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Research Paper

Super Imposing Psycho-Electromagnetic Waves/Telepathic Waves on Individual Consciousness. During This Phenomena Which Brain Centers/ Bioplasmic Channels are Being Activated

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ABSTRACT

ACTIONS happen through consciousness. British researchers believe that experimental findings suggest consciousness could exist in the absence of a functioning brain. Many seekers testify to this observation that the microcosm is the macrocosm in miniature. Growth in the real sense enables a person to 'see' (or experience) the untapped potential. Energy can take many forms and may be transformed into various other forms. They may be electromagnetic physical waves or psychic waves of the combined unified electro-magnetic waves plus psychic waves which are termed as "Psycho electromagnetic Waves".

Keywords: *Psycho-Electromagnetic Waves, Telepathic Waves, Individual Consciousness, Phenomina, Brain, Bioplasmic Channels*

Can conscious experience – feelings, phenomenal qualia, and our 'inner life' – be accommodated within present – day science?

Those who believe it can (e.g., proponents of phsycalism, reductionism, materialism, functionalism, computationalism) see conscious experience as an emergent property of complex computation in networks of brain neurons. In these approaches consciousness is viewed as a higher order effect emerging from lower level, non-conscious entities**.**

Others believe consciousness cannot be accommodated within present day or future sciences. Cartesian dualists see consciousness and physical matter as separate and irreconcilable. A modern version of dualism is 'mysterianism' or cognitive closure, which suggests that consciousness exists within science but cannot be understood by conscious beings, and we should stop worrying about it.

A third set of philosophical ascribes to consciousness (or its precursors) ontological status as a foundational component of reality. These positions (e.g. panpsychism, pan-experimentialism, idealism) relate consciousness to irreducible ('funda-mental') components

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of reality, something akin to mass, spin or charge. These views take consciousness to be present in low level entities, in which-on some readings- they inherently contain a phenomenal nature or subjective experience (qualia). Consciousness or its 'proto-conscious' precursors are thus somehow built into the structure of the universe- a view that we might label *pan-protopsychism.*

Most of these views are monist in nature. In that they take reality to be, ultimately, a single entity or substance. At issue, then, are two key points; 1) the essential characteristic(s) of the monist substance, and (2) how it gives rise to apparently diverse entities like 'mind' and 'matter'. If the one reality is essentially mind-like, then we have a form of idealism-which may or may not entail panchism. If it is essentially physical or material, physicalism obtains.

Alternatively, the one reality can be seen as something other than mind or matter, in which case we have a form of neutral monism; Spinoza, James, and Russell are typically cited as holding this view. A contemporary form of neutral monism- one defended in this paper- defines the one reality in terms of *quantum space-time geometry*, i.e., as a consequence of the fine-grained structure of the universe. Figure 1 summarizes the situation.

The 20th century rise of computation and cognitive science cast consciousness- mind, the mental-as a computational processing of discrete (e.g. digitized) information. Regarding 'the physical' advances in the string theory, quantum field theory, quantum geometry and other approaches attempt to account for the fine structure of the physical world differently, but are all based on discrete quantized units of information.

Wheeler (1994), Smolin (2001). Lloyd (2008) and others have suggested in various ways that information is fundamental to the nature of reality, and that in some sense the universe is composed of interactive information processing-that the universe is, in essence, a computer.

Applying an information-based reality to neutral monism, Bateson (1970), Bohm (1986), Wheeler (199) and Chalmers (1996) proposed dual-aspect panphychist (or near panphychist) theories in which information has both a) psycho/experimental/mental, and b) physical/material aspects. But the question remains : How specifically, are these two aspects related? What is the connection between them?

This notion of a connection or bridge between mind and matter has been examined at least since the 1920s. Harvard philosopher Leonard Troland (1922) speculated about "psycho-physical bridging principles" as a way of unifying the two and of putting mind on firm theoretical foundations. Chalmers later adopted this notion, combining with an information based ontology to arrive at a tentatively panphychist theory of mind. But neither of these two men elaborated on the nature of this bridge, nor how it might function.

We propose that a pathway to understanding might be found in identifying both sides of the bridge, and the nature of the connection, i.e., that the bridge itself. We attempt to describe the psycho-physical bridge using the Penrose-Hameroff Orch OR theory of consciousness. The underlying psycho/experimential/mental side that embeds proto-conscious experience is described in the physics of the universe. The physical/material side resides in the brain-specifically, in quantum electron dipole states mediating computations in microtubules and other biomolecular structures involving in consciousness. The connection between the two sides- the psycho-physical bridge-is a specific process called Penrose objective reduction (OR), a proposed threshold for quantum state reduction inherent in Planck scale quantum geometry.

Pan-protopsychism thus becomes the most accurate picture of our universe. Orch OR describes how well-understood neuronal-level functions (e.g., axonal firings, synaptic transmissions, dedritic synchrony) 'orchestrate' quantum computations in microtubules within brain neuronal interiors. The quantum computations reduce to classical solutions by Penrose OR, connecting brain functions to Planck scale quantum geometry which may embed proto conscious experimential qualities. Orch OR events are correlated with gamma synchrony EEG occurring roughly 40 times per second, conceptually; these may be seen as equivalent to Whitehead's "occasions of experience".

Discrete conscious moments and quantum state reductions.

Pan-experiential philosopher Alfred North Whitehead (1929; 1933) viewed the universe as comprised nit of things, but of events-in other words, as a process. Two centuries earlier, Leibniz (1714) had quantized reality, describing fundamental 'monads' as the ultimate entities of reality, but Whitehead transformed monads into "actual occasions" occurring in a" basic field of proto-conscious experience." Whitehead's occasions are spatio-temporal quanta, each endowed-usually on ver low level-with mentalistic characteristics like "experience, subjective immediacy, and appétit ion." In his view, highly organized collections ("societies") of occasions permit primitive mentality to become intense, coherent and fully conscious.

But Whitehead's theory of mind is counterintuitive: is consciousness indeed quantized, composed of discrete events? Trained Buddhist meditators describe distinct "flickering" in their experience of reality. Buddhist text portray consciousness as "momentary collections of mental phenomena," and as 'distinct, unconnected and impermanent moments which perish as soon as they arise." Our normal conscious experience seems continuous, but so does a motion picture-even though we know it to be composed of discrete frames. There is no doubt that we perceive motion pictures as continuous despite their actual 'quantum' structure. Perhaps consciousness is the same.

Some Buddhist writings even quantify the frequency of conscious moments. For example the *Sarvaastivaadins* (von Rospatt 1995) describe 6,480,000 'moments' in 24 hours (an average of one moment per 13.3 msec), and some Chinese Buddhists as one 'thought' per 20 msec. others describe the duration of a conscious moment as "$1/64^{th}$ snap of a finger". All these are consistent with gamma synchrony.

William James (1890) initially considered consciousness a sequence of 'specious moments' but later embrace the idea of continuous 'streams of consciousness'. The 'perceptual moment' theory of Stroud described consciousness as discrete events, rather like sequential frames of a movie. 1. Evidence in recent years suggests periodicities for perception and reaction times in the range of 20 to 50 milliseconds (gamma EEG waves; 30 to 90 Hz) and another in the range of milliseconds (alpha and theta EEG waves; 3 to 7 Hz), the latter consistent with saccades and the visual gestalt (Van Rullen and Thorpe 2001). Regarding visual consciousness, several author groups (Woolf and Hameroff 2001; Van Rullen Koch 2003) have suggested that integrated visual perceptions are a series of fast gamma waves (each corresponding to specific component of vision, e.g., shape, color, motion, meaning) riding on a slower, e.g., theta wave. Similarly, Freeman (2006) has characterized theta waves steps with fine scale cortical dynamics as video-like frames of conscious content.

Using visual consciousness as an example, if we equate the visual gestalt with a cinematic scene, consciousness may be considered sequences of scenes (~3 to 7 scenes per second), each composed of sequences of individual frames (~10 to 30 frames per scene, hence 40 or more frames per second). Gamma frequency frames could relate to Whitehead's low-level mental occasions, and theta frequency scenes to his 'intense, coherent and fully conscious' occasions.

If so, what are 'occasions of experience'; what is the 'basic field of proto-conscious experience'; and how does the brain fit in? What underlying process correlates with synchronized gamma and theta frames and scenes? Abner Shimony (1993; 1997) recognized that Whitehead's approach was potentially compatible with modern physics, specifically quantum theory, and suggested that quantum state-reductions actual physical events-could represent Whitehead's "occasions".

Brain Computer Interface: is a direct communication pathway between a brain and an external device. There are several types of brain-computer interfaces that are reported. One of the techniques uses implanting electrodes inside the brain, called invasive and the other is non-invasive which include haptic controllers and EEG scanners. The basic purpose of these devices is to intercept the electrical signals that pass between the neurons in the brain and translate them to a signal that is sensed by external devices. Neurons fire electrical impulses in the brain which are captured by an electrode that is inserted directly into the cerebral cortex (invasive), or that are in contact with the scalp (non-invasive). Other methods of capturing brain signals include electroencephalography (EEG) and magneto encephalography (MEG). The methods are not in use but are being considered include magnetic resonance imaging (MRI) and near infrared spectrum imaging (NIRS) to provide analysis of brain wave and chemical patterns, but are currently impractical due to their size [29]. The most commonly used signal that is identified and captured with EEG method is called the P300 wave. The P300 is an event related potential, a BCI can directly translate a persons' intent to electrical commands that control artificial devices [30]. The applications of BCI have extensions into many fields like medicine, military, manufacturing, gaming, and communications.

EEG based BCI: a common method for designing BCI is to use EEG signals extracted during mental tasks. EEG is the recording of electrical activity along the scalp produced by the firing of neurons within the brain. EEG refers to the recording of the brains spontaneous multiple electrodes placed on the scalp.

Tensor mapping of Data: A tensor is a multidimensional or N-way array. A first-order tensor is a vector; a second-order tensor is a matrix and tensors of order three or higher is called higher-order tensor. The need for such a theory is motivated by the fact that there are many physical quantities of complicated nature that cannot naturally be described or represented by scalars or vectors. These quantities can be described and represented only by the more sophisticated mathematical entities called tensors. The scalars and vectors are special cases of tensors.

Since original tensors are high dimensional they have to be summarized in to smaller tensors to save space and to detect patterns. Tensors based dimensionality reduction methods like PARAFAC or TUCKER3 can be used which gives better performance than two dimensional Principal Component Analysis.

Decompositions of higher-order tensors have applications in psychometrics, chemo-metrics, signal processing, numerical linear algebra, computer vision, numerical analysis, data mining, neuroscience, graph analysis, etc.

A tensor-based scheme for single trial EEG classification in BCI can be introduced. Firstly, EEG signals can be represented as third order tensors in the spatial-spectral-temporal domain by wavelet transform. Then, a regularized tensor discriminant analysis (RTDA) algorithm can be used for a multi-way discriminative subspace extraction from tensor-represented EEG data. This scheme includes the structural information in multi-channel time-varying EEG spectrums endorsed by tensor representation, and improves the performance for EEG classification. It has great potential for the practical application of BCI.

Latest work done around the proposed area (Literature survey):

The quantum/classical divide.

The material reality we perceive is the physical side of the psychophysical bridge. But upon introspection, physical reality appears to derive from a deeper, non-material quantum level. The everyday 'classical' word is composed of matter and energy following Newton's laws of motion, Maxwell's equations for electromagnetism, and other predictable behaviors. At small scales, however, the bizarre laws of quantum mechanics reign. Atoms and sub-atomic quantum particles may exist in two or more states or places simultaneously, more like waves than particles, and existing as multiple coexisting wave-like possibilities in our everyday, classical world. We see objects and particles as definite, classical material things in specific locations and states. Even when we measure atomic and sub-atomic system they behave classically. The issue of why we don't see quantum superposition in our everyday classical world is known as the 'measurement problem', which has led to various interpretations of quantum mechanics (discussed below).

Another problem is 'entanglement', or quantum coherence, in which components of a system become unified, governed one common quantum wave function. If one member of an entangled system is measured or perturbed, other members are instantaneously affected, even over great distances.

One example of entanglement is the famous 'ERP pairs' (after Einstein, Podolsky and Rosen, who posed the problem as a thought experiment in the 1930's). Imagine two members of a quantum system (e.g., two electrons with complimentary spin down, and vice versa). If the paired electrons (both in superposition of both spin up and spin down) are separated by being sent along different wires, say to two different villages' miles apart from each other, they each remain in superposition. However when one super positioned electron is measured by a detector at its destination and reduces/collapses to a particular spin, (say spin up), its entangled twin miles away *instantaneously* reduces/collapses to the compliment (spin down). The nonlocal effect has been verified with electron spin pairs, polarized photons and other quantum systems but remains unexplained. 2. Entire clouds of millions of atoms have been entangled. Non-local entanglement-referred to as 'quanglement' by Penrose-remains a fundamental mystery.

Another form of entanglement occurs in quantum coherent systems such as Bose-Einstein condensates in which a group of atoms or molecules surrender individual identity and are governed by a single quantum wave function. If one component is perturbed, all components 'feel' it and act accordingly.

Quantum superpositions and entanglements have very practical consequences; they are used technologically in quantum information processors. Conventional classical computers represent digital information as 'bits' of either 1 or 0, in quantum computers information may be represented as quantum superpositions of both 0 *and* 1 (quantum bits or 'qbits'). While in superposition qbits interact with other entangled qbits, allowing computational interactions of enormous speed and near-infinite parallelism.

During quantum computation, the superposed entangled system must be isolated from the environment to avoid decoherence- a loss or degradation of quantum properties. After the quantum computation has run, qbits are 'measured', i.e., exposed to the classical environment, which causes an abrupt loss of superposition (state reduction/collapse), reducing qbit value to specific classical states (1 or 0) which constitute the solution. Measurement-induced reduction (like decoherence) introduces and randomness in the choice of particular classical state outputs (the randomness is overcome by redundancy). Quantum cryptography and quantum teleportation also utilize quantum superposition and entanglement, and promise to revolutionize information processing.

However, the underlying mechanisms remain unknown. What does it actually mean for an object to be in two or more places or states simultaneously? How can nonlocal entanglement occur? What happens to isolated quantum superpositions?

Experiments near the turn of the 20th century seemed to show that the multiple possibilities in quantum superpositions persisted until observed by a conscious human. This led prominent quantum theorists like Bohr, Heisenberg and Wigner to conclude that consciousness caused quantum state reduction, that consciousness 'collapsed the wave function' (this is the so-called Copenhagen interpretation, reflecting the Danish origin of Nils Bohr, its leading proponent). This pragmatic approach allowed quantum systems to be studied successfully, putting aside both consciousness and underlying reality.

Modern interpretations consider any interactions of superposed systems with the classical environment to cause loss of superposition and to 'decohere' the quantum state to randomly chosen classical states. But again, the fate of *isolated* superpositions is unknown.

Another approach is the 'multiple worlds' hypothesis which assert that every superposition is a *separationin the universe itself,* and that each possibility evolves into its own universe. 3. Hence there exist an infinite number of worlds co-existing in perpetual superposition.

David Bohm (e.g., Bohm and Hiley 1993) proposed that the wave function contains active information which guides the movement of particles, and that consciousness was associated with active information. Both Bohm and the multiple worlds view avoid quantum state reduction, or collapse of the wave function. Hennery Stapp's view (Stapp 2004) identifies consciousness with collapse/reduction.

Some theories propose an objective threshold for quantum state reduction, hence 'objective reduction' (OR), one such OR threshold was proposed by Ghirardi, Remini and Webber, who suggested that spontaneous self-collapse occurs when a critical number of particles are superpositioned. Subsequent experiments, however, have failed to confirm their threshold.

The 'objective reduction' of Roger Penrose is, at its base, similar to the multiple worlds view in which each superposition is a separation in the underlying fabric of the universe, expressed as quantum space-time geometry. But according to Penrose the space-time separations are unstable and will spontaneously self-objective threshold degree of separation. These OR events are quantum level processes-ripples-in the fundamental geometry of the universe. Penrose proposed that such objective reductions were essential to consciousness.
So: What is the fundamental geometry of the universe?

The psycho/experimental side of the psycho-physical bridge: quantum space-time geometry

Atoms, atomic nuclei and electrons occupy only a small fraction of an atom's volume-mostly of an atom is empty space. What is empty space?

Democritus (circa 400 BCE) described empty space as a true void, where as Aristotle saw a background of "plenum" filled with substance. Maxwell's 19th-century "luminiferous ether" sided with Aristotle, but attempts to detect the ether failed. Furthermore, Einstein's special relativity suggested that there was no background pattern or structure at all. However, Einstein's general relativity related mass to curvature in a geometric space-time 'metric', and swung the pendulum back to the view of an underlying pattern in 4-dimensional space-time. Where, then, is the pattern? At what level of the universe could quantized information occur and interact?

As we go down in scale from the size of atoms (10-8 centimeters), space-time is smooth and featureless until eventually we find granularity at the incredibly small 'Planck scale' of space and time (10-33 centimeters 10-43 seconds). The Planck scale is the basement level of reality- the ground floor, if you will.

The best description of Planck scale geometry is through *loop quantum gravity* related to Penrose spin networks. (In comparison, string theory attempts to describe particles and energy through vibrating strings, but does not include the background medium in which the strings vibrate.) Penrose portrayed the Planck scale as a dynamical web of spin networks.

Taking spin as a irreducible, fundamental entity, spin networks define spectra of discrete Planck scale volumes and configurations which dynamically evolve and define space-time geometry. Smolin (2001) has described quantum spin network as continually evolving, as being in way alive. They may also quantify to Whitehead's 'basic field of protoconscious experience.'

The amount of potential in Planck scale spin networks is vast; each Planck scale volume, or 'pixel of reality', may be shaped by a huge variety of combinations of 'edge' lengths, number of spins per edge, and nonlocal interactions. In addition to the enormous potential variety in each Planck scale pixel, their sheer number compared to our macroscopic scale is enormous-there are roughly 10107 Planck volumes or pixels in the volume of human brain, far greater than the number of particles in the universe.

Whether or not spin networks, twister theory, loop quantum gravity or other approaches are correct, the fine structure of the universe is constructed of Planck scale quantum geometry whose configurations and dynamics lead to all matter and energy. Other avenues have

suggested a holographic arrangement, so that Planck scale patterns and information may recur, fractal-like, at various larger scales.

If consciousness derives from fundamental, irreducible entities (e.g., 'proto- conscious qualia'), they should be embedded in Planck scale geometry. Where else *could* they be embedded? Fundamental space-time geometry is all there is! Quantum geometry is the prime candidate to contain proto-conscious experience. But a huge question remains: How could it connect to the brain to produce the richness of conscious experience?

Penrose OR- the conscious connection

Penrose OR is a theoretical construct which addresses several issues. It is a proposed solution to the measurement problem in quantum mechanics, explaining the fateof isolated quantum superpositions. It ties together quantum mechanics and general relativity, two branches of science which have been irreconcilable. And it offers an accounting of consciousness as a sequence of discrete events, each event being an objective reduction occurring in the brain.

Penrose Or is one way similar to Everett's multiple worlds views, in which each superposition is a separation in underlying reality, i.e., with each and every superposition the universe bifurcates, or separates, with each possibility of branching off to form a new universe, a new reality. Thus, according to this view, there exist an infinite number of universes. For the Schrodinger's cat story (i.e., assuming superposition of such a microscopic object is possible), each time the box is opened the universe bifurcates into one universe with a live cat, and another universe with a dead cat. But how are we to envision the universe- the fabric of reality-separating from itself?

For illustration we can ignore the details at the Planck scale and condense 4-dimensional space-time into a 2-dimensional space-time sheet: one spatial dimension and one time dimension. This space-time is slightly curved, in accordance with Einstein's general theory of relativity, in a way which encodes the gravitational fields of all distribution of mass density. Each mass density-each object or particle- affects a space-time curvature, albeit tiny for small objects.

The idea of large objects causing large space-time curvature is familiar. Einstein had predicted that the space-time curvature of our sun would bend light from stars, distorting their position from our vantage point. Some 50 years after this prediction, Sir Arthur Eddington made the critical observations during a solar eclipse to prove Einstein's hypothesis. However, the idea of small, quantum objects causing small space-time curvatures was first put forth by Penrose.

Consequently we can view any mass in one location as space-time curvature in a particular direction, and location of the mass in a different location as space-time curvature in another direction. Therefore quantum superposition of a particle in two locations may be considered simultaneous curvatures in opposite directions (Penrose 1989; 1994). As in the multiple worlds view, the space-time sheet separates into two opposing curvatures, resulting in a 'bubble' or a 'blister' in underlying reality.

Strictly speaking the separations cannot be considered to have any true 'width', or 'length', as space-time defines its dimensions, rather than exists in dimensions. However, metaphorically we can consider that the distance between the separated space-time (width) is

on the order of a Planck length (10-33 centimeters) or larger, or the distance over which mass separation distance e.g., nanometers (10-8 centimeters) or larger, or the distance over which mass separation distance occurs (e.g., ~10 centimeters, as may occur in the brain). That such 'narrow' separations have significant consequences may seem surprising. However, an anology may be drawn to earthquakes in which the earth separates only slightly, but over a great length or fault line, with significant consequences.

In the multiple worlds view, each possible space-time sheet-each side of the blister- evolves into a separate universe. In Penrose's view these separation's, bubbles or blisters are, however, unstable; somewhat like soap bubbles, they will eventually reduce, or collapse, to one particular curvature or the other, with the reduction's occurring virtually instantaneously-actual events producing definite classical reality from quantum possibilities. The instability is inherent in the properties f space-time geometry (quantum gravity) and constitutes an *Objective* threshold for an isolated quantum state reduction, hence 'objective reduction', 5. This whole process has a direct bearing on the mind. Penrose proposed that objective reductions *are conscious*, and convey experiential qualities and conscious choice. Hameroff and Penrose (1996b) proposed this occurred due to pan-experiential qualities embedded in Planck scale geometry-that which we are calling pan-protopsychism. As actual events occurring in a medium which may be construed as a 'basic field of proto-conscious experience', Penrose OR qualifies as Whitehead an occasions (as suggested by Abner Shimony), and provide a psycho-physical bridge between pan-experiential quantum geometry and brain. But where in the brain are OR events able to interface? What is the physical (brain) side of the psycho-physical bridge?

The biological side of the psycho-physical bridge-the Orch OR model.

A connection from the Planck scale to the brain- a psycho-physical bridge-implies influences scaling up from infinitesimally tiny lengths and energies to result in conscious perceptions and choices, and hence casual efficiency in the classical world. To bridge this daunting chasm of scale, a quantum lever or amplifier must exists in the brain which is sensitive to Planck scale influence, and able to control or regulate neuronal processes relevant to consciousness. If we assume consciousness emerged during evolution, such functional quantum effects in bio-molecules must have preceded consciousness, and have played (continue to play) some general role in biological systems. Yet technological quantum devices must be isolated to near absolute zero to prevent decoherence. How can quantum systems control high energy molecules? It appears that isolated quantum zones exist within bio-molecules, forming extended quantum phases in living systems (Hameroff 2008).

Proteins, lipids and nucleic acids based on carbon chemistry are the primary components of organelles and cells. They are described by various characteristics, one being solubility- a molecule's ability to dissolve in a particular solvent. Water is the major solvent in the bio-molecular systems.

Water is a *polar* molecule, with exposed electrical charges (positive on one end, negative on the other) allowing charge interactions with neighboring waters and charged molecules. Organic bio-molecules generally have charged groups on their exterior surface which interact with and dissolve in water, and are referred to as 'hydrophilic' (water-loving).

Another type of solvent, e.g., benzene, is *non-polar*, hence oil-like, or fatty. This type excludes water (oil and water do not mix), and is referred to as hydrophobic (water-fearing).

Organic bio-molecules are generally 'amphiphilic', e.g., having both polar and non-polar regions. *Exterior* surfaces of bio-molecules are polar, hydrophilic and water soluble. Within *interiors* of sufficiently large bio-molecules are regions which are non-polar, hydrophobic and oil-soluble. Extended non-polar hydrophobic phases develop when bio-molecules assemble and organize into structures and organelles. Lipid membranes contain an internal hydrophobic planar layer composed of non-polar groups in cholesterol and other lipids.

Proteins have internal non-polar 'hydrophobic pockets' composed of amino acid residues (including the electronic ring structures of amino acids tryptophan, tyrosine and phenylalanine). These arrangements enable electron resonance effects in non-polar regions throughout bio-molecules, organelles, cells and organisms. Most importantly, within this phase, quantum effects are shielded from decohering interactions with the polar environment. As real time engines of living systems, proteins provide movement, force and information processing. Protein ion channels, enzymes, receptors, cytoskeletal proteins all function by a process of *conformation*, or shape changing. For many proteins, conformation is a delicate balance between countervailing chemical energies, such that quantum (London) forces in hydrophobic pockets are pivotal.

These quantum forces are essential to consciousness, as evidenced by the action of anesthetics gas molecules. Anesthetic gas molecules selectively erase consciousness, sparing other brain activities. They bind by London forces in non-polar, hydrophobic pockets in a group of brain proteins (receptors, channels, components of cytoskeletal microtubules, etc.). Presumably, such subtle quantum actions prevent or inhibit the normally-occurring quantum forces required for consciousness.

Hydrophobic pockets must be large enough for anesthetic gases to fit, thus during anesthesia quantum processes due to electron resonance in smaller non-polar regions continue, perhaps essential to non-conscious life functions. Cooperative resonance and entanglement among quantum forces in bio-molecular assemblies have been proposed as an underlying mechanism of living systems (Hameroff 2008).

Among anesthetic-sensitive proteins, *tubulin*-the constituent protein of *microtubules*-is arrayed in geometric lattices particularly suited to computation.9 The Penrose-Hameroff model of 'orchestrated objective reduction' (ORCH OR) proposes that neuronal processes potentially related to consciousness may be regulated by quantum computations occurring in cytoskeletal microtubules within the brain's neurons. These processes are isolated and shielded from environmental decoherence by a variety of evolutionary adaptations (Hameroff and Penrose 1996a, 1996b; Hagan et al 2002).

An essential feature of the Penrose-HameroffOrch OR model is that tubulins become quantum superpositions of alternative conformations, and function as qbits by interacting nonlocally (entangling) with other tubulin qbits so that microtubules act as quantum computers. Microtubules whose tubulins are in quantum superposition in particular neurons via quantum tunning across window-like 'gap junctions' gamma synchrony EEG, the best measurable correlate of consciousness.

Microtubules exist in all our cells, but only in the brain (presumably) are sufficiently large number of tubulins isolated from decoherence and entangled to reach threshold (by $E=h/t$) I reasonably short times, and thus to manifest consciousness.

When enough entangled tubulins are super positioned long enough to reach OR threshold (by $E=h/t$), a conscious event (Whitehead an 'occasion of experience') occurs. The classical tubulin states chosen in the OR event proceed to regulate classical neural activities, e.g. trigger axonal action potentials, adjust synaptic strengths and rearrange the cytoskeleton, thus exerting causal efficacy, learning and memory.

Gamma synchrony EEG correlating with consciousness is on the order of 25 milliseconds (1/40th second). For OR/Whitehead events in the brain to correspond with gamma-synchronized events we can use $E=h/t$ and set t = 25 milliseconds (coherent 40 Hz). $E$is then equivalent to superposition/separation of approximately 2 x 1010 tubulins. Estimating for the percentage of tubulins per neuron involved in consciousness gives roughly *10,000 to 100,000 neurons* involved in each gamma-synchronized OR/Whitehead/conscious event.

Thus Orch OR provides a possible connection between quantum space-time geometry—a possible repository of proto-conscious experience—and brain processes regulating consciousness.

Consciousness in the universe

Consistent with a general framework of neutral monism, a pan-protopsychist Orch OR places precursors of consciousness in Planck scale quantum geometry, the most basic level comprising the universe. Such precursors are presumably embedded in some way as *discrete information states*, along with other entities that give rise to the particles, energy, charge and/or spin of the classical world.

For Orch OR to be logically consistent, any quantum state reduction occurring via Penrose OR as determined by $E=h/t$ would comprise a moment of conscious experience—a quantum of consciousness, a Whitehead an 'occasion of experience'—regardless of whether it occurred in a brain, a biological system in general, or an inanimate object. Aside from biological brains, where else in nature might this occur? Is consciousness happening 'here and there' throughout the universe?

It turns out that the conditions for $E=h/t$ are rather stringent. $E=h/t$ means that superpositions which persist long enough (avoiding decoherence) to reach a time threshold t will collapse to classical states with a moment of conscious experience. Because E and $t$are inversely related, larger superpositions (larger E) will reach threshold sooner, i.e. with shorter time t. Smaller superpositions (smaller E) will require longer times t. In all cases, environmental decoherence resulting in loss of quantum superposition must be avoided long enough to reach threshold t for consciousness. Decoherence may be avoided through shielding and screening isolation, active pumping (e.g. lasers), quantum error correction topologies and/or decoherence-free subspaces (Hagan et al 2002).

A single electron in superposition has a very small E, and would require a very long t—about 10 million years—to reach threshold. If a super positioned electron avoided decoherence for 10 million years, according to Orch OR it would have a moment of consciousness.E is also purported to relate to the intensity of the experience, so the electron's moment of awareness would be extremely dull (analogous to a low energy, long wavelength photon). A large system in superposition (large E) would have a very brief t, and a high intensity example, superposition of one kilogram rock avoiding decoherence would reach threshold for OR after

only 10-12 seconds, and have a high intensity conscious moment. Does this imply a rock could be conscious, perhaps conscious (higher intensity) than we humans?

Probably not. Rocks are composites of various types of atoms bound together by strong covalent bonds allowing little flexibility for influence by quantum processes. Electrons and other quantum-level particles comprising the structure of a rock are generally tied up in these chemical bonds, and mobile electrons within the rock have a little or no influence on other components (unlike the situation in anesthetic-sensitive proteins whose conformation is leveraged or amplified by activities of electrons).

Another consideration is what 'superposition' of a rock would actually mean. Would a rock be separated by itself as one object, or separated at the level of its constituent atoms or sub-atomic particles? Large scale superpositions are more readily obtained in crystal-like structures composed of geometric arrays of one type of atom particle.

Consider a particular type of rock made entirely of carbon atoms in a crystal-like structure of benzene-type rings with delocalizable electrons('graphene')- otherwise known as diamonds. Indeed, quantum spin effects occur in a diamonds at room temperature. However, only the mobile electrons within the diamonds are in quantum superposition, as the carbon nuclei are held rigidly in the classical structure. Because of their low mass (small E), $E=h/t$, electrons in superposition within a diamond (assuming they avoided decoherence caused by, e.g., light passing through it) would require a very long time to reach threshold for OR and a conscious moment- something like 1 year for 10 million superposition electrons.

On the other hand, Penrose observed that interiors of neutron stars may have huge quantum superpositions which would reach OR with very large E, brief t and high intensity. 12 By Orch OR criteria such events would indeed be conscious. But because the conditions are presumably random, such conscious moments would lack cognitive moments without cognition may be occurring in various crystal-llike, large scale quantum materials throughout the universe.

Astrophysicist Paola Zizzi has applied Penrose OR to the problem of inflation in the early universe. During the Big Bang, the universe expanded (inflated) rapidly—for about 10-33 seconds. But rapid inflation then stopped abruptly, and expansion has been slow ever since. Zizzi (2002) considered that during inflation the universe was in quantum superposition of multiple possible universes. Using$E=h/t$ and setting E to the mass of the universe, Zizzi calculated that OR threshold would be met, surprisingly, at 10-33 seconds into the Big Bang, and conjectured that the end of inflation coincided with the universe undergoing a *cosmic conscious moment* (the 'Big Wow'). She further suggested our individual consciousnesses are literal microcosms related to the initial cosmic conscious moment.

It is argued, then, that pan-protopsychic qualities leading to conscious experience are woven into the quantum entanglements of the universe. This should be no less mysterious than electromagnetic fields emerging from Planck scale precursors of charge and spin. But is the Planck scale information random? Or is there a plan, rhyme or reason? Penrose proposed that non-computable information, including 'Platonic' values, might be encoded in Planck scale geometry. Could there be not only proto-conscious experience, but also *wisdom* and *intelligence* in the fine grain of reality?

STATEMENT OF PROBLEM

It is experimentally possible to superimpose psycho-electromagnetic waves on any individual consciousness, thereby to make him experience during the halfway stage between full waking consciousness and sleep.

What interests me here is, during this experimental phenomenon, which brain centers are activated in both the experimenter & the subject who are being experienced.

Objectives of the research

1. To study during experimentation which brain centers are activated in both the Experimenter and the Subject who are being experienced.
2. To encourage research in the area of Psycho-Physics, Neurology and Bio-chemistry of brain behavior.
3.

CONCLUSION

Cognitive brain functions, including sensory processing and motor control of behavior, are often non-conscious—terms like 'easy problems,' 'zombie modes,' or 'auto-pilot' apply here. These non-conscious functions are explained by synaptic neurocomputation in axonal-dendritic networks, i.e. the brain's neuronal firings and synaptic transmissions acting like 'bit states' and switches in computers. They are not really easy, but at least approachable through neurocomputation. Consciousness, however, does not naturally derive from neurocomputation—hence the 'hard problem.'

But consciousness and non-conscious cognition are not separable. At times, habitual auto-pilot modes become driven or accompanied by conscious experience. We often walk or drive while daydreaming, seemingly on auto-pilot with consciousness somewhere else. When novelty occurs we consciously perceive the scene and assume conscious control. So rather than a distinction between non-conscious auto-pilot modes on the one hand, and conscious experience on the other, the essential distinction is between non-conscious modes which at any given moment are, or are not, accompanied by some added fleeting feature which conveys conscious experience and choice. That feature, the neural correlate of consciousness (NCC), appears to involve spatio-temporal envelopes of gamma synchronized dendritic activity moving through input layers in the brain's neurocomputational networks. Dendritic synchrony conveys a 'conscious agent' able to experience and control—tune into and take over—otherwise non-conscious neurocomputation.

The conscious agent is Orch OR. It operates in microtubules within gamma-synchronized dendrites, generating e.g. 40 conscious moments per second. Each conscious moment, each occasion of experience, is, according to Penrose OR, an event or transition in space-time geometry. Consciousness is a sequence of transitions, of ripples in fundamental space-time geometry, connected to the brain through Orch OR. Pan-protopsychism thus provides the best general framework for understanding the mind-matter bridge, and hence the nature of reality.

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