

# **THE BODY MAGNETIC – PHYSICAL SOURCE OF CONSCIOUSNESS, THE PARANORMAL AND SURVIVAL**

James E. Beichler  
Professor of Physics, Retired  
Independent Theoretical Researcher

## **ABSTRACT**

Both human and non-human living organisms have traditionally been viewed and studied as material organisms. Within this context, life has been defined by the biochemical processes that sustain the living organisms, while mind and consciousness have been relegated to functions within the brain. Yet the body is just a complex pattern of energetic material particle exchanges to physicists when compared to the biochemical processes studied by chemists and biologists. As the scientific view of life has expanded beyond these early limits, new research has centered more upon the electric, magnetic and electromagnetic characteristics of living material bodies as well as the brain, but the overall concept of life has not kept pace or changed at all. Once these new research efforts have been taken into account, it is easy to demonstrate that life, or rather the “living force” as it was once called, can be equated to the overall matter/energy pattern of the organism, while mind and consciousness can be equated to the electric and magnetic counterparts of the matter/energy pattern of living organisms. Doing so does nothing to disrupt or disturb the current thinking that the ‘process of life’ is purely biochemical. In fact, all living organisms, from the simplest one-celled organism to the most complex living organism known, a human, are extremely complex material/energy patterns (comprising the structural and biochemical body) superposed by the extremely complex electric (electromagnetic scalar potential) field patterns and magnetic (electromagnetic vector potential) field patterns that constitute minds and consciousness. As humans, we may have the most complex and advanced mind and consciousness, but all other living organisms display mind and consciousness at various lower levels than our human mind and consciousness. The brain alone should no longer be considered the sole source and home of mind and consciousness. Mind and consciousness have mistakenly become associated with the brain and no other part of the body because of the dense concentration of neurons in the brain, a fact which can only be understood by studying the electric and especially the magnetic characteristics of the neuron. A strict study of the magnetic (electromagnetic vector potential) field patterns associated with neurons and neural nets demonstrates how thoughts and streams of thought originate in the brain and are stored magnetically at and within the points in space-time occupied by the brain and body. Microtubules, which act as magnetic induction coils, are the primary structural bio-unit used for building, storing and retrieving memories in the mind. In a very strict sense of the concepts, mind and consciousness could be considered a mixed four-dimensional electric-magnetic potential field holographic body that maintains a semi-independent existence with the material/energy field or structural/biochemical body of every living organism. The consequences of this physical model of mind and consciousness are revolutionary and imply a physical basis for (Darwinian) evolution as well as simple explanations of many paranormal phenomena, including the survival of mind and consciousness after death of the material body.

## **INTRODUCTION**

The key to our understanding the nature of the universe as well as our place in the greater world is locked away in our minds and consciousness. The truth of this simple statement should be evident to everyone given the fact that we use our minds and consciousness to interpret the events, observations, experiments and our perceptions of the external world of the universe even though the biological systems by which we sense the external world, such as the neurons and brain, are part of that external system. And therein lays the problem – understanding mind and consciousness requires mind and consciousness to reduce themselves for scientific analysis while they are themselves the objects of that analysis. It is about time that we relegate questions of how this is possible to the philosophers and just get on with learning how mind and consciousness work, where they are located, why they exist at all and who we really are.

Scientists who work directly with mind and consciousness need to stop thinking about how to interpret mind and consciousness and just do it because scientists in other related fields are already doing it in the regular course of their ongoing neurophysical researches. Psychologists, who normally tend to reject any direct references to mind and consciousness, and parapsychologists, whose province of study is directly related to mind and consciousness, need to heed these words. In other words, this prescription for progress may seem mentally impossible, but it is far simpler than one could imagine.

The study of consciousness has traditionally been associated with philosophy, at least until a little more than a century ago when the brain was first studied in any scientific detail. Philosophers still have a great deal to say about consciousness, if for no other reason than only because of the inherent scientific difficulties of determining where consciousness begins with respect to the neural correlates of consciousness. The philosophical discourse on consciousness ranges from the idealist point-of-view to the materialist. In the words of Gerald Feinberg, a particle physicist rather than a parapsychologist or neurophysicist,

Views on the nature of consciousness range from the idealist position that consciousness is the only reality, through the dualist view that consciousness and matter are separate but equal elements of the universe, to the materialist position that consciousness is a particular manifestation of the properties of matter. Most scientists prefer the materialist position, perhaps because it seems most amenable to scientific investigation, although not much progress has yet been made along these lines. (Feinberg, 23)

Feinberg made this statement in 1974. Quite a bit of research into the material aspects of consciousness, or rather the neural correlates of consciousness, has been conducted since then, so the situation has changed drastically. However, a fourth worldview of consciousness has also developed that would carry as much scientific weight as the materialist view – the notion that consciousness could be a field effect. (Carr, 27-28, 62) Materialism refers to matter, which of course is physical, but fields are also physical yet non-material. So consciousness and mind could be field effects of living bodies that are associated with material interactions, but are themselves non-material. This distinction is quite important in physics.

A new view came from the life sciences disciplines as scientists learned more about the workings of the brain in the mid to late twentieth century. Biologists and physiologists discovered that the chemical neurotransmitters that cross the synaptic gaps between neurons are somehow connected to the thinking process. This view gained acceptance primarily through the efforts and researches of Sir John Eccles from the 1960s through the 1990s. More recently Evan Harris Walker has developed a quantum theory of this process, but there is absolutely no method known by which all of the concepts and ideas associated with consciousness could be reduced to such simple matter/energy or biochemical synaptic interactions in the brain. These synaptic interactions are most assuredly part of the story, but they are neither the whole story nor even the most important part of the story.

A slightly more expanded view of the synapse model finds expression in the concept of neural synchrony, the simultaneous and synchronous action of potential differences across neural membranes interlinked by synaptic connections, as the source of consciousness. In this view, consciousness is somehow an as yet unexplained emergent complexity of the neural net. If not consciousness itself, this system of neurons would amount to the neural correlate of consciousness. But it is hard to believe that something as complex and complicated as mind and consciousness could be so easily reduced to electrical variations across synapses or how those electrical variations result in neural synchrony. At the very least consciousness is associated with the vast complexity of memories that exist in any person's mind, but they could never be reduced to just a few ionic transfers across the synaptic junctions in the brain. Even though there may be thousands upon thousands of such junctions in a single neural net, that amount is still not enough to explain the great multiplicity and complexity of memories needed by a viable consciousness. Memory has to be explained before mind and consciousness can be understood in even the simplest of terms because memory seems to be more basic to consciousness than the neural nets themselves.

Recent observational and experimental evidence implies that mind and consciousness are not located in a specific section of the brain, but is instead dispersed throughout the brain in the same manner

as information is dispersed throughout a hologram. Karl Pribram and David Bohm have actively pursued this avenue of modeling mind and consciousness, but Pribram has been more explicit in stating that consciousness is a hologram that can be modeled mathematically by Fourier transforms. Memory plays a very important role in holographic models and evidence to support the holographic view of mind and consciousness is constantly growing. Complex memory certainly seems to be dispersed throughout the brain after the manner of a hologram rather than stored at a single location, but the theoretical validity of that observation still depends on the discovery of the sources of memory that allow or support such dispersion throughout the brain, i.e., the simplest units of primary memory.

In the past two decades, a new proposal for the physical source of consciousness has emerged – the possibility that consciousness is a quantum process originating in the microtubules found in neural axons. According to Stuart Hameroff, an anesthesiologist who was the first to equate microtubules to human consciousness as opposed to just giving them a role to play in differentiating between the various states of consciousness that he studied in his profession, the tubulin proteins can exist in either one of two ionic states,  $\alpha$  or  $\beta$ . When a tubulin protein fires, for example changes its electronic state from  $\alpha$  to  $\beta$ , the change initiates a cascade of similar changes that form a spiraling ring of tubulin proteins of consistent continuous ionization states around the microtubule. In the Hameroff-Penrose model of consciousness, also called the Orch-OR model, a quantum collapse of a dual  $\alpha$ - $\beta$  quantum state initiates the cascade of states. Roger Penrose's contribution to the model is the limitation of the various quantum possibilities to two creating the dual  $\alpha$ - $\beta$  quantum state, which he has termed Objective Reduction, while Hameroff added the Orchestration or the cascading of states along the circular spiraling path around the microtubule. Thus the name Orch-OR.

Many researchers have also investigated the possibility that the brain represents a type of computer consciousness, but this seems to be more of a structural issue. Overall, the large gelatinous mass of fats, water and cells that we call the brain does act like a computing machine. In the opinions of some, the question of a complex consciousness is thus reduced to a question of computer intelligence, whereas intelligence is normally regarded as only one of the many facets of consciousness. Even if a computer was designed and built that displayed true AI (artificial intelligence), there would still remain the question whether AI constituted consciousness or not. Computers do have memory, but that does not mean that they have the ability to independently develop complex perceptive abilities whereby they can use those memories to form either subjective or objective conclusions by which to interact with the external world in which they exist or by which they could become aware of their unique place in the external world of matter and energy. Within this context, the structure and function of neural nets have been studied as logic circuits in an attempt to improve the computing power and efficiency of human-made computers. Many researchers use these studies to associate memory and/or mind and consciousness with the neural synchrony within these biological networks. The primary unit of memory and/or consciousness in this case is the qubit.

The qubit represents a two-state quantum system. It is the quantum mechanical equivalent of the on/off (or the go/no go) choices of an electronic computer bit. As such this quantum bit is the basic unit of quantum information. Many of the scientists who see the human brain and mind as computers are simply seeking the neural correlate that exhibits the specifications and requirements of the qubit. They assume that if the qubit is found and explained the quantum computer would reduce to no more than a simple arrangement of entangled atoms in the brain as represented by the qubit. Mind would simply provide the quantum algorithm used by consciousness to initiate the physical process of entanglement. However, the problem with all such systems and models is that entanglement is just a word that quantum theorists and others use to describe a mysterious and otherwise unexplained process. Since entanglement is itself unexplained, it cannot legitimately be used to explain other mysterious and unexplained phenomena, especially phenomena that in themselves are merely speculative.

When scientists use the word entanglement as a broad brush for explaining so many different otherwise unexplained processes, the word entanglement merely becomes an excuse for not trying to find real physical explanations. In the Hameroff-Penrose model, the superposed two-state system is supplied by the OR (Objective Reduction) in the individual tubulin proteins in the microtubule structure, but beyond this point the model assumes some form of entanglement that has yet to be defined. In other

words, the Hameroff-Penrose model suffers from a lack of explanation of the quantum coherence upon which the model depends, as do other quantum based models and theories. In more general terms, all matter/energy explanations of mind and consciousness suffer from similar criticisms and all quantum based theories fall into this category.

These advances in developing physical models of consciousness have coincided with other advances in biology that may not seem, at first glance, to be related. The problem is that science has become far too favorable to explaining everything related to life through its matter/energy worldview. Although the vast majority of scientists have long given up actively looking for a 'life force' or 'elan vital' that could explain the evolutionary and biological gaps that the genetic and biochemical life worldviews have failed to explain, the concept of life has more recently become associated with the electrical and electromagnetic characteristics that living bodies exhibit. In the 1980s a novel new approach to the study of living bodies was enshrined by Robert O. Becker in the book *The Body Electric* (1985). The notion that the electrical nature of living bodies could affect health and well being as expressed in this book was not new but nonetheless controversial. James B. Beal, a NASA scientist who was also had a reputation as a parapsychist, had expressed similar concerns more than a decade earlier. Beal summarized the changing views of biologists toward the basic unit of life, the cell, as well.

Until comparatively recently (the 1950s) biologists regarded a cell as a minute bag of fluid that was relatively simple in structure. But under the electron scanning microscope, cells were seen to be exceedingly complex. What earlier seemed to be a "simple cell wall" was likely to be folded, convoluted and multi-layered – precisely the right kind of structure to serve as a semiconductor. And components of the cell are likely to include organic semiconductors such as liquid crystals ... a material that is hypersensitive to temperature changes, magnetic and electric fields, stress, radiation, and trace contamination. To complicate matters even more, many cells have a double outer membrane; electrically, such a membrane functions as a capacitor with the characteristics of a leaky dielectric. (Beal, 1974a, 46)

In this paragraph, Beal was only summarizing a newfound relationship between electricity and magnetism that had lain dormant for more than a century and a half. The electric and magnetic natures of life have an extremely long history in science, but have been largely ignored until recently by all and the study of life has very nearly been completely surrendered to chemists and biologists who concentrate on the biochemical processes alone. In general, physicists have completely ignored the problems and mysteries of life, yielding any priority in the studies of life, mind and consciousness to the other scientific disciplines. Earlier in modern science when all was Natural philosophy this was not true of physics.

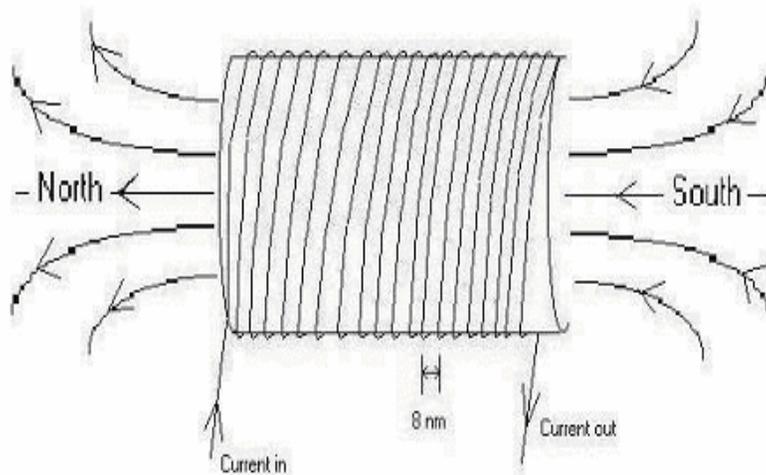
The electrical nature of living bodies and organisms has had a long and sometimes illustrious yet sometimes problematical history, dating back to the original work of Augustus Coulomb in the 1780s. Coulomb thought that he had discovered the very 'life force' in what he called 'bio-electrogenesis' during his researches, but instead he initiated the study of current electricity (as opposed to static electricity) that effectively separated electrical studies from biology over the next few decades. These electrical studies soon drew magnetism and electricity together, further separating them from biology in spite of the fact that magnetism, like electricity, had earlier been equated to the 'life force' as exemplified by the medical practices of Anton Mesmer in pre-revolutionary Paris. (Beichler, 2008, 15) Since these early analogies between life and either electricity or magnetism were overthrown by the discovery of electromagnetism, which became a new branch of physics, any relationship between magnetism and life or living processes was all but eradicated from all of science. Yet none of these scientists had so much as scratched the surface of the relationship of electricity to life, let alone between magnetism and life, mind and consciousness. They all failed to take the conceptual analogies far enough to make any theoretical progress as has everyone since. Scientists and researchers have completely failed to recognize or even realize the simple and undeniable fact that living organisms are comprised of extremely complex electrical field patterns as well as magnetic field patterns and that they both complement and supplement the material/energy and biochemical processes and structures that scientists normally study.

The role of electricity in living organisms goes far beyond the simple transmission of electrical potential signals along the axons of neurons or between neurons through synaptic connections. Every time that an electrical ion is transferred through or along a cell wall or undergoes any type of movement within a living cell, internal organ or body, a small variation in the overall electrical field pattern of the body as a whole changes. For the most part, the living body as a whole is electrically neutral, all the little bits and pieces of positive and negative electrical charge cancel each other out over the whole body, so the pattern itself must still be self-organizing, self-consistent, self-perpetuating and internally stable in order to support the biochemical and electrical interactions that constitute the living being. Within this context, the overall comprehensive electrical pattern has the ability to modify and regulate as well as organize biochemical interactions and bodily functions and must therefore be equated to the functioning of mind.

All electrical changes or electric field variations in the electrical field pattern also generate magnetic field variations and a complementary extensive and comprehensive magnetic field pattern of a higher order emerges according to the third and fourth parts of Maxwell's theory of electromagnetism. Since magnetic fields guide the movements of electrically charged particles, the overall magnetic pattern can only be associated with consciousness. All living bodies are therefore electromagnetic in nature while mind and consciousness are electric and magnetic in particular. Keeping all of this in mind, neurons can be modeled as complex radio transceivers. So, all scientists merely need to do is study the physical nature of mind and consciousness with no preconceived notion or bias as to where they are located and how (quantum or classical) they may manifest. This prescription starts with the simplest classical concept of a radio, which eventually leads to an understanding of the direct physical but non-material interactions between different minds (consciousness) or between minds (consciousness) and matter that science considers paranormal.

### SIMPLE RADIO TECH

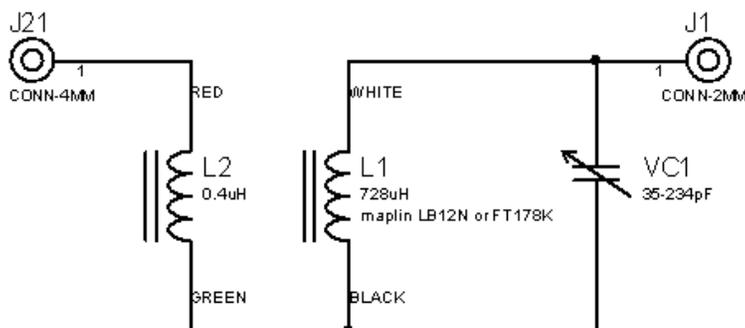
The basic principles of radio communication (transmission and reception) are simple. Charged electric particles vibrate to give off electromagnetic waves at the same frequencies as they vibrate. Otherwise, when electrons orbiting an atomic nucleus fall into lower level orbits they emit photons with the same energy as the difference between the initial and final energies of the electron orbits. These processes are often reversed in nature for the absorption of electromagnetic waves and photons. However, we can also build macroscopic devices to emit (transmit) and absorb (receive) electromagnetic waves using a simple device called an induction coil.



Induction coils of this type form the central core of all simple radio transceivers (transmitter/receivers). If alternating current is input into the coil, electromagnetic waves are emitted at the same frequency. The direction of the magnetic field reverses every time the direction of the alternating current changes causing

free electrons in the wire to vibrate. If a detector is instead wired to the coil then the free electrons are forced to vibrate at the same frequency as incoming electromagnetic waves, which can then be detected (received).

All frequencies of waves are detected in this case with the strongest wave dominating the detected signal. The simple wiring diagram below explains this idea further. JC1 is the grounding wire, J1 can be anything from a rudimentary earphone to a complicated amplifier/speaker system, L2 and L1 are the induction coils, wires wrapped around a central ferrite core. The ferrite core just serves to further strengthen the magnetic fields. A two coil system is not necessary, but in this case is used to choke down the system and better isolate a single strong wave. VC1 is a variable capacitor that is used to tune the circuit to a single specific wavelength or frequency.



(David Holburn, 2008)

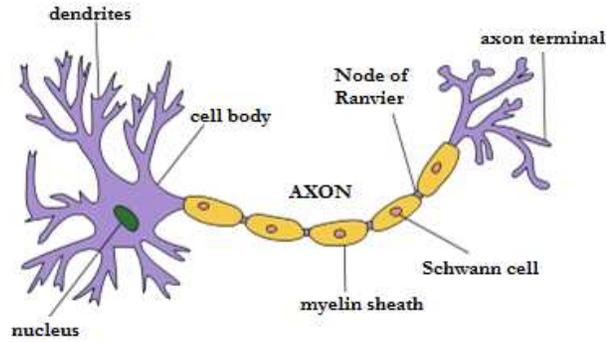
If the capacitor is removed from the circuit, the coils merely pick up the strongest electromagnetic wave and play that frequency of the radio band. The radio band contains waves that are longer than visible light and microwaves, because those waves are long enough to be effectively absorbed by the free electrons in the coil. If an antenna were added to the circuit without the capacitor, the most effectively absorbed or received wave would be the wave with the same length as the antenna. This case represents a Marconi radio receiver. However, if the capacitor is left in the circuit then the capacitor would tune the circuit to a specific resonant frequency according to the formula

$$f_0 = 1/2\pi\sqrt{1/LC} .$$

The capacitor circuit is normally called an LRC (inductance, resistance, and capacitance) circuit. It was invented by Sir Oliver Lodge and has become the primary tuning circuit for all radio transceivers since its invention. The variable capacitor merely allows a person to tune the receiver to any desired frequency within a specific radio band width. With these radio basics in hand it will soon become evident how the neuron can act as an extremely complicated and complex electromagnetic wave transceiver.

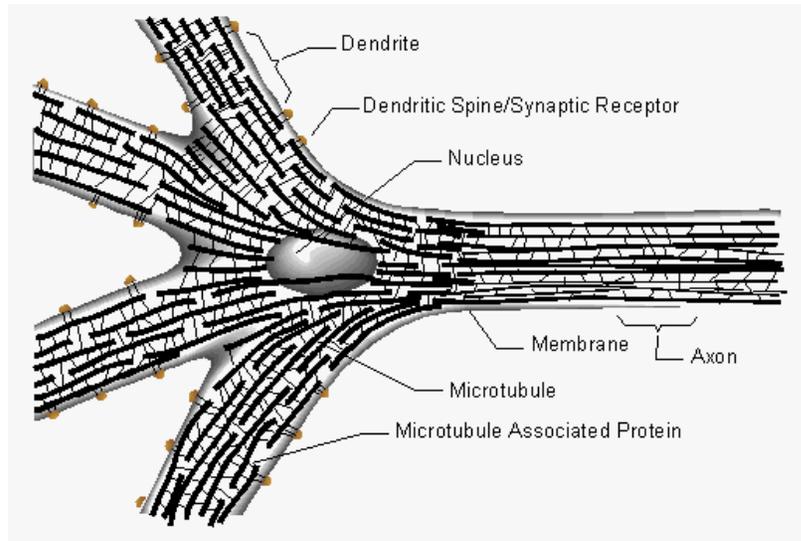
### THE NEURON TRANSCIEVER

The neuron is the basic carrier of sensations, signals and information between the brain and other parts of the body, or so it has been portrayed in the past. The main parts of the neuron are the soma (cell body), axon and dendrites. The dendrites end in synaptic bulbs which connect to other axons and neurons. A group of specialized biochemicals called neurotransmitters travel across the gaps between the synaptic bulbs and other axons or neurons to keep the flow of electricity between neurons in a neural net consistent, thus establishing neural synchrony between the various neurons in the neural net. The axon portion of the neuron can be extremely long in comparison to the soma and dendrites.



(Wikipedia)

The axon is composed of a cell wall or membrane enclosing an internal cytoskeletal structure of microtubules, long cylindrical units made of tubulin proteins, with with a purified water interior. The microtubules are connected to each other as well as the cell wall by MAPs or Microtubule Associated Proteins filaments, forming a rigid structure.



(Hameroff and Penrose, 1996)

Electrical signals pass up and down the length of the axon in the form of action potentials, voltage differences. In other words, the action potential moves along the outer wall of the axon as ions pass into and out of the interior of the axon as a voltage difference pulse. The action potential is important because it carries information throughout the body along the highway of neurons, which permeates the whole body. Sensations are carried to the brain as action potentials just as commands are carried from the brain to the rest of the body as action potentials, rendering the action potentials moving along the axons the minds source of information and contact with the external world of material reality - thus the importance of axons and the action potential in understanding the workings and existence of mind and consciousness.

While the action potential is usually studied in its role as a signal transmission, it is also important to note that it renders the axon wall a capacitor with a capacitance or electrical field potential storage capacity according to the formula

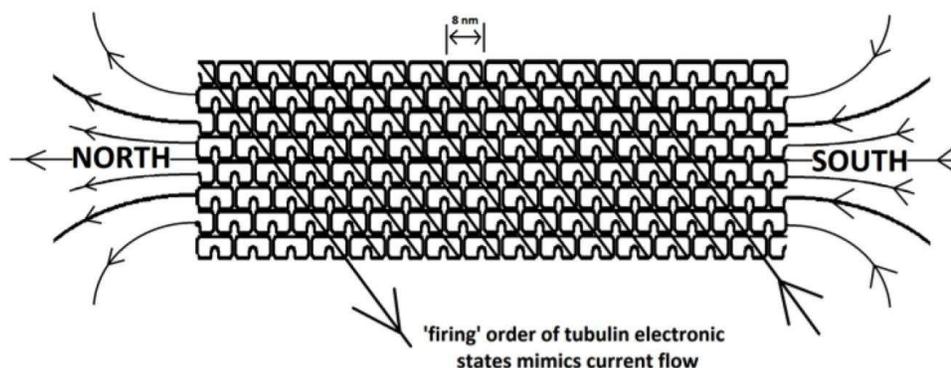
$$C = K\epsilon_0 A/d.$$

The capacitance  $C$  is a product of the dielectric constant  $K$ , the electric permittivity of free space, the plate area of the capacitor and the distance between the parallel plates or  $d$ . An order of magnitude estimate for an axon 10 centimeters long, of radius 10 micrometers, a membrane thickness of about  $10^{-8}$  meters and a dielectric constant of about 3 would be at least  $10^{-8}$  farads. (Giancoli, 475) The capacitance, although not well-defined in the case of a microtubule, can at least be approximated to within an order of magnitude for axons.

However, the capacitance exhibited by the axon wall of the neuron while the action potential moves up or down the neuron is only half of the story, and the smaller half at that. Another component of neurons, the microtubule cytoskeletal system, plays a far more important role in conjunction with the axon capacitor. The Hameroff-Penrose model of the microtubule's role in consciousness is the best known of such models, which is quite natural since it was the first such model to be developed and introduced the world of neuroscience to the importance of microtubules in the thinking process. If for no other reason, the fundamental role microtubules play is guaranteed by the simple fact that only microtubules occur in the brain in sufficient numbers to explain the great diversity and 'resolution' of memories in mind. However, the question and mechanics of how they play this role is far from being decided at this time even though just mentioning the role of microtubules in relationship to consciousness immediately evokes the Hameroff-Penrose model of consciousness. A large part of the story may deal with microtubules, but not exactly the popular picture of microtubules offered in Hameroff's Orch/OR model of consciousness. Hameroff-Penrose has serious problems accounting for the high level of quantum coherence necessary to create and maintain memories, thoughts and the streams of thought that constitute consciousness.

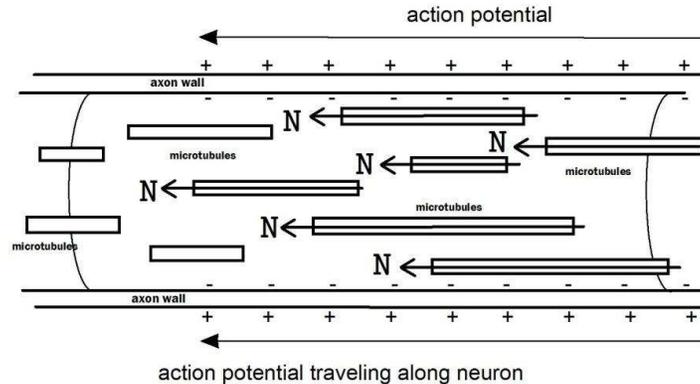
The objections to the Hameroff-Penrose model of consciousness are numerous and these objections are both profound and significant. Perhaps the major criticism rests in the fact that the brain is warm and moist and thus does not offer a hospitable environment for cohesive quantum action. In other words, the objections are not trivial philosophical meanderings and will not disappear without major persuasive arguments and data. In particular, the Hameroff-Penrose model does not include either method or mechanism by which the random quantum process of collapse of a single tubulin protein and the subsequent cascading sequence of ionizations of the tubulin proteins could spread from one microtubule to another creating a single thought let alone a stream of thought and consciousness. Yet Hameroff insists that consciousness ultimately rests in a single microtubule, rendering the microtubule the seat of consciousness, and consciousness is thus a quantum-only process. Consciousness and mind are not to be found in either a single MT, a single neuron or in the collective pattern of MTs in the brain alone. For all intents and purposes, both mind and consciousness are collective phenomena exhibiting a broad variety of characteristics across the whole brain if not the whole body. Hameroff cannot just not just expect or even hope that some unspecified form of entanglement gives rise similar 'conscious' experiences within the neuron or a collection of neurons.

Hameroff and others have failed to realize that the spiral sequence of the electronic state firing mechanism around the microtubule renders the microtubule an electromagnetic induction coil (or solenoid). They are just too enamored with the matter/energy and quantum worldviews and prejudiced against the possibility of a classical scientific interpretation of mind and consciousness to see the obvious.



Under these circumstances, the sequential firing or ionization of the tubulin proteins would constitute an electrical current such as that in the wire loops of an induction coil initiated by the passing of the action potential. The firing sequence would not require quantum action so the controversial concept of Objective Reduction is unnecessary. As the action potential travels up (or down) the axon, it would cause electrical field changes within the axon that would induce the sequential loops of electronic state changes around the microtubule, thus creating the magnetic field inside the microtubule.

### The neuron as an LRC circuit



The advancing action potential induces the microtubules to 'charge' magnetically in a sequential pattern

Furthermore, the combined and coordinated action of the axon wall capacitor and the induced coil microtubule would constitute a natural biological LRC or radio tuning circuit. So microtubules clearly participate in mind and consciousness and in fact have a central role, but a microtubule alone does not constitute either mind or consciousness and there is no necessity to invoke the quantum theory or quantum principles at this level to explain the role that microtubules play in mind and consciousness. However, quantum principles and concepts do play a role at another level of the theoretical model.

Danko Georgiev has pointed out that the flip-flopping ionization of the tubulin molecules in the microtubule cylinder as described by Hameroff would destabilize the microtubule (Georgiev, 60-61) and this objection potentially affects the radio transceiver model since an unstable microtubule could not act like an induction coil. He instead pictures the microtubule as having a permanent helical or spiraling alpha-beta structure along the outer microtubule surface. The helical structure is explained in more detail by Andreas Mershin and his colleagues. (Mershin, et al., 97-99) Whichever model of the microtubule proves accurate in the end is of no consequence since the permanent helical structure would also allow the microtubule to act like a biological magnetic induction coil. In the Hameroff structure, the 'electrical current' structure would be induced by electric action potential traveling along the outer surface of the axon and form a stronger magnetic field within the microtubule coil. On the other hand, the permanent helical structure proposed by Georgiev would induce the corresponding internal axon electric field, which he calculates would vary up to 20V/m, to follow a spiral path in the vicinity of the microtubules and thus induce a magnetic field inside the microtubule that would still create a resonance pattern with similar microtubules throughout the brain. The magnetic fields inside the microtubules would be weaker than the case would be with Hameroff's model, but the microtubule would still act as an induction coil, changing nothing. Given the large number of microtubules within the axon, and in fact within the neuron as a whole, the axon would act as a vastly complicated and complex system of primary radio tuners, a fact which completely changes the scientific picture of how mind and the brain interact.

Under these physical circumstances, the magnetic characteristics of the microtubule constitute the real story as the primary component of mind and consciousness, simply because the microtubule is a natural biological induction coil which generates its own magnetic field. Since the microtubules are much

longer, ranging from about a hundred nanometers to nearly a centimeter, (Georgiev, 21) in comparison to their external width of twenty-five nanometers, the internal magnetic fields that they generate are fairly uniform with almost no magnetic fields induced outside of their confines, i.e., the magnetic fields created by the microtubules would be almost completely concentrated within their cores and thus isolated from external magnetic sources. Technically the magnetic field and magnetic properties of induction coils (solenoids) are well known and defined in physics and electromagnetic theory. The interior magnetic field strength  $B$  is simply given by the formula

$$B = \mu_0 n I ,$$

where  $\mu_0$  is the permittivity of free space which would be slightly modified for the microtubule because pure water which fills the cavity of the microtubule,  $n$  is the loops or turns per length of the tubulin molecules that make up the microtubule and the current passing through the microtubule is noted as  $I$ .

All of the microtubules in the axon would have the same set of values for each of these variables, which means that the microtubules in an axon would all have the same magnetic field strength  $B$ . The helical pitch is three nanometers per turn (Mershin, et al., 98) so the value of  $n$  is known and the magnetization can be easily calculated. Only the value of the current is in question and Georgiev gives the current a value of one micro-amp along the axon. The magnetic field Strength  $B$  would thus be approximately  $1.05 \times 10^{-4}$  Teslas. This value would need to be modified for the permeability of water ( $\mu/\mu_0$  of 0.999992), which would not change the value by much under normal conditions. However, if the water in neurons becomes a ferrofluid (Frick, et al., 2003) as advocated by Georgiev, (Georgiev, 44) then the field strength  $B$  would be ten times greater. These are average size magnetic fields when compared to the earth's magnetic field of  $5 \times 10^{-4}$  Teslas. These values are tentative given the state of actual experimental measures from neurophysical researches.

This value of  $B$  is vastly different from the axon Georgiev calculated value of  $1.6 \times 10^{-7}$  Teslas for the interior of the axon. Quite simply, Georgiev did not calculate his value correctly. He used the formula

$$B = \mu_0 I / \pi d ,$$

where  $d$  is the diameter of the axon. This is a common formula used in physics to calculate the external magnetic field strength  $B$  surrounding a long current carrying wire. In so far as scientists can model the axon as a current carrying wire, this formula is valid. However, Georgiev used the formula to mistakenly evaluate the internal field strength 'in' the axon rather than the external field strength around the axon. (Georgiev, 52) His value is only valid at the outer surface of the axon and would decrease as the inverse of the distance moving away from the center of the axon.

Georgiev also argues that the magnetic strength  $B$  that he calculated has no importance because it is too small compared to the earth's magnetic field of 5 Gauss (a Gauss =  $10^{-4}$  Teslas).

Local magnetic flux density is less than 1/300 of the Earth's magnetic field that's why any magnetic signal will be suffocated by the surrounding noise. In contrast the electric field carries biological important information and acts upon voltage-gated transmembrane ion channels that control the neural action potential. If mind is linked to neural processing of information in the brain microtubules then microtubule interaction with the local electric field, as input source of information is crucial. (Georgiev, 1; 52)

The earth's magnetic field has nothing to do with the axonal magnetic field and has no effect on it. If it did, then every time a person turned from north to south, relative to the earth, their axons and neurons would demagnetize then remagnetize in the opposite direction. We can assume that this would not be good for brain function, to say the least. The magnetic field surrounding the neurons is part of a stable magnetic domain that contributes to the overall magnetic field of the whole body. As such, the magnetic field of the whole body buffers the effect of external magnetic fields on neural and other internal magnetic domains.

Furthermore, Georgiev's comments concerning the importance of the electric field in brain function are equally valid for the magnetic fields because electric field variations generate magnetic fields and vice versa according to the third and fourth laws of electromagnetism. It is impossible to separate the various contributions of either electricity or magnetism to either mind or consciousness in either or their roles of form or function.

Within this context, the electromagnetic emission/absorption spectrum of the complex system of microtubule/axon wall radio transceivers depends on the inductance of the individual microtubules which is independent of the magnetic field strength  $B$  inside the microtubules. So the real value of importance is the inductance of any given microtubule, which is given by the formula

$$L = \mu_0(N^2/l)A .$$

The inductance  $L$  would be the product of the magnetic permeability  $\mu_0$  for free space and modified by the material in the interior of the microtubule cavity, the number of loops  $N$  that make up any particular microtubule, the cross-sectional area  $A$  of the microtubule and the length  $l$  of the microtubule.

The inductance obviously depends on the internal geometric and structural factors of the microtubules rather than the external influences and factors such as voltage and current. So since all microtubules have essentially the same structure but different lengths, we can put this equation into a more convenient form for all microtubules,

$$L/l = \mu_0(N^2/l^2)A$$

or

$$L/l = \mu_0(n)A .$$

This value for the inductance per length ratio thus has greater applicability for microtubules. Given the length of a microtubule, its inductance could be easily calculated. For example, a microtubule of length one-thousand nanometers would have an inductance of  $1.61 \times 10^{-7}$  Newtons per amp squared. This value is far more accurate than others because the values used for the variables are fairly well known in neurophysical research.

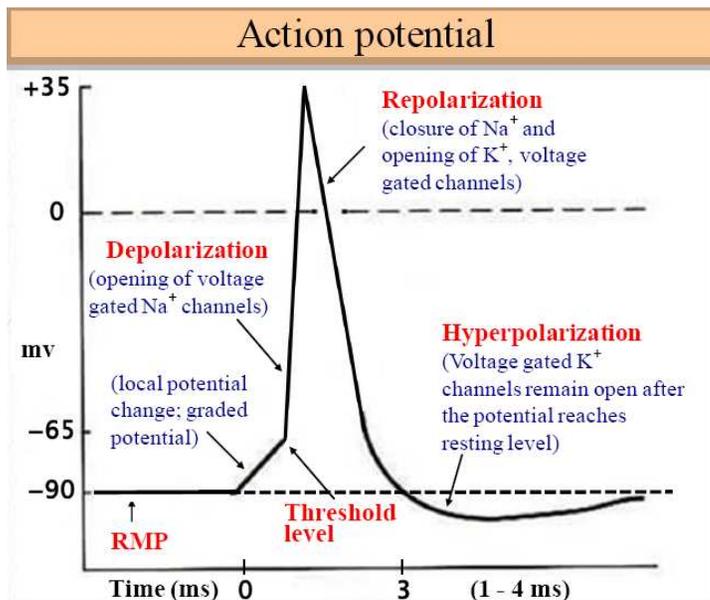
This fact is important because the ratio of loops to length, although constant across different microtubules, would affect the inductance  $L$  rather than the magnetic field strength  $B$ . After all, the inductance is related to the energy potential of the magnetic field within the coil while the magnetic field strength is not. Since the number of loops in the numerator is squared and the length in the denominator (whose increase would decrease the inductance) is not, the value of  $N$  dominates the formula, the inductance for longer microtubules with more loops, which means a proportional greater length, would be greater. This difference is more evident in calculating the resonant frequency of any given axon-microtubule circuit, where the resonant frequency of the transceiver system is proportional to the inverse square root of the inductance and capacitance.

Since the microtubules within a single axon differ in length and thus total number of loops, each microtubule would have a different resonant frequency in relationship to a constant capacitance across the total length of the axon wall. This defines the resonant frequency of the oscillating circuit, in this case the axon-microtubule circuit. This means that a single axon that could contain as many as ten million different microtubules of different lengths could theoretically comprise a single complex radio transceiver of that many different wavelengths and frequencies. More appropriately, these individual axon-microtubule radio transceivers would make a distinct and unique pattern of electromagnetic wave transmissions developing over a short interval of time corresponding to the action potential moving along the outer surface of the axon. Yet even this is still only the beginning of the story concerning the magnetic properties of the neuron and its immediate environment in the brain.

The microtubules are immersed in pure water inside the axon. Pure water is a diamagnetic material at the molecular level and above, which means that when a magnetic field is induced in water by an external source the water's magnetic field weakly opposes the direction of the external magnetic field. So the water surrounding the microtubule would tend to isolate the magnetic field of the microtubule and dampen any transformer effect between neighboring microtubules. The extent to which the surrounding water itself is magnetized by a microtubule would be different in the case of particle spins within the water molecule. A group of German scientists has recently discovered that nuclear magnetic spins of water molecules do not behave as expected from experience for the case of ultra weak magnetic fields. (Smart, 2011) In other words, water interacts differently with ultra weak magnetic fields than it does with stronger magnetic fields. The same could be expected for particle spins within the water molecules outside of the axons.

As a rule of thumb, an electromagnetic wave emitted by an antenna establishes regions or emission zones around it. In the case of the microtubule radio transceiver, the microtubule is also the antenna. Standard electromagnetic theory establishes three zones of transmission around an antenna as characterized by the vector potential **A**. The near (static) zone extends out to a wavelength, the intermediate (induction) zone occurs at approximately a wavelength distance and beyond a distance equal to the wavelength the far (radiation) zone. Well away from the antenna in the far zone the emitted waves spread out spherically as normal, but within the near region less than a wavelength from the antenna, the emitted waves interfere with each other and set up diffraction patterns. In the closest region "the near fields are quasi-stationary, oscillating harmonically as  $e^{-i\omega t}$ , but otherwise static in character." (Jackson, 393) In the case of microtubule radio transceivers, which are already so minute in proportion to the wavelengths of the emitted waves, unique diffraction patterns would be established in the water medium surrounding the different microtubules. In a sense, these diffraction patterns would imprint themselves within the water medium by altering the quantized electron-spins within the water molecules in an unexpected way. The pattern of particle spins would then reinforce the electromagnetic signal from the microtubules if normal electromagnetic waves were emitted by the microtubules.

This particular model has so far assumed that the emitted electromagnetic waves would be normal waves displayed the sine wave pattern of an alternating current, but that is probably not true. The pseudo-current established by the potential difference traveling along the axon is a direct current spike and not an alternating current.



(HowMed.net)

If a large number of direct current spikes followed one another in a continuous series and timely manner (to establish a definable frequency), they could act as a pseudo-alternating current and there would be no problem. Rather like the pattern of heart beats read by an EKG. However, a single isolated current spike traveling along the axon would still induce a matching magnetic pulse in the microtubule, which would emit an electromagnetic pulse called a soliton. A soliton, being a one-shot deal, would not necessarily create an electromagnetic interference pattern to imprint on the surrounding water medium as discussed above. However, a magnetic interference or diffraction pattern would still be possible by other means.

### THE MYSTERY OF MEMORY

Soliton emissions from microtubules have already been studied in relation to the Hameroff-Penrose microtubule model and it has been found that neighboring microtubules within the axon interact to establish diffraction patterns between them. Different soliton waves from adjacent microtubules would interact or interfere with each other to form a different type of diffraction pattern than described above, but a diffraction pattern nonetheless. Solitons interfere with each in a different manner than electromagnetic waves. Normal electromagnetic waves must be coherent before they will interfere. Solitons on the other hand can take many different forms, so the manner in which they interfere would depend more upon the individual characteristics of the interfering solitons. However, once this has been established, they do follow a specific pattern of interference that is defined by the sine-Gordon equation.

$$\left( \frac{\partial^2}{\partial t^2} \phi(x, t) \right) - \left( \frac{\partial^2}{\partial x^2} \phi(x, t) \right) + \sin(\phi(x, t)) = 0$$

(Miroshnichenko, et al.)

Whereas an ordinary electromagnetic wave interfering with itself would add linearly in the region near the emitting antenna/microtubule, solitons would imprint their magnetic characteristics in the surrounding magnetic particle spins of the water medium in a different manner. The two solitons would form a small region of interference as they pass through each other, like passing ships in the night, and then recover their shapes and continue their independent journeys with the only lasting result being a phase shift.

Thus there would still be two levels of magnetization due to the microtubules. These are called magnetic domains and they are a common property of everyday permanent magnets. While particle spins within the water molecules hold and reinforce the pattern of magnetic variations outside of the microtubules, magnetic fields within the microtubules create their own magnetic vector pattern outside of the microtubules, together creating a complex-complex or double complex magnetic pattern that would correspond to a simple thought.

Whether the waves involved in this process are short duration irregular electromagnetic waves or solitons, they would still be transverse electromagnetic waves. They would create another level of magnetic pattern when they are absorbed by microtubules and resonate in synchrony with other nearby neurons, further extending the complexity of the magnetic pattern representing a simple thought. The magnetic wave patterns would imprint themselves as unique vector potential patterns in the very points of space-time occupied by the neurons and their environs. These imprinted vector potential patterns in space-time itself would constitute long term memories. Not much is known about electromagnetic vector potentials other than the fact that electromagnetic theory predicts their existence and they do in fact exist, although they have never even been directly detected or measured before. This situation almost sounds like how we regard mind and consciousness.

The electromagnetic vector potential or magnetic vector potential is normally designated by **A**. It is a necessary and fundamental component of electromagnetic theory, without which electromagnetic theory would disappear, even though it cannot be directly measured or detected. In fact, the magnetic field strength **B** is defined by its relationship to **A** according to

$$\mathbf{B} = \mathbf{del} \text{ cross } \mathbf{A} .$$

The mathematical operator **del** is defined as the field gradient across a point in three-dimensional space, such that

$$\mathbf{del} = (\mathbf{i} \partial/\partial x + \mathbf{j} \partial/\partial y + \mathbf{k} \partial/\partial z) .$$

This means that the gradient or **del** is a measure of the infinitesimal field variations along all three-dimensions of space. So when the **curl** (**del** cross product) of the vector potential **A** is taken, the magnetic field strength **B** is a measure of how steeply or radically **A** at any given dimensionless geometrical point in three-dimensional space. However, it is also assumed in this product that the vector potential **A** is perpendicular to all three dimensions of space, x, y and z, at all points in three-dimensional space simultaneously and **A**, as a spatial vector, must have magnitude or a length in the direction that it points. In other words, **A** must be along a fourth direction of space, although those words are never really uttered except in very hushed tones in physics and such thoughts are never written down. Instead, the pernicious paradox represented by the magnetic vector potential is over restricted to the role of a mathematical formalism without true physical content at least that is the manner by which it is normally treated in physics.

The higher-dimensional solution or interpretation of this paradox was first developed by William Kingdon Clifford in the 1870s, but was not accepted by the majority of scientists and indirectly entered physics by way of the theoretical work of Theodore Kaluza in 1921. Kaluza was able to successfully unify Einstein's general relativity and Maxwell's electromagnetic theory by assuming the existence of a higher fifth dimension of space-time (or fourth of space alone within the space-time framework). Kaluza's extension of relativity theory has been the only successful unification of gravity theory and electromagnetic theory ever since, but it is pretty well ignored today. Kaluza posited that each point in three-dimensional space was actually a one-dimensional **A**-line with special mathematical properties that was extended in the higher dimension. By calling those one-dimensional lines **A**-lines, Kaluza was indirectly relating the magnetic vector potential to the higher dimension, whether that was his purpose in so doing or not. More than half a century later, Kaluza's **A**-lines became the basis for superstrings that extended into several higher dimensions in the superstring theory, but the superstring theorists have all but thrown away Kaluza's original theory upon which their own work is based in order to make their theory work. Under these circumstances, superstring theory no longer utilizes the space-time curvature from general relativity to explain matter even though that was the starting point of their work. The superstring theory has absolutely no relationship to this model of mind and consciousness.

Unfortunately, it cannot be both ways in physics – the vector potential exists but it does not exist in any observable or measurable way – because existence is determined by observation and measurement. Thus there is no direct physical evidence of the existence of the vector potential even though electromagnetic theory requires it. The physics student in college might run into a paradoxical statement like this and blindly accept the concept of a vector potential without argument or question based solely on the authority of the textbook.

We have calculated (Section 6.3.2) the mutual inductance between coaxial solenoids [long coils]. It is paradoxical that a varying current in the inner solenoid should introduce an electromotance in the outer one, since we have shown in Section 5.11.3 that the magnetic induction outside a long solenoid is zero! The explanation is that the induced electric field intensity at any given point is equal to the negative time derivative of the vector potential at that point and that the vector potential **A** does not vanish outside an infinite solenoid, despite the fact that  $\mathbf{B} = \mathbf{del} \text{ cross } \mathbf{A}$  does. (Corson and Lorrain, 238)

In this and similar textbooks' descriptions, a physics student would learn all that is presently known about the physical reality of the vector potential – “the vector potential does not vanish outside of an infinite

solenoid” – but no more. Given this fact, the magnetic field strength  $\mathbf{B}$  outside of a long microtubule (solenoid or coil) would be zero, but the magnetic vector potential  $\mathbf{A}$  would still be non-zero. The emitted soliton or wave would add its own component or varying  $\mathbf{A}$  to that of the magnetic field  $\mathbf{B}$  which would serve to imprint that variation in the very point-by-point fabric of four-dimensional space where  $\mathbf{A}$  physically exists. Under these circumstances, physicist can rarely question the ‘status quo’ regarding the magnetic vector potential.

Although the vector potential  $\mathbf{A}$  has never been directly detected, it has been indirectly verified. A rather famous ‘evidentiary proof’ known as the Aharonov-Bohm experiment established the physical reality of the magnetic vector potential a few decades ago. The experiment is similar to the double coaxial solenoid explained above; at least it relies on the same principles. An electron beam is split and travels around a single solenoid that has been magnetized. Varying the magnetic field strength in the solenoid should not affect the traveling electrons because they move around the solenoid where the magnetic field strength is zero. But the electron beams do bend in reaction to the magnetic field potential in the points in space surrounding the solenoid. The paradoxical Aharonov-Bohm experimental results are usually chalked up to quantum variations in the vector potential at individual dimensionless points in space-time.

Roger Penrose explains them as “gauge invariances” and “quantum interference” in the magnetic field and claims that the  $\mathbf{del}$  operator only acts at the “level of quantum phenomena” (Penrose, 2007, 453-455), but that is about as far as explanations of why magnetic vector potentials cannot be detected or measured ever go. However, there is no reason to limit the  $\mathbf{del}$  operator to quantum levels alone in this one respect, since the  $\mathbf{del}$  operator works well with vectors at every level of reality and the magnetic field is macroscopic in the case of the Aharonov-Bohm experiment. So, magnetic vector potentials do exist even though they have never been directly measured or detected within three-dimensional space. This predicament presents a physical paradox for modern science that has been all but wholly ignored by researchers, especially neuroscientists. It would seem that the vector potential  $\mathbf{A}$  is one of those forgotten little dirty secrets in the physics closet. It must be a quantifiable ‘thing’, but it is not quantifiably measurable even though quantifiability means measurable in physics. Whereas the electric scalar potential has a unit for measure called the volt, there is not even a corresponding unit of measure for the vector potential. In this manner, the vector potential  $\mathbf{A}$  shares some characteristics with the elusive Dark Matter and Dark Energy that scientists recently discovered. Coincidentally, mind and consciousness are also every bit as physically ephemeral, enigmatic and misunderstood as the magnetic vector potential, a point of observation that can never be overstated.

Given these facts, the theoretical argument for memory storage in a higher-dimensional vector potential is not so farfetched. Short term memory would exist at the interface between the three-dimensional quantized particle-spin diffraction patterns in neural water and the fourth direction of five-dimensional space-time which constitutes the magnetic vector potential patterns. In this regard, many scientists have studied the possibility of imprinted memory and memory retention in water. William Tiller has conducted research on memory in water, (Tiller, 2002a) while other scientists have also studied the reported phenomena associated with water memory. (I-SIS, 2008; Science 2.0, 2008) These studies have existed at the very edge of science for the past few decades because water memory has been unfortunately associated with homoeopathic medicine, which is tainted in the minds of many scientists. But new studies and research dealing with water memory have been conducted within more mainstream science as of late. (Tiller, 2004) The concept of water memory is thus somewhat minimally established within science although no theoretical explanation for water memory has yet been forthcoming. The situation presented by independent research into water memory is also ironically similar to the situation regarding magnetic or rather electromagnetic vector potential.

Other processes of memory are just as easily explained by this model, in particular recognition and recall. When a person sees an object, like a chair or a friend, the signal travels from the eyes along the axons of the optic nerves to the brain. What the eyes see is duplicated in the brain as an image represented by a complex-complex magnetic vector pattern in both short term and long term memory as described above. Suppose the same chair or person is seen again at a later time. When this new sensation of the chair or person travels along the optic nerve to the brain it initiates the same or at least a very similar microtubule response pattern in the brain to be stored in the mind where the original memory of the chair

or person was stored at an earlier time. When the new image is impressed in mind for storage as either a short term or long term memory, it establishes a resonance with the same or very nearly same pattern that is already stored in long term memory, forcing the brain to cognize or re-cognize the object sensed in the real three-dimensional material world as a chair or person. This particular pattern resonance is called recognition. It is merely a form of pattern matching between the short and long term memory complexes. On the other hand, when a person thinks of that or any other object in their mind, say a mother's face, without actually having sensed that object within the material world, a resonance of the stored memory pattern in mind and consciousness initiates a reverse process from mind to microtubules in the appropriate neurons in the brain. This particular process does not include action potentials moving along axons and thus a mental picture of the remembered object would only form in the brain. This reverse process explains the recall of memories. Obviously, this model can simply explain such complex mental process as recognition and recall.

At the very least, laboratory research has confirmed that microtubules are electromagnetically active. Nancy Woolf, (Woolf, 2007A) an experimental psychologist at UCLA, and other researchers have discovered that shining a red laser on the interior of an axon will cause some of the microtubules to light up or resonate.

Now, this depends on microtubules being sensitive to electromagnetic energy, but it turns out they are. Second harmonic, generation microscopy shows that microtubules are one of a very small number of proteins that do respond to laser excitation in the near infrared range. Also, individual microtubules respond to near infrared waves by growing towards the source. So, there are two different indicators that microtubules respond to electromagnetic energy. (Woolf, 2007a)

To any physicist, this physical response would appear to be a normal resonance implying that the primary resonance frequency of those microtubules that respond in this manner perfectly matches the frequency of the red or infrared light that is used to stimulate the microtubule: The resonant frequency of the microtubule induction coil is the same as the laser light.

It is amazing that this observation verifies that microtubule can act as classical electromagnetic resonators, but the results of these observations have more often than not been classified and interpreted as quantum effects. This phenomenon clearly and dramatically confirms that the microtubules are biological inductance coils that can act like electromagnetic resonators and when acting individually, without being moderated or tuned by the axon wall/capacitor circuit, their resonant frequencies fall in or somewhere near the range of visible light.

The biophysical properties of microtubules are just beginning to be understood at the molecular and atomic levels and recent empirical evidence suggests quantum-based interactions occur between microtubules, at least under certain experimentally induced conditions. Two groups, one led by Watt web at Cornell and another led by Paul Campagnola and William Mohler at the University of Connecticut, observed that microtubules give rise to intense second-harmonic generation, a frequency doubling upon exposure to a sapphire laser in the 880 nm range. (Other frequencies were partially were partially effective). (Tuszynski and Woolf, 21)

This line of research offers circumstantial evidence at best, but it is evidence that is important to this particular model of the neuron transceiver, evidence that along with other researches indirectly confirms the role of microtubules in this model.

Further circumstantial evidence can be found in the example of Michael Persinger's 'God Helmet' since the effects evoked by the 'God helmet' can be adequately explained within the framework of this model. Persinger has designed and conducted experiments with skull caps lined with small induction coils that can 'induce' paranormal like visions and events in the brain and mind of test subjects. (Persinger, 2003) Persinger's magnetic coils emit a particular frequency or frequency pattern that may or may not

resonate with one or more microtubules, but they do not resonate with enough microtubules in the axons to create a complete magnetic memory pattern, which would also include the real material-world contextual memories are stored in mind that are necessary to create the image or mental experience of a real material body. Therefore, they do not and cannot evoke completely real memories or thought patterns. Instead, they evoke, at best, only partial or fragmentary memories and thought patterns. The frequency patterns emitted by the 'God helmet' are so 'low grade' that they cannot even evoke enough of a partial memory for the mind to place the memory in a larger context even though that is what the brain is wired to do, but they do activate the complex neuron transceiver system by initiating fragmentary magnetic cascades at the microtubule level, forcing the mind to create a false context for the fragmentary magnetic event in the affected neurons or neural nets. The mind only mimics a real 'Out-of-Body Experience' since it lacks the context of a real physical event which cannot be accessed in stored memory – the invoked and degraded partial pattern resulting from the 'God helmet' transmission goes to a default context of having no body. The mind literally cannot sense the body although it is expecting to sense the body. So, while Persinger's false 'images' of pseudo-events in the mind are explained by this model, they also confirm the model to a small degree in that the explanation makes a direct connection stored memories and activated microtubules based on the resonant frequencies of microtubules.

Similar effects have been noted elsewhere. Dr. Gordon Dougal, a medical company researcher, discovered in 2007 that a specially built infrared-blasting helmet could be used to treat Alzheimer's patients. It seems that "The infrared light supposedly stimulates brain cells to regenerate and, according to the researchers, can reverse dementia in just a few weeks" (Cheung, 2007), but the mechanism by which this process occurs has yet to be explained. The microtubule transceiver model not only explains how microtubules are associated with memory and memory storage/retrieval, but implies that the 'infrared blasting helmet' developed by Dr. Dougal could work by 'exercising' or stimulating the microtubules through simple electromagnetic resonance, to keep them in good working order and protect their functions of storing and retrieving memories as little LRC circuits.

Researchers have recently discovered that the microtubules in neurons breakdown or unravel in Alzheimer's patients with symptoms of advanced dementia (memory loss).

Alzheimer disease (AD) is a clinicopathologic syndrome of unknown etiology with numerous abnormalities in neuronal and nonneuronal cells. A review of the literature suggests that a common basic intracellular defect may underlie many of the reported abnormalities. We hypothesize impairment of the microtubule (MT) system as one explanation for the pathogenesis of AD. Evidence in support of the hypothesis includes the following: MTs are ubiquitous and vital cell components, unequally distributed, with the highest concentration in the brain; various abnormalities, including the key neuropathologic lesions, can be explained by impairments of the MT system; and experiments utilizing pharmacologic agents known to disrupt MTs have reproduced certain abnormalities observed in AD. The hypothesis provides a framework for systematic investigations of MTs at the cellular and molecular levels as well as the basis for in vivo diagnostic tests for AD. (Matsuyama and Jarvik, 1989)

The microtubules inside axons are attached to each other as well as the inner axon walls by MAPs, Microtubule Associated Proteins. The cylindrical shaped microtubules are also bound by string-like TAU proteins that wrap around the microtubule cylinders in a spiral fashion. In Alzheimer patients with advanced dementia, the TAU protein strings break down as do the MAPs, leaving the microtubule cylinders to unravel. (Gustke, et al., 1992) If the microtubules are individual transceivers that act as guides to store and retrieve memories in mind, then the loss of memory function associated with dementia and Alzheimer's is explained by the unraveling of the induction coil like microtubules and subsequent loss of communication coherence in and between the axons. These patients do not really lose their memories, which are permanently stored in the complex field pattern of mind and thus protected. They instead lose the ability to access their stored memories in mind and perhaps to build new memory complexes for storage because the microtubule transceivers have deteriorated with the unraveling of the microtubule

magnetic coils. Microtubules are also accountable for the coherence of thoughts and building and maintaining streams of thought within the higher functioning neural networks, so those who suffer from Alzheimer's disease would also have problems maintaining thoughts, as has been observed.

In a similar manner, Jennifer Rodger and her colleagues (Rodger, 2012) are using a method of magnetically stimulating the brain at intensities that are too low to make a neuron fire to remove unwanted neural connections in mice. The method is called transcranial magnetic stimulation (TMS). It is thought that the magnetic coil initiating the TMS induces electric currents in the brain that can strengthen or suppress neural connections. But perhaps the low intensities are affecting the magnetic fields in microtubules which act as guides to strengthen or suppress those neural connections. TMS is also used on patients with brain disorders such as autism and depression for relieving some of the symptoms of their ailments. In the meantime, Talis Bachmann's team in Estonia is using TMS to hamper the ability of subjects to lie. (Karton and Bachmann, 2011) Applying TMS to the dorsolateral prefrontal cortex seems to hamper the subject's ability to lie. The mechanism for this effect has yet to be explained, but it will most assuredly have something to do with the magnetic connections between neurons in the neural networks. In all of these examples, it is quite clear that magnetic field variations introduced from outside the brain can influence the brain in very specific ways. The various quantum theories of consciousness are completely unable to account for these effects and experimental results, but this model can.

There is also ample support for the microtubule transceiver model in the as yet unexplained findings that complex memory recognition occurs in single neurons. In June of 2005, news of what scientists dubbed the "Jennifer Aniston Neuron" made international news. The research that garnered this dubious title actually demonstrated that single neurons in people's brains react to the faces of specific people. Whether a single neuron actually contains a memory of Jennifer Aniston or any other individual is still a debate. That particular single neuron could just have a general idea of the person, but still somehow 'collects data' from other neurons elsewhere in the brain by some unknown process to build a more complete 'picture' of a particular person, or for that matter, any specific thought. "The [research] team thinks that these brain cells probably respond to a range of different items, but that this limited study didn't include all the various pictures that might make a particular cell light up." This research came from Rodrigo Quiroga's research group at Cal Tech as part of their ongoing investigations of single neurons in the brain.

Here we report on a remarkable subset of MTL neurons that are selectively activated by strikingly different pictures of given individuals, landmarks or objects and in some cases even by letter strings with their names. These results suggest an invariant, sparse and explicit code, which might be important in the transformation of complex visual percepts into long-term and more abstract memories. (Quiroga, et al, 1102)

This notion of such a 'concept specific cell' reflects suggestions made in 1969 by Jerry Lettvin of the existence of a 'grandmother cell' and Jerzy Konorski in 1967 of a 'gnostic cell'. "A "grandmother cell" is a hypothetical neuron that responds only to a highly complex, specific, and meaningful stimulus, such as the image of one's grandmother." (Gross, 512) If such a cell exist, and Lettvin's suggestion was originally made as a parable in the classroom and thus lacks some scientific credibility, then a mechanism explaining the characteristics of its functioning would be necessitated. Yet this is exactly what this particular model of a complex neuron transceiver offers.

William James offered a similar but far more comprehensive contextual suggestion in his *Principles of Psychology* in 1890. In his example, it was called a 'pontifical cell'. The pontifical cell is presently defined as a cell that contains all of a person's memories and experiences of a specific topic, concept or idea. The pontifical cell is in this way different from the concept specific cell in that it is the site of experience of sense data. James's 1890 definition of a pontifical cell was instead a cell "to which the rest of the brain provided a representation" of a grandmother or other central concept. In other words, the experience of grandmother occurred in this cell, but the actual memory of grandmother was not specifically stored in this cell.

In a far broader sense, the complex axon transceiver acts in just this manner. An action potential moves along the axon transmitting a sensation to the brain. The potential excites the microtubules in the axon which then resonate with similar microtubules in other axons and neurons, more-or-less establishing a pattern which is the sensation or ‘experience of grandmother’ in the initiating neuron. The initiating cell also happens to represent other neurons associated with the knowledge and experience of grandmother throughout the brain. In this broader sense, the complex neuron transceiver almost seems a compromise between the concepts of the pontifical, grandmother and concept specific cells. Oddly enough, James mentions the pontifical cell in his chapter on “The Mind-Stuff Theory” in yet another one of those pernicious ironical coincidences. Mind-stuff is a concept first developed and popularized by William K. Clifford, the same mathematician who first equated a fourth dimension of space to magnetic induction, which is the theoretical basis of this model.

## NEURAL NETS

Groups of individual neurons tasked for a specific purpose and connected by dendrites form neural nets “whose inputs or signaling targets define a recognizable circuit.” (Wikipedia) For all intents and purposes, these nets are thought to implement logical, arithmetic and symbolic functions within the brain. For this reason, attempts are being made to develop artificial neurons and electronic circuits to mimic how these biological neural networks are thought to conduct logical and mathematical processes. During the course of conducting these mental processes, the neural nets can display a great deal of plasticity, the ability of synapses to disconnect from one location and relocate to another location on another neuron in order to facilitate a greater effectiveness in the neural net’s primary task. This plasticity can be affected or influenced by physical activity or mental activity, learning and experience. The mechanisms and processes by which this plasticity occurs is slowly being learned, but one persistent problem endures. If the plasticity depends on learning and experience, i.e. existing memories, how do neurons know where to place new connections or delete old connections (manipulate synaptic connections) to enhance or facilitate the networks tasks? In other words, how can the synapses be guided to new connection sites? That particular answer could also be much simpler than originally expected.

The synapses are all about electrical charges and variations through neurotransmitter exchange between different neurons. The idea is that they set up or establish synchronous networks for the simultaneous transmission of action potentials. Electrical potentials can only be guided in this manner by magnetic field variations. For example, the magnetic field gradients at the north and south poles of the earth guide ionized particles collectively referred to as the solar wind into the upper atmosphere of the earth where they create the aurora borealis and aurora australis. Similar magnetic field gradients could provide guidance and direct the electrical synapses of the neuron to where they would best benefit the workings of the neural network. The guiding magnetic gradients would be a product of the direct interaction between microtubules in neighboring neural axons and dendrites that form resonances together and the magnetic fields that surround the axons and neurons themselves.

When an action potential travels up or down an axon, it induces yet another level of magnetic field circularly around the outer axon, just as a direct current traveling through a conducting wire will create a magnetic field around its outer surface. This level of magnetic field would not directly have anything to do with memory, although it would add indirectly to the overall magnetic field of the brain and body, i.e., the magnetic vector pattern that is consciousness. This particular magnetic field would also tend to protect or rather isolate the magnetic field patterns within the axon and neuron from simple (non-patterned) external magnetic interference. These axonal magnetic fields would follow along to the dendrites and on to their connections to other neurons and thereby direct where synapses attached to other axons and neurons. In other words, these external magnetic fields would follow the path of least magnetic resistance or flow, establishing a continuous and consistently varying magnetic field for the neural net as a whole – a fourth level magnetic domain within the brain.

There can be no doubt that neural nets play an important role in memory and mind simply because they are pliant and reorganize their internal structures according to what is happening in memory.

Plasticity of this type cannot be and is not a random process, nor can it be the only memory process or even the only process at that level of mind and consciousness. Yet the neural nets are believed by many to represent the brain and mind's innate ability to learn the complex patterns representing external reality that we observe and experience in the external world.

In the brain, memories are very likely represented by patterns of activation amongst networks of neurons. However, how these representations are formed, retrieved and reach conscious awareness is not completely understood. Cognitive processes that characterize human intelligence are mainly ascribed to the emergent properties of complex dynamic characteristics in the complex systems that constitute neural networks. Therefore, the study and modeling of these networks have attracted broad interest under different paradigms and many different theories have been formulated to explain various aspects of their behavior. One of these — and the subject of several theories — is considered a special property of a neural network: the ability to learn complex patterns. (Wikipedia)

So, while the construction of the neural networks is guided by the overall magnetic field variations of the individual neurons that constitute the network, they must also conform to a larger context within the brain and mind as a whole, which is established by patterns of microtubule resonance.

Scientists well know that the body has a single overall magnetic field. They have also determined that the strongest individual magnetic field in the body is associated with the heart, not the brain. (HeartMath) The existence of these individual magnetic fields or domains implies that all organs and constructional units in the body have their own specific and unique magnetic field domains like the brain and heart — these others have just not been studied yet in any detail within the regular course of science. On the other hand, we have at least four levels of magnetic field domains in the brain that compose the most fundamental levels of memory: Memory level one — quantum particle-spin structure in water inside axons that is activated by electromagnetic interference between neighboring microtubules; Memory level two — the axon wall/microtubule transceiver complex system in neurons; Memory level three — the normal magnetic field around axons and neurons; and Memory level four — the internal magnetic field of neural nets that directs and regulates plasticity in order to facilitate efficiency, economy of memory, learning, experience, comprehension and other functions of mind.

Knowing this, it is logical to conclude that all cellular structures in the body have their own specific and unique magnetic field structures. All cells have cell walls that could act as capacitors, are filled with water and have internal components including microtubules that could act as coils. For example, DNA has a spiral structure that could be conducive to establishing a magnetic field structure that would render it an electromagnetic wave transceiver. Furthermore, neurons are not only found in brain, but throughout the body. In fact, the heart has the largest concentration of neurons in the body outside of the brain. These neurons were, until recently, thought necessary to control and monitor heart function. But recent studies suggest that as least 80% of the heart's neurons are not needed for these activities. (HeartMath) This fact has convinced some scientists to refer to the heart as the body's second brain. Many scientists also believe that individual cells have rudimentary memories and that neurons retain memories at individual sites throughout the body, not just in the brain. So it is no far stretch of the imagination to suggest that both mind and consciousness extend throughout the whole body and that consciousness is the whole of the magnetic field corresponding to the body.

If anyone doubts that the human body is electromagnetically active or has a single magnetic field as a whole, the reality is easy to demonstrate. Just find an old television with rabbit-ears antenna. For that matter any external antenna will work in this demonstration. As you approach the television and try to adjust the antenna for an improved image the reception begins to change, sometimes the picture is lost altogether before you even touch the antenna. After you adjust the antenna for maximum reception and a good image you release the antenna, but as soon as you move away the reception is again lost. What happened? The explanation is simple. Your magnetic field alters the electromagnetic field of the incoming waves. In fact, when you move close to and touch the antenna, you actually become part of the antenna system due to your magnetic field. So when the television antenna is released, the antenna system changes

and reception either degrades or is lost altogether. People and living organisms are naturally electromagnetic, rather than just material energetic bodies.

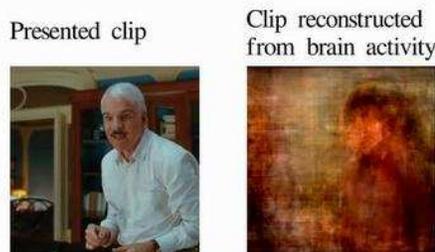
The work and researches of Fritz-Albert Popp offers further justification for an electromagnetic model of the human body and all living organisms. It indirectly supports this model of the microtubules and this electromagnetic model of mind and consciousness. Popp has been studying the production of biophotons in cells throughout the body, and indeed throughout the cells of all living organisms, for the past few decades. Popp and others have suggested that individual cells throughout the body communicate with each other through the exchange of biophotons.

Biophoton emission is a general phenomenon of living systems. It concerns low luminescence from a few up to some hundred photons-per-second per square-centimeter surface area. At least within the spectral region from 200 to 800nm. The experiential results indicate that biophotons originate from a coherent (or/and squeezed) photon field within the living organism, its function being intra- and inter-cellular regulation and communication. (Popp, 1999)

Use of the word biophotons suggests only a quantum source of electromagnetic emission in living cells and organisms, but that need not be true. The cells as a whole or in part could be emitting electromagnetic waves classically by interactions between microtubules and cell walls, and/or other bio-components in the cells. There is no need to just assume that everything that happens in the cell is quantum mechanical just because the cells are so small. Otherwise, Popp's speculation that all cells communicate through biophotons exchange fits this neo-classical model of the axon wall/microtubule transceivers very well.

While science waffles on the existence of the paranormal, many scientists, especially in the physics community, still want nothing to do with either mind or consciousness. To study or conduct research in the physics of consciousness is neither the best way to make friends nor impress colleagues in the physics community. Yet the public remains enamored with the concept of the paranormal. In just the last few months, two new advances in the neurophysical sciences that caught the public's imagination have been announced. The first has been billed by the popular press as a telepathy machine. The claim is that "Neuroscientists at the University of California, Berkeley, have been able to listen in on people's thoughts, using brain waves to reconstruct the actual words that subjects have been hearing," (Woolacott, 2012) however this claim might be a bit premature and inaccurate. The research has been conducted by Robert Knight. Up to two-hundred and fifty-six electrodes were placed on subjects temporal lobes to 'listen' to their brain activity while they listened to conversations. The signals were relayed to a computer and interpreted as speech. This of course is not a telepathy or 'mind-reading' machine because it merely interprets electrical signals in the brain as detected at the surface of the brain, but it does mark a new understanding in the electrical language of the brain and interpretation of electrical signals in the brain – an obvious advance in brain research and neurophysics.

The second advance uses a standard fMRI machine, which scientists have successfully used to reconstruct rudimentary images from the brain in real time. This particular research was conducted at the Gallant Laboratory at Stanford University. The test subjects actually watch movies and movie clips while undergoing fMRI scans and a computer interprets the signals and reconstructs a very rough image of the movies from the test subject's mind.



(Nishimoto, 2011)

In this case, the fMRI is merely interpreting changes in magnetic particle spins within the brain, in particular magnetic resonance spins in water molecules. It would seem then that the thoughts generated in the test subject's mind while viewing the movies are either building memories within their greater context of real life experiences or recognizing and comparing what they are seeing with real life experiences by utilizing the quantized magnetic spins of particles within water molecules in the brain, much as is suggested by this model of the microtubules and how they interact with each other to establish memories. Moreover, those patterns are being detected outside of the skull without any material devices such as electrodes in direct contact with the brain or skull. In other words, the fMRI and the computer program interpreting the magnetic pattern signal are acting as a true although low level mind reading machine. This experiment very nearly verifies the model proposed here that thoughts and memories are stored as magnetic patterns that these patterns can be 'sensed' or detected outside of the originating brain.

### **A STRANGE PHYSICAL GEOMETRY**

So far, this model only explains memories and some of the more important characteristics of memory in the minutest details although it implies a more comprehensive model of consciousness. For mind and memory, the important thing to remember is that everything electrical has a magnetic counterpart and vice versa and the relationship between electricity and magnetism is not unlike that between mind and consciousness, offering the most important clue to discovering the physical identity of mind and consciousness – not just their physical correlates. Other scientists have determined through observation and have enough confidence in those observations to convince them that mind and consciousness can be found in the synaptic gaps, individual microtubules or neural synchrony. But consciousness is not just one or the other of these; it is a far more complicated and complex global effect.

Karl Pribram, David Bohm and many others have argued that mind and consciousness are holographic in nature and in a sense that is true. But the hologram that corresponds to mind and memory is actually the vast complex pattern of electric (electromagnetic scalar) potential that makes of the electric field and the vast pattern of magnetic (electromagnetic vector) potential variations that constitute the magnetic field corresponding to the whole body – the electromagnetic body. Different parts of the brain handle different functions of mind and consciousness while different groups of neural bundles comprise the different parts of the brain, right on down to the neural nets, neurons, microtubules and water molecules in the neurons. A continuity of magnetic domain levels that handle different aspects of what emerges as consciousness from the brain and body as a whole exists and connects the matter/energy bodies of organisms to their electromagnetic counterparts.

Since the magnetic vector potential is four-dimensional, scientists and scholars must first learn about the strange geometry of space inhabited by consciousness and the universe as a whole to understand consciousness at an even higher level than they presently use to muddle through the concepts. Consciousness physically extends in the fourth direction of space and the geometry of four-dimensional space differs from that of our commonly experienced three-dimensional material space. That is why people who have directly experienced pure consciousness, such as episodes of spiritual or mystical enlightenment or NDEs, have trouble explaining their experiences in common languages that were developed to explain three-dimensional experiences.

Technically the common three-dimensional space that we experience is just a 'slice', 'cut' or 'sheet' extending across the whole of the four-dimensional expanse of physical space. This 'sheet' has been described in the past as the skim on boiled milk, but it is far more complicated than this simple analogy suggests. The fourth dimension would look more like a book of individual pages, only one of which represents our common three-dimensional space. The pages are actually continuous with each other such that the fourth direction in space is continuous, but each page would have an 'effective' thickness that is proportional to the quantum and thus defines the materiality (limits the size of material particles) of our three-dimensional space. Matter would thus be restricted to just this one 'sheet' or page within the greater four-dimensional space. The special geometrical properties of the four-dimensional space that

render it different from our three-dimensional space can explain many of the quirks of both consciousness and the universe as a whole. For example, the fourth direction of space extends from each and every geometrically dimensionless point in three-dimensional space. So the fourth dimension is inside us, at least in each and every point in the three-dimensional volume that our body inhabits, but since we are materially restricted to exist within the 'sheet' cutting through the fourth dimension that point-by-point extension is also outside of our three-dimensional material body. Our extension in the fourth direction of space is both inside (from the three-dimensional perspective) and outside (from the four-dimensional perspective) of us at the same time.

A four-dimensional being or a pure consciousness would thus have instant and direct access to each and every three-dimensional geometrical point within a three-dimensional material body. This fact could explain how true healers are able to diagnose problems and heal as well as many purely material phenomena such as presented by atomic nuclei. Experiments confirm that protons and neutrons in nuclei maintain an independent existence and give the nuclei definite internal structures, i.e., nuclei should be lumpy, yet other experiments show that the nuclear particles somehow meld together to form a unitary spherical mixed fluid body. These two opposing views of the nuclei can only be remedied if the structure occurs in the fourth direction of space as the protons and neutrons are stacked on top of each other, thus they would only show a three-dimensional spherical mixed surface to the external three-dimensional world in the 'sheet'. With this structure, quantum tunneling within the nucleus would be rendered unnecessary during the radioactive decay process of emitting particles.

If a person is locked away in a three-dimensional jail cell, that person could escape from the jail cell by going through the four-dimensional extension of the jail cell without ever having passed through the three-dimensional wall of the jail cell. The escape would be no more trouble for a four-dimensional being or a three-dimensional being with access to the fourth dimension than when a three-dimensional being steps off of a two-dimensional rug without passing through one-dimensional line that forms the geometric edge of the rug. We could only imagine that a three-dimensional person escaping from the three-dimensional cell by passing through the fourth dimension would just appear to dissolve as he passed through the three-dimensional cell wall and resolve or just appear magically on the other side of the wall. This fact explains quantum tunneling without having to invoke any reference to quantum mechanics or probabilities, but doing so is all but prohibited by the reigning paradigm in physics today.

By the same token, a three-dimensional basketball that is hollow inside could be turned inside out by passing through the fourth dimension without tearing, bending or rupturing the ball. An extremely complicated knot of string, impossible to untie in three-dimensional space, could be untied without trying or effort by passing it through the fourth dimension. The knot would not even be tied in the higher dimension because every point in the three-dimensional space occupied by the string would be simultaneously open (untied) to a four-dimensional being. All of these physical characteristics of a higher-dimensional space were originally discovered in the 1870s (Newcomb, 1877, 1879; Frankland, 1877), but seem to have been forgotten by today's scientists and mathematicians.

Understanding these finer geometrical points of the higher space also explains a lot about the relationship between consciousness and three-dimensional mind, brain and matter in general. These two perspectives of geometrical structure introduce a duality of perception into everything that we know. In modern physics this duality appears as the infamous wave/particle duality in the quantum theory. This problem is directly related to the differences between the quantum theory and relativity that cause so many headaches for modern physicists. The matter/energy pattern that constitutes life and the electric scalar potential field that constitutes mind are both three-dimensional, while the magnetic vector potential pattern constituting consciousness is four-dimensional. Our logical interpretation of the external material world is based upon our three-dimensional experiences and observations of the world, but we still have an unexplained intuitive sense of the world. The difference between logic and intuition is the same as these other dualities. Logic is a three-dimensional property of the brain and mind while intuition is a four-dimensional property of consciousness. We could say that intuition is the normal sense by which the consciousness interacts with the universe at large through its four-dimensional continuity with the rest of the universe. Our intuitive sense of the world is part of our consciousness and thus naturally and

instantaneously utilizes its four-dimensional connection to the rest of the universe to impart unlearned knowledge of the world even if we are not consciously aware of that knowledge.

There is even a duality to normal electromagnetic waves that spread out through space at the speed of light. Electromagnetic theory predicts the existence of the normal transverse three-dimensional electromagnetic waves, but it also predicts the existence of corresponding four-dimensional longitudinal electromagnetic waves that accompany the transverse waves. (Whittaker, 1903; 1904) Like the magnetic vector potential, these waves have never been detected or observed in three-dimensional space, simply because the longitudinal waves travel through the fourth-dimension which also cannot be detected or observed. (Beichler, 2007) Yet they still play an important role in the physics of the universe and consciousness. The longitudinal portion of the electromagnetic waves or solitons emitted by microtubules explains how the microtubules are able to imprint long-term memory in the fourth dimension of space as opposed to the transverse waves that cause diffraction patterns in the surrounding water medium and resonate with similar microtubules in other neurons to establish a wider net of patterns.

Louis DeBroglie attempted to develop a quantum theory of relativity in the 1920s that he called the ‘theory of the double solution’. (DeBroglie, 1956) He proposed that pilot waves accompanied the normal matter waves corresponding to the Schrödinger wave mechanics that explains the quantum. This interpretation of quantum wave mechanics was completely non-probabilistic and classically deterministic which went against the grain of thought concerning the quantum theory at that time, so the theory was completely disregarded by the quantum physicists of his day. In DeBroglie’s theory, the pilot wave traveled faster than the speed of light by the same proportion that the matter wave representing the material particle traveled slower than the speed of light, but his theory only utilized an Einsteinian four-dimensional space-time. Had DeBroglie more fully adopted a five-dimensional space-time framework his theory would have made more sense because the relationship between his pilot and matter waves would correspond directly to the relationship between four-dimensional space (five-dimensional space-time) and three-dimensional space (four-dimensional space-time). This same relationship also applies to the differences between the four-dimensional longitudinal electromagnetic waves and the three-dimensional transverse electromagnetic waves and thus he could have unified all of gravity theory (Einstein’s general relativity), electromagnetic theory (Maxwell’s theory with an added spatial dimension) and the quantum theory with just a few minor changes, which was actually his intent.

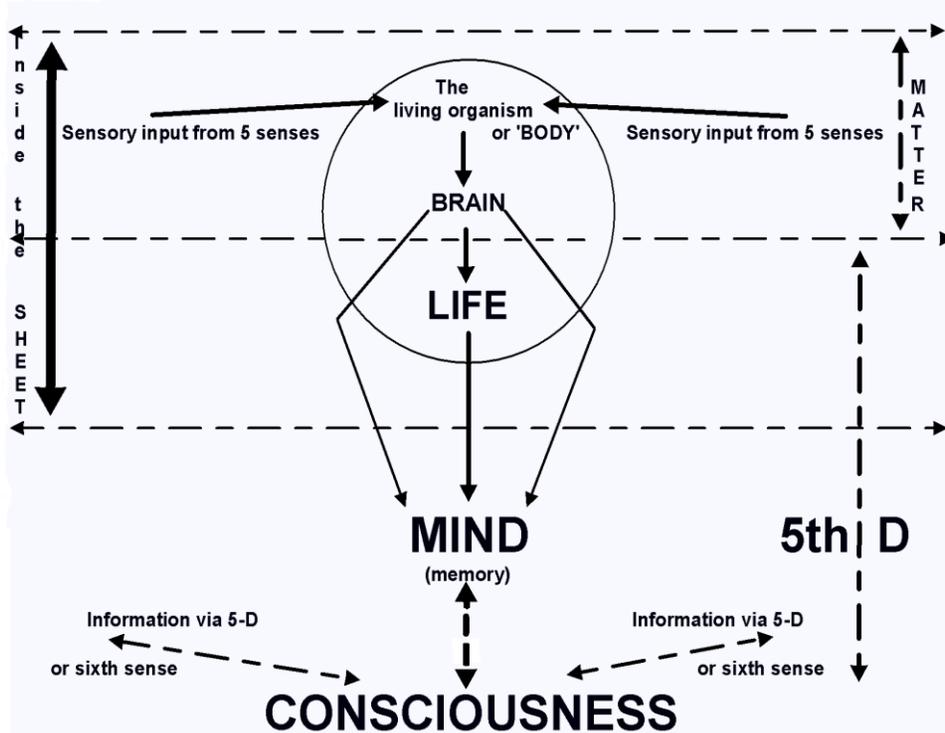
The advantage to the higher dimension in this sense is the simple fact that Einstein’s limit of the speed of light for material particles only refers to three-dimensional space. In three-dimensional space the speed of light depends on the values of the magnetic permeability and electric permittivity of free space, but these two values differ in the higher dimension of space. So the speed of light does not apply to signals crossing through four-dimensional space. This fact offers a simple explanation of how DeBroglie’s pilot wave could travel faster than the speed of light and still affect matter and matter/field interactions in three-dimensional space. Moreover, three-dimensional transverse electromagnetic waves are restricted by the speed of light, but the longitudinal waves that travel in the higher fourth dimension are not restricted by the speed of light because they travel outside of our three-dimensional material ‘sheet’.

DeBroglie’s theory was rejected at the time. It laid fallow and was all but forgotten until it was revived and reinvented by David Bohm and Jean-Pierre Vigièr nearly three decades later. The theory eventually evolved into Bohm’s concepts of a quantum potential field, the implicate/explicate model of the quantum universe and the holographic universe, which Bohm later combined with Pribram’s concept of a holographic consciousness. Once again, the notion of relating a specific model of fundamental physics and consciousness had come full circle, back to consciousness, which should be expected since a complete unification in physics implies that a physical explanation of consciousness is necessary. Furthermore, experimental evidence from remote viewing research (Puthoff and Targ, 1979) implies that the signal strength of psi does not attenuate over distances and the signal, whatever it is physically, is not limited by the speed of light. The same would be true for the portion of electromagnetic waves traveling outside of the ‘sheet’ that represents our three-dimensional material world, which once again favors the five-dimensional model of space-time.

Kaluza set two mathematical conditions for his purely mathematical model in his original five-dimensional extension of Einstein’s general relativity. Each geometric point in three-dimensional space

(or four-dimensional space-time) extended into the higher spatial dimension along an **A**-line. However, those **A**-lines must be of (1) equal length and (2) they would have to return to the other side of the three-dimensional space at the same point that they exited it. Beyond this, Kaluza only suggested that the fourth dimension of space (fifth dimension of space-time) must be infinitesimally small because it could not be detected or sensed. A few years later Oskar Klein tried to quantize Kaluza's framework of space-time by equating the suggested infinitesimal length of the **A**-lines to the quantum. He was unsuccessful in these attempts and admitted so, but more than five decades later Klein's unsuccessful model was adopted by the superstring theorists to explain their vision of a ten-dimensional universe. The **A**-lines took on a new life as superstrings. Einstein rejected Klein's adaptation of Kaluza's model although he was enamored with Kaluza's original five-dimensional model and sought to extend it with the help of colleagues in the late 1930s and early 1940s. (Beichler, 1980) They were able to prove mathematically that the extension in the higher space was not necessarily infinitesimal, but that it could be macroscopically extended. Einstein abandoned this particular avenue toward developing a unified field theory because he could not come to terms with the fact that a macroscopically extended higher dimension could not be detected or sensed.

Unfortunately, Einstein was too positivistic and never realized the possibility that we sense and use the higher dimension intuitively through consciousness. He did not nor could he understand at the time that the physical characteristics of how consciousness interacts directly with the material world and the external world of the universe depended on the physical geometry of the universe.



Our sixth sense works exclusively in the higher dimension of space, just as our normal five senses work only in our common three-dimensional space with time.

Einstein envisioned the four-dimensional space-time continuum of our world as a unified gravity and electromagnetic field. His was a purely three-dimensional brain-logical worldview. He only considered the possibility that the trees constituted the forest and did not see the forest as a whole through the trees. However, from the perspective of the fourth spatial dimension the four-dimensional expanse is filled with a single field of potential that is the precursor to everything that exists in three-dimensional space – gravity, electricity, magnetism, matter, life, mind and consciousness. These are all different aspects of physical and/or material manifestations of the single field. In other words, seeing the forest and how the trees are related to make it a forest. This worldview thus introduces a certain duality to our world

that has already been discussed to some extent as wave/particle duality and the logical/intuitive duality. Einstein as well as other scientists have fallen prey to the duality of worldviews, or perhaps they have been prisoners to it. This duality, whether it is called yin and yang or male and female is built into the very fabric of space time. In physical geometry, this duality takes the form of the difference between a space made from dimensionless points and one made from extensions such as lines, areas and volumes.

Theoretical geometry is based on the fact that lines or extensions are continuous (unbroken) yet composed of an infinite number of dimensionless points. This basic notion is then applied to the real world to explain motion in the science called physics. The theoretical manipulations and basic calculations of motion in physics are based on calculus, which is really neither more nor less than mathematics of motion whereby a change in position in space (distance) in ratio to a change in position in time (duration) is a velocity. Velocity is the basic manifestation of motion in our three-dimensional material world. However, that simple definition is not enough to conduct science. Science needs an instantaneous velocity to define accelerations, which are changes in motion, but an instantaneous velocity would be one that occurred over an instant or ideally zero time. An instantaneous velocity ideally occurs at a single (dimensionless) point in space-time, which is virtually impossible to imagine or calculate. So the calculus of motion defines an instantaneous velocity as a limit whereby the change in time only approaches but never reaches zero. Classical physics, including Newtonian gravity, is based upon this concept.

On the other hand, general relativity is based upon the Riemannian metric, such that the curvature of the space-time continuum is taken over progressively smaller regions of three-dimensional space approaching the dimensionless point, but never reaching that geometrical point. In other words, science can approximate how space and time act as they approach a dimensionless point or over a small interval or volume of space passing through the dimensionless point without having to actually think about what actually happens at that point. Nonetheless, both of these mathematical methods represent extension-geometries that only look at shorter and shorter extensions in three-dimensional space that never actually reach zero, i.e., the dimensionless point. Fortunately, the mathematical models that science has developed for the purpose work well – well almost! It seems that the opposite arguments should also be true from an idealistic mathematical point-of-view and that dimensionless points could be used to generate extensions in space, but there exists no accurate method by which dimensionless points could ever generate extensions in space or be used to develop an equivalent geometry of extensions. Yet the existence of these geometrical points is guaranteed by continuity theorems for linear extensions in calculus and geometry. There is however a way to get around this predicament.

Solving this geometrical problem is important for parapsysics as well as the physics of consciousness because consciousness essentially exists within these dimensionless points in three-dimensional space that extend into the fourth dimension of space. The only possible way to get around this impasse is to demonstrate that a physical space can only be real if the geometrical points from which that space is constructed do, in fact, extend into a higher dimension. Otherwise, the dimensionless points cannot be extended in any manner to build the lower-dimensional space for which they are the primary geometrical elements. This argument would constitute a mathematical proof that our physical three-dimensional space exists and is real, but it also places mathematical conditions on our three-dimensional space by defining the characteristics of the fourth dimension that allow physical space to exist. This theorem is actually implied in the original paper written by Bernhard Riemann that developed the general form of Riemannian geometry “On the hypotheses which lie at the foundation of geometry”. Riemann found that an  $n$ -dimensional space would always be embedded in a higher  $n+1$ -dimensional manifold in his explanation of a curved space. Einstein did not take into account the possibility that our  $n=3$  space was embedded in a higher  $n+1=4$  dimensioned manifold in his successful application of the Riemannian geometry, but instead assumed that the fourth dimension was time for his theories of relativity. The spatial curvature that Einstein equated to gravity and material bodies was thus reduced to a mathematical formalism rather than a physical reality.

The mathematical conditions on this higher space that are required to render three-dimensional space real are quite simple. They are four in number. The first two are easily recognizable: (1) a one-dimensional line extending in the fourth direction from a dimensionless point in three-dimensional space must complete a circuit and return to that same point from the opposite direction; and (2) all lines

extending from all dimensionless points in three-dimensional space must be of equal length. These are just the mathematical conditions that Kaluza set on his five-dimensional extension of Einstein's four-dimensional space-time continuum. The third and fourth conditions are not so easily recognized: (3) the one-dimensional lines extending into the higher dimension from three-dimensional space must all be at least as long as a circumference line that completely encircles the embedded three-dimensional space. That is because (4) All of the one-dimensional lines that extend from the dimensionless points in three-dimensional space must pass through a single common point in their circuit before returning to the three-dimensional space in the opposite direction. These last two conditions can only be fulfilled if the higher embedding space is macroscopically sized, just as Einstein and his colleagues proved in the 1930s. It must also assume a single-polar elliptical Riemannian shape. In laymen's terms, each of the one-dimensional lines extended in the fourth direction of space look like a Möbius strip. This means that each point in three-dimensional space would have an inherent half-twist to it. These last two conditions impose the same overall structure as the four-dimensional space that Clifford envisioned in the 1870s, but the physical consequences of these conditions are really what is important.

The half-twist in each point of our three-dimensional space means that rotations of extended lines around a central point are possible in our common space. In other words, three-dimensional space can be characterized by its support of either translational or rotational motions, which just happens to be observationally and experimentally true. Furthermore, this twist to the points in space accounts for the half-spin of particles and, in fact, sets a requirement that all real stable material particles have half-spin. So material particles can only be stable and real if they meet the geometrical condition of a half-spin in the higher fourth dimension. Only protons, neutrons, electrons (muons and taus) and neutrinos are real material particles. In a strict mathematical sense then, all points in three-dimensional space correspond to each other and are co-existent with one another since all points in three-dimensional space pass through a single point, the single pole in the higher dimension. With regard to consciousness, all consciousnesses in the universe as well as all points in the universe coincide at the pole in the fourth dimension. When people become enlightened such that they reach a higher level of consciousness than normal human consciousness, they experience a direct connection with everything in the universe through the single continuous field that fills all of four-dimensional space and time or five-dimensional space-time. A still higher level of consciousness would emerge in a person who directly experienced the pole-point in the single polar elliptical fourth dimension of space. When this occurs, a person is literally at one with the universe.

Einstein used the Riemannian structure of a double polar Riemannian sphere to model gravity as four-dimensional space-time curvature, but it was really space alone that was curved in the higher fourth dimension of space independent of its connection with time. Einstein's positivistic leanings just got the better of him when he interpreted his mathematical model of gravity and curved space-time. But the Riemannian geometry that he used is only a metrical extension-geometry and cannot directly account for the individual points in space. On the other hand, classical electromagnetic theory implies both an extension- and a point-geometry because electricity has a three-dimensional scalar potential structure and magnetism has a four-dimensional vector structure. Common gravity only utilizes an extension-geometry while electromagnetic theory implies a combined point- and extension-geometry. That is why Einstein was unable to unify them. In their classical formulations these two forms of the potential field can be expressed by the classical forces associated with them.

The first equation is the Lorentz equation and the second is just the Newtonian equation for gravity.

$$\mathbf{F}_{EM} = q\mathbf{E} + m\mathbf{v} \times \mathbf{B}$$

$$\mathbf{F}_{gr} = m\mathbf{g}$$

In the first equation, the total electric force is a combination of a charged body ( $q$ ) interacting with the electric field ( $\mathbf{E}$ ) and the magnetic field of a moving charge ( $m\mathbf{v}$ ) interacting with the total local external

magnetic field (**B**). The gravitational force is just the product of a body with mass (m) interacting with the local gravity field (**g**) due to a single material object. And therein lays the problem of unification between the gravity and electromagnetism that no one except Kaluza has yet solved. Yet even Kaluza's solution was a mathematical formalism rather than a true physical unification. There is a global (multi-source and multi-dimensional) implication for the magnetic field **B** that is not repeated in the equation for gravity. In other words, gravity has a two-body interpretation and no more. It does not take into account the gravitational attraction of other bodies, up to the gravitational attraction of the rest of the universe, which could be interpreted in a higher level geometric structure as a point-by-point application of geometry.

Einstein's mistake was only accounting for the metric structure of space-time and not the point-by-point equivalent structure as implied by the Lorentz equation. The Riemannian geometry that he used to derive the equation for gravity only accounts for an extension-geometry. In the classical Newtonian case, another factor can be added so that the gravity equation also implies a point-by-point interpretation by making the two equations symmetric.

$$\mathbf{F}_{gr} = m\mathbf{g} + m\mathbf{v} \times \mathbf{\Gamma}$$

In this equation, the quantity  $\mathbf{\Gamma}$  represents the global gravitational field strength or rather the gravitational contributions of all material objects in the universe other than the one represented by the mass m while the quantity 'm $\mathbf{v}$ ' would amount to the momentum of the material object with mass m that is due to the material body generating gravity **g** alone. The first part of each equation represents the scalar potential field and the second part of each equation represents the vector potential field. The first part of each equation is three-dimensional and the second part of each equation is four-dimensional. But the really nice thing about the second part of the new gravity equation is that it leads to a Newtonian explanation for Dark Matter and Dark Energy. The final product of the 'm $\mathbf{v} \times \mathbf{\Gamma}$ ' term indicates that a ring of curvature representing the non-local contribution of gravity from the rest of the universe would form around a galaxy. This ring has been detected by scientists who have interpreted it as a ring or halo of Dark Matter while the vector potential associated with the quantity is itself the Dark Energy that exists in each and every point in three-dimensional space. When this Dark Energy is confined or restricted to the interior geometrical points of a material particle by the curvature of space, it is commonly called inertia.

Furthermore, and this is the important aspect of the geometry with regard to consciousness, the first part of each equation can be interpreted as function dominant and the second part of each equation as form dominant. The electrical particles in the body relate primarily to body functions – biochemical processes, ions passing into and out of cells, action potential starveling along axons, and so on - while the overall electric potential pattern associated with the body functions as mind. Although indirectly related to function just as the magnetic field is indirectly related to function according to the third and fourth of Maxwell's laws of electromagnetism, the second portion of the equation relates directly to function. Put another way, the appropriate magnetic field guides the structural formation of neural nets to allow a more effective flow of action potential and coordination between different neurons in the network as well as forming the basic patterns for memory storage in the higher-dimensional magnetic vector potential field. The second part of the new gravity field equation plays an important role in galactic formation and helps to hold galaxies together, giving them their characteristic spiral shapes. Yet the magnetic forces are properties of the very points in space and space-time so they can easily play a formative role across an extremely wide range of physical magnitudes and material sizes, from atoms and molecules all the way up to stars, star systems and galaxies.

The notion that magnetism can act as a guide to the structural formation of any part of a living organism is radical and new, although it should not seem so. Rupert Sheldrake severely criticizes modern biology for its lack of any theoretical method to explain form and structure in biological organisms. According to Sheldrake,

It is generally the case that the matter and energy of which things are composed have the potential to be present in many different forms, and so these forms cannot be fully explained just in terms of their material constituents and the energy within them. The

---

form seems to be something over and above the material components that make it up, but at the same time it can be expressed only through the organization of matter and energy. So what is it? (Sheldrake, 58-59)

Sheldrake's answer comes with his theory of morphic fields and a hypothetical process that he calls formative causation, which he defines as the "hypothesis that organisms or morphic units at all levels of complexity are organized by morphic fields, which are themselves influenced and stabilized by morphic resonance from all previous similar morphic units." (Sheldrake, 368) However, Sheldrake further points out that biologists will not take their explanations past the molecular level because they have no need to do so, but still assume that the ultimate behavior of molecular particles will be reduced to modern physics. (Sheldrake, 70) Yet physicists do not seem so eager to look for anything that smacks of a 'life force' or any similar concept that goes beyond the molecular explanations of life made by the biologists. Hence the problem for the life sciences, which is multiplied by related problems in consciousness studies, needs a whole new paradigm in physics to break this impasse and move forward.

Although indirectly related to function, the second portion of the Lorentz electromagnetic equation is related to form and formative processes. Put another way, the appropriate magnetic field guides the formation of neural nets and also forms the memory patterns that are stored to form consciousness, while the second part of the new Newtonian gravity equation forms and holds galaxies together giving them their characteristic spiral shapes. The fact remains though, gravity must be expressed as a point phenomenon just as electromagnetism is before the two can be unified, and as it stands the Riemannian metric structure of space-time advocated by general relativity is 'only' an extension-geometry. If twist is a physical property of a point in space, as has been guaranteed by the new mathematical existence theorem for three-dimensional space, then the twist in a dimensionless point will affect everything in that space. This is especially true for physical constructs that depend so heavily on spatial characteristics, such as the gravitational field and not just the electromagnetic field. So gravity must have some geometrical representation and relationship to each and every point of space as does electromagnetism, but this representation is not explicitly expressed in either the Newtonian or the classical Einsteinian theories of gravity.

This new formulation for the Newtonian gravitational force is not completely unknown in physics, although it has been misinterpreted to represent a fifth fundamental force in nature by those who have used it in the past. It is sometimes called gravitomagnetism or gravitoelectromagnetism (GEM) and is often associated with a new field called the torsion field. The equations were first published in 1893, before general relativity, by Oliver Heaviside as a separate theory expanding Newton's law. The concept of torsion (another name for the 'twist' in each dimensionless point of geometrical space) and the torsion field has also been related to Einstein's 1929 attempt to unify gravity and electromagnetism (Beichler, 2006, 256-257) using a form of point-geometry developed by Élie Cartan instead of Riemann's metric geometry. Unfortunately, the Einstein-Cartan theory, as it is sometimes called, is still represented by the more common four-dimensional space-time geometry. The fact that it is so represented reflects the extent to which the concepts inherent in the Cartan geometry that is used are not completely understood by those using the geometry. Cartan's development of the point-geometry which bears his name was based on Clifford's geometrical theories from the 1870s, which were without any doubt based on a four-dimensional spatial geometry.

A newer expansion of the notion of torsion based on the Einstein-Cartan theory has been developed over the past three decades by Anatoly Akimov and Gennedy Shipov. (Akimov and Shipov, 1996) Their theoretical research has been and remains quite controversial, but has also gained a few non-Russian advocates. (Reed, 1998) These particular torsion fields have also been used to explain paranormal phenomena and consciousness, but they are not five-dimensional models so the concept of torsion that they present remains a mathematical artifact of a dimensionless point rather than a measurable physical attribute of space. Beyond the basic idea that torsion of some form exists in every point of space, which is an accepted idea in different areas of physics, there is little relationship between these proposed torsion fields and this five-dimensional model of physical reality. The concept of a torsion field is a misinterpretation of the quantity  $\Gamma$  in the new Newtonian gravity equation, which equates to the quantity

Lambda-CDM in Einstein's metric formulation of gravity, at least in the four-dimensional representation of the space-time continuum. However, other scientists, notably Henry T. Flint and his colleagues, have either adopted the Einstein-Cartan theory or blended it into more comprehensive five-dimensional theory of unification (Flint, 1966) and this model of physical reality does bear characteristics and interpretations in common with them. In other words, ample background material is available in standard physics to support this overall five-dimensional single field theory.

## COSMOLOGY OF CONSCIOUSNESS

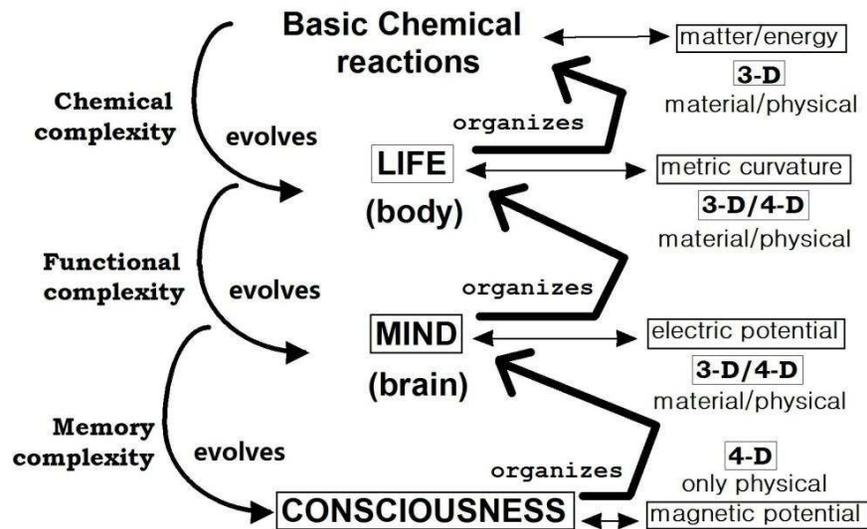
In the grand scientific scheme of things, the universe is thought to have originated in a hot Big Bang. Then came inflation, followed by particle creation along with gravity, electromagnetism, light and energy, after which came the primary elements, the first stars, heavier elements and a great deal later a second generation of stars, galaxies and planets revolving around the stars. At first the universe seemed to be ruled by chaos, quantum fluctuations and entropy, but they could not have completely dominated the early universe because orderly structures took form and emerged. After maybe a hundred million years or more, the first of those structures emerged and structures and order have been emerging ever since. Even though the thermodynamical principle of entropy is increasing for the universe as a whole, there must have been some form of early symmetry between order and disorder for order in the universe to emerge. Order is also a fundamental principle and with entropy (disorder), forms one of the more fundamental dualities in nature. This is because the action of fundamental forces of nature – gravity and electromagnetism – on a chaotic system allow the emergence of complexities in spite of the thermodynamical increase in entropy, and so on and so on. This duality of nature, an ongoing battle between order (complexity) and disorder (entropy or chaos), still continues today in one form or another.

But something else happened when the environmental and other external influences on planets and possibly elsewhere started to form complexities. Different chemical structures formed groups that remained stable when stability enhanced their possibility to survive and increased their efficiency with respect to their environmental conditions. Eventually, by some as yet unknown cause, life emerged as a new and unique complexity based on the mutual benefit of a special group of chemical interactions. This first complexity of matter and energy that we call life either evolved in a pre-cellular form or soon evolved into the cells that form the basic structural unit of life today. One-celled organisms ruled the earth for millions upon millions of years. These one-celled organisms were themselves a chaotic soup that eventually came together in a new unique pattern and a new complexity emerged – multi-cellular life. At this point if not earlier, life bifurcated or branched out forming the forerunners of plants and animals. The concept of form dominated plant life so plants grow after the fashion of fractal patterns, while the concept of function dominated animal life allowing animals to grow evermore complex internally and eventually develop brains. All of the living organisms were a three-part mix of matter/energy scalar field pattern, electrical scalar field pattern and magnetic vector field pattern. Life itself is the matter/energy field pattern, mind the electric field pattern and consciousness the magnetic field pattern. All life has mind and consciousness, but mind and consciousness only developed further for animals since mind and consciousness are basically functional in design.

The simplest valid form of biological evolution was first described by Charles Darwin. His theory stressed the process of natural selection, but cellular mutations were also found to cause evolution at a later date. However, beneficial mutations that are not destroyed in the first generation of offspring are very rare and cannot account for many of the evolutionary jumps that the fossil record demonstrates reveals. Natural selection is random and very slow, so the rapidity of the evolutionary jumps and their seemingly guided results are at complete odds with Darwinian natural selection. In other words, there are severe problems with evolution theory. These problems arise from the fact that natural selection and beneficial cellular mutations are forms of evolution that proceed from the bottom-up. It is difficult, given the circumstances, to explain how such slow minor evolutionary changes can cause, as if by magic, the eventual rapid evolution of *Homo sapiens* characterized by self-awareness. Bottom-up evolution is obviously incomplete, although that fact does not warrant attributing the evolutionary jumps found in the

fossil records to some form of superior intelligence or being. In other words, there must be another fundamental type of natural evolution that science does not yet recognize – evolution from the top-down.

As normal Darwinian evolution developed a complex enough organism that the organism needed a brain to control and coordinate the other organs, structures and chemical processes that support life, the electrical complexity pattern of mind reached a new complexity level of its own to begin top-down evolution. After the brain developed, memories began to collect in mind. They were chaotic at first, but the mind learned as the organism gained more experience of the world through its five senses and the chaotic memories began to form sub-groups based on similarity in patterns. The mind began developing connections between different memory patterns until the memory patterns, magnetically stored in the higher dimension of space, developed their own connections and a new level of memory complexity emerged as a new and higher level of consciousness.



As higher and higher levels of mind and consciousness complexes emerged, they literally programmed or organized the chemistry of the brain and body to undergo corresponding evolutionary steps, but these top-down evolutionary advances caused greater individual evolutionary jumps than their bottom-up compatriots. The present human level of consciousness emerged perhaps a hundred or a hundred and fifty thousand years ago when the latest memory complexity allowed humans to distinguish their positions space, developing their first abstract notion of space, and then developed an abstract notion of time relative to their present place in time. Humans literally developed the notion of a past, present and future – knowledge of their own place in history and thoughts regarding their own destiny. Humans developed ‘self-awareness.’ At this point in time, Homo sapiens evolved and separated from the pre-Homo species of humans, based solely on their ability to abstractly separate their own ‘selves’ from their environment and other living organisms in space and time. This process continued unabated and there is no reason to believe that it does not continue today.

Understanding how the most basic memories develop in the cells, neurons and eventually the brain as a whole, places science one step closer to understanding how consciousness manifests within the mind and body of succeeding generations. The memories themselves, those electromagnetic vector potential patterns stored in the very points of relative space within the brain and body, grow and grow in number, variation and complexity. They slowly begin to make new connections between each other to form higher levels and ever more stable complexity patterns – patterns within patterns within patterns. They form their own chaotic system of patterns as their numbers grow and eventually reach they a point whereby a new higher level complexity of memories and memory connections emerges. These complexities constitute new and different levels of consciousness in mind, but they are also far more than just new levels of consciousness. Over vast numbers of millennia they rewire the brain and DNA so that

future generations inherit a template for developing consciousness even further. These levels represent new contexts for the further storing of new memories and the evolution of consciousness.

Even today, humans are still evolving very slowly in the sense of bottom-up natural selection and possible beneficial mutations, but far more rapidly in consciousness. Humans now have the ability to increase their own individual level of consciousness through various methods. When they do so they reach what is normally called spiritual enlightenment. However, the human race as a whole seems to be growing closer to a new evolutionary jump from the top down. Evidence of this increasing likelihood of the emergence of a new higher level of consciousness comes with the increase of experiences of NDEs (Near Death Experiences) and the lasting memory of those experiences. Just as the last big evolutionary jump came when humans realized their relative place in three-dimensional space and time, as humans experience the next higher dimension of space and remember their experience they bring the human race as a whole closer to a new evolutionary jump. This trend has been greatly enhanced by the exponential leap in the knowledge curve and subsequent leap in learning that has characterized human civilization for the past century or more.

On the other hand, spiritual enlightenment marks an individual's progress toward the same goal that evolution is now taking the human race toward as a whole. It occurs when a person purposely or accidentally experiences and remembers a direct contact with the fourth dimension of space (or fifth dimension of space-time). This is normally reached after a great deal of work at suppressing the normal five senses and their connection to the three material dimensions of common space and letting go of the self, the memory complex of our normal individual space-time existence. By accomplishing this a person opens themselves up to their own natural higher-dimensional connections with the rest of the universe through the single field – what is normally referred to as being one with the universe. The remembered experience of this event, a purely magnetic occurrence and thus within consciousness, rewires the neural nets in the brain and possibly even affects the microtubules themselves that store the memory.

During life, the brain interacts with a person's environment by way of electrical signals from the common senses. These electrical signals generate magnetic fields that are secondary to them. Together they form complexity patterns that constitute the mind (electric) and consciousness (magnetic), but consciousness is in many ways subordinate to mind. From these the mind builds a worldview or sort of a contextual map of the external world and environment while consciousness grows ever more complex depending upon memories, experiences and the expanding worldview. This model is guaranteed by the first and third laws of Maxwell's electromagnetic theory.

- (1) Gauss' law of electricity – electric fields begin on electric points or charged bodies
- (2) Gauss' law of magnetism – the magnetic field is continuous through magnetic bodies
- (3) Modified Ampere's law – a changing electric field generates a magnetic field
- (4) Faraday's law – a changing magnetic field generates an electric field

The first two laws pertain to the material sources of electric and magnetic fields, while the second two relate the electric and magnetic fields directly to each other. The material sources of the magnetic field, moving electrical charges, guarantee the priority of mind over consciousness in the living body. In other words, higher levels of mind develop before consciousness develops, but electricity at this lower level is a product of the material interactions of the living body. This notion means that the 'self' or 'self-image' that is pictured in mind is first and foremost related to the material body. Yet the 'self' is also the internal person that is interacting with the external world as interpreted within the context of that person's worldview. It would thus seem natural to a person that everything, every event that occurs and is experienced, is strongly dependent upon if not completely about the material self.

Some level of enlightenment can come in any one of three ways: practice and discipline, spontaneously or through an NDE. In each case the higher fourth dimension of space is directly experienced to one degree or another, but not through any of the five common senses in any way that resembles how knowledge and experience normally come to the brain by way of electrical signals. Instead, consciousness becomes the primary route for sensory (the sixth sense) data to reach the mind in a reversal of roles.

---

3-D external world → sensory input → brain → mind → consciousness

reverses to become

brain ← mind ← consciousness ← 4-D external world

However, when this reversal occurs during the enlightenment event a far more comprehensive four-dimensional external world is revealed. When the mind realizes and re-cognizes this far more comprehensive four-dimensional physical reality relative to the mental background of its own three-dimensionally acquired worldview changes can occur in the brain to compensate. In this case, intuition overrules logic in a process of re-cognizing instead of an initial cognizing because everyone already has a well established subconscious lifelong contact in their own intuition. The conscious memory retained in mind of the new experience depends on the extent to which the mind re-cognizes the new experience of direct contact with the four-dimensional space and environment, but it is only when the 'self' or three-dimensional 'self-image' – the three-dimensional internal view or our individual relationship to our internal worldview – is subordinated to the new higher-dimensional experience by consciousness that the experience can be totally re-cognized for what it was.

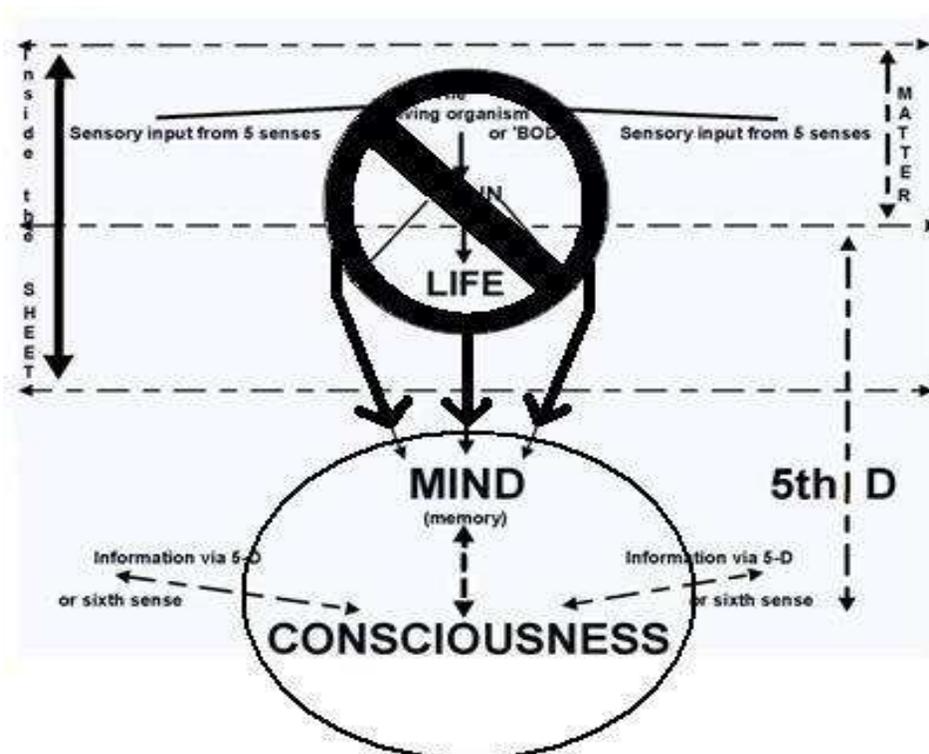
Pre-knowledge of the process and the true relationship between the external world and consciousness can help prepare the mind, whether that knowledge is gained through mystical, spiritual, philosophical or scientific study, but does not guarantee that the initiating event will ever occur. Yet it can enhance the experience when it occurs and definitely helps in the conscious interpretation of the experience. Every mind has a threshold and only when this threshold has been surpassed does the experience unfold. This threshold can be approached by minimizing the (electric signals of sensory data) effect of direct experience with the external three-dimensional world, i.e., quieting the senses (meditation), but even that does not necessarily ensure initiating the experience. The experience of quieting the senses comes naturally during NDEs because the person momentarily dies, but the NDE experience is not as pure in most cases because the person was not prepared or preparing for the experience as is the case with meditation where the person has a conscious awareness of what is unfolding as it unfolds.

In any case, the extent to which any person recognizes the experience for what it is – direct contact with the fourth dimension of space and the consequent expanded worldview – determines how the newly altered consciousness (magnetic) complexity pattern emerges and guides rewiring in the neural nets and brain to facilitate future conscious experience with the higher-dimensional reality. Future ongoing contact would manifest as a altered perspective of the three-dimensional experiential world that could include enhanced mental abilities such as telepathy, enhanced intuition, greater capacity for compassion, loss of fear of death, greater ecological concerns and so on. Intuition is already our subconscious common sense of the fourth spatial dimension before enlightenment or other form of experience. The normal subconscious connections to all of space-time are brought into conscious awareness to some degree after the initial experience, so the enhancement of intuition that comes with contact will change out logical worldview which will in turn affect science directly.

What we normally call paranormal, anomalous or psychic phenomena result from the reversal of information flow from the newly discovered greater external world to consciousness to mind via the sixth sense (magnetic vector field and longitudinal waves) rather than through the normal sensory channels (electric signals traveling as action potentials). Psi, the mechanism by which paranormal phenomena occur is no more than magnetic pattern transmission through the single field in the fourth dimension of space. Psi can be described as a process of passive memory pattern matching between two individual consciousnesses in the single field (telepathy) or between a single consciousness and material objects (clairvoyance and remote viewing). The process could also be active (consciously directed toward a goal) in which case an individual consciousness projects a specific pattern to another person (healing) or material object (microPK). In the case of macroPK, which is much rarer, the mind of a person projects a much stronger time sequence pattern from his consciousness to the object of the action to be accomplished. The pattern magnetically conditions the space affected in a point-by-point manner to

complete the specified task. The actions are guided by magnetic field lines in much the same manner as solar flares are guided by magnetic field lines. Unlike other psi interactions, this phenomenon is energetic and that energy must be derived from the source and its local environment through atomic and molecular magnetic resonances.

Maxwell's electromagnetic theory also all but guarantees that the mind and consciousness survive death of the physical body as a single electric/magnetic entity, however the state of awareness of that entity depends on the level of consciousness that the person reached prior to death. When a person dies, all of the biochemical processes that support life cease as do the electrical signals that carry sensory input and information to and from the brain. Brain function as a whole also ceases because it is primarily based on electrochemical processes. Life ends. In a strict physical sense, the matter/energy pattern decoheres – breaks down or destabilizes because it can no longer sustain itself – and life can no longer be prolonged by direct biochemical or electrical processes (intervention).



### The shift of awareness from 'self-image' to the mind/consciousness complex after death

However, from an electromagnetic point of view, this break down refers only to the material sources of the electric and magnetic field patterns as expressed in the first and second laws of electromagnetism. At the moment of death, both electric and magnetic field patterns in the brain and elsewhere in the body are in a state of changing. The changes do not just automatically stop because the material sources stop because the electric and magnetic scalar (mind) and vector (consciousness) field patterns have reached a semi-independent state of emergent complexities. In other words, they are mutually self-supporting (continuous over time) in spite of the discontinuity of motion of their original material sources. A vibrating electron, charged particle or body emits an electromagnetic wave, but when the vibration ends and emission stops the wave already emitted continues to travel on independently through space. Only in this case, the complexity patterns constrain the electromagnetic 'self' to a central location, i.e., the electromagnetic pattern field does not spread out or dissipate into space.

The electric and magnetic field patterns form a hologram of sorts. While the body was alive, it formed the material source of that holographic image. But when the body died, the holographic image,

imprinted in the very points of space-time and not just the material sources of that holographic pattern, survived. However, the mind and consciousness reverse roles. The mind would have normally been expecting sensory input from the external world via the brain, but receiving no external input from the now dead brain the mind would continue searching for a source of sensory input. Mind would thus turn to consciousness and become aware, if it had not already done so through various learning experiences such as enlightenment, NDEs or previous knowledge, of its new environmental situation as an individual physical entity within the greater expanse of the fourth dimension of space. The mind, through consciousness, would sense every point in the four-dimensional space and every point is filled with electromagnetic potential, i.e., light. The mind would interpret this according to the old learned rules of three-dimensional reality as a combination of all wavelengths of light, visible or not, and thus sense a bright white light. The mind and consciousness complex would have no specific form or shape, so it would revert to a universal fallback shape of a point or sphere which does not give precedence to any one dimension over any other of the four dimensions of space. If the mind senses the flow of time at all at this moment, its spherical 'self' would be moving through the time dimension and thus forming a cylinder, tube or tunnel.

However, this scenario is not absolutely necessary. Different people will interpret death in different ways for a seeming infinite number of different reasons even though they all experience the same new existence and connection to the single field within the higher dimension of space. Other sequences of thought and interpretation of the event of death could take place. If the mind does not sense the 'light' and anything that happens to be in the 'light', such as other consciousnesses, it might begin to cannibalize its own memories in the search for normal sensory input. The mind could thus experience a past-life review, or in an even worse case scenario get stuck in one or more very emotional memories which were originally imprinted with greater energy and thus create its own living 'hell'. The mind could even refuse to accept the new reality of its existence and block out all input through consciousness of its new higher-dimensional environment. Since the mind could not possibly receive any sensory input from its now dead body and brain, it would sense nothing and thus will have created its own world of nothingness or complete darkness. In a very real sense, the mind creates its own afterlife experience depending on the state of its associated consciousness at the time of death. People with very strong religious convictions could even carry their own prejudices about death into their new existence.

Refusing to accept death, the mind/consciousness complex could also latch onto the three-dimensional 'sheet' slicing across four-dimensional space and get stuck in its own memories of a three-dimensional past world with which it would have, at best, minimal to no physical influence. A person could thus become a ghost or apparition until it accepted its death, saw the light and moved on. The 'ghost' could influence the minds of the living through a form of telepathy, or possibly even be seen by the living under the proper three-dimensional environmental conditions that would allow its electric/magnetic holographic 'body' to create a real electromagnetic hologram in three-dimensional physical space. The entity could also latch onto a physically appropriate human and be reborn into the world. However, the best possible outcome would be for the entity, in whatever form it takes, to realize and re-cognize its new situation so that it could continue to communicate with its new surroundings and situation, explore, learn and evolve consciously. In Buddhist philosophy, this would be the equivalent to breaking the cycle of life and death.

## CONCLUSION

Conscious awareness and other characteristics associated with a higher consciousness are usually meant to distinguish a human level of consciousness only, but are not and cannot be limited to human consciousness. Consciousness, in general, is not unique to humans alone. Different levels of consciousness with different groups of characteristics form when specific functional memory complexities begin to emerge in mind, but consciousness is not defined by this or any single group of characteristics alone – only the levels of consciousness are defined by them. In reality, the intricate patterns of magnetic vector variations that contribute to the overall magnetic vector field of the body or organism must constitute the

consciousness of the living organism because every little magnetic variation anywhere in the body subtly changes the overall pattern at one level or another. The gross magnetic field for the whole body, in a sense a magnetic body, remains fairly constant even though the internal magnetic field variations continue to grow in complexity from new memories and experiences as well as new connections within and up and down the magnetic domain levels. The overall magnetic field associated with a material living body of organism is not and cannot be consciousness per se, but the pattern that forms it is consciousness.

The electric and magnetic field patterns that constitute mind and consciousness are the collective patterns that represent all electric and magnetic field interactions that occur in the body as a whole. This must be true since the scalar and vector potential fields are continuous, meaning that the smallest possible quantum level measurable variations at one place in a body cause infinitesimal changes in the whole field at all points in the field at the very least. In other words, the individual electric and magnetic field patterns that occur in the brain can be neither completely separated nor isolated from other such patterns that occur elsewhere in the body. We only sense and thus associate mind and consciousness with the brain because that is where memories and most other facets of consciousness correlate to electrochemical and thus functional processes. The brain is merely the place where the concentration of neural axons is densest and most effective in terms of the most common functions of mind and consciousness. We only 'think', literally, that mind and consciousness are located in the brain, which is part of the illusion of our three-dimensional material dominated 'self'.

This particular model differs from other quantum models of consciousness in that it is based on neither an Orch-OR nor other quantum model of the microtubule, but rather a classical electromagnetic model of the microtubule up to the point where it utilizes a five-dimensional Einstein-Kaluza space-time model for storage of the magnetic vector patterns as memories. The quantum aspect of this model only refers to the particle-spin diffraction patterns that the microtubules establish within the water molecules in the neuron and brain. The theoretical structure of solitons produced by the microtubules has been studied at length with respect to other models of quantum microtubules as a possible method of solving the coherence problem. The microtubules do produce solitons and irregular electromagnetic waves, but that production does not come from quantum processes in the microtubules. So this model has no coherence problem since the soliton waves or wave groups act classically to create active connections between different microtubules.

In so far as other scientists study the magnetic properties of the neurons and even the microtubules, their theoretical structures misuse the concept of magnetism. The classical neural magnetic fields that others mistakenly attribute to microtubules are no more than the external magnetic field surrounding the axon as the action potential travels along the surface of the axon. This magnetic field does really exist and can be easily modeled by analogy with a simple current carrying wire, but it is a magnetic field external to the neuron. This external neural magnetic field cannot account for the magnetic properties of the internal portion of the neuron because it represents another domain of magnetic interactions. Otherwise, if quantum theorists speak of internal magnetic fields associated with microtubules, they are only referring to the individual magnetic dipoles of the tubulin proteins that make up the microtubules, not the classical magnetic field that this model describes. Other scientists have misrepresented the magnetic fields associated with microtubules, so they cannot adequately answer the simple question of how to get from tubulin magnetic dipole moments to the coordinated coherent actions of the tubulin molecules within a single microtubule, let alone how those actions influence other microtubules to construct a simple thought or stream of thoughts.

This theoretical model of consciousness describes how consciousness is, literally, every person's personal connection to the universe as a whole throughout space and time. The model thus reflects the geometrical and quantum properties of mind and consciousness. However, the microtubule remains the central and primary element in explaining and understanding consciousness and the different magnetic domain levels that form consciousness through memory acquisition and patterning. The overall effect of the microtubule transceivers is to establish a 'thought complex' in the magnetic vector potential patterns within a single neuron as well as transmit that pattern to other neural microtubules. The microtubule transceivers accomplish this by emitting transverse electromagnetic waves in three-dimensional space (four-dimensional space-time) to build a more comprehensive memory context within neuron nets. Yet the

whole complex pattern is also transmitted by longitudinal electromagnetic waves that store (imprint) the pattern as a memory (long term) in four-dimensional space (five-dimensional space-time) as a semi-permanent magnetic vector potential pattern. In other words, space-time is conditioned as a long term memory storage unit. Allusions to this appear in the work of Tiller and others who have studied the concept of conditioned space under other auspices. In a sense then, this conditioned four-dimensional space would amount to a hologram that creates an energy pattern in the three-dimensional space of the brain under the correct physical conditions although it could also be described as a more dynamical four-dimensional holomovement in five-dimensional space-time.

Consciousness first takes form in the brain at four cellular levels of magnetic field variations, each with its own purpose. These levels form magnetic domains that interact together to form still larger magnetic contextual patterns and structures all the way up to the brain and then living body as a whole. The lowest level is that of the quantized magnetic particle spins in the water molecules amplify and stabilize electromagnetic interference patterns between microtubules. The interaction of these three-dimensional particle spin patterns in conditioning the magnetic properties associated with complex pattern consisting of points in four-dimensional space forms short-term memory, while the actual and more permanent complex pattern of magnetic variations stored in the points of four-dimensional space form the long-term memory. The second level magnetic pattern is due to the direct magnetic charging and discharging of the microtubules within any given axon. This complex magnetic pattern also has a two-fold purpose. It acts as a pattern guide for both short-term and long-term memories as stored in the points of four-dimensional space by longitudinal waves, but it also generates the transverse electromagnetic waves that form resonance patterns with other microtubules in other neurons. The third level magnetic field is that which is normally studied by most scientists resulting from the action potential traveling up or down the outer surface of the axon. This magnetic field isolates the internal magnetic patterns from any possible disrupting magnetic interference from outside the axon as well as acts as a guide for the formation of neural nets. The neural nets then form larger functional magnetic domains that characterize the different characteristics of individual portions of the brain itself. The neural nets constitute the fourth level of magnetic field variations that can imprint in water in the brain. It is only at this level that researchers first begin to observe logical thought processes and not just memory storage, so it is at this level that consciousness can be observed as a discerning process and a contextual framework for mind to interpret physical reality.

One of the major problems facing all physical models of consciousness, as noted by other scientists, is the level at which mind and consciousness can be distinguished as either quantum or classical phenomena.

The challenge is to show how brain-cell firings and communication between cells may be influenced by the weak and delicate, very small-scale quantum processes. To put it another way, we need to answer: At what level of organization are quantum effects required in order to explain biological phenomena? Can that level, in turn, influence activities at the neural level? The search for answers to these questions is, in a nutshell, the objective of this book. (Tuszynski and Woolf, 11)

The microtubule transceiver model faces no such challenge or problem since the communication between cells comes from the classical production of electromagnetic waves by the induction coil-like microtubules, rather than through some undefined small-scale quantum process. The quantum processes in this model only refer to the magnetically conditioned water surrounding the microtubules, reinforcing the magnetic characteristics of the microtubules and imprinting memories in the very fabric of space-time. The microtubules act as magnetic guides in this respect in addition to their role as three-dimensional radio transceivers.

Once mind and consciousness are explained as separately distinguishable 'entities' or 'things' in physics, rather than just byproducts of the brain, the whole panorama of paranormal effects and phenomena is opened for scientific scrutiny and review. Whole new areas of more traditional study are also opened to scientific possibility and investigation. It is unfortunate that other scientists are so intent on

explaining everything in terms of the quantum that they ignore and even disparage any theoretical contributions to a model of consciousness that can be made by classical or neoclassical theories of physics. In other words, many scientists seem to have serious problems dealing with the possibility that the quantum theory is limited, even though the limits of quantum theory are inherent in the theoretical structure itself. They have unilaterally and a priori decided that the quantum and only the quantum can explain consciousness without realizing that the quantum theory, as it is now understood and interpreted, is prohibited from explaining consciousness. The concept of quantum consciousness is condemned by its own dictums since consciousness collapses the wave function. If the wave collapse defines all of reality and consciousness can be explained by the wave function, then the wave function in essence must be capable of collapsing itself, which is ridiculous.

The problem is that the present interpretation of the collapse by quantum theorists and philosophers dictates that 'only' consciousness collapses the wave packet and in the minds of many scientists and scholars the word 'only' refers to human consciousness. Some quantum theorists even go so far as to revel in this insight into the nature of physical reality, which is nothing more than a misconstrued egocentric view or the universe itself. The very interpretation of the quantum and fundamental quantum theory that they propose places consciousness outside of the reality created by the collapse of the wave packet. Therefore, the quantum theory cannot logically be used to explain consciousness. However, the reality of such a quantum limitation is false. The fact that consciousness can collapse the wave function does not mean that 'only' consciousness can and must collapse the wave function. Since all life has consciousness at some level, it would be preferable as well as more accurate to say that life has the ability to collapse the wave function. Even when the only contribution of the quantum to mind and consciousness occurs with the quantized magnetic spins of particles in water molecules, as in this theory, consciousness cannot be the only 'thing' that has the ability to collapse the wave function and thereby create physical reality. Entanglement can also collapse the wave function, which can then be used to explain how the physical universe predates the emergence of life, mind and consciousness within the universe. Such a concept of entanglement would imply a quantum geometry of the universe that is both complementary and supplementary to the geometry of the universe defined by relativity theory. Entanglement itself would thus be reduced to a form of quantum relativity. New physics and new interpretations of old physics just ooze from this theoretical model of mind and consciousness.

The overall message to be gained from these theoretical implications should be clear to all – it is time for psychologists, parapsychologists and physicists to take a serious look at the possibility that consciousness is a real physical process and consider the consequences of that possibility. Feinberg has already commented on just that possibility.

The previous considerations lead me to suggest a strategy for Psychic research. I believe it would be appropriate for researchers to concentrate on detailed studies of psychic phenomena rather than to concentrate on further efforts whose primary purpose is to convince others that the phenomena exist. I have two reasons for this. One is that the bare statement of existence of a phenomenon is much less useful than statements about its relations to other phenomena. Also, it is my impression that scientists are much more likely to believe that something is real after its properties have been studied and delimited in this way, so that the strategy I am suggesting might even be a good way of convincing others. (Feinberg, 24)

In other words, scientists should stop devoting the majority of their time and efforts, if not all of their efforts, toward the useless task of proving the existence of psi. Science proves nothing; science only develops hypotheses and theories and verifies them. Proofs are left up to mathematicians and are nothing but logical creations of the human mind. Scientists and researchers need to stop their search for 'proofs', which by definition cannot exist, and just study paranormal phenomena for what they are – natural although not exactly normal phenomena. Scientists will never be convinced of the reality of psi and survival if all that parapsychologists have show for their efforts to 'prove' their existence is the statistical evidence that dominates nearly all of their research to date.

The study of psychic phenomena is probably more important to physics than it is to consciousness studies, because it opens new possibilities for studying and learning for the physical characteristics of the universe. This fact was clearly stated by Feinberg. He even believes that “physicists would be happy for the challenge” posed by studying the paranormal if “new physical laws were involved ...” (Feinberg, 22) and that is just what this theory and model of consciousness clearly demonstrates. Under these circumstances, Feinberg posed two questions that need to be considered by physicists: “What is the range of consciousness in the universe?” And “How is consciousness related to the other aspects of the world?” (Feinberg, 22) If consciousness is indeed physical and the paranormal can be explained by physics, then both of these questions are completely valid for consideration by physicists. In fact, both of these questions have been indirectly answered within the context of this particular model of consciousness. Feinberg’s views are all the more relevant since he is neither a parapsychologist nor a parapsychologist, he is a well respected particle physicist and therefore his views can be thought of as representing more than just a few modern physicists.

In this respect, modern neurophysiologists and neurophysicists are making phenomenal discoveries that are laying the foundations for future legitimate scientific studies of mind, consciousness, psi and survival without any reference to ‘proving’ anything. They are observing mind and consciousness in action at the cellular and near cellular level of the brain. The facts that they establish as accurate are merely there for use by theoretical scientists to develop hypotheses and theories to be tested and verified. This is how science works. These new fields of scientific investigation are leaving parapsychology and parapsychics behind and will eventually, if not in the very near future, render them irrelevant and obsolete unless parapsychologists embrace and adopt their methods and discoveries. Physicists would argue, and many have, that there can be no such thing as para-physics because there is nothing beyond (para-) physics. Once something is known it is automatically adopted into ‘normal’ physics because physics already covers everything and every possibility in the universe. It seems that this notion may already be becoming true for para-psychology and para-psychologists need to heed the implied warning.

#### REFERENCES

- Elcio Abdalla, Bouchra Maroufi, Bertha Cuadros Melgar, and Moulay Brahim Sedra. (2001) “Information transport by sine-Gordon solitons in microtubules.” Available online at arXiv:physics/0103042v1. [Phys, bio-ph]
- A.C. Alonso, T. Zaidi, I. Grundke-Iqbal and K. Iqbal. (1994) “Role of abnormally phosphorylated tau in the breakdown of microtubules in Alzheimer disease”. *Proceedings of the National Academy of Science* 91, 12: 5562–5566.
- Akimov, A.E. and G. I. Shipov. (1997) “Torsion Fields and their Experimental manifestations.” *Journal of New Energy* 2, 2: 67-84. Available online at [newenergytimes.com/v2/archives/fic/J/JNE2N2.PDF](http://newenergytimes.com/v2/archives/fic/J/JNE2N2.PDF). Abstract available online at [amasci.com/freenrg/tors/tors.html](http://amasci.com/freenrg/tors/tors.html).
- Becker, Robert O. with Gary Selden. (1985) *The Body Electric: Electromagnetism and the Foundation of Life*. New York: Morrow.
- Beal, James B. (1973) “Electrostatic Fields, Electromagnetic Fields, and Ions – Mind/Body/Environment Interrelationships.” Paper presented at Neuro-electric Society Symposium and Workshop, Snowmass-at-Aspen, Colorado, February 1973.
- Beal, James B. (1974a) “How Fields Affect Us.” In: The World Council Institute, No.12 *Fields within fields ... within fields*.
- Beal, James B. (1974b) “The Emergence of Parapsychics: Research and applications.” In: Mitchell *Psychic Exploration*: 426-447.
- Beichler, James E. (1980) *A five-dimensional approach to a unified field theory*. An unpublished Master’s Thesis, San Francisco State University.

- Beichler, James E. (2006) "Alternative physical models of the universe." In: Savely Savva, editor *Life and Mind: In search of the physical basis*. Victoria, BC: Trafford: 239-232.
- Beichler, James E. (2007) "Three Logical Proofs: The five-dimensional reality of space-time." *Journal of Scientific Exploration* 21, 3: 523-542.
- Beichler, James E. (2008) *To Die For: The physical reality of conscious survival*. Victoria, B.C.: Trafford.
- Beichler, James E. (2009) "The Dark Mysteries of Consciousness: Paranormality within the greater universe". *Spirituality, Science and the Paranormal, 2009 Annual Conference Proceedings, Academy of Spirituality and Paranormal Studies Inc.*, Bloomfield, CT: 66-94.
- Beichler, James E. (2009) "A Mysphyt Revolution: The logical nature of spiritual enlightenment". *Journal of Spirituality and Paranormal Studies* 32, 4:
- Beichler, James E. (2010) *Evo: The next step*. Victoria, B.C.: Trafford.
- Beichler, James E. (2011) "Consciousness and Consequences." In: Ingrid Fredricksson, editor "Aspects of Consciousness: Essays on Physics, Death and the Mind.
- Bohm, David. (1980) *Wholeness and the Implicate Order*. London: Routledge
- Brizhik, Larissa, Agata Scordino, Antonion Triglia and Francesco Musumeci. (2001) "Delayed Luminescence of Biological Systems arising from Correlated Many-Soliton States." *Physical Review E* 64, 031902.
- Carr, Bernard. (2008) "Worlds Apart? Can Psychical Research Bridge the Gap between Matter and Mind?" *Proceedings of the Society for Psychical Research*, 59, 1-96.
- Cartan, Élie. (1922) "Sur une généralisation de la notion de courbure de Riemann et les espaces à torsion." *C. R. Acad. Sci. (Paris)* 174:593–595.
- Cartan, Élie. "Sur les variétés à connexion affine et la théorie de la relativité généralisée." Part I: *Ann. Éc. Norm.* 40: 325–412 and *ibid.* 41: 1–25; Part II *ibid.*: 42: 17–88.
- Clifford, William Kingdon. (1870) "On the Space Theory of Matter." *Transactions of the Cambridge Philosophical Society* Volume 2 (1866/1876). Cambridge: University Press: 157-158; reprinted in: *Mathematical Papers*. Edited by Robert Tucker, Introduction by H.J. Stephen Smith. Bronx, New York: Chelsea Publishing, 1969; reprint of first edition, 1882: 21-22. Originally read 21 February 1870.
- Clifford, William Kingdon. (1873) "Preliminary Sketch of Biquaternions." *Proceedings of the London Mathematical Society* (12 June 1873): 381-395; Reprinted in *Mathematical Papers*: 181-200.
- Corson, Dale and Paul Lorrain. *Introduction to Electromagnetic Fields and Waves*. San Francisco: Freeman, 1962.
- Cheung, Humphrey. (2008) "Infrared-Blasting Helmet could reverse Alzheimer's Disease." *Tom's Hardware Guide* 25 January 2008. Accessed 5 October 2009. Available online at [www.tomshardware.com/news/infrared-blasting-helmet-reverse-alzheimers-disease.4748.html](http://www.tomshardware.com/news/infrared-blasting-helmet-reverse-alzheimers-disease.4748.html).
- DeBroglie, Louis. (1956) *Une tentative d'interprétation causale et non linéaire de la mécanique ondulatoire: la théorie de la double solution*. Paris: Gauthier-Villars; English translation: *Non-linear Wave Mechanics: A Causal Interpretation*. Amsterdam: Elsevier, 1960.
- Eccles, Sir John C. (1977) *Understanding the Brain*, second edition. McGraw-Hill.
- Einstein, Albert and Peter G. Bergmann. (1938) "On a Generalization of Kaluza's Theory of Electricity." *Annals of Mathematics* 34, 3: 683-701.

- Einstein, Albert, Peter G. Bergmann and Valentine Bargmann. (1941) "On the Five-Dimensional Representation of Gravitation and Electricity." In: Theodor von Karman Anniversary Volume. Pasadena: California Institute of Technology: 212-225.
- Einstein, Albert. (1956) *The Meaning of Relativity*, sixth edition. Princeton: Princeton University Press.
- Feinberg, Gerald. (1974) "Foreword." In: *Mitchell Psychic Explorations*: 21-24.
- Flint, Henry T. (1966) *The Quantum Equation and the Theory of Fields*. London: Methuen.
- Frankland, F.W. (1877) "On the Simplest Continuous Manifoldness of Two Dimensions of Finite Extent." *Nature* 12: 515-517.
- Frick, P., et al. (2003) "Effective magnetic permeability of a turbulent fluid with macroferro particles." EPJ manuscript. Available online at [www.ens-lyon.fr/~pinton/ARTICLES/mhd\\_SB\\_EPJB.pdf](http://www.ens-lyon.fr/~pinton/ARTICLES/mhd_SB_EPJB.pdf).
- Georgiev, Danko Dimchev. "Electric and magnetic fields inside neurons and their impact upon the cytoskeletal microtubules." Accessed 12 February 2012. Available online at [www.researchgate.net/publication/28763820\\_Electric\\_and\\_magnetic\\_fields\\_inside\\_neurons\\_and\\_their\\_impact\\_upon\\_the\\_cytoskeletal\\_microtubules](http://www.researchgate.net/publication/28763820_Electric_and_magnetic_fields_inside_neurons_and_their_impact_upon_the_cytoskeletal_microtubules).
- Georgiev, Danko D., Stelios N. Papaioanou and James F. Glazebrook. (2007) "Solitonic Effects of the Local Electromagnetic Field on Neuronal Microtubules." *Neuroquantology* 5, 3: 276-291. Available online at [cogprints.org/5814/1/solitons\\_in\\_brain.pdf](http://cogprints.org/5814/1/solitons_in_brain.pdf).
- Giancoli, Douglas C. (1991) *Physics: Principles with Applications*, third edition. Englewood Cliffs, New Jersey: Prentice Hall.
- Granqvist, P., M. Fredrikson, P. Unge, A. Hagenfeldt, A., S. Valind, S., D. Larhammar and M. Larsson. (2005). "Sensed presence and mystical experiences are predicted by suggestibility, not by the application of transcranial weak complex magnetic fields". *Neuroscience Letters* 379, 1: 1-6. Available online at [dx.doi.org/10.1016/j.neulet.2004.10.057](http://dx.doi.org/10.1016/j.neulet.2004.10.057).
- Gross, C.G. (2002) "Genealogy of the "Grandmother Cell." *Neuroscientist* 8, 5:512-518; Available online at [dx.doi.org/10.1177/107385802237175](http://dx.doi.org/10.1177/107385802237175).
- Gustke, N., B. Steiner, E.-M. Mandelkow, J. Biernat, H.E. Meyer, M. Goedert and E. Mandelkow. (1992) "The Alzheimer-like phosphorylation of tau protein reduces microtubule binding and involves Ser-Pro and Thr-Pro motifs." *Federation of the European Biochemical Societies* 307, 2: 199-205.
- Hagan, S., S. Hameroff and J. Tuszynski. (2002) « Quantum Computation in Brain Microtubules? Decoherence and Biological Feasibility." *Physical Reviews E*, 65: 061901.
- Hameroff, Stuart and Roger Penrose. (1996) "Orchestrated Reduction Of Quantum Coherence In Brain Microtubules: A Model For Consciousness?" In: S. Hameroff, A.W. Kaszniak and A.C. Scott, editors *Toward a Science of Consciousness - The First Tucson Discussions and Debates*. Cambridge, MA: MIT Press: 507-540.
- Hameroff, Stuart. (1998) "Quantum Computation in Brain Microtubules? The Penrose-Hameroff "Orch OR" model of consciousness." *Philosophical Transactions Royal Society London (A)* 356:1869-1896.
- Hameroff, Stuart. (2006) "Consciousness, Neurobiology and Quantum Mechanics: The case for a connection." In: Tuszynski *Emerging Physics of Consciousness*: 193-254.
- HeartMath Research Center. *Science of the Heart: Exploring the role of the heart in human performance*. Available online at [www.heartmath.org/templates/ihtm/downloads/pdf/e-books/science-of-the-heart.pdf](http://www.heartmath.org/templates/ihtm/downloads/pdf/e-books/science-of-the-heart.pdf).

- Heaviside, Oliver. (1893) "A gravitational and electromagnetic analogy." *The Electrician* 31: 81–82. Available online at [serg.fedosin.ru/Heavisid.htm](http://serg.fedosin.ru/Heavisid.htm).
- Holburn, David. (2012) "A Simple Radio Receiver". Last updated 18 July 2008, Downloaded 5 January 2012. Available online at [www2.eng.cam.ac.uk/~dmh/ptialcd/trf/trf.htm](http://www2.eng.cam.ac.uk/~dmh/ptialcd/trf/trf.htm).
- HowMed. <http://howmed.net/physiology/action-potential/>
- I-SIS News Staff. (2008) "DNA Sequence Reconstructed from Water memory?" *Scientific Blogging*, 25 October 2008. Available online at [http://www.i-sis.org.uk/DNA\\_sequence\\_reconstituted\\_from\\_Water\\_Memory.php](http://www.i-sis.org.uk/DNA_sequence_reconstituted_from_Water_Memory.php).
- Jackson, John David. (1974) *Classical Electrodynamics*, second edition. New York: John Wiley & Sons.
- James, William. (1890) *The principles of psychology*. New York: Dover. Available online at [psychclassics.asu.edu/James/Principles/prin6.htm](http://psychclassics.asu.edu/James/Principles/prin6.htm).
- Kaluza, Theodor. (1921) "Zur Unitätsproblem der Physik," *Sitzungsberichte der Preussischen Akademie der Wissenschaften* 54: 966-972.
- Karton, I. and Bachmann, T. (2011). "Effect of prefrontal transcranial magnetic stimulation on spontaneous truth telling." *Behavioural Brain Research* 225:209 – 214. Available online at [dx.doi.org/10.1016/j.bbr.2011.07.028](http://dx.doi.org/10.1016/j.bbr.2011.07.028).
- Kay, Kendrick N., Thomas Naselaris, Ryan J. Prenger and Jack L. Gallant. (2008) "Identifying natural images from human brain activity." *Nature* 452: 352-355. Available online at [dx.doi.org/10.1038/nature06713](http://dx.doi.org/10.1038/nature06713).
- Khamsi, Roxanne. (2005) "Jennifer Aniston Strikes a Nerve: Single brain cells show selective response to specific celebrity photos." *Nature: International Journal of Science* (22 June 2005). Available online at [www.nature.com/news/2005/050620/full/news050620-7.html](http://www.nature.com/news/2005/050620/full/news050620-7.html).
- Konorski, J. (1967) *Integrative activity of the brain; an interdisciplinary approach*.
- Larsson, M., D. Larhammarb, M. Fredrikson and P. Granqvist. (2005) "Reply to M.A. Persinger and S. A. Koren's response to Granqvist et al. "Sensed presence and mystical experiences are predicted by suggestibility, not by the application of transcranial weak magnetic fields"", *Neuroscience Letters* 380, 3: 348–350. Available online at [dx.doi.org/10.1016/j.neulet.2005.03.059](http://dx.doi.org/10.1016/j.neulet.2005.03.059).
- Manka, Ryszard and Bogdan Ogrodnik. "A Model of Soliton Transport along Microtubules." *Journal of Biological Physics* 18, 3: 185-189. Available online at [dx.doi.org/10.1007/BF00417807](http://dx.doi.org/10.1007/BF00417807).
- Matsuyama, S.S. and L.F. Jarvik. (1989) "Hypothesis: microtubules, a key to Alzheimer disease." *Proceedings of the National Academy of Sciences* 86, 20: 8152-8156. Available online at [www.pnas.org/content/86/20/8152.full.pdf](http://www.pnas.org/content/86/20/8152.full.pdf).
- Mershin, Andreas, et al. (2006) "Towards experimental Tests of Quantum Effects in Cytoskeletal Proteins." In: *Tuszynski Emerging Physics of Consciousness*: 95-170.
- Miroshnichenko, Andrey E., Aleksey A. Vasiliev and Sergey V. Dmitriev. "Solitons and Soliton Collisions." Available online at [homepages.tversu.ru/~s000154/collision/main\\_r.html](http://homepages.tversu.ru/~s000154/collision/main_r.html) and/or [www.mpipks-dresden.mpg.de/~andrey/solitons/collision/main.html](http://www.mpipks-dresden.mpg.de/~andrey/solitons/collision/main.html).
- Mitchell, Edgar D. (1974) *Psychic Exploration: A challenge for science*, edited by John White. New York: Putnam's Sons.
- Naselaris, Thomas, Kendrick N. Kay, Shinji Nishimoto and Jack L. Gallant. (2011) "Encoding and decoding in fMRI." *Neuroimage* 56: 400-410. Available online at [gallantlab.org/publications](http://gallantlab.org/publications).

- Newcomb, Simon. (1877) "Elementary theorems relating to the geometry of a space of three dimensions and of uniform positive curvature in the fourth dimension." *Crelle's Journal für die reine und angewandte Mathematik* 83: 293-299.
- Newcomb, Simon. (1879) "Note on a Class of Transformations Which Surfaces May Undergo in Space of More Than Three Dimensions." *American Journal of Mathematics* 1: 1-4.
- Nishimoto, Shinji, An T. Vu, Thomas Naselaris, Yuval Benjamini, Bin Yu and Jack L. Gallant. (2011) "Reconstructing Visual Experiences from Brain Activity Evoked by Natural Movies." *Current Biology* 21, 19: 1641-1646. Available online at [dx.doi.org/10.1016/j.cub.2011.08.031](https://doi.org/10.1016/j.cub.2011.08.031).
- Klein, Oskar. (1926) "Quantentheorie und fünfdimensionale Relativitätstheorie." *Zeitschrift für Physik* 3, 12: 895-906.
- Klein, Oskar, (1926) "The Atomicity of Electricity as a Quantum Theory Law." *Nature* 118, 2971: 516.
- Klein, Oskar. (1927) "Zur fünfdimensionalen Darstellung der Relativitätstheories." *Zeitschrift für Physik* 46, 3-4: 188-208.
- Klein, Oskar. (1927) "Sur L'Article de M.L. DeBroglie "L'Univers A Cinq Dimensions et la Mécanique Ondulatoire."" *Le Journal de Physique et le Radium, Serie 6, Tome 8*: 242-243.
- Penrose, Roger. (2007) *The Road to Reality: A complete guide to the laws of the universe*. Vintage Books.
- Persinger, Michael A. (2003) "Experimental simulation of the god experience: implications for religious beliefs and the future of the human species." In: R. Joseph, editor *Neurotheology: Brain, Science, Spirituality, Religious Experience*. San Jose, CA: University Press: 267-284
- Persinger, Michael A. (2003) "Neurobehavioral effects of brief exposures to weak intensity, complex magnetic fields within experimental and clinical settings." In: M. J. McLean, S. Engstrom and R. R. Holcomb, editors *Magnetotherapy: potential therapeutic benefits and adverse effects*. New York: TFG Press: 89-118.
- Popp, Fritz-Albert. (1979) "Photons and their importance to biology." In: Z.W. Wolkowski, editor *Proceedings of the International Symposium on Wave Therapeutics - Interaction of non-ionizing electromagnetic radiation with living systems*. Versailles, 19.-20. Mai 1979. Université de Paris-Val de Marne, Créteil 1983: 43-59.
- Popp, Fritz-Albert and Y. Yan. (2002) "Delayed luminescence of biological systems in terms of coherent states." *Physics Letters A* 293: 93-97.
- Popp, Fritz-Albert, J.J.Chang, A.Herzog, Z.Yan and Y. Yan. (2002) "Evidence of non-classical (squeezed) light in biological systems." *Physics Letters A* 293: 98-102.
- Popp, Fritz-Albert, Walburg Maric-Oehler, Klaus-Peter Schlebusch, Wolfgang Klimek. (2005) "Evidence of Light Piping (Meridian-Like Channels) in the Human Body and Nonlocal EMF Effects." *Electromagnetic Biology and Medicine* 24, 3: 359-374.
- Popp, Fritz-Albert. (1999) "About the coherence of biophotons." In: *Macroscopic Quantum Coherence, Proceedings of an International Conference at Boston University*. Boston University and MIT: World Scientific Press. Available online at [www.stealthskater.com/Documents/Consciousness\\_31.pdf](http://www.stealthskater.com/Documents/Consciousness_31.pdf).
- Pribram, Karl H. (1971) *Languages of the brain: experimental paradoxes and principles in neuropsychology*. Englewood Cliffs. New Jersey: Prentice-Hall.
- Pribram, Karl H.. (1987) "The Implicate Brain." In: B. J. Hiley and F. David Peat, editors *Quantum Implications: Essays in Honour of David Bohm*. London: Routledge.

- Pribram, Karl H.. (1991) *Brain and Perception: Holonomy and Structure in Figural Processing*. Hillsdale, N. J.: Lawrence Erlbaum Associates.
- Puthoff, Harold and Russell Targ. (1997) *Mind-Reach: Scientists Look at Psychic Abilities*. Charlottesville, NC: Hampton Roads.
- Puthoff, Harold and Russell Targ. (1979) "Direct Perception of Remote Geographical Locations." In: Andrija Puharich, editor *The Iceland Papers*. Essentia Research Associates: 17-48.
- Quiroga, R. Quian, L. Reddy, G. Kreiman, C. Koch and I. Fried. (2005) "Invariant visual representations by single neurons in the human brain." *Nature* 435: 1102-1107. Available online at [dx.doi.org/10.1038/nature03687](http://dx.doi.org/10.1038/nature03687).
- Reed, Donald. (1998) "Torsion Field research." *New Energy News* 6, 1: 22-24. Available online at [www.padrak.com/ine/NEN\\_6\\_1\\_6.html](http://www.padrak.com/ine/NEN_6_1_6.html)
- Riemann, Bernhard. (1854, 1873), "Ueber die Hypothesen welche der Geometrie zu Grunde liegen." Translated by W.K. Clifford, "On the Hypotheses which lie at the Bases of Geometry". *Nature*, 7 (1 May 1873): 14-17; continued in 8 (8 May 1873): 36-37; Reprinted in Clifford, *Mathematical Papers*: 55-71. Delivered at Göttingen University, 1854.
- Rodger, Jennifer et al. (2012) "Transcranial pulsed magnetic field stimulation facilitates reorganization of abnormal neural circuits and corrects behavioral deficits without disrupting normal connectivity." *The FASEB Journal*. Available online at [dx.doi.org/10.1096/fj.11-194878](http://dx.doi.org/10.1096/fj.11-194878).
- Science 2.0 News Staff. (2008) "Magnetic Water's memory effect." *Scientific Blogging*. Available online at [www.science20.com/news\\_articles/magnetic\\_waters\\_memory\\_effect](http://www.science20.com/news_articles/magnetic_waters_memory_effect).
- Scott, Alwyn C and Stephen D Luzader. (1979) "Coupled Solitary Waves in Neurophysics." *Phys. Scr.* 20: 395. Available online at [dx.doi.org/10.1088/0031-8949/20/3-4/014](http://dx.doi.org/10.1088/0031-8949/20/3-4/014)
- Sheldrake, Rupert. (1988) *The Presence of the Past: Morphic resonance and the habits of nature*. New York: Vintage.
- Smart, Ashley G. (2011) "Ultralow magnetic fields elicit unexplained spin dynamics in water". *Physics Today* 64, 10: 14, 16.
- St-Pierre, LS and Michael A. Persinger. (2006). "Experimental facilitation of the sensed presence is predicted by the specific patterns of the applied magnetic fields, not by suggestibility: re-analyses of 19 experiments". *International Journal of Neuroscience* 116, 9: 1079-96. Available online at [dx.doi.org/10.1080/00207450600808800](http://dx.doi.org/10.1080/00207450600808800).
- Smith, Cyril W. (2004) "Quanta and Coherence Effects in Water and Living Systems." *Journal of Alternative and Complementary Medicine* 10, 1: 69-78.
- Tiller, William A., Walter Dibble, Michael Kohane. (2002) "Exploring robust Interactions between Human Intention and Inanimate/Animate Systems." *Subtle Energies & Energy Medicine* 11, 3: 265-291.
- Tiller, William A., Walter Dibble, C.T. Krebs. (2002) "Instrumental Response to Advanced Kinesiology Treatments in a 'Conditioned' Space." *Subtle Energies & Energy Medicine* 13, 2: 91-108.
- Tiller, William A., W.E. Dibble, R. Nunley and C.N. Shealy. (2004) "Towards General Experimentation and Discovery in 'Conditioned' Laboratory Spaces: Part I: Experimental pH-Change Findings at Some Remote Sites." Available online at [www.ncbi.nlm.nih.gov/pubmed/15025888](http://www.ncbi.nlm.nih.gov/pubmed/15025888) and [www.tillerfoundation.com/ToGenExpPart1.pdf](http://www.tillerfoundation.com/ToGenExpPart1.pdf).
- Tiller, William A. (2006) "Towards a New Physics and Biology that includes consciousness". In Savely Savva, editor. *Life and Mind: In search of the physical basis*. Victoria, B.C.: Trafford.

- Tuszynski, Jack A., editor. (2006) *The Emerging Physics of Consciousness*. Germany: Springer.
- Tuszynski, Jack A. and Nancy J. Woolf. (2006) "The Path Ahead". In Tuszynski, *Emerging Physics*: 1-24.
- Walker, Evan Harris. (2000) *The Physics of Consciousness*. Basic Books.
- Whittaker, Edmund T. (1903) "On the partial differential equations of mathematical physics." *Mathematische Annalen* 57: 337.
- Whittaker, Edmund T. (1904) "On an extension of an electromagnetic field due to electrons by means of two scalar potential functions." *Proceedings of the London Mathematical Society* 1: 367-372.
- Wikipedia. (2012) "Torsion Field (Pseudoscience)". Last modified 2 March 2012. Downloaded 5 March 2012.
- Wikipedia. (2102) "Neuron". Last Modified 10 March 2012. Accessed 10 March 2012.
- Woolf, Nancy. (2006) "Microtubules in the Cerebral Cortex: Role in Memory and Consciousness", in Tuszynski, *Emerging Physics of Consciousness*: 49-94.
- Woolf, Nancy. (2007) "From Neuronanotechnology to Cure Criminality and Mental Illness". *The Journal of Geoethical Nanotechnology* 2, 2. Available online at [www.terasemjournals.org/GN0202/Woolf\\_c.html](http://www.terasemjournals.org/GN0202/Woolf_c.html).
- Woollacott, Emma. (2012) "'Telepathy machine' close to reality, say scientists." Available online at <http://www.tgdaily.com/trendwatch-features/61154-telepathy-machine-close-to-reality-say-scientists>.
- Zukerman, Wendy. (2012) "Prune bad brain wiring with magnetic pulses." *New Scientist*. 21 February 2012. Available online at [www.newscientist.com/article/mg21328524.600-prune-bad-brain-wiring-with-magnetic-pulses.html](http://www.newscientist.com/article/mg21328524.600-prune-bad-brain-wiring-with-magnetic-pulses.html).