On the Possible New Brain Wave 100 MHz and Microtubule Quantum Vibrations

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ABSTRACT

There has been interest in dark matter having "warm" properties for a significant amount of time. Interest in the dark matter increased in proposed solutions to the "missing satellites" problem of the Local Group of galaxies. A single-particle sterile neutrino $\nu$ addition to the standard model of particle physics provides a minimalist extension that can be produced as a particle in negligible (standard) lepton number cosmologies through non resonant collision-dominated production via neutrino oscillations in the early Universe. The new sterile neutrino with mass 7 keV decays according to the formula $\nu \rightarrow 2\gamma$, where $\gamma$ are the photons with energy $\sim 3.5$ keV. In this paper according to our model presented in paper. We calculate the rescaled energy of the photons emitted by analog of the sterile neutrino decays in brain. The calculated energy is of the order of the $10^{-7}$ eV much higher than the energy of the $\alpha, \beta, \gamma, \theta$ photons. The new wave, with new name $\psi$ wave have frequency 100 MHz. In the paper we argue that the result of measurement by Anirban Bandyopadhyay confirmed our theoretical model calculation for the new $\psi$ wave with frequency 100 MHz.

Key Words: consciousness, new brain wave, 100 MHz

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1. Introduction

Review and update of a 20-year-old theory of consciousness published in Physics of Life Reviews claims that consciousness derives from deeper layer, finer scale activities inside brain neurons (Hameroff and Penrose, 2013). The recent discovery of quantum vibrations in "microtubules" inside brain neurons corroborates this theory, according to review authors Stuart Hameroff and Sir Roger Penrose (Hameroff and Penrose, 2003). They suggest that EEG rhythms (brain waves) also derive from deeper level microtubule vibrations, and that from a practical standpoint, treating brain microtubule vibrations could benefit a host of mental, neurological, and cognitive conditions.

The theory, called "orchestrated reduction" (Orch OR), was first put forward in the mid-1990s by eminent mathematical physicist Sir Roger Penrose and Stuart Hameroff. They suggested that quantum vibrational computations in microtubules were "orchestrated" (Orch) by synaptic inputs and memory stored in microtubules, and terminated by Penrose "objective reduction" (OR), hence "Orch OR." Microtubules are major components of the cell structural skeleton.

Orch OR was criticized from its inception, as the brain was considered too "warm, wet, and..."
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noisy” for seemingly delicate quantum processes (Tarlaci and Pregolato, 2015). His recent discovery of warm temperature quantum vibrations in microtubules inside brain neurons by the research group led by Anirban Bandyopadhyay corroborates the pair's theory and suggests that EEG rhythms also derive from deeper level microtubule vibrations (Tarlaci and Pregolato, 2015). In addition, work from the laboratory of Roderick G. Eckenhoff, at the University of Pennsylvania, suggests that anesthetics, which selectively erases consciousness while sparing non-consciously brain activities, acts via microtubules in brain neurons (Sahni, 2014); “The origin of consciousness reflects our place in the universe, the nature of our existence. Did consciousness evolve from simple computations among brain neurons, as most scientists assert? Or has consciousness, in some sense, been here all along, as classical approaches maintain?” ask Hameroff and Penrose in the current review. This opens a potential Pandora’s Box, but our theory accommodates both these views, suggesting consciousness derives from quantum vibrations in microtubules, protein polymers inside brain neurons, which both govern neuronal and synaptic function, and connect brain processes to self-organizing processes in the fine scale, 'proto-conscious' quantum structure of reality.

After 20 years, "the evidence now clearly supports Orch OR", continue Hameroff and Penrose. "Our new paper updates the evidence, clarifies Orch OR quantum bits, or "qubits," as helical pathways in microtubule lattices, rebuts critics, and reviews 20 testable predictions of Orch OR published in 1998 - of these, six are confirmed and none refuted." (Hameroff and Penrose, 2003).

An important new facet of the theory is introduced. Microtubule quantum vibrations (e.g. in megahertz) appear to interfere and produce much slower EEG "beat frequencies." Despite a century of clinical use, the underlying origins of EEG rhythms have remained a mystery. Clinical trials of brief brain stimulation aimed at microtubule resonances with megahertz mechanical vibrations using transcranial ultrasound have shown reported improvements in mood, and may prove useful against Alzheimer’s disease and brain injury in the future (Hameroff and Penrose, 2013).

2. Consciousness and Quantum Theory

The issue of observation in QM is central, in the sense that objective reality cannot be disentangled from the act of observation, as the Copenhagen Interpretation (CI) nearly states. In the words of John A. Wheeler 1981, we live in an observer-participatory Universe. His vast majority of today's practicing physicists follow CI's practical prescriptions for quantum phenomena, while still clinging to classical beliefs in observer-independent local, external reality. There is a critical gap between practice and underlying theory. In his Nobel Prize speech of 1932, Werner Heisenberg concluded that the atom "has no immediate and direct physical properties at all." If the universe's basic building block isn't physical, then the same must hold true in some way for the whole. The universe was doing a vanishing act in Heisenberg's day, and it certainly hasn't become more solid since (Schild, 2012). This discrepancy between practice and theory must be confronted; because the consequences for the nature of reality are far-reaching an impressive body of evidence has been building to suggest that reality is non-local and undivided. Non-locality is already a basic fact of nature, first implied by the Einstein-Podolsky-Rosen thought experiment despite the original intent to refute it, and later explicitly formulated in Bell's Theorem.

Moreover, this is a reality where the mindful acts of observation play a crucial role at every level. Heisenberg again: “The atoms or elementary particles themselves ... form a world of potentialities or possibilities rather than one of things or facts.” He was led to a radical conclusion that underlies our own view in this paper: “What we observe is not nature itself, but nature exposed to our method of questioning.” Reality, it seems, shifts according to the observer's conscious intent. There is no doubt that the original CI was subjective (Schild, 2012).

3. Model

In order to put forward the classical theory of the brain waves we quantize the brain wave field. In the model (Marciał-Kozłowska and Kozlowski, 2013) we assume (i) the brain is the thermal source in local equilibrium with temperature T. (ii) The spectrum of the brain waves is quantized according to formula

\[ E = \hbar \omega \]
where $E$ is the photon energy in eV, $\hbar=$ Planck constant, $\omega = 2\pi v$, $v$ - is the frequency in Hz. (iii).

The number of photons emitted by brain is proportional to the (amplitude)$^2$ as for classical waves. The energies of the photons are the maximum values of energies of waves for the emission of black body brain waves we propose the well know formula for the black body radiation.

In thermodynamics we consider Planck type formula for probability $P(E)dE$ for the emission of the particle (photons as well as particles with $m\neq0$) with energy $(E,E+dE)$ by the source with temperature $T$ is equal to:

$$P(E)dE= BE^2 e^{-E/kT} dE$$

(2)

where $B=$ normalization constant, $E=total\ energy$ of the particle, $k= Boltzmann\ constant=1.3 \times 10^{-23} J\ K^{-1}$, $K$ is for Kelvin degree. However in many applications in nuclear and elementary particles physics $kT$ is recalculated in units of energy. To that aim we note that for $1K$, $kT$ is equal $k1K=K x 1.3 \times 10^{-23} J x K^{-1}= 1.3 \times 10^{-23} Joule$ or $kT$ for $1K$ is equivalent to $1.3x 10^{-23}$ Joule $=1.3x 10^{-23} / (1.6x10^{-19}) eV = 0.8x10^{-4} eV$. Eventually we obtain $1K=0.8x10^{-4} eV$, and $1eV=1.2x10^{4} K$,

$$\frac{dN}{dE} = BE^2_{max} e^{-E_{max}/T}$$

(2)

where, $B$ is the normalization constant, $T$ is the temperature of the brain thermal source in eV. The function $dN/dE$ describes the energy spectrum of the emitted brain photons. Until 2014 no one has find the experimental evidence of the cold source of the brain photons. But recently the new sort of neutrino with the mass of the order $7\ keV$ was experimentally evidenced. The neutrino $\nu$ decays according to the scheme:

$$\nu \rightarrow 2\gamma$$

(3)

where $\gamma$ denotes x ray photons with energy $3.5\ keV$. In the paper (Marcia-Kozlowska and Kozlowski 2013) the comparison of the photon spectra of Cosmic Microwave Background (CMB) and the spectra of brain electromagnetic emission was performed. It occurs that both spectra can be described with formula (2), but with different temperatures. The ratio of the temperatures is

$$\frac{T_{brain}}{T_{CMB}} = 10^{-10}$$

(4)

Following formula (4) we argue that in brain spectra the photons with energy of the order of

$$10^{-10}3.7x10^3 eV = 3.7x10^{-7} eV = 3.7x10^{-3} K$$

(5)

can be observed.

In Figure 1, we present the result of the comparison of the calculated, formula (2), temperature $T=0.8x10^{-14} eV=0.810^{-10} K$, and observed spectra of the brain waves. The calculated spectra are normalized to the maximum of the measured spectra.

The obtained temperature is the temperature for the brain source in the thermal equilibrium. The source is thermally isolated adiabatic well). It must be stressed that in the paper we abandon the idea that every physical object is either a wave or a particle. Neither it is possible to say that particles "become" waves in the quantum domain and conversely that waves are "transformed "into particles. It is therefore necessary to acknowledge that we have here a different kind of an entity, one that is specifically quantum. For this reason Levy-Leblond and Balibar developed the name quanton (Levy-Leblond and Balibar, 1990). Following that idea the human brain emits quantons with energies $E = \hbar\omega$. The brain quantons are the quantum objects that follows all quantum laws: tunneling, the superposition and Heisenberg uncertainty rule.

In Figure 2, we present the theoretical spectrum of the brain waves with for temperature $T=10^{-3} K$ we will call them $\psi$ waves.

Beginning in 2009, Anirban Bandyopadhyay and colleagues at the National Institute of Material Sciences in Tsukuba, Japan, were able to use nanotechnology to address electronic and optical properties of individual micro tubules Bandyopadhyay, 2013. The group has made a series of remarkable discoveries suggesting that quantum effects do occur in microtubules at biological temperatures. First, they found that electronic conductance along microtubules, normally extremely good insulators, becomes exceedingly high, approaching quantum conductance, at certain
specific resonance frequencies of applied alternating current (AC) stimulation.

**Figure 1.** Comparison of experimental and theoretical results for brain vibration.

**Figure 2.** The model calculation of the ψ wave energy spectrum.

These resonances occur in gigahertz, megahertz and kilohertz ranges, and are particularly prominent in low megahertz (e.g., 8.9 MHz). Conductances induced by specific (e.g., megahertz) AC frequencies appear to follow several types of pathways through the microtubule—helical, linear along the microtubule axis, and ‘blanket-like’ along/around the entire microtubule surface. Second, using various techniques, the Bandyopadhyay group also determined AC conductance through 25 nm-wide microtubules is greater than through single 4 nm-wide tubulins, indicating cooperative, possibly quantum coherent effects throughout the microtubule, and that the electronic properties of microtubules are programmed within each tubulin. Their results also showed that conductance increased with microtubule length, indicative of quantum mechanisms.

The resonance conductance (‘Bandyopadhyay coherence’ – ‘BC’) through tubulins and microtubules is consistent with the intra-tubulin aromatic ring pathways) which can support Orch OR quantum dipoles, and in which anesthetics bind, apparently to selectively erase consciousness. Bandyopadhyay's experiments do seem to provide clear evidence for coherent microtubule quantum states at brain temperature.

In our model the new ψ wave have the frequency ω =100 MHz in rather good agreement with Bandyopadhyay measurement. In light of the above it seems reasonable to argue that the ψ vibration postulated in this paper is the candidate for the resonances observed in Bandyopadhyay's experiments.

In Table 1, the calculated energy and wave length according to formulae

$$ E[eV] = 10^{-15} \omega [Hz] $$

$$ \lambda [m] = \frac{10^{-7}}{E[eV]} $$

**Table 1.** The full spectrum of the brain vibrations with new ψ wave included.

<table>
<thead>
<tr>
<th>WAVE</th>
<th>Max Freq[Hz]</th>
<th>ENERGY [×10^{15} eV]</th>
<th>Wave length [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>δ</td>
<td>3.9</td>
<td>3.9</td>
<td>10^{9}</td>
</tr>
<tr>
<td>θ</td>
<td>7.9</td>
<td>7.9</td>
<td>10^{9}</td>
</tr>
<tr>
<td>α</td>
<td>13.9</td>
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</tr>
<tr>
<td>ψ</td>
<td>10^{8}</td>
<td>10^{8}</td>
<td>1</td>
</tr>
</tbody>
</table>

**Conclusions**

It is obvious that consciousness is not located in space. According to special relativity theory all physically observed phenomena are located in 4D space-time. In conclusion the conscious not exist in time also. Consciousness is timeless. The brain photons are the effect of the interaction of the timeless consciousness with human brain. The final result of this interaction are the alpha, beta, delta and theta and new ψ waves. In the paper we calculated the energy of the new ψ wave $$ E_\psi = 10^{-7} eV, \omega = 100MHz. $$
References