The questions, posted by Lian Sidorov and answers by Alex Kaivarainen:

1. You approach the problems of the standard model by revising its basic axioms essentially starting with a new interpretation of its physical building blocks. Could you briefly summarize this approach?

The coherent physical theory of psi-phenomena is absent yet due to its high complexity and multilateral character. It is clear also, that such *Quantum-Psi* theory should be based on new physical paradigm.

The original mechanism of *Bivacuum* mediated Mind-Matter and Mind-Mind interaction, proposed, is based on the following stages of our long term efforts (see http://arXiv.org/find/physics/1/au:+Kaivarainen A/0/1/0/all/0/1):

- Unified model of Bivacuum, [Corpuscle (C) \Rightarrow Wave (W)] duality of particles, Electromagnetism, Gravitation & Time. The superfluous energy of asymmetric Bivacuum (http://arXiv.org/abs/physics/0207027);

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

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

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

- The specific quantum and neurodynamics processes, responsible for 'Psi field';

- The role of local, nonlocal and distant Bivacuum mediated quantum phenomena, including quantum teleportation, in Mind-Matter and Mind-Mind interaction.

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

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

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

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

In *secondary* Bivacuum, in presence of matter and fields, the properties of rotors and antirotors do not compensate each other totally and BVF^{\ddagger} and BVB^{\pm} turns to asymmetric. In such a conditions they acquire very small, but nonzero mass, momentum and charge.

Virtual particles and antiparticles in our model are the result of certain combinations of virtual clouds $(\mathbf{VC}_{j,k}^+ \sim V_j^+ - V_k^+)^i$ and anti clouds $(\mathbf{VC}_{j,k}^- \sim V_j^- - V_k^-)^i$, composed from sub-quantum particles. Virtual clouds and anti clouds emission/absorption represents a correlated transitions between different excitation states (j,k) of rotors $(V_{j,k}^+)^i$ and antirotors $(V_{j,k}^-)^i$ of Bivacuum dipoles $[BVF^{\ddagger}]^i$ and $[BVB^{\pm}]^i$. Three generation of Bivacuum fermions correspond to three lepton generation $(i = e, \mu, \tau)$.

The process of [*creation* \Rightarrow *annihilation*] of virtual clouds is accompanied by oscillation of virtual pressure (VP[±]) in form of positive and negative virtual pressure waves (VPW⁺ and VPW⁻), forming in certain conditions the autowaves in Bivacuum with properties of active medium. In primordial Bivacuum the virtual pressure waves: VPW⁺ and VPW⁻, emitted/absorbed in a course of exchange interaction between [BVF[†] and BVF[↓]]^{*i*} of opposite spins, totally compensate each other. However, in asymmetric secondary Bivacuum, in presence of matter and fields such compensation of virtual particles or antiparticles becomes nonzero. In contrast to real particles, the virtual ones may exist only in the wave [W] phase, but not in corpuscular [C] phase (see Section 3). It is a reason, why [VPW[±]] and their superposition in form of the virtual autowaves do not obey the laws of relativist mechanics and causality principle.

The correlated by virtual clouds exchange of interaction pairs of Bivacuum fermions (BVF) with opposite spins (S= $\pm \frac{1}{2}\hbar$) :

$$[BVF^{\uparrow} \bowtie BVF^{\downarrow}]_{S=0} \equiv [(V^{+} \uparrow\uparrow V^{-}) \bowtie (V^{+} \downarrow\downarrow V^{-})]_{S=0}$$
 1

have a properties of massless *Goldstone bosons* with zero spin: S = 0.

Superposition of their virtual clouds, emitted and absorbed in a course of correlated transitions of $[BVF^{\uparrow} \bowtie BVF^{\downarrow}]_{S=0}$ compensate the virtual energy of each other:

$$BVF^{\uparrow} \equiv (V^{+} \uparrow\uparrow V^{-}) \qquad 2$$

$$\Leftrightarrow [\mathbf{V}\mathbf{C}_{j,k}^{+} - \mathbf{V}\mathbf{C}_{j,k}^{-}]_{S=0} \to 0$$

$$BVF^{\downarrow} \equiv (V^{+} \downarrow\downarrow V^{-}) \qquad 2a$$

Each of Bivacuum fermions has a properties of massless Goldstone fermions (Goldstino). At the absence of Bivacuum supersymmetry breach (primordial Bivacuum) BVF^{\ddagger} is a neutral particle.

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

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

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

I. Conservation rule of the actual and complementary internal kinetic energies of vortex and antivortex: V^+ and V^- of $BVF^{\ddagger} = [V^+ \ddagger V^-]^i$ and their asymmetric vortex and rotor states of F_{\uparrow}^{\pm}

= $[V^+ \ \ V^-]^{i*}$, correspondingly, in form of equality of modules of the internal actual $|2T_{kin}^+|^{in}$ and complementary $|-2T_{kin}^-|^{in}$ kinetic energies to the rest mass energy (m_0c^2) of corresponding electron's generation:

$$\left[|2T_{kin}^{+}|^{in} = |m_{C}^{+}|(v_{gr}^{in})^{2} = |-2T_{kin}^{-}|^{in} = |-m_{C}^{-}|(v_{ph}^{in})^{2} = m_{0}c^{2} = const\right]^{i}$$
3

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

$$v_{gr}^{in}v_{ph}^{in} = v_{gr}v_{ph} = c^2$$
 3a

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

$$|\pm\mu_{+}| = \frac{1}{2}|e_{+}|\frac{|\pm\hbar|}{|m_{C}^{+}|v_{gr}^{in}} = |\pm\mu_{-}| = \frac{1}{2}|-e_{-}|\frac{|\pm\hbar|}{|-m_{C}^{-}|v_{ph}^{in}} = \mu_{B} = \frac{1}{2}|e|\frac{\hbar}{m_{0}c} = const \qquad 4$$

where: e_+ and e_- are the *internal* electric charges of actual vortex and complementary rotor, correspondingly; |e| is a module of the resulting charge of the electron or positron;

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

$$m_C^+ = \frac{m_0}{\pm [1 - (v/c)^2]}$$
5

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

$$m_C^- = \pm m_0 [1 - (v/c)^2]$$
 5a

It is easy to see from 5 and 5a that the rest mass squared (m_0^2) and the the energy of quantum beats between the actual and complementary states, equal to energy of sub-elementary particles, as de Broglie wave, are:

$$|m_C^+ m_C^-| = m_0^2 6$$

and :
$$E_{C \Rightarrow W} = |m_C^+ - m_C^-|c^2 = m_C^+ v^2$$
 6a

In conditions of total symmetry of primordial Bivacuum, when symmetry shift of BVF^{\ddagger} is zero: $\Delta m_C = |m_C^+ - m_C^-| = 0$, their external translational velocity is also zero: $v_{ext} \equiv v = 0$.

From (6a) we determine the radius of domains of nonlocality in Bivacuum by characteristic scale of virtual Bose condensation (VirBC), equal to:

$$L_{VirBC} = \frac{\hbar}{m_C^+ v(v/c)} \to \infty \quad at \quad v \to 0$$
 6b

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

$$\frac{|e_{+}|}{|m_{C}^{+}|v_{gr}^{in}} = \frac{|-e_{-}|}{|-m_{C}^{-}|v_{ph}^{in}} = const$$
7

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

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

$$m_C^+| = |-m_C^-| = m_0 8$$

$$|e_{+}| = |e_{-}| = e$$
 8a

$$v_{gr}^{in} = v_{ph}^{in} = c ag{8b}$$

$$|\pm\mu_+| = |\pm\mu_-| = \mu_B = const \qquad 8c$$

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

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

$$\left[\omega_{C \neq W} = |m_C^+ - m_C^-|^{\phi} c^2 / \hbar = m_0 c^2 / \hbar = \omega_0\right]^t$$

Sub-elementary particles $(\mathbf{F}_{\uparrow}^{\pm})^i$, like primordial Bivacuum fermions $(BVF^{\ddagger})^i$, can be of three modes, corresponding to three lepton generation: $i = e, \mu, \tau$. The square root of product of radiuses of the actual vortex $(L^+ = \hbar/m_C^+ c)^i$ and complementary rotor $(L^- = \hbar/m_C^- c)^i$ of sub-elementary particles (the resulting radius) is equal to *Compton radius vorticity of the electron* of corresponding generation: $L_0^i = (L^+L^-)^{1/2} = \hbar/m_0^i c$, as far $[m_C^+m_C^- = m_0^2]^i$. In accordance to UM three generation frequencies (6) coincide with three fundamental quantized frequencies of Bivacuum, making it possible the exchange resonant interaction between Bivacuum and matter.

The coherent triplets, formed by pair: sub-elementary fermions + sub-elementary antifermion: $[\mathbf{F}^-_{\uparrow} \bowtie \mathbf{F}^+_{\downarrow}]$ and one sub-elementary fermion $\mathbf{F}^-_{\downarrow}\rangle$: $\langle [\mathbf{F}^+_{\downarrow} \bowtie \mathbf{F}^-_{\uparrow}] + \mathbf{F}^-_{\downarrow}\rangle$ or one sub-elementary antifermion $\mathbf{F}^+_{\downarrow}\rangle$: $\langle [\mathbf{F}^+_{\downarrow} \bowtie \mathbf{F}^-_{\uparrow}] + \mathbf{F}^+_{\downarrow}\rangle$ represent the electrons and positrons, correspondingly. The absolute values of energy of sub-elementary particles/antiparticles in triplets are equal and determined by energy of *uncompensated* $[\mathbf{F}^\pm_{\downarrow}\rangle$. Certain combinations of such triplets form quarks and photons. In latter case of elementary bosons, all the properties, except spins, of three sub-elementary particles are compensated by properties of three sub-elementary antiparticles. The structure of triplets is stabilized by exchange of virtual clouds of sub-quantum particles between two sub-elementary fermions or antifermions of the opposite spins: $[\mathbf{F}^+_{\downarrow}]$ and $\mathbf{F}^+_{\uparrow}\rangle$ or $[\mathbf{F}^-_{\uparrow}]$ and $\mathbf{F}^-_{\downarrow}\rangle$ in a course of their *counterphase* pulsation. Stabilization of pair of sub-elementary fermion of local Bivacuum energy/symmetry shift. The orientation of sub-elementary particles/antiparticles in triplets is normal to each other (x,y,z). This determines three dimensions (3D) of space.

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

The physical nature of electromagnetic potential of elementary particles can be related to non local equilibrium shifts between rotors and antirotors ($\mathbf{V}^+ \uparrow\uparrow \mathbf{V}^-$) of infinitive number of BVF[‡] of Bivacuum, compensating the local symmetry shift, induced by *longitudinal vibrations* (ω_{\parallel}),

accompanied the $[C \rightleftharpoons W]$ pulsation of uncompensated $[\mathbf{F}_{\downarrow}^{\pm}\rangle$ and corresponding instant momentum oscillation, coinciding with vector of particle's external momentum.

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

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

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

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

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

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

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

The nonlocal $[BVF^{\dagger} \Rightarrow BVF^{\downarrow}]$ dynamic equilibrium shifts, compensated the local symmetry shifts, induced by different spinning velocity of the vortex and rotor of sub-elementary particles and corresponding resulting rotational moment of cumulative virtual cloud: CVC° or CVC° , depending on spin of $[\mathbf{F}_{\downarrow}^{\pm}\rangle$, is responsible for virtual magnons and the *spin field* potential origination. The total energy of sub-elementary particle can be presented, as a sum of one rotational (spin) contribution (E_s) and two translational: longitudinal, responsible for electromagnetic potential (E_{EM}) and transversal, responsible for gravitational potential (E_G) :

$$E_{\mathbf{F}_{\uparrow}^{\pm}} = E_S + E_{EM} + E_G = m_0 \omega_0^2 L_0^2 + \alpha m_C^+ v^2 + \beta m_C^+ v^2$$
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where :
$$E_S = m_0 \omega_0^2 L_0^2$$
; $E_{EM} = \alpha m_C^+ v^2 = 2[(T_k)_{\parallel tr}; E_G = \beta m_C^+ v^2 = 2[(T_k)_{\perp tr}]$ 10a

where: $\alpha = e^2/\hbar c$ is electromagnetic fine structure constant; $\beta = m_0^2/M_{Pl}^2$ is gravitational fine structure constant.

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

$$[d\ln t = -d\ln(E_{EM} + E_G) = -d\ln[(T_k)_{\parallel tr} + (T_k)_{\perp tr}]_{x,y,z}$$
 11

The spatial anisotropy of all of these parameters are determined by anisotropy of translational momentum and kinetic energy distribution: $\left[\vec{T}_{k} = \vec{p}^{2}/2m\right]_{xyz}$.

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

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

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

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

Bivacuum has a properties of the active medium with ability to self-organization, as a result of interaction with matter. The asymmetric double cells-dipoles, pulsing between [C] and [W] phase, serve as the active elements of medium. The existence of different 3D structures of virtual autowaves, formed by VPW^{\pm}, modulated by external EM, gravitational fields and matter dynamics, are also the important feature of secondary Bivacuum.

The notion of Virtual Replica (VR) of condensed matter is introduced, as a multidimensional standing VPW[±], forming the autowaves in Bivacuum under the influence of hierarchy of quantum $[C \rightleftharpoons W]$ and molecular dynamics of matter.

2. Are there historical figures from which you can claim inspiration or current physical models under discussion which offer points of convergence with your model ?

First of all - Thales, born in Miletus (Greece) about 600 BC. According to Thales, the original principle of all things is water, from which everything proceeds and into which everything is again resolved.

In our Unified model, the original principle of matter, including elementary particles, atoms, molecules, etc. is Bivacuum and *local* strong symmetry shift of part of its cells-dipoles $(\mathbf{BVF}^{\uparrow} \rightarrow \mathbf{F}^{\pm}_{\uparrow})$, compensated by opposite *non local* small symmetry shift of much bigger fraction of \mathbf{BVF}^{\uparrow} , in space, responsible for fields.

The infinitive Universe expansion and gradual degradation/conversion of the matter to radiation, [neutrino + antineutrino] pairs, gradually change the Universe properties to those of ideally symmetric primordial Bivacuum, ready to the next cycle of spontaneous symmetry breach (the analog of Big Bang).

So, Bivacuum, like water after Thales, is the active medium, responsible for evolution of the

Universe.

In turn, water itself after our Hierarchic theory of condensed matter is a medium and factor of evolution of all living objects.

The Plato's theory of Forms or Ideas has some similarity with introduced in our Unified model Virtual Replica (VR) of the material objects in Bivacuum with hologram properties. After Plato the Forms have greater reality than objects in the physical world because of their perfection and stability. They are models, resemblance to which gives real objects the reality they have. Stability of VR are provided by ability of VR represent superposition of standing Virtual Pressure Waves (VPW[±]), resulting from modulation of Virtual Clouds (VC[±]) of Bivacuum by [Corpuscle - Wave] pulsation and thermal dynamics of matter. The life-time of stable VR can be bigger than life-time of the objects, generated them.

After Plato everything in space and time is what it is by virtue of its resemblance to, or participation in its universal Form. Plato conceived the Forms as arranged hierarchically. The supreme Form is the Form of the Good, which illuminates all the other Ideas. There is a sense in which the Form of the Good represents Plato's movement in the direction of an ultimate principle of explanation. Ultimately, the theory of Forms is intended to explain how things have come to be as they are. In our UM theory "Good" reflects the properties of systems, following Golden mean conditions in their spatial and dynamic properties. The tendency of all material systems to Golden mean conditions (illumination) occur under the influence of Harmonization energy of Bivacuum (HaE - see my paper in this issue of Journal) and can be considered as self-organization and evolution of the Universe on all hierarchical levels.

The "LOVE" in Plato's philosophy is a streaming of any systems (living and nonliving) to the 'WHOLENESS" i.e. tendency to self-organization, synchronization and quantum entalgement under the action of HaE in terms of our theory.

In Platonic philosophy the ultimate dualism between ideas and matter was introduced. In the 17th century Rene Descartes was the first to emphasize the duality between mind and matter. The difficulty created by this view was to explain how mind and matter interact. We are just now feel ourself more or less ready for making an attempt to solve this fundamental problem.

The philosopher Lao-tzu, who lived during the 6th century BC, is regarded as the founder of Taoism. Taoism sought to preserve human life by following the Way of Nature (Tao). Taoism attempted to bring the individual into perfect harmony with nature through a mystical union with the Tao. This concept is close to our idea about influence of Harmonization Energy (HaE) Bivacuum on evolution of matter, including living organisms, brains, etc., tending them to Golden mean conditions.

In the 12th century the Neo-Confucian Chu Hsi developed the doctrines of the School of Principle. This school asserted that all things were composed of two elements: principle (li), which was a reflection of the Great Ultimate (Tai-chi), and matter (ch'i). Through the "investigation of things" and through self-cultivation, one could penetrate matter and perceive principle. This would result in an understanding of all things and at the same time accentuate the principle (the fundamentally good human nature), and minimize ch'i (the physical propensities) in one's mind. Thus enlightened, the individual could comprehend the affairs of the universe and regulate them through the power of personal virtue. This idea is also presented in our Unified model, as possible feedback reaction of the individual virtual replica (VR) of human being on the Global/Cosmic virtual replica (GVR), reflecting the properties of the Universe.

In 20th century Teihard de Chardin and biochemist Jhon Haldein come to conclusion, that like cooperation of billions of neurons in our brain results in appearance of consciousness on the next stage of evolution, the interaction and unification/convergence of billions of human brains will lead to emergence of Supreme Being.

In terms of Teihard de Chardin this process of transformation of biosphere to noosphere is the way from ALPHA to OMEGA. The level of consciousness after him is directly related to complexity of systems, participating in consciousness. Our Unified model includes this process of $[\alpha \rightarrow \rho]$, as a convergence of individual virtual replicas (VR) of human beings into Global Virtual Replica of the Universe (GVR).

Our idea of GVR, as a evolving system of hierarchy of virtual autowaves, has common features with David Bohm's idea of Holographic Universe. The telepathic interactions between human beings is one of possible mechanisms for such unification. Corresponding mechanism of telepathy includes the interaction between different individual VR, compatible with Karl Pribram idea of holographic memory and mind.

Dirac's important result of equal probability of positive and negative energy distribution in the Universe was a background of our Bivacuum concept.

3. How do you view the relation between material systems and consciousness? Is one an emergent property of the other or are they equivalent on some level?

In general form the response to this question is presented above.

In accordance to UM all material systems are the result of Bivacuum symmetry shift of its cells-dipoles, turning them to sub-elementary particles, combinations of elementary particles in hierarchic forms, atoms, molecules, biopolymers, cells, organisms, consciousness organisms, etc.

The important issue of remote mental interactions in our approach is a notion of Virtual replica (VR) of any kind of matter: from elementary particles to molecules, cells, organisms, rocks, planets, stars, etc.

In accordance to our Unified model (UM) *Virtual Replica (VR)* of any condensed matter, including living organism, is a result of superposition of standing virtual pressure waves (VPW_{Bv}^{\pm}) of Bivacuum with VPW_{M}^{\pm} of Matter, activated by $[C \rightleftharpoons W]$ pulsation of symmetric pairs $[\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{+}]$ of triplets $\langle [\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{+}] + \mathbf{F}_{\downarrow}^{\pm} \rangle$, forming elementary particles, like electrons and quarks with frequency $\omega_{C \nleftrightarrow W}^{i} = m_{0}^{i}c^{2}/\hbar$, where m_{0}^{i} is the rest mass of the electrons/positrons of three generation ($i = e, \mu, \tau$) at Golden mean conditions (Kaivarainen, 2002).

In turn, $[C \rightleftharpoons W]$ pulsation of elementary particles can be modulated via combinational resonance by thermal oscillations of atoms and molecules of condensed matter due to in-phase relativist mass oscillation of particles. The bigger are coherent clusters of oscillating molecules with modulation frequency ($\Omega \ll \omega_{C \rightleftharpoons W}$) and their kinetic energy, the bigger is modulation amplitude. As far the Bivacuum fundamental frequency of quantum transitions between its excited substates is close to $\omega_{C \rightleftharpoons W}^i$, it interacts with matter by resonance principle. As far Bivacuum has a properties of the active medium tending to self-organization, superposition of many different VR of matter may exist in form of virtual multidimensional autowave, forming a part of Global Virtual Replica (GVR). Another way of VR modulation is oscillation of nonlocal Bivacuum symmetry (BvSO), induced by $[C \rightleftharpoons W]$ pulsation of unpaired sub-elementary particles $\mathbf{F}_{\uparrow}^{\pm}$) of triplets.

We present a basically new physical approach to problem of Mind-Matter and Mind-Mind interaction, based on the exchange of Virtual Replicas (VR) of 'sender' [S] and 'receiver' [R]: $(VR^{S} \Rightarrow VR^{R})$, using mechanism of *quantum teleportation* (Bouwmeester et al. 1997; Marcer, 2001). Each VR can be subdivided to the *internal-local* (VR^{*in*}) and the two kinds of *external* (VR^{*ext*}) contributions.

The *internal-local* contribution of VR^{*in*} represents all kinds of virtual 3D standing de Broglie waves (VC^{*in*}) in the volume of condensed matter, corresponding to [W] phase of all particles of matter and virtual quanta, responsible for interactions, mediated by their exchange. This includes nuclear and intermolecular electromagnetic Van-der Waals interaction.

The *external* VR^{*ext*} contribution has a properties of *quantum hologram*, containing two modulated by matter inseparable components: the *distant* (VR^{*ext*}_{*dis*}) and *nonlocal* (VR^{*ext*}_{*nl*}) one. It is supposed, that between external and internal virtual replicas strong interdependence is existing, providing feedback reaction, like (VR^{*in*} \Rightarrow VR^{*ext*}). Unification/superposition of the individual VR of different pieces of matter of the Earth and outside can be resulted in appearance of Global Virtual Replica (GVR)

Taking into account the possibility of feedback reaction between self-organization of Bivacuum in form of GVR and evolution of real/material part of the Universe, the main stages of evolution of system [Bivacuum + Matter + Fields] under the influence of Bivacuum Harmonization energy [HaE], can be presented as follows:

The feedback reaction between *Superconsciusness* and *Individual Consciusness* means that at proper conditions of high *Global Virtual Replica* instability (bifurcation point), even very small perturbation of GVR may influence *Superconsciusness*.

4. How would you summarize your approach to remote mental interactions like anomalous cognition (remote viewing) and anomalous perturbation (PK) ?

For explanation of different Psi phenomena the notion of Virtual replica of Sender [S] and Receiver [R], their superposition, formation of *Psi-channel* between [S] and [R] with altered properties of Bivacuum has been introduced.

The modulation of virtual pressure waves of Bivacuum (VPW[±]_{Bv}), excited, as a result of transitions between quantized excitation states of Bivacuum fermions: $[(BVF^{\ddagger})_j - (BVF^{\ddagger})_k]$ by VPW[±]_M, generated by elementary particles of matter (*M*), results in formation of distant (VR^{ext}_{dis}).

The *primary* modulation of VPW[±]_{Bv} by matter is a result of superposition of $(VC^{\pm})_{Bv}$ of Bivacuum with virtual clouds $(VC^{\pm})_M$, emitted and absorbed in a course of $[C \rightleftharpoons W]$ pulsation of symmetric pairs $[\mathbf{F}_{\uparrow}^- \bowtie \mathbf{F}_{\downarrow}^+]$ of triplets $\langle [\mathbf{F}_{\uparrow}^- \bowtie \mathbf{F}_{\downarrow}^+] + \mathbf{F}_{\downarrow}^{\pm} \rangle$ of elementary particles of matter.

In turn, the *secondary* modulation of pulsation frequency $\omega_{C \neq W}$ and VPW[±]_M occurs with frequency ($\Omega_{tr,lb}$) of *coherent vibrations* (translations, librations) of atoms and molecules of matter. The fundamental Bivacuum VPW[±]_{Bv} with Golden mean frequency [$\omega_0 = m_0 c^2/\hbar$]^{*i*} play the role of the pilot waves in formation of quantum hologram (VR^{ext}_{dis}) of matter. The VR^{ext}_{dis} realize the *amplitude/frequency correlation* between [$C \neq W$] pulsation of particles of [S] and [R] in the process of quantum informational exchange.

After our Unified Model, the energy/informational exchange interaction between Sender and Receiver involves three following dynamic processes:

1) the exchange between Virtual Replicas (VR)_{*S*,*R*} of Sender [S] and Receiver [R] by Virtual Pressure waves (VPW[±])_{*S*,*R*}, generated by in-phase [$C \Rightarrow W$] pulsation of pairs [$\mathbf{F}^-_{\uparrow} \bowtie \mathbf{F}^+_{\downarrow}$] of elementary particles;

2) the correlated Bivacuum symmetry oscillations $(BvSO)_{S,R}$, induced by $[C \rightarrow W]$ pulsation of uncompensated sub-elementary particles of triplets $\langle [\mathbf{F}_{\uparrow}^{-} \bowtie \mathbf{F}_{\downarrow}^{+}] + \mathbf{F}_{\downarrow}^{\pm} \rangle$ of [S] and [R];

3) superposition of Virtual Spin Waves (VSW) in Bivacuum, stimulated by rotational momentum ($p_{rot} = m_0 \omega_0 L_0$) of cumulative virtual clouds (CVC_{\cup}^{\pm} and CVC_{\cup}^{\pm}), *emitted* \Rightarrow *absorbed* in the process of [$C \Rightarrow W$] pulsation of uncompensated $\mathbf{F}_{\uparrow}^{\pm}$ of [S] and [R].

The dynamic spin equilibrium $[BVF^{\uparrow} \Rightarrow BVF^{\downarrow}]$ is very sensitive to magnetic fields and rotational momentums of cumulative virtual clouds (CVC[±]), emitted by sub-elementary particles, as a result of $[C \rightarrow W]$ transition. The equilibrium constant:

$$K_{BVF^{\uparrow} \Rightarrow BVF^{\downarrow}} = \exp\left(-\frac{\varepsilon_{BVF^{\uparrow}} - \varepsilon_{BVF^{\downarrow}}}{U_{H}^{eq}}\right)$$
 13

where: U_H^{eq} is the equilibrium energy of Bivacuum 'noise', induced by external spin field and EM fields.

The oscillations of $K_{BVF^{\dagger} \Rightarrow BVF^{\downarrow}}$ represent *virtual spin waves (VSW)*, transmitting the information in Bivacuum without change/transmission of momentum and energy. The oscillation

of this equilibrium represent *virtual spin waves (VSW)*, transmitting the information in Bivacuum. Corresponding massless nonlocal collective modes in Bivacuum, representing oscillation of degeneration parameter have similarity with Nambu-Goldstone (NG) bosons, introduced in quantum field theory (QFT).

A standing nonlocal $[VSW_S \approx VSW_R]$ along with standing Bivacuum symmetry waves $[BvSW_S \approx BvSW_R]$ and superposition of $[VR_S \approx VR_R]$ may be responsible for creation of Psi - channel between Sender [S] and Receiver [R].

The nonlocal long-range correlation between virtual replicas of [S] and [R] via Bivacuum, provided by massless Nambu-Goldstone bosons, as oscillation of equilibrium constant $K_{BVF^{\dagger} \Rightarrow BVF^{\downarrow}}$, stimulated by rotating moments of cumulative virtual clouds CVC_S^{\cup} and CVC_R^{\cup} , emitted by uncompensated sub-elementary particles of triplets with opposite spins, can be illustrated as:

$$[F^{\uparrow}]_{S}^{\mathbf{C} \to \mathbf{W}} \xrightarrow{} CVC_{S}^{\cup} \underset{VSW_{S} \bowtie VSW_{R}}{\overset{K_{BVF^{\downarrow} \Rightarrow BVF^{\downarrow}}}{\longleftrightarrow}} CVC_{R}^{\cup} \xleftarrow{} [F^{\downarrow}]_{R}^{\mathbf{C} \to \mathbf{W}}$$

$$14$$

The examples of Nambu-Goldstone bosons in condensed matter are phonons, magnons and Cooper pairs.

The $[C \Rightarrow W]$ pulsation of two *BVF* with opposite spins (2 and 2a) are counterphase. Consequently, they are spatially compatible and have a boson properties.

The virtual Pauli repulsion pressure (PRP) participates in interaction between distant elementary particles with the same spins and in-phase $[C \Rightarrow W]$ pulsation:

$$[F^{\uparrow}]_{S}^{\mathbf{C} \to \mathbf{W}} \xrightarrow{} CVC_{S}^{\cup} \underset{VSW_{S} \bowtie VSW_{R}}{\overset{K_{BVF^{\uparrow} \Rightarrow BVF^{\downarrow}}}{\longleftrightarrow}} CVC_{R}^{\cup} \xleftarrow{} [F^{\uparrow}]_{R}^{\mathbf{C} \to \mathbf{W}}$$
14a

In secondary Bivacuum, when supersymmetry is broken under the influence of external fields, the repulsion between two BVF^{\ddagger} of the same spins is a consequence of Pauli principle action, based, in accordance to our UM, on the effect of excluded volume, induced by simultaneous emission of virtual clouds (VC^{\ddagger}), as a result of their in-phase [$C \rightarrow W$] transitions. If we assume that the impulse magnetic field, radiated by the nerve system of gifted Sender (healer), can change the $BVF^{\ddagger} \Rightarrow BVF^{\ddagger}$ equilibrium in Psi-channel between [S] and target, the repulsion between BVF^{\ddagger} of similar spins could explain the psychokinesis (PK) phenomena.

Superposition of virtual clouds, emitted and absorbed in a course of in-phase $[C \rightarrow W]$ transitions of $[BVF^{\uparrow} \cup BVF^{\uparrow}]$ or $[BVF^{\downarrow} \cup BVF^{\downarrow}]$ increases the density of virtual energy between them more than outside:

$$BVF^{\uparrow} \equiv (V^{+} \uparrow\uparrow V^{-})_{j,k}$$

$$\bigcirc \qquad \Rightarrow [\mathbf{V}\mathbf{C}_{j,k}^{+} + \mathbf{V}\mathbf{C}_{j,k}^{-}]_{\cup} > 0$$

$$BVF^{\uparrow} \equiv (V^{+} \uparrow\uparrow V^{-})_{j,k}$$
15a

Let us illustrate the processes, accompanied $[C \rightleftharpoons W]$ transitions of pairs $[\mathbf{F}^+_{\uparrow} \bowtie \mathbf{F}^-_{\downarrow}]$ of triplets:

$$\langle [\mathbf{F}^+_{\uparrow} \bowtie \mathbf{F}^-_{\downarrow}]_W + (\mathbf{F}^-_{\uparrow})_C \rangle \rightleftharpoons \langle [\mathbf{F}^+_{\uparrow} \bowtie \mathbf{F}^-_{\downarrow}]_C + (\mathbf{F}^-_{\uparrow})_W \rangle$$
 16

we have here:

$$\langle [\mathbf{F}^+_{\uparrow} \bowtie \mathbf{F}^-_{\downarrow}]_C$$
 17

$$[\mathbf{F}^+_{\uparrow} \bowtie \mathbf{F}^-_{\bot}]_W$$
 17b

where: $\Delta VP^{\pm} = VP^{+} - VP^{-}$ is the excessive virtual pressure of asymmetric secondary

Bivacuum.

Our Unified Model (UM) suggests, that each kind of field, radiated by particle or system of coherent particles, is a consequence of corresponding kind of their uncompensated sub-elementray particles $[F_{\downarrow}^{\pm} > dynamics: spin field (virtual spin waves in Bivacuum) are excited by spinning of CVC^o or CVC^o of [W] phase; the electromagnetic and gravitational fields are result of modulation of CVC by longitudinal and transversal components of momentum and kinetic energy of <math>[F_{\downarrow}^{\pm} >$ as respect to direction of particle propagation.

The VR can be subdivided to the internal local (VR^{in}) and the external (VR^{ext}) contributions. The *internal - local* contribution of VR^{in} represents all kinds of virtual 3D standing de Broglie waves (VC^{\pm}) in the volume of condensed matter, corresponding to [W] phase of all particles of matter and interactions, mediated by virtual quanta exchange, from nuclear to intermolecular electromagnetic Van-der Waals interaction.

The overall shape of the total virtual replica is a superposition of virtual replicas of its elements is close to shape of the whole body and corresponds to notion of the "*ether body* (*EB*)" in Eastern philosophy:

$$EB \equiv VR_{tot}^{in} = \sum VR^{in}$$
 18

The *external* VR^{*ext*} contribution has a properties of *quantum hologram*, containing **two modulated by matter** inseparable components:

1) the *distant* in forms of superposition of Virtual Pressure Waves (VPW⁺ and VPW⁻) of positive and negative vacuum (VR^{*ext*}_{*dis*}), electromagnetic and gravitational contributions, reflected in longitudinal and transversal *Bivacuum symmetry oscillations* (BvSO_{||} and BvSO_⊥);

2) the *nonlocal* (VR^{*ext*}_{*nl*}), presented by virtual spin waves (VSW_{*S*,*R*}) and repulsion/attraction between BVF^{\cup} and BVF^{\cup} or BVF^{\cup} in Psi-channel, provided by Pauli principle.

The superposition of all kind of external virtual replicas of body may correspond to notion of *"astral body (AB)"*:

$$AB \equiv VR_{tot}^{ext} = \sum VR_{dis}^{ext} + \sum VR_{nl}^{ext}$$
¹⁹

The esoteric theosophical concept of Helena Blavatsky is indebted to several philosophical and religious traditions: Zoroastrianism, Hinduism, Gnosticism, the Cabala, among others.

After esoteric philosophy, except the regular physical body, seven other bodies are existing.

The *physical* and the *ether body* are similar by their shape and by energetic functions as well; the *astral body* possesses extraordinary mobility and can accept different shapes and sizes, depending on emotional state; the *mental body* (mind, intellect) is the strongest body among others. It connects to our physical body by meridians (energy pathways); *karmic body* is a ruler of our ego. All events, their reasons, and all of the unconscious traits of past lives that determine individual's being and destiny, are kept in the karmic body (karma); *intuitive body* contacts to the intuitive world by Ajna-chakra (the third eye), which can be a source of intuitive insight and superconsciousness (unconscious sphere of consciousness); *nirvana body* has a connection with physical body through the heart. A peak of our soul is a body of Nirvana, which acts as fusion of our ego and the Universe; the last - *absolute body* is a consequence of the development of all bodies of a cosmic organism.

In terms of our Unified model, the *Absolute body, as a hierarchic system of all other bodies,* is a part of *Global Virtual Replica (GVR)* of the Universe.

The nonlocal and distant \mathbf{VR}_{nl}^{ext} and \mathbf{VR}_{dis}^{ext} , modulated by Psi field, are responsible for the phase and amplitude signals transmission between [S] and [R], correspondingly, in the process of quantum teleportation via Psi-channel. This would permit the virtual hologram's patterns exchange in the process of Mind-Matter (i.e. telekinesis and remote vision) and Mind-Mind (i.e. telepathy and remote healing) interaction. The mechanism of *quantum teleportation* has been discussed also by Bouwmeester et al. 1997 and Marcer, 2001.

The 1st stage of 'targeting' of Receiver [R] by Sender [S] in the process of remote vision or

remote healing is superposition of their "astral bodies $(AB_{S,R})$ " and their 'tuning' after "search" in Global virtual replica (GVR), using specific 'key words'; the 2nd stage is modulation of such macroscopic state of quantum entalgement of $[AB_S \approx AB_R]$ by the "ether bodies" of [S] and [R], providing such phenomena as remote vision (RV), healing, telepathy, etc.

The concrete mechanism of telepathy and healing, as a private case of Mind-Matter interaction, is related to perturbation by Sender [S] the properties of Bivacuum in Psi channel in such a way, that Bivacuum permittivity (ε_0) and permeability (μ_0) is changed, depending on [S] intention (in approach of polarizable vacuum, used by Puthoff, Little and Ibison (2001) in discussing of space-time metric engineering, the transformations of ε_0 and μ_0 also where considered). In turn, this influence on the strength of Van-der-Waals interaction increases or decreases the probability of thermal molecular fluctuations, like cavitational ones, in body of [R], including cytoplasm of biocells and microtubules. In accordance to our theory of elementary act of consciousness, the modulation of [assembly \Rightarrow disassembly] of microtubules due to cavitational fluctuations in the nerve cells and corresponding [$gel \Rightarrow sol$] transitions by directed mental activity of [S] can provide *telepathic contact* between [S] and [R]. The mechanism of *remote healing* could be the same, but the local targets in the body of patient [R] should be not necessarily the MTs of nerve cells, but MTs or microfilaments, like actin fibers in cells of the ill organs, which also have their 'ether body'-internal virtual replica, and can be targeted by healer.

The specific magnetic component of Psi field of [S], responsible for targeting in Remote Vision (RV), Remote Healing (RH) and other Psi-phenomena is generated by the nerve impulse propagation along the axons, depolarization of nerve cells membranes in 'tuned' ensemble of neuron cells. The nonlocal component of Psi-channel, determined by massless virtual spin waves (VSW), is most sensitive to variations of specific magnetic field, radiated by [S] in series of elementary acts of consciousness, perturbing in such a way the local Virtual Replica and quantum neurodynamics of [R]. The Psi-channel between [S] and [R] works better, if the frequency of geomagnetic Schumann waves have the same frequency (around 8 Hz), close to brain waves frequency, is the same in their location, providing better resonance conditions.

Modulation of Schumann waves by low frequency brain waves may participate in telepathic contacts on macroscopic (whole body) and mesoscopic (neurons). Modulation of neutrino flux between [S] and [R] by scattering on electrons and protons of nerve cells membranes is also possible. The coherency of all components of Psi-channel between [S] and [R], formed by nonlocal virtual spin waves (VSW^{O,O}), virtual pressure waves (VPW[±]) and Bivacuum symmetry oscillation (BvSO) corresponds to finest tuning of telepathic contact. The level of coherent water clusters dynamics in state of molecular Bose condensate (mBC) in microtubules of nerve cells, modulating BvSO and VPW[±], is crucial for quantum Psi phenomena. The virtual replica of MTs can be modulated also by VR of DNA.

5. How do you interpret the effect of geomagnetic fluctuations and local sidereal time on anomalous cognition?

Sidereal time is the hour angle of the vernal equinox, the ascending node of the ecliptic on the celestial equator. The daily motion of this point provides a measure of the movement of the Earth with respect to the stars, rather than the Sun. Local mean sidereal time is computed from the current Greenwich Mean Sideral Time plus an input offset in longitude (converted to a sidereal offset by the ratio 1.00273790935) of the mean solar day to the mean sidereal day.

The correlation between anomalous cognition (AC) and geomagnetic fluctuations, or the absence of such correlation, in accordance to eq. 13, is related to contribution of such fluctuations to equilibrium energy of magnetic fluctuations U_{H}^{eq} , or to direct modulation of $[BVF^{\uparrow} \Rightarrow BVF^{\downarrow}]$ equilibrium.

It means possible influence of geomagnetic fluctuations on nonlocal component of Psi-channel: virtual spin waves (VSW).

Very interesting and important data, obtained by James Spottiswoode and Edwin May, point to dependence of AC on the orientation Receiver [R] on the surface of the earth as respect to

stars. The maximum effect of AC revealed around 13.5 h of local sideral time, corresponding to optimal orientation of [R] relatively to celestial sphere. It means also, that limited region of sky is responsible for modulation of AC. This may be explained: a) by existence of the *localized center* of Global virtual replica (GVR) with properties of potential field coinciding, for example, with center of our Galactic or center of the Universe and b) by screening effect of the terrestrial globe, decreasing the positive effect of participation of GVR in Psi-channels formation on the Earth between sender [S] and target - receiver [R].

6. Temporal effects such as pre-cognition and retro-pk have been a long-standing puzzle complicating the emergence of compelling physical models in parapsychology. How do you solve these paradoxes within the framework of your theory ?

The individual virtual replicas(VR) and GVR due to their virtuality by definition do not follow the laws of special theory of relativity and, consequently, the causality principle. Due to ability of GVR to evolution in Bivacuum, as in active medium in each selected moment of time t = t_s , we have an infinitive number of projections of current GVR on the future time (t_F) : $\sum_{\infty}^{\infty} GVR_F(t) = \sum_{\infty}^{\infty} VR_F(t)$ and 'memorized' ones in Bivacuum: $\sum_{\infty}^{\infty} GVR_P(t) = \sum_{\infty}^{\infty} VR_P(t)$ of the past time (t_P) :

$$t_F = t_S + \sum_{\substack{q=1\\q=\infty}}^{q=\infty} \Delta t_q$$

$$t_P = t_S - \sum_{\substack{q=1\\q=1}}^{q=\infty} \Delta t_q$$
20

where Δt_q is a quantum of time (minimum time interval) separating formation of stable states of GVR_q and GVR_{q+1}, representing system of standing virtual waves, forming individual virtual replicas, interconnected by nonlocal Virtual spin waves (VSW).

The quanta of global information is emitted or absorbed in the process of quantum jump between GVR_{q+1} and GVR_q by analogy with emission/absorption of quanta of energy (photons), as a result of quantum transitions between different electronic states of atoms and molecules. In accordance to eq.(11), pace of time in GVR is determined by pace of virtual external translational kinetic energy of BVF^{\uparrow} and BVF^{\downarrow} , related directly to symmetry shift of these dipoles: $\Delta m_C = m_C^+ - m_C^-$.

We may consider GVR, as a virtual quantum supercomputer, which is able to extrapolate the most probable unknown future from the known past, taking into account all details of current GVR_C. Clairvoyance or anticipation is a result of ability of gifted psychic [Sender] to 'search', using specific 'key words-address' at first stage - the right $\text{GVR}_F(t)$ at certain time and then select from this future Global virtual replica the right individual $\text{VR}_F(t)$. This complex process includes very 'tuned' interaction of the astral (distant VR) and ether (local VR) bodies of [Sender] with $\sum_{n=0}^{\infty} \text{GVR}_{-}(t)$

[Sender] with $\sum_{n=1}^{\infty} GVR_F(t)$. Similar mechanism works, in accordance to our approach, in extra-perception by [S] of the past of individual VR_P(t), as a selected component of $\sum_{n=1}^{\infty} GVR_P(t)$.

7. Mark Germine's data seems to suggest that the conscious measurement of an event by one brain tends to reduce the element of surprise for subsequent conscious observers, as measured by the associated event related potential. How do you interpret these findings?

These most interesting data can be explained in framework of our UM model as a two stage process, involving hierarchy of virtual replicas.

The 1st stage is represented by following scheme of modification of Global virtual replica and Superconsciousness: $[GVR \rightarrow GVR^* \text{ and } SC \rightarrow SC^*]$, induced by change of mental and internal-ether physical VR of human brain and nerve system, as a result of 'leaning - getting the same new information' by one or few human beings via external astral VR:

$$\sum_{j} \left[VR_{mental} + VR_{ether} \right] + Info \rightarrow \sum_{j} \left[VR_{mental}^* + VR_{ether}^* \right] \rightarrow \sum_{j} VR_{astral}^* \rightarrow \left[GVR^* \bowtie SC^* \right]$$
 22

The 2nd stage is related with action of modified Superconsciousness (SC^*) on the individual consciousness via its astral (VR_{astral}) mental (VR_{mental}) and ether (VR_{ether}) virtual replicas of another (k) persons, accompanied by transmission of Information:

$$[GVR^* \bowtie SC^*] \xrightarrow{Injo}_{k} [VR_{astral} + Info] \xrightarrow{k} VR^*_{astral} \xrightarrow{k} [VR^*_{mental} + VR^*_{ether}]$$
23

The mental and ether virtual replicas; VR_{mental} and VR_{ether} are the reflections of quantum neurodynamics process in brain and the nerve system. Each elementary act of consciousness, as a transition between discreet neuron's ensemble states, should be accompanied by corresponding transition between mental and ether VR, following by emission or absorption of quantum of information (*infoquant* - IQ) quantum states:

$$[VR_{mental} + VR_{ether}]_{i} - [VR_{mental} + VR_{ether}]_{k} = IQ$$
²⁴

We may postulate, that IQ is minimum information ($IQ = \min Info$), which can irreversibly change the astral virtual replica:

 $[VR_{astral} + IQ] \rightarrow VR^*_{astral}$ and perturbation of Global virtual replica and Superconsciousness:

$$[GVR \bowtie SC] \rightarrow [GVR^* \bowtie SC^*]$$
^{1Q}
²⁵

If such a model is right, then we share with mankind all our well formulated ideas, as a coherent and stable superposition of IQ: $Idea = \sum c_k IQ_k$, influencing Superconsciousness and then, via feedback reaction all the rest of human beings.

8. Both of your models require massive quantum coherence as a basis for conscious experience. How do you solve the famous decoherence problem?

There are no way to avoid the decoherence of quantum system totally, as a result of action of thermal fluctuations, i.e. in nerve cells, actin filaments, microtubules, DNA, etc. However, there are two factors, which oppose the decoherence and even use it to extend the degree of coherence on the next [coherence \Rightarrow decoherence] cycle, as a result of molecular subsystems dynamic adaptation to each other. One of them is screening effect by tubulin's walls of MTs, increasing the life-time of coherent water clusters inside MTs, participating directly in elementary act of consciousness, in accordance to our model (http://arXiv.org/abs/physics/0003045); the another is anti-decoherence action of Harmonization energy (HaE) of Bivacuum on all hierarchic levels of matter (see http://arXiv.org/abs/physics/0207027 and paper in this issue).

The water clusters in MTs represent, in accordance to our Hierarchic theory of condensed matter (http://arXiv.org/abs/physics/0102086), the mesoscopic molecular Bose condensate $(mBC)_{lb}$ with dimensions, determined by the most probable de Broglie wave length of H_2O , related to molecular librations. Due to anharmonism of H_2O librations, corresponding de Broglie wave length (λ_{lb}) at room and physiological temperature is more than the average distance between centers of molecules:

$$\lambda_{lb} = h/p_{lb} > (V_0/N_0)^{1/3}$$
 26

It is shown, using our Hierarchic theory based computer program (CAMP), that librational

 λ_{lb} and translational λ_{tr} wave length, as anticipated, are temperature dependent, decreasing with T-increasing. The 1st order phase transitions, like boiling and melting, are related with two conditions, correspondingly:

$$\lambda_{lb} = h/p_{lb} \le (V_0/N_0)^{1/3}$$
 boiling 27

$$\lambda_{tr} = h/p_{tr} \le (V_0/N_0)^{1/3} \quad melting \qquad 27a$$

$$\lambda_{lb} >> \lambda_{tr}$$
 27b

The interaction of internal water with MTs walls decreases the librational mobility of H_2O , their momentum and increases the size of coherent water clusters - $(mBC)_{lb}$. Decoherence in our model of quantum neurodynamics is related with reversible dissociation of these clusters. For the other hand, as far the clusters are localized in the cavities between α and β tubulins, the dynamic equilibrium [*association* \Rightarrow *dissiciation*] of clusters is accompanied by dynamic equilibrium of ($\alpha \nabla \beta$) cavity between [*open* \Rightarrow *close*] states.

The shift of latter equilibrium, induced by depolarization of nerve cells, due to piezoelectric properties of MTs, change overall stability of MTs and shift their [*assembly* \Rightarrow *disassembly*] equilibrium, accompanied by shift of [*gel* \Rightarrow *sol*] equilibrium and redistributions of synaptic contacts on the surface of the nerve body cells.

So the both: quantum coherence and decoherence participate in elementary acts of consciousness, i.e. are 'useful' processes.

The anti-decoherence influence of Harmonization energy of Bivacuum on matter (combinational resonance interaction), driving it to coherent with Bivacuum dynamics Golden mean conditions, is described in http://arXiv.org/abs/physics/0207027 and in paper of this issue of Journal.

9. A natural sequel to question 8: what is the physical basis for individual memory and for the sharing of mental images as seen in remote viewing, telepathy and other transpersonal experiences (Jung, Grof, Stevenson)?

The stability of each new synaptic distribution in the ensemble of nerve cells, participating in elementary act of consciousness, is responsible partly for long-term memory. Each redistribution in neuron's system of brain and central nerve system is accompanied by modulation of previous internal (ether) virtual replica VR_{in} with hologram properties. This part of our approach is close to idea of Karl Pribram about holographic nature of memory. The stability and coherency of VR_{in} is related directly with stability and coherency of biological structures, responsible for memory on neurodynamics level.

The another - nonlocal contribution to memory can be provided by concomitant to VR_{in} change of the mental and astral virtual replicas of human body, leading finally to specific perturbation of Global VR (GVR). The stability of modulation of GVR by new information, processed by brain, determines the stability of VR_{in} and corresponding memory. It means that, if the Virtual pressure waves (VPW[±]) in Bivacuum, excited as a result of certain elementary act of consciousness and memorizing, can form a system of virtual standing waves, incorporated well in holographic structure of GVR, then we got a stable imprinting of idea or image or series of physical actions, representing specific kinds of superposition of VPW[±].

However, their should be existing a kind of filters and thresholds, preventing 'downloading' to GVR and Superconsciousness the information in form of standing VPW^{\pm}, of already existing or 'destructive' info, destabilizing GVR. The principle of selection of "valuable" new information/perturbation could be based on criteria of Golden mean, as background principle of Bivacuum dynamic/spatial self-organization.

In accordance to UM, the physical basis for sharing of mental images in remote viewing, telepathy and other transpersonal experiences is interaction between hierarchy of virtual replicas (from the ether one to GVR) of 'sender or searcher' and 'receiver or target'. The are no principal difference between $[\sum VR_i]^R$ of the living object, as a target, and nonliving object in such

phenomena, as remote viewing (RV). The living target makes difference in telepathy and remote healing. The Psi interaction between living objects is more 'tunable' and telepathic contact is possible due to feedback reaction.

10. Is remote sensing of a remote physical target (as opposed to collective information) possible in your model - and on what basis?

Yes, it is possible on the basis, described above as a result of superposition of complex VR of 'searcher' and target. The notion of "collective information" in UM may be replaced by "cumulative, collective perturbation of Global virtual replica (GVR), with properties of "holomovement" after Bohm and Superconsciousness". The Superconsciousness (SC) can be considered, as a virtual processing of information, organizing it by certain principles with possibility of feedback action on the astral, mental and ether bodies (VR) of individuals or non biological objects, geophysical and cosmic processes, etc.

The quantity and quality of these perturbation is a measure of "collective information". The main idea of our approach is that Mind-Matter and Mind-Mind interactions are complex Bivacuum - mediated dynamic processes. We are working on the concrete mechanism of such processes.

11. How do you interpret the massive data fragmentation and plurality of sensory modalities characterizing the typical RV signal? What about the phenomenon of biolocation?

The plurality of the RV signals can be explained by the big fluctuating ratio of "noise to signal" in extra perception, changing in time and space. For the other hand different psychic have a different 'resolution abilities' in remote vision. Increasing the psi-abilities of psychic may be achieved by special action on chacras and acupuncture points by special device, like our "audio-video signals skin transmitter", described at the end of section 4 of my paper of this issue of journal.

Another explanation also is possible. The Global virtual replica, as a source of global information, can be considered as a hierarchic virtual construction, able to space/time self-organization with properties of huge virtual hologram, pervading all the Universe and composed from huge virtual domains with nonlocal properties. So, if for example, the virtual replica (VR) of the target is changing with time, the plurality of modalities of RV by the same psychic, can mean that he get the image of the target's shape and other properties from the past, future and current moment.

The strongest effect of biolocation, like location of underground water, confirms, that the internal water clusters in microtubules in state of mesoscopic Bose condensation (mBC) participate in the mechanism of Psi-channel creation and action. The superposition and interaction between virtual replicas of water in MTs of "searcher" and remote macroscopic volume of water is already "tuned' on similar resonant frequencies of VPW[±] of "searcher" and "target". Consequently, the conditions for virtual standing wave formation, providing interaction between "searcher" and "target'-water are preexisting in this case.

12. Gariaev's work with modulated laser irradiation of DNA has yielded some fascinating insights into the possibility of non-local, non-canonical (codon-based) genetic regulation, possibly via large-scale biophoton and radiowave interference grids leading to the idea of an electromagnetic holographic blueprint for living organisms. What is the significance of his results for your model and how do you envision the hierarchy of morphogenetic and regulatory control systems in living organisms ?

In accordance to our UM, all material objects, from elementary particle to planets and stars, including all intermediate scales, like macromolecules, cells, organs, animals, etc. has very

specific hierarchical virtual replicas, roughly subdivided to local and nonlocal. Some of VR are the carriers of information only and some of them can carry the momentum and energy.

The virtual replica ($VR_{DNA}^{S,R}$) of highly ordered parts of the **eukaryote's** chromosomes (**introns**), not participating directly in biosynthesis and including more than 95% of total DNA, may play the active and very specific role in the [Mind-Matter] and [Mind-Mind] interaction. The so-called *nucleosomes* represent long parts of DNA, tuned around the histone octamer. The diameter of such nucleosomes (stable nuclear-protein complexes) is about 110 Å. The histones are able to modulate the DNA structure and functions. In accordance to our Hierarchic theory of condensed matter (Kaivarainen, 2000; 2001), the high density and stability of nucleosomes and native chromosomes provides condition for mesoscopic Bose condensation [mBC] at ambient temperature in their volume. The [mBC] may exist in form of so-called *primary translational and librational effectons*, representing 3D standing de Broglie waves of atoms/molecules of condensed matter (chromosomes in private case).

The existence of [mBC] and their coherent $[C \Rightarrow W]$ pulsation, allows the quantum entalgement between chromosomes and microtubules of distant cells and even between different organisms with similar properties of their molecular Virtual Replica (VR), as between [S] and [R].

It leads from our model, that the synchronization of the interacting chromosomes dynamics by coherent photons of certain frequency and polarization, should enhance the effect of quantum entalgement and interaction of their (VR^S and VR^R), because of induced combinational resonance.

Synchronization and spatial polarization of modulated by BvSO [$C \Rightarrow W$] pulsation of elementary particles of chromosomes of *organisms-senders* (*S*) and *organisms - receivers* (*R*) can be provided by polarized electromagnetic waves with length, determined by dimensions of interacting organisms and distance between them, i.e. the order of meters for animals and human beings. These conditions points to radio-frequency of EM waves: $(10^4 \div 10^8)$ 1/s, generated by coherent fluctuations of density and dipole moment of DNA and microtubules, carrying such function.

This consequence of our Unified model of Bivacuum and quantum entalgement between synchronized particles of certain spatial relative orientation can be considered, as a physical background for distant transmission of genetic information between cells (donors-senders) and cells (acceptors-receivers) of different organisms, revealed by Dzang Kangeng (1992; 1993) and Gariaev's group (1994), activated by special optoelectronic equipment.

Dzang Kangeng (1992; 1993) used hexahedron, cone, sphere and a parabolic-reflector aerial, as a kind of forms, providing specific spinning (polarization) of the electromagnetic (EM) field. In the D. Kangeng's equipment the high-frequency generator of two orthogonally-polarized electromagnetic beams has been used, which repeatedly pass throw the donor and the accepting biosystems, necessary for informational exchange between them. All known biopolymers are optically active, sometimes in very specific way. Consequently, polarization of photons should increase the effectiveness of interaction of chromosomes with coherent photons, dependent also on their frequency and density. It is obvious that *polarization modulation* of electromagnetic beam by sender [S] (donor), should influence the quantum and small-scale dynamics of DNA of receiver [R] (acceptor) and, consequently on its VR^{*R*}.

In Gariaev's version of Dzang Kangeng's device, the **polarized laser visible beam** $(\lambda = 632 \text{ nm})$ transforms to *coherently polarized radio waves* (PLRW) of frequency range: $(10^3 - 10^6)s^{-1}$. This effect is explainable in the framework of our Hierarchic theory of condensed matter (Kaivarainen, 2000; 2001), as a consequence of stimulated by laser photons transitions (fluctuations) of atoms in composition of nucleosomes, accompanied by so-called *convertons, macrodeformons and superdeformons, accompanied by EM-waves of (kHz - MHz) radio frequency* (Kaivarainen, 2000a). This device, like that of Dzang Kangeng, is shown to be able to transfer the genetic information between different organisms. This information may be related not only to gene-controlled biosynthesis, but also to *generation of still mysterious morphogenetic*

field, responsible for spatial organization of the cells in organs and organs in organisms.

The spontaneous radiation of coherent 'biophotons' by DNA of wide frequency range has been revealed earlier by Gurvich (1977) and Popp (2000). Corresponding visible photons also may be converted in radio waves, as described above, even without external source of EM energy, like used in Gariaev's experiments.

I put forward a conjecture, that the interaction between cells of the same eucaryotic organisms may be responsible for self-reparation/regeneration of the damaged cells. In this case two orthogonally-polarized electromagnetic beams may be radiated by microtubules of two orthogonal centrioles. The frequency, intensity and polarization of these two beams could be modulated by VR and radiation of DNA of the same cells as microtubules. It is assumed, that radiation and VR of 'healthy' cells influence the structure of damaged DNA of other cells and activate corresponding enzymes, repairing due to such specific distant way the damaged DNA structure and finally the cells function. The selected mutagenesis of DNA of receiver [R], induced by combination of all kind of Bivacuum excitation, generated by cells of sender [S], like virtual spin waves (VSW), Bivacuum symmetry oscillation (BvSO) and virtual pressure waves (VPW $^{\pm}$) is possible also.

The experimental facts, pointing to possibility of genetic information exchange between different cells of the same organisms and even different organisms by means of polarized EM waves, stimulating macroscopic quantum entanglement, may change our conventional paradigm of genetics and biological evolution drastically.

13. This is probably the most dreaded question for a theoretician - but is your model falsifiable? Are there conceivable physical tests that could definitely validate (or disprove) your theory? How about quantitative predictions - any corroborating data so far ?

All the existing experimental data of Psi-field interaction with physical fields, matter and remote biosystems are in accordance with our model. For example, changing the rate of nuclear decay could be a result of influence of introduced in UM Bivacuum excitations, forming hierarchical Virtual replica, on probability of certain stages of decay. The rotation of plane of polarization of laser beam under Psi-field action may be induced by changing of Bivacuum symmetry by Bivacuum symmetry oscillation (BvSO) and virtual spin waves (VSW). The change of Bivacuum symmetry shift also can be responsible for psychokinesis and gravitational interaction perturbation.

Changing the water pH may be a result of modulation by Psi-field probability of cavitational fluctuations, accompanied by dissociation of water molecules: $H_2O \Rightarrow HO^- + H^+$. The mechanism of such modulation is related with the influence of virtual replica of sender [S] on the excessive virtual pressure, responsible for Casimir force. Changing the enzyme kinetics and cell-culture growth rate also can be explained by influence of Psi-field on water properties.

The direct way to verify our theory is a measurement of Casimir force and spectral Lamb-shift change in Psi-field, both of them depending on vacuum properties. The monitoring of behavior of microtubules in nerve (and other) cells in cells culture and pure system of microtubules 'in vitro' may confirm our conjecture of role of MTs in telepathic contacts and remote healing.

The quantitative predictions of Unified Model also are in accordance with experiment.

For example, the magnetic moment of the electron, calculated on the base of analytical expressions, leading from UM, is fairly close to experimental one and given by perturbation approach in Quantum electrodynamics (see http://arXiv.org/abs/physics/0207027).

Another experimental evidence in proof of UM is cyclotron and synchrotron radiation of photons by the electrons. Such radiation of charge particles with alternating velocity and kinetic energy is a direct consequence of our theory.

However, the conventional theory of electrodynamics also explains this radiation. Less trivial consequence of UM is the strongly asymmetric character of radiation of accelerating particles. Most of energy, emitted by relativist particle is located in direction, close to its instant velocity in

narrow angle range, determined by semiempirical expression:

$$\Delta \theta \simeq [1 - (v/c)^2]^{1/2} = \frac{m_0 c^2}{E} \ll 1$$
28

where: *E* is a total relativist energy of the charged particle.

Our theory leads to same result. From the ratio of 5a to 5 for relativist condition ($v \rightarrow c$) we get the formula:

$$[1 - (v/c)^2]^{1/2} = \left|\frac{m_C^-}{m_C^+}\right|^{1/2} = \frac{m_0 c^2}{m_C^+ c^2} = \frac{S^+}{S^-}$$
²⁹

where S^+ and S^- are the cross section of the actual vortex and complementary rotor of uncompensated sub-elementary particles.

As far, in accordance to our approach, the actual energy of particle is $E = m_C^+ c^2$, we can see that 28 coincides with 29.

14. What are some of the fields to which you believe your model could make major contributions (i.e. neurophysiology, q-computing, parapsychology, etc)

The construction of Unified model, as a background for explanation of Psi-phenomena, is based on theory of Bivacuum, elementary particles and fields. So I think this work may be useful in theory of vacuum and superunification. It looks also that UM could be a way to unification of quantum neurodynamics with Bivacuum engineering. The understanding of how we can selectively modulate the properties of Bivacuum, using the Golden mean principles, may contribute strongly to quantum computing technology.

Development of corresponding equipment in future may provide a telepathic communication between people, like we get our days, using mobile telephone.

The solution of quantum Psi problem will be the main goal in developing of Unified Model and its experimental validation.

The most important task of following generations could be a direct interaction of human beings with Superconsciousness for the end of optimization of such a contact and getting the information about our past and future. It's tempting to suppose, that wise regulation of such interaction with Superconsciousness may change the future of mankind to better direction. However, as far the other intelligent civilizations in the Universe also may contribute to Superconsciousness, the unification with these words will be necessary.

15. What, in your opinion, are the most promising experimental and theoretical directions to be followed toward a unified theory of mind and matter ?

1. Finding a way for increasing the psychic abilities to make the results of experiments more reliable and reproducible;

2. Using the water and aqueous solutions of proteins and microfilaments for monitoring the effects of Psi-field;

3. Confirmation of data, pointing to ability of crystals for imprinting of Psi-field and elucidation of mechanism of imprinting;

4. Systematic study of Bivacuum perturbation by Psi-field, using Casimir effect and spectral Lamb shift in the same set of experiments;

5. Creation as much new theoretical approaches to Psi- problem, as possible and elaboration them to the level, making possible experimental verification.