Human Consciousness as Limited Version of Universal Consciousness

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ABSTRACT

In this article, we address the nature and substrates of human Consciousness, the nature and attributes of Universal Consciousness and the relationship between the two in light of the groundbreaking new results obtained by Persinger's group. These new results together with what have already been achieved by herein authors, Persinger's group and some of the other researchers shed important light on these fundamental issues of life and existence.

Key Words: human Consciousness, Universal Consciousness, spin-mediated consciousness, mind-pixel, nonlocality, quantum entanglement, God Helmet, photon emission, biophoton, brain.

All things by immortal power, Near and Far, Hiddenly, To each other linked are, That thou canst not stir a flower Without troubling of a star. Francis Thompson

1. Introduction

Our search on the nature and substrates of human Consciousness lead us to the spin-mediated consciousness theory, spin being the mind-pixel and its further developments put forward in Refs. [1-4, 7-9]. To test this theory experimentally, we conducted experiments and discovered photon and magnetic pulse induced non-local effects of general anesthetics on the brain [5] and nonlocal thermal, chemical and gravitational effects in simple physical systems [6]. Recently, we also found new nonlocal biological effect of a substance on human heart [15]. Experimental supports of spin-mediated consciousness theory from various sources, especially the results of Persinger's group, were discussed in Ref. [10]. Current landscape and future direction of theoretical & experimental quantum brain research were reviewed in Ref. [11].

The research reported in Refs. [1-9] further lead us to the search on the nature and attributes of Universal Consciousness and the discoveries of the Principle of Existence and its further developments put forward in Refs. [12-14]. According to this fundamental Principle, in the beginning there was Universal Consciousness by itself $e^{0i}=1$ materially empty and spiritually restless; and it began to imagine through primordial self-referential spin $1=e^{0}=e^{iM-iM}=e^{iM}e^{-iM}=e^{-iM}/e^{-iM}=e^{iM}/e^{iM}\ldots$ such that it created the external object to be observed and internal object as observed, separated them into external world and internal world, caused them to interact through self-referential Matrix Law and thus gave birth to the Universe which it has since passionately loved, sustained and made to evolve.

Persinger has been a pioneer in the field of experimental studies of mystical experiences and is known together with his research team for the "God Helmet" [e.g., 16-17]. Recently, Persinger

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and his team have also obtained important results in the field of quantum brain & nonlocality research [16-24]. Now, he and his team have obtained groundbreaking new results in the latter areas published in this Special Issue[25-27]. These new results together with what have already been achieved by the herein authors [1-15], Persinger's team [16-24] and some of the other researchers (e.g., 28-47, some of which were scorned and/or alleged to be pseudoscientific or unreproducible) have very important implications for further advancements of these and related fields and shed important light on the fundamental issues of life and existence.

2. Brief Analysis of Persinger Group's Recent & New Results

(1) Biophoton emissions while imagining white light

Persinger's group first reported significant increases in biophoton emissions along the right side brain but not the left when subjects imagined white light in a dark environment in Ref. [18]. The group reported that the increased biophoton emissions did not occur when the same subjects thought about mundane experiences [18]. This fascinating phenomenon has been further studies in Ref. [25] published in this Special Issue.

In the new study [25], Persinger and his team found that during brief periods of imagining white light the power density of photon emissions from the right hemisphere was about 10-11 $W \cdot m^{-2}$ that was congruent with magnetic energy within the volume associated with a diminishment of ~7 nT. Their spectral analyses showed maxima in power from electroencephalographic activity within the parahippocampal region and photon emissions from the right hemisphere with shared phase modulations equivalent to about 20 ms. They further found that beat frequencies (6 Hz) between peak power in photon (17 Hz) and brain (11 Hz) amplitude fluctuations during imagining light were equivalent to energy differences within the visible wavelength that were identical to the intrinsic 8 Hz rhythmic variations of neurons within the parahippocampal gyrus.

According to Persinger and his team, these quantitative measurements plus quantitative analysis strongly suggest that spin energies similar to what was discussed by the herein authors in Ref. [3] can accommodate the interactions between protons, electrons, and photons and the action potentials associated with intention, consciousness and entanglement [25].

We point out here that mind-matter interactions have been widely studies but little specifics are known scientifically. It is well known that the placebo effect is produced by the mind and different thoughts and/or intentions are associated with different brain electrical activities. Further, it is apparent that we carry out our intentions through our physical body at will. The fascinating aspects of Persinger's group's findings are that a particular thought/imagination produces corresponding physical entities in the thought/imagination and other measurable and quantitative parameters such as decreased geomagnetic field around the brain and location specific EEGs associated with the particular brain activity.

However, there are several plausible causes for the increased biophoton emissions in the right brain when imagining white light: (1) increased blood flow and oxygenation; (2) increased cell metabolism; (3) electric discharge across neural membranes; (4) spin-mediated consciousness

functions and dynamics coupled to action potentials; (5) direct photon creation by intention or imagination in apparent but not real violation of energy conservation according to the Principle of Existence [see 14-16]; and (6) certain mixture or combinations of (1)-(5).

Causes (1)-(3) are coincidental causes non-specific to imagination of white light and can be confirmed or eliminated through additional control studies. Indeed, these coincidental causes are already disfavored by the finding of Persinger's group that the increased biophoton emissions did not occur when the same subjects thought about mundane experiences. If the observed biophoton emissions are intention/imagination specific, imagination of different colors of light may produce different profiles of increased biophoton emissions and imagination of other intense non-light experience should not produce increased biophoton emissions.

Cause (4) is favored by the currently available data of Persinger's group [25] and theoretically supported by spin-mediated consciousness theory and its further developments in Refs. [1-4, 7-9]. Both causes (4) and (5) are theoretically supported by the Principle of Existence and its further developments put forward in Refs. [12-14]. Cause (6) is not a separate cause.

(2) Nonlocal doubling of local photon emissions

In Ref. [19], Dotta and Persinger first reported their finding of the doubling of local photon emissions when two simultaneous, spatially separated, chemiluminescent reactions share the same magnetic field configurations. In the new experimental study reported in Ref. [26] in this Special Issue, Persinger and his team applied same magnetic field configurations in Ref. [19] to photons from light-emitting diodes (LEDs). They found a significant but weaker enhancement of photon emissions as measured by photomultiplier tubes occurred when the two LEDs were activated simultaneously within two loci separated by several meters.

If alternative explanations can be excluded, the observed effect suggest that under optimal conditions photons emitted from two, magnetic field congruent, loci become macroscopically entangled and that the two loci display properties of a single space as proposed by Persinger's group [26].

We point out here that the natural targets of these magnetic field configurations are the unpaired nuclear spins and electron spins in the test materials [10], and, if alternative explanations are excluded, the finding of Persinger's group indicates that the nonlocal property is even deeper and stronger than previously realized.

Plausible alternative explanations include: (1) Pre-existing quantum entanglement (contamination) between the instruments used to produce the two congruent magnetic field configurations due to common material source and builder of the instruments, etc.; (2) Pre-existing quantum entanglement (contamination) between the test materials and/or experimenters; (3) Direct quantum entanglement or electromagnetic influence due to the short distance of several meters between the two loci; and (4) Certain combinations of (1)-(3).

Indeed, the finding by Persinger's group that only a specific magnetic field configuration could produce the observed effect have already reduced the plausibility of these alternative explanations. However, by avoiding using common materials and builder, increasing the distance between the two loci and employing test materials of different sources and non-acquaintance experimenters, these alternative explanations can be eliminated more thoroughly.

(3) Potential entanglement of brain activity over 300 Km

In Ref. [20], Persinger and his team first reported that light flashes delivered to one aggregate of cells evoked increased photon emission in another aggregate of cells maintained in the dark in another room if both aggregates shared the same temporal and spatial configuration of changing magnetic fields. They also reported that increased photon emissions occurred beside the heads of human volunteers if others in another room saw light flashes during the presentation of the same shared circumcerebral magnetic fields. They further reported that when the shared magnetic fields were not present, both cellular and human photon emissions during the light flashes did not occur.

In the new experimental study reported in Ref. [27] of this Special Issue, pairs of subjects separated by 300 km were either exposed or not exposed to specific configurations of circular magnetic fields. Persinger and his team found that when one person in the pair was exposed to sound pulses within the classical electroencephalographic band, there were discrete changes in power within the cerebral space of the other person even though they were not aware of the stimulus times and separated by 300 km. However, the intracerebral changes that only occurred if the magnetic fields were activated around the two cerebrums simultaneously were discrete and involved about single, punctate volumes of about 0.13 cc (125 mm^3).

We point out here again that the natural targets of these magnetic field configurations are the unpaired nuclear spins and electron spins in the test cells or brain [10], and, if alternative explanations are excluded, the finding of Persinger's group indicate that the nonlocal property is even deeper and stronger than previously realized and achievable over very large distances.

Plausible alternative explanations include: (1) Pre-existing quantum entanglement (contamination) between the instruments used to produce the two congruent magnetic field configurations due to common material source and builder of the instruments, etc.; (2) Pre-existing quantum entanglement (contamination) between test cells/subjects and/or the experimenters; and (3) combinations of (1) and (2).

Indeed, the finding by Persinger's group that only a specific magnetic field configuration could produce the observed effect have already reduced the plausibility of these alternative explanations. However, by avoiding using common materials and builder and employing independent test cells and non-acquaintance test subjects and experimenters, these alternative explanations can be eliminated more thoroughly.

3. Omnipotence of Universal Consciousness: How GOD Creates Light & Its Governing Law?

In Genesis of the Old Testament, "God said 'Let there be light,' and there was light." However, Genesis does not tell us how this was done scientifically. One scientific solution is given in the Principle of Existence [12-14, also see 49]. This Principle further endows humans with the limited power to create through intentions/imagination [12-14].

In the source-free vacuum, light as electromagnetic field (photon) is governed by the following Maxwell equations (c=1):

$$\partial_t \mathbf{E} = \nabla \times \mathbf{B} \qquad \nabla \cdot \mathbf{E} = \mathbf{0}$$
$$\partial_t \mathbf{B} = -\nabla \times \mathbf{E} \qquad \nabla \cdot \mathbf{B} = \mathbf{0}$$

Scientifically, the question then becomes how Universal Consciousness created the electromagnetic field (photon) and the governing law as manifested by the Maxwell equations. We have already answered this question in Ref. 49 and will answer this question here in accordance to the Principle of Existence [12-14]. It turns out that Universal Consciousness created both the light and the governing law through imagination and matrixization of Its etheric body.

Based on the Principle of Existence [12-14], before creation, Universal Consciousness was alone in a singular (primal) state of Being – Oneness and Unity of Existence:

$$e^{i0}=1$$

where

"*e*" is the body of Universal Consciousness, ether, the foundation of existence;
"*i*" is the imagination of Universal Consciousness, the source of creativity; and
"*0*" is initial state of Universal Consciousness's mind; emptiness, nothingness.

To create light and the governing law, Universal Consciousness imagined and matrixized Its etheric body as follows:

$$\mathbf{1} = e^{i0} = e^{i0}e^{i0} = e^{-iL+iL}e^{-iM+iM} = (\cos L - i\sin L)(\cos L + i\sin L)e^{-iM+iM} =$$
$$\left(\frac{0}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{0}{E} + i\frac{|\mathbf{p}|}{E}\right)e^{-ip^\mu x_\mu + ip^\mu x_\mu} = \left(\frac{\mathbf{p}^2}{E^2}\right)e^{-ip^\mu x_\mu + ip^\mu x_\mu} = \left(\frac{E^2}{\mathbf{p}^2}\right)e^{-ip^\mu x_\mu + ip^\mu x_\mu} =$$
$$\left(\frac{E}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E}\right)^{-1}\left(e^{-ip^\mu x_\mu}\right)\left(e^{-ip^\mu x_\mu}\right)^{-1} \rightarrow \frac{E}{-|\mathbf{p}|}e^{-ip^\mu x_\mu} = \frac{-|\mathbf{p}|}{E}e^{-ip^\mu x_\mu} \rightarrow$$

$$\frac{E}{-|\mathbf{p}|}e^{-ip^{\mu}x_{\mu}} - \frac{-|\mathbf{p}|}{E}e^{-ip^{\mu}x_{\mu}} = 0 \quad \rightarrow \begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix} \begin{pmatrix} a_{e,+}e^{-ip^{\mu}x_{\mu}} \\ a_{i,-}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = 0$$

$$\rightarrow \begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathrm{E}_{0e,+}e^{-ip^{\mu}x_{\mu}} \\ i\mathrm{B}_{0i,-}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = 0$$

where **S** is photon spin (spin operator). The last equation is one form of the wave equation of a photon in relativistic quantum mechanics.

After the substitutions $E \rightarrow i\partial_t$ and $\mathbf{p} \rightarrow -i\nabla$, we have

$$\begin{pmatrix} i\partial_t & i\mathbf{s}\cdot\nabla \\ i\mathbf{s}\cdot\nabla & i\partial_t \end{pmatrix} \begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = 0 \rightarrow \begin{pmatrix} \partial_t\mathbf{E} = \nabla\times\mathbf{B} \\ \partial_t\mathbf{B} = -\nabla\times\mathbf{E} \end{pmatrix}$$

together with $\nabla\cdot\mathbf{E} = \mathbf{0}$ and $\nabla\cdot\mathbf{B} = \mathbf{0}$ are the Maxwell equations in the source-free vacuum.

It is plausible that the above process of creation is enabled in the human brain through spin-mediated consciousness functions and dynamics with further coupling to action potentials [1-9]. The experiments of Persinger's group [18, 25] may support this proposition if coincidental causes can be eliminated.

4. Omnipresence & Omniscience of Universal Consciousness

It is often said that Universal Consciousness has three Attributes: Omnipotence, Omniscience and Omnipresence. The latter two Attributes require Universal Consciousness to be everywhere at the same time within Its Creation. The question we have asked then is: Is there any experimental evidence/proof of a process or force which allows Universal Consciousness to be everywhere at the same time? [50]

The answer is "yes" and it is nonlocal cause such as quantum entanglement mediated process as experimentally shown in our own experiments [5, 6, 15]. The Experiments of Persinger's group [19-27] and perhaps some of other researchers [see, e.g., 28-47] also seem to support the Omnipresence and Omniscience of Universal Consciousness.

According to the Principle of Existence [12-14], such process or force is no other than the manifested universal force of gravitation. The idea of instantaneous gravity is nothing new. Newton's law of universal gravitation implies instantaneous "action at a distance" which he felt deeply uncomfortable with, but Newton was not able to find a cause of gravity [52]. Later Mach suggested that "[t]he investigator must feel the need of...knowledge of the immediate

connections, say, of the masses of the universe…[t]here will hover before him as an ideal insight into the principles of the whole matter, from which accelerated and inertial motions will result in the same way" [53]. Ontologically, Mach's above suggestion is a form of holism and implies that gravity is relational and instantaneous. It was Einstein who fulfilled Mach's "relational" suggestion of gravity by inventing general relativity [54]. However, such fulfillment may be at the sacrifice of Mach's "immediate connections" by assuming that the speed of gravity is the speed of light. However, gravity wave of linearized Einstein's field equation has not been detected.

On the other hand, we theorized in [8] that gravity originates from the primordial spin processes in non-spatial and non-temporal prespacetime, is the manifestation of quantum entanglement, and implies genuine instantaneous interconnectedness of all matters in the universe. Thus, the principle of non-local action is advocated. To certain degree, this view is a reductionist expression of Newton's instantaneous universal gravity and Mach's Principle with important consequences.

Importantly, we found experimentally that the weight of water in a detecting reservoir quantum-entangled with water in a remote reservoir can change against the gravity of its local environment when the latter was remotely manipulated [6]. If independently verified, these experiments demonstrated Newton's instantaneous gravity and Mach's instantaneous connection conjecture and the relationship between gravity and quantum entanglement.

In turn, instantaneous gravity as quantum entanglement provides scientific evidence in support of Universal Consciousness' Attributes of Omnipresence and Omniscience.

5. Michael Persinger and His Team's "God Helmet"

Wired Magazine published an article in 1999 entitled "This Is Your Brain on God" in which the author, Jack Hitt stated that "Michael Persinger has a vision - the Almighty isn't dead, he's an energy field. And your mind is an electromagnetic map to your soul" [56].

Persinger states at his website [55] that "[a]s a human being, I am concerned about the illusionary explanations for human consciousness and the future of human existence. Consequently after writing the Neuropsychological Base of God Beliefs (1987), I began the systematic application of complex electromagnetic fields to discern the patterns that will induce experiences (sensed presence) that are attributed to the myriad of ego-alien intrusions which range from gods to aliens. The research is not to demean anyone's religious/mystical experience but instead to determine which portions of the brain or its electromagnetic patterns generate the experience. Two thousand years of philosophy have taught us that attempting to prove or disprove realities may never have discrete verbal (linguistic) solutions because of the limitation of this measurement. The research has been encouraged by the historical fact that most wars and group degradations are coupled implicitly to god beliefs and to the presumption that those who do not believe the same as the experient are somehow less human and hence expendable. Although these egocentric propensities may have had adaptive significance, their utility for the species' future may be questionable."

Our own theoretical and experimental studies [1-15] have shown that: (1) human Consciousness is non-spatial and non-temporal and not in the brain but in prespacetime; (2) brain is an interface between human Consciousness and the external world; (3) quantum spin is the mind-pixel; (4) magnetic field is manifestation of the internal world based on the Principle of Existence [12-14].

Therefore, altered states of consciousness such as sensed presence and out-of-body experience whether they are produced by magnetic, electric or other stimulations or circumstances can be most effectively explained as the changes of the relative contents and/or intensities of the test subjects' neural quantum entanglement with their surroundings etc. (including possibly spiritual environments or information) [51].

Thus, interpreted from the perspectives of our own findings [1-15], Persinger's "God Helmet experiments" might not have proven that mystical experiences are a mere phenomenon localized in the material brain but can be explained as the non-spatial and non-temporal human Consciousness through the brain quantum-entangles with his/her environments possibly including the spiritual environment, thus, experiencing sensed presence, out-of-body etc.

In Ref. [17], Persinger and his team summarize their results as follows:

> *Quantitative EEG data indicate that a sequence of stimulation by between 1 and 5 uT fields at the scalp's surface with as little as 10% greater intensity over the right hemisphere compared to the left is associated with greater convergence of theta activity between the left temporal and right prefrontal region. Subsequent bilateral stimulation is associated with greater right-to-left temporal coherence. These two experimental conditions and quantitative EEG patterns are associated with reports of out-of-body experiences and the sensed presence, respectively.*
>
> *....*
>
> *The results and approaches of our research and those of Olaf Blanke both show that out-of-body-experiences and the sensed presence can be generated experimentally by stimulating either one or the other of the hemispheres within specific regions. The quality of the experiences, although direct comparisons have not been made, appears to be similar and the quantitative or meaningful intensity reveal similar values for individual salience.*
>
> *....*
>
> *[We] reviewed and re-analyzed the approximately 20 experiments involving 407 subjects that have demonstrated the experimental elicitation of either the sensed presence or out of body experience. [Our] re-analyses clearly showed the specific magnetic configurations and not the subjects' exotic beliefs or suggestibility was responsible for the increased incidence of sensed presences. The subjects' histories of spontaneous sensed presences before the experiment (and exposure to the magnetic fields) were moderately correlated with exotic beliefs and temporal lobe sensitivity. The side attributed to the presence at the time of the experience was affected by the parameters of the fields, the hemisphere to which they were maximized, and the person's a priori beliefs.*

In vivid terms one test subject in Persinger's experiment reported "I felt a presence behind me and then along the left side. When I tried to focus on the position, the presence moved. Every time I tried to sense where it was, it moved around. When it moved to the right side, I experienced a deep sense of security like I have not experienced before. I started to cry when I felt it slowly fade away ([Persinger] had changed the field patterns)" [17].

Also in vivid terms, another test subject reported an out-of-body experience stating "I feel as if there was a bright white light in front of me. I saw a black spot that became a funnel....no tunnel that I felt drawn into. I felt moving, like spinning forward through it. I began to feel the presence of people, but I could not see them. They were along my sides. They were colorless and grey looking. I know I was in the chamber but it was very real. I suddenly felt intense fear and felt ice cold" [17].

Persinger and his team reasoned that: "Our primary assumption is that consciousness and its variants of mystical states can be expressed as quantum phenomena. If consciousness and thought are coupled to electron movements, then a macroscopic manifestation should be congruent with the magnetic field strengths associated with neurocognitive activities. Access to the information within the movements of an electron, its fundamental charge, and the photon emissions associated with changes in electron movements, would allow mystical states and the information with which they are associated to have alternative interpretations that recruit the fundamental properties of space-time and matter" [17].

The above experimental results of Persinger and his team can be best explained by the spin-mediated consciousness theory [1-9] for the reasons stated below [10]:

(1) The primary targets of interactions for the weak pulsed magnetic field used by Persinger's Group are the nuclear and/or electron spins associated with the neural membranes, protein and water, etc. Indeed, neural membranes and proteins contain vast numbers of nuclear spins such as 1H, 13C, 31P and 15N.

(2) As we have experimentally demonstrated, pulsed electromagnetic field (photons) carries information through quantum entanglement from external substance (and environment) which they interacted with.

(3) Nuclear spins in the brain form complex intra- and inter-molecular networks through various intra-molecular J- and dipolar couplings and both short- and long-range intermolecular dipolar couplings. Further, nuclear spins have relatively long relaxation times after excitations.

(4) Quantum spin is a fundamental quantum process with intrinsic connection to the structure of space-time and was shown to be responsible for the quantum effects in both Hestenes and Bohmian quantum mechanics.

6. Human Consciousness

As stated earlier, our own theoretical and experimental studies [1-15] have shown that: (1) human Consciousness is non-spatial and non-temporal and not in the brain but in prespacetime; (2) brain is an interface between human Consciousness and the external world; (3) quantum spin is the mind-pixel; (4) magnetic field is manifested by the internal world based on the Principle of Existence [12-14].

So, what is human consciousness in the big scheme of things? Our answer is that human consciousness is a limited or individualized version of Universal Consciousness such that we have limited free will and limited observation/experience which is mostly classical at macroscopic levels but quantum at microscopic levels [12-14, 48]. For example, as a limited Universal Consciousness, we have through free will the choice of what measurement to do in a quantum experiment but not the ability to control the result of measurement (at least not until we can harness more abilities of our Universal Consciousness). That is, the result appears to us as random. On the other hand, at the macroscopic level, we also have the choice through free will of what to do but the outcome, depending on context, is sometimes certain and at other times uncertain. Further, we can only observe the measurement result in a quantum experiment that we conduct and experience the macroscopic environment surrounding us as the classical world [48].

Next, we focus on some of the details of how our experience is produced through the brain and how human free-will may operate through the brain [see 14-16].

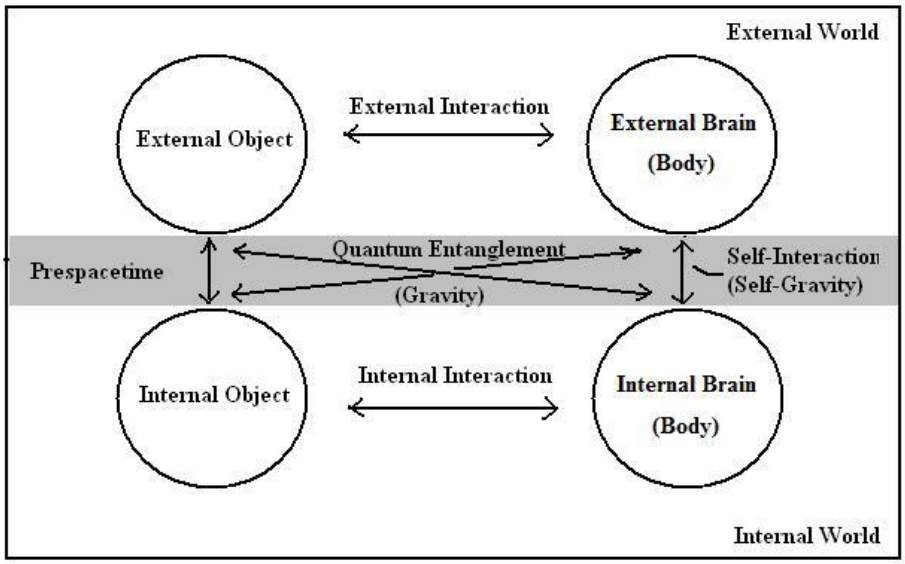

Figure 1 Interaction between an object and the brain (body) in the dual-world

As illustrated in Figure 1, according to the Principle of Existence, there are two kinds of interactions between an object (entity) outside the brain (body) and the brain (body). The first and commonly known kind is the direct physical and/or chemical interactions such as sensory input through the eyes. The second and lesser-known but experimentally proven to be true kind

is the instantaneous interactions through quantum entanglement. The entire world outside our brain (body) is associated with our brain (body) through quantum entanglement thus influencing and/or generating not only our feelings, emotions and dreams but also the physical, chemical and physiological states of our brain and body.

Importantly, quantum entanglement may participate in sensory experience such as vision, for example, as follows (keep in mind that an interaction with the external world is accompanied by its counterpart interaction with the internal world): (1) A light ray reflected and/or emitted from an object outside the brain enters the eye, gets absorbed, converted and amplified in the retina as propagating action potentials which travel to the central nervous system (CNS); (2) In the CNS, the action potentials drive and influence the mind pixels which according our theory is the nuclei such as protons with net nuclear spins and/or electrons with unpaired spins; and (3) Either the driven or influenced dynamic patterns of the mind-pixels in the internal world form the experience of the object, or more likely our visual experience of the object is the direct experience of the object in the external world through quantum entanglement established by the physical interactions. In the latter case, there is no image of the outside world in the brain. Further, in the case in which the object outside the brain is an image such as a photograph, there also exists the possibility that our visual experience is not only the experience of the photograph as such through quantum entanglement but also the experience of the object within the photograph through additional quantum entanglement. We hope that through careful experiments, we can find out which mechanism is actually true or whether both are true in reality.

The action potentials in the retina, the neural pathways and the CNS are driven by voltage-gated ion channels on neural membranes as embodied by the Hodgkin-Huxley model:

$$\partial_t V_m = -\frac{1}{C_m}\left(\sum_i (V_m - E_i) g_i\right) \tag{1}$$

where V_m is the electric potential across the neural membranes, C_m is the capacitance of the membranes, g_i is the ith voltage-gated or constant-leak ion channel (also see, Hu & Wu, 2004c & 2004d). The overall effect of the action potentials and other surrounding factors, especially the magnetic dipoles carried by oxygen molecules due to their two unpaired electrons, is that inside the neural membranes and proteins, there exist varying strong electric field **E** and fluctuating magnetic field **B** that are also governed by the Maxwell equation:

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} \boldsymbol{\sigma}\cdot\mathbf{E} \\ i\boldsymbol{\sigma}\cdot\mathbf{B} \end{pmatrix} = 0 \quad \text{or} \quad \begin{pmatrix} \partial_t\mathbf{E} = \nabla\times\mathbf{B} \\ \partial_t\mathbf{B} = -\nabla\times\mathbf{E} \\ \nabla\cdot\mathbf{E} = 0 \\ \nabla\cdot\mathbf{B} = 0 \end{pmatrix} \tag{2}$$

where we have set the classical (macroscopic) electric density and current $j^\mu = (\rho, \mathbf{j}) = 0$ inside the neural membranes. Further, for simplicity, we have not considered the medium effect of the membranes, that is, we have treated the membranes as a vacuum.

Microscopically, electromagnetic fields **E** and **B** or their electromagnetic potential representation $A^{\mu}=(\phi,\mathbf{A})$:

$$\begin{pmatrix}\mathbf{E}=-\nabla\phi-\partial_t\mathbf{A}\\ \mathbf{B}=\nabla\times\mathbf{A}\end{pmatrix} \tag{3}$$

interact with proton of charge *e* and unpaired electron of charge –*e* respectively as the following Dirac-Maxwell systems:

$$\left(\begin{pmatrix}E-e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A})\\ -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) & E-e\phi+m\end{pmatrix}\begin{pmatrix}\psi_{e,-}\\ \psi_{i,+}\end{pmatrix}=L_M\psi=0\right)_p \tag{4}$$

$$\begin{pmatrix}E & -\boldsymbol{\sigma}\cdot\mathbf{p}\\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E\end{pmatrix}\begin{pmatrix}\boldsymbol{\sigma}\cdot\mathbf{E}\\ i\boldsymbol{\sigma}\cdot\mathbf{B}\end{pmatrix}=\begin{pmatrix}-i\boldsymbol{\sigma}\cdot(\psi^{\dagger}\beta\boldsymbol{\alpha}\psi)\\ -i(\psi^{\dagger}\beta\beta\psi)\end{pmatrix}_p \tag{5}$$

and

$$\left(\begin{pmatrix}E+e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi+m\end{pmatrix}\begin{pmatrix}\psi_{e,+}\\ \psi_{i,-}\end{pmatrix}=L_M\ \psi=0\right)_e \tag{6}$$

$$\begin{pmatrix}E & -\boldsymbol{\sigma}\cdot\mathbf{p}\\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E\end{pmatrix}\begin{pmatrix}\boldsymbol{\sigma}\cdot\mathbf{E}\\ i\boldsymbol{\sigma}\cdot\mathbf{B}\end{pmatrix}=\begin{pmatrix}-i\boldsymbol{\sigma}\cdot(\psi^{\dagger}\beta\boldsymbol{\alpha}\psi)\\ -i(\psi^{\dagger}\beta\beta\psi)\end{pmatrix}_e \tag{7}$$

where β and $\boldsymbol{\alpha}$ are Dirac matrices.

In equations (4) and (6), the interactions (couplings) of **E** and/or **B** with proton and/or electron spin operator $(\boldsymbol{\sigma})_p$ and $(\boldsymbol{\sigma})_e$ are hidden. But they are due to the self-referential Matrix Law which causes mixing of the external and internal wave functions and can be made explicit in the determinant view as follows. For Dirac form, we have:

$$\begin{aligned}&\left(\begin{pmatrix}E-e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A})\\ -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) & E-e\phi+m\end{pmatrix}\begin{pmatrix}\psi_{e,-}\\ \psi_{i,+}\end{pmatrix}=L_M\psi=0\right)_p\\ &\rightarrow\left(\begin{vmatrix}(E-e\phi-m)(E-e\phi+m)- & \\ (-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}))(-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}))\end{vmatrix}I_2\psi_{e,-}\psi_{i,+}^{*}=0\right)_p\\ &\rightarrow\left(\left((E-e\phi)^2-m^2-(\mathbf{p}-e\mathbf{A})^2+e\boldsymbol{\sigma}\cdot\mathbf{B}\right)I_2\psi_{e,-}\psi_{i,+}^{*}=0\right)_p\end{aligned} \tag{8}$$

For Weyl (chiral) form, we have:

$$\begin{aligned}
&\left(\begin{pmatrix} E-e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) & -m \\ -m & E-e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) \end{pmatrix}\begin{pmatrix} \psi_{e,r} \\ \psi_{i,l} \end{pmatrix}=0\right)_p \\
&\rightarrow \left(\left((E-e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}))(E-e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}))-m^2\right)I_2\psi_{e,r}\psi_{i,l}^{*}=0\right)_p \\
&\rightarrow \left(\left((E-e\phi)^2-m^2-(\mathbf{p}-e\mathbf{A})^2+e\boldsymbol{\sigma}\cdot\mathbf{B}\text{-}ie\boldsymbol{\sigma}\cdot\mathbf{E}\right)I_2\psi_{e,r}\psi_{i,l}^{*}=0\right)_p
\end{aligned} \tag{9}$$

These two couplings are also explicitly shown in Dirac-Hestenes formulism or during the process of non-relativistic approximation of the Dirac equation in the present of external electromagnetic potential A^{μ}. We can carry out the same procedures for an electron to show the explicit couplings of $(\boldsymbol{\sigma})_e$ with **E** and **B**.

One effect of the couplings is that the action potentials through **E** and **B** (or A^{μ}) input information into the mind-pixels in the brain [3, 7-9]. Judging from the above Dirac-Maxwell systems, we are inclined to think that said information is likely carried in the temporal and spatial variations of **E** and **B** (frequencies and timing of neural electric spikes and their spatial distributions in the CNS). Another possible effect of the couplings is that they allow the transcendental aspect of Consciousness through wave functions (the self-field) of the proton and/or electron to back-influence **E** and **B** (or A^{μ}) which in turn back-affect the action potentials through the Hodgkin-Huxley neural circuits in the CNS [see, 7-9].

We have speculated about how human free-will as a macroscopic quality of limited Universal Consciousness may originate microscopically under the particular high electric voltage environment inside the neural membranes [7-9, 12-14]. For example, one possibility is that the human free will as thought or imagination produces changes in the phase of external and internal wave functions:

$$e^{i0}=e^{-i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})+i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})}=\left(e^{-i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})}\right)_e\left(e^{+i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})}\right)_i \tag{10}$$

where $(\ )_e$ and $(\ )_i$ respectively indicate external and internal wave functions, which in turn back-affect **E** and **B** (or A^{μ}) in the high electric voltage neural membranes through the Dirac Maxwell systems illustrated above.

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