

Virtual Replica of Matter in Bivacuum & Possible Mechanism of Distant Mind - Matter and Mind - Mind Interaction

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The Extended Summary

The coherent physical theory of psi-phenomena is absent till now due to its high complexity and multilateral character. The original mechanism of **Bivacuum** mediated Mind-Matter and Mind-Mind interaction, proposed in this paper, is based on the following stages of long term efforts (see http://arXiv.org/find/physics/1/au:+Kaivarainen_A/0/1/0/all/0/1/):

- New dynamic models of **Bivacuum, sub-elementary particles and Corpuscle-Wave** [$C \rightleftharpoons W$] **duality**, as a background of Superunification (<http://arXiv.org/abs/physics/0003001>);
- New Hierarchic theory of liquids and solids, verified on examples of water and ice by computer simulations (<http://arXiv.org/abs/physics/0003044>);
- New Hierarchic model of elementary act of consciousness, based on coherent librational IR photons exchange interaction between microtubules of distant neurons (<http://arXiv.org/abs/physics/0003045>);
- Introducing the concept of Virtual Replica (VR) of matter, including living organisms, in bivacuum.

The notion of **Bivacuum** emerged as a result of new interpretation of Dirac's theory, pointing to equal probability of positive and negative energy. Bivacuum may be defined as a micro-matrix of the Universe with nonlocal properties, composed from sub-quantum particles and antiparticles, existing in form of correlated pairs of virtual rotors and antirotors. Violation of symmetry of these pairs results in origination of sub-elementary particles. The triplets of sub-elementary particles/antiparticles build elementary particles, like electrons, positrons, photons and quarks.

Unification of electromagnetic and gravitational potentials of real particles is shown to be based on dependence of these fields on kinetic energy of particles, which determines also the frequency of their [$C \rightleftharpoons W$] pulsation. **The feedback reaction between dynamics of Bivacuum and real particles** is a crucial consequence of my [$C \rightleftharpoons W$] duality model, important for understanding of Mind-Matter and Mind-Mind interaction.

Modulation of the high frequency [$C \rightleftharpoons W$] pulsation of elementary particles by **thermal vibrations** of atoms and molecules determines the frequency, phase and amplitude of **nonlocal Bivacuum symmetry oscillations (BvSO)**. In turn, the **low frequency BvSO** modulate the **high frequency luminal Virtual Pressure Waves: VPW⁺ and VPW⁻** of positive and negative vacuum, correspondingly. The **VPW⁺ and VPW⁻** represent the density oscillations of virtual particles and antiparticles in bivacuum.

The **BvSO** is responsible for the **1st - nonlocal vibro-gravitational** component of **Virtual Replica (VR) of matter** in Bivacuum. The **system of 3D standing VPW[±]** of Bivacuum, activated by [$C \rightleftharpoons W$] pulsation of elementary particles of matter, corresponds to **2nd - luminal** component of **(VR)** of this matter.

The Mind-Matter and Mind-Mind interaction is considered as interaction between **VR of 'sender' (S)** and **VR of 'receiver' (R)**. The Mind is considered in 1st approximation, as a result of Brain and nerve system activity. The important role in these kinds of bivacuum mediated interaction plays the coherent fraction of water in **microtubules** of neurons ensembles in state of

mesoscopic molecular Bose condensate (mBC), existing at physiological temperatures. This fraction of **mBC** is a variable parameter, dependent on structural state of microtubules and number of simultaneous elementary acts of consciousness (Kaivarainen, 2000, 2001).

The resonant [**Mind (S) - Matter (R)**] and [**Mind (S) - Mind (R)**] interactions are mediated by **Bivacuum symmetry oscillation (BvSO)** and **3D standing VPW $^{\pm}$** , forming **nonlocal** and **luminal** parts of **VR S** and **VR R** . This [$S \leftrightarrow R$] interaction involves the feedback reaction between **VR** of [S] (**VR S**) and **VR** of [R] (**VR R**) and has the dynamic exchange character.

The frequency (Ω) and amplitude of BvSO, responsible for specific modulation of high-frequency 3D -VPV $^{\pm}$, forming VR of Mind (S) are determined by three factors: **a) frequency (Ω)** of thermal oscillations of coherent water molecules in microtubules (**mBC**); **b) number** of coherent molecules in neuron's microtubules, including internal water in state of **mBC**; **c) tension and shape of the magnetic field**, radiated in a course of the nerve impulse propagation via axons.

The change of probabilities of selected kind of fluctuations, including cavitational ones, in the volume of **receiver [R] (including microtubules)** is dependent on change of corresponding activation barriers. It is induced by change of **VR R** of [R] under the influence of **VR S** of sender [S]. This interaction seems to have two mechanisms: **dynamic and static**.

The **dynamic type** of [$VR^S \leftrightarrow VR^R$] impulse-energy exchange interaction is dependent on **asymmetry** of bivacuum density of energy $\Delta\varepsilon^{\pm} = |\varepsilon^+ - \varepsilon^-|^{S,R}$ and corresponding difference of **virtual pressure** between positive and negative realms of Bivacuum $\Delta VP^{\pm} = |VP^+ - VP^-|^{S,R}$, related to **VR S** and **VR R** . The frequency of these differences oscillation is equal to modulation frequency (Ω) of BvSO, defined by frequency of thermal molecular oscillations in matter.

The another, **static type** of [$VR^S \leftrightarrow VR^R$] interaction is dependent on total density of bivacuum energy $|\varepsilon^+ + \varepsilon^-|$, determined by total density of virtual particles and antiparticles of opposite charges. This contribution to [S - R] interaction, influence bivacuum permittivity (ε_0) and permeability [$\mu_0 = (\varepsilon_0 c^2)^{-1}$], providing shielding of the Coulomb interaction between nucleons and electronic shells in atoms/molecules, changing thereby their polarizability.

The values of ε^+ , VP^+ and ε^- , VP^- can be modulated by alternating electromagnetic fields, radiated by [S] and [R], exciting bivacuum quantum states.

These two mechanisms: dynamic and static may be responsible for subtle change of probability of selected thermal fluctuations (i.e. cavitational fluctuations) and intermolecular Van der Waals interaction in the body of [R], induced by [S].

If the receiver [R] is another Mind/Brain, the most sensitive targets for VR S of sender [S] are also coherent water clusters (mBC) in microtubules of [R]. In resonant conditions, i.e. when the modulation BvSO frequency of **VR R** and **VR S** are close enough: ($\Omega^S \simeq \Omega^R$), the effect of [$S \leftrightarrow R$] interaction is maximum. In this case, realization of the same series of **elementary acts of consciousness** in brains of [S] and [R], means informational exchange between their Virtual Replicas, i.e. **telepathy**.

The experimental data are existing, pointing to influence of specific human intention on water pH (Dibble, Ditron and Tiller, 1999) and water structure (Pyatnitsky and Fonkin, 1995).

The **Remote Viewing**, studied in Stanford Res. Institute from 1972 to 1986 (Puthoff, 1996; Targ, 1996) may be a consequence of the described mechanism of distant Mind-Matter interaction.

The **Virtual Replica (VR)** of any system, in contrast to system itself, did not follows the relativist laws and casualty principle. **Consequently, the different metastable VR, corresponding to past, present and future states of real system may coexist. The VR of any selected system (i.e. human), as a part of superposition of huge number of Virtual Replicas of other material objects of the Universe, we named Global Virtual Replica (GVR), - may be involved in global virtual self-organization (evolution) process.** This makes possible influence of the virtual **Future state** of the given system on its real **Present state**. Such mechanism of interaction between **future and present virtual replicas of the same system** can be responsible for "**anticipation**" for real complex systems, for example, living systems.

The private case of anticipation is a clairvoyance. This psi-phenomena may be a consequence of interaction of selected parts of **future GVR** with **VR** of human Mind with extrasensory abilities.

The **telekinesis** may be a consequence of Mind to change the amplitude and anharmonicity of bivacuum symmetry oscillations BvSO and corresponding asymmetry of virtual pressure ΔVP^\pm , accompanied by cumulative excessive virtual pressure near **target**. This phenomena could be considered as a special case of macroscopic quantum entanglement.

The possible influence of individual VR, corresponding to some special states of Mind, on Global VR in bifurcation points of GVR self-organization, displays the active role of human's consciousness in evolution of the Universe. This consequence of our theory, unifying **consciousness/brains/bodies with Bivacuum and Universe**, is in accordance with ideas, developed by von Neumann (1932), Stapp (2001), supported by Conrad and Josephson (2001).

Our theory of **Matter-Bivacuum** interaction predicts also, that large scale collective and spatially directed big changes of kinetic energy in the volume of Earth, other planets and Sun (i.e. movement of huge mass of matter with high speed in selected direction), like in Earthquakes, volcanic eruptions, deep internal mass shifts should be accompanied by big fluctuations of electromagnetic, gravitational potentials, virtual pressure shift ΔVP^\pm in corresponding sectorial form of Virtual Replica (VR) of the Earth. The accompanied localized changes of fields, Bivacuum permittivity and permeability may influence strongly the Van der Waals interaction between air molecules in regions of maximum of these changes, leading to anomalous atmospheric phenomena, like local shining, **UFO**, etc.

Key words: Duality, nonlocality, Superunification, Golden mean, Bivacuum gap and symmetry oscillations, Virtual replica, act of consciousness, Mind-Matter interaction, telepathy, telekinesis, causality, anticipation, clairvoyance, UFO.

1. New Model of Bivacuum

Our Dynamic model of Corpuscle -Wave [$\mathbf{C} \rightleftharpoons \mathbf{W}$] duality is based on the new notion of bivacuum (Kaivarainen, 2000). We postulate the existence of POSITIVE (real) and NEGATIVE (mirror) vacuum as two non mixing 'oceans' of superfluid liquid, formed by **sub-quantum particles** of the opposite energies. The unified system of positive (real) and negative (mirror) vacuum is termed: BIVACUUM. It is assumed to be an infinitive source of virtual collective excitations: **bivacuum fermions** with positive ($BVF_{S=1/2}^\uparrow$) and negative ($BVF_{S=-1/2}^\downarrow$) half-integer spins and **bivacuum bosons** ($BVB_{S=0}^\pm$) of two possible polarization (\pm) and zero spin. The (BVF^\uparrow) and (BVF^\downarrow) are introduced in our model as a correlated **pairs of in-phase circulations (rotors)** of quantum liquid, but in two opposite directions: i.e. clockwise and anticlockwise ($\uparrow\uparrow$ and $\downarrow\downarrow$), like:

$$BVF_{(S=1/2)}^\uparrow = [\text{real rotor}(V_\uparrow^+) + \text{mirror rotor}(V_\uparrow^-)] \equiv [V^+ \uparrow\uparrow V^-] \quad 1.1$$

and:

$$BVF_{(S=-1/2)}^\downarrow = [\text{real antirotor}(V_\downarrow^+) + \text{mirror antirotor}(V_\downarrow^-)] \equiv [V^+ \downarrow\downarrow V^-] \quad 1.2$$

correspondingly.

For the other hand, the (BVB^\pm) of two possible polarization: (+) and (-) are formed by the pairs of real and mirror circulations, rotating in opposite direction:

$$BVB_{S=0}^\pm = [\text{real rotor}(V_\uparrow^+) + \text{mirror antirotor}(V_\uparrow^-)] \equiv [V^+ \uparrow\downarrow V^-] \quad 1.3$$

The BVB^\pm with properties of Falaco soliton (Kiehn, 1998) is the intermediate transition state between (BVF^\uparrow) and (BVF^\downarrow):

$$BVF_{(S=1/2)}^\dagger \Leftrightarrow BVB_{S=0}^\pm \Leftrightarrow BVF_{(S=-1/2)}^\dagger \quad 1.4$$

1.1. Virtual Bose condensation (VirBC) in bivacuum as a base of nonlocality

The condition of **primordial** bivacuum in the absence of matter is its total symmetry, defined as equality of the effective mass of rotors and antirotors: V^+ and V^- of $BVF_{(S=\pm 1/2)}^\dagger$ and $BVB_{S=0}^\pm$:

$$|m_{\bar{V}}| = |m_V| \quad \text{and} \quad \Delta m_V = |m_{\bar{V}}| - |m_V| = 0 \quad 1.5$$

The **internal** group velocity of Compton vortices, forming BVB^\pm and BVF^\dagger is equal to light velocity ($v^{in} = c$). The **external** resulting impulses (momentum) of all of three kind of symmetric primordial bivacuum excitations as well as their kinetic energies (T_{kin}^{ext}) are equal to zero, as far their external group velocity ($v^{ext} = 0$) is zero:

$$\mathbf{P}_{BVB^\pm} = \mathbf{P}_{BVF^\dagger} = \mathbf{P}_{BVF^\dagger} = m_0 v^{ext} = 0 \quad 1.5a$$

$$(T_{kin}^{ext})_{BVB^\pm, BVF^\dagger} = (\mathbf{P}_{BVB^\pm, BVF^\dagger}^{ext})^2 / (2m_0) = 0 \quad 1.5b$$

where: m_0^i is the effective mass of BVB^\pm and BVF^\dagger , corresponding to the rest mass of the electrons of three generation: $i = e, \mu, \tau$.

Conditions 1.5 and 1.5a mean that **external** virtual wave B length of bivacuum fermions and bivacuum bosons, as a ratio of Plank constant to their **external** impulse, is infinitive:

$$\lambda_{BC}^{ext} = \mathbf{h} / \mathbf{P}_{BVB^\pm, BVF^\dagger}^{ext} = h / (\Delta m_V c) = \infty \quad 1.6$$

It is shown in our work, using **Virial theorem**, that corresponding to (1.6) infinitive virtual Bose condensation (BC) of bivacuum coincide with condition of **nonlocality** (Kaivarainen, 2000). **We define nonlocality, as independence of any potential in the volume of BC (real or virtual) on distance (r):**

$$\bar{V}(r) \sim r^n = const \quad 1.6a$$

In the case under consideration (1.5a and 1.5b): $n = 2T_{kin}/V = 0$ and $r^n = 1 = const$.

Nonlocality is one of the most intriguing problem of quantum theory (Peres, 1993). Experimental evidence of quantum nonlocality of Einstein-Podolsky-Rosen type (1935) has been obtained the first time by Aspect and Grangier in 1983 in experiments with twin photons. Nonlocal interaction between entangled ions has been proved recently, as experimental violation of Bell's inequality with efficient detection (Rowe et al., 2001).

Deviation of **secondary vacuum** from ideal symmetry (1.5) leads to nonzero impulse $\mathbf{P}_{BVB^\pm, BVF^\dagger}^{ext} = (\Delta m_V c)_{BVB^\pm, BVF^\dagger} > 0$ and disassembly of infinitive primordial virtual BC to huge, but finite **domains of virtual BC** with characteristic dimension:

$$\lambda_{VirBC}^{ext} = \mathbf{h} / \mathbf{P}_{BVB^\pm, BVF^\dagger}^{ext} = h / (\Delta m_V c)_{BVB^\pm, BVF^\dagger} < \infty \quad 1.6b$$

The values of λ_{BC}^{ext} are dependent on gravitational and magnetic fields tension, affecting bivacuum symmetry shift. The λ_{BC}^{ext} is a characteristic spatial parameter of nonlocality in the volume of corresponding domains of bivacuum in state of virtual BC. The nonlocal in the volume of domain of virtual BC bivacuum symmetry shift (Δm_V) oscillation (BvSO) should be accompanied by corresponding oscillation of value of λ_{VirBC}^{ext} .

1.2. Quantization of primordial Bivacuum and Bivacuum gap oscillations (BvO)

The energies of **real and mirror rotors**, forming bivacuum fermions (BVF^\dagger) and bivacuum bosons (BVB^\pm) are quantized as quantum harmonic oscillators of positive and negative energy:

$$(E_V^+)_n^i = +\hbar\omega_0^i\left(\frac{1}{2} + n\right) = +m_0^i c^2\left(\frac{1}{2} + n\right) = \frac{\hbar c}{(L_V^+)_n^i} \quad 1.7$$

$$(E_V^-)_n^i = -\hbar\omega_0^i\left(\frac{1}{2} + n\right) = -m_0^i c^2\left(\frac{1}{2} + n\right) = -\frac{\hbar c}{(L_V^-)_n^i} \quad 1.7a$$

where: ω_0^i and m_0^i correspond to zero-point angle frequency and effective mass of real and mirror rotors with quantum number $n = 0$.

It is assumed in this model, that the resonant zero-point frequencies of bivacuum (ω_0^i), dependent on generation of $(BVF^\dagger)^i$ are related directly to the rest mass of basic elementary particles, corresponding to **three generation**: $i = (e, \mu, \tau)$ of the electrons, quarks and neutrinos:

$$\omega_0^i = m_0^i c^2 / \hbar \equiv \omega_0^{e,\mu,\tau} = m_0^{e,\mu,\tau} c^2 / \hbar \quad 1.8$$

The radiuses of corresponding rotors and antirotors, forming BVF^\dagger and BVB^\pm of primordial vacuum are equal:

$$(L_V^+ = L_V^-)_n^i = \hbar / [m_0^i c \left(\frac{1}{2} + n\right)] \quad 1.9$$

It is easy to see from (1.7 and 1.7a), that in symmetric **primordial** bivacuum (i.e. in the absence of vacuum symmetry shift) the resulting energy of BVF^\dagger and BVB^\pm are equal to zero:

$$E_{BVF^\dagger}^i = E_{BVB^\pm}^i = (E_V^+)_n^i + (E_V^-)_n^i = 0 \quad 1.9a$$

This condition of energetic symmetry means the absence of excessive matter or antimatter in **primordial bivacuum**.

The rotors $(V_\uparrow^+)^i$ and antirotors $(V_\downarrow^+)^i$ of two possible polarization (\uparrow and \downarrow) in realms of positive (real) and negative (mirror) vacuum, are separated from each other by **quantized energetic gap** $(A_V^n)^i$. **The value of this gap is equal to difference between quantized energy of rotors and antirotors of $(BVF^\dagger)^i$ or (BVB^\pm) eqs. (1.7 and 1.7a) in realms of positive and negative energy:**

$$(A_V^n)^i = (E_V^+)_n^i - (E_V^-)_n^i = \hbar\omega_0^i(2n + 1) = m_0^i c^2(2n + 1) \quad 1.10$$

The harmonic Bivacuum oscillations (BvO) are introduced as a symmetric oscillations of bivacuum energetic gap $(A_V^n)^i$, resulting from transitions between the gap with integer quantum numbers j and k .

The energy of BvO, corresponding to transitions between selected sublevels j and k from (1.10) is:

$$(A_{BvO}^{j-k})^i = (A_V^j)^i - (A_V^k)^i = 2(j - k) \hbar\omega_0^i = 2(j - k) m_0^i c^2 \quad 1.11$$

The bivacuum excitations: BVB^\pm , BVF^\dagger and BVF^\downarrow have a broad spectra of quantized energetic gaps (1.11) as far $(j - k)$ may change from 1 to ∞ at condition of primordial vacuum (1.9a).

1.3. Quantization of secondary Bivacuum

In **secondary Bivacuum**, existing in excess of inertial matter or antimatter and fields, the dynamic equilibrium (1.4) is shifted to the left or to the right, correspondingly.

For such a case the eqs.(1.7 and 1.7a), characterizing the energies of rotors and antirotors of BVF^\dagger and BVB^\pm transform to:

$$(E_V^+ + \Delta E_V^+)_n^i = +\hbar(\omega_0^i + \Delta\omega_0^i)\left(\frac{1}{2} + n\right) = +(m_0^i + \Delta m_0^i)c^2\left(\frac{1}{2} + n\right) \quad 1.12$$

$$(E_V^- + \Delta E_V^-)_n^i = -\hbar(\omega_0^i - \Delta\omega_0^i)\left(\frac{1}{2} + n\right) = -(m_0^i - \Delta m_0^i)c^2\left(\frac{1}{2} + n\right) \quad 1.12a$$

In general case: $|\pm\Delta\omega_0^i| \ll \omega_0^i$ and $\Delta m_0^i \ll m_0^i$.

The difference between the effective mass of V^+ and V^- of BVF^\dagger and BVF^\ddagger in accordance to our model, means **possibility of virtual charge (positive and negative) existing**, related to these bivacuum excitations.

The resulting energy of asymmetric BVF^\dagger and BVB^\pm , composing secondary bivacuum, as a sum of (1.12 and 1.12a) **in contrast to primordial one (see 1.9a) is nonzero** and dependent on the sign of vacuum shift (+ or -), related, in turn, to matter or antimatter excess:

$$\left(E_{BVF^\dagger, BVB^\pm}^i\right)_n = \pm 2\hbar\Delta\omega_0^i\left(\frac{1}{2} + n\right) = \pm 2\Delta m_0^i c^2\left(\frac{1}{2} + n\right) \quad 1.13$$

We can see, that the difference between sublevels of positive and negative secondary bivacuum - energetic gaps is dependent on vacuum symmetry shift $\hbar\Delta\omega_0^i = \Delta m_0^i c^2$ and excitation state, determined by (n) .

1.4. Virtual particles and antiparticles of bivacuum.

Virtual pressure waves (VPW $^\pm$) of positive and negative vacuum

The virtual particles ($\mathbf{VP}_{j,k}^+$) and antiparticles ($\mathbf{VP}_{j,k}^-$) *origination*, in this model are the result of **correlated transitions between different excitation states (j, k) of rotors ($\mathbf{V}_{j,k}^+$) and antirotors ($\mathbf{V}_{j,k}^-$)** in realms of positive and negative energy of Bivacuum:

$$[\mathbf{V}_j^+ - \mathbf{V}_k^+ \equiv \mathbf{VP}_{j,k}^+] \quad \text{virtual particles} \quad 1.14$$

$$[\mathbf{V}_j^- - \mathbf{V}_k^- \equiv \mathbf{VP}_{j,k}^-] \quad \text{virtual antiparticles} \quad 1.14a$$

from higher to lower levels ($j > k$), leading to emission of corresponding **virtual clouds (VC)**, formed by subquantum particles and antiparticles.

The *annihilation* of virtual particles and antiparticles represent the reverse transitions

$$[\mathbf{V}_k^\pm - \mathbf{V}_j^\pm \equiv -\mathbf{VP}_{k,j}^\pm] \quad 1.15b$$

accompanied by absorption of **VC**.

From (1.12 and 1.12a) the quantized energy of virtual particles and antiparticles of three generation ($i = e, \mu, \tau$) is defined by difference between j and k excitation states of rotors and antirotors, correspondingly:

$$(\mathbf{VP}_{j-k}^+)^i = E_{j-k}^i = \hbar(\omega_0^i + \Delta\omega_0^i)(j - k) = (m_0^i + \Delta m_0^i)c^2(j - k) \quad 1.16$$

$$(\mathbf{VP}_{j-k}^-)^i = \tilde{E}_{j-k}^i = -\hbar(\omega_0^i - \Delta\omega_0^i)(j - k) = -(m_0^i - \Delta m_0^i)c^2(j - k) \quad 1.16a$$

The resulting energy of pair of virtual particle and antiparticle is a sum of 1.16 and 1.16a:

$$(2\mathbf{VP}_{j-k}^\pm)^i = E_{j-k}^i + \tilde{E}_{j-k}^i = \hbar 2\Delta\omega_0^i(j - k) = 2\Delta m_0^i c^2(j - k) = \hbar(\omega_{2VP^\pm}^i)_{j-k} \quad 1.17$$

For the case when pair of **virtual** particle and antiparticle represents fermions with opposite charge, like virtual [electron + positron] pair our theory predicts that they may be excited in bivacuum by photons of frequency, leading from (1.17):

$$(\omega_{2VP^\pm}^i)_{j-k} = 2\Delta\omega_0^i(j - k) = 2\Delta m_0^i c^2(j - k)/\hbar \ll \omega_{e^-, e^+}^i = 2m_0^i c^2/\hbar \quad 1.17a$$

This frequency is much lower, than ω_{e^-, e^+}^i , necessary for generation of **real** [electron +

positron] pair.

It will be shown later in our work that only at the Golden mean condition, when the virtual mass symmetry shift is equal to the real rest mass of the electron, i.e. $\Delta m_0^i(j-k) = m_0$, the frequencies $(\omega_{2VP^\pm}^i)_{j-k}$ and ω_{e^-,e^+}^i coincide. Generation of virtual pairs of virtual particles and antiparticles in conditions of small **bivacuum symmetry shift** do not need very high frequencies of electromagnetic field due to compensation of their positive and negative energy.

At real condition: $\Delta m_0^i \ll m_0^i$, and most probable transitions with minimum $(j-k) = 1$ we have:

$$|\mathbf{VP}^+|^i \simeq |\mathbf{VP}^-|^i = m_0^i c^2 \quad 1.17b$$

Comparing this formula for minimum energy of virtual particle or antiparticle with expression for Bohm's nonlocal quantum potential in Sidrach's (1998) interpretation for the case when: $m = m_0$ we see that they coincide:

$$Q = -\frac{\hbar^2}{2m}(\nabla^2 R/R) = m_0^i c^2 = |\mathbf{VP}^+|^i \simeq |\mathbf{VP}^-|^i \quad 1.18$$

It means that in the framework of our theory the three possible values of quantum potential (Q^i) is equal to energy most probable virtual particles and antiparticles eqs. (1.16 and 1.16a). In secondary bivacuum such virtual particles may have nonlocal properties in the volumes of virtual Bose condensate, formed by them.

The process of [*origination* \rightleftharpoons *annihilation*] of virtual particles and antiparticles is accompanied by oscillation of **virtual pressure (VP $^\pm$)** in form of **positive and negative virtual pressure waves (VPW $^+$ and VPW $^-$)**. These quantum beats between BVB_j^\pm and BVB_k^\pm correspond to [*origination* \rightleftharpoons *annihilation*] of neutral **virtual bosons** and between BVF_j^\dagger and BVF_k^\ddagger correspond to [*origination* \rightleftharpoons *annihilation*] of charged **virtual fermions**. **As shown above this process may be stimulated by external electromagnetic field.**

The value of difference $[j-k]$ in (1.16 and 1.16a) determines the energy/mass and life-time of virtual particles and antiparticles in accordance to uncertainty principle.

Virtual pressure oscillations in form of VPW $^+$ and VPW $^-$ in realms of positive and negative vacuum **totally compensate each other in symmetric primordial bivacuum.**

However, in **secondary bivacuum**, in presence of matter and fields such compensation is violated and the resulting pressure of virtual particles or antiparticles becomes nonzero. This displays, for example, in Casimir effect. More detailed description of virtual energy density (ε^+ and ε^-) and virtual pressure waves (VPW $^+$ and VPW $^-$) of Bivacuum is presented in **Appendix A.**

2. Origination of matter as a result of bivacuum symmetry shift.

Sub-elementary particles and antiparticles

Our model postulates, that **the sub-elementary particles and sub-elementary antiparticles** in corpuscular [C] phase represent the asymmetrically excited bivacuum fermions:

$$(\mathbf{BVF}^\dagger)^* \equiv \mathbf{F}_\uparrow^- \quad \text{or} \quad (\mathbf{BVF}^\ddagger)^* \equiv \mathbf{F}_\downarrow^+ \quad 2.1$$

in form of [**real (m_C^+) + mirror (m_C^-)**] mass-dipole with opposite spins ($S = \pm \frac{1}{2}$) and charge (e^\pm). The spatial image of this **mass-dipole** is a correlated dynamic pair: [**real vortex + mirror rotor**] (Kaivarainen, 2000).

The difference between real inertial (m_C^+) and inertialess (m_C^-) mass are the result of bivacuum symmetry shift, accompanied by sub-elementary particle or sub-elementary antiparticle origination. The latter is dependent on the sign of shift.

The asymmetrically excited **bivacuum bosons**:

$$(\mathbf{BVB}^\pm)^* \equiv \mathbf{B}^\pm \quad 2.2$$

represent the intermediate or transition state between sub-elementary fermions of opposite spins:

$$\mathbf{F}_{\uparrow}^{-} \rightleftharpoons \mathbf{B}^{\pm} \rightleftharpoons \mathbf{F}_{\downarrow}^{+} \quad 2.3$$

2.1. The triplets of sub-elementary particles as a background of elementary particles

The electron, in accordance to our model, is a triplet formed by **two** negatively charged sub-elementary fermions of opposite spins ($\mathbf{F}_{\uparrow}^{-}$ and $\mathbf{F}_{\downarrow}^{-}$) and **one** sub-elementary antifermion ($\mathbf{F}_{\uparrow}^{+}$) with positive charge:

$$e^{-} = \langle [\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{-}] + \mathbf{F}_{\uparrow}^{+} \rangle \quad 2.4$$

The symmetric pair of standing sub-elementary fermion and sub-elementary antifermion:

$$[\text{wave} + \text{antiwave}B] \equiv [\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{+}] \quad 2.5$$

are pulsing between Corpuscular [C] and Wave [W] states in-phase, compensating the energy, spin and charge of each other. Notation (\bowtie) means such compensation. However this compensation is not total due to vacuum symmetry shift, produced by the uncompensated sub-elementary particle. Deviation of total compensation increases with particle velocity and fields tension, increasing symmetry shift.

The positron is like electron (2.4), however, with uncompensated sub-elementary antifermion ($\mathbf{F}_{\uparrow}^{+}$):

$$e^{+} = \langle [\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{-}] + \mathbf{F}_{\uparrow}^{+} \rangle \quad 2.6$$

The u -quark is considered as superposition of two μ or/and τ positron like structures

$$u = [e^{+} + e^{+}]_{\mu,\tau} \quad Z = +2/3 \quad 2.7$$

and **d -quarks** may be composed from two electron and one positron (μ or/and τ) like structures:

$$d = [(e^{-} + e^{-}) + e^{+}]_{\mu,\tau} \quad Z = -1/3 \quad 2.8$$

It is supposed, that each uncompensated sub-elementary fermions/antifermion of quarks has elementary charge: $\pm Z = \pm 1/3$.

It leads from our model, that elementary particles with fermion properties are composed from non equal number of sub-elementary particles and with boson properties - from their equal number.

For example photon, resulting from annihilation of the electron and positron may be considered as a system of three pairs of sub-elementary fermions and antifermions:

$$\text{photon} = 3[\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{+}] \quad e = 0; \quad S = 1 \quad 2.9$$

The value of spin of photon $S = 1$ may be explained by the in-phase rotation of both sub-elementary particles, forming one pair $[\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{+}]$ in contrast to other two pairs with antiphase rotation of $\mathbf{F}_{\uparrow}^{-}$ and $\mathbf{F}_{\downarrow}^{+}$.

The self-assembly of elementary particles from sub-elementary particles in asymmetric bivacuum may resemble self-organization of interacting vortices into vortex crystals (Jin, Dubin, 2000).

The symmetry of our bivacuum as respect to probability of elementary particles and antiparticles origination, makes it principally different from asymmetric Dirac's vacuum (1958), with its realm of negative energy saturated with electrons. Positrons in his model represent the 'holes', originated as a result of the electrons jumps in realm of positive energy.

3. Dynamic model of [Corpuscle(C) \rightleftharpoons Wave (W)] duality

It is supposed in this dynamic model, that duality of particle do not display itself as corpuscle [C] or wave [W], depending simply on the experimental way of particle detection. In such generally accepted opinion the both properties are embedded in particle **permanently**. In my model it is assumed, that the corpuscular [C] and wave [W] phases of sub-elementary particles/antiparticles represent two **alternative** phase of de Broglie wave (wave B), which are in dynamic equilibrium (Kaivarainen, 1993, 1995, 2000).

The frequency of [C \rightleftharpoons W] pulsation of sub-elementary particles is equal to frequency of quantum beats (ω_B) between asymmetric $[(BVF^\dagger)^* \equiv F_{\uparrow}^\dagger]$ states of bivacuum sub-elementary fermions (F_{\uparrow}^-) and antifermions (F_{\uparrow}^+) and symmetric (**BVF †**) of secondary Bivacuum.

In terms of quantized Bivacuum the energy of [C] phase (E_C) is a sum of energies of real (E_{C^+}) and mirror (E_{C^-}) corpuscular states of asymmetrically excited bivacuum fermion (F_{\uparrow}^\dagger).

For example:

$$E_C = E_{(V_{\uparrow}^\dagger)^*} + E_{V_{\uparrow}^\dagger} = \frac{3}{2}\hbar\omega + (-\frac{1}{2})\hbar\omega = \hbar\omega_B \quad 3.1$$

where: E_{C^+} corresponds to energy of excited rotor ($(V_{\uparrow}^\dagger)^*$); E_{C^-} corresponds to energy of antirotor in ground state (V_{\uparrow}^\dagger).

The asymmetric sub-elementary positive fermion may be presented as:

$$(F_{\uparrow}^+) \equiv [(V_{\uparrow}^\dagger)^* \Downarrow (V_{\uparrow}^\dagger)] \quad 3.2$$

and the asymmetric sub-elementary negative antifermion as:

$$(F_{\uparrow}^-) \equiv [(V_{\uparrow}^\dagger) \Downarrow (V_{\uparrow}^\dagger)^*] \quad 3.3$$

The energy of [W] phase (E_W) of the same sub-elementary particle (F_{\uparrow}^\dagger) is defined as the energy of **transition state** between rotors in excited real ($(V_{\uparrow}^\dagger)^*$) and ground (V_{\uparrow}^\dagger) states:

$$E_W = E_{(V_{\uparrow}^\dagger)^*} - E_{V_{\uparrow}^\dagger} = \frac{3}{2}\hbar\omega - \frac{1}{2}\hbar\omega = \hbar\omega_B \quad 3.4$$

This transition state, i.e. virtual sub-elementary particle, exists in form of **cumulative virtual cloud (CVC) of subquantum particles**.

We can see from eqs. (3.1 and 3.4), that the energy of both phase: [C] and [W] are equal to energy of de Broglie wave (wave B):

$$E_B = \hbar\omega_B = E_C = E_W \quad 3.4a$$

3.1. The extension of special theory of relativity, as a consequence of duality model

Postulated in our work **mass of rest (m_0) conservation law** for sub-elementary fermion (antifermion) in form of eq. (3.5) interrelates the real inertial mass (m_C^+), corresponding to asymmetrically excited rotor (antirotor) and mirror mass (m_C^-), corresponding to rotor (antirotor) in realm of negative (positive) energy

$$m_C^+ m_C^- = m_0^2 \quad 3.5$$

The real (inertial) and mirror (inertialess) masses - change with external group velocity ($v \equiv v_{gr}$) of sub-elementary particles, composing particles in the counterphase manner, compensating each other:

$$real\ mass: m_C^+ = \pm m_0 / [1 - (v/c)^2]^{1/2} \quad 3.6$$

$$mirror\ mass: m_C^- = \pm m_0 [1 - (v/c)^2]^{1/2} \quad 3.6a$$

The **real** mass (m_C^+) corresponds to the energy of excited positive vacuum and the **mirror** mass (m_C^-) to the ground state of the negative vacuum.

The properties of sub-elementary particles, related to mirror mass and negative energy are **hidden** in positive vacuum. For sub-elementary **antiparticles** with opposite symmetry shift of bivacuum the properties of mirror and real state change their place. The mass of negative vacuum becomes real and that of positive one - mirror:

$$\text{real mass: } m_C^- = \pm m_0/[1 - (v/c)^2]^{1/2} \quad 3.6b$$

$$\text{mirror mass: } m_C^+ = \pm m_0/[1 - (v/c)^2]^{1/2} \quad 3.6c$$

Dividing eq.(3.6a) to (3.6), we get important relation between **real** and **mirror** mass of sub-elementary particles:

$$\frac{m_C^-}{m_C^+} = 1 - (v/c)^2 \quad 3.7$$

It easy to see from this formula, that if the external group velocity is zero: $v = 0$, we get the conditions of **primordial bivacuum**:

$$\text{mass symmetry shift: } \Delta m_C = m_C^+ - m_C^- = 0 \quad 3.7a$$

$$\text{vacuum symmetry shift: } \Delta m_V = m_V^+ - m_V^- = 0 \quad 3.7b$$

The eqs. 3.6 and 3.6a can be transformed to following shapes:

$$(E_C^+)^2 = (m_C^+)^2 c^4 = m_0^2 c^4 + (m_C^+ v)^2 c^2 \quad 3.8$$

$$(E_C^-)^2 = (m_C^-)^2 c^4 = m_0^2 c^4 - (m_0 v)^2 c^2 \quad 3.8a$$

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

The first of these eqs. coincides with formula, obtained by Dirac (1958), the second is a new one.

At the external group velocity, equal to zero, $v = 0$, the real and mirror energies are equal to the rest energy of symmetrical BVF⁺ and BVB[±] :

$$E_C^+ = E_C^- = \pm m_0 c^2 \quad 3.8b$$

3.2. Corpuscular and Wave phase of sub-elementary particles.

Unification of quantum mechanics and relativist theory

The **[C] phase of sub-elementary particle** is considered in this model as [real (m_C^+) + mirror (m_C^-)] mass dipole. The **[W] phase** of sub-elementary particle has the same energy and impulse, as the [C] phase $E_C = E_W$; $P_C = P_W$ and emerge as a result of quantum beats between real [C⁺] and mirror [C⁻] states of [C] phase in a form of **cumulative virtual cloud [CVC]** of subquantum particles (Kaivarainen, 2000, 2001).

The energy of sub-elementary **particles**, pulsating between two phase [C \rightleftharpoons W] with frequency (ω_B) may be presented in few forms:

$$E_W = \hbar\omega_B = m_C^+ c^2 - m_C^- c^2 = m_0 c^2 \frac{(v/c)^2}{[1 - (v/c)^2]^{1/2}} = m_C^+ v^2 = 2T_k = E_C \quad 3.9$$

where: $2T_k = m_C^+ v^2$ is a doubled real kinetic energy of sub-elementary particle.

The real energy of sub-elementary particle: $E^+ = m_C^+ c^2$ can be expressed from (3.9) as:

$$E^+ = m_C^+ c^2 = m_C^+ v^2 + m_C^- c^2 \quad 3.9a$$

The subquantum particles and antiparticles, in accordance to our model, form the superfluid bivacuum and sub-elementary particles/antiparticles.

It easy to see that the energy $E_{C,W}$, equal to the doubled real kinetic energy ($2T_k$) of sub-elementary particle, is related to corresponding **hidden** impulse (momentum) P^\pm :

$$E_{C,W} = (2T_k) = (m_C^+ - m_C^-)c^2 = m_C^+v^2 = P^\pm c \quad 3.10$$

$$\text{where : } P^\pm \equiv P_{W,C}^\pm = (m_C^+ - m_C^-)c = m_C^+v(v/c) \quad 3.11$$

The hidden (L^\pm) and real **external** (L_C^+) spatial dimensions of sub-elementary particle as mass dipole are, correspondingly:

$$L^\pm \equiv L_{W,C}^\pm = \frac{\hbar}{(m_C^+ - m_C^-)c} = \frac{\hbar}{m_C^+v(v/c)} \quad 3.12$$

$$\text{and } L_C^+ = \frac{\hbar}{m_C^+v} \quad P_C^+ = m_C^+v \quad 3.12a$$

We can see from (3.12), that the characteristic hidden dimension of [C] phase and hidden dimension of [W] phase in form of CVC are equal: $L^\pm \equiv L_C^\pm = L_{W,C}^\pm$.

For nonrelativistic elementary particles ($v \ll c$), the external L_C^+ is much shorter, than hidden L_{CVC}^\pm , as it leads from (3.12) and (3.12a):

$$L_C^+/L^\pm = P^\pm/P_C^+ = v/c \quad 3.13$$

However, for particles, like photon, when: $v = c$, the hidden and real length and impulses of elementary particles are equal: $L_C^+ = L^\pm$ and $P^\pm = P_C^+$.

It leads from canonical forms of eqs. (3.8) and (3.8a) that spatial image of real $[C^+]$ state is **equilateral hyperbola** and spatial image of mirror $[C^-]$ state of [C] phase is a **circle** (Kaivarainen, 2000, 2001).

Spatial image of CVC, representing the [W] phase, as a difference between images of $[C^+]$ and $[C^-]$ states is a **parted (two-cavity) hyperboloid** (Kaivarainen, 2000, 2001).

The restoration of [C] - PHASE in form of $[real + mirror]$ mass-dipole is a result of binding of CVC to the ground state of BVF^\uparrow or BVF^\downarrow , accompanied by their asymmetric excitation to state of uncompensated sub-elementary particle of corresponding spin: $+1/2$ or $-1/2$:

$$[BVF^\uparrow + CVC] \xrightarrow{[W \rightarrow C]} F_{\uparrow}^\pm \quad 3.14$$

. This $[W \rightarrow C]$ transition is totally reversible with the opposite one $[C \rightarrow W]$:

$$F_{\uparrow}^\pm \xrightarrow{[C \rightarrow W]} [BVF^\uparrow + CVC] \quad 3.15$$

It leads from (3.6 and 3.6a) that in general case mass of rest of elementary particles (m_0) has the intermediate value between real and mirror masses:

$$|m_C^+| \geq m_0 \geq |m_C^-| \quad 3.16$$

The resulting energy of CVC in bivacuum, equal to energy of elementary de Broglie wave (wave B) in both phase, may be presented as a difference between contributions to CVC of positive and negative vacuum:

$$E_{CVC} = (m_C^+ - m_C^-)c^2 = E_{CVC}^+ - E_{CVC}^- = \hbar\omega_B \quad 3.17$$

where the contributions of positive and negative subquantum particles to resulting energy (E_{CVC}) of CVC are:

$$E_{CVC}^+ = m_C^+c^2 \quad 3.18$$

$$\text{and } E_{CVC}^- = m_C^-c^2 \quad 3.18a$$

We can see, that formula (3.17) may be interpreted as a difference between energies of

positive and negative vacuum, generated by sub-elementary fermion:

$$E_{CVC}^+ \sim \varepsilon^+ \quad \text{and} \quad E_{CVC}^- \sim \varepsilon^- \quad 3.19$$

Propagation of elementary fermions $\langle [F_{\uparrow}^- \otimes F_{\uparrow}^+] + F_{\uparrow}^{\pm} \rangle$ in bivacuum in a course of $[C \rightleftharpoons W]$ cycling is a jump-way process, termed '**kangaroo effect**', because the **[W] phase** of uncompensated sub-elementary particle F_{\uparrow}^{\pm} is luminal, in contrast to sub-luminal **[C] phase**. For the other hand, both phase [C] and [W] of symmetric pair $[F_{\uparrow}^- \otimes F_{\uparrow}^+]$ are luminal in accordance to our model.

4. Electromagnetism, gravitation and their unification

4.1. The electric and magnetic components of electromagnetic charge

The energy of [W] phase of sub-elementary particle in form of CVC results from difference between energies of subquantum particles of positive and negative vacuum, composing CVC (eq. 3.17).

In our model we relate electric (i) and magnetic (η) components of electromagnetic charge (e) to contributions of positive and negative subquantum particles, correspondingly (eqs. 3.18 and 3.18a):

$$i \sim E_{CVC}^+ = m_C^+ c^2 \quad 4.1$$

$$\eta \sim E_{CVC}^- = m_C^- c^2 \quad 4.1a$$

The product of two components is equal to resulting charge squared, which is permanent value, in contrast to i and η :

$$i \times \eta = e^2 = \alpha \hbar c \quad 4.1b$$

The electromagnetic fine structure constant is: $\alpha = e^2/\hbar c = e^2/Q^2$, where the total charge we define like: $Q = (\hbar c)^{1/2}$.

Our notion of magnetic component of electromagnetic charge is alternative to notion of Dirac's monopole (Dirac, 1958). His theory leads to following relation between monopole - magnetic elementary charge (g) and electric charge (e):

$$ge = \frac{n}{2} \hbar c \quad 4.1c$$

where : n is the integer number

It follows from this definition that minimal magnetic charge (at $n = 1$) is as big as $g \cong 67.7e$. The mass of monopole should be huge $\sim 10^{16} GeV$.

All numerous attempts to reveal such particles in experiment has failed.

Our model does not need monopole for explanation the symmetry of electromagnetism. The notion of monopole is replaced by that of magnetic component of electromagnetic charge (η), related to dynamics of mirror mass of uncompensated sub-elementary particle of the electron.

4.2. Electromagnetic potential of sub-elementary fermion

We define the maximum of electromagnetic potential, generated by sub-elementary particle, as the internal interaction energy between electric (i) and magnetic (η) fractions of elementary charge on the distance, determined by the mass-dipole radius (3.12):

$$E_{el}^{\max} = \frac{i \times \eta}{L^{\pm}} = \frac{e^2}{L^{\pm}} = \alpha(m_C^+ - m_C^-)c^2 = \quad 4.2$$

$$= \alpha m_0 c^2 \frac{(v/c)^2}{[1 - (v/c)^2]^{1/2}} = \alpha m_C^+ v^2 = \alpha 2T_k \quad 4.2a$$

where the Compton radius of vorticity of sub-elementary fermion (3.12) is:

$$L^\pm = \hbar/[(m_C^+ - m_C^-)c] = \hbar c/[m_C^+ v^2] \quad 4.2b$$

It leads from equations obtained, that small part of W-phase energy in form of CVC (3.9), determined by electromagnetic fine structure constant ($\alpha = e^2/\hbar c$) as a factor, is responsible for maximum of internal electromagnetic potential, equal to that of external [E_{el}^{\max}].

From (4.2a) the maximum of electromagnetic force of elementary particle with kinetic energy T_k , acting on other charged elementary particle with real inertial mass (m_C^+), moving with velocity v , may be presented in form:

$$F_{el}^{\max} = \frac{e^2}{(L^\pm)^2} = 2 \frac{m_C^+ v^2}{\hbar c} \alpha T_k \quad 4.2c$$

The doubled real kinetic energy of elementary particle in **general case of its translational and rotational movement** with angle frequency (ω_{rot}) on the orbit with radius (L_{rot}) may be presented as:

$$2T_k = (m_C^+ v^2)_{tr} + (m_C^+ \omega_{rot}^2 L_{rot}^2)_{rot} = m_C^+ (v^2 + \omega_{rot}^2 L_{rot}^2) \quad 4.3$$

4.3. Gravitational potential of sub-elementary fermion

The maximum of gravitational potential of uncompensated sub-elementary particle of elementary particle, we define as the energy of gravitational attraction between real (m_C^+) and mirror (m_C^-) mass of [C] phase, separated by wave B hidden mass-dipole dimension (3.12):

$$E_G^{\max} = G \frac{m_C^+ m_C^-}{L^\pm} = G \frac{m_0^2}{L^\pm} = \quad 4.4$$

$$= \beta_G (m_C^+ - m_C^-) c^2 = (m_V^+ - m_V^-) c^2 = \beta_G 2T_k = \quad 4.4a$$

$$= \beta_G m_C^+ (v^2 + \omega_{rot}^2 L_{rot}^2) = E_G^{tr} + E_G^{rot} \quad 4.4b$$

where the contribution to gravitation, related to translational component of mass is

$$E_G^{tr} = \beta_G m_C^+ v^2$$

and contribution of particle rotation (torsion) is:

$$E_G^{rot} = \beta_G m_C^+ \omega_{rot}^2 L_{rot}^2$$

In contrast to E_{el}^{\max} , defined by electromagnetic fine structure constant ($\alpha = e^2/\hbar c$), the maximum of gravitational potential (E_G^{\max}) is determined by introduced in our work (Kaivarainen, 2000, 2001) **gravitational fine structure factor**

$$\beta_G = m_0^2/M_{Pl}^2 \quad 4.4c$$

The Plank mass is defined as: $M_{Pl} = (\hbar c/G)^{1/2}$.

It is supposed in our definitions of electromagnetic and gravitational potentials (4.2 and 4.4), that the **maximums of external and internal potentials**, generated by sub-elementary particles, are equal.

The maximum value of electromagnetic and gravitational potentials decreases with distance (R) like:

$$[E_{el}(r) \text{ and } E_G(r)] \sim \vec{r}/r \quad 4.5$$

The maximum of internal gravitational force of elementary particle with kinetic energy T_k ,

acting on other particle with real inertial mass (m_C^+), moving with velocity (v) :

$$F_G = (\vec{r}/r)^2 F_G^{\max} = (\vec{r}/r)^2 G \frac{m_0^2}{(L^\pm)^2} = (\vec{r}/r)^2 \frac{2\beta T_k}{\hbar c} m_C^+ v^2 \quad 4.5a$$

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

For the case of macroscopic body as a system of interacting atoms and molecules, the translational and rotational contributions should be subdivided to internal (microscopic) and external (macroscopic) sub-contributions.

The resulting gravitational potential of body, containing (i) particles, with total mass (M), rotating on orbit with radius (R_{rot}^{ext}), will have a shape:

$$\begin{aligned} \vec{E}_G &= [(E_G^{tr})^{in} + (E_G^{tr})^{ext}] + [(E_G^{rot})^{in} + (E_G^{rot})^{ext}] = \\ &= \frac{\vec{r}}{r} \beta_G \left(\sum_i^i (\overline{m_C^+ v^2})_i^{in} + M v_{ext}^2 \right)^{tr} + \frac{\vec{r}}{r} \beta_G \left(\sum_i^i (\overline{m_C^+ \omega_{rot}^2 L_{rot}^2})_i^{in} + M (\omega_{rot}^{ext} R_{rot}^{ext})^2 \right)^{rot} \end{aligned} \quad 4.6$$

The contribution of internal translational and rotational (librational) dynamics may be comparable or bigger than the external ones. Our theory predicts that the increasing of temperature of solid body may increase its gravitational potential due to activation of thermal dynamics of atoms and molecules.

For the other hand, interaction of molecules of body with electromagnetic field (photons), increasing their polarizability and, consequently, Van der Waals interactions, will reduce molecular thermal dynamics and the internal kinetic energy of body. It should reduce also its gravitational potential. There are some experimental evidence, pointing, that the above predictions of my theory are right.

The gravitational factor ($\beta_G = m_0^2/M_{Pl}^2$) relates the mass symmetry shift ($m_C^+ - m_C^-$) with vacuum symmetry shift $\Delta m_V = (m_V^+ - m_V^-)$, which, in turn, is dependent on equilibrium constant between bivacuum fermions of opposite spins ($K_{BVF^\uparrow \rightleftharpoons BVF^\downarrow} = \frac{N^+[BVF^\uparrow]}{N^-[BVF^\downarrow]}$):

$$\Delta m_V = |m_V^+| - |m_V^-| \equiv \beta_G (m_C^+ - m_C^-) \sim (N^+ m_{BVF^\uparrow} - N^- m_{BVF^\downarrow}) \quad 4.7$$

It means that local gravitational potential may be regulated by fields, influencing vacuum symmetry shift via equilibrium constant ($K_{BVF^\uparrow \rightleftharpoons BVF^\downarrow}$) change.

In our approach, the **spin (torsion) potential** (\vec{E}_S) may be defined simply as a part of gravitational field of body, dependent on its rotational kinetic energy (internal and external), and asymmetry of its distribution in 3D space. From (4.6), we get the formula of torsion field (\vec{E}_T):

$$\begin{aligned} \vec{E}_T &\equiv E_G^{rot} = [(E_G^{rot})^{in} + (E_G^{rot})^{ext}] \\ &= \frac{\vec{r}}{r} \beta_G \left(\sum_i^i (\overline{m_C^+ \omega_{rot}^2 L_{rot}^2})_i^{in} + M (\omega_{rot}^{ext} R_{rot}^{ext})^2 \right)^{rot} \end{aligned} \quad 4.8$$

Like the gravitational field, the torsion field is not nonlocal. Only nonresonant Bivacuum oscillations (BvO) are nonlocal in the scale of virtual Bose condensate, where they are excited.

4.4. The influence of curled magnetic field, generated by rotating body, on its gravitational potential

The dynamic equilibrium between bivacuum fermion and antifermions [$BVF^\uparrow \rightleftharpoons BVF^\downarrow$] may be changed also due to difference of interaction energy of curled magnetic field (\vec{H}), generated by rotating body, with magnetic moments of **virtual fermions** ($\vec{\mu}_{BVF^\uparrow}$) and **virtual antifermions** ($\vec{\mu}_{BVF^\downarrow}$), which are different in conditions of asymmetric secondary Bivacuum:

$$\Delta \vec{E}_G^H = \vec{H}(N^- \vec{\mu}_{BVF^\dagger} - N^+ \vec{\mu}_{BVF^\downarrow}) \quad 4.9$$

Consequently, the equilibrium constant, influencing the gravitational potential may be expressed as:

$$K_{BVF^\dagger \rightleftharpoons BVF^\downarrow} = \exp\left(-\frac{\Delta \vec{E}_G^H}{kT_R + \Delta U}\right) \quad 4.9a$$

Corresponding contribution of the curled magnetic field to asymmetry of bivacuum ($\Delta m_V = m_V^+ - m_V^-$) and excessive virtual pressure ΔVP^\pm (see Appendix A) change the resulting gravitational potential (4.6). This effect is dependent on relative orientation of vectors of gravitational field polarization between two interacting mass [$\vec{E}(M \leftrightarrow m)$] and \vec{H} and the value of magnetic field \vec{H} tension.

Consequently, in the presence of curled magnetic field, generated by rotating body the resulting gravitational potential may be expressed as a sum of three contributions:

$$E_G = [E_G^tr + E_G^{rot}]^{in,ext} \pm \Delta E_G^H \quad 4.10$$

Contribution of magnetic field to resulting gravitational potential, defined by (4.9), may have the opposite sign, than $[E_G^tr + E_G^{rot}]^{in,ext}$. It means, that magnetic field, generated by body, may influence its gravitational potential and effective mass, increasing or decreasing E_G . This important result of our theory is in total accordance with Searl effect, confirmed in experiments of de Palma, Baurov (1998), Roshin and Godin (2000). These experiments and our theory results point to possibility of extraction of 'free' energy from **secondary bivacuum** due to its artificial symmetry shift. The absence of this symmetry shift in **primordial bivacuum**, i.e. in the absence of matter and fields (see section 1.1) makes such energy pumping impossible. It means that the gravitational and electromagnetic potentials of secondary bivacuum could be a real source of "free" energy, like in the case of waterfall.

The Einstein's theory of general relativity did not take into account such factors as body rotation, its internal dynamics and magnetic field, generated by body.

4.5. Possible hydrodynamic mechanism of gravitational interaction

The gravitation mechanism can be similar to hydrodynamic Bjorkness interaction between pulsing particles in liquids, radiating acoustic waves. We suppose that gravitational waves in form of quantum beats between asymmetric positive and negative ground states of bivacuum, decrease the vacuum symmetry shift. In turn, this leads to decreasing of the **virtual pressure (VP $^\pm$)** between particles more than outside of them. **The excessive outside virtual pressure provide the gravitational attraction between bodies.**

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

In our approach instead the radiuses of spheres we can introduce the **effective amplitude of uncompensated virtual pressure waves (VPW $^\pm$)** proportional to number of elementary particles in the volume of gravitating body with coherent [$C \rightleftharpoons W$] pulsation of pairs [$\mathbf{F}_\uparrow^- \rightleftharpoons \mathbf{F}_\downarrow^+$] as a part of triplets, forming elementary particles (see 2.4 - 2.8). This effective VPW $^\pm$ amplitude is directly related to the real mass of body, defined by contribution of uncompensated sub-elementary particles/antiparticles [\mathbf{F}_\uparrow^\pm].

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 (repulsion) factor with increasing the distance between galactics. This confirms our hydrodynamic model of mechanism of gravitation.

Gravitational waves represent the density/pressure oscillations of virtual particles and antiparticles in form of excessive virtual pressure waves (VPW[±]), depending on vacuum symmetry shift: $\Delta m_V = |m_V^+ - m_V^-|$.

In contrast to gravitational field, the electromagnetic field is a result of distant components of CVC interference, dependent on mass symmetry shift: $\Delta m_C = |m_C^+ - m_C^-|$, generated by **uncompensated** sub-elementary particles of triplets.

The mass symmetry shift is interrelated with Δm_V as:

$$\Delta m_V = |m_V^+ - m_V^-| = \beta |m_C^+ - m_C^-| \quad 4.10a$$

Comparing our formulae for total electromagnetic (4.2) and gravitational (4.4a) energies, we get the relation between them:

$$\frac{E_{el-m}}{E_G} = \frac{\alpha}{\beta} = \frac{e^2}{Gm_0^2} = 4.1975 \cdot 10^{42} \quad 4.11$$

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

4.6. The interrelation of new model of gravitation 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 bivacuum symmetry shift parameter (4.10a).

Einstein postulates that gravitation changes the trajectory of probe body from the straight line 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 the flat surface, the Lobachevskian 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:

$$R = \sqrt{\frac{S}{\Sigma - \pi}} \quad 4.12$$

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

$$\Sigma = \pi + S/R^2 \quad 4.13$$

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.

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

$$\pm L_V = \pm \frac{\lambda_V}{2\pi} = \frac{\hbar}{\pm \Delta m_V c} = \frac{\hbar}{\pm \beta \Delta m_C c} \quad 4.14$$

where:

$$\pm \Delta m_V = \pm (|m_V^+| - |m_V^-|) = \pm \beta \Delta m_C \quad 4.14a$$

is a vacuum symmetry shift, positive for particles and negative for antiparticles, related directly to mass symmetry shift:

$$\begin{aligned} \Delta m_C &= m_C^+ - m_C^- = m_C^+ (v/c)^2 & 4.14b \\ m_C^+ &= m_C^+, \quad \text{if } m_C^+ > m_C^- \quad (m_C^+ \text{ is a real mass}) \\ m_C^+ &= m_C^-, \quad \text{if } m_C^+ < m_C^- \quad (m_C^- \text{ is a real mass}) \end{aligned}$$

The real mass, in contrast to mirror one, follows the law of relativist mechanics.

The m_C^+ is a real mass for particles (at positive mass symmetry shift) and m_C^- is a real mass for antiparticles (at negative mass symmetry shift). However, for both case the relation $m_C^+ m_C^- = m_0^2$ is true.

It is possible to calculate, using (4.14) that vacuum curvature, induced by particle with mass, equal to that of the electron at Golden mean condition: $\Delta m_C = m_0$ (see eq. 5.6), taking $m_0 = m_e = 9.1095 \cdot 10^{-31} \text{ kg}$ is: $L_V^e = 3.2288 \cdot 10^{35} \text{ m}$.

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

The maximum of gravitational potential, produced by one proton, calculated from (4.4a) at Golden mean condition (5,6) is equal to: $\epsilon_G^P = 8.8904 \cdot 10^{-52} \text{ J}$.

The analogy between R and L_V (4.12 and 4.14) is obvious. The more is energy of gravitational field ϵ_G , the more is the mass and vacuum symmetry shift (Δm_V) and bivacuum curvature. The bigger is bivacuum curvature, the less is radius (L_V).

In condition of black hole origination, leading from our theory, when $\Delta m_V \rightarrow \beta M_{Pl}$ the bivacuum curvature radius tends to that, determined by gravitational radius ($r_g = 2\hbar/M_{Pl}c$) of black hole and Plank length ($L_{Pl} = \hbar/M_{Pl}c$):

$$L_V^* = \frac{\hbar}{\beta M_{Pl}c} = r_g/2\beta \quad 4.15$$

On the other hand, in the absence of real mass and gravitation, i.e. in primordial bivacuum, when the positive and negative vacuum ground states are in equal:

$$\begin{aligned} |m_V^+| &= |m_V^-| = \beta m_0 & 4.16 \\ \text{and } m_C^+ &= m_C^- = m_0 \end{aligned}$$

and $\Delta m_V = 0$, then the bivacuum is flat: $L_V = R = \infty$.

The photons trajectory reflects the bivacuum curvature in 3D space. It is a consequence of our model of photon (see 2.9) as a superposition of three pairs of coherent pair: $3[F^+ \bowtie F^-]$, moving in bivacuum without its symmetry perturbation.

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

As well as General theory of relativity our theory can explain the red shift of photons in

gravitational field. The RED or BLUE, frequency shift of photons in gravitation field:

$$\Delta\omega_p^{1,2} = \omega_p^{(1)} - \omega_p^{(2)} \quad 4.17$$

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

$$\Delta\Delta m_V^{2,1} = \Delta m_V^{(2)} - \Delta m_V^{(1)} \quad 4.18$$

in a form:

$$\hbar\Delta\omega_p^{2,1} = \Delta\Delta m_V^{2,1} c^2 \quad or : \quad \Delta\omega_p^{1,2} = \frac{\Delta\Delta m_V^{2,1} c^2}{\hbar} \quad 4.19$$

It is easy to see that if $\Delta\Delta m_V^{1,2} = 0$, i.e. bivacuum is flat, then $\omega_p^{(1)} = \omega_p^{(2)}$ and the photon frequency shift is absent.

If the difference: $\Delta m_V^{(2)} - \Delta m_V^{(1)} < 0$, then $\Delta\Delta m_V^{1,2}$ and $\Delta\omega_p^{1,2}$ are negative and we get the red shift of photon frequency, meaning its decreasing:

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

If $\Delta m_V^{(2)} - \Delta m_V^{(1)} > 0$, then $\Delta\Delta m_V^{1,2}$ and $\Delta\omega_p^{1,2}$ are positive and we get the blue shift of photon:

$$\omega_p^{2,1} = \omega_p^1 + \Delta\omega_p^{2,1} \quad (blue \ shift)$$

We may conclude, that our theory of Gravitation, based on idea of Bivacuum and $[C \rightleftharpoons W]$ duality model explains the same phenomena, as do the General theory of relativity, but in terms of quantum mechanics and bivacuum symmetry shift, instead of curved space-time. The tensor properties of bivacuum symmetry shift is related directly to that of mass symmetry shift: $(\Delta m_V = \beta\Delta m_C)_{x,y,z}$, produced by 3D asymmetry of relativist real mass dependence on the external group velocity in 3D space.

5. Interrelation Between Hidden and External Parameters of Elementary Particles.

5.1. Hidden Harmony as a Condition of Golden Mean

The internal (v_{gr}^{in} and v_{ph}^{in}) and external ($v^{ext} \equiv v$ and $v_{ph}^{ext} \equiv v_{ph}$) group and phase velocities of sub-elementary particles are unified with light velocity as follows (Kaivarainen, 1993; 2000):

$$v_{gr}^{in} v_{ph}^{in} = v_{gr} v_{ph} = c^2 \quad 5.1$$

This condition in combination with: $m_0^2 = m_C^+ m_C^-$ and important postulate of our model, that the internal kinetic energies of positive and negative vortices of sub-elementary particles are permanent and equal to the Compton energy or relativist rest energy of particles ($m_0 c^2$):

$$2T_k^{in} = m_C^+ (v_{gr}^{in})^2 = m_C^- (v_{ph}^{in})^2 = m_0 c^2 = 2T_0 = const \quad 5.1a$$

easily get us to the following relation between internal and external group velocities:

$$\frac{c}{v_{gr}^{in}} = \frac{1}{[1 - (v/c)^2]^{1/4}} \quad 5.2$$

$$\text{or : } \frac{v_{ph}^{in}}{v_{gr}^{in}} = \frac{1}{[1 - (v_{gr}^{ext}/v_{ph}^{ext})]^{1/2}} \quad 5.2a$$

$$\text{as far : } c^2 = v_{gr}^{in}v_{ph}^{in} = v_{gr}^{ext}/v_{ph}^{ext} \quad \#$$

In **primordial vacuum**, when the external group velocity of BVF[†] and BVB[±] is zero $v = 0$, the internal group and phase velocities of subquantum particles, participating in corresponding vortices are luminal:

$$v_{gr}^{in} = c = v_{ph}^{in} \quad \text{at} \quad v = 0 \quad 5.2b$$

This means that formalism developed in this work is consistent with our model of bivacuum.

At the **Hidden Harmony conditions**, when the internal (hidden) and external group and phase velocities are equal:

$$v_{gr}^{in} = v_{gr}^{ext} \equiv v \quad \text{and} \quad v_{ph}^{in} = v_{ph}^{ext} \quad 5.3$$

equation (5.2a) turns to simple quadratic equation after substitution:

$$\phi = \frac{v_{gr}^{in}}{v_{ph}^{in}} = \frac{v_{gr}^{ext}}{v_{ph}^{ext}} \quad 5.3a$$

$$\phi^2 + \phi - 1 = 0 \quad 5.4$$

$$\text{or : } \frac{\phi}{(1 - \phi)^{1/2}} = 1 \quad 5.4a$$

the positive solution of eq.5.4 is equal to Golden Mean ($\phi = 0.618$):

$$\phi = \frac{v_{gr}^{in}}{v_{ph}^{in}} = \frac{v_{gr}^{ext}}{v_{ph}^{ext}} = 0.618 \quad 5.5$$

It is well known, that Golden mean value is related strongly to Fibonacci series:

$$1, 2, 3, 5, 8, 13, 21, 34, 55, \dots \quad 5.5a$$

where the value of next term of series is defined as a sum of two antecedent terms:

$$(n + 1) = n + (n - 1) \quad 5.5b$$

The bigger is (n) , the closer is ratio: $n/(n + 1)$ to Golden mean value: $\phi = 0.618$:

$$\frac{n}{n + 1} \rightarrow 0.618 \quad \text{at} \quad n \rightarrow \infty \quad 5.5c$$

From comparison (5.4a) and formula for wave B energy (3.9) in form:

$$\begin{aligned} [E_W = E_C]^G &= (m_C^+ - m_C^-)^G c^2 = m_C^+ v^2 = m_0 c^2 \left[\frac{(v/c)^2}{[1 - (v/c)^2]^{1/2}} \right]^G = \\ &= m_0 c^2 \left[\frac{v_{gr}^{ext}/v_{ph}^{ext}}{[1 - v_{gr}^{ext}/v_{ph}^{ext}]^{1/2}} \right]^G = m_0 c^2 \end{aligned} \quad 5.5d$$

it leads, that **at the Hidden Harmony condition (5.3) realization and (5.5d), that the mass**

symmetry shift of uncompensated sub-elementary particle is equal to the rest mass of this sub-elementary particle:

$$[\Delta m_C = |m_C^+ - m_C^-| = m_0]^\phi \quad 5.6$$

$$\text{and : } \phi = (v/c)^2 = (v_{gr}/v_{ph})^{in,ext} = \left[\frac{2T_{kin}}{E_{tot}} \right]^\phi = 0.618 \quad 5.6a$$

where the total energy of wave B is a sum of kinetic and potential ones: $E_{tot} = T_{kin} + V$.

Using (5.6) and (3.9) in form of Golden mean:

$$E_{C \rightleftharpoons W} = \hbar \omega_0 = \Delta m_C c^2 = m_0 c^2$$

we get, that the frequency of $[C \rightleftharpoons W]$ pulsation at Golden mean conditions (5.5 and 5.6) is determined by the **rest mass** of elementary particle:

$$\omega_0^\phi = m_0 c^2 / \hbar \quad 5.7$$

We define this fundamental frequency of elementary particles pulsation as **Golden mean** frequency.

For m_0 , equal to mass of rest of the electron, the Golden mean frequency is:

$$(\omega_0^\phi)^e = 9.03 \cdot 10^{20} \text{ s}^{-1} \quad 5.7a$$

For quarks it is about three order higher. The latter is close to Golden mean frequency of τ -electrons, as a possible sub-elementary particles of quarks.

The expressions for electromagnetic (4.2) and gravitational (4.4a) potentials at the Golden mean condition $[\Delta m_C = m_0]^\phi$ (see 5.6) became even more elegant and symmetric:

$$E_{el}^\phi = \alpha m_0 c^2 \quad 5.8$$

$$E_G^\phi = \beta m_0 c^2 \quad 5.8a$$

where **electromagnetic** fine structure constant: $\alpha = e^2/\hbar c = (e/Q)^2$ and the **gravitational** fine structure constant: $\beta = (m_0/M_{Pl})^2$.

From eq.(5.1a), taking into account (5.3), we get the following expressions for real (m_C^+) and mirror (m_C^-) mass at Golden mean conditions:

$$[m_C^+ v^2 = m_0 c^2]^2 \rightarrow (m_C^+)^2 v^4 = m_C^+ m_C^- c^4 \quad 5.9$$

$$\text{or : } \left[\frac{m_C^-}{m_C^+} \right]^\phi = \left(\frac{v^\phi}{c} \right)^4 = \phi^2 \quad 5.9a$$

$$\text{where : } [m_C^+]^\phi = \frac{m_0}{\phi^2} \quad \text{and} \quad [m_C^-]^\phi = m_0 \phi^2 \quad 5.9b$$

5.2. Principle of Least Action and the Time Problem

It leads from our model, that the **Action** in Lagrange form can be presented as a difference between external and permanent internal kinetic energy:

$$S = |S^{ext} - S^{in}| = \left| m_C^+ (v_{gr}^{ext})^2 - m_C^+ (v_{gr}^{in})^2 \right| t \quad 5.10$$

As far the **internal** kinetic energies of positive $[m_C^+ (v_{gr}^{in})^2]$ and negative $[m_C^- (v_{ph}^{in})^2]$ vortices of sub-elementary particles in [C] phase, in contrast to **external** one $[m_C^+ (v_{gr}^{ext})^2]$, are permanent and equal to the Compton energy of these real and mirror states (see 5.1a):

$$m_C^+(v_{gr}^{in})^2 = m_C^-(v_{ph}^{in})^2 = m_0c^2 = const \quad (\text{see eq. 5.1a})$$

we have from (5.10):

$$S = |m_C^+(v_{gr}^{ext})^2 - m_0c^2|t \quad 5.11$$

Applying of Principle of Least Action, as a minimum of the S variation to (5.11) and taking into account that, $\delta[m_0c^2] = 0$, we get the unification of pace of time ($\delta t/t$) with pace of external kinetic energy, including pace of real mass and pace of de Broglie wave (L^+) length change:

$$\delta S = 0$$

$$\text{or : } \frac{\delta t}{t} = -\frac{\delta T_k}{T_k} \rightarrow \quad 5.12$$

$$d \ln t = -d \ln T_k = d \ln m_C^+ + 2d \ln L^+ \quad 5.12a$$

$$\text{where : } L^+ = \hbar/(m_C^+v_{gr}^{ext})$$

The real kinetic energy $T_{kin}^+ = \hbar^2/2m_C^+L^2$ is related with space parameter - the radius of wave B length of particle, as: $L^+ = \hbar/m_C^+v$.

The differentiation of uncertainty formula in coherent form:

$$E \cdot t = \hbar \quad 5.12b$$

where $E = 2T_k$ get us to the same result as (5.12).

Consequently, we can define the pace of TIME, as a measure of the closed system's real kinetic energy pace of change (Kaivarainen, 2000; 2001). This means that any closed system - from the molecule to Universe has its own pace of time.

Increasing the external velocity of system, accompanied by increasing of its kinetic energy corresponds to decreasing of pace of time in total accordance with special theory of relativity.

It is easy to show, that at permanent velocity $v = const$, the real mass m_C^+ and real space L^+ are also constant and, consequently, the time: $t = const$.

Increasing of wave B length of elementary systems (particles) means increasing the probability of their Bose condensation and unification. At critical values of wave B length, the process, like 1st order phase transition of matter, takes a place (Kaivarainen, 1995, 2000).

5.3. Unification a of Electromagnetism and Gravitation with Time, Space and Mass

Taking into account (4.2) and (4.4a), we get from (5.12a) a **simple, symmetric and very important formula of unification** of temporal field change [$d \ln t$] for any closed system, including individual particles, with changes of its electromagnetic and gravitational potential, mass and space:

$$d \ln t = -d \ln T_{kin} = -d \ln E_{el} = -d \ln E_G = d \ln m_C^+ + 2d \ln L \quad 5.13$$

All these parameters may be different for different closed systems.

As far the properties of virtual particles and, consequently, **virtual replica of condensed matter did not follow the causality principle, related to special theory of relativity**, the equality (5.13) turns to uncertainty.

5.4. Neutrino, antineutrino and gravitation

Neutrino and antineutrino are the neutral fermions with opposite spins (spirality) and very small (or even zero) mass, propagating in vacuum with light velocity. Due to neutrality and small probability of scattering any kind of screens are transparent for neutrino/antineutrino like for gravitational field.

My model postulates, that **three generations of neutrino and antineutrino**: the electron's ($\nu_e, \bar{\nu}_e$), the muon's ($\nu_\mu, \bar{\nu}_\mu$) and tau-electron's ($\nu_\tau, \bar{\nu}_\tau$) - are stable excitations of bivacuum symmetry

$$\begin{aligned} [BVF^\uparrow]_{\bar{\nu}}^{e,\mu,\tau} &- \text{three generations of neutrino} & 5.14 \\ \text{and } [BVF^\downarrow]_{\bar{\nu}}^{e,\mu,\tau} &- \text{three generations of antineutrino} \end{aligned}$$

induced by **mass symmetry shift** of unpaired sub-elementary particles and antiparticles $[F_\uparrow^+ \text{ and } F_\downarrow^-]^i$, equal to the rest mass (see eq. 5.6) of the electron (m_0^i) of corresponding generation ($i = e, \mu, \tau$):

$$\Delta m_C^i = |m_C - m|^i_C = m_0^i \quad 5.15$$

In accordance to (5.6) this is a condition of Golden mean realization for elementary particles.

If so, the energy and effective mass $[\pm\Delta(m_{\bar{\nu}}^{e,\mu,\tau})_n]$ of **neutrino/antineutrino**, as a selected bivacuum symmetry excitation is quantized, as the energy and mass of **corresponding generation of the electrons** ($m_0^{e,\mu,\tau}$) in following manner:

$$\left[(E_{e,\mu,\tau})_n = \pm\Delta(m_{\bar{\nu}}^{e,\mu,\tau})_n c^2 = \pm\beta_{e,\mu,\tau} \left(\frac{1}{2} + n \right) m_0^{e,\mu,\tau} c^2 \right]_{\nu, \bar{\nu}} \quad 5.16$$

where ($m_0^{e,\mu,\tau}$) are the rest mass of $[e, \mu, \tau]$ electrons; $\beta_{e,\mu,\tau} = (m_0^{e,\mu,\tau}/M_{Pl})^2$ is a gravitational fine structure constant, different for each leptons generation (eq.4.4c).

It is important to stress, that the energies of neutrinos (5.16) coincide with the quantized maximum gravitational potential of corresponding generations of the electrons at Golden mean conditions, as it leads from eq.(4.4a) after substitution of (5.15):

$$\left[(E_G^{\max})_{e,\mu,\tau} = (E_{e,\mu,\tau})_n = \pm\Delta(m_{\bar{\nu}}^{e,\mu,\tau})_n c^2 = \pm\beta_{e,\mu,\tau} \left(\frac{1}{2} + n \right) m_0^{e,\mu,\tau} c^2 \right]_{\nu, \bar{\nu}} \quad 5.16a$$

It means that neutrino and antineutrino may fulfill the role of gravitational/antigravitational interaction carriers or mediators.

Our model explains the simultaneous origination/annihilation of neutrino (ν) and antineutrino ($\bar{\nu}$) in pairs:

$$[\text{neutrino} + \text{positron}]^{e,\mu,\tau} = [\nu + \langle [\mathbf{F}_\uparrow^- \otimes \mathbf{F}_\uparrow^+] + \mathbf{F}_\uparrow^+ \rangle]^{e,\mu,\tau} \quad 5.17$$

$$[\text{antineutrino} + \text{electron}]^{e,\mu,\tau} = [\bar{\nu} + \langle [\mathbf{F}_\uparrow^- \otimes \mathbf{F}_\uparrow^+] + \mathbf{F}_\uparrow^+ \rangle]^{e,\mu,\tau} \quad 5.17a$$

accompanied all reactions of **weak interaction**, as a result of stable bivacuum symmetry shift $[\pm\Delta(m_{\bar{\nu}}^{e,\mu,\tau})_n]$, induced by mass symmetry shift of unpaired sub-elementary particles and antiparticles in composition of electrons or positrons with Golden mean properties $[\mathbf{F}_\uparrow^+]$ and $[\mathbf{F}_\uparrow^-]$ origination and annihilation.

For the other hand, bivacuum symmetry shift in accordance to our theory (see 4.4a) means the gravitational potential change, as a consequence of real fermions fusion from asymmetric bivacuum vortices.

The maximum curvature of vorticity for neutrinos at the ground state at $n = 0$, when their mass $[(m_{\bar{\nu}}^\pm)_{e,\mu,\tau}^{n=0} = \beta_{e,\mu,\tau}(m_0)_{e,\mu,\tau}]$ is tending to zero, may be of cosmic scale:

$$L_{e,\mu,\tau} = \hbar / [\beta_{e,\mu,\tau}(m_0)_{e,\mu,\tau} c] \rightarrow \infty \quad 5.18$$

As far the neutrinos and antineutrinos do not annihilate in contrast to electrons and positrons, this explains their excessive number in the Universe as respect to that of the electrons.

Possible way of verification of this theory of neutrino is stimulation of oscillations between neutrinos of e μ and τ lepton generations by applying low frequency electromagnetic field to neutrinos trap - chamber, resonant to frequency, corresponding to difference between energies of

neutrinos of different generations at $n = 0$:

$$\omega_{e\Rightarrow\mu} = (E_\mu - E_e)/\hbar = \frac{1}{2}c^2(\beta_\mu m_0^\mu - \beta_e m_0^e)/\hbar \quad 5.19$$

$$\omega_{e\Rightarrow\tau} = (E_\tau - E_e)/\hbar = \frac{1}{2}c^2(\beta_\tau m_0^\mu - \beta_e m_0^e)/\hbar \quad 5.19a$$

Corresponding induced oscillations between neutrinos should be accompanied by the in-phase oscillations of gravitational field.

6. Bivacuum - Matter Interaction

6.1. Harmonization Force of Bivacuum as a base of Principle of Least Action

We put forward a hypothesis, that **any kind of selected system, able to self-assembly, self-organization and evolution from atoms to living organisms and from galactics to Universe - are tending to condition of Hidden Harmony (5.3), displaying in Golden Mean realization.** Corresponding driving force may be named **"Harmonization Force (HF)"**.

This **HF** is responsible for minimization of difference between the external and internal kinetic energies, i.e. for **realization of Principle of Least Action** in form (5.10) at the **Hidden Harmony** condition (5.3) $v_{gr}^{ext} \rightarrow v_{gr}^{in}$ or $m_C^+(v_{gr}^{ext})^2 \rightarrow m_0c^2$ for each generation of leptons ($i = e, \mu, \tau$) :

$$\Delta S = |m_C^+(v_{gr}^{ext})^2 - m_C^+(v_{gr}^{in})^2|^{e,\mu,\tau} t \rightarrow 0 \quad 6.1$$

$$or : \Delta S = |m_C^+(v_{gr}^{ext})^2 - m_0c^2|^{e,\mu,\tau} t \rightarrow 0 \quad 6.1a$$

$$at : v_{gr}^{ext} \rightarrow v_{gr}^{in} \quad and \quad v_{ph}^{in} \rightarrow v_{ph}^{ext} \quad 6.1b$$

This is accompanied by tending of mass symmetry shift to value, equal to the rest mass of elementary particle:

$$\Delta m_C^{e,\mu,\tau} = |m_C^+ - m_C^-|^{e,\mu,\tau} = [m_C^+(v/c)^2 \rightarrow m_0]^{e,\mu,\tau} \quad 6.2$$

In accordance to our model (5.1a), the internal (hidden) kinetic energy is a constant, determined by the rest mass of each generation of sub-elementary particle:

$$[2T_k^{in} = m_C^+(v_{gr}^{in})^2 = m_0c^2]^{e,\mu,\tau} = const \quad 6.3$$

Consequently, conditions (6.1a and 6.2) may be achieved only by change of external doubled kinetic energy: $2T_{kin}^{ext} = m_C^+(v_{gr}^{ext})^2$.

The corresponding driving **Harmonization force (HF)**, in accordance to our theory, is responsible for induced resonance between secondary Bivacuum gap oscillations (BvO) with basic frequencies

$$(\omega_0^i \pm \Delta\omega_0^i) \simeq \omega_0^i \quad 6.3a$$

$$at : \omega_0^i \gg \Delta\omega_0^i \quad (i = e, \mu, \tau)$$

and $[C \Rightarrow W]$ pulsation of elementary particles of matter. Under the permanent action of BvO in form of virtual pressure waves (VPW) the synchronization of the total system [*bivacuum + matter*] occur, driving the matter to Golden mean conditions.

The HF, acting on each generation of elementary particles, composing body of total mass ($M = \sum m_C^+$), may be defined as:

$$F_{VPW}^i = \frac{|m_C^+(v_{gr}^{ext})^2 - m_0c^2|^i}{L_{VPW}^i} = \frac{(j-k)\omega_0^i}{c} \hbar |\omega_{C \rightleftharpoons W} - \omega_0|^i \quad 6.3b$$

where the radius of virtual pressure waves (VPW) and their energies are:

$$L_{VPW}^i = \frac{c}{(j-k)\omega_0^i} \quad 6.3c$$

$$\hbar\omega_{C \rightleftharpoons W} = m_C^+(v_{gr}^{ext})^2; \quad \hbar\omega_0 = m_0c^2$$

It leads from theory of autooscillations of nonlinear systems with many degrees of freedom (condensed matter in our case), that the resonance may take a place **not only at the equality** of external frequency ($\omega_{VPW}^i = \omega_0^i + \Delta\omega_0^i$) of secondary VPW in our case) and internal **Golden mean frequency** ($\omega_{VPW}^i = \omega_0^i + \Delta\omega_0^i$) of $[C \rightleftharpoons W]$ pulsation of pairs $[\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+]$ of triplets of elementary particles/antiparticles $\langle [\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+] + \mathbf{F}_\uparrow^\pm \rangle$, but at following **combinations** of external (ω_{VPW}^i) and internal ($\omega_{C \rightleftharpoons W}^i$) frequencies:

$$p\omega_{VPW}^i = q\omega_{C \rightleftharpoons W}^{(1)} \quad or : \quad 6.4$$

$$p\omega_{VPW}^i = q\omega_{C \rightleftharpoons W}^{(1)} + r\omega_{C \rightleftharpoons W}^{(2)}$$

$$p, q, r = 1, 2, 3 \dots (\text{integer numbers})$$

The resonant energy exchange between interacting elements of nonlinear systems with many degrees of freedom, i.e. between nuclears and electrons, atoms and molecules may occur. The energy exchange between different degrees of freedom at resonance conditions may be displayed in coherent change of external kinetic energy of clusters of atoms and molecules and finally in acceleration of even macroscopic bodies, like in Searl effect (Roshin and Godin, 2000), **if the amplitude of VPW $^\pm$** , defined by the value of $(j-k)$ in eq.6.3b and **is big enough**. The latter may be achieved by excitation of bivacuum transistons under the influence of alternating electromagnetic field with certain frequency (see 1.17a).

Except the definite relations between the frequency of external and internal frequencies (6.4), the resonant excitation of system (matter) needs **certain geometrical conditions**, which exclude possible compensation of the external field action by different elements of this system. The latter conditions means that resonant interaction of VPW $^\pm$ with macromolecules, like DNA and proteins, as well as with macroscopic systems may **direct the evolution of such systems geometry to Golden mean, inducing the changes of not only in their dynamics, but also of spatial parameters**.

Certain demands to three-dimensional parameters of systems with dissipation, interacting with BvO, may be determined by the **autooscillations** regime conditions. The web site of Dan Winter contains a lot of evidence, confirming that Golden mean is a general principle of World organization on its each hierarchic level (www.danwinter.com).

The described directed influence of Bivacuum oscillations with fundamental frequencies (ω_0^i) on elementary particles, their assembles in form of atoms and molecules, affecting the dynamics and geometry of microscopic, mesoscopic and macroscopic systems - could be a **physical background for realization of Principle of Least Action**.

6.2. Resistance of Bivacuum Symmetry to Perturbation, as a Reason of Inertia

The inertial property of real mass (m_C^\pm) of $[C]$ phase in our model is a consequence of bivacuum symmetry reaction to real kinetic energy increasing ($m_C^\pm v^2$) and corresponding increasing of CVC energy of $[W]$ phase, necessary to keep $[C \rightleftharpoons W]$ equilibrium. Such tendency to keep dynamic $[C \rightleftharpoons W]$ equilibrium of sub-elementary particles, corresponding to certain bivacuum symmetry shift, in spite of external perturbation of this equilibrium, we termed **generalized principle of Le Chatelier** (Kaivarainen, 2000).

The bivacuum symmetry resistance to perturbation, responsible for inertia, is a distant, but

not nonlocal effect. In contrast to nonlocal Mach's principle, our theory explains the existence of inertial mass even for only one particle in the empty Universe. We do not need to apply in our theory to mass producing Higgs-like fields also. The equality of inertial and gravitational mass leads naturally from our theory of gravitation and inertial mass.

Another approach to problem of inertia is related to possibility of nonzero ZPF momentum flux origination in accelerating coordinate frames. Scattering of this zero-point oscillation (ZPF) momentum flux by an object will yield a reaction force, responsible for second Newton's law (Haish, Rueda and Puthoff, 1998; Rueda and Haish, 1998):

$$F = ma = (dP/dt)_m \quad 6.5$$

6.3. Influence of Matter on Bivacuum Properties

It follows from my duality model of elementary particles (e^- , e^+), as a triplets of sub-elementary particles $\langle [\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\uparrow^+] + \mathbf{F}_\uparrow^\pm \rangle$ and their superposition in quarks (section 2.1), that symmetric pairs $[\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\uparrow^+]$ are responsible for interaction of particles with positive and negative vacuums in a course of their $[C \rightleftharpoons W]$ pulsation. However, it is important for Virtual Replica (VR) origination, that this interaction is modulated by the external dynamic behavior of uncompensated sub-elementary particle $[\mathbf{F}_\uparrow^\pm]$.

The model predicts, that the system of atoms and molecules, generating gravitational (E_G) and electromagnetic (E_{el}) fields may change the properties of bivacuum due to following interrelated factors:

1. Changing the probability of virtual pressure waves (VPW⁺ and VPW⁻) excitation due to change of values of $\Delta U = E_{el} + E_G$ (see eqs. A4; A5; A20 and A23 in Appendix) and resonant frequency shift: $\Delta\omega_0^i = \Delta m_0 c^2 / \hbar$ (see section 1.4).

The electromagnetic and gravitational radiation by material object, increasing the virtual particles and antiparticles density, energy and charge, increase also the resulting virtual energy density: $\varepsilon^{res} = \varepsilon^+ + \varepsilon^-$ (see eq. A39) and change permittivity (ε_0) and permeability [$\mu_0 = (\varepsilon_0 c^2)^{-1}$] of bivacuum. The Coulomb interaction is dependent on these parameters;

2. Making the VPW[±] more uniform due to coherent dynamics of molecules of matter in state of mesoscopic Bose condensation (mBC) and coherent $[C \rightleftharpoons W]$ pulsation of elementary particles, composing these molecules;

3. Changing the asymmetry of virtual energy density $\Delta\varepsilon^{res} = \varepsilon^+ - \varepsilon^-$, as a difference between energy densities of positive (ε^+) and negative (ε^-) vacuum (eq. A36). Changing of bivacuum symmetry shift (Δm_V) and value of $\Delta\varepsilon^{res} = \pm(\varepsilon^+ - \varepsilon^-)$, related with $[BVF^\uparrow \rightleftharpoons BVF^\downarrow]$ equilibrium shift, may be achieved by influence of magnetic field, radiated by body (see eq. A8). This difference regulation means possibility of space-time metric engineering. For particles $\Delta\varepsilon^{res} > 0$ and for antiparticles $\Delta\varepsilon^{res} < 0$;

4. Generation of **Virtual Replica (VR)** of body in form of **modulated** 3D VPW[±] due to modulation of mass symmetry shift ($\Delta m_C = m_C^+ - m_C^-$)ⁱ of elementary particles, interrelated with modulation of bivacuum symmetry shift ($\Delta m_V = m_V^+ - m_V^-$)ⁱ and Golden mean frequency shift ($\Delta\omega_0^i$) induced by relativist effects, accompanied the thermal oscillation of molecules and their **instant kinetic energy fluctuations**: $2T_k = m_C^\pm v^2 = F(\Omega)$ with modulation frequency ($\Omega \ll \omega_{C \rightleftharpoons W}$) :

$$\Delta\omega_0^i(\Omega) \sim \Delta m_V(\Omega) c^2 = \beta_G \Delta m_C(\Omega) c^2 = \beta_G [m_C^\pm v^2](\Omega) \quad 6.6$$

6.4. Positive and negative Casimir effects, Virtual Jet Generator

The decreasing of bivacuum virtual pressure (VP) in space between close and parallel conducting plates, as respect to virtual pressure outside the plates, explains the Casimir attractive (positive) effect.

Increasing the Bivacuum gap oscillations (BvO) symmetry and making them more **coherent**

in space between plates may be induced by the coherent $[C \rightleftharpoons W]$ pulsation of the electrons of conducting plates in accordance to factor 2, mentioned above.

Decreasing the resulting virtual energy density $\varepsilon^{res} = \varepsilon^+ - \varepsilon^-$ (factor 3) between plates more than outside the plates.

These factors determine the effective value of density/pressure of virtual particles or antiparticles between conducting plates.

In contrast to this situation, it is known that cavities with some special geometry, like two close hemispheres - increase the probability of virtual particles and antiparticles origination in bivacuum, leading to repulsion between hemispheres (Lamoreaux, 1997). We termed like phenomena as **negative Casimir effect** (Kaivarainen, 2000).

It is a consequence of my model, that each of two separated hemispheres or other asymmetric structures, like open cones, pyramids, etc. may serve as Virtual Jet Generators (VJG), increasing the uncompensated fraction of virtual pressure:

$\Delta VP = |VP^+ - VP^-| \sim |\varepsilon^+ - \varepsilon^-|$, acting on surface of VJG. This effect could be used for extraction of free energy from secondary asymmetric bivacuum and propulsion of VJG in bivacuum (Kaivarainen, 2000; 2001).

6.5. Virtual replica (VR) of condensed matter

The Virtual Replica (VR) of matter, formed by thermally modulated 3D -VPW $^\pm$ may be characterized by following contributions:

internal - local and

external, subdivided to:

a) distant and b) nonlocal contributions.

The **internal VR** represents all kinds of virtual 3D standing waves **in the volume of body**, related to interactions, mediated by virtual quanta exchange, i.e. from nuclear to intermolecular electromagnetic Van-der Waals interaction.

The **external distant VR** may be subdivided to:

- **electromagnetic replica**, as a system of 3D standing IR photons, radiated by any body with absolute temperature $T > 0$);

- **virtual VR, formed by 3D virtual pressure waves (3D-VPW) of bivacuum, modulated by thermal oscillations of atoms and molecules of body. This component of VR is named "vibro-gravitational replica" of matter.**

Both of these contribution are dissipating with distance (r), as the energy of spherical waves (1/r).

The **local and distant type of VR** may be considered also as superposition of N-dimensional standing vibro-gravitational waves (VGW) and modulated VPW, correspondingly. The N is a number of virtual degrees of freedom in bivacuum, excited by matter in bivacuum. Consequently, VR has the N-dimensional **hologram** properties. At this point our theory is close to ideas, developed by Bohm (1986), Bohm and Hiley (1993).

All kinds of VR are the result of coherent $[C \rightleftharpoons W]$ transitions of quasisymmetric pairs $[\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+]^*$ of triplets $\langle [\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+]^* + \mathbf{F}_\uparrow^\pm \rangle$, modulated by molecular dynamics of condensed matter, related with properties of uncompensated sub-elementary fermion/antifermion (\mathbf{F}_\uparrow^\pm).

The resulting Pointing vector ($\Delta \vec{P}_{e-m}^{res}$) of quasisymmetric pair $[\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+]^*$, in contrast to ideally symmetric one $[\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+]$, is nonzero, because the electromagnetic components of CVC in former case of secondary bivacuum do not compensate each other totally:

$$\Delta \vec{P}_{e-m}^{res} = \vec{P}_{e-m}^{\mathbf{F}_\uparrow^-} - \vec{P}_{e-m}^{\mathbf{F}_\downarrow^+} = [\mathbf{E} \times \mathbf{H}]^{\mathbf{F}_\uparrow^-} - [\mathbf{E} \times \mathbf{H}]^{\mathbf{F}_\downarrow^+} \neq 0 \quad 6.7$$

This inequality determines the difference between energy and pressure of virtual particles and antiparticles, due to asymmetry of BvO, generated by coherent $[C \rightleftharpoons W]$ pulsation of $[\mathbf{F}_\uparrow^- \text{ and } \mathbf{F}_\downarrow^+]^*$ of pair $[\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+]^*$.

The bigger is gravitational potential of body, the bigger is induced by it resulting bivacuum symmetry shift: $E_G \sim \Delta m v c^2$ and absolute value of excessive $\Delta \left| \vec{P}_{e-m}^{res} \right|$ in (6.7).

Rotation of this body will increase the above effect as a result of its particles kinetic energy increasing.

The 3D spatial structure of body and its asymmetric density distribution may influence the shape of VR generated by gravitating body.

The electromagnetic field, generated by rotating body may increase the probability of transitions between bivacuum energy sublevels, density of virtual particles/antiparticles and resulting (uncompensated) virtual pressure around the body.

Our notion of bivacuum symmetry shift and its consequences have some similarity with notion of Polarizable Vacuum (PV), introduced by Puthoff (1999, 2001). This approach is based on treatment Maxwell's equations in curved space in the isomorphism of PV of variable refractive index in FLAT space (Volkov, et al., 1971). The bending of light beam near a massive body and the change of its effective velocity is considered as a result of variation of in the refractive index of the vacuum near body. The PV approach means, in principle, the possibility of space-time metric "engineering" by changing vacuum permittivity: $\epsilon_0 \rightarrow K\epsilon_0$ and permeability: $\mu_0 \rightarrow K\mu_0$, where K is a variable vacuum dielectric constant (Puthoff, Little and Ibison, 2000):

$$K \approx 1 + 2GM/rc^2 \text{ in solar system} \quad 6.7a$$

If $K > 1 (M > 0)$, this decreases the values of light velocity, frequency of photons, energy, length, pace of time and increases the mass of body, as respect to the values of same parameters of body in the absence of gravitational field, when $K = 1 (M = 0)$.

In terms of our theory $K > 1$, corresponds to positive vacuum symmetry shift and $K = 1$ corresponds to vacuum symmetry shift equal to zero. At condition $K < 1 (M < 0)$, corresponding to our negative vacuum symmetry shift all the above listed parameters, related to space-time metric, change in opposite direction as respect to $K > 1$.

The components of VR, surrounding the body in form of thermally modulated standing VPW⁺ and VPW⁻, are kind of very specific to this body excitations of bivacuum, which may be named AURA.

If the AURA of two bodies: "sender" and "receiver" are quite similar, they may be in resonant interaction with each other via **nonlocal** component of VR. This problem will be discussed in section 8.

The external NONLOCAL contribution to VR may be related to nonresonant perturbation of Bivacuum gap symmetry oscillations (BvSO) in the volume of Virtual Bose Condensate (VBC), formed by BVF[†] and BVB[±] of secondary bivacuum. The BvSO in secondary bivacuum, unable to excite BVF[†] of BVB[±] to next quantum state, in contrast to BvO and VPW[±] of secondary bivacuum, are nondissipative and nonlocal.

The nonlocal BvSO with coherent frequencies (Ω_{BvSO}^S), generated by 'sender -S' molecules in state of mesoscopic Bose condensation (mBC) may induce the resonant excitation of local VR around the 'receiver -R' (AURA) with close **modulation frequencies** ($\Omega_{BvSO}^R \sim \Omega_{BvSO}^S$). These modulation frequencies, equal to frequency of thermal fluctuations and BvSO:

$\Omega_{BvSO}^{S,R} \sim (10^{11} - 10^{13}) s^{-1}$ are many orders lower than frequencies of VPW[±] ($\omega_{VPW^\pm} \simeq \omega_{[F_\uparrow^\mp \otimes F_\uparrow^\pm]} \sim 10^{21} s^{-1}$), activated by $[C \rightleftharpoons W]$ pulsation of pairs $[F_\uparrow^- \otimes F_\uparrow^+]$ * as a part of elementary particles.

At certain quantum boundary conditions, satisfying the conservation laws, the **transaction** (Cramer, 1988, 2001) between emitter and absorber of nonlocal BvSO via bivacuum may lead to system of standing vacuum pressure waves (VPW) origination in form of **unified 3D Virtual replica (VR) of emitter/sender and absorber/receiver**.

The radius of Virtual Bose Condensate (L_{VBC}), equal to radius of nonlocality (L_{NL}), generated by body, is related directly to bivacuum symmetry shift around this body

$$L_{VBC} = L_{NL} = \frac{\hbar}{\Delta M_V c} \quad 6.8$$

$$\text{where : } \Delta M_V = \beta \Delta M_C = \beta \sum_i^N [m_C^+ (v/c)^2] \quad 6.8a$$

$\beta = (m_0/M_{Pl})^2$ is gravitational fine structure constant (section 4.3); N is a number of elementary particles of body with doubled kinetic energy $2T_k = (m_C^+ v^2)_i$. The curled magnetic field, radiated by rotating body, may influence ΔM_V , shifting the $[BVF^\uparrow \rightleftharpoons BVF^\downarrow]$ equilibrium, increasing or decreasing the effect of gravitational field.

The corresponding to (6.8) volume of nonlocality around spherical and homogenic by density body is

$$V_{NL} = \frac{4}{3} \pi L_{NL}^3 \quad 6.9$$

The high-frequency VPW and VR can be modulated by thermal translations, librations and fluctuations of condensed matter. This contribution, named Vibro-Gravitational replica, can be evaluated, using our Hierarchic theory of condensed matter (Kaivarainen, 2001) and related computer program.

7. Vibro-gravitational replica and Hierarchical molecular dynamics of matter

It leads from our Hierarchic theory of condensed matter (Kaivarainen, 1995; 2001, 2001a) that each of 24 collective quantum excitations, introduced in new theory, is characterized by specific coherent thermal oscillations and corresponding averaged kinetic energy (T_{kin}^i). Each of these contributions to resulting gravitational potential of body may be evaluated separately. Our Hierarchic theory of condensed matter in combination with described model of duality allows the quantitative evaluation of **distant component** of vacuum replica: Vibro - Gravitational Replica (VGR).

7.1. Main features of Hierarchic theory of condensed matter

A basically new hierarchic quantitative theory, general for solids and liquids, has been developed (Kaivarainen, 2000a,b). It was 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 mesoscopic 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 mesoscopic 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 molecular mesoscopic Bose-condensation in form 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.

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 ($a \rightarrow b$) or ($b \rightarrow a$) transition states of the primary effectons (tr and lb), defined as primary transitons, 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 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 [$lb \rightleftharpoons tr$] *convertons* and *secondary transitons* are accompanied by the density fluctuations, leading to *absorption or radiation of phonons*.

Superposition 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, macrotransitons 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 macroconvertons in the same volume means creation of **superdeformons**. Superdeformons are the biggest (cavitation) 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 - is proved to be able to explain virtually all the properties of condensed matter. It is quantitatively verified on examples of water and ice in wide T-interval: 5-373 K, using new theory based computer program (copyright, 1997, Kaivarainen). Our hierarchic concept creates a bridge between micro- and macro- phenomena, dynamics and thermodynamics, liquids and solids in terms of quantum physics.

7.2. Contributions of selected kinds of thermal vibrations to

gravitational potential of body

For each of 24 selected collective excitation of condensed matter, considered in our Hierarchic theory of condensed matter (Kaivarainen, 2000a), the averaged thermal vibrations contribution to gravitational potential of particles, can be evaluated:

$$A_{VGW}^i = \beta 2 \bar{T}_{kin}^i \quad 7.1$$

The equation for total internal kinetic energy of condensed matter is a sum of contributions of each of 24 excitation. It may be calculated, using our computer program (Kaivarainen, 1995; 2000a).

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 bivacuum. Due to coherency of VGW, excited in bivacuum 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 bivacuum is very short.

Taking this into account, the energy of vibro-gravitational waves (as a part of CVC energy), generated by one mole of condensed matter may be calculated (Kaivarainen, 2000a):

$$\begin{aligned} A_{VGW} &= 2\beta(\bar{T}_{kin}^{tot}) = 2\beta[\bar{T}_{kin}^{eff} + \bar{T}_{kin}^t + \bar{T}_{kin}^{con}] = & 7.2 \\ &= \beta V_0 \frac{2}{Z} \sum_{tr,lb} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} (P_{ef}^a + P_{ef}^b) \right] + \left[n_t \frac{\sum (E_t)_{1,2,3}^2}{2M_t(v_s^{res})^2} P_d \right] & 7.2a \\ &+ V_0 \frac{n_{con}}{Z} \frac{(E_{ac})^2}{6M_c(v_s^{res})^2} P_{ac} + \frac{(E_{bc})^2}{6M_c(v_s^{res})^2} P_{bc} + \frac{(E_{cMd})^2}{6M_c(v_s^{res})^2} \end{aligned}$$

7.3. Special features of VR, generated by biological cells

Our Hierarchic Model of Consciousness - HMC (Kaivarainen, 2000b; 2001) is based on Hierarchic theory of condensed matter (Kaivarainen, 1995; 2000a; 2001). In accordance to this theory, coherent properties of water clusters in **microtubules (MT)** and distant exchange by IR photons, radiated by these clusters (mesoscopic molecular Bose condensate - mBC) may be responsible for distant interaction between MT of different neurons and neuron ensembles with similar orientation of MT. The existences of distant coherent interaction (from 10 microns to one millimeter) in brain has been confirmed recently by magnetic resonance imaging (MRI) by Warren and colleagues in Princeton university (Rizi et al., 2000; Richter et al., 1995; 2000, see also <http://www.princeton.edu/~wwarren/NMRintro>).

In accordance to our HMC, each specific kind of neuron ensembles excitation - corresponds to hierarchical system of three-dimensional (3D) standing waves of following interrelated kinds: thermal de Broglie waves (waves B), produced by anharmonic vibrations of molecules; electromagnetic (IR) waves; acoustic waves and vibro-gravitational waves (Kaivarainen, 2000b; 2001). Corresponding complex hologram may be responsible for distant quantum neurodynamics regulation and for morphogenetic field.

In this aspect our approach has a common features with ideas, developed by Pribram (1991).

In our model we consider a number of quantum collective excitations, resulted from coherent anharmonic translational and librational oscillations of water in the hollow core of the microtubules. It was shown, that water fraction, related to librations, represent mesoscopic molecular Bose condensate (mBC) in form of coherent clusters. The dimensions of water clusters

(nanometers) and frequency of their IR radiation may be enhanced by interaction with walls of MT. It is most organized and orchestrated fraction of condensed matter in biological cells. The Brownian effects, which influence reorientation of MT system and probability of cavitation fluctuations, stimulating [gel - sol] transition in nerve cells - may be responsible for non-computational element of consciousness. Other models (Wigner, 1955; Penrose, 1994; Hameroff and Penrose, 1996) relate this element to wave function collapse.

Change of the ordered fraction of water in microtubules in form of mBC, leads to [gel-sol] transition, related to reversible [assembly - disassembly] of actin microfilaments, change of osmotic pressure, pulsation of cells volume and membranes deformation. Corresponding "holomovement" of Virtual replica (VR) of living organism may be responsible for mind-matter interaction, telepathy and other phenomena, related to parapsychology. The bigger is number of MTs with similar orientation of coherently interacting cells, the bigger is corresponding fraction of ordered water, very sensitive to nerve excitation.

It is shown experimentally that the frequency of [gel \rightleftharpoons sol] transitions in cytoplasm, regulated by Ca^{2+} and enzyme gelsolin, is about $40 s^{-1}$ (Miamoto, 1995, Muallem et al. 1995).

There are evidence, pointing that spatial properties of DNA and [MTs + microtubules associated proteins (MAP)] system follow the Golden mean or Fibonacci series rule (see related articles by Stuart Hameroff: www.consciousness.arizona.edu/hameroff/info-processing01.htm). In accordance to our results, it is a condition, optimal for exchange interaction of matter with bivacuum by means of Bivacuum gap oscillations (BvO). The introduced in section 6.1 notion of **Harmonization force of Bivacuum** looks to be responsible for adaptation of biosystems dynamic and spatial properties to those of bivacuum in a course of long term biological evolution.

Topological quantum computational/error correction in [MTs - MAP], based on Fibonacci series, related directly to Golden mean (GM) condition, suggested by Roger Penrose, may be responsible for resistance of subunits of MTs to decoherence. In turn, this means resistance to decoherence of water clusters (primary librational effectons in state of mBC) inside MTs, maintaining their stability.

It leads from our approach, that DNA, chromosomes, microtubules and bunches of MTs may serve as effective virtual jet generators (VJG), increasing virtual pressure (VP^{\pm})_{1,2,3} in selected direction. It may be due to coherent [C \rightleftharpoons W] pulsation of elementary particles, composing atoms and molecules in state of mesoscopic molecular Bose condensate (mBC), existing in these structures and modulating dynamics of Bivacuum.

The collective contribution of MTs, related to **librational** kinetic energy of internal **coherent** water, in **Virtual replica of living organisms** may be significant. This contribution for one mole of water may be calculated like (Kaivarainen, 2000):

$$(2\bar{T}_k^{lb})^{in} = V_0 \frac{2}{Z} \sum_{lb} \left[n_{ef} \frac{\sum (E^a)_{1,2,3}^2}{2M_{ef}(v_{ph}^a)^2} (P_{ef}^a + P_{ef}^b) \right] \quad 7.3$$

The doubled kinetic energy of [lb/tr] convertions as important collective transition of water in microtubules of biological cells, including neurons, also may be evaluated:

$$(2\bar{T}_k^{con})^{in} = V_0 \frac{n_{con}}{Z} \left[\frac{(E_{ac})^2}{6M_c(v_s^{res})^2} P_{ac} + \frac{(E_{bc})^2}{6M_c(v_s^{res})^2} P_{bc} + \frac{(E_{cMd})^2}{6M_c(v_s^{res})^2} P_{cMd} \right] \quad 7.4$$

The charged bilayer membranes of biological cells, including neurons and axons have a properties of system of Casimir chambers of variable geometry. At certain conditions (i.e. depolarization) they may provide also the cumulative virtual jet effect, modulating the specific electromagnetic field and 3D-VPW $^{\pm}$ around body (AURA).

At the "rest" condition of cells the resulting concentration of internal anions of neurons is bigger than that of external ones, providing the difference of potentials equal to 50-100mV. As

far the thickness of membrane is only about 5nm or 50Å it means that the gradient of electric tension is about:

$$100.000 \text{ V/sm}$$

i.e. it is extremely high. Depolarization of membrane usually is related to penetration of Na^+ ions into the cell. The processes of depolarization, accompanied by pulsation of nerve cell body, - change the properties of membranes as Casimir chambers and, consequently, the virtual replica of cell.

The virtual replica of all cells, involved in nerve excitation, including acupuncture points, change in-phase with corresponding elementary acts of consciousness.

7.4. Modulation of virtual pressure waves (VPW $^\pm$) by thermal oscillations of condensed matter molecules

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

$$\langle [F_{\uparrow}^- \bowtie F_{\downarrow}^+] + F_{\uparrow}^\pm \rangle \quad 7.5$$

the direct correlation is existing. Such correlation is a result of highly correlated dynamics of sub-elementary particles, composing particles. The mass, charge and other properties of elementary particle are determined by uncompensated sub-elementary particle (F_{\uparrow}^\pm) of triplet.

The vibro-gravitational waves A_{VGW}^i with frequency about:

$$\Omega_{VGW} = \Omega_{BvSO} \sim (10^{11} - 10^{13}) s^{-1}$$

related with coherent thermal vibrations of atoms and molecules of condensed matter, **modulate** the high-frequency $[C \rightleftharpoons W]$ pulsation ($\nu_{C \rightleftharpoons W} \sim 10^{21} s^{-1} \sim \omega_0$) of pairs $[F_{\uparrow}^- \bowtie F_{\downarrow}^+]$ of elementary particles due to relativist real and mirror mass difference ($\Delta m_C = m_C^+ - m_C^-$) oscillation. This mass symmetry oscillation is related directly to Bivacuum symmetry ($\Delta m_V = \beta \Delta m_C$) oscillation (see eq. 6.6).

Each of 24 collective excitations of condensed matter has his own modulation frequency, equal to that of vibro-gravitational waves (VGW) and BvSO:

$$\Omega_{VGW}^q = \Omega_{BvSO}^q \equiv \Omega^q \quad \text{where : } q = 1, 2, 3, \dots, 24 \quad 7.5a$$

In turn, these thermally modulated cumulative virtual clouds of [W] phase of pairs $[F_{\uparrow}^- \bowtie F_{\downarrow}^+]$: [CVC $^+$ and CVC $^-$] superimpose with subquantum clouds of pairs of virtual particles and antiparticles of Golden mean frequency ($\omega_0 = m_0 c^2 / \hbar$), postulated in my model of Bivacuum (eq. 1.8; 1.12 and 1.12a).

This superposition results in **frequency modulation** (Harkevich, 1962) of bivacuum **virtual pressure waves (VPW $^\pm$)** by matter (M) as ($\omega_{VPW^\pm} \rightarrow \omega_{VPW^\pm}^M$):

$$\omega_{VPW^\pm}^M = \omega_{VPW^\pm} + \Delta \omega_{VPW^\pm} \cos \Omega^q t \quad 7.6$$

and in the **amplitude of VPW modulation**:

$$A_{VPW^\pm}^M \approx A_{VPW^\pm} (\sin \omega_{VPW^\pm} t + \beta \sin \Omega^q t \cdot \cos \Omega^q t) \quad 7.7$$

Eq.7.6 is correct, at conditions, when the index of frequency modulation: $\beta^q = \Delta \omega_{VPW^\pm} / \Omega^q$ is much less that one ($\beta \ll 1$). Such kind of modulated frequency is characterized by carrying frequency, close to Golden mean frequency: $\omega_{VPW^\pm} \simeq \omega_0$ and two satellites with frequencies: ($\omega_{VPW^\pm} + \Omega^q$) and ($\omega_{VPW^\pm} - \Omega^q$).

For the case of **phase modulation** by matter the amplitude of VPW change as:

$$A_{VPW^\pm}^M = A_{VPW^\pm} \sin(\omega_{VPW^\pm} t + \Delta\varphi^q \sin \Omega^q t) \quad 7.8$$

The resulting superposition of 3D - standing VPW^\pm , modulated by thermal vibrations of molecules, corresponding to q excitations contains information about matter properties and may be termed "**Virtual replica (VR)**" of matter. The value of $\Delta\varphi^q$ may be related with geometrical properties of body.

The energetic landscape, determined by **3D-standing VPW^\pm** may be very unsmooth, depending on kinetic energy distribution of particles and pairs [$V^+ \bowtie V^-$] in composition of oscillating atoms and molecules of condensed matter.

Distant **VR** reflects the matter dynamic and geometrical properties. Any changes of these properties are accompanied by change of VR, i.e. **holomovement** after Bohm.

Superposition and unification of all compatible VR of the Earth may form the **Global Virtual Replica (GVR)** with properties of active medium, able to self-organization and evolution. The nonequilibrium properties of GVR are determined by Bivacuum symmetry shift in gravitational field of the Earth.

8. Possible mechanism of Bivacuum mediated Matter-Matter and Mind-Matter interaction

The distant virtual replica (Aura) of condensed matter (living organisms in private case), represents 3D- VPW^\pm , modulated by BvSO, generated, in turn, by coherent thermal oscillations of ions (i.e. in plasma), atoms or molecules.

The deviation of virtual replica (VR) in form of standing VPW^\pm from "Virtual Noise" of bivacuum and a life-time of VR are dependent on the scale of coherent molecular/atomic excitations in the volume of matter, i.e. **amplitude of VR** and proximity of characteristic frequencies of VR to fundamental Golden mean frequencies of BvO, pertinent for bivacuum, i.e. **the effectiveness of resonant matter-bivacuum energy exchange**.

The bivacuum mediated distant matter-matter and mind-matter interaction mechanism includes following processes:

1. The nonlocal propagation of signal from **sender (S) to receiver (R)**, realized by bivacuum symmetry oscillation (BvSO) in the volume of virtual domain of nonlocality (see eq. 6.8) with frequency of modulation $(\Omega^q)^S$. In accordance to our conjecture (Kaivarainen, 2000; 2001), the nonlocality is possible, if both: sender (mind) and receiver (matter or another mind) are in the volume of the same domain of virtual Bose condensate of BVF^\dagger and BVB^\pm of secondary bivacuum (see also eq. 1.6b);

2. The resonant excitation of aura of 'receiver (R)' is possible if it has the similar frequency - amplitude - phase parameters, as the aura of 'sender (S)' and their modulation frequencies are close: $(\Omega^q)^S \approx (\Omega^q)^R$;

3. Influence of the **excited aura of receiver (R)** on thermal fluctuations of molecules of 'receiver' body, activating the resonant vibrational-rotational modes and changing their Van der Waals interactions and shifting equilibrium between different types of quantum excitations of receiver. In condensed matter the number of collective excitation is equal to 24;

4. Feedback reaction between excited BvSO of **(R)** and **(S)**, meaning unification of two subsystems: S and R in one system, including informational exchange ($S \rightleftharpoons R$). It is a kind of macroscopic quantum entanglement.

From eq.(4.5a), the maximum of internal gravitational force of elementary particle with kinetic energy T_k , acting on other particle with real inertial mass (m_C^+), moving with velocity (v):

$$F_G^{\max} = \frac{2\beta T_k}{\hbar c} m_C^+ v^2 \quad 8.1$$

The vibro-gravitational force $F_{VGW}(\Omega^S)$ of modulated by 'sender (S)' virtual replica (VR) of

'receiver (R)', acting on damped harmonic oscillations of molecules in the volume of (R) should be proportional to the amplitude of F_G^{\max} oscillations:

$$F_{VGW}(\Omega) \sim \Delta F_G^{\max}(t)$$

Corresponding equation of motion for this case is well known:

$$F_{VGW}(\Omega^S) = m \left(\frac{d^2 \mathbf{x}}{dt^2} + \gamma \frac{d\mathbf{x}}{dt} + (\Omega^R)^2 \mathbf{x} \right) \quad 8.2$$

where: $[\mathbf{x}]$ is molecular displacement parallel to the field. The $[m(\Omega^R)^2 \mathbf{x}]$ is the harmonic restoring force; $[m]$ is the reduced mass of molecule; γ is the damping coefficient.

Solution of (8.2) gives following dependence of molecular displacement on resonant conditions and dissipation processes:

$$\mathbf{x} = \frac{1}{m} \frac{F_{VGW}(\Omega^S)}{(\Omega^R)^2 - (\Omega^S)^2 + \text{Im} \gamma \Omega^S} \quad 8.3$$

Between the value of $[\mathbf{x}]$ and probability of thermal fluctuation of density of condensed matter of receiver the direct correlation should exist.

The closer are values of $(\Omega^q)^S$ and $(\Omega^q)^R$, the bigger is probability of corresponding to (q - type) collective quantum excitation.

It is a resonant mechanism of energy exchange interaction between virtual replicas of 'sender' and 'receiver'. Its effectiveness is dependent on the resulting virtual energy density shift of bivacuum (see Appendix A26), i.e. on difference of energy density:

$$\varepsilon^{res} = \varepsilon^+ - \varepsilon^- \quad 8.4$$

The another possible mechanism of distant interaction between VR^S and VR^R is based on the exchange between their **modulated bivacuum polarizations** with modulation frequencies $(\Omega^q)^S$ and $(\Omega^q)^R$, correspondingly. The effectiveness of such mechanism is proportional to absolute values of virtual density energy of virtual particles and antiparticles and their sum (see A29):

$$\varepsilon^{res} = \varepsilon^+ + \varepsilon^- \quad 8.5$$

It may be responsible for **charge screening** effects in matter, which displays themselves in the spectral Lamb shift and changing the atomic and molecular polarization, leading in turn, to change of Van der Waals interactions in condensed matter. This mechanism, in contrast to the first one, is not related with impulse - energy transmission. **The exchange between the charge screening effect of virtual replica of [S] and [R] could be also mediated by nonlocal BvSO.** This effect also can be modulated by hierarchy of vibrations of molecules of [S] with frequency (Ω^R) . It means modulation of bivacuum bivacuum permittivity (ε_0) and permeability $[\mu_0 = (\varepsilon_0 c^2)^{-1} = f(\Omega^R)]$, affecting the electromagnetic intermolecular interactions in condensed matter.

Transmission of modulated VR from [S] to [R] induces similar modulation of intermolecular interaction in [R], as in [S]. Again this exchange interaction is most effective at resonance conditions:

$$(\Omega^R) = (\Omega^S) \quad 8.6$$

Distant Mind-Matter interaction, including telekinesis, may be related to dependent on human will changes of cumulative **virtual pressure waves (VPW)** parameters, generated by orchestrated dynamics of lot of neurons and their microtubules/water systems. It means Mind-induced virtual jet generation effect, produced **by the first** of two described above mechanisms.

It is obvious that parameters of VR of Mind are much more variable than those of Matter. They are dependent of human will and are more adjustable for maximum of Mind-Matter interaction.

In more conventional terminology (Puthoff, Little, Ibison, 2000) the Mind activity may change vacuum dielectric constant to value ($\pm\Delta K$), vacuum permittivity to value ($\pm\Delta\epsilon_0$) and vacuum permeability to value ($\pm\Delta\mu_0$). In turn, these vacuum changes affect the matter, existing in vacuum.

The described mechanism of distant matter-matter and mind-matter interaction may be resulted in change of velocity of radioactive decay, process of phase transitions, kinetics of self-organization, rate of microorganisms division, deviations of random number generator data from normal distribution (Dobyns, 2000) and perturbation of many other cooperative collective processes. The CIA-initiated **Remote Viewing Program** at Stanford Res. Institute (1972-1995) contains a lot of evidence, confirming the existence of **psi phenomena** (Puthoff, 1996; Turg1996). It was demonstrated that the accuracy and reliability of remote viewing is not dependent on distance, size or electromagnetic shielding.

It leads from mechanism, proposed in this work, that the value of spectral Lamb shift, dependent on virtual particles screening of electromagnetic interaction in hydrogen and other atoms, may be used as indicator of bivacuum mediated Mind-Matter interaction. Another possible experimental approach to detect bivacuum perturbation, related to Mind activity, is the precise measurement of Casimir effect (Lamoreaux, 1997; Mohideen and Roy, 1998) and its Mind - Bivacuum induced variations. The value and sign of Casimir effect is determined by difference between the external as respect to conducting surfaces and internal effective virtual pressure.

8.1. Bivacuum mediated Mind-Mind Interaction (telepathy)

We assume, that the **mechanisms**, responsible for distant Mind-Mind interaction and subtle interaction between living organisms are the same as described above for Matter-Matter and Mind-Matter interaction, however, more flexible and tunable.

The amplitude of bivacuum gap oscillation (BvO), modulated by **coherent pair**: $\langle [F_{\uparrow}^- \bowtie F_{\uparrow}^+] \rangle$ and the **third** sub-elementary particle (F_{\uparrow}^{\pm}) of **triplet** $\langle [F_{\uparrow}^- \bowtie F_{\uparrow}^+] + F_{\uparrow}^{\pm} \rangle$ of elementary particles of matter, is dependent on the:

- 1) number of coherent particles, participating in this specific kind of interaction, i.e. scale of mesoscopic Bose condensation (**mBC**) of water in microtubules of neurons, interacting in each elementary act of consciousness (Kaivarainen, 2000; 2001);
- 2) sharpness of resonance between $[C \rightleftharpoons W]$ pulsation of elementary particles of matter and fundamental frequencies of BvO, close to Golden mean frequency ($\omega_0 = m_0 c^2 / \hbar$) $_{e,\mu,\tau}$;
- 3) sharpness of resonance between modulation frequencies of 'sender' $(\Omega^g)^S$ and 'receiver' $(\Omega^g)^R$, related to thermal molecular dynamics, which are many orders lower than (ω_0) .

The latter factor is dependent, in turn, on spatial-dynamic properties of matter or neuron's organelles in private case. The VR of orchestrated system of **nerve cells -'senders'**, excited by coherent water of their microtubules, membranes and synaptic contacts and perturbations of this VR, as a result of series of elementary acts of consciousness induce corresponding changes in similar organelles of **nerve cells -'receivers'**.

The experimental evidence are existing, that cavitation fluctuations, accompanied by sonoluminescence and playing the important role in [gel-sol] transitions in neurons cytoplasm, are related to vacuum fluctuations (Eberlein, 1996). These data in combination with revealed change of pH of water (Dibble, Ditron, Tiller, 1999) and water light scattering (Pyatnitsky and Fonkin, 1995) under specific human intention confirm that water is a sensitive 'target' in Mind-Matter and Mind-Mind interaction. In latter case, as a result of exchange interaction between virtual replicas of [S] and [R], the probability of the similar consequence of [gel-sol] transitions in neurons of [R], as in neurons of [S] increases. This mean a possibility of similar consequence of elementary acts of consciousness in Mind

- [R], induced by Mind-[S].

The Vibro-gravitational modulation of VR of [S] and [R], generated by microtubules, is most effective and specific in a course of nerve cells ensembles excitation.

Bivacuum symmetry shift oscillation induce in-phase oscillation of effective, **uncompensated virtual pressure** ($\Delta VP^\pm = VP^+ - VP^-$) in water structure of microtubules and biomembranes as Casimir chambers of 'receiver'.

The charged virtual particles density oscillation modulate correspondingly the electromagnetic Van der Waals interaction between molecules and the rate of physicochemical processes in nerve cells of 'receiver'. Just this secondary effect of modulated VR of [R] is important for Mind-Mind interaction.

In such a way the transmission of emotions and images from Mind sender to Mind receiver may occur. The closer are VR frequency-phase parameters of two or more interacting biosystems, the higher is probability of resonant VPW exchange interaction between such systems.

The Mind-Mind interaction, mediated by modulated BvSO, is much more specific and tunable, than Mind-Matter interaction.

It may be most effective, when interacting persons are genetically close, i.e. their nerve systems are tuned to each other on molecular, cell/subcell levels, generating very close Virtual Replicas and with similar reaction on them.

As far our emotional perception of beauty, harmony (at least visual, geometrical) is strongly related to Golden mean, it points that even our consciousness on macroscopic level responsible for such complex phenomena like emotions, was evolved during millions of years and "constructed" under the influence of fundamental dynamic properties of bivacuum, its virtual pressure waves (VPW $^\pm$) of Golden mean frequency.

This resembles the influence of water properties on evolution of biopolymers and cells (Kaivarainen, 2000, 2001).

9. Two-slit experiment and nonlocal interaction between coherent particles

It leads from our model, that the energy and momentum of the triplets of electron and positron are determined mostly by uncompensated sub-elementary particle (\mathbf{F}_\dagger^\pm). The parameters of (\mathbf{F}_\dagger^\pm) are correlated strictly with similar parameters of pair [$\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+$] due to conservation of symmetry of properties of sub-elementary particle/antiparticle in triplets. It means, that energy/impulse of uncompensated sub-elementary fermion (\mathbf{F}_\dagger^\pm) and, consequently, the whole particle (electron or positron) may be dependent on **resonant exchange interaction** between Bivacuum gap oscillations (BvO) and pairs [$\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+$] of triplets $\langle [\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+] + \mathbf{F}_\dagger^\pm \rangle$, mediated by **virtual pressure waves (VPW $^\pm$)** of bivacuum.

From the features of our model, described above, the bunched character of the electron's trajectory can be explained as a result of alternating impulse (momentum) of **uncompensated** sub-elementary particle (\mathbf{F}_\uparrow^-) in a course of its [$C \rightleftharpoons W$] pulsation, accompanied by radiation and absorption of **cumulative virtual cloud (CVC $^-$)**, i.e. exchange interaction with bivacuum.

In turn, the in-phase [$C \rightleftharpoons W$] pulsation of sub-elementary particle \mathbf{F}_\uparrow^+ and sub-elementary antiparticle \mathbf{F}_\uparrow^- of pair [$\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+$] are responsible for excitation of virtual pressure waves: VPW $^+$ and VPW $^-$ in bivacuum with the same frequency and wave length as CVC $^+$, corresponding to [W] phase of \mathbf{F}_\uparrow^+ and CVC $^-$, corresponding to [W] phase of \mathbf{F}_\uparrow^+ . The interference of VPW $_{\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+}^\pm$, generated by one or more elementary particles or atoms/molecules, with (**VPW $_{BvO}^\pm$**) of bivacuum due to **feedback reaction** with uncompensated \mathbf{F}_\dagger^\pm induces the wave - like behavior of the whole elementary particles $\langle [\mathbf{F}_\uparrow^- \bowtie \mathbf{F}_\downarrow^+] + \mathbf{F}_\dagger^\pm \rangle$ or atoms. In accordance to our model, just the value of external impulse of \mathbf{F}_\dagger^\pm determines the real value of de Broglie wave (wave B) length of particle:

$$\lambda^{ext} = \frac{h}{m_C^\pm v} \quad 9.1$$

The interference between $VPW_{\mathbf{F}_{\uparrow}}^+$ and $VPW_{\mathbf{F}_{\downarrow}}^-$, generated by sub-elementary particles and antiparticles of the electrons/atoms of beam with $VPW_{S_c}^{\pm}$, excited by electrons of screen and **mediated by VPW_{BvO}^{\pm}** , also can contribute to results of two slit experiment.

9.1. The mechanism of quantum entanglement between two or more coherent particles

Such a mechanism can be mediated by nonlocal Bivacuum symmetry oscillations (BvSO) in the volume of virtual Bose condensate (VirBC) of BVF and BVB $^{\pm}$ (see section 1.1).

The BvSO are the consequence of different bivacuum symmetry shifts $\Delta m_V^{[C,W]}$, induced by [C] and [W] phase of **uncompensated** sub-elementary particles $\mathbf{F}_{\uparrow}^{\pm}$. Their values are correspondingly:

$$\Delta m_V^{[C]} = \beta(m_C^+ - m_C^-) = \beta m_C^+ (v/c)^2 = \frac{\beta}{c^2} \hbar \omega_{C \rightleftharpoons W} \quad 9.2$$

$$\Delta m_V^{[W]} \cong 0, \quad \text{as far in [W] phase : } m_C^+ \cong m_C^- \quad 9.2a$$

The bivacuum symmetry shift, related to [W] phase, can be exactly equal to zero $\Delta m_V^{[W]} = 0$ only in primordial bivacuum. However, in secondary bivacuum this shift is also close to zero (9.2a). Consequently, [C \rightleftharpoons W] pulsation of uncompensated sub-elementary particle of each elementary particle is accompanied by BvSO with the same frequency, which tends to Golden mean frequency ($\omega_0 = m_0 c^2 / \hbar$) under Harmonization force of Bivacuum (see eq. 6.3b):

$$\omega_{BvSO} = \omega_{C \rightleftharpoons W} = (m_C^+ - m_C^-) c^2 / \hbar \rightarrow m_0 c^2 / \hbar \quad 9.3$$

the amplitude of BvSO, generated by pulsation of one uncompensated $\mathbf{F}_{\uparrow}^{\pm}$ is equal to difference between 9.2 and 9.2a:

$$\Delta \Delta m_{BvSO}^{C \rightleftharpoons W} = \Delta m_V^{[C]} - \Delta m_V^{[W]} = \beta m_C^+ (v/c)^2 \cong \Delta m_V^{[C]} \quad 9.4$$

$$\text{or : } \Delta \Delta m_{BvSO}^{C \rightleftharpoons W} = \frac{\beta}{c^2} 2T_k = \frac{\beta}{c^2} \frac{(P^{ext})^2}{m_C^+} = \frac{\beta}{c^2} \frac{\hbar^2}{m_C^+ L^2} \quad 9.5$$

where: $L = \hbar / P^{ext}$ is a real de Broglie wave length of particle.

The effective parameter of nonlocal exchange interaction between particles: 'sender (S)' and 'receiver (R)' ($A_{C \rightleftharpoons W}$) may be qualitatively described, using well known model of **damped harmonic oscillator** interacting with external alternating field:

$$A_{C \rightleftharpoons W} \sim \frac{1}{(m_C^+)_R} \frac{F_{BvSO}}{\omega_R^2 - \omega_S^2 + \text{Im } \gamma \omega_S} \quad 9.6$$

where: ω_R and ω_S are the frequencies of C \rightleftharpoons W pulsation of uncompensated sub-elementary particles of (S) and (R); γ is damping coefficient due to exchange interaction of pairs $[\mathbf{F}_{\uparrow}^- \bowtie \mathbf{F}_{\downarrow}^+]$ of triplets $\langle [\mathbf{F}_{\uparrow}^- \bowtie \mathbf{F}_{\downarrow}^+] + \mathbf{F}_{\uparrow}^{\pm} \rangle$ with bivacuum, inducing decoherence of (S) and (R) pulsation; $(m_C^+)_R$ is a real mass of (R).

F_{BvSO} is a force of matter-induced bivacuum symmetry oscillation (BvSO), dependent on energy of these oscillations ($\Delta \Delta m_{BvSO}^{C \rightleftharpoons W} c^2$), number of elementary particles of body (N), pulsating with frequency (9.3) and radius of action of BvSO, corresponding to bivacuum symmetry shift oscillation ($\Delta \Delta m_{BvSO}^{C \rightleftharpoons W}$), accompanied C \rightleftharpoons W pulsation of one or more elementary particle (L_{BvSO}):

$$F_{BvSO} \sim N \frac{\Delta \Delta m_{BvSO}^{C \rightleftharpoons W} c^2}{L_{BvSO}} = \frac{N^2}{\hbar} (\Delta \Delta m_{BvSO}^{C \rightleftharpoons W})^2 c^3 \quad 9.7$$

where radius of BvSO, equal to radius of virtual Bose condensate (L) nonlocality (L_{NL}), generated by particles, is related directly to bivacuum symmetry shift (ΔM_V) around the system of N interacting particles (see eqs. 6.8 and 6.8a):

$$L_{BvSO} = L_{VBC} = L_{NL} = \frac{\hbar}{\Delta M_V c} = \frac{\hbar}{N \Delta \Delta m_{BvSO}^{C \rightleftharpoons W} c} \quad 9.8$$

$$\text{where : } \Delta M_V = \beta \Delta M_C = N \Delta \Delta m_{BvSO}^{C \rightleftharpoons W} c = \beta \sum_i^N [m_C^+(v/c)_i^2] \quad 9.8a$$

It is easy to see from (9.6 and 9.7), that the bigger is force F_{BvSO} , dependent on amplitude of bivacuum symmetry oscillation ($\Delta \Delta m_{BvSO}^{C \rightleftharpoons W}$), induced by sender (S) and the more coherent are $C \rightleftharpoons W$ pulsation of (S) and receiver (R), i.e. the less is frequency deviation $\Delta \omega = \omega_R - \omega_S$, the more effective is nonlocal interaction (quantum entanglement) between particles, described by $A_{C \rightleftharpoons W}$.

10. Telekinesis, as a result of macroscopic quantum entanglement in the process of Mind-Matter interaction

The **telekinesis** may be a consequence of Mind to change the amplitude and anharmonicity of bivacuum symmetry oscillations BvSO, related to corresponding oscillations of space curvature (eq.9.8). The amplitude of BvSO is proportional to number (N) of coherent particle in (S)-Mind and (R)- object and anharmonicity is related to value of $\Delta M_V = N \Delta \Delta m_{BvSO}^{C \rightleftharpoons W}$ in eq. 9.9. The torsion and curled magnetic field effects also may influence the value of bivacuum symmetry shift, generated by Mind.

It could be a consequence of ability of Mind (S) to change the vacuum symmetry shift (ΔM_V), by orchestrated and cumulative activity of microtubules of brain + nerve system of sender (S), changing the VR of (S), gravitational potential and space curvature near the target-receiver (R).

The **anisotropic** difference in virtual pressure of positive and negative vacuum named "The effective virtual pressure": $\Delta VP^\pm = |VP^+ - VP^-|_{1,2,3}$ see Appendix eq. A.26, generated by sender (S) around (R), interrelated with ΔM_V also may contribute to asymmetric perturbation of virtual replica of (R)- object, inducing its moving in space in selected direction. In such a case the sender (S) acts as a tunable **virtual jet generator** (VJG).

The positive and negative Casimir effects, also related to effective virtual pressure ($\pm \Delta VP^\pm$), could be a test systems for telekinesis.

11. Interaction between VR of individual mind and Global Virtual Replicas (GVR)

a) Possible mechanism of anticipation/clairvoyance

The **Virtual Replica (VR)** of any open system in contrast to system itself, named **Real Replica (RR)**, do not follow the relativist laws and causality principle. Consequently, the different metastable VR, corresponding to past, present and future of **RR** may coexist. **The metastable VR of future is possible, if the present VR of given system, as a part of superposition of huge number of compatible Virtual Replicas of the material objects of the Earth or even Universe, named Global Virtual Replica (GVR) is involved in global virtual self-organization process (virtual evolution) to the most probable state of GVR.** This makes possible influence of **Future state** of the given system, as a [FS] on its present time Real Replica (RR). Such mechanism of interaction between **future** and **present replicas** could be responsible for "anticipation" of real complex systems, especially such as living systems and human beings.

The evolving/self-organization of GVR is possible as far the **secondary bivacuum with nonzero symmetry shift** has a properties of nonequilibrium dissipative medium. Each VR in composition of GVR can be considered as macroscopic dissipative structure or **autostructure**. The theory of **self-organization (SO)** is a part of nonlinear dynamics of nonequilibrium medium (Prigozin, Nicholas, 1972; Haken, 1983; Rabinovich and Sushik, 1990). For example in the **gradient models of SO** the function of free energy is decreasing, tending to minimum,

corresponding to few static states (attractors). Selection of one of these attractors is dependent on the initial conditions. The **self-organization** may display itself not only in static structures, but in form of rotating structures (spiral waves), grids of periodically changing symmetry, [origination \Rightarrow degeneration] of localized structures, etc. Due to dissipative properties of such systems, their internal noise and small fluctuations do not influence on final result of self-organization.

Such psi-phenomena, as **clairvoyance** could be a consequence of interaction of number of metastable **GVR of future, corresponding to different stages of evolution of GVR** with VR of person of extrasensory abilities. Lot of experimental evidence, confirming the existence of different type of psi-phenomena, including clairvoyance, are presented in book of Dean Radin (1998).

b) Possible role of human consciousness in evolution of the Universe

The possible influence of individual VR on GVR may point to the active role of human's consciousness in evolution of the Universe. Such influence may be a result of some **special states of Virtual replica (VR) of one or few coherent minds**, related, for example, to generation of basically new physical idea. Even weak interaction of this **VR state with Global VR**, changing a bit one of **GVR** parameters, crucial for stability, may creates **BIFURCATION**. Concomitant change in dynamic character (most probably periodic one) of GVR, influence the process of its self-organization. However, GVR could be 'sensitive' only to such states of individual VR, which lead the GVR to new **stable** dynamic structure. In another case of small perturbations of GVR by VR it returns to former dynamic behavior. This consequence of our theory, unifying consciousness/brains/bodies with Bivacuum and Universe, is in accordance with ideas, developed by von Neumann (1932), Stapp (2001), supported by Conrad and Josephson (2001).

c) Possible mechanism of UFO origination

Our theory of Matter-Bivacuum interaction predicts also, that large scale collective and spatially directed big changes of kinetic energy $\Delta(Mv^2)$ in the volume of Earth, other planets and Sun (i.e. movement of huge mass of matter with high speed in selected direction), like in Earthquakes, volcanic eruptions, deep internal fluctuations (see eq. 5.13):

$$\Delta(Mv^2)/Mv^2 = \Delta E_{el}/E_{el} = \Delta E_G/E_G \quad 11.1$$

should be accompanied by big fluctuations of electromagnetic, gravitational potentials, virtual pressure shift ΔVP^\pm in corresponding parts of Virtual Replica (VR) of the Earth. The accompanied fluctuations of fields, Bivacuum permittivity and permeability may influence strongly the Van der Waals interaction between molecules of the atmosphere in space of maximum of these effects, leading to anomalous atmospheric phenomena, like local shining, **UFO**, etc. Possible ionization of gas molecules increase their interaction with each other and electromagnetic field may lead to formation of stable structures like **vortices** of different shape.

If the dynamics of ions in such vortices turns to coherent, such system could be considered as macroscopic **atmospheric quantum excitation (AQE)**. The rotation of this collective macroscopic excitation in air should be accompanied by different kinds of electromagnetic, optoacoustic and aerodynamic effects.

Changing the geometry and intensity of source of **AQE** in the Earth body would influence the properties and spatial position of AQE in atmosphere.

12. The ways of experimental verification of new model of Mind-Mind interaction.

Audio/Video Signals Skin Transmitter, based on Hierarchic model of consciousness

I proposed the idea of new device, where the laser beam of ultraweak intensity with frequency of cavitational fluctuations and/or convertons - selected types of 24 collective excitations, introduced in my Hierarchic theory of condensed matter (Kaivarainen, 1995; 2000; 2001) will be modulated by acoustic and/or video signals. The modulated output optic signals can be transmitted from laser to the nerve nodes of skin, using wave-guides. It is supposed that

the nerve impulses, stimulated by modulated laser beam, can propagate via complex axon-synapse system to brain centers, responsible for perception and processing of audio and video information. The long-term memorizing process also can be stimulated effectively by Skin Transmitter.

The direct and feedback reaction between brain centers, responsible for audio and video information processing and certain nerve nodes on skin is predictable. The coherent electromagnetic radiation of these nodes, including the acupuncture one can be responsible for so-called aura.

One of the important consequence of our Hierarchic model of consciousness is related to radiation of ultraviolet and visible photons ("biophotons") as a result of water molecules recombination after their dissociation. Dissociation can be stimulated by cavitation fluctuation of water in the volume of superdeformons, inducing reversible disassembly of microfilaments and [gel-sol] transition. The frequency and intensity of this electromagnetic component of biofield, in turn, can affect the kinetic energy of the electrons, emitted by skin in the process of Kirlian effect measurement. Our model predicts, that the above mentioned stimulation of psi-activity by resonant external radiation, should influence on colors and character of Kirlian picture, taken even from distant untreated by skin-transmitter points of human body. There are another resonant frequencies also, calculated from my Hierarchic theory of matter, enable to stimulate big fluctuations of water in MTs and their disassembly.

Verification of these important consequences of our model and making a prototype of Audio/Video Signals Skin Transmitter is the intriguing task of future. The practical realization of Audio/Video Signals Skin Transmitter could be a good additional evidence in proof of Hierarchic model of consciousness (Kaivarainen, 2000) and serve a lot of people with corresponding disabilities.

The existence of distant Mind-Mind interaction may be proved by encephalogram registration and Kirlian effect. It is predictable, that application of audio/video signals skin transmitter (Kaivarainen, 2000b), to acupuncture points, should be the effective regulator and stimulator of psi-abilities.

13. CONCLUSION

The mechanism of Bivacuum mediated Mind-Matter and Mind-Mind interaction, proposed in this work, includes theory of Superunification and elementary act of consciousness, developed earlier (Kaivarainen, 2000; 2001) as the intermediate stages.

Theory of Superunification is based on new models of **Bivacuum**, sub-elementary particles/antiparticles, their self-assembly to particles and [*corpuscle*(*C*) \rightleftharpoons *wave*(*W*)] duality (Kaivarainen, 1995; 2000; 2001). It elucidates the quantum background of non-locality, principle of Least Action and Golden mean, unifies the quantum and relativist theories.

Bivacuum is introduced as two non mixing superfluid oceans of subquantum particles and antiparticles (not following the principle of uncertainty) of positive (real) and negative (mirror) energy, correspondingly. The idea of **bivacuum** is a consequence of new interpretation of Dirac's theory, pointing to equal probabilities of positive and negative energy. Bivacuum is considered in my theory as a micro-matrix for the elementary particles fusion with complex dynamics, flexible symmetry and nonlocal properties.

The couples of vortices of subquantum particles and antiparticles leads to emergency of **Bivacuum fermions** ($BVF^\uparrow = [V^+ \uparrow\uparrow V^-]$) and **Bivacuum antifermions** ($BVF^\downarrow = [V^+ \downarrow\downarrow V^-]$) in form of pairs of **rotors and antirotors**, rotating in clockwise and anticlockwise direction in realms of positive and negative vacuums, forming bivacuum. The intermediate transition states: $[BVF^\uparrow \rightleftharpoons BVB^\pm \rightleftharpoons BVF^\downarrow]$ represent **Bivacuum bosons** ($BVB^\pm = [V^+ \uparrow V^-]$) with zero spin and two possible polarization (\pm). The rotors and antirotors of positive and negative vacuum are separated by **bivacuum energetic gaps**, depending on radius of these rotors.

Virtual particles (VP⁺) and antiparticles (VP⁻) - result from transitions between differently excited rotors ($V_j^+ - V_k^+$) and antirotors ($V_j^- - V_k^-$) in realms of positive and negative

vacuum. The energy of pairs $[VP^+ + VP^-]$ is related to the amplitude of **Bivacuum gap oscillation (BvO)**. Oscillation of density of VP^+ and VP^- represent the virtual pressure waves: VPW^+ and VPW^- , correspondingly.

The **primordial** bivacuum is symmetric totally in contrast to **secondary** one, containing matter and field.

In secondary bivacuum, the number of BVF^\uparrow and BVF^\downarrow are not equal as a consequence of its asymmetry.

Asymmetry of secondary bivacuum is a result of asymmetric structure of **elementary particles, like electrons and quarks**, composed from **triplets** of sub-elementary fermions (F_\uparrow^-) and sub-elementary antifermions (F_\uparrow^+). The electron may be presented as: $e^- = \langle [F_\uparrow^- \otimes F_\uparrow^+] + F_\uparrow^- \rangle$ and positron as: $e^+ = \langle [F_\uparrow^- \otimes F_\uparrow^+] + F_\uparrow^+ \rangle$.

Each sub-elementary **particle** in **[C] phase** represent the [real (m_C^+) + mirror (m_C^-)] mass dipole. The **[W] phase** in form of cumulative virtual cloud (CVC) of subquantum particles is a result of quantum beats between real and mirror states of [C] phase. It has the same energy and impulse, as the [C] phase:

$$\begin{aligned} E_{C,W} &= (m_C^+ - m_C^-)c^2 = m_C^+v^2 \\ P_{C,W} &= (m_C^+ - m_C^-)c = m_C^+v^2/c \end{aligned} \quad 13.1$$

The new principle of the rest mass conservation was introduced (Kaivarainen 1993, 1995, 2001) in form of product:

$$m_C^+ m_C^- = m_0^2$$

where the **real inertial** mass: $m_C^+ = m_0[1 - (v/c)]^{1/2}$ follows relativistic mechanics and **mirror inertialess** mass has the reverse dependence on the external group velocity (v): $m_C^- = m_0/[1 - (v/c)]^{1/2}$. The properties of sub-elementary **particles**, related to mirror mass and negative vacuum are **hidden**.

For **sub-elementary antiparticles** the symmetry shifts their electromagnetic and gravitational potential signs are opposite to those of **sub-elementary particles**. The properties of real and mirror states change their place: $m_C^- = m_0[1 - (v/c)]^{1/2}$ $m_C^+ = m_0/[1 - (v/c)]^{1/2}$, going from particles to antiparticles. The formulae (13.1) for antiparticles looks like:

$$\begin{aligned} \tilde{E}_{C,W} &= (m_C^- - m_C^+)c^2 = m_C^-v^2 \\ \tilde{P}_{C,W} &= (m_C^- - m_C^+)c = m_C^-v^2/c \end{aligned} \quad 13.1a$$

The mass and Bivacuum symmetry shifts, induced by particles and antiparticles has the opposite sign:

$$\Delta m_V = (m_V^\uparrow - m_V^\downarrow) = \beta(m_C^+ - m_C^-) = -\Delta \tilde{m}_V \quad 13.1b$$

The $[C \rightleftharpoons W]$ pulsation of sub-elementary fermions in pair $[F_\uparrow^- \otimes F_\uparrow^+]$ are in-phase with each other and counter phase with third uncompensated sub-elementary fermion $\langle F_\uparrow^- \rangle$.

The state of elementary particles, corresponding to **[C] phase of uncompensated sub-elementary particle** $\langle F_\uparrow^- \rangle$ and [W] phase of pair $[F_\uparrow^- \otimes F_\uparrow^+]$ represents the **visible matter** of the Universe. **The opposite [C] phase of pair** $[F_\uparrow^- \otimes F_\uparrow^+]$, when $\langle F_\uparrow^- \rangle$ is in [W] phase may be responsible for **dark matter** of the Universe, containing 2/3 of the total mass and energy of the Universe, as it leads from our model.

Self-organization and evolution of Matter at huge range of scales: from microscopic to cosmic ones occur under the influence of fundamental **Bivacuum gap oscillations (BvO) with Golden Mean (GM) frequencies** ($\omega_0^i = m_0^i c^2 / \hbar$). Index $i = e, \mu, \tau$ corresponds to three leptons generation. This **"Harmonization process"** is a result of tending of $[C \rightleftharpoons W]$ pulsation frequency and phase of elementary particles of matter to resonance with fundamental GM

frequencies of BvO. In turn, it leads to *combinational resonant interaction* between quantum and thermal degrees of freedom of evolving matter, as nonlinear system, **driving it to autooscillation regime**.

The principle of Least action is shown to be a consequence of such ”**Harmonization driving force of Bivacuum**”, affecting the impulse (momentum) and trajectory of triplets $\langle [F_{\uparrow}^- \bowtie F_{\uparrow}^+] + F_{\uparrow}^{\pm} \rangle$ of elementary particles via resonant interaction of BvO with pairs $[F_{\uparrow}^- \bowtie F_{\uparrow}^+]$ in a course of their in-phase $[C \rightleftharpoons W]$ pulsation.

The feedback reaction between dynamics of Bivacuum and dynamics of particles is existing.

It is postulated, that **modulated by matter system of 3D standing virtual pressure waves (VPW $^{\pm}$) is responsible for virtual replica (VR)** of condensed matter (living organisms in private case).

The effectiveness of [Matter \rightleftharpoons Bivacuum] interaction is dependent on following factors:

1. The average bivacuum symmetry shift: $[\Delta \bar{m}_V(G, H) = m_V^+ - m_V^-]_{1,2,3}$, related to average gravitational potential and magnetic field, generated by macroscopic body. This shift induce the inequality of **carrier frequencies** of positive and negative realms of bivacuum: $\omega^+ = \omega_0 + \Delta \bar{\omega}_0$ and $\omega^- = \omega_0 - \Delta \bar{\omega}_0$, where the carrier frequency shift is defined as: $\Delta \bar{\omega}_0 = [\Delta \bar{m}_V c^2] / \hbar$. This symmetry shift leads to disbalance between energy and pressure of virtual particles and antiparticles and between corresponding virtual pressure waves: VPW $^+$ and VPW $^-$ with frequencies ω^+ and ω^- . The VPW $^{\pm}$ are the result of oscillation of virtual pressure (VP $^{\pm}$) in a course of transitions between quantum sublevels of positive and negative vacuums: Bivacuum gap oscillations (BvO), accompanied by virtual particles/antiparticles origination and annihilation.

The more is the anisotropic frequency deviation of bivacuum:

$$[\Delta \omega^{\pm} = \omega^+ - \omega^- = 2\Delta \bar{\omega}_0]_{1,2,3} \quad 13.1c$$

the more is the excessive anisotropic virtual pressure of bivacuum (see Appendix):

$$[\Delta VP^{\pm} = VP^+ - VP^-]_{1,2,3} \quad 13.1d$$

The average value of resulting kinetic energy, as a sum of external macroscopic and internal microscopic contributions, influence the average bivacuum symmetry shift.

The **external** average contribution, related to anisotropic **macroscopic translational** velocity of macroscopic body $(v^{ext})_{1,2,3}$ and its **external** angle frequency of **rotation** $(\omega^{ext})_{1,2,3}$ can be presented as:

$$[\Delta \bar{m}_V(G,)]_{1,2,3}^{ext} = \beta [m_C^+ (v^{ext})_{tr}^2 + m_C^+ (\omega^{ext} R^{ext})_{rot}^2]_{1,2,3} = \beta 2 (T_{kin}^{ext})_{1,2,3} \quad 13.2$$

and the **internal** average contribution, related to anisotropic **microscopic internal** translation and rotations of particles of body is:

$$[\Delta \bar{m}_V(G,)]_{1,2,3}^{in} = \beta [m_C^+ (v^{in})_{tr}^2 + m_C^+ (\omega^{in} r^{in})_{rot}^2]_{1,2,3} = \beta 2 (T_{kin}^{in})_{1,2,3} \quad 13.3$$

where, in accordance to our gravitation theory, the gravitational fine structure constant (β) is introduced as a squared ratio of the electron's mass of rest of certain lepton generation ($i = e, \mu, \tau$) to the Plank mass: $\beta^i = (m_0^i / M_{Pl})^2$.

Due to relativistic mechanics, both of the above mentioned factors influence the average **deviation** between the Golden mean **carrier frequency** of BvO: $\omega_0^i = m_0^i c^2 / \hbar$ and the average frequency of $[C \rightleftharpoons W]$ pulsation of sub-elementary particles, composing matter $(\bar{\omega}_{C \rightleftharpoons W}^i)$:

$$\Delta \bar{\omega}_{1,2,3} = |\omega_0^i - \bar{\omega}_{C \rightleftharpoons W}^i|_{1,2,3} \quad 13.4$$

where:

$$\begin{aligned} (\overline{\omega}_{C\rightleftharpoons W}^i)_{1,2,3} &= |\overline{m}_C^+ - \overline{m}_C^-|_{1,2,3}^i c^2/\hbar = \left[m_C^+ (\overline{v}^{in} + v^{ext})^2 \right]_{1,2,3}^i / \hbar = \\ &= m_C^+ [(\overline{\omega}^{in} r^{in})^2 + (\omega^{ext} R^{ext})^2]_{1,2,3}^i \end{aligned} \quad 13.5$$

The resulting kinetic energy factor affects the **average deviation** (detuning) of [body \rightleftharpoons bivacuum] dynamic exchange interaction from the **Golden mean resonant conditions**, corresponding to:

$$\begin{aligned} (\overline{\omega}_{C\rightleftharpoons W}^i)_{1,2,3} &= \omega_0 \\ \text{and } |\overline{m}_C^+ - \overline{m}_C^-|_{1,2,3}^i &= m_0 \end{aligned}$$

2. The exchange interaction between matter and bivacuum, mediated by VPW $^\pm$, related to fundamental bivacuum gap oscillation (BvO) with frequency ($\omega_{BvO} \simeq \omega_0$) occur due to **combinational resonance** at condition:

$$p\omega_{BvO} = q\omega_{fl}^{in} + r\omega^{ext} \quad (p, q, r \text{ are the integer numbers}) \quad 13.7$$

In such a case, the internal microscopic degrees of freedom, characterized by (ω_{fl}^{in}), may interact with the external macroscopic degrees of freedom of whole body, characterized by (ω^{ext}).

If the external energy of VPW $^\pm$, absorbed by body from bivacuum, exceeds the dissipation in the body volume due to microdynamics and dissipation in a course of its macroscopic rotation, the self-acceleration of body rotation occur. The known magnito-gravitational Searl effect, confirmed by Roshin and Godin (2000) could be explained in such a way.

3. Modulation frequency (Ω) of [C \rightleftharpoons W] pulsation of elementary particles (anisotropic in general case), is equal to frequency of coherent thermal fluctuations [$\Omega = \omega_{fl} \ll (\overline{\omega}_{C\rightleftharpoons W}^i)_{1,2,3}$] of atoms and molecules. Consequently, the frequency of **instant deviation [$\Delta\omega_{1,2,3}^i(\Omega) = |\omega_0^i - \omega_{C\rightleftharpoons W}^i|_{1,2,3}$] is a function of modulation frequency (Ω). Corresponding **Bivacuum symmetry shift oscillation (BvSO) also is a function of (Ω):****

$$\Delta\omega_{1,2,3}^i(\Omega) \sim [\Delta m_V(\Omega)]_{1,2,3} = \beta[|m_C^+ - m_C^-|(\Omega)]_{1,2,3} = \beta[m_C^+ v^2(\Omega)]_{1,2,3} \quad 13.6$$

The BvSO is responsible for **modulation frequency** of virtual pressure waves (VPW $^\pm$) $_{1,2,3}$ **close to basic Golden mean frequency ($\omega_0 \pm \Delta\omega$) i . The frequency** of modulation (Ω) of VPW $^\pm$ is in-phase with oscillation of kinetic energy of uncompensated sub-elementary particles ($\langle F_{\uparrow}^\pm \rangle$) of triplets ($\langle [F_{\uparrow}^- \times F_{\uparrow}^+] + F_{\uparrow}^- \rangle$), forming elementary particles.

In accordance to our model, BvSO with frequency Ω_{BvSO} has the nonlocal properties in the volume of virtual Bose condensate formed by bivacuum fermions (BVF †) and bivacuum bosons (BVB $^\pm$) of secondary bivacuum.

4. The amplitude of in-phase thermal oscillation of atoms and molecules with modulation frequency (Ω) $_{1,2,3}$ is determined by number of **coherent** elementary particles and atoms/molecules of body. This number is dependent on fraction of **molecular mesoscopic Bose condensation (mBC)** of condensed matter (Kaivarainen, 1995, 2001). Such a factor affect the amplitude of modulation of 3D-VPW $^\pm$, forming virtual replica (VR) of body by anisotropic BvSO with frequency (Ω) $_{1,2,3}$. The fraction of mBC and, consequently, the amplitude of BvSO is sensitive to temperature, pressure and external fields.

5. The symmetry/shape change of crystal (solid or liquid), related to corresponding change of symmetry in impulse space and redistribution of most probable kinetic energy value of atoms and molecules in three main directions/axes (1, 2, 3). This factor via the above described mechanism can determine the change of shape of **VR as metastable anisotropic 3D**

superposition of VPW[±].

The important role in Mind-Matter and Mind-Mind interaction is related to coherent fraction of water in state of mesoscopic molecular Bose condensate (mBC) in microtubules of neurons. This fraction of mBC is a variable parameter, dependent on number of simultaneous/coherent elementary acts of consciousness (Kaivarainen, 2000, 2001).

The distant resonant [Mind ('sender') - Bivacuum - Matter ('receiver')] and [Mind ('sender')-Bivacuum-Mind ('receiver')] interaction is mediated by nonlocal Bivacuum symmetry oscillation (BvSO) and luminal VPW[±]. These bivacuum excitations are form the Virtual replica (VR^S) of Mind- 'sender'.

Modulation of VR^R of 'receiver' by VR^S of sender is dependent on modulation frequency (Ω), phase and amplitude of BvSO, generated by 'sender'.

It is supposed, that due to nonlocal properties of **BvSO, as a carrier of properties of 'sender'**, the VR^S, generated by "sender (mind)", induces similar oscillations of VR^R of 'receiver' and bivacuum permittivity ϵ_0 and permeability [$\mu_0 = (\epsilon_0 c^2)^{-1}$], resulting from oscillation of **nonzero resulting virtual charge** around and inside the "receiver". The described mechanism of Mind-Matter influence change the intermolecular Van der Waals interaction in the volume of "receiver" in similar way like in "sender". Consequently, it change the **probability of selected thermal fluctuations in the volume 'receiver' - Matter.**

If the 'receiver' is another Mind, the most sensitive targets for VR of 'sender' is highly cooperative water clusters (mBC) in microtubules. In the case of resonant conditions of [Mind - Mind] interaction, i.e. if the VR of 'sender' and receiver are similar or close enough, the effect is maximum. The same series of elementary acts of consciousness, mediated by microtubules, in nerve system of 'sender' and 'receiver' means informational exchange in a course of [Mind - Bivacuum - Mind] interaction, i.e. **telepathy.**

Possible mechanisms of **telekinesis** and **clairvoyance** are also considered in the framework of our new **Hierarchic theory of Bivacuum, Matter Duality and Superunification.**

APPENDIX A:

Calculation of virtual pressure and energy densities in positive and negative energy realms of secondary bivacuum

1. Properties of virtual particles of bivacuum

The quantized energies (E_{j-k}^i) of virtual particles of selected leptons generation ($i = e, \mu, \tau$) are defined as energies of **transition states (quantum beats)** between energy sublevels j and k ($j > k$) of **positive** vacuum in three directions, normal to each other (1,2,3). Consequently, the energies of corresponding virtual particles are:

$$\langle E_{j-k}^i \rangle_{1,2,3} = \hbar(\omega_0^i + \Delta\omega_0^i)_{1,2,3}(j-k) = c^2(m_0^i + \Delta m_0^i)_{1,2,3}(j-k) = \hbar(c/L_{j-k}^i)_{1,2,3}$$

where the difference between sublevels : $(j-k) = 1, 2, 3, \dots$

In accordance to our model, three fundamental frequencies of bivacuum are determined by the rest mass of leptons (i.e. electrons) of three generation:

$$\omega_0^i = m_0^i c^2 / \hbar \tag{A1a}$$

The values of frequency and effective mass deviations ($\Delta\omega_0^i$ and Δm_0^i) are a measure of **secondary** bivacuum symmetry shift in presence of matter and fields. In **primordial** bivacuum $\Delta\omega_0^i$ and Δm_0^i are zero. These shifts are related mostly with gravitational field. However, they also may be affected by magnetic field, shifting the equilibrium between bivacuum fermions of opposite spins (see eq. A.8).

In the case of strong bivacuum symmetry shifts, the deviation of mass shift value ($m_C^+ - m_C^-$) from those, **corresponding to Golden mean** (m_0) may be expressed in following way:

$$[\Delta m_0^i]^{GM} = [(m_C^+ - m_C^-) - m_0]_{1,2,3}^i = [m_C^+(v/c)^2 - m_0]_{1,2,3}^i = f(v/c)^2 \quad A.1b$$

From eqs.(5.5d) it is easy to see, that at Golden mean condition: $(v/c)^2 = (v_{gr}/v_{ph}) = 0.618$, the deviation

$$[\Delta m_0^i]^{GM} = 0 \quad A.1c$$

The value of $(j - k)$ is dependent on applied to Bivacuum electromagnetic field frequency.

The energy of 3D standing wave, formed by virtual particles, corresponding to transitions in three directions in the same space volume is a sum:

$$(E_{j-k}^i)_{3D} = (E_{j-k}^i)_1 + (E_{j-k}^i)_2 + (E_{j-k}^i)_3 \quad A.1d$$

The Compton radius of virtual particle in each of three direction is:

$$\left[L_{j-k}^i = \frac{c/(j-k)}{(\omega_0^i + \Delta\omega_0^i)_{1,2,3}} = \frac{\hbar/(j-k)}{(m_0 + \Delta m_0)^i c} \right]_{1,2,3} \quad A.2$$

The density of 3D standing waves of virtual particles may be expressed in the same way like density of 3D standing de Broglie waves of molecules (primary effectons) in our Hierarchic theory of condensed matter (Kaivarainen, 1989; 1995; 2001):

$$n_{j-k}^i = \frac{8}{9} \pi \frac{1}{(2\pi L_{j-k}^i)_{1,2,3}^3} = \frac{1}{9\pi^2} \frac{1}{(L_{j-k}^i)^3} = \frac{1}{9\pi^2 c^3} \frac{\prod_{1,2,3}^3 (\omega_0^i + \Delta\omega_0^i)}{(j-k)^3} \quad A.3$$

and probability of virtual particles excitation:

$$(P_{j-k}^i)_{1,2,3} = \exp \left[-\frac{\hbar(\omega_0^i + \Delta\omega_0^i)(j-k)}{kT_R + \Delta U} \right]_{1,2,3} \quad A.4$$

where: k is a Boltzman constant and $T_R \simeq 3K$ is a known temperature of relict radiation in vacuum;

ΔU is the increment of bivacuum equilibrium energy (U_{eq}) in the presence of electromagnetic and gravitational fields, increasing the probability of $(j - k)$ transitions

$$U_{eq} = kT_R + \Delta U \quad A.5$$

For example, in the case of alternating electromagnetic field, the volume density of its energy in bivacuum is equal:

$$\Delta U = \overline{W} = [\epsilon E^2 + \mu H^2]/2 \quad A.6$$

where ϵ and μ are bivacuum **permittivity and permeability**, correspondingly, depending on density of resulting virtual charge in given point of space.

The resulting probability of **simultaneous** excitation of three virtual particles, forming 3D standing wave is a product:

$$(P_{j-k}^i)_{3D} = (P_{j-k}^i)_1 (P_{j-k}^i)_2 (P_{j-k}^i)_3 \quad A.6a$$

The relative mass symmetry shift in selected volume of space is equal to that of frequency shift. It is dependent on gravitational potential (E_G) and equilibrium constant ($K_{BVF^\uparrow \rightleftharpoons BVF^\downarrow}$) between Bivacuum fermions (BVF^\uparrow and BVF^\downarrow) of opposite spins and magnetic moments (μ_{BVF^\uparrow}

and μ_{BVF^\downarrow}):

$$\frac{\Delta m_0^i}{m_0^i} = \frac{\Delta \omega_0^i}{\omega_0^i} = 1 - \frac{m_C^+ - m_C^-}{m_0} = 1 - \frac{E_G/\beta c^2}{m_0} = 1 - K_{BVF^\uparrow \rightleftharpoons BVF^\downarrow} \quad A.7$$

where the dependence of equilibrium constant $K_{BVF^\uparrow \rightleftharpoons BVF^\downarrow}$ on magnetic field \vec{H} is:

$$K_{BVF^\uparrow \rightleftharpoons BVF^\downarrow} = \exp \left[-\frac{\vec{H}(N^-\vec{\mu}_{BVF^\uparrow} - N^+\vec{\mu}_{BVF^\downarrow})}{kT_R + \Delta U} \right] \quad A.8$$

The gradient of increment $(\Delta m_0^i/m_0)$ may be responsible for so called **TORSION Field** (\vec{TF}):

$$\vec{TF} = \text{grad}[\Delta m_0^i/m_0] = \text{grad}[1 - K_{BVF^\uparrow \rightleftharpoons BVF^\downarrow}] \quad A.8a$$

The **kinetic energy of virtual particle** is related to its Compton radius (A.2) as:

$$(T_k)_{j-k}^i = \frac{\hbar^2}{2m(L_{j-k}^i)^2} = \frac{1}{2} E_{j-k}^i \quad A.9$$

The **virtual pressure (VP⁺), provided by virtual particles** is defined by product of maximum density of such virtual particles (n_{j-k}) and probability of their excitation $(P_{j-k})_{3D}^i$

$$(VP_{j-k}^+)^i = \frac{1}{3} n_{j-k}^i (P_{j-k}^i) (T_k)_{j-k}^i = n_{j-k} (P_{j-k})_{3D}^i \frac{\hbar^2}{6m(L_{j-k}^i)^2} \quad A.10$$

Factor (1/3) means that we consider the VP⁺ only in one of six possible directions of virtual particles impulse.

The total energy density of virtual particles in positive realm of bivacuum may be expressed like A.10 using instead kinetic energy, the formula for total energy of 3D standing virtual particle (A.1a):

$$(\varepsilon_{j-k}^+)^i = n_{j-k}^i (P_{j-k}^i) (E_{j-k}^i)_{3D} \quad A.10a$$

2. Properties of virtual antiparticles of bivacuum

Presented above formulae for virtual particles are symmetric to those of antiparticles, taking into account the opposite sign of frequency and mass symmetry shift in negative energy realm of bivacuum.

The quantized energies of virtual antiparticles for three generations ($i = e, \mu, \tau$) and three directions, normal to each other (1,2,3), are less, than those for virtual particles due to opposite symmetry shift:

$$\left(\tilde{E}_{j-k}^i \right)_{1,2,3} = -\hbar(\omega_0^i - \Delta\omega_0^i)_{1,2,3}(j-k) = \hbar(c/\tilde{L}_{j-k}^i)_{1,2,3} \quad A.11$$

For the energy of 3D standing virtual antiparticles we have:

$$\left(\tilde{E}_{j-k}^i \right)_{3D} = \left(\tilde{E}_{j-k}^i \right)_1 + \left(\tilde{E}_{j-k}^i \right)_2 + \left(\tilde{E}_{j-k}^i \right)_3 \quad A.11a$$

where the Compton radius of virtual antiparticle in the same directions is:

$$\left(\tilde{L}_{j-k}^i \right)_{1,2,3} = \frac{c/(j-k)}{(\omega_0^i - \Delta\omega_0^i)_{1,2,3}} = \frac{\hbar/(j-k)}{(m_0 - \Delta m_0)_{1,2,3}^i} \quad A.12$$

The corresponding kinetic energy of most probable virtual antiparticle is:

$$(\tilde{T}_k)_{j-k}^i = \frac{\hbar^2}{2m(\tilde{L}_{j-k}^i)^2} = \frac{1}{2}\tilde{E}_{j-k}^i \quad \text{A.13}$$

The density of 3D standing waves of virtual antiparticles:

$$\tilde{n}_{j-k}^i = \frac{1}{9\pi^2} \frac{1}{(L_{j-k}^i)_{1,2,3}^3} = \frac{1}{9\pi^2 c^3} \frac{1}{(j-k)^3} \prod_{1,2,3}^3 (\omega_0^i - \Delta\omega_0^i)_{1,2,3} \quad \text{A.14}$$

and probability of **virtual antiparticles** excitation:

$$\left(\tilde{P}_{j-k}^i\right)_{1,2,3} = \exp\left[-\frac{\hbar(\omega_0^i - \Delta\omega_0^i)_{1,2,3}(j-k)}{kT_R + \Delta U}\right] \quad \text{A.15}$$

The probability of 3D standing virtual antiparticles:

$$\left(\tilde{P}_{j-k}^i\right)_{3D} = \left(\tilde{P}_{j-k}^i\right)_1 \left(\tilde{P}_{j-k}^i\right)_2 \left(\tilde{P}_{j-k}^i\right)_3 \quad \text{A.15a}$$

The **virtual pressure (VP⁻)**, provided by most probable virtual antiparticles is dependent on their kinetic energy (A.13), maximum density of such virtual particles (\tilde{n}_{j-k}) and probability of their excitation $\left(\tilde{P}_{j-k}^i\right)_{3D}$:

$$(VP_{j-k}^-)^i = \frac{1}{3}\tilde{n}_{j-k}^i \left(\tilde{P}_{j-k}^i\right)_{3D} (\tilde{T}_k)_{j-k}^i = \tilde{n}_{j-k}^i \left(\tilde{P}_{j-k}^i\right)_{3D} \frac{\hbar^2}{6m(\tilde{L}_{j-k}^i)^2} \quad \text{A.16}$$

The total energy density of virtual antiparticles, using (A.11a) is

$$(\varepsilon_{j-k}^-)^i = \tilde{n}_{j-k}^i \left(\tilde{P}_{j-k}^i\right)_{3D} (\tilde{E}_{j-k}^i)_{3D} \quad \text{A.16a}$$

3. The properties of most probable virtual particles and antiparticles

It is natural to assume, that the properties of most probable virtual particles and antiparticles **correspond to minimum difference between quantum sublevels of positive and negative vacuum, forming bivacuum, when:**

$$j - k = 1 \quad (j > k) \quad \text{A.17}$$

At this condition, the **most probable energy, density and excitation probability of virtual particles** and their 3D superposition (eqs. A.1-A.10a) could be expressed as:

$$E_{1,2,3}^i = \hbar(\omega_0^i + \Delta\omega_0^i)_{1,2,3} = (m_0 + \Delta m_0)_{1,2,3}^i c^2; \quad E_{3D}^i = (E_1^i + E_2^i + E_3^i) \quad \text{A.18}$$

$$n^i = \frac{1}{9\pi^2} \frac{1}{(L^i)^3} = \frac{1}{9\pi^2 c^3} \prod_1^3 (\omega_0^i + \Delta\omega_0^i)_{1,2,3}; \quad L_{1,2,3}^i = \frac{c}{(\omega_0 + \Delta\omega_0)_{1,2,3}^i} \quad \text{A.19}$$

$$(T_k)_{1,2,3}^i = \frac{\hbar^2}{2m(L_{1,2,3}^i)^2} \quad \text{A.19a}$$

$$P_{1,2,3}^i = \exp\left[-\frac{\hbar(\omega_0^i + \Delta\omega_0^i)_{1,2,3}}{kT_R + \Delta U}\right]; \quad P_{3D}^i = P_1^i P_2^i P_3^i \quad \text{A.20}$$

$$VP_{1,2,3}^+ = \frac{1}{3} n^i (P_{3D}^i) (T_k)_{1,2,3}^i = n^i (P_{3D}^i) \frac{\hbar^2}{6m(L_{1,2,3}^i)^2} \quad \text{A.20a}$$

$$\varepsilon^+ = n^i (P_{3D}^i) E_{3D}^i \quad \text{A.20b}$$

The similar parameters we get for **most probable virtual antiparticles at condition (A.17)**:

$$\tilde{E}_{1,2,3}^i = -\hbar(\omega_0^i - \Delta\omega_0^i)_{1,2,3} = -(m_0 - \Delta m_0)_{1,2,3}^i c^2; \quad \tilde{E}_{3D}^i = (\tilde{E}_1^i + \tilde{E}_2^i + \tilde{E}_3^i) \quad \text{A.21}$$

$$\tilde{n}^i = \frac{1}{9\pi^2} \frac{1}{(L^i)^3} = \frac{1}{9\pi^2 c^3} \prod_1^3 (\omega_0^i - \Delta\omega_0^i)_{1,2,3}; \quad (\tilde{L}_{j-k}^i)_{1,2,3} = \frac{c}{(\omega_0^i - \Delta\omega_0^i)_{1,2,3}} \quad \text{A.22}$$

$$(\tilde{T}_k)_{1,2,3}^i = \frac{\hbar^2}{2m(\tilde{L}_{1,2,3}^i)^2} = \frac{1}{2} \tilde{E}_{1,2,3}^i \quad \text{A.22a}$$

$$\tilde{P}_{1,2,3}^i = \exp\left[-\frac{\hbar(\omega_0^i - \Delta\omega_0^i)_{1,2,3}}{kT_R + \Delta U}\right]; \quad \tilde{P}_{3D}^i = \tilde{P}_1^i \tilde{P}_2^i \tilde{P}_3^i \quad \text{A.23}$$

$$VP_{1,2,3}^- = \frac{1}{3} \tilde{n}^i (\tilde{P}_{3D}^i) (\tilde{T}_k)_{1,2,3}^i = \tilde{n}^i (\tilde{P}_{3D}^i) \frac{\hbar^2}{6m(\tilde{L}_{1,2,3}^i)^2} \quad \text{A.24}$$

$$\varepsilon^- = \tilde{n}^i (\tilde{P}_{3D}^i) \tilde{E}_{3D}^i \quad \text{A.25}$$

In general case **virtual particles and antiparticles** could be considered as quantum harmonic oscillators with energy, presented by (A.1 and A.11), where: $(j-k) = 1, 2, 3, \dots, \infty$.

However, it looks that the distribution between these virtual energy states do not follow the Plank's distribution, true for real quantum oscillators. More likely is a situation that the probability of excitation of certain energy transitions in Bivacuum (i.e. virtual particles and antiparticles) is dependent on the tension, geometry and dynamic properties of electromagnetic and gravitational fields in volume of space under consideration (see eqs. A.4a - A.6).

4. The disbalance between positive and negative realms of bivacuum, as potential source of free energy

The difference between virtual pressure of positive and negative vacuum determines the cumulative effect of Virtual Pressure and Energy density of bivacuum on the object.

In the case of Mind - Matter interaction it could be responsible for **telekinesis**:

$$[\Delta VP^\pm]_{1,2,3} = \frac{1}{Z} [|VP^+| - |VP^-|]_{1,2,3} \quad \text{A.26}$$

where: $Z = (P_{j-k}^i)_{3D} + (\tilde{P}_{j-k}^i)_{3D}$ is a partition function for virtual excitations of bivacuum.

The final expression of bivacuum energy density shift ($\Delta\varepsilon^\pm$), looks like difference between energy densities of positive and negative vacuum:

$$[\Delta\varepsilon^\pm]_{1,2,3} = \frac{1}{Z}[\varepsilon^+ - \varepsilon^-]_{1,2,3} \quad \text{A.27}$$

where: ε^+ and ε^- are the energy densities of positive and negative vacuum;
Taking into account A.9, we have:

$$[\Delta VP^\pm]_{1,2,3} = \frac{1}{2}[\Delta\varepsilon^\pm]_{1,2,3} \quad \text{A.29}$$

In the case of symmetric primordial bivacuum, when the energy of excitations of positive vacuum is totally compensated by that of negative vacuum, the resulting energy of bivacuum is zero and:

$$\Delta\varepsilon^\pm = 0 \quad \text{at} \quad \varepsilon^+ = \varepsilon^- \quad \text{A.30}$$

The sum of **absolute value** of energy density of virtual fermions and antifermions of **opposite charge**: ε^+ and ε^- is also related with sum of positive and negative virtual pressure:

$$[\varepsilon^{tot}]_{1,2,3} = \frac{1}{Z}[\varepsilon^+ + \varepsilon^-]_{1,2,3} = \frac{2}{Z}[|VP^+| + |VP^-|]_{1,2,3} \quad \text{A.31}$$

may be responsible for **charge screening** effects in real matter, which displays themselves in the spectral Lamb shift and changing the atomic and molecular polarization, leading in turn, to change of Van der Waals interactions. The latter effect is important for possible mechanism of distant Mind-Matter and Mind-Mind interaction, discussed in section 8.

For **contribution of most probable 3D standing waves** of virtual particles and antiparticles to the total virtual energy density we have, using eqs. (A.18 - A.23):

$$\begin{aligned} \varepsilon^{mp} &= \frac{1}{Z^{mp}}[\varepsilon^+ + \varepsilon^-] = \frac{1}{Z} [n^i P_{3D}^i E_{3D}^i - \tilde{n}^i \tilde{P}_{3D}^i \tilde{E}_{3D}^i] = \\ &= \frac{1}{Z^{mp}} \left[\frac{1}{9\pi^2 c^3} \prod_1^3 (\omega_0 + \Delta\omega_0)_{1,2,3}^i (P_1^i P_2^i P_3^i) (E_1^i + E_2^i + E_3^i) - \right. \\ &\quad \left. - \frac{1}{Z^{mp}} \left[\frac{1}{9\pi^2 \hbar^3} \prod_1^3 (\omega_0^i - \Delta\omega_0^i)_{1,2,3} \right] \left(\tilde{P}_1^i \tilde{P}_2^i \tilde{P}_3^i \right) (\tilde{E}_1^i + \tilde{E}_2^i + \tilde{E}_3^i) \right] \end{aligned} \quad \text{A.32}$$

where: $Z^{mp} = P_{3D}^i + \tilde{P}_{3D}^i$

The ideas and formalism, developed in this paper, may serve in future as a background for deeper understanding and quantitative analysis of Mind-Matter and Mind-Mind interaction, telekinesis and clairvoyance, as a highly complicated physical phenomena, based on amplification of very weak signals, their transmitting by Bivacuum and ability of Bivacuum to self-organization.

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