Hierarchic Model of Consciousness: from Molecular Bose Condensation to Synaptic Reorganization

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Abstract

Hierarchic Model of Consciousness (HMC) presented here, is based on my Hierarchic Theory of Condensed Matter (Kaivarainen, 1995; 2000a). In accordance to HMC, each specific kind of neuron ensembles excitation - corresponds to complex system of three-dimensional (3D) standing waves of different nature: thermal de Broglie waves (waves B), produced by anharmonic vibrations of molecules; electromagnetic (IR) waves; acoustic waves and vibro-gravitational waves (Kaivarainen, 2000b). Corresponding dynamic hologram may be responsible for large-scale quantum neurodynamics and for morphogenetic field.

In our model we consider the role of quantum collective excitations, produced by coherent translational and librational oscillations of water in the hollow core of the microtubules (MT). It is 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 influence of rigid walls of MT. The MBC is most ordered fraction of matter in biological cells. The increased frequency of coherent IR photons, radiated by MBC in MT, make possible the distant exchange interaction between MT of different neuron ensembles without absorption of photons by cytoplasmic water.

The Brownian effects, which influence reorientation of "tuned" MTs and increase the probability of cavitational fluctuations in cytoplasmic water, stimulating [gel sol] transition – may be responsible for non-computational element of consciousness. Other models (Wigner, 1955 and Penrose, 1994) relate this element to wave function collapse.

1 Introduction

A basically new hierarchic quantitative theory, general for solids and liquids (Kaivarainen, 2000a), has been used as a background of Hierarchic model of consciousness (HMC). It is assumed, that anharmonic oscillations of particles of condensed matter lead to emergence of three-dimensional (3D) superposition of standing

International Journal of Computing Anticipatory Systems, Volume 10, 2001
Edited by D. M. Dubois, CHAOS, Liège, Belgium, ISSN 1373-5411 ISBN 2-9600262-3-3

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 the Einstein's and Debye's models.

Collective excitations in form of coherent clusters, representing at certain conditions the mesoscopic molecular Bose condensate (MBC), were analyzed. It was shown, that most probable de Broglie wave (wave B) length can exceed the classical thermal wave B length and the distance between centers of molecules many times. This makes possible partial Bose condensation in solids and liquids at high temperatures in form of 3D standing waves B: so-called primary translational and librational effectons (Kaivarainen, 2000a). It is one of the most important result of new theory, which was confirmed by computer simulations on examples of water and ice.

2 Properties of Actin Filaments, Microtubules and Internal Water

There are six main forms of actin existing. Most general F-actin is a polymer, constructed from globular protein G-actin with molecular mass 41.800. Each G-actin subunit is stabilized by one ion Ca^{2-} and is in noncovalent complex with one ATP molecule. Polymerization of G-actin is accompanied by splitting of phosphate group. The velocity of F-actin polymerization is enhanced strongly by hydrolysis of ATP. However, polymerization itself do not needs energy. Simple increasing of salt concentration (decreasing of water activity), approximately till to physiological one - induce polymerization and strong increasing of viscosity.

The actin filaments are composed from two chains of G-actin with diameter of 40 Å and forming double helix. The actin filaments are the polar structure with different properties of two ends. Disassembly of actin and ($gel \rightarrow sol$) transition is dependent strongly on water activity and energy of thermal fluctuation.

Let us consider the properties of microtubules (MT) as one of the most important component of cytoskeleton, responsible for spatial organization and dynamic behavior of the cells. The stability and dynamics of microtubules composed of α and β tubulins is also dependent on water activity a_{H_2O} (see Section 13.7 of book: Kaivarainen 1995 and Kaivarainen, 2000c), concentration of Ca^{2+} and on the electric field gradient change due to MTs piezoelectric properties. The α and β tubulins are globular proteins with equal molecular mass ($MM = 55.000$), usually forming $\alpha\beta$ dimers with linear dimension 8nm. Polymerization of microtubules can be stimulated by NaCl, Mg^{2+} and GTP (1:1 tubulin monomer) (Alberts et al., 1983). The presence of heavy water (deuterium oxide) also stimulates polymerization of MT. In contrast to that the presence of ions of Ca^{2+} even in micromolar concentrations, action of *colhicine* and lowering the temperature till 4^0C induce disassembly of MT.

Microtubules are hollow cylinders, filled with water. Their internal diameter about d_{in} =140Å and external diameter d_{ext} =280Å. These data, including the dimensions of $\alpha\beta$ dimers were obtained from x-ray crystallography (Amos and Klug, 1974).

The length of microtubules (MT) can vary in the interval:

$$l_t = (1 - 20) \cdot 10^5 \mathring{A} \tag{2.1}$$

The spacing between the tubulin monomers in MT is about 40 Å and that between $\alpha\beta$ dimers: 80 Å are the same in longitudinal and transversal directions of MT.

Microtubules sometimes can be as long as axons of nerve cells, i.e. tenth of centimeters long. Microtubules (MT) in axons are usually parallel and are arranged in bundles. Microtubules associated proteins (MAP) form a "bridges", linking MT and are responsible for their interaction and cooperative system formation. Brain contains a big amount of microtubules. **Their most probable length is about 10^5Å.**

The viscosity of ordered water in microtubules seems to be too high for transport of ions or metabolites at normal conditions.

All 24 types of quasiparticles, introduced in our hierarchic theory of matter (Kaivarainen, 2000a), also can be pertinent for ordered water in the microtubules (MT). However, the dynamic equilibrium between populations of different quasiparticles of water in MT must be shifted towards primary librational effectons, comparing to bulk water due to clusterphilic interactions (see Kaivarainen, 2000d). The dimensions of internal primary librational effectons have to be bigger than in bulk water as a consequence of stabilization effect of MT walls on the thermal mobility of water molecules, increasing their most probable de Broglie wave length.

Strong interrelation must exist between properties of internal water in MT and structure and dynamics of their walls, depending on $[\alpha - \beta]$ tubulins interaction.

The biggest cavitational fluctuations of internal water - (superdeformons) in the volume of 3D standing IR photons can induce total cooperative disassembly of MT. Superdeformons excitation in MT internal water could be an explanation of experimentally revealed dynamic instability (catastrophes) as a stochastic switching of MT growth to shrinkage (Mitchison and Kirschner, 1984; Horio and Hotani, 1986; Odde at al., 1994). The frequency of superdeformons excitation in bulk water is about $10^4 s^{-1}$, however, in cytoplasm of high viscosity this value may strongly decrease till $10^2 s^{-1}$. Consequently, the coherent excitation of superdeformons in cytoplasm of neurons ensemble in a course of their firing may be interrelated with disassembly of actin and partially MTs, leading to [*gel* → *sol*] transition.

Each of $\alpha\beta$ dimers, composing MT, is a dipole with negative charges, shifted towards α subunit (De Brabander, 1982). Consequently, microtubules, as an oriented

elongated structure of dipoles system, have the piezoelectric properties (Athestaedt, 1974; Mascarennas, 1974).

Intra-microtubular **clusterphilic interactions** (see Kaivarainen, 2000d) stimulate the growth of tubules from $\alpha\beta$ tubulin dimers. The structural physical-chemical asymmetry of $\alpha\beta$ dimers in composition of microtubules determines their different rates of growth from the opposite ends ([+] and [-]).

The equilibrium of "closed" (A) and "open" (B) states of nonpolar cavities between α and β tubulins in $(\alpha\beta)$ dimers can be shifted to the (B) one under the change of external electric field in a course of membrane depolarization. It can be a consequence of piezoelectric properties of MTs and will stimulate the formation of coherent water clusters in the open nonpolar cavities of $(\alpha\beta)$ dimers. The open cavities can serve as a centers of water cluster formation and molecular Bose condensation (primary librational effectons). The coherent properties of water and total mass of water in form of Bose condensation in the hollow core of MTs system should be enhanced as a result of this stage of elementary act of consciousness.

The parallel orientation of MT in different cells, optimal for maximum [MT-MT] resonance interaction by means of coherent IR photons, could be achieved due to twisting of centrioles, changing spatial orientation of MT. However, it looks that the normal orientation of MT as respect to each other corresponds to the most stable condition, i.e. minimum of potential energy of interaction (see Albreht-Buehner, 1990). It is important to stress here that the orientation of two centrioles as a source of MT bundles in each cell are always normal to each other. The stronger is the nerve excitation, the bigger is population of coherently firing cells, tending to similar orientation of their internal MT.

The linear dimensions of the edge (l^{lb}_{ef}) of coherent water clusters - primary librational effectons in pure water at physiological temperature (36^0C) - is about 11 Å and 45 Å in the ice at 0^0C. We assume that in the rigid internal core of MT, the linear dimension (edge length) of librational effecton, approximated by cube is between 11Å and 45 Å i.e. about $l^{lb}_{ef} \sim 23$Å.

It will be shown below, that this assumption fits the spatial and symmetry properties of MT very well. The most probable group velocity of water molecules in composition of primary *lb* effectons is:

$$v^{lb}_{gr} \sim h/(m_{H_2O}\, l^{lb}_{ef}) \tag{2.2}$$

The librational mobility of internal water molecules in MT, which determines (v^{lb}_{gr}) should be about 2 times less than in bulk water at 37^0C, if we assume $l^{lb}_{ef} \sim 23$Å (see Kaivarainen, 2000a).

The length of a orchestrated group of primary *lb* effectons in the direction of microtubule main axis can be determined by the length of edge of primary librational IR deformons, i.e. about 10 microns.

Results of our computer simulations for pure **bulk** water shows, that the distance between centers of primary [lb] effectons, approximated by cube exceed their linear dimension to about 3.5 times (Fig 1b). For our case it means that the average distance between the effectons centers is about:

$$d = l_{ef}^{lb} \cdot 3.5 = 23 \cdot 3.5 \sim 80\,\text{Å} \tag{2.3}$$

It gives a possibility for equidistant (80 Å) localization of the primary *lb* effectons in clefts between α and β tubulins of each $(\alpha\beta)$ dimer in the internal core of MT. Such a **regular spatial symmetry** of the internal flickering clusters distribution in MT is an important factor for realization of the [optoacoustic-conformational] signal propagation of configurational waves along the MT, accompanied by their bending. It is related to alternating [closing⇌opening] clefts between α and β tubulins. This large-scale protein dynamics is correlated with dissociation/association of water clusters in clefts between $(\alpha\beta)$ dimers of MT due to [*lb*/*tr*] convertons excitation with frequency $\tilde{}10^7\,s^{-1}$.

The size of *tr* primary effectons in MT is significantly smaller, than that of *lb* ones and the microviscosity of water in regions, occupied by translational effectons - lower. The average angle between α and β tubulins change and the cavity's [open ⇔ closed] states equilibrium shifts to the closed one as a result of conversion of *lb* effectons to *tr* ones (dissociation of coherent water cluster).

The dynamic equilibrium between *tr* and *lb* types of the intra MT water effectons can be very sensitive to $\alpha - \beta$ tubulins interactions, dependent on nerve excitation.

Our hypothesis of IR superradiation, produced by water in MT's - is an inherent property of our primary effectons, resulted from mesoscopic molecular Bose condensation (Kaivarainen 1992, 1995). This idea is independent of similar, used in the model of MT's as wave guide of superradiation for longitudinal photons, proposed by Jibu et al., (1994). The difference in two approaches is that we assume in MT the existence of "transverse" radiation of IR photons as well as "longitudinal" ones. Such assumption means that the density of electromagnetic energy in MTs is low enough and not destroying the protein's of MT's. Another advantage of our model - is the possibility of electromagnetic interaction between MT's by the exchange of coherent transverse IR photons. We also do not need to use in our model the strong assumption of self-induced transparency in hollow core of MT, because the half of wave length of IR librational photons (about 5μ) is much more than the distance between neighboring primary librational effectons, radiating photons.

3 Role of Actin Filaments and Microtubules in Neuron's Body Volume/Shape Adaptation to Nerve Excitation

In the normal state of nerve cell the dynamic equilibrium the gradient of ionic concentration, produced by ionic pumps activity, is compensated by the electric

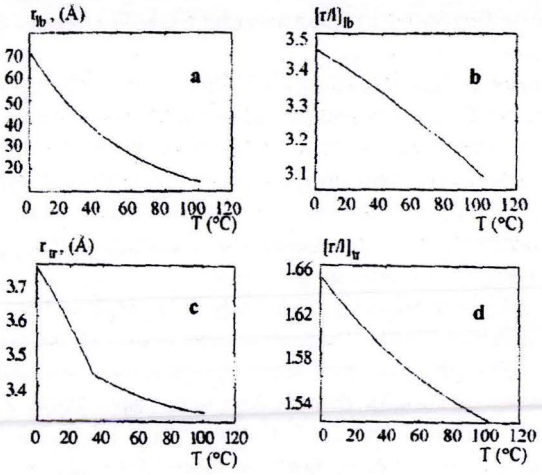

Fig. 1: Theoretical temperature dependencies of: (a) - the space between centers of primary [lb] effectons; (b) - the ratio of space between primary [lb] effectons to their length; (c) - the space between centers of primary [tr] effectons; (d) - the ratio of space between primary [tr] effectons to their length.

tension gradient. The *electrochemical gradient* is equal to zero at this state. The equilibrium concentration of Na^+ and Cl^+ in space out of cell is bigger than in cell, the gradient of K^+ concentration has an opposite sign. The external concentration of Ca^{2+} (about $10^{-3}M$) is few orders higher than in cytosol (about $10^{-7}M$). Such a big gradient provide fast and strong increasing of Ca^{2+} internal concentration after activation of corresponding membrane channels.

At the "rest" condition of equilibrium 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:

$$100.000\ V/sm$$

i.e. it is extremely high.

Depolarization of membrane usually is related to penetration of Na^- ions into the cell. This process of depolarization could be inhibited by selected diffusion of Cl^- into the cell. Such diffusion can produce even *hyperpolarization* of membrane.

As far the $\alpha\beta$ pairs of tubulins have the properties of "electrets" (Debrabander, 1982), the piezoelectric properties of core of microtubules can be predicted (Athenstaedt, 1974; Mascarenhas,1974). It means that structure and dynamics of

microtubules can be regulated by electromagnetic field change, which accompanied the nerve excitation.

In turn, dynamics of tubulins of MT's hollow core affects the properties of internal ordered water. Shift of the [open $\Leftrightarrow$ closed] states equilibrium of cavity between α and β tubulins to the open one in a course of nerve excitation should lead to:

[I]. Increasing the dimensions and life-time of coherent water clusters (primary *lb* effectons) in the open nonpolar cavities between α and β tubulins;

[II]. Destabilization of MT, increasing the probability of its partial disassembly and disconnection with plasmatic membrane;

The stability of MTs in the nerve cell body is lower than that in bundles of axon or cilia. It is a consequence of fact that microtubules in bundles are interconnected by "handle" - like proteins (deneins) and other microtubule associated proteins (MAP).

The LS-dynamics of tubulin dimers represent the change of "bending" angle between α and β tubulins of about 21^0 (Melki et al., 1989), corresponding to fluctuation of the inter-tubulins cavity between closed (A) and open (B) states. Such bending may be a result of macroconvertons (flickering clusters) excitations with frequency: $(10^6 - 10^7)\,Hz$ (Kaivarainen, 2000a).

The [assembly $\rightleftharpoons$ disassembly] dynamic equilibrium of the actin filaments in cells in terms of colloid chemistry represents [coagulation $\rightleftharpoons$ peptization] or [gel $\rightleftharpoons$ sol] equilibrium. These cycles are rapid and correlate with neurotransmitter release and nerve excitation (Miyamoto, 1995; Muallem et. al., 1995). The increasing of cell's volume, accompanied the actin orchestrated disassembly is a result of cell "swelling" due to osmotic diffusion of water from the extracell medium. The decreasing of water activity in cell, inducing osmotic flow of water to cell cytoplasm, is a consequence of increasing of "bound" or "hydration" water fraction after actin microfilaments disassembly to huge number of subunits. The nerve cell body and dendrites swelling can trigger the collective nonspecific opening of big number of ionic channels and strong resulting postsynaptic potential (PSP) emergency. The bigger is resulting PSP the higher is frequency of the nerve impulses, generated by this cell and penetrating via axon to other neurons (Coombs, et al., 1957).

The new assembly of MT-system in nerve cell's body is accompanied by pumping out the extra water from cell and restoring the state of rest of ionic channels. This may stimulate also the reorganization of synaptic contacts on the cell surface.

The [gel-sol] transition, induced by cavitational fluctuations of water in cytoplasm (superdeformons) can be accompanied by coherent "biophotons" emission/absorption in the ultraviolet (UV) and visible range. Such radiation is possible due to water molecules dissociation $\rightleftharpoons$ recombination in a course of cavitational fluctuations. These high-frequency coherent photons exchange, like the IR photons and nerve impulses, propagating via axons - may be responsible for synchronized firing of distant neuron ensembles in head brain (Singer, 1993). The firing is a complex nonlinear process. Its characteristic time of about 1/50 of second (20ms) is much longer than pure quantum phenomena in MT like photons radiation and

Bose [condensation $\rightleftharpoons$ evaporation], corresponding in our model to [lb/tr] convertons excitation of the internal water in MTs.

One of the important consequence of our HMC is that interactions of distant neurons in head brain can be realized not only by means of nerve impulse via axons. Simulteneous neurons excitation may be accompanied also by quantum stage: resonant photon exchange between MT of distant neurons.

3.1 The entropy-driven information processing

It leads from our HMC that changes of system of electromagnetic, acoustic and vibro-gravitational 3D standing waves in the ensemble of nerve cells, produced by the internal water of MTs in course of braining - may change the properties of this water in a course of MT system reorientation and 'tuning'.

This process induces redistribution of **probabilities of different water excitations** in huge number of microtubules. It means corresponding change of informational entropy <I>, related to microtubules in accordance with known relations (Kaivarainen 1995; 2000b):

$$< I >= \sum_i P_i \lg(1/P_i) = -\sum_i P_i \lg(P_i) \tag{3.1}$$

where: P_i is a probability of the (i) state with energy (E_i), defined as:

$$P_i = \frac{\exp(-\frac{E_i}{kT})}{\sum_i \exp(-\frac{E_i}{kT})} \tag{3.2}$$

For the total system the relation between entropy (S) and information (I) is:

$$S(e.u.) = k \cdot \ln W = (k \cdot \ln 2)I = 2.3 \cdot 10^{-24} I \text{ (bit)} \tag{3.3}$$

where: statistical weight of macrosystem:

$$W = \frac{N!}{N_1! N_2! \ldots N_q!} \tag{3.4}$$

the total number of internal water molecules in macrosystem of interacting MT is: $N = N_1 + N_2 + \ldots + N_q$;

$[q]$ is number of **non degenerated** states of 24 quasiparticles of intra MT water.

The **reduced information** of condensed matter (Kaivarainen, 2000d) to the number of molecules (n_i) in each kind of excitations:

$$n_i = v_i / v_{H_2O} = (1/n_i)/(V_0/N_0) \tag{3.4a}$$

- gives characteristic not only of quantity (I) but also about the **quality of the information**:

$$< \mathbf{Iq} >= -[N_0/V_0] \cdot \sum_i P_i \lg_2(P_i)/n_i \tag{3.5}$$

where N_0 and V_0 are the Avogadro number and molar volume; n_i is a concentration of excitation of (i)-type.

The distant energy exchange between MT, accompanied by the change of P_i for different excitations can be considered as an informational exchange between nerve cells. It is related to change of fractions of water excitations in system of interacting MTs.

Our model consider fluctuations and dissipation, stimulating [gel $\rightleftharpoons$ sol] transitions and synaptic system reorganization, as a necessary phenomena for brain "working". However this CHAOS is organized by quantum phenomena, like mesoscopic Bose-condensation of water in MT. The higher is quantum order and coherence, the less is the number of mistakes in brain working. At the same time, the possibility of mistakes due to competition between discreet quantum and continuous thermal properties, producing thermal fluctuations, Brownian movement and decoherence - make the process of braining NON-DETERMINISTIC. The main difference between computer and brain could be that in brain, in contrast to computer, the input and output the information is not always adequate to each other.

The INTUITION from such point of view means the ability to choose one right solution (rigorously inadequate) from huge number of wrong, but adequate to the available information. It looks that **associative memory**, helping the right choose, is the most probable background for INTUITION.

4 Stages of Hierarchic Model of Consciousness

In accordance with our HMC, the sequence of following interrelated stages is necessary for elementary act of perception and memory (see Fig.2), resulted from simultaneous excitation and depolarization of big enough number of neurons, forming cooperative ensemble:

1. The change of the electric component of neuron's body internal electromagnetic field as a result of cells depolarization; 2. Opening the potential - dependent Ca^{2+} channels and increasing the concentration of these ions in cytoplasm. Activation of Ca^{2+} - dependent protein gelsolin, which stimulate fast disassembly of actin filaments; 3. Shift of $A \rightleftharpoons B$ equilibrium between the closed (A) and open to water (B) states of cleft, formed by α and β tubulins in tubulin pairs of microtubules (MT) to the right as a consequence of piezoelectric effect, induced by depolarization of membrane of nerve cell; 4. Increasing the life-time and dimensions of coherent "flickering" water clusters in MT, representing the 3D superposition of de Broglie

standing waves of H_20 molecules in hollow core of MT. It is a result of the water molecules immobilization by 'open' nonpolar clefts of $(\alpha\beta)$ dimers in MT; 5. Increasing the superradiance of coherent IR photons induced by synchronization of quantum transitions of the *effectons* between *acoustic* and *optic* like states. Corresponding increasing of probability of superdeformons (cavitational fluctuations) excitation in water of cytoplasm; 6. The *disassembly of actin filaments system to huge number of subunits, [gel→sol]* transition *and increasing of water fraction in hydration shell of proteins in cytoplasm.* This transition is a result of cavitational fluctuations and destabilization of actin filaments by Ca^{2+}. Corresponding decreasing the water activity in cytoplasm - increases strongly the passive osmotic diffusion of water from the external volume to the cell; 7. As a consequence of previous stage, a jump-way increasing of the nerve cell body volume (pulsation), accompanied by disrupting the (+) ends of MTs with cytoplasmic membranes occur. This stage makes it possible for MTs to change their orientation inside neuron's body; 8. Spatial "tuning" - collective reorientation of MTs of simultaneously excited neurons to geometry, corresponding to minimum potential energy of distant (but not nonlocal) electromagnetic and vibro-gravitational interaction between MTs and centrioles twisting; 9. Decreasing the concentration of Ca^{2+} to the critical one, when disassembly of actin filaments is stopped and [gel $\rightleftharpoons$ sol] equilibrium shifts to the left again, stabilizing the new MTs system spatial configuration and corresponding nerve cell body volume and geometry. This new geometry of nerve cells after fixation of (+) ends of MTs back to plasmatic membrane - determine the new distribution of ionic channels activity and reorganization of synaptic contacts in all excited ensemble of neurons after relaxation, i.e. **short-term and long-term memory**.

This cyclic consequence (hierarchy) of quantum mechanical, physico-chemical and classical nonlinear events can be considered as elementary acts of memorizing and consciousness. The total period of listed above stages can be as long as 500 ms, i.e. half of second. The elementary act of consciousness described, includes a stage of coherent electric firing in brain (Singer, 1993) of distant neurons groups with period of about $1/40\,\mathrm{sec}$. Corresponding frequency may be related to **frequency of superdeformons** (cavitational fluctuations) origination in of cytoplasm, stimulating [gel-sol] transition of cytoplasm, following after depolarization of nerve membranes. This frequency for pure water, calculated on the base of Hierarchic theory (Kaivarainen, 1995; 2000a), is about $10^4\,s^{-1}$. However, in viscous medium of cytoplasm it may be much lower ($\tilde{}10^2\,s^{-1}$).

The process of cavitational fluctuations 'collapsing' is accompanied by high-frequency (UV and visible) "biophotons" radiation due to recombination of part of water molecules. These biophotons may be responsible for short range morphogenetic field in contrast to coherent IR photons, responsible for long-range morphogenetic field.

The dimension of IR superdeformon (3D superposition of IR photon) edge is

determined by the length of librational IR standing photon - about 10 microns. It is important that this dimension corresponds to the average microtubule length in cells confirming in such a way our idea. Another evidence in proof is that is that the resonance wave number of excitation of superdeformons, leading from our model is equal to 1200 $(1/cm)$.

The experiments of Albrecht-Buehler (1991) revealed that just around this frequency the response of surface extensions of 3T3 cells to weak IR irradiation is maximum. Our model predicts that IR irradiation of microtubules system *in vitro* with this frequency will dramatically increase the probability of microtubules catastrophes. It's one of the way to verify our model experimentally.

Except **superradiance**, two other cooperative optic effects could be involved in supercatastrophe realization: **self-induced bistability** and the **pike regime** of IR photons radiation (Bates, 1978; Andreev et al.,1988). **Self-induced bistability** is light-induced phase transition. It could be related to nonlinear shift of $[a \Leftrightarrow b]$ equilibrium of primary librational effectons of intra MT water *to the right* as a result of *saturation* of IR (lb)-photons absorption. As far the molecular polarizability and dipole moments in (a) and (b) states of the primary effectons - differs, such shifts of $[a \Leftrightarrow b]$ equilibrium should be accompanied by *periodic jumps of dielectric permeability and stability of coherent water clusters.* **These shifts could be responsible for the pike regime of librational IR photons absorption and radiation.** *As far the stability of b-states of lb effectons is less than that of a-states, the characteristic frequency of pike regime can be correlated with frequency of MTs-supercatastrophe activation. This effect can orchestrate the [gel-sol] transitions of neuronal groups in head brain.*

MAP- microtubules associated proteins stabilize the overall structure of MTs. They prevent the disassembly of MTs in bundles of axons and *cilia* in a course of their coherent bending. *In neuron's body the concentration of MAP and their role in stabilization of MTs is much lower than in cilia.* **The local acousto-conformational signals** between MT are realized via MTs - associated proteins (MAP), induced by transitions of the cleft, formed by α and β tubulins, between closed (A) and open (B) states. The orchestrated dynamics of individual *MT as quantum conductor* is a result of phonons $(h\nu_{ph})$ exchange between $(\alpha\beta)$ clefts due to $[lb/tr]$ conversions, corresponding to water clusters, "flickering", in-phase to $[B \rightleftharpoons A]$ pulsations of clefts.

The distant electromagnetic and vibro-gravitational interactions between different MT are the consequence of IR photons and coherent gravitational waves exchange. The corresponding two types of waves are excited as a result of orchestrated $(a \Leftrightarrow b)$ transitions of water primary librational effectons, localized in the open B-states of $(\alpha\beta)$ clefts. When the neighboring $(\alpha\beta)$ clefts has the alternative open and closed states like on Fig 2, the general spatial structure remains straight. However, when $[A \Leftrightarrow B]$ equilibrium of all the clefts from one side of MT are shifted to the left and that from the opposite side are shifted to the right, it leads to bending of

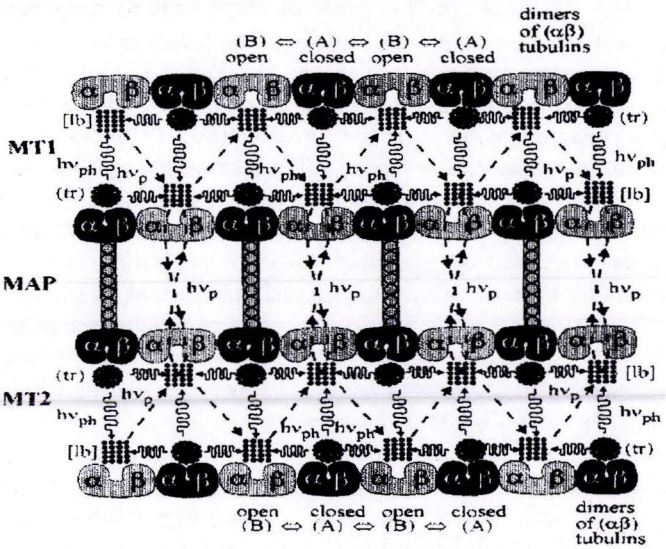

Fig. 2: The schematic presentation of the local, acousto-conformational and distant - electromagnetic interactions between microtubules (MT1 and MT2), connected by MAP.

MT. Coherent bending of MTs could be responsible for [volume/shape] vibrations of the nerve cells and the **cilia bending**.

The **Brownian effects**, which influence reorientation of MTs system and probability of cavitational fluctuations, stimulating [gel - sol] transition in a course of nerve cells tuning and excitation-relaxation cycles - represent in our model the **non-computational element of consciousness**. Other models (Wigner, 1955 and Penrose, 1994) relate this element to wave function collapsing.

Possible application of our model: Audio/Video Signals Skin Transmitter

We propose the idea of new device, where the laser beam with caviatational fluctuations frequency and ultraweak intensity will be modulated by acoustic and/or video signals. The modulated output optic signals will 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.

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 cavitational 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 even from distant untreated by skin-transmitter points of skin. There are another resonant frequencies also, calculated from our theory, enable to stimulate big fluctuations of water in MTs and their disassembly.

Verification of these important consequences of our model and elaboration of Audio/Video Signals Skin - Transmitter is the intriguing task of future. The practical realization of Audio/Video Signals Skin Transmitter will be a good additional evidence in proof of HMC and useful for lot of people with corresponding diseases.

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