macroeffectons, macrotransistons and macrodeformons (tr and lb respectively).*

*Correlated simultaneous excitations of *tr* and *lb* macroeffectons in the volume of superimposed *tr* and *lb* electromagnetic deformons lead to origination of supereffectons.*

In turn, the coherent excitation of *both: tr and lb macrodeformons and macroconvertions* in the same volume means creation of **superdeformons**. Superdeformons are the biggest (cavitational) fluctuations, leading to microbubbles in liquids and to local defects in solids.

Total number of quasiparticles of condensed matter equal to $4!=24$, reflects all of possible combinations of the four basic ones [1-4], introduced above. This set of collective excitations in the form of "gas" of 3D standing waves of three types: de Broglie, acoustic and electromagnetic - is shown to be able to explain virtually all the properties of all condensed matter.

The important positive feature of our hierarchic model of matter is that it does not need the semi-empiric intermolecular potentials for calculations, which are unavoidable in existing

theories of many body systems. The potential energy of intermolecular interaction is involved indirectly in dimensions and stability of quasiparticles, introduced in our model.

The main formulae of theory are the same for liquids and solids and include following experimental parameters, which take into account their different properties:

- [1]- **Positions of (tr) and (lb) bands in oscillatory spectra;**
- [2]- **Sound velocity;**
- [3]- **Density;**
- [4]- **Refraction index (extrapolated to the infinitive wave length of photon).**

The knowledge of these four basic parameters at the same temperature and pressure makes it possible using our computer program, to evaluate more than 300 important characteristics of any condensed matter. Among them are such as: total internal energy, kinetic and potential energies, heat-capacity and thermal conductivity, surface tension, vapor pressure, viscosity, coefficient of self-diffusion, osmotic pressure, solvent activity, etc. Most of calculated parameters are hidden, i.e. inaccessible to direct experimental measurement.

The new interpretation and evaluation of Brillouin light scattering and Mössbauer effect parameters also have been done on the basis of hierarchic theory. Mesoscopic scenarios of turbulence, superconductivity and superfluidity are elaborated.

Some original aspects of water in self-organization, evolution and large-scale dynamics of biosystems - such as proteins, DNA, microtubules, membranes and regulative role of water in cytoplasm, cancer development, quantum neurodynamics, etc. have been analyzed in the framework of hierarchic theory.

Computerized verification of our Hierarchic concept of matter on examples of water and ice has been performed, using special computer program: Comprehensive Analyzer of Matter Properties [CAMP, copyright, 1997, Kaivarainen]. The new optoacoustic device (CAMP), based on this program, with possibilities much wider, than that of IR, Raman and Brillouin spectrometers, has been proposed (see URL: <http://www.karelia.ru/~alexk> [CAMP & Innovations]).

This is the first theory able to predict all known experimental temperature anomalies for water and ice. The conformity between theory and experiment is very good even without adjustable parameters.

The hierarchic concept creates a bridge between micro- and macro- phenomena, dynamics and thermodynamics, liquids and solids in terms of quantum physics.

9.2. Generation of Vibro-Gravitational Waves (VGW) by condensed matter

The energy of vibro-gravitational waves A_{VGW}^i , modulate the energy of high-frequency cumulative virtual cloud (CVC) and corresponding contributions of electromagnetic and gravitational fields (9.11-9.11b).

For each selected collective excitation **in condensed matter**, described above, corresponding contribution to energy of CVC can be expressed as:

$$A_{VGW}^i = \Delta CVC^i = (M_C^+ - M_C^-)^i \cdot c^2 = 2\bar{T}_{kin}^i \quad 9.1$$

where the most probable kinetic energy (\bar{T}_{kin}^i), characteristic for given excitation, may be calculated, using computer program, based on our Hierarchic theory of matter.

The equation for total internal kinetic energy of condensed matter is a sum of contributions of each excitation. It may be calculated as a next stage after calculation the

same contributions in total internal energy.

The total internal energy of matter (U^{tot}) is equal to the sum of total kinetic (T^{tot}) and total potential (V^{tot}) energy:

$$U^{\text{tot}} = T^{\text{tot}} + V^{\text{tot}} \quad 9.1a$$

The kinetic energy of wave B (T_B) of one molecule may be expressed using its total energy (E_B), mass of molecule (m), and its phase velocity as wave B (v_{ph}):

$$T_B = \frac{mv_{gr}^2}{2} = \frac{E_B^2}{2mv_{ph}^2} \quad 9.2$$

The total mass (M_i) of 3D standing waves B forming effectons, transitons and deformons of different types are proportional to number of molecules in the volume of corresponding quasiparticle ($V_i = 1/n_i$):

$$M_i = \frac{1/n_i}{V_0/N_0} m \quad 9.3$$

the limiting condition for minimum mass of quasiparticle is:

$$M_i^{\text{min}} = m \quad 9.4$$

Consequently the kinetic energy of each coherent effectons is equal to

$$\left[T_{\text{kin}}^i = \frac{E_i^2}{2M_i v_{ph}^2} \right]_{ef} \quad 9.5$$

where: E_i is a total energy of given quasiparticle.

The kinetic energy of coherent primary and secondary deformons and transitons we express analogously to eq. (9.5), but instead of the phase velocity of waves B we use the light speed and resulting sound velocity v^{res} , respectively:

$$\left[T_{\text{kin}}^i = \frac{E_i^2}{2M_i c^2} \right]_d \quad \text{and} \quad \left[\bar{T}_{\text{kin}}^i = \frac{E_i^2}{2M_i (v_s^{\text{res}})^2} \right]_{\bar{d}} \quad 9.6$$

The kinetic energies of $[tr/lb]$ convertons:

$$\left[T_{\text{kin}}^i = \frac{(E_i/3)^2}{2M_i (v_s^{\text{res}})^2} \right]_{con} = \left[T_{\text{kin}}^i = \frac{E_i^2}{6M_i (v_s^{\text{res}})^2} \right]_{con} \quad 9.7$$

According to our model, the kinetic energies of the effectons in a and b and also in the \bar{a} and \bar{b} states are equal. Using (9.5-9.7) we obtain from the total internal energy eq.(4.3 from

<http://arXiv.org/abs/physics/0003044>) the internal kinetic energy for 1 mole of matter:

$$T^{\text{tot}} = V_0 \frac{1}{Z} \sum_{tr,lb} \left\{ \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef} (v_{ph}^a)^2} * (P_{ef}^a + P_{ef}^b) + \bar{n}_{ef} \frac{\sum (\bar{E}^a)_{1,2,3}^2}{2M_{ef} (v_{ph}^a)^2} * (\bar{P}_{ef}^a + \bar{P}_{ef}^b) \right] + \right. \\ \left. + \left[n_t \frac{\sum (E_t)_{1,2,3}^2}{2M_t (v_s^{\text{res}})^2} P_d + \bar{n}_t \frac{\sum (\bar{E}_t)_{1,2,3}^2}{2\bar{M}_t (v_s^{\text{res}})^2} \bar{P}_d \right] + \left[n_d \frac{\sum (E_d)_{1,2,3}^2}{2M_d c^2} P_d + \bar{n}_d \frac{\sum (\bar{E}_d)_{1,2,3}^2}{2M_d (v_s^{\text{res}})^2} \bar{P}_d \right] + \right.$$

$$\begin{aligned}
& + \left[n_M \frac{(E_M^A)^2}{6M_M(v_{ph}^A)^2} * (P_M^A + P_M^B) + n_D \frac{(E_D)^2}{6M_D(v_s^{res})^2} P_D^M \right]_{tr,lb} + \\
& + V_0 \frac{n_{con}}{Z} \left[\frac{(E_{ac})^2}{6M_c(v_s^{res})^2} P_{ac} + \frac{(E_{bc})^2}{6M_c(v_s^{res})^2} P_{bc} + \frac{(E_{cMd})^2}{6M_c(v_s^{res})^2} P_{cMd} \right] + \\
& V_0 \frac{1}{Z} \left[n_{cda} \frac{(E_{ac})^2}{6M_c(v_s^{res})^2} P_{ac} + n_{cdb} \frac{(E_{bc})^2}{6M_c(v_s^{res})^2} P_{bc} + \frac{n_{cMd} (E_{cMd})^2}{6M_c(v_s^{res})^2} P_{cMd} \right] + \quad 9.8 \\
& + V_0 \frac{1}{Z} \left[n_S \frac{(E_S^{A*})^2}{6M_S (v_{ph}^{A*})^2} * (P_S^{A*} + P_S^{B*}) + n_S \frac{(E_D^*)^2}{6M_S(v_s^{res})^2} P_S^{D*} \right]
\end{aligned}$$

where the effective phase velocity of A-state of macroeffectons is introduced as:

$$\left[\frac{1}{v_{ph}^A} = \frac{1}{v_{ph}^a} + \frac{1}{\bar{v}_{ph}^a} \right]_{tr,lb} \rightarrow \left[v_{ph}^A = \frac{v_{ph}^a \cdot \bar{v}_{ph}^a}{v_{ph}^a + \bar{v}_{ph}^a} \right]_{tr,lb} \quad 9.9$$

and the effective phase velocity of supereffecton in A*-state:

$$v_{ph}^{A*} = \frac{(v_{ph}^A)_{tr} \cdot (v_{ph}^A)_{lb}}{(v_{ph}^A)_{tr} + (v_{ph}^A)_{lb}} \quad 9.9$$

For other notations of (9.8) see: <http://arXiv.org/abs/physics/0003044>

Total potential energy is defined by the difference between total internal and total kinetic energy (eq. 9.8):

$$V^{tot} = U^{tot} - T^{tot} \quad 9.10$$

Consequently, we can separately calculate the kinetic and potential energy contributions to the total thermal internal energy of matter, using four experimental parameters, obtained at the same temperature and pressure:

- 1) *density or molar volume;*
- 2) *sound velocity;*
- 3) *refraction index and*
- 4) *positions of translational and librational bands in oscillatory spectrum of condensed matter.*

The most effective source of vibro-gravitational waves (VGW) are coherent clusters, existing in liquids (**librational primary effectons**) and solids (**librational and translational primary effectons**) as a result of high-temperature mesoscopic Bose condensation. Primary **transitons**, representing transition state between optic (b) and acoustic (a) modes of the primary effectons and **convertions** - transition states between primary librational and translational effectons also may generate VGW and vibro-gravitational replica (VGR) in bi-vacuum. Due to coherency of VGW, excited in bi-vacuum by listed kind of excitations, they may form a hologram-like system

of standing waves - VGR. Other excitations of condensed matter are not so coherent. Their VGW can not form standing waves and their VGR are not stable. This means that corresponding 'memory' of bi-vacuum is very short.

Taking this into account, the energy of vibro-gravitational waves (9.1), as a part of CVC, generated by one mole of condensed matter may be calculated from (9.8) like:

$$A_{VGW}^{CVC} = 2(\overline{T}_{kin}^{tot}) = 2[\overline{T}_{kin}^{eff} + \overline{T}_{kin}^t + \overline{T}_{kin}^{con}] = \quad 9.11$$

$$= V_0 \frac{2}{Z} \cdot \sum_{tr,lb} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} * (P_{ef}^a + P_{ef}^b) \right] + \left[n_t \frac{\sum (E_t)_{1,2,3}^2}{2M_t(v_s^{res})^2} P_d \right]$$

$$+ V_0 \frac{n_{con}}{Z} \left[\frac{(E_{ac})^2}{6M_c(v_s^{res})^2} P_{ac} + \frac{(E_{bc})^2}{6M_c(v_s^{res})^2} P_{bc} + \frac{(E_{cMd})^2}{6M_c(v_s^{res})^2} P_{cMd} \right]$$

$$A_{VGW}^{el-m} = \alpha \cdot A_{VGW}^{CVC} \quad (\text{electromagnetic component of VR}) \quad 9.11a$$

$$A_{VGW}^G = \beta \cdot A_{VGW}^{CVC} \quad (\text{gravitational component of VR}) \quad 9.11b$$

Changing of corresponding Vibro-gravitational waves interference pattern in bi-vacuum with hologram properties, related to change of matter properties, means holomovement after Bohm.

Such holomovement can be imprinted in $[\text{VACUUM}_S]_{OFF}$ and, consequently, in $[\text{VACUUM}]_{ON}$ in form of Vibro-Gravitational Replica (VGR) of our World.

The deviation of VGR from "Thermal Noise" of $[\text{VACUUM}_S]_{ON}$ and its stability is dependent on the scale of coherent molecular/atomic excitations, responsible for Virtual Replica origination and possibility of distant and nonlocal components of VGW to form standing waves.

10. The influence of 3D rigid cavities with shape, following Golden mean, on surrounding medium

In general case the vacuum replica (VR) of condensed matter is composed from:

I. Local component of cumulative virtual cloud (CVC), comparable with wave B length, i.e. with linear dimensions of mesoscopic Bose condensation (from 10 to 10^5 Å);

II. Distant electromagnetic components of CVC, related to flickering charge (Van der Waals interaction);

III. Nonresonant and nonlocal vacuum amplitude waves (VAW), generated by matter.

The characteristic parameters of vacuum replica (VR) of condensed matter are dependent:

1. On the frequency and amplitude of cumulative virtual cloud (CVC). It is related to coherent component of condensed matter with in-phase $[C \rightleftharpoons W]$ pulsation, i.e. kinetic energy and fraction of molecular Bose condensate;
2. On the phase shift of CVC, radiated by different coherent collective excitations;
3. On the spatial distribution of density of virtual pairs of particles and antiparticles. It is dependent on shape of matter construction (anisotropy of Casimir effect and its sign: positive or negative).

Parameters (2) and (3) are important for local and distant component of vacuum replica (VR). Parameter (1) is characteristic for nonlocal component of vacuum replica.

The energy of components of **vibro-gravitational field** (A_{VGW}), modulating CVC, its electromagnetic and gravitational components, generated by condensed matter, may be calculated using (9.11).

In accordance to our model, $[C \rightleftharpoons W]$ pulsations of $[V^- + V^+]$ pairs in composition of

elementary particles (fermions) like electrons, positrons and quarks (composed from triplets of sub-elementary particles and sub-elementary antiparticles) - are accompanied by *emission* \rightleftharpoons *absorption* of twin $[CVC^- + CVC^+]$ and twin vacuum amplitude waves $[VAW^- + VAW^+]$. In composition of twin CVC^\pm the superposition of virtual density and virtual symmetry waves (VDW $^\pm$ and VSW $^\pm$) in form of standing waves, compensate each other and the Pointing vector is zero.

It was shown (see section 3.12), that the condition of Hidden Harmony is the equality the internal and external group and phase velocities (3.7):

$$v_{gr}^{in} = v_{gr}^{ext} \quad \text{and} \quad v_{ph}^{in} = v_{ph}^{ext} \quad 10.1$$

This condition is a background of Golden mean :

$$S = \frac{v_{gr}^{in,ext}}{v_{ph}^{in,ext}} = \frac{(v_{gr}^{in,ext})^2}{c^2} = \left[\frac{2T_k}{E_B} \right]^S = 0.618 \quad 10.2$$

$$\text{or : } \left[\frac{T_k}{E_B} \right]^S = 0.309 \quad \left[\frac{V}{T_k} \right]^S = 2.236 \quad 10.2a$$

In turn, eq.(10.2) leads to another important condition: the equality of mass symmetry shift of $[C]$ phase of particle $|\Delta m_C^S|$ to its mass of rest (m_0):

$$|\Delta m_C^S| = |m_C^+ - m_C^-|^S = m_0 \quad 10.3$$

The energy of wave B at condition of Hidden harmony and Golden mean, is equal to:

$$E_B^S = \hbar\omega_0 = m_0 \cdot c^2 \quad 10.4$$

the angle frequency of $[C \rightleftharpoons W]$ pulsations of the electron or other particle, at condition (10.4) is determined by its rest mass (m_0):

$$\omega_0 = m_0 c^2 / \hbar = 9.03 \cdot 10^{20} \text{ s}^{-1} \quad 10.5$$

We can see, that at condition of Hidden Harmony, the total energy of wave B is described by Einstein's formula, unifying the energy and mass: each cycle of $[C \rightleftharpoons W]$ pulsation is accompanied by reversible annihilation of each of sub-elementary particle, composing elementary particles.

One of conditions of distant and nonlocal components of Vacuum Replica stability is a coherency of VAW, i.e. $\omega_0 = \text{const}$. This resonant frequency may be modulated by vibrations of molecules in composition of mesoscopic Bose condensate of condensed matter, radiating vibro-gravitational waves (VGW).

The set of resonant energies of bi-vacuum virtual states, representing different excitations of bi-vacuum bosons (BVB) are the result of quantization:

$$E^n = n \cdot m_0 c^2 \quad (n = 1, 2, 3, \dots) \quad 10.6$$

The radius of corresponding symmetrical and metastable BVB, following principle of uncertainty, is equal to: $L_{BVB}^0 = \hbar/m_0 c$; and $L_{BVB}^n = \hbar/(n \cdot m_0 c)$.

The frequencies of resonant VAW, accompanied by origination/annihilation of pairs of virtual particles, inducing fluctuations of bi-vacuum density are:

$$v_{VAW}^n = n \cdot v_{VAW}^0 = n \cdot m_0 c^2 / \hbar = n \cdot \frac{c}{L_0} \quad 10.7$$

The strong experimental evidence for influence of condensed matter on vacuum

properties is existing in form of Casimir effect.

10.1. The positive and negative Casimir effect

The [*origination* \Rightarrow *annihilation*] of pairs of virtual particles and antiparticles, accompanied by fluctuation of bi-vacuum density and pressure, can be a result of transitions (vacuum transits VT) between symmetric BVB^\pm with resonant energetic gaps, accompanied by [*absorption* \Rightarrow *emission*] of vacuum amplitude quanta of energy (A_{VAW}).

The **resonant** energies of BVB^\pm in ground and excited states (E_n^{BVB}) at conditions of Golden mean (10.6) are related with corresponding values of vacuum amplitude waves energy (A_{VAW}^n), as follows from (1.5).

The radiuses of corresponding symmetrical and metastable BVB , following principle of uncertainty in conventional form, are equal to:

$$L_{BVB}^0 = \hbar/m_0c \quad \text{and} \quad L_{BVB}^n = \hbar/(n \cdot m_0c) \quad 10.8$$

The frequencies of resonant VAW, accompanied by origination/annihilation of pairs of virtual particles and fluctuations of bi-vacuum density are described by (10.7).

The mass-energy of short-living **virtual pairs**, equal to energy of resonant VAW, is determined by difference of energetic gaps of two or resonant BVB^\pm of the same polarization:

$$E_n^{BVB} = n \cdot A_{VAW}^0 = 2\Delta m^*c^2 = [(m^+ - m^-)_{BVB_2} - (m^+ - m^-)_{BVB_1}] \cdot c^2 = n \cdot \hbar\omega_0 \quad 10.10$$

where : m^+ and m^- are the effective masses of circle and anticircle of two BVB^\pm

with corresponding radiuses:

$$L_2^\pm = \hbar/m_2^\pm c < L_1^\pm = \hbar/m_1^\pm c \quad 10.11$$

Pairs of virtual particles and antiparticles originate as a transition state between two resonant BVB^\pm , with different energetic gaps. Conversion of BVB_2 with bigger gap to BVB_1 with smaller gap is accompanied by excitation of vacuum amplitude wave (VAW^\pm). The absorption of this VAW^\pm by another BVB_1^\pm in the ground state may turn it to excited state BVB_2^\pm .

Propagation of VAW^\pm may be realized under such conditions as alternative absorption and emission of corresponding virtual quanta ($n \cdot A_{VAW}^0$) by BVB^\pm in different resonant states of excitation. The velocity of VAW propagation in bi-vacuum is dependent on life-time of virtual particles and antiparticles in a course of their [*origination* \Rightarrow *annihilation*].

The nonresonant and nondissipative VAW^\pm may be nonlocal and their propagation - instant.

The Casimir attraction force between closely spaced conducting plates could be a consequence of decreasing of difference between energetic gaps of BVB^\pm . This leads to decreasing the probability of [*origination* \Rightarrow *annihilation*] of virtual particles and corresponding declining of bi-vacuum density and pressure fluctuations. The effect of virtual pressure decreasing between plates is bigger than outside. This is our explanation of positive Casimir effect, resulting in attraction between plates.

The equalizing and decreasing of energetic gaps of BVB^\pm between parallel conducting plates and corresponding stabilization of bi-vacuum pressure fluctuations may be induced by standing VAW, generated by the electrons of plates with coherent [$C \Rightarrow W$] pulsation. The correlation of electrons (their collective properties), in turn, is dependent on their most probable wave B length and distant Van der Waals interaction between plates. It is responsible for short-range vacuum replica (VR) of condensed matter, discussed before, and decreases strongly with separation between plates.

It is important, that in contrast to van-der-Waals interactions, which are always attractive, the Casimir force is geometry - dependent. For example, if a thin spherical

conducting shell is cut in half, the two hemispheres will experience a repulsive force (Boyer, 1968; Elizalde and Romeo, 1991). We explain this as a result of **increasing the difference** of energy gaps of BVB[±]. **Such negative Casimir effect may be stimulated by spatially inhomogeneous distribution of VAW energy, radiated by electrons of two separated hemispheres. In such geometry VAW, radiated by walls, can not form a standing waves in hollow space between them, making distribution of BVB[±] properties more homogenous.**

As a result, the probability of [origination ⇌ annihilation] of virtual particles of high energy in the volume between hemispheres increases, as well as corresponding bi-vacuum pressure. Consequently, the Casimir effect change its sign from positive to negative.

The dependence of Casimir effect sign on geometry of construction means possibility to use the negative Casimir effect as a source of pure and free energy.

10.2. Idea of Virtual Jet Generator (VJG) as a source of free energy

If VAW-source has **asymmetric shape**, the ΔA_{VAW} may be considered as asymmetric scalar potential of Vibro-Gravitational Field [VGF]. The corresponding component of (VGF) is the vector, defined as

$$\vec{I}_{VAW} = grad(\Delta A_{VAW}) \quad 10.12$$

It is evident that correlation should exist between **condensed matter shape** and vector's field $\sum \vec{I}_{VAW}$, generated by this matter. The probability of **metastable pairs** of virtual [particle + antiparticle] origination under the influence of resonant VAW may increase, if the shape of condensed matter follows the Golden mean.

The experimental data are existing, pointing that Virtual Replica (VR), generated by Golden mean based cavities can influence the properties of other medium. We explain this influence as a result of such cavities (cones, pyramids, etc.) to produce maximum gradient of virtual pairs density. In turn, it corresponds to maximum gradient of virtual pressure. Consequently, we suppose, that cavities with conducting walls and geometry, following Golden mean, may be termed: 'Virtual Jet Generators (VJG)'.

The ability of such constructions to create cumulative impulse of virtual pairs, as a result of changing the isotropy of bi-vacuum excitations (BVB) in their special cavities - may be used for free energy generation. Such cavities with gradient of BVB[±] degree of excitation could be a source of cumulative flow of virtual particles and antiparticles ("bi-vacuum transits" in terms of our model) in direction from the base to apex.

Such 'enriched' bi-vacuum excitations easily penetrate to any matter and may affect Van der Waals interactions between its atoms and molecules, changing matter properties. We predict, that properties liquids, related to their molecular dynamics, like viscosity, self-diffusion, surface tension and process of liquid-solid phase transition should be most sensitive to action of Virtual Jet Generators (VJG).

10.3. Possible effect of VJG rotation on its effectiveness

The rotation of structures, exerting the negative Casimir effect may increase the nonequilibrium and anisotropy of bi-vacuum excitations (BVB). This may rise the effectiveness of VJG.

Let us consider how this hypothesis may work. It was shown in sections 4, 5, 6 and 8, that the energy of cumulative virtual clouds, vacuum symmetry shift, electromagnetism, gravitation, time and, **most important for us, the energy of BVB[±] – are dependent on kinetic energy of particles.**

The resulting kinetic energy ($2T_k^{ves}$) in general case may have a following contributions:

1. Translational external macroscopic contribution for body with mass M :

$$(2T_k^{tr})^{ext} = M(v_{tr})^2 \quad 10.13$$

2. Translational internal microscopic contribution, reduced to one mole of this body $(2\bar{T}_k^{tr})^{in}$ is determined by kinetic energy of primary translational effectons (for explanations see section 9.2 and eq. 9.11):

$$(2\bar{T}_k^{tr})^{in} = V_0 \frac{2}{Z} \cdot \sum_{tr} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} * (P_{ef}^a + P_{ef}^b) \right] \quad 10.14$$

3. Rotational/librational external macroscopic contribution for body with mass M .

The kinetic energy of rotating bodies with axial symmetry may be presented as a sum of kinetic energies of rotating with the same angle frequency ($\omega = const$) rings (belts) with different radiuses (R_i^{belt}) and masses (M_i^{belt}). The sum of mass of all belts is equal total mass of body: $M = \sum M_i^{belt}$.

The doubled kinetic energy of this macroscopic rotational contribution may be presented as:

$$2(T_k^{rot})^{ext} = \omega^2 \cdot \sum_i^{N \rightarrow \infty} M_i^{belt} \cdot (R_i^{belt})^2 \quad 10.15$$

4. Librational internal microscopic contribution, reduced to one mole of this body $(2\bar{T}_k^{lb})^{in}$ is determined by kinetic energy of primary librational effectons (for explanations see section 9.2 and eq. 9.11):

$$(2\bar{T}_k^{lb})^{in} = V_0 \frac{2}{Z} \cdot \sum_{lb} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} * (P_{ef}^a + P_{ef}^b) \right] \quad 10.16$$

The resulting kinetic energy is a sum of all four described contributions:

$$2T_k^{res} = M(v_{tr})^2 + V_0 \frac{2}{Z} \cdot \sum_{tr} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} \cdot (P_{ef}^a + P_{ef}^b) \right] + \quad 10.17$$

$$\omega^2 \cdot \sum_i^{N \rightarrow \infty} M_i^{belt} \cdot (R_i^{belt})^2 + V_0 \frac{2}{Z} \cdot \sum_{lb} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} * (P_{ef}^a + P_{ef}^b) \right]$$

For the case of macroscopic cone - shape virtual jet generators (VJG), the maximum additional effect of its rotation should be related with third contribution to resulting kinetic energy and to increasing the gradient of BVB $^{\pm}$ inside the rotating cone:

$$2T_k^{res} = c^2 \cdot \sum_i^Q (m_C^+ - m_C^-)_i \sim \omega^2 \cdot \sum_i^{N \rightarrow \infty} M_i^{belt} \cdot (R_i^{belt})^2 \quad 10.18$$

One can see from this formula, that if VJG has a shape of cone, rotating with angle frequency (ω) the density of pairs of virtual particles will increase with radius squared R_i^{belt} .

Consequently, due to VJG rotation the "flow" of virtual density from the base of cone to its apex will increase. If we are right, the effectiveness of VJG, as a source of free energy, may be elevated by increasing of dimension of cone or pyramid and by increasing the frequency of its rotation (see 10.18).

Our theory predicts also, that the closer is geometry of construction, serving as recipient of virtual pairs, to conditions of Hidden harmony (see eq. 10.1), the bigger is influence of Virtual

Jet Generators (VGR). It is a condition of resonant kind of exchange by bi-vacuum excitations between "inductor"- VJG and "recipient".

Experimentally the influence of VJG on bi-vacuum may be detected by change of positive Casimir effect. The distant VJG effect also may be investigated in similar way. Properties of water may be very sensitive indicator of VJG effect, as well as behavior of water-rich microorganisms.

The interrelation is predictable between the scale of real atomic/molecular Bose condensation in condensed matter and influence of this matter on very distant regions of bi-vacuum due to nonlocal component of VR. The future instant transmitters/receivers of information, containing cells of macroscopic Bose condensate (BC), like superconductors, superfluids and piezocrystals with modulated BC parameters, could be based on the principle of VJG. The more shape of these cells follows the Golden mean rules, the bigger is predictable informational effect. Rotation of such cells as discussed above, may increase the effects of VJG, mediated by stimulated anisotropic properties of bi-vacuum, related to gradient of its virtual hydrodynamic defects.

10.4. Vibro-Gravitational Replica of living organisms

The most ordered fraction of matter in living organisms, sensitive to nerve activity and braining (for people) is **water in microtubules** of nerve cell bodies in condition of **mesoscopic Bose condensation** (primary librational effectons). Our Hierarchic model of consciousness is based on special properties of this water, its IR superradiation and [gel-sol] transitions in cytoplasm (see <http://arXiv.org/abs/physics/0003045>).

Changing the fraction of this water and corresponding holomovement of Vibro-gravitational replica (VGR) may be responsible for mind-matter interaction, telepathy and other phenomena out of field of conventional science. The bigger is number of MTs of coherently interacting cells, the bigger is corresponding fraction of ordered water, very sensitive to nerve excitation. There are evidence, pointing that properties of MTs and internal water structure follow the Golden mean rule.

Microtubules (MT) and their bunches, like in axons, may serve as mesoscopic virtual jet generators (VJG), discussed above. It may be due to dynamic properties of librational water effectons in MT. The collective contribution of MT to librational kinetic energy, related to energy of bi-vacuum bosons (BVB) may significant.

This contribution is a part of more general eq.10.17 (see also 10.16):

$$(2\bar{T}_k^{lb})^{in} = V_0 \frac{2}{Z} \cdot \sum_{lb} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} * (P_{ef}^a + P_{ef}^b) \right] \quad 10.19$$

The [lb/tr] convertions also may contribute in properties of MTs as VJG (for explanations see eq.9.11 and corresponding comments):

$$(2\bar{T}_k^{con})^{in} = V_0 \frac{n_{con}}{Z} \left[\frac{(E_{ac})^2}{6M_c(v_s^{res})^2} P_{ac} + \frac{(E_{bc})^2}{6M_c(v_s^{res})^2} P_{bc} + \frac{(E_{cMd})^2}{6M_c(v_s^{res})^2} P_{cMd} \right] \quad 10.20$$

It is important to note, that the quantitative evaluations may be performed, using these formulae, based on our Hierarchic theory of condensed matter (Kaivarainen, 2000): <http://arXiv.org/find/cond-mat,physics/1/au:+kaivarainen/0/1/0/past/0/1>

Telepathy, as informational exchange between living organisms may be a result of resonant interaction between their neurons and [microtubules + internal water]. It could be

produced by distant or even nonlocal exchange by Virtual Replicas (VR) between organisms and properties of MT as VJG. Such exchange may be effective only in the case, if interacting systems are 'tuned' to each other, i.e. have very close psyche-physical properties.

Virtual Replicas of living organisms may be more or less stable, depending on the properties of their nerve system, including microtubules of neurons and internal water.

CONCLUSION

Our bi-vacuum model predicts that at very low density of matter, corresponding to small bi-vacuum energy gap - the huge energy explosion, resulting from [vacuum + antivacuum] 'annihilation' may occur as analog of Big Bang. This makes possible fusion of elementary particles and atoms from sub-elementary particles, representing asymmetrical excitations of bi-vacuum bosons (analog of Falaco solitons).

The formulae, obtained in our work, interrelate electric and magnetic elementary charges, electromagnetic and gravitational interactions, theory of relativity and quantum mechanics, [mass - velocity - space - time].

The dynamic model of duality provides the deeper understanding of Pauli and Heisenberg principles. It explains the quantum roots of Golden mean. It is shown, using the Virial theorem, that conditions of Bose condensation (BC), which is real in matter and virtual in bi-vacuum, coincide with conditions of nonlocality.

General principle of Le Chatelier has been proposed and applied in this work for explanation of inertia of mass.

The new fundamental principle of self-assembly of "simple" systems, like elementary particles, atoms, molecules, self-organization of complex open systems, like condensed matter, star systems, galactics and evolution of very complex systems like biopolymers (proteins, DNA, microtubules), cells, organisms has been proposed. The results, obtained in our work, point that: "The different selected systems on each level of temporal and spatial hierarchy are tending spontaneously to condition of Hidden Harmony - the equality of internal and external velocities of de Broglie waves, which determines the quantum roots of Golden Mean". It is shown, that just such processes of self-organization, accompanied by decreasing of internal kinetic energy and entropy, correspond to positive course of time, in accordance to our theory.

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