

Quantum and Classical Neural Networks for Modeling Two Modes of Consciousness: Cognitive Implications

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Abstract—Quantum bases of consciousness and free will are considered with implications of two cognitive modes of consciousness (direct religious/creative, characteristic of quantum-coherent transitional and altered states of individual consciousness, and indirect perceptually/rationally mediated, characteristic of classically-reduced normal states of individual consciousness), as well as conditions of transformations of one mode into another.

Keywords—Quantum & Classical Hopfield-like Associative Neural Networks; Two Cognitive Modes of Individual Consciousness: Quantum (Altered/Transitional States) & Classical (Normal States); Quantum Holography & Quantum Decoherence; Free Will.

I. INTRODUCTION

THE prevailing scientific paradigm considers information processing within the central nervous system as occurring through *hierarchically organized and interconnected neural networks* [1-3]. Alongside with the development of experimental techniques enabling physiological investigation of interactions of hierarchically interconnected neighboring levels of biological neural networks, significant contribution in establishing the neural network paradigm was given by theoretical breakthroughs in this field during the past two decades [2]. It seems that this hierarchy of biological neural networks is going down subcellular *cytoskeleton* level, being according to some scientists a kind of interface between *neural* and *quantum* level [4] - the last one having within the Feynman propagator version of Schrödinger equation *analogous* mathematical formalism as the Hopfield associative neural network, implying possibility to implement the model of quantum associative neural networks' parallel information processing both on software's level in classical digital computers and hardware's level in any of numerous physical media which can realize holography, with tremendous potential physical and engineering implications [3] (However, it should be pointed out that quantum associative neural networks, working in the multi-dimensional Hilbert state space, ought to be distinguished from Deutch-based quantum computing algorithms with logic gates, working in two-dimensional Hilbert state space of qubits [5]).

The mentioned analogy opens additional fundamental question how *quantum* parallel processing level gives rise *classical* parallel processing one, which is a general problem of relationship between quantum and classical levels within the *quantum decoherence theory* as well [6]; naturally, the same question is closely related to fundamental nature of *consciousness*, whose indeterministic manifestations of *free will* [7-9], and other *holistic manifestations* of consciousness, like transitional states [9] and altered states of consciousness [10], conscious/unconscious transitions and consciousness pervading body [11] - necessarily imply that some manifestations of consciousness must have deeper *quantum origin*, with significant *psychosomatic implications*.

Namely, as demonstrated by *quantum-coherent characteristics* of the Russian-Ukrainian school of *microwave resonance therapy* (MRT) [12,13], the *acupuncture system* is the only *macroscopic quantum system* in our body (while brain still seems not to be [14]) which might be related to consciousness;³ and as recent investigations show that any quantum system has formal mathematical structure of *quantum-holographic associative neural network* [3] - then (acupuncture-meridian temporary-reprogrammable)⁴ *memory attractors of the quantum-holographic acupuncture network* can be treated as *psychosomatic individual disorders* representing EM/MW (*quantum*) *holistic records* - which might represent biophysical basis of (*quantum*)*holistic local psychosomatics* [9,16,18]! At the same time, the mentioned analogy between mathematical formalisms of *Hopfield's associative neural network* and *Feynman's propagator version of the Schrödinger equation* implies that *collective consciousness* is possible *ontological property of the physical field itself* [9,16] with various

³ An additional support that acupuncture system is really related to consciousness is provided by novel *meridian (psychoenergetic) therapies*, with very fast removing of persistent phobias, allergies and other psychosomatic disorders [15] - whose simultaneous effects of *visualization of the psychosomatic problems* and *tapping/touching of some acupuncture points* might be interpreted as a "smearing" of *memory attractors* of the psychosomatic disorders, through successive imposing of new boundary conditions in the acupuncture energy-state space during visualizations of the psychosomatic problems [16], cf. Fig. 1.

⁴ According to *Tibetan traditional medicine*, an acupuncture procedure must be repeated every several months - presumably as a consequence of restituted patient's mental loads from his mental-transpersonal-environment of closely related family members and enemies, that remained nonreprogrammed on the level of quantum-holographic collective consciousness, which might be supported by Tibetan pulse diagnostics based on 20 pulses, enabling precise diagnosis of psychosomatic disorders not only of the patient himself but also of his family members and enemies [17].

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microquantum and macroquantum (both nonbiological and biological) excitations, which is widely spread thesis of *Eastern esoteric/religious traditions* [19] - and then *memory attractors of the quantum-holographic space-time network of collective consciousness* can be treated as *psychosomatic collective disorders* representing (*quantum*)*holistic field records* (including interpersonal hesychastic-prayer finally-reprogrammable loads [20]) - which might represent biophysical basis of (*quantum*)*holistic global psychosomatics* [9,16,18]!

So it seems that the *whole psychosomatics is quantum hologram*, both on the level of individual and collective consciousness, which resembles on Hinduistic relationship Brahman/Atman, as wholeness and its part which bears information about wholeness [19]. The mentioned quantum-holographic picture also implies that quantum-holographic hierarchical parts carry information on wholeness, enabling subtle *quantum-holographic fractal coupling* between different hierarchical levels⁵ - including quantum-holographic coupling of the acupuncture and genetic levels, with mutual *quantum-informational control of ontogenesis and morphogenesis*, starting from the first fertilized cell division which initializes differentiation of the acupuncture system of (electrical synaptic) "gap-junctions" [21]. Then emphasis on *three front lines of psychosomatic medicine* might also be pointed out [16]: *hesychastic spirituality*, with prayer-mediated final erasing of quantum memory attractors on the level of collective consciousness; *holistic Eastern medicine*, with acupuncture/psychotherapy-mediated temporary erasing of quantum memory attractors on the level of individual consciousness; and *symptomatic Western medicine*, with immunology/pharmacology/surgery-mediated alleviation of the somatized consequences of the carelessness on the first two front lines - with stressing *religious/social implications* that *necessary* activities on the second and third front lines, with *neglect* of the first one, have a consequence of *further transfer* of quantum memory attractors on the level of individual and collective consciousness in this and coming generations, thus *accumulating* quantum-holographic loads

⁵ On *fractal-information coupling of hierarchical levels* in Nature, see the articles M. Rakočević, "The universal consciousness and the universal code" and Dj. Koruga, "Information physics: In search of a scientific basis of consciousness," in D. Rakočević and Dj. Koruga, Eds., *Consciousness: Scientific Challenge of the 21st Century*, Belgrade: ECPD, 1995, and Y. J. Ng, "From computation to black holes and space-time foam," *Phys. Rev. Lett.*, vol. 86, pp. 2946-2949, 2001, as well as the book P. Plichta, *God's Secret Formula*, Shaftesbury: Element Books, 1997. For most fascinating manifestation of *global quantum-holographic coupling* on the level of preferences of collective and individual history coded within The Old Testament, see the paper D. Witztum, E. Rips, Y. Rosenberg, "Equidistant letter sequences in The Book of Genesis", *Statistical Science*, vol. 9, pp. 429-438, 1994, as well as the books M. Drosnin, *The Bible Code*, New York: Simon & Schuster, 1997 and M. Drosnin, *Bible Code II: The Countdown*, New York: Viking Penguin, 2002 - which might be interpreted as a consequence of the quantum-holographic nature of the cosmic collective consciousness (God!?) and its every original manifestation (including The Old Testament, as well as every individual consciousness) - which still does not mean the strict determinism of the History by the existing state of collective consciousness, whose memory attractors could be reprogrammed by hesychastic prayer for the others thus removing interpersonal loads of the quantum-holographic Hopfield-like neural network of collective consciousness - so leaving the room for free will and influence on the future preferences [9,16].

which afterwards cause not only illnesses, but also interpersonal fights, wars, and other troubles; this also implies necessity of *re-consideration* of educational/ informational/ political goals of our civilization, with re-orientation towards *holistic gentle actions for global solutions of the "global risk society"* [22].

In the following, we shall focus particularly on the *quantum bases* of consciousness and free will, and related two cognitive modes of consciousness, with conditions of transformations of one cognitive mode into another.

II. QUANTUM AND CLASSICAL NEURAL NETWORKS FOR MODELING TWO COGNITIVE MODES OF CONSCIOUSNESS

Really, we may speak of *two cognitive modes* of individual consciousness [9,16]: the quantum-coherent direct one (religious/creative, in altered and transitional states of consciousness) and the classically-reduced indirect one (perceptually/rationally mediated, in normal states of consciousness) - to which theoretical methods of associative neural networks and quantum neural holography [3] combined with quantum decoherence theory [23] might be applied.

The *direct cognitive mode* of individual consciousness may be related to weakly coupled consciousness-environment communication, within the nonlocal quantum-holographic/ quantum-gravitational space-time network of collective consciousness (characteristic of quantum-coherent *transitional and altered states of individual consciousness*, in religious-esoteric transpersonal communications, of the quantum-gravitationally tunneled quantum-holographic-Hopfield-like electromagnetic/ionic out-of-body displaced part of the acupuncture network of individual consciousness, with the mentally addressed nonlocal environment-target, including anticipation in intuition, precognition, and deep creative insights [9,16] - being after quantum collapsing in classical/ normal state of consciousness, through restituted strong coupling of quantum-holographic-consciousness-contents with the body, further subjected to indirect language/ artistic/scientific filtering through extended reticular-thalamic activated system, ERTAS [1], thus classically-reducing initially obtained direct quantum-coherent information content - so explaining *generally poor* informational rationalization of the initial full quantum-holographic awareness of spiritual/ religious mystical experiences).

The *indirect cognitive mode* of individual consciousness may be related to strongly coupled consciousness-body-environment communication via space-time limited perceptual sensations, further processed by classical/electrochemical hierarchical neural networks and rationally filtered in conscious content by approximate empirical/artistic/scientific concepts dependent of cultural/scientific tradition and education of the inhabitants of some society (characteristic of classically-reduced *normal states of individual consciousness* in everyday communications, additionally *filtered* and amplified by ERTAS system - and afterwards transcribed in conscious content of the quantum-informational acupuncture network of individual consciousness, via brainwaves' EM fields every ~ 0.1 s - so generating normal "stream of consciousness" [9]).

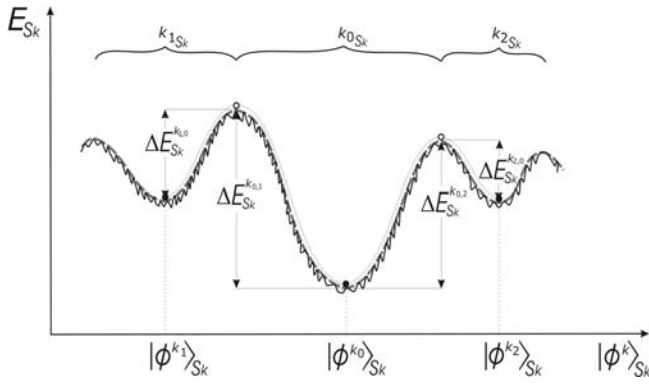


Fig. 1 Schematic presentation of the memory attractors of microwave (MW/dashed line) ultralowfrequency (ULF/full line) modulated EM/ionic quantum-holographic acupuncture system/consciousness of the k -th organism in the energy-eigenstate space $(E_{S_k}, |\phi^k\rangle_{S_k})$ of the system S_k : k_{0S_k} - basin

of attraction of the ground (healthy) MW state $|\phi^{k_0}\rangle_{S_k}$; k_{1S_k} and k_{2S_k} -

basins of attractions of the two excited (psychosomatically disordered) MW states $|\phi^{k_1}\rangle_{S_k}$ and $|\phi^{k_2}\rangle_{S_k}$ (hundreds of them being in general, according to

Tibetan traditional medicine [17]), modulated by numerous low-amplitude ULF states of the brain hierarchical neural networks. It should be pointed out that energy surface changes gradually during the quantum-holographic MRT treatment, by decreasing the potential barriers $\Delta E_{S_k}^{k_{1,0}}$ and $\Delta E_{S_k}^{k_{2,0}}$ (and

corresponding MRT sensory responses) of the potential wells k_{1S_k} or k_{2S_k} , to be overcome in traversing to the k_{0S_k} basin of attraction of the ground (healthy) state, when organism gradually recovers by further deepening healthy state $|\phi^{k_0}\rangle_{S_k}$. Such a picture is very close to the associative neural

networks in their energy-configuration spaces, and Hebbian modification of the minima depths of the energy hypersurface, being the attractors of neural networks memory patterns $|\phi^{k_0}\rangle_{S_k}$, $|\phi^{k_1}\rangle_{S_k}$, $|\phi^{k_2}\rangle_{S_k}$. The above approach

may be generalized on quantum-holographic collective consciousness, with religious/social implications on the necessity of transpersonal spiritual quantum-holographic cleansing of all undesired side memory attractors (which, unless reprogrammed by hesychastic prayer [20], would give rise to development of psychosomatic diseases or interpersonal conflicts in this or further generations, to which these memory patterns will be transpersonally and unconsciously temporally transferred through quantum-holographic collective consciousness) [9,16].

More concretely, in approximation of almost non-interacting individual consciousnesses, the state of collective consciousness is $|\Phi\rangle_S \sim \prod_k |\phi^k\rangle_{S_k}$. Here the quantum-

coherent state of k -th individual consciousness, $|\phi^k\rangle_{S_k} =$

$\sum_i c_{k_i} |\phi^{k_i}\rangle_{S_k}$, is described by superposition of its all possible

states (ϕ^{k_i}) , which after quantum collapsing in classically-reduced state gives rise to stochastic state described by density

matrix $\bar{\rho}_{S_k}^k = \sum_i |c_{k_i}|^2 |\phi^{k_i}\rangle_{S_k} \langle \phi^{k_i}|$, with probabilities $|c_{k_i}|^2$

of the realization of one of the classically decoherent states $|\phi^{k_i}\rangle_{S_k}$ - in quantum measurement-like process upon the initial

quantum-coherent state $|\phi^k\rangle_{S_k}$. The time evolution

$|\phi^k(t)\rangle_{S_k}$ of the quantum-coherent state of k -th individual

consciousness might be described in Feynman's representation by quantum-holographic Hopfield-like neural network [3,16], while the time evolution $\bar{\rho}_{S_k}^k(t)$ of the classically-reduced

stochastic state of k -th individual consciousness might be described by classical Hopfield-like neural network [2,16], represented by changes in the shape of the potential hypersurface in the acupuncture energy-state space $(E_{S_k}, |\phi^k\rangle_{S_k})$, cf. Fig. 1.

These cognitive modes of individual consciousness are presumably interchanged by periodicity of ~ 2 -hour *ultradian rhythm*, both in waking and sleep states [24], which according to quantum-relativistic model of consciousness [9] might be the cause of corresponding changes in subjective sense in

transitions between normal and altered states of consciousness (with dilations of subjective time sense and mixing of normally conscious and unconscious contents). According to

this model, *consciousness* is subtle internal display in the form of EM component of the acupuncture EM/ionic system, as *microwave/ultralowfrequency (MW/ULF) modulated quantum-holographic Hopfield-like neural network*, in which complete

information is continuously coded (both normally conscious and unconscious) from brain's neural networks (where synaptic coding is still electrochemical one), mediated by brainwaves as an interface. Then *altered states of consciousness* (REM

sleep phase, hypnosis, meditation, hallucinogenic states, some psycho-pathological states, clinical death, ...) are consequence of an out-of-body displacement of the part of the acupuncture EM/ionic acupuncture system (when its "embedded" EM component of ionic currents propagates through slightly non-homogeneous low-dielectric weakly ionized out-of-body gaseous structure) with ERTAS system switched off, while *normal states of consciousness* (normal waking state, non-REM sleep phase, ...) are realized without these displacements (when EM component of ionic currents propagates through strongly nonhomogeneous high-dielectric body tissues). It should be specially pointed out that in altered states of consciousness the EM component of ionic currents propagates both through the body and the displaced part of the ionic acupuncture system, but conscious contribution of the first ones is negligible due to the overlapping of non-amplified contents, while the second ones give rise to conscious contribution due to good temporal differentiation of the same contents - and hence it seems that condition for strong manifestation of altered states of consciousness is both switched off ERTAS and generation of the displaced (out of body) part of acupuncture EM/ionic system [9]. This is typically fulfilled in *altered states of consciousness*, when model also predicts mixing of normally conscious and unconscious contents, due to relativistic Doppler mapping of the "objective" brainwave power spectrum (as a superposition of γ , β , α , θ , and δ bands) onto "subjective" zero-frequency peak - this being the reason for a role of REM-dreaming (and meditation) in integration of normally conscious and

unconscious contents (otherwise divided by normal daily brain functioning) around one dominant associative "ego" state, and consequently *personality growth and alleviation of emotional conflicts* [9].

The above-mentioned division in *two cognitive modes* of individual consciousness, *quantum-coherent direct one* (in religious/creative altered and transitional states of consciousness) and *classically-reduced indirect one* (in perceptually/rationally mediated *normal states of consciousness*) - is still non-quite sharp.

Namely, in religious/creative *altered and transitional states of consciousness*, quantum-coherent direct mode might be *transformed* into classically-reduced indirect mode, in the case of strong out-of-body interaction consciousness-environment, with quantum-reduced out-of-body *extrasensory perception of the mentally addressed environment*, which transforms out-of-body displaced part of individual consciousness from non-stationary quantum-coherent state of the quantum-holographic Hopfield-like neural network in the above described stationary classically-reduced stochastic state of the classical Hopfield-like neural network. After interruption of this interaction, with returning out-of-body displaced part of individual consciousness in quantum-gravitationally mentally-channeled tunneling of the displaced part of individual consciousness upon its body, this information is further transcribed through (MW/ULF) EM interaction acupuncture system/nervous system and afterwards language/artistic/scientific filtered by the brain hierarchical neural ERTAS system (with accompanied "brainwave frequency" uprising thought from lower-frequency ULF (δ, θ) unconscious form of subliminal thought to higher-frequency ULF (α, β, γ) conscious form, with significant unconscious-contextual cognitive/linguistic and psychotherapeutic implications [25]. It should be also pointed out that mentioned (MW/ULF) EM *acupuncture system/nervous system interaction* has its threshold potential of the nervous electrochemical synapses (in contrast to practically non-existing threshold potential of the acupuncture electrical "gap-junction" synapses [9,18], which makes bodily acupuncture system an extremely sensitive quantum sensor) and therefore filters all thus extrasensory obtained information below nervous threshold potential, preventing it to be additionally language/artistic/ scientific articulated by the brain hierarchical neural ERTAS system - enabling further processing of only that information which is sufficiently "emotionally colored" i.e. has sufficient critical depth of MW/ULF EM acupuncture memory attractors (cf. Fig. 1), or has greater general acupuncture energetic potential (inborn or gained through various traditional techniques of stimulation, deep breathing, relaxation, meditation or prayer [18]).

On the contrary, the reverse *nervous system/acupuncture system interaction* - effective in transcription of language/artistic/scientific articulated brain information into conscious content of the acupuncture network of individual consciousness, mediated by ULF EM field of brain neural activities every ~ 0.1 s thus generating normal "stream of consciousness" and ULF-modulating acupuncture MW-memory attractors - is going *without threshold limits*. In this context, in perceptually/rationally mediated *normal states of consciousness*, the classically-reduced indirect mode can be *transformed* into quantum-coherent direct mode of individual consciousness after ULF EM transcription of the brain articulated information into

conscious content during interaction nervous system/acupuncture system, in the case of short-lasting *nonstationary excitations of acupuncture system* in interactions with strongly changing environment [23] - like MRT or other types of acupuncture stimulation, inhalation of the air ions in deep yoga breathing and their redistribution over acupuncture system, different meditative and other psycho-muscular relaxation techniques, stressful situations, transitional and altered states of consciousness [18] - which transform the acupuncture system from stationary classically-reduced stochastic state of classical Hopfield-like neural network into nonstationary quantum-coherent state of quantum-holographic Hopfield-like neural network, which then collapses into following stationary classically-reduced state. This might be a model of perceptually/rationally induced strong intentional classical/quantum/classical stationary/nonstationary/stationary backward hierarchical (inter)actions nervous/acupuncture/nervous systems - i.e. model of *free will*.

III. CONCLUSION

In this paper, *quantum bases of consciousness* and *free will* are considered with implications of *two cognitive modes of individual consciousness* (the quantum-coherent direct one and the classically-reduced indirect one) - to which theoretical methods of associative neural networks and quantum neural holography, combined with quantum decoherence theory, might be applied.

The *direct cognitive mode* of individual consciousness might be related to weakly coupled consciousness-environment communication, within the nonlocal quantum-holographic/quantum-gravitational Hopfield-like space-time network of collective consciousness (characteristic of quantum-coherent transitional and altered states of individual consciousness in religious-esoteric transpersonal communications, including anticipation in intuition, precognition, and deep creative insights), while the *indirect cognitive mode* of individual consciousness might be related to strongly coupled consciousness-body-environment communication via space-time limited perceptual sensations, further processed by classical/electrochemical hierarchical neural networks and rationally filtered in conscious content by approximate empirical/artistic/scientific concepts dependent of cultural/scientific tradition and education of the inhabitants of some society (characteristic of classically-reduced normal states of individual consciousness in everyday communications - being *generally poorer* in information than full quantum-holographic awareness of spiritual/religious mystical experiences).

On these lines, the *conditions of transformations* of one cognitive mode into another are considered, as well as the model of perceptually/rationally induced strong intentional backward classical/quantum/classical stationary/nonstationary/stationary hierarchical (inter)actions nervous/acupuncture/nervous systems - i.e. model of *free will*.

REFERENCES

- [1] K. R. Popper and J. C. Eccles, *The Self and Its Brain*. Berlin: Springer, 1977; B. J. Baars, *A Cognitive Theory of Consciousness*. Cambridge,

- MA: Cambridge Univ. Press, 1988; F. Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul*. New York: Charles Scribner's Sons, 1994; D. Raković and Dj. Koruga, Eds., *Consciousness: Scientific Challenge of the 21st Century*. Belgrade: ECPD, 1995; D. Raković; *Fundamentals of Biophysics*; Beograd: Grosknjiga, 1995, Chs. 5-6, in Serbian.
- [2] J. J. Hopfield, "Neural networks and physical systems with emergent collective computational abilities," *Proc. Natl. Acad. Sci. USA*, vol. 79, pp. 2554-2558, 1982; T. Kohonen, *Self-Organization and Associative Memory*. Berlin: Springer, 1984; D. Amit, *Modeling Brain Functions: The World of Attractor Neural Nets*. Cambridge: Cambridge Univ. Press, 1989; H. Haken, *Synergetic Computers and Cognition: A Top-Down Approach to Neural Nets*. Berlin: Springer, 1991.
- [3] M. Peruš, "Neuro-quantum parallelism in mind-brain and computers," *Informatica*, vol. 20, pp. 173-183, 1996; M. Peruš and S. K. Dey, "Quantum systems can realize content-addressable associative memory," *Appl. Math. Lett.*, vol. 13, no. 8, pp. 31-36, 2000; M. Peruš, "Multi-level synergetic computation in brain," *Nonlinear Phenomena in Complex Systems*, vol. 4, pp. 157-193, 2001; M. Peruš, H. Bischof, and L. C. Kiong, "Quantum-implemented selective reconstruction of high-resolution images," www.arxiv.org/abs/quant-ph/0401016, 2004; and references therein.
- [4] S. R. Hameroff, "Quantum coherence in microtubules: a neural basis for emergent consciousness?," *J. Consciousn. Stud.*, vol. 1, pp. 91-118, 1994; Dj. Koruga, "Information physics: In search of a scientific basis of consciousness," in D. Raković and Dj. Koruga, Eds., *Consciousness: Scientific Challenge of the 21st Century*. Belgrade: ECPD, 1995.
- [5] D. Deutch, "Quantum theory, the Church-Turing principle and the universal quantum computer," *Proc. R. Soc. A*, vol. 400, pp. 97-117, 1985; See also an overview web site by M. Dugić with wider reference list on Quantum Computation: <http://www.pmf.kg.ac.yu> and further link to <http://fizika.pmf.kg.ac.yu>.
- [6] D. Giulini, E. Joos, C. Kiefer, J. Kupsch, I. -O. Stamatescu, and H. D. Zeh, *Decoherence and the Appearance of a Classical World in Quantum Theory*. Berlin: Springer, 1996.
- [7] J. von Neumann, *Mathematical Foundations of Quantum Mechanics*. Princeton, NJ: Princeton Univ. Press, 1955.
- [8] H. P. Stapp, "Quantum theory and the role of mind in nature," *Found. Phys.*, vol. 31, pp. 1465-1499, 2001; H. Stapp, *Mind, Matter, and Quantum Mechanics*. New York & Berlin: Springer, 1993.
- [9] D. Raković, "Brainwaves, neural networks, and ionic structures: Biophysical model for altered states of consciousness," in D. Raković and Dj. Koruga, Eds., *Consciousness: Scientific Challenge of the 21st Century*. Belgrade: ECPD, 1995; D. Raković, "Prospects for conscious brain-like computers: Biophysical arguments," *Informatica (Special Issue on Consciousness as Informational Phenomenalism)*, vol. 21, pp. 507-516, 1997; D. Raković, "Transitional states of consciousness as a biophysical basis of transpersonal transcendental phenomena," *Int. J. Appl. Sci. & Computat.*, vol. 7, pp. 174-187, 2000; and references therein.
- [10] C. Tart, Ed., *Altered States of Consciousness*. New York: Academic, 1972.
- [11] A. Shimony, in R. Penrose, A. Shimony, N. Cartwright, and S. Hawking, Eds., *The Large, the Small and the Human Mind*. Cambridge: Cambridge Univ. Press, 1995.
- [12] N. D. Devyatkov, "Influence of the millimeter wavelength range electromagnetic radiation upon biological objects," *Soviet Physics - Uspekhi*, vol. 110, pp. 452-454, 1973; see also pp. 455-469 in this volume; N. D. Devyatkov, O. Betskii, Eds., *Biological Aspects of Low Intensity Millimeter Waves*. Moscow: Seven Plus, 1994.
- [13] S. P. Sit'ko, Ye. A. Andreyev, and I. S. Dobronravova, "The whole as a result of self-organization," *J. Biol. Phys.*, vol. 16, pp. 71-73, 1988; S. P. Sit'ko and V. V. Gizhko, "Towards a quantum physics of the living state," *J. Biol. Phys.*, vol. 18, pp. 1-10, 1991; S. P. Sit'ko and L. N. Mkrtychian, *Introduction to Quantum Medicine*. Kiev: Pattern, 1994.
- [14] M. Tegmark, "Importance of quantum decoherence in brain processes," *Phys. Rev. E*, vol. 61, pp. 4194-4206, 2000.
- [15] R. J. Callahan and J. Callahan, *Thought Field Therapy and Trauma: Treatment and Theory*, Indian Wells, CA: 1996; R. J. Callahan and R. Trubo, *Tapping the Healer Within*, Contemporary Books, NY: 2001; R. J. Callahan, "The impact of thought field therapy on heart rate variability (HRV)," *J. Clin. Psychol.*, Oct. 2001, and also www.interscience.Wiley.com; Ž. Mihajlović Slavinski, *PEAT and Neutralization of Primeval Polarities*, Belgrade: 2000, in Serbian.
- [16] D. Raković, M. Dugić, and M. M. Ćirković, "Macroscopic quantum effects in biophysics," *Proc. Satell. Symp. Quantum Epoch: 100 Years from the Discovery of Quantum Physics*. Banja Luka: Academy of Sciences and Arts of Serbs Republic, 2001, in Serbian; D. Raković, "Hopfield-like quantum associative neural networks and (quantum)holistic psychosomatic implications," in B. Reljin and S. Stanković, Eds., *Proc. NEUREL-2002*. Belgrade: IEEE Yugoslavia Section, 2002; D. Raković, "Biophysical bases and frontiers of (quantum)holistic psychosomatics," in V. Jerotić, Dj. Koruga, and D. Raković, Eds., *Science - Religion - Society*. Belgrade: Theological Faculty of Serbian Orthodox Church & Serbian Ministry of Religions, 2002, in Serbian; D. Raković and M. Dugić, "Quantum and classical neural networks for modeling two cognitive modes of consciousness," in I. Kononenko and I. Jerman. Eds., *Proc. 6th Int. Multi-Conf. Information Society IS'2003, Mind-Body Studies*. Ljubljana: Information Society, 2003.
- [17] S. Petrović, *Tibetan Medicine*, Belgrade: Narodna knjiga - Alfa, 2000, in Serbian.
- [18] Z. Jovanović-Ignjatić and D. Raković, "A review of current research in microwave resonance therapy: Novel opportunities in medical treatment," *Acup. & Electro-Therap. Res., The Int. J.*, vol. 24, pp. 105-125, 1999; D. Raković, Z. Jovanović-Ignjatić, D. Radenović, M. Tomašević, E. Jovanov, V. Radivojević, Ž. Martinović, P. Šuković, M. Car, and L. Škarić, "An overview of microwave resonance therapy and EEG correlates of microwave resonance relaxation and other consciousness altering techniques," *Electro- and Magnetobiology*, vol. 19, pp. 193-220, 2000; D. Raković, "Biophysical bases of the acupuncture and microwave resonance stimulation," *Physics of the Alive*, vol. 9, pp. 23-34, 2001.
- [19] K. Wilber, *The Atman Project*. Wheaton, IL: Quest, 1980; P. Vujićin, "States of consciousness in esoteric practice," in D. Raković and Dj. Koruga, Eds., *Consciousness: Scientific Challenge of the 21st Century*. Belgrade: ECPD, 1995, and references therein.
- [20] J. Vlahos, *Orthodox Psychotherapy: The Holy Fathers Science*. Belgrade: Orthodox Missionary School of St. Alexander Nevskiy Church, 1998, Serbian translation from Greek.
- [21] D. Djordjević, *Electrophysiological Research of Reflexotherapy Mechanisms*. M.Sc. Thesis in Medicine, University of Belgrade, 1995, in Serbian, Chs. 1.2 and references therein.
- [22] D. P. Kreculj and J. P. Marić, "'The world risk society' and globostress", in V. Jerotić, Dj. Koruga, and D. Raković, Eds., *Science - Religion - Society*. Belgrade: Theological Faculty of Serbian Orthodox Church & Serbian Ministry of Religions, 2002, in Serbian; U. Beck, *The Global Risk Society*, London: Sage Publ., 1999.
- [23] D. Raković and M. Dugić, "A critical note on the role of the quantum mechanical 'collapse' in quantum modeling of consciousness", *Informatica*, vol. 26, pp. 85-90, 2002; D. Raković, M. Dugić, and M. Plavšić, "The polymer conformational transitions: A quantum decoherence theory approach", *Materials Science Forum*, vols. 453-454, pp. 521-528, 2004; D. Raković and M. Dugić, "Quantum and classical neural networks: Implications for modeling psychosomatic and cognitive functions", in S. Jovičić and M. Sovilj, Eds., *Language and Speech: Interdisciplinary Research of Serbian Language I*. Belgrade: IEFPG, 2004, in Serbian.
- [24] R. Broughton, "Human consciousness and sleep/ waking rhythms," in B. B. Wolman and M. Ulman, Eds., *Handbook of States of Consciousness*. New York: Van Nostrand Reinhold, 1986.
- [25] D. Raković, "Hierarchical neural networks and brainwaves: Towards a theory of consciousness," in Lj. Rakić, G. Kostopoulos, D. Raković, and Dj. Koruga, Eds., *Brain and Consciousness: Proc. ECPD Workshop*. Belgrade: ECPD, 1997; D. Raković, "On brain's neural networks and brainwaves modeling: Contextual learning and psychotherapeutic implications," in B. Lithgow and I. Cosic, Eds., *Biomedical Research in 2001: Proc. 2nd IEEE/EMBS (Vic)*. Melbourne: IEEE/EMBS Victorian Chapter, 2001; D. Raković, "Thinking and language: Maturation of EEG and model of contextual language learning," in M. Sovilj, P. Marković, S. Jovičić, A. Kostić, and D. Raković, Eds., *Speech and Language*. Belgrade: IEFPG, 2003.