Theoretical

QUANTUM MECHANICS & THE ROLE FOR CONSCIOUSNESS IN THE PHYSICAL WORLD

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ABSTRACT

In this paper we will address important considerations for the structure of a physical theory and the need and implications for the conscious observer and creator. Complementarity and reciprocity are dominate in the structure of the Quantum World. It is clear that one's meaningful existence directly involves one's intent and action both mental and physical in consequence. Hence, it is vital to understand what intentional will is, the manner in which it arises, as it relates to one's ethical responsibility the meaning of their life may also be considered in the context of intentional will and may be described and understood. We investigate the role of conscious intention in the physical and mental world. In this paper, we examine the theoretical constructs of the properties of observational intention and their local and nonlocal effects on mind and matter. One begins by sensing a physical or psychic input and then becoming consciously aware of it as perceptions and thoughts which result in concepts developed for memories, reasoning and feelings. Then a thought and decision will be made and intention are carried into action in the physical and mental world. We proceed by investigating the role and action of the thought of intentional will and its role in quantum mechanics, its structure of the theory and manner in which it appears to demand a role for consciousness. In order to proceed with our investigation will present some of the basic tenants of quantum mechanics, the structure of the theory and manner in which it appears to demand a role for consciousness in quantum measurement and its non local intentional interaction. The quantum theory gives us two inescapable conclusions: 1) we are intimaly linked to the world as participatory observers, and 2) nonlocal remote connections and interactions are shown to be part of our world process. Discoveries, and/or creations of new concepts in physics lead to the observer/participant issue. Quantum mechanics, the theory of atomic microcosm, is a description that may imply that the observer has an impact on the observed, that the observer has an effect on what is observed. The relativity theory seems to imply that the state of the observer affects his interpretation of what he sees. In the context of quantum theory and relativity, we may be able to shed light on the relationship of discovery as well as creation and its validation of the properties of an external reality. In quantum physics, as well as in the structure of n-dimensional relativistic models, the implication for a fundamental remote connection of events is deeply implied by the structure of these models and their experimental test and we can use this property for our experimental models of the properties of consciousness. The structure of physical theory, its very fabric, is pointing towards a world view that speaks of concepts which have been considered external to the body of science but yet may be implied by modern physical theory itself.

KEYWORDS: Quantum mechanics, consciousness, intentional will

INTRODUCTION

This author believes that the quantum theory is an important formalism to examine because inherent in its structure is the role for **an observer**, and some physicists believe **a participator**, in physical processes. It is the only highly accepted physics theory that appears to contain a role for consciousness and this role is at the seat of the resolution of the paradoxes in the theory. The two major theories developed in this century, highly regarded and accepted is the theory of relativity and quantum mechanics. These theories accepted as being universally true for high velocities, near the velocity of light c (relativity) and where $\hbar$ is significant (quantum theory). In consideration of our theoretical model of intentional will should involve: 1) substantially accepted physics, 2) physics which relevant to what we are studying. We have examined the relativity theory in detail in which the correlation of events in forward, backward and elsewhere in Minkowski metrical space. In this paper we detail some of the major tenants of quantum mechanics, its implications for nonlocality and the possible reconciliations of some of the paradoxes of quantum theory with the consideration of the action of consciousness in the physical domain.

The standard and universally accepted form of quantum mechanics that it is linear and obeys the supposition principle and the accepted interpretation of the quantum mechanics is the Copenhagen View. This View states that the principle interpretation of quantum mechanics is that the theory well predicts certain results of experimental data. In the Copenhagen View what is the meaning or interpretation of the theory and its structure is to not be asked, questioned or addressed.

This author's opinion is non-Copenhagen, that is it is important and vital that one questions why and how a particular theory predicts the outcome of a particular set of experimental results; how well it works and what are its possible implications about a model of reality and its limitations. Note the Einstein—Podolsky—Rosen, EPR paradox as well as the Schrödinger cat paradox and the particle-wave paradox arose out of such questioning.

The term Copenhagen interpretation of quantum mechanics arose from the location of a conference in Copenhagen, Denmark in which Werner Heisenberg meeting with Niels Bohr and Heisenberg stated, "we should only utilize

quantum theory and not question how it works." Erwin Schrödinger, Werner Heisinberg, Albert Einstein, Lewis de Broglie, and other physics luminaries of the 1920's and 1930's attended one of the Solvey conference in about 1926 to discuss these very issues. The Copenhagen "school of thought" currently dominates physics and but a few physicists are committed to interpreting the meaning of the quantum theory.[1,2]

Essentially, the fascination for interpreting the foundations of the quantum theory is that the paradoxes that the theory implies is that the observer (in the usual case human observer) determines the state of the system i.e. the wave function that corresponds to the particular state of the system. This is called "the collapse of the wave function." Hence, in some interpretations human consciousness "enters the equation" or occupies a role in physical processes in that by setting up a particular experiment, the human observer when he/she makes an observation they determine the outcome of that experiment.

Since certain predictions of the quantum theory are so accurate, and if the observer does in some manner participate in determining (and possible by creating) the state of the system, we have a very strong statement for the existence of and certain properties of consciousness called the "observer effect." The quantum mechanics formulism is very successful, for example, in describing the photoelectric effect, the Compton effect, the spectrum of the hydrogen atom and the implications for nonlocality in the formulation of J. Bell of the EPR paradox.[3,4] There is some controversy over the concept of nonlocality and the Young's double slit experiment and some laser interferometric effects. Perhaps Heisenberg's "potentia" model is relevant here in these interpretation of nonlocality.

It is interesting to note that states of consciousness appear to be definite and discrete such as awake, excited, or bored, asleep, asleep dreaming, meditative bliss, reverence for life, "in the now," past memories, future precognition, etc. The Hindus formulate and describe some of these discrete states in detail in the Vedic tradition, so do shamans of various cultures.

Discrete nature is quantum like. The fundamental tenant of quantum theory is discreteness and possibly we can form an analogy to the perception of discrete states of consciousness, which are subjectively perceived, but also can be correlated with the monitoring of external, physiological responses.

The psi or psychic aspect of consciousness that involves nonlocal perception is also consistent with the Bell's theorem and Clauser-Horn and Alan Aspect experimental test of the EPR theorem of quantum mechanics.[3,5,6] Essentially if the quantum mechanics fits the Bell's theorem test, which it does, then nonlocality must be true! Nonlocal consciousness has vast potential for the conscious mind.

If we can demonstrate that the form, structure and verification of the quantum theory truly implies the existence of a role for consciousness then we have found that physical processes manifest in ordinary four space or space-time that may demand that there exists other dimensions and a higher dimensional geometry to explain reality to include nonlocality aspect of reality particularly in relativistic physics. The richness and universality as well as the success of the quantum theory leads us to examine in detail this complex theoretical structure and the nature and function of human intentionality. The basis of quantum mechanics is the concept of discreteness of the microscopic domain or the idea of "quanta" discreteness are the particle like aspect of particles and waves.

The structure and formalism of quantum theory deals in abstract vector spaces, such as Hilbert space, group theory such as special unitary groups and Lie algebras and more advances concepts such as Cartan spaces, Clifford algebras and fiber bundal spaces and manifold topological structures. Although so termed ordinary perception does not directly "see these spaces" nevertheless, vector topology might well be a good description and model for the process of the act of observation and intentional will since quantum theory appears to demand a role for conscious interaction in physical processes and also physical and perhaps remote perceptual and interactive nonlocality.[7,8]

DERIVATION OF THE SCHRÖDINGER EQUATION, OTHER WAVE EQUATIONS AND RECIPROCITY AND OR INVERSE RELATIONS

In this section we will detail some of the form and structure of the ubiquitous quantum formulism, particularly detailing the successful Schrödinger equation. A successful theory predicts and describes natural phenomena completely and

in accurate detail. Current physical thought holds that one of the most vital and successful theory of the 20th Century is the quantum theory and the other is relativity. We shall examine this view in detail including quantum mechanical paradoxes which appear to demand a role for consciousness in physical processes to resolve some of the results of quantum experiments such as the Young's double slit experiment and Bell's theorem and paradoxes such as the Schrödinger cat paradox and particle wave paradox. Essentially, a paradox indicates a lack of understanding of a physical process as no paradoxes occur in nature.

In considering the properties of the usual space of variable, inverse variable and their relationship, we examine of inverse relationships in the Schrödinger equation, other quantum mechanical equations and the structure of quantum mechanics and its possible implications for intentional intervention in material, primarily in microscopic systems.

Reciprocal relations occur in the cannongically conjugate variables and applications which use phase space ($\underline{p},\underline{x}$). We will demonstrate some of these reciprocity relations, the manner in which they relate to the Schrödinger equation, and a conceptual derivation of the Schrödinger equation which can easily be made for both the time dependent and time independent forms. The following derivation of the Schrödinger equation is the author's own and is based on the de Broglie relation and the Einstein photoelectric effect equation.

We proceed for the energy Hamiltonian, H which has the dimensions of energy. Two basic equations of quantum mechanics is the de Broglie relation $p = h/\lambda$ where we can define $k \equiv 1/\lambda$ the wave number, this relation relates the momentum of a "wavelet" particle-wave to its wavelength, λ. The second equation $E = h\nu$ relates the energy of a photon or electromagnetic quantum to its frequency and was developed and applied by Einstein to the photoelectric effect in which a beam of photons impinging on a metal produces a current flow. For $E = \frac{1}{2}mv^2$ and momentum $p = mv$ and m is the energy mass of a particle then $E = p^2/2m$ which is the form we use on the energy Hamiltonian in the Schrödinger equation. In the quantum theory we have a set of operators which can be expressed as Matrices which operate on a wave function which can be expressed as a row or column Vector. The wave function has a classical analogy in a wave amplitude.

Returning to the de Broglie relation of $p = h/\lambda$, where λ is in dimensions of length and can be written as an operator as $p_{xop} \rightarrow [\hbar/2][\partial/\partial x]$ for $1/\lambda \rightarrow \partial/\partial x$ and the arrow denotes "goes to" then $p_x^2 \rightarrow -\hbar^2[\partial^2/\partial x^2]$. Now consider the photoelectric equation $E = h\nu$ for νoc $1/t$ where ν is frequency and t is time. In operator form then $E_t = [\hbar/2][\partial/\partial t]$. We note that the wave number k is reciprocal to λ as $1/\lambda$ and that ν is reciprocal to t as $1/t$, $E_t \rightarrow [\hbar/i][\partial/\partial t]$.

The Hamilton operator can be written as: $H = p^2/2m = -[\hbar^2/2m][\partial^2/\partial x^2]$ in the one dimension of space, x. Equating the two energy operators in short hand notation we write the Schrödinger equation as $H\Psi = E\Psi$ where Ψ is the wave function of the system and Ψ is a function of x and t as $\Psi(x, t)$. We now have $[\hbar^2/2m][\partial^2\Psi/\partial x^2] = [\hbar/i][\partial/\partial t]$ *or* $[\hbar/2m][\partial^2\Psi/\partial x^2] = [1/i][\partial/\partial t]$ this is the potential free space or no potential $V(x, t) = 0$ time dependent form of the Schrödinger equation. Since the energy Hamiltonian represents the total energy of the system, then $(H + V)\Psi = E\Psi$ which is the time independent form of the Schrödinger equation in a potential V. The total energy $E_t = E_k + V$ for E_k the kinetic energy and V, the potential energy; the total energy is a conserved quantity.

Returning to the time dependent form in a potential free space, the solutions to this equation of the form $\Psi(x, t) = \exp[i(px - Et)/\hbar]$ which is the general solution to the Schrödinger equation and satisfies this equation and $i \equiv \sqrt{-1}$. If we define $(px - Et)/\hbar = \eta$ then $\Psi = e^{i\eta} = \cos\eta + i\sin\eta$ by Euler's equation and $e^{-\eta}$ can represent the wave's envelope. Note that x or $\lambda \propto 1/k$ from $p = h/\lambda$ the wave number k and $t \propto 1/\nu$ the frequency from $E = h\nu = \hbar\omega$ and ω and t are the variables of phase space and also of Fourier analysis. The energy relationship $E = h\nu = \hbar\omega$ is the photoelectric effect equation formulated by Einstein in one of his three classic 1905 papers.[1]

In atomic processes where the Schrödinger equation well applies, the potential term is taken to be the electric Coulomb potential of the electric attraction of electrons and protons and mutual election repulsion for free elections not in Bohr orbitals. Quantum theory applies to small scale phenomena where $\hbar$ is effectively non zero.

Let us consider the properties of the useful four space having the usual variables and their inverses and the implications for these types of space-time forms and

the Schrödinger equation. A conceptual derivation of the Schrödinger equation can easily be made for both the time dependent and time independent forms. We proceed from the energy Hamiltonian H which is in the dimensions of energy. The two basic equations of $p = h/\lambda$ and $E = h\nu$ can then be utilized. Recalling that $E = p^2/2m$ where E is energy $E = \frac{1}{2}mv^2$, p is momentum; $p = mv$ and m is mass, we can now use the relation p in the Hamiltonian, $H = p^2/2m = 1/2m(h/\lambda)^2 = E = h\nu$. Now recall that λ is length and in the derivative form $\partial/\partial x$ (in one dimension of space) and ν, is proportional to $\nu \propto 1/t$ or in derivative form $\partial/\partial t$ so that we have a form of the Schrödinger equation for a potential free space $[h^2/2m][\partial^2/\partial x^2] = h[\partial/\partial t]$ or $[h/2m][\partial^2/\partial x^2] = [\partial/\partial t]$. These forms are operators that must operate on a wave function Ψ so that $[h/2m][\partial^2/\partial x^2]\Psi = \partial\Psi/\partial t$. For energy conservation the total energy, E_t or we can refer to it as H is $E_t = E_k + V$ where E_k is the kinetic energy and V is the potential energy; we can write the Schrödinger equation form as $[h/2m][\partial^2/\partial x^2]\Psi + V\Psi = \partial\Psi/\partial t$ in a potential field, V and combining terms on the left side we have, $\{[h/2m][\partial^2/\partial x^2] + V\}\Psi = \partial\Psi/\partial t$. The potential term is taken to be the Coulomb electric charge attraction or repulsion of atomic particles and is effectively relevant then that we are considering small scale phenomena.

We can write the time independent Schrödinger equation for E replacing the $\partial\Psi/\partial t$ term so that $\{[h/2m][\partial^2/\partial x^2] + V\}\Psi = E\Psi$ or in short hand $H\Psi = E\Psi$. In general Ψ, m and V are dependent variables on the independent variables (x, y, z, t) for the three dimensional (spatial) form of the Schrödinger equation. An exception is the Lippmann-Schwinger equation treated in (p, x) phase space which utilizes p and x as independent variables. We will explore this point further.

Let us point out that in general x and t are chosen as independent variables and Ψ is a function of these as $\Psi(x, t)$. The potential V is usually dependent on dimension x or r (in spherical coordinates). Of course, also a three dimensional form of the Schrödinger equation can be written as $\{h/2m[\partial^2/\partial x^2 + \partial^2/\partial y^2 + \partial^2/\partial t^2] + V(x, y, z)\}\Psi(x, y, z, t) = \partial\Psi(x, y, z, t)/\partial t$ or we can write $\{[h/2m]\nabla^2 + V\}\Psi = \partial\Psi/\partial t$ for del operator $\nabla^2 \equiv \partial^2/\partial x^2 + \partial^2/\partial y^2 + \partial^2/\partial z^2$. The usual four space are dependent on x, y, z, t and on the inverse variable k_x, k_y, k_z, k_t where $k_t = \omega/2\pi$.

We can write the de Broglie relation as $p = h/\lambda$ which are equivalent forms. The form that E. Schrödinger derived in 1926 is of the form

$[-\hbar^2/2m]\nabla^2\Psi + [\hbar^2/i][\partial\Psi/\partial t] = 0$ and is equivalent to the previous form. The generalized three dimensional wave packet solution with proper normalization $\Psi(\underline{r}, t) = [1/(\sqrt{2\pi\hbar})^3]\int a(p)\exp[i/\hbar\ (\underline{p}.\underline{r} - Et)]d\underline{p}$ where $\underline{r}$ is the radius vector, $\underline{p}$ is the momentum vector and the limits of integration are over the space where Ψ is defined. Parsevals formula gives $\int|\Psi|^2 dr = \int|a(p)|^2 dp$ = constant.

The derivatives which depend on momentum and energy occurring in the Schrödinger wave equation are $\partial\Psi/\partial t = [1/(2\pi\hbar)^{3/2}]\int[-iE/\hbar]a(\underline{p})\exp.[i/\hbar\,(\underline{p}.\underline{r}) - Et]\,d\underline{p}$ and $\nabla^2\Psi = [1/(2\pi\hbar)^{3/2}]\int[-p^2/\hbar^2]a(\underline{p})\exp.[i/\hbar\,(p.r) - Et]\,d\underline{p}$. So that the left side of the Schrödinger equation becomes: $[1/(2\pi\hbar)^{3/2}]\int[p^2/2m - E]a(\underline{p})exp.\{i/\hbar^{-}[p.r] - Et\}d\underline{p}$ where $d\underline{p} = dp_x dp_y dp_z$ which vanishes because $E = p^2/2m$ and hence the above is the solution to Schrödingers' wave equation.[9-12] Note that $d\underline{r} = d_x d_y d_z$ and $d\underline{p} = dp_x dp_y dp_z$ and *exp.* denotes the exponents to the log to the base *e*. Recall that the "real meaning" of quantum interpretation of Ψ is not just wave amplitude analogous to the classical wave amplitude spatial-temperal wave amplitude $U(x, y, z, t)$ but is expressed in terms of probabilities such as the probability wave function $\Psi^*\Psi = |\Psi^2|$. Units and dimensionality of terms need to be of consideration and dimensional analysis needs to be preserved which is accomplished.

It is quite interesting to note that the Greek letter Ψ or psi used to represent the wave function in the quantum theory also is the Greek word for mind and is used in the word psychology and is the abbreviation Ψ or psi for psychic phenomena, an aspect of mind and of consciousness.

In high energy physics *PCT* is conserved in some processes and *PC* and *T* are considered as conserved quantities in most cases, where *P* is parity conservation, *C* is charge conjugation or charge conservation, and *T* is time reversal invariance. We know that macroscopic time reversal invariance (running a film forwards and backwards) is not conserved due to entropy which increase as, $\Delta S > 0$ and which prevents perpetual motors of the second kind. In a sense, this is the reason the world is always in flux and change, which makes it possible for physical reality to exist. Hence, if macroscopic invariance of parity is found to be violated in observer effected systems or other systems, a new variable similar to entropy is introduced. We have examine thermodynamics, energy conservation ΔU, and entropy and the action of psychokinesis. We have designed experiments to examine parity and *PCT* conservation in

macroscopic and microscopic systems. Thus the systems under development by W. Van Bise test some of these theoretical models involving possible parity violation or non conservation, hence the need for multidimensional geometries.[7,8,13]

Since we can write alternate forms of quantum equations such as the Lipppmann-Schwinger equation in phase-space which is an abstract space, we can also write other abstract forms. In fact Hilbert space itself is an abstract vector space and the quantum domain itself is considered in detail to describe predictive results in real experiments but the equations for it exist in an abstract vector space. We therefore conclude that a number of form spaces can be constructed which are quite distinct but related to each other, yet constraints and conditions must apply for these forms to be accepted by the general physics community; conditions such as unitarity, analyticity, Lorentz invariance, etc. In the Lippmann-Schwinger formalism momentum, p and energy E are the independent variables unlike x and t as in the Schrödinger equation so that p, E, x, t become on equal footing. We think of space and time as mutable absolutes which act as the arena of the events of reality to occur. Yet, as we shall discuss later space-time, matter-energy, momentum and frequency may be intimately linked.

We can enumerate three fundamental principles of quantum particle physics. These are: 1) Poincare invariance or Lorentz invariance of the energy Hamiltonian which implies the conservation of energy E, momentum p, and angular momentum L in the vernacular of the S-matrix formalism. Also the equivalence of different inertial frames of reference is assumed under this principle; 2) causality which implies analyticity of scattering amplitudes of functions of particle energy and momenta (associated with isolated singularities in the complex plane which represent particle states) and is determined by the cause—effect event structure of space-time; 3) unitarity, which implies the conservation of probability as well as the superposition of wave function amplitude.[8,14,15]

The significance of the Schrödinger equation and the quantum approach in general is the possibility, at least in part, of describing possible micro psychokinetic links between intentional observation and effect on a system and hence in some sense linking of body (the physical) and the spiritual "unseen" domain

which produces affects on the physical domain.[16-21] We will discuss quantum measurement in more detail later in this section.

For completeness, we present the classical wave equation in one spatial dimension by way of comparison in terms of the wave amplitude $U(x,t)$ as a function of space and time, $\partial^2 U/\partial x^2 = [1/c^2][\partial^2 U/\partial t^2]$ where c is the propagation velocity of the wave and the solution of the equation is in the form $U = A(\sin\Theta + i\cos\Theta)$ standing wave solution. This equation can describe sound waves, water waves and many other forms of mechanical oscillations.

The Schrödinger wave equation previously discussed is for applications for non relativistic physical processes. It is an inhomogeneous hypergeometric equation, for the time dependent form. Two relativistic quantum wave equations are the Dirac electron theory equation and the relativistic Klein-Gorden equation. Perhaps the clearest analogy is between the classical wave equation and the Klein-Gorden equation. The Klein-Gorden equation is a four dimensional form where the wave function depends on (x, y, z, t) and is written as $\Box^2\Psi + [2m/\hbar]\Psi = 0$ where $\Box^2$ is the D' Alembartian operator $\Box^2 = \partial^2/\partial x^2 + \partial^2/\partial y^2 + \partial^2 z/\partial t^2 - [1/c^2][\partial^2/\partial t^2]$ and m is the mass of the particle under consideration. Note that this equation is second order in space and time as is the classical wave equation whereas the Schrödinger equation is second order in space and first order in time in part the reason for the $i = \sqrt{-1}$ term in the equation. The relationship of quantum mechanics and relativity is a major topic of research on quantum gravity.[22]

We can write the wave mechanical treatment by revising the relativistic Klein-Gorden equation for the zero rest mass of the photon, $m = 0$ so that $\{\nabla^2 - k^2[\partial/\partial t^2]\}\phi = 0$. Under the action of a potential which goes as $1/r$ for a particle of mass such as the pion, π particle mass $\{\nabla^2 - k^2[\partial^2/\partial t^2] + m^2\}\phi = 0$ then $\phi \rightarrow (e - cr)/r$ which yields the Yukawa potential for nuclear forces. The key here is the richness of the quantum theory approach and perhaps its universality as exemplified by the Heisenberg uncertainty or indeterminacy relations and the conditions of the EPR paradox.[3,4] The Summerfield quantization condition $\oint pdq = n\hbar$ is to the Heisenberg relations and to phase space analysis. The duality of the canonically conjugate pairs of variable p and x and E and t in a sense form reciprocal spaces. Note

that q denotes a generalized spatial parameter such as x. This phase space (p, q) approach leads to the Heisenberg indeterminacy or uncertainty principle. We may be able to relate the "phase spaces" such as (x, t), (p, E), and (x, p), (E, t), to multidimensional Fourier transforms and some physical processes.

In order to preserve the conservation of mass, energy and relativistically mass energy we must normalize our wave functions as $\int \Psi^* \Psi d\tau = \int |\Psi|^2 dt = 1$. We can only observe and measure real quantities and sometime Ψ itself is not real but $\Psi^* \Psi$ is, where Ψ^* is the complex conjugate of Ψ where all i quantities become $-i$. Orthongonality relates to the construct of a set of orthogonal dimensions in Hilbert of vector space out of which we can construct wave functions Ψ_n and Ψ_m. If $n = m$ then we have $\int \Psi_n(x) \Psi_m(x) dx = 1$ and if $m \neq n$ then $\int \Psi_n(x) \Psi_m(x) dx = 0$ or in Dirac notation $<n|m>$. If H is the Hamiltonian equation for Ψ_m and ϕ_n where Ψ_m and ϕ_n are different wave functions, or eigen vectors of H then $\langle \Psi_m | H | \phi_n \rangle$ is the matrix element for m,n which can be written as $<m|H|n>$. The Hamiltonian must be real so that all eigenvalues are real. We can write this as $H\Psi_i = E_i \Psi_i$ where E_i is the energy eigenvalue in the Schrödinger like form of the quantum wave equation. The probability or likelihood of a quantum event is expressed in terms of the expectation value. We can calculate this value but it requires an experiment to measure the actual real physical state of the system.[22]

Starting from the photoelectric effect $E = h\nu = \hbar \omega$ and as de Broglie pointed out that, if ω and k are connected with the energy and momentum of a particle according to $p = h/\lambda$ and $E = \hbar \omega$ then the group velocity is $v_g = dE/dp$. The quantity of the right is just the classical Hamiltonian expression for the velocity of the particle. Thus, for a free nonrelativistic particle, $E = p^2/2m$ and $dE/dp = p/m = v$ or velocity.

Thus, the quantum hypothesis of Einstein and Planck and the wave-length-momentum relationship introduced by de Broglie lead to the conclusion that the velocity of a particle is to be associated with the group velocity of the corresponding wave packet. The consistency of this view is confirmed by the fact that the pairs of variables (x,t) and (k,ω) behave similarly when transformed from one Lorentz frame to another, so the group velocity and

particle velocity can be associated with one another in a relativistically covariant way. It was emphasized by de Broglie that the theory satisfies, at least to this degree, the requirements of special relativity. The wave pocket concept of $\Psi^*\Psi$ yields the idea that all waves such as light can be treated as a particle and particles can be treated as waves. This is called the particle wave paradox. But it is not a paradox that is depending on the experiment conducted, these entities will act as a particle or a wave, depending on how they are observed.

Again we consider the wave function for a free particle satisfying the Schrödinger equation where the potential $V = 0$. A nonrelativistic free particle with an energy $E = \frac{1}{2}mv^2$ and momentum $\underline{p} = m\underline{v}$ is associated with a wave of frequency $\nu = E/k$ and wave length $\lambda = h/p$ using the photoelectric effect and de Broglie equations; when the potential $V \neq 0$ then the Hamiltonian, $H = T + V$ where T is the kinetic energy and V is the potential energy in $H\Psi = E\Psi$.

Then the propagation vector is $k = p/\hbar$. Momentum and frequency are related by the dispersion law, therefore from $E = h\nu$, and $\omega = E/\hbar = p^2/2m\hbar$ and $\omega/2\pi = \nu$. A usual plane wave solution is $exp.\{i/\hbar\ [\underline{p}.\underline{r} - Et]\}$ or in one dimension, then $exp.\{i/\hbar\ [px - (p^2/2m)t]\}$. By superposition of a set of such waves, a wave packet can be constructed so that, $\Psi(x,t) = [1/\sqrt{2\pi\hbar}\ ]$ $\int_x^x a(p)exp.(i/\hbar\ )(px - Et)dp$ where *exp.* stands for the exponent of log to the base, *e*.

The photoelectric effect and Compton scattering effects gives us good examples in which the quantum mechanics gives us a description of the manner in which the observer effects the processes observed in the physical world. In Compton effect, scattering a quanta of light or photon in the x-ray region, scatters off of and moves or nudges an electron by a distance Δx. Then the photon is reborn at a different frequency and energy depending on how big Δx is. The photon's energy change is given as $\Delta E = h\Delta\nu$, where $\Delta\nu$ is the frequency shift the electron, initially at rest, acquires an energy $E = \frac{1}{2}m_e v^2$ where m_e is the electron mass. Hence the photon does not relinquish all its energy to the scattered electron. The incident photon scatters the electron at an angle relative to the direction of motion of the incident photon and the emitted photon

moves at an angle to the incident photon path. The scattered photon loses energy $h\Delta\nu = \frac{1}{2} m_e v^2$ for the conservation of energy. Hence we cannot observe an electron or any piece of matter without perturbing it to some degree. The frequency downshift in the photon's frequency from λ_i, its initial wave length to λ_f, its final wave length is $\Delta\lambda = \lambda_i - \lambda_f = h/m_e c(1 - \cos\phi)$ where the angle ϕ is the angle at which the scattered photon is changed form its initial path of flight. The photon's wave length can be related to its momentum by the de Broglie relation, $p_i = h/\lambda_i$ and $p_f = h/\lambda_f$.

Professor Geoffrey Chew, Chairman of the theoretical physics division of Lawrence Berkeley National Laboratory, where I spent many happy years doing physics, likes the concept of the "soft photon" effect. The photon, unlike elementary particles such as electrons or protons, collided with matter more gently with less effect, leaving external matter less effected by observation. Yet all quantum measurement, even the use of a flash light leaves the observed effected by the act of observation.[14]

We can interpret the Schrödinger wave functions in some physical terms. The Schrödinger equation for the wave function of a free particle arises directly from the Einstein-de Broglie relations and is, in a sense, equivalent to them. However, until suitable boundary conditions and requirements concerning the continuity of solutions are imposed, the properties of the wave function are not completely described by the Schrödinger equation. Moreover, it will usually be true that Ψ is a continuous function of x, y, and z. In a very general sense, any continuous solution of the Schrödinger equation which vanishes at infinity in such a manner that the integral $\int |\Psi|^2 d\underline{r}$ exists, can be represented as superposition of plane waves, and the two descriptions of the wave function are entirely equivalent. This is a matter of great practical importance, because many of the properties of Ψ which are of physical interest are brought out more clearly by the Schrödinger equation than by the direct representation of Ψ in terms of its harmonic components. The harmonic oscillator form of the potential $V(\underline{r}, t)$ gives rise to harmonic oscillator wave functions. The key is that the wave function Ψ is said to correspond, one to one with an external entity such as an electron which it is said to describe. This match of mathematical construct and a physical state or quantity is fundamental to the quantum theory.

QUANTUM MECHANICS, NONLOCALITY, CANOCALLY CONJUGATE VARIABLE PAIRS AND THE OBSERVER'S INTENTION

The quantum theory is considered complete, that is in all microsystems and perhaps for some macrosystems, it appears that the quantum description is ubiquitous for these systems. This definition of microsystems includes, of course, small size defined as a system where $\hbar \neq 0$ and quantum effects are experimentally observed.

The correspondence principle is the statement that there exists for each physical entity, particle, wave "universe," etc. there exists a mathematical description or wave function that corresponds to and describes this physical entity. This point is central to the EPR paradox and the J. S. Bell's theorem test. Also that the quantum description, corresponds or makes a smooth transition to a classical system in the cases which no longer applies to the micro quantum system.

The complementarily principle is basic to the quantum description and arises out of the definition of the energy Hamiltonian and the Hamilton-Jacobi mechanics, as does the duality concept of canonically conjugate variables, phase space, etc. One of the most interesting and discussed are the Heisenberg uncertainty or indetermined relations as the canonically conjugate expressions $[p, x] \geq \hbar$ or $\Delta x \Delta p \geq \hbar$. As we know the interpretation of the latter expression is that as the uncertainty of the position x becomes larger, the determinacy of the momentum p can be made more well known within the limits of this expression where $\hbar = 1.0544x10^{-27}$ erg-sec. Also considered is the indeterminacy of the canonically conjugate expression $[E, t] \geq \hbar$; other Heisenberg relations may exist.[22,23] This is a non-commuting algebra in terms of the energy uncertainty ΔE and temperal uncertainty Δt as $\Delta E \Delta t \geq \hbar$. Usually x, t are considered to be independent variables and p and E, dependent variables for $p(x, t)$ and $E(x, t)$.

Some physicists have examined the possibility that maybe there are viable nonlinear quantum theories such as proposed by Eugene Wigner, this author and others. Perhaps the "Standard quantum theory" is only an approximation in a given domain to a larger "truth" or theory. Indeed and if conscious observation is necessary to determine the collapse of the wave function to a particular

state of a system then in a sense the quantum theory implies consciousness exists and is necessary to the quantum formalism! Maybe in nonlinear quantum series, a collection of more global state of consciousness determines the final outcome or state of a system. These nonlinear theories, though not well accepted usually involve additional nonlinear terms in quantum wave equations such as the Schrödinger equation, the Dirac equation, the Klein-Gorden equation in the form of the sine-Gorden equation, etc. The issue of local, nonlocal and global action of consciousness may be addressed by these considerations.

How well does the quantum theory really describe the micro domain? We discussed completeness, that is the quantum theory is universal; for example the Heisenberg Principle always applies, but is the quantum theory really an exact theory? Does the Heisenberg principle apply in an $N > 4$ dimensional space in its higher order dimensions?

In the case of the Niels Bohr hydrogen atom description utilizing the quantum principle of discreteness formulated by Max Planck in terms of h or $\hbar = h/2\pi$, Planck's constant and the de Broglie relation $p = h/\lambda$, the excitation and emission spectrum of hydrogen, the two body system of a proton and electron, is well described including the Rydberg constant, R. Note that Newton's universal gravitational theory also has a constant, G the universal Gravitational constant which occurs in his two body interaction law of the force of gravitational attraction between two massive bodies. In many body quantum mechanical theories for more than two interacting bodies or systems, approximations have to be made. This is true for calculating orbits of planets in the solar system in which other planets produce perturbations on a planets' orbit about the sun.

In atomic as well as in nuclear physics, where the quantum formalism applies, again multi-particle systems for greater than two particles or a particle and a field require that approximations and additional terms are required, for example, to calculate the emission spectrum of the sodium atom. Note also that law of the electron charge between two charge particles is exact and a constant $1/\sqrt{4\pi\varepsilon_0}$ where ε_0 is the permittivity of the vacuum. More detailed analysis on these constants such as e, the charge on a single electron, proton, etc., G, R, $\hbar$, c, as fundamental universal constants are in my book on General Relativity and quantum gravity. This model utilizes a ten dimensional geometry.[22]

It is vitally important to examine the applicability and universality and implications of various significant theories and their relevance to that aspect of consciousness in general and that aspect termed psi or psychic phenomena in particular. In general the formulation of physics and psi both involve the correlation of local and nonlocal events in space and time.[17-20] Psi necessarily involves nonlocality.

We will address some of the general issues later but let us return to the quantum theory since it may have an inherent role for the consciousness formulated in it. In general all of physics, engineering (theory and application) and science in general are formulated to exclude psi and most systems, physical, equipment, etc. are "hardened against" the action of conscious intention so that reproductability is possible and so is reliability. To construct a system that is conducive to intentional intervention one must deal with nonlinear, metastable systems to enhance that ability to observe psi effects. Such systems have been constructed by a number of researchers including Rauscher, Van Bise, Schmidt, Tiller and others which have demonstrated the correlation of intersion (will) and effect (result).[20,21,24-26] Various methods to enhance the correlation and magnitude of the effect are being developed. Some involve effects that are quantum mechanical in nature.[21-24] Conscious intent and/or psi has both macroscopic, quantum domain consequences. It can be argued that macro-events can be made up of a group or series of (atomic) micro events or that a series of micro events "add up" to macro events. This is a debatable issue.

The two major key elements in the case of the possible relevance of the quantum theory to psi are: 1) how an observation may select or determine a specific state of a system i.e. relate observation and state selection to conscious intent, and 2) inherent, fundamental theoretical description and experimental verification and determination of nonlocality. Furthermore, we need to examine more deeply the implications of the conscious observer's role in collapsing a wave function and whether mind-matter interactions or psychokinesis are involved. This collapse of the wave function may appear not to be the most statistically probable one.

We can argue that in the photoelectric effect and photons, some in the optical and some in the x-ray region produce a change in the system. It is through

the optical and in more complex systems of visible light and electrons, in electromicroscopes, x-rays and x-ray film, and gamma rays to make systems visible to the human eye. Electromagnetic waves of sufficient energy, even IR, heat surfaces, excite atoms, make changes in the systems so that we may ultimately view them and/or measure them—this is the key to observation.[27]

THE SCHRÖDINGER CAT PARADOX AND THE PARTICLE WAVE PARADOX AND THEIR IMPLICATIONS FOR NONLOCALITY

The Observer as a Conscious Intentive Observer

What constitutes an observer, particularly in the quantum sense? A recording instrument can be designed to record the state of a system, for example, one of two states as in the Schrödinger equation in the "Schrödinger cat paradox." Is the point at which the knowledge of the state of the cat only when a human observer makes the observation and determination?

The so termed Schrödinger cat paradox arises out of the linear properties of the structure of the quantum theory. Basically, all quantum process are considered to be linear and obey linear superposition. This is stated that all quantum wave functions are constructed out of a linear sum over a basis set vector space. The case of the Schrödinger cat paradox is a hypothetical experiment or Gedanken experiment.

We discussed the Schrödinger cat paradox in detail at the November 1977 Iceland conference and its implications for consciousness and its effect/and causal intent on the physical world.[8] The cat paradox involves the "Gedanken" or thought experiment in which a cat is enclosed in an airtight cage with a cyanide pellet and a means to break it such as a hammer poised on a lever. The possibility of activating the hammer to break the pellet is "chosen" by the random decay of a radioactive element. A proper connection is made so that the emission of a radioactive particle is detected and then transmitted to a system to activate the hammer mechanism to crush the cyanide capsule. It is assumed there is enough oxygen to keep the cat alive if the pellet remains intact. The state of affairs dependents on two factors: 1) the probability

of the decay of the radioactive element (or some other random event generation), 2) the actuality of the event i.e. its actual occurrence.[18,28]

The system is set up so that the experimental set up remains behind a curtain unobserved by a human observer. The wave function, using linear supper position, is given as $\Psi = a\Psi_{alive} + b\Psi_{dead}$ where a and b are normalization constants. This wave function is a solution to the Schrödinger wave equation. If the curtain is removed then the observer collapses the wave function to one of two state, either cat Ψ_{alive} or cat Ψ_{dead}. The paradox arises out of the fact that the fate of the cat is (presumably) determined by the act of removing the curtain and observing the state of the cat, alive or dead (not and/or). A facetious part of the argument in Iceland turned to the desire not to kill a cat so that the rat and even the knat paradox was addressed. The SPCA would not have bothered Shcrödinger over a rat or a knat but a cat, well there might have been difficulties. In fact there is an important issue to be addressed that is, the cat knows its state or at least that it is alive, Ψ alive (and if there is life after death, the cat may also perceive the dead cat state, Ψ dead). A central issue then is whose consciousness perceives what when?[28]

The Everett-Graham-Wheeler (EGW) model "resolves" the cat paradox by suggesting that at each instant in forward time an infinite set of possibilities exist or in a sense an infinite number of Universes, two of which contain a cat Ψ alive and a cat Ψ dead, or if one prefers a rat alive and rat dead Universe. The observer then just finds himself in one of these Universes. This is sometimes referred to as quantum entanglement.[29] *See page 30, Some Consideration on Nonlinear Superposition in Quantum Mechanics and the Action of Observation.*

In this type of picture, a psychokinetic PK event becomes a-causal or a synchronicity. The PK event occurs and the human "agent" then just happens to be near by. In the pure EGW model there is no "communication" between the various universes and hence there is no way to detect any other possible state of a system so the existence of these other universes becomes a mute point i.e. immaterial since one cannot have knowledge of them. It is only if there is some small overlap between these alternate universes, that the EGW model have any validity which requires a nonlinear space.

The central issue of the Schrödinger cat paradox is who causes what. How is the state of a system determined and the wave function collapsed to a particular single valued state!? Actually, the paradox embodies the issue of who or what is conscious, is it the wave function for the whole universe or all the universes that determine the state of each and all systems? Is (are) the universe(s) conscious? Can we deny consciousness to a cat, a rat and how about a knat?

Central to the operation of the scientific method is causality and objectivity. In classical physics, it is believed processes occur and all things go about their business without a human observer. A human observer enters the scene and the processes continue, although some animals can be effected by the observer i.e. as they observe the observer and make a choice about their observation. Plants may be effected by humans who water them or cut them down, etc. This involves observation and interaction.

What is the role of a passive human observer? Can the observation be made completely without interaction? Probably not in the true sense of air molecules and other physiological processes—the universe is changed at each instant by some degree by one's very state of being Ψ alive, human or otherwise.

Our question centers on, besides physical effects, what about mental intent and thought transference between the human observer/participator/interactor with animals, plants, the physical states of systems and other humans. At the other end of the spectrum of thought is Rene Descartes and George Berkeleys' view stating that "I think therefore I am" and I cannot prove anything else exists—it may all be a total illusion of my mind! This view has shades of Jean Paul Sartre's "it's all an illusion."

Actually, Rene Descartes argument was a silogistic one "I think therefore I am," "I did not create myself," "therefore God did it."[28] Philosophical arguments in Descarte's day were often concerned with developing a logical and scientific proof of God's existence. It appears that Descartes neglected the act of his parents in his existence but then perhaps he could argue about the existence of his parents, their origin, etc. These paradoxes, Schrödinger's cat, Descartes existence, the multi-universe EGW notion and formalism express ignorance as to what consciousness is, what is intentional will (and responsibility), etc. Essentially a paradox expresses our ignorance of a particular understanding or

lack thereof of our conceptual framework and its descriptive value in comprehending **Reality**.

It appears that the resolution of the Schrödinger cat paradox lies in how the possible becomes actualized in time. And what is time? With the linear superposition principle, the paradox remains and it may require a nonlinear quantum theory which may be only slightly nonlinear to select a preferred state, perhaps by the action of consciousness. Before we turn to another related quantum paradox, to quote Schrödinger on the cat paradox "I don't like it, and I'm sorry I ever had anything to do with it" Erwin Schrödinger (1887-1961).[12] Another much discussed, and this author believes, related paradox is the particle-wave paradox. Is light, or electromagnetic energy, a particle or a wave? Sir Isaac Newton (1642-1727) believed that light was corpuscular in nature, that is particle like. His experiment with prisms and light spectrum in which, white light passing through a prism creates the band of colors of the rainbow by internal refraction appears to indicate light is wave like.

The Schrödinger cat paradox exists because of the linear superposition of quantum mechanics. It appears that the state of the system is determined by the act of observing and recording observational data and the result depends on **when** one looks. In the case of the particle-wave paradox, the results of which depend on **what** experiment is performed on photons, of light or light waves (and equivalently via the de Broglie relation) thus depends on the **way** one looks i.e. what experiment is performed.

In a sense, the Schrödinger cat paradox violates Aristotelian logic. After the cat is observed, the state of the cat is determined to be (1) dead **or** (2) alive but before the moment the cat is dead and/or alive or neither or both for $\Psi = a\Psi_{alive} \pm b\Psi_{dead}$, where the case corresponds to a linear relation of neither (–) and both (+). The formulation of the cat paradox is usually formulated as a symmetric superposition or (+) not an antisymmetric superposition (–). In a sense Zen "logic" is non-Aristotelian, that is contains the group of operators of neither **and** both. Since Aristotelian logic is the dominate logic form of western European/American culture that is why the cat paradox or the meaning and interpretation of quantum measurement is considered a paradox according to this author.[19] Zen logic is also refered to as four logic.

Nature does not admit of paradox and paradoxes only arise out of the ignorance of human interpretation. The resolution of the paradox is well within the of understanding and the where and what of human consciousness and other forms of consciousness. (Appendix I).

The Schrödinger Cat Paradox Explained

The Schrödinger cat paradox is hypothetical but does demonstrate that the linear superposition principle may not fit the "real world" in which most actual processes are nonlinear. It appears that biological systems are more nonlinear than chemical or physical. Galileo's, Newton's and Einstein's theoretical models of the gravitational field formulate in terms of very nonlinear formalisms because the gravitational phenomena is very nonlinear. Certainly one of the major difficulties in developing a theory of quantum gravity arises out of the linear model of quantum processes and the nonlinear properties of the gravitational field. Resolution of the quantum gravity problem may be found by quantizing space-time itself as well as considering a multidimensional geometric picture of reality.[17-19,22,25,27,31-33]

We attempt to reconcile the physics of quantum mechanics (and physics in general) with consciousness and deduce from the quantum theory and experiment, a role demanded for consciousness in the physical world, at least in part, in the micro domain. If this approach is a viable one, we need to examine in detail which of the quantum formalisms are most relevant to relating physics and consciousness.

The Schrödinger equation applies to non-relativistic systems but is descriptive of many types of quantum systems. The Dirac equation is relativistic but primarily applied to electron theory. The Klein-Gorden equation is relativistic and the modification of the Klein-Gorden equation as the nonlinear form, the sine-Gorden equation, which has solitary wave or soliton solutions is relevant to description of phenomena involving nonlocality and nonlinearity. Since nonlinearity or nonlocality are properties of consciousness, this fact lead us to consider the sine-Gorden equation as a fruitful area of physics to examine which may be relevant to describing the properties of consciousness.[33]

Table I

Some Quantum Mechanical Attributes and Evaluations

1. "Two paths to the same place," Young's double slit experiment implies connectedness in a multidimensional space.

2. "Microscopic indeterminacy" or quantum uncertainty that is the Heisenberg and Compton Effects appears to be due to scale difference of the observer and the observed.

3. "Photonic measurement" or "seeing with light;" most measurements involve visible frequency electromagnetic interactions in the initial, immediate and final analysis.

4. "Remote connection" in three space as explained by John S. Bell's theorem and the John Clauser and later Alan Aspect Experiments (connected by a multidimensional space).[19,31]

5. "Discreteness or particle nature of the 'Photon of Light' and matter,"e.g. grainy nature of substance and the fundamental nature of identity of substance.

6. "Relationship of 'particle' and 'wave,'" i.e. the manner in which one examines Nature and determines what on "sees" (observes), the de Broglie relation, $P = \hbar/\lambda$.

7. "Photoelectric effect," $E = h\nu$ indicates and implies discreteness of substance and its consequences.

Remote intentional perceptional communication and interaction may be well described and fit with the nonlocality described by the coherent collective nonlinear soliton solutions that can represent a signal, which remains coherent over large distances. We have also determined that one can formulate nonlinear forms of the Schrödinger equation as soliton solutions so that we have both relativistic and non-relativistic quantum formalisms that can relate to remote connectedness phenomena i.e. such as an observer and the observed or perceived or/and its physically remote cause.[31-33]

The reason to consider a relativistic quantum theory is not related to the fact that relativistic phenomena occur near to the velocity of light but the relativity theory formally formulates the correlation of events in space and time. Since essentially we argue that the measure the existence of psi and

the causal effects of psi are determined by the correlation of events in space and time, then we may argue that we should concentrate on the sine-Gorden equation.[33] On the vast domain of the validity of the quantum theory, every act of measurement is an act of consciousness and the only way we can know is to measure! (Table I)

Quantum Measurement and The Collapse of The Wave Function, Ψ

Let us consider, who "collapses the wave function, Ψ," i.e., who can make or is making a quantum measurement? Is it humans only (plus a meter); is it man and animals? Consider the Schrödinger cat paradox in which a cat is an external stimulus to us humans, or what about the cat's observations; what about plant observations, or rock observations? The interpretation of quantum mechanics and its formalism is very much affected and is changed by the assumption of the "universe as a whole hypothesis" that all existence is alive and conscious.

Let us consider the system which is sensitive to remote mental influences, i.e. a system in which current flow depends on intentional volitional intervention and interaction between observer and a system (that is observed).[24-26] The system, in this case, is defined as inorganic or apparently nonliving, and yet this system responds to intension to be in one specific state or another; is this not similar to one state or another chosen by a cat, rat, or knat in the "cat paradox?" What about the states of existence and changes that affect plants, rocks, etc.? This brings us to the "Gaia hypotheses" that the Earth itself is a living organism since it gives rise to life, although not quite of the same kind as itself, but it certainly supports life. Then the planet as a whole is observed, but can observe and hence, choose, to a lawful degree, its state of existence.

The elements, are ever moving, changing, and giving rise to new states of existence, give rise to weather and earth changes and matter's dynamical process. In all cases of existence, it is consciousness plus the system, that is all that can be perceived and observed. But the system itself may be generated by another aspect of consciousness.[16]

John Wheeler has spoken of some of the fundamental aspects of the quantum measurement process, stating "the quantum principle tells us that the observer is more than an observer, he is a participator. In some strange sense, this is a participatory universe and if human consciousness did not exit, the universe would not exist."[22]

A "PHYSICAL" EIGHT SPACE, OTHER MULTIDIMENSIONAL GEOMETRIES AND CONSCIOUSNESS

We can express the relationship of dependent variables such as $p(x, t)$ and $E(x, t)$ on independent variables x,t and their recipicals. Let us consider x, t comprise the usual four spaces. Then $p = h/\lambda$ where λ is a distance in the dimension of x space and $E = h\nu \propto h/t$ where t is the dimensions of time. Then we can say x, t comprise a reciprocal "space" to p, E and visa versa. The x, t space is the domain of the Schrödinger, Klein-Gorden equation and in the Lippman-Schwinger equation, p and E are the independent variables.

Now the p, E variables can be said, in a sense, to comprise another dependent space as expressed by the Lippmann-Schwinger equation where p and E are the independent variables. Then $p = h/\lambda \propto \hbar k$, where k is the wave number and $E \propto 1/t$.

In phase space (p, x) which is the pair variables of the Heisenberg uncertainty relation we are now driven to consider new possible relations. These may be expressed as the canonically conjugate pairs (p, x), (E, t); the second pair is also associated with a Heisenberg type relation $\Delta E \Delta t \geq \hbar$ and also there may be implied other relationship such as (p, t) and (E, x) that may comprise "spaces" [i.e. vector spaces such as: $(p, x) \geq \hbar$ and $(E, t) \geq \hbar$].[23,29]

It is clear that the foundation of quantum theory, specifically Young's doubles slit experiment and Bell's nonlocality theorem and action at a distance involve the relationship of local or non local phenomena results from an understanding of the fundamental nature of nonlocality. Certainly remote perception (remote viewing) and remote space connections are deeply embedded in each other.[17-20]

We have the usual canonically conjugate pair (p, x), also termed (p, q) giving rise to the phase space (x, p), if x and p commute which they do not in the Heisenberg uncertainty relation ($\Delta x \Delta p \geq \hbar$). If we use $p = mv = m\dot{x}$, the momentum for unit mass $m = 1$ then $p \equiv \dot{x}$ so we can call this phase space $(x, \dot{x})$, where $\dot{x} \equiv dx/dt$. The cross or inverse spaces, p (momentum) and E (energy) have inverse relations.[23] Now we can form an equivalent phase space for energy and time (E, t) and an analogous Heisenberg uncertainty relation $\Delta E \Delta t \geq \hbar$, which was hotly debated in the Bohr-Einstein debates of the 1920's and 1930's but there is an analytic proof of this relation.[22,23]

Physical space, in simple terms is "what one moves around in." As we discussed elsewhere the concept of space, x, y, z has expanded to include time, t via the work of Minkowski and Einstein. Mental space or spaces are what the mind can access and "move around in." This is an apparently larger space of mental interactions where "one can mentally move in." The "motion" and actions in "mind or mental space" appear and act in ordinary space or physical space as apparent events that are nonlocal in the usual four space of space-time and local in higher dimensional spaces.[8,17-19] We might term the mind space as the super or cover space and can describe the relationship of the cover space and the usual physical space in terms of generalized Minkowski space.[7,8,17,18]

In addition to and related to mental nonlocality or remote perception and intervention (in the physical space) are other processes which likewise are manifest physically such as the EPR paradox or Bells' theorem as well as non Hertizian magnetic and electric phenomena in which $(\underline{A}, \phi)$, the vector and scalor potentials, activity occurs in the "mental domain possibly measurable by a remote psychokinetic sensor and other such devices and perceptors such as the mind itself.[25] The mind and the ten billion neuronal and glial cells of the brain may act as non-Hertizian antennae transmittion and reception of information.[27] More work on this topic is in progress.

Recall that, to paraphrase Niels Bohr "if it isn't strange enough, it isn't quantum mechanics" or to quote biologist J. B. S. Haldane "not only is the universe queerer than we suppose but queerer (more queer) than we can suppose." When we deeply and truly examine the nature of what we term real there is plenty of "room" for psi, consciousness and many dimensions of existence for future generations to discover, for it is certainly true that there is no illusion

Table II

Multidimensional Models, The Macrocosmos and Consciousness

1. Einstein-Minkowski 4-dimensional space, expressed as 3-dimensions of space and one dimension of time, is the usual physical *space* we live in and is modeled on the light cone diagram.[1]
2. The 4-space can be expanded to a multidimensional quantum-gravity *space* of 10-dimensions; space-time, momentum, mass-energy, force, velocity, acceleration, power, pressure, density, rotation which comprise the Descartes space.[22]
3. Complex 8-dimensional *space* is generated by compexifying the usual four space, using $\sqrt{-1}$, and has nonlocality and remote interconnectedness and is related by the twister algebra to the spinor calculus of the Kaluza-Klein 5-space geometry and to complexified Maxwell's equation and non-Hertzian phenomena.[7,8,17-19,27]
4. The Kaluza-Klein geometry which relates Einstein-Minkowski 4-space of relativity to electromagnetic phenomena and is related to the complex 8-space.[7,8]
5. The Einstein-Minkowski 4-space, the Kaluza-Klein 5-space and Rauscher 8-space relate to the topological geometries of modern particle physics quantum theory and relativity.
6. These multidimensional models allow a domain to exist, in the physical world, for the action of local and non-local aspects of consciousness.

more dangerous than the belief that the progress in the advancement of science is predictable![28,29]

We make some observations on the nature of remote connectedness and nonlocality. "Some physicists are interested in another observation about the microscopic domain which implies that systems (such as particles) which are correlated (or related in their physical properties) remain correlated even when great distances separate them. This form of interconectness is termed Bell's theorem.[3] It is as if a spider in its web feels each disturbance in the web's far reaches as it sits at the web's center, which represents the web of all conscious interconnections."[28] "The world thus appears as a complicated tissue of events in which connections of different kinds alternate or overlap and combine and thereby determine the texture of the whole," from *Physics and Philosophy* by Werner Heisenberg.[29] It is clear that the issue of the collapse of the wave function has to do with the manner in which the past, present and future are connected on a light cone like model (see Table II).

Philosophical View Points or "Who Killed Schrödinger's Cat?"

Listed are some of the philosophical views that relate to the interpretation of quantum mechanics and the so termed Schrödinger cat paradox which we discussed in the previous section.

1. **Positivism** is the view that "Everything" is considered as a series of experiences and observations; in quantum mechanics, the observer does not participate, that is, "reality" just is.

2. **Innate knowledge** such as the epistemology in Emmanuel Kant's view of innate categorization and causality.

3. **Ontology**, that is what exists as fundamental being as perceived reality, connected to or unconnected to conscious perception. Conscious perception of existence "brings it into being or existence," for example, Wheeler's concept "the unobserved universe would not exist."

4. **Structuralists**, particularly in biology the concept of the "Survival of the fittest" as in Darwinian evolutionary concept, space-time evolve out of the biological evolutionary process so the space and time are not external constructs. This may be compatible with quantum theory in that integral time does not exist in the microcosmos. Issues of causality come to the fore in this view.

5. **Time and causality** are intimately connected; time seems so exact and it's fundamental nature so illusive—time itself, at least in the microdomain may be quantized (which Rauscher and Prigogine formulated).[22,23] To quote one of Albert Einstein's concepts in 1941 "time and space are modes by which we think and not conditions in which we live." Also Sir Arthur S. Eddington in 1923 suggested that "time is a mental construct of our private consciousness . . . physicist construct the concept of a world wide time from a string of subjective instances."[18]

6. **Discrete states of reality**, includes the self organizing principle of Illya Prigogine, where systems act as macroscopic "quantum" or discrete processes

under the influence of an energy flux. State changes occur in discrete catastrophic steps for nonlinear, non equilibrium open systems.[25]

7. **Mutogenic**, metabolic processes in which specialization and diversification occurs as expressible in terms of energy, entropy and informational processes. We can consider such a system as dynamic or process oriented on its structural and energy properties may give rise to a concept of time. These processes can be microscopic or quantum in nature or macroscopic in biological and cosmological in nature. (Issues related to points 5 and 6 in this table may involve a Lemarkian modification of Darwinian model of evaluation.)

8. **Dualistic** concept such as mind/body duality, cause effect pairs, paired variables in physical theory and conceptual opposites. Dual concepts have been put forward for centuries, such as the Chinese Yin-Yang each carrying seeds of the opposite. Dual concepts lead to unity attempts such as those of Libintz mind/matter monad model. The Heisenberg uncertainty principle results from the relationship of paired variables which is at the foundation of the structure of the Hamilton-Jacobi classical mechanics and the foundation of quantum theory.

We can form an analogy to attempt to resolve the particle/wave duality and the mind/body duality: the specific experiment one conducts makes light or particles act and "look like" a particle or a wave. The perceptual experiment about our observations of reality determines how we perceive reality to be in terms of the mind/body or mind/brain issue. Assumption of the purely mechanistic view will imply that Brain/body concept dominates. The assumption of the non-mechanistic view gives more credence to the mind or conscious spirit view. Each fundamental assumption about reality further reinforces what reality is to each individual perceiver. We often accept our beliefs to the exclusion of contradictory perceptions.

To quote Wolfgang Pauli on the topic of quantum mechanics and the mind/body duality problem; "the deeper the physicist intruded into the realms of the subatomic and supergalactic dimensions, the more intensely he was made aware of their paradoxical and common sense-defying structure, and the more open-minded he became toward the possibility of the seemingly impossible.

His own world, based on relativity and quantum theory, is, in fact, a world of impossibles. The psychological parallelism envisioned in the last century will not account for the general problem posed by the relationships of mind/body."[28]

Mach's principle, although it is concluded to have macroscopic implications only, is possibly relevant to our current discussion as it also appears to have embedded in it the structure of nonlocality. Macroscopic remote interconnectedness is well expressed by Mach's principle. Mach's principle is concerned with the relationship of a local phenomena to cosmic, large-scale phenomena, and hence relates smaller scale occurrence to large scale existence by nonlocality. If a bucket of fluid is rotated, the meniscus (surface of the fluid) changes shape, from flat to parabolic as the rotation takes place. The faster the rotation, the more parabolic the surface becomes. Ernst Mach stated that the rotation of the bucket affects the surface of the liquid because the rotation is defined and occurs relative to the fixed star system, hence a local occurrence finds its existence in a larger scale phenomena. Water or fluid is made up of atomic or microscopic components.[22,32,34]

This author has detailed the relationship schematically between five different geometric models. We relate the usual "real" Minkowski space (x,t) or (x,ict) upper left to the "real" expanded ten dimensional space of Rauscher which attempts to unify quantum theory and relativity.[22] We can relate this space to the five dimensional space of Kaluza-Klein which relates electromagnetic to gravitational phenomena. This geometry is mappable one to one with the Rauscher complex eight dimensional space. We can complexify the ten dimensional space forming a dual space. Detailed examination may lead to a connection with the Minkowski four space and the four imaginary $\sqrt{-1}$ space of eight dimensions. We may be able to find a mapping of the complexified ten dimensional geometry, which includes the inhomogeneous Lorentz group with rotation and parity conservation.[7,8,17-19,21] It should be noted that there are many possible formalisms currently available to be addressed and we must deduce what is the best and most efficient one or ones to consider in our quest for a picture of reality in which we can include consciousness or where consciousness is a dominate feature of reality (see Table II).

In 1982 this author addressed a conference on consciousness at the University of Philadelphia, Pennsylvania, in which many physics' luminaries were present.

After my talk and panel presentation, Eugene Wigner of Princeton University, New Jersey, commented on this author's talk on the implication for the complex eight dimensional geometry, superluminal information transmission, Bell's theorem and consciousness. He commented as follows:

> I would like to point out that the possibility of transluminal (superluminal) information transmission has been essentially experimentally demonstrated. J. S. Bell formulated a theorem in 1964 which involves a correlation function which describes remote connectedness of correlated events—consider two particles, which have opposite spin, for example, in the ground state of a hydrogen atom. The measurement of the spin of one electron, determines the spin observed in the other electron. These probability measurements indicate that information can be transmitted transluminally. I'll also mention that the quantum mechanics of the J. S. Bell experiment was questioned, but in a couple of years it was very well confirmed.
>
> There is one other thing that I can mention in this connection. A space-time point cannot be defined in quantum mechanics, because suppose one constructs a state of a particle which exists at a certain time at this point. In other words, that state is different from, perpendicular to, a state which is displaced from it. Then this is not relativistically invariant, it will not be orthogonal to the initial state. It is easy to prove that the wave function spreads out with greater than light velocity. That means the space-time concept, in my opinion, will have to be reviewed in quantum mechanics—maybe what you propose is the best thing, but maybe it isn't.[30]

SOME CONSIDERATION ON NONLINEAR SUPERPOSITION IN QUANTUM MECHANICS AND THE ACTION OF OBSERVATION

In recent years this author and a few others have examined some novel approaches to the Schrödinger cat paradox by considering and extending the space so that quantum effects are considered in this space that includes domains where nonlinear effects occur. For example, some researchers have extended the Klein-Gorden equation to the sine-Gorden equation (as a relativistic equation) having soliton solutions. This work was conducted in the late 1970's. Rauscher developed a nonlinear Schrödinger equation also having solitary wave

or soliton solutions which is formulated in the complex eight space geometry. The quality of these waves is that nonlinear terms overcome dispersive losses in a manner to allow long range (nonlocal) coherent information and physical effect transfer; perhaps utilizing the EPR paradox, Young's double slit experiment, the conscious observer effect and psi in general.[17,19,32] If we consider a Hilbert space or domain, we extend the applicability of quantum mechanics to nonlinear regions of the larger space. The implication is that we may be required to include more dimensions (see Table III).[7,8,18,19]

The nonlinear quantum approach may be one of the most exciting and vital to including the observer in the arena of reality. It is a new exciting approach. The analogy is that if we consider a parameter as a function of a variable $P(v)$ over a domain D, then on a small range of values, v the function $P(v)$ will appear linear in a plot of $P(v)$ vs. v. Over a larger range of values of v then $P(v)$ could appear quite nonlinear over the larger domain. Near the linear domain but outside it, $P(v) = fn(v)$ may appear approximately linear but contain additional but small nonlinear term. The usual domain of observation of many quantum processes is approximately linear. It is where consciousness enters as a more dominate process; as in psi phenomena, that the system is considered in a larger domain space where nonlinear effects are observed. Such an approach may require more dimensions than the Minkowski four space.[7,17]

Eugene P. Wigner in his classic book, *Symmetries and Reflections* discusses the implications of a nonlinear quantum theory and the role of an active observer and for the nature of life itself.[2] He expands the vector space to include a matrix form that allows a method to analyze the effect of one or more observers (i.e. perhaps a human and a cat) and/or multiple humans. In his book Wigner discusses parity and other symmetries. A discussion of the implications of Wigner's work by William Van Bise is useful at this point. This discussion is taken from his 1975 essay on his research on low intensity, electromagnetic effects of VHF and microwave on the human brain. Essentially this discourse relates to all effects of or by human (and possibly other) consciousness. To quote Bise:

> A quote from Eugene P. Wigner seems appropriate—"Every phenomenon is unexpected and most unlikely until it has been discovered—and some of them remain unreasonable for a long time after they have been discovered"—The arguments used in Wigner's essay on *The Mind Body Question*, evolved in the

Table III

Tenents of the Properties of Consciousness and Quantum Measurement

1. Consciousness is involved in all measurement processes and procedures.
2. The greater degree that consciousness in involved, the more nonlinear the system behaves.
3. Consciousness is definable in physical terms, at least in part, because it interacts with physical processes such as the act of measurement or psychokinetic effects and can interact other consciousness or "mind stuff" such as telepathy, etc.
4. Consciousness can effect micro as well as macroscopic (such as earth size scale) phenomena.
5. Consciousness may act as a conserved entity, that is, have density-like properties and can have volume like spatial, temporal modalities of influence.
6. No observed event occurs without conscious interaction. Each perception that is recordable involved "mind"-matter interaction or "mind"-"mind" interaction. We identify "mind" as consciousness and mind involves consciousness and brain interaction events.
7. This author believes it is quite possible for any event to occur, no matter how involved with just physical process it is, it cannot occur without conscious intervention or interaction. In fact, the primary substance of the universe, may indeed be what we term consciousness.
8. What we can well formulate in terms quantum mechanics including the linear superposition principle involves minimal conscious intervention and interaction and may be linear in the higher dimensional space.
9. A more complete description of a quantum process, involving conscious intervention, is represented as nonlinear processes in greater than four dimensional space.
10. The usual superimposable solutions to wave equations are represented in four space (space and time) as a slice through a higher dimensional space ($N > 4$) which contains a domain of action of consciousness.
11. We represent state vectors as tensors in a complex eight dimensional geometric space.
12. We consider the relationship of this space to other multidimensional spaces.

language of quantum mechanics in which he pointed out that physicists possible learned "that the principle problem was no longer the fight with the adversities of nature, but the difficulties of understanding ourselves if we want to survive." If more than one conscious observer enters into a system of measurement this joint system cannot be described by a wave function Ψ **after** the interaction since the result of an observation modifies the wave function of the system by another observer. A proper description of their quantum state is a mixture state. The wave function is: $(\Psi_1 \times \chi_1)$ with a probability $|\alpha|^2$; it is $(\Psi_2 \times \chi_2)$ with a probability of $|\beta|^2$ where χ_1 and χ_2 are of great complexity.

To continue the quote of Bises', "Philosophically this implies that if an observer of one group of experiments asks another observer of the same experiments about his feeling **before** he observed the results, his answer, whether or not it agrees with the questioning observer's conclusions, shows that the question was already decided in his mind before he was asked. In order to avoid this difficulty, it is necessary to postulate that the equations of motion of quantum mechanics are grossly non-linear when conscious beings with opinions enter into the equations.[2] Here again is a paradox in scientific research which requires resolution.

Complete objectivity in the real world is only approachable—not attainable. Even the most stubborn scientific attitudes and the most carefully contrived and controlled experiments suffer from subtle biases within each of us—in other words we are subject to human emotions. And if any of us are not human in any way, then the conclusions from non-humans about humans are not applicable to humans."[21,25]

Before we leave this section, the issue of the active observer as a participator; the relevant issues are given in the following table. This is an updated version of earlier work by this author from 1984 (Table III).

QUANTUM MECHANICS AND CONSCIOUSNESS

We in Western scientific culture have just begun, collectively, to explore our inner cosmos. Inner exploration has been an intellectual activity in the past, such as in psychotherapy. Now it is beginning to enter the domain of emotional and spiritual development as well. Certainly the nature of our inner being,

the nature and structure of our consciousness, shapes and determines our concepts of reality. This realization is having a vast impact on us as a society and as individuals. Techniques such as yoga and meditation have opened our horizons to the attributes of consciousness. There also appear to be clues to the nature of consciousness in the structure of physical theory. In fact, the so-called internal journey and external validation system of science may be leading us onto the same path of knowing.

The interaction of mind and matter, the nature of consciousness and its role in physical theory set the stage for a whole new domain of exploration. Certain indications in quantum mechanics point to vital areas of new research. Perhaps through such exploration we will gain a new view of what it means to be human and a better understanding of the messages inherent in mystical writings from many traditions throughout the world.

In the conventional view of the scientific method, such things as motivation, intention, purpose, values, and other characteristics of human consciousness have no role in physics. However, recent discoveries in physics indicate that the structure and content of physics may depend deeply on the relationship of physical theory and the nature of consciousness.

For example, new concepts in physics have led into discussions about the role of the observer of events, or the scientific experimenter. Now we are seeing that in quantum mechanics, the theory of the atomic microcosm, the observer has an effect on what is observed and is actually a participant in the event. And relativity theory seems to imply that the state of the observer affects the interpretation of what she or he sees. So, in the context of quantum theory and relativity, we can no longer concretely validate or define the properties of external reality as completely independent of the process of observation. Realism, upon which Western science rests, is a philosophical view in which external reality is assumed to exist and have definite properties which are fundamentally independent of an observer and are also objectively identifiable. Yet the existence of consciousness may create an intrinsic subjective aspect to reality. It seems that the intervention of mind in the universe of matter leads the process of observation to be one of participation. For example to paraphrase H. Stapp, nonlocality is one of the greatest discoveries of the 20th Century.[35]

Free will involves determinism and choice, which represent two or more possible states or wave functions, and a mechanism to determine or measure a state. The role of mind and will comes into effect when choice is made or determined by specific procedures of measurement of observation. Since intention into action appears to be fundamental to consciousness, what creates intention is of vital interest. This issue may be complex but certainly involves motivation, purpose and value. Emotions, intention, and the human spiritual nature may not be separable from any natural process.

A unique stage is set for the development of new concepts about reality. We have at our disposal new discoveries in physics as well as parapsychology. The development of new views about the mind-body interaction, the ordering of events in space and time, the nature of space-time itself, as well as explorations into such areas as intention, free will, choice, motivation, purpose, and values, all within the realm of human consciousness, present us with new tools for contemplating ancient mystical paradoxes and creating a better world for all beings.

Perhaps through such exploration we will gain a new view of humankind and a better understanding of the messages inherent in mystical writings. Opportunities for new solutions to current problems appear on the horizon of human exploration. There are many exciting concepts and developments to challenge us. There are many new avenues for exploration and hence many possibilities of creating and building a new tomorrow and a new social conceptual framework on Earth. I think we have been doing too much science without reverence for nature and life. Now we need to do it *with* reverence.

I believe that the rationalistic, logical approach of science and the intuitive creative mystical aspects of being need to come together. These two paths are necessary to know the meaning of life and our purpose on this planet.

CONCLUSION

To quote Bryce DeWitt, 1971 on the reality problem in quantum theory "No development of modern science has had a more profound impact on human thinking than the advent of quantum mechanics. Wrenched out of centuries

old thought patterns, physicists of a generation ago found themselves compelled to which this reorientation caused continues to the present day. Basically physicists have suffered a severe loss: their hold on (classical) reality."[36] It is clear that the quantum theory requires an observer to record the results of experiments in the quantum domain as other have pointed out. This observer must be able to read, record and analyze the results of these experiments and to even create the quantum theory and to design quantum experiments!

Hence, it appears that the quantum theory implies consciousness; that is a conscious observer. Every act of consciousness, in fact all sensual input is a measurement, although the senses, and hence all sentient beings are conscious! Ernst Mach pointed out some of these issues for humans in his book, *The Analysis of Sensations.*[34]

Can we somehow write a Ψ wave function for the universe as a whole? Is the universe just a giant observer of itself? The universe (one-verse) appears to require a duality to complete the cycle of observer and observed. In the words of Dennis Adams, "Man is God studying the creation of itself and God is man studying the creation of itself."[37] One cannot know oneself without observing oneself. The self observer effect is an interesting phenomena where one appears to observe oneself from "outside" oneself. As philosophers and religious leaders have discussed, life is like a movie and one's dreams are like a movie such as I and others have suggested.[38] There is the script writer, the projector and the film and its observer. Yet in a dream we are all of these the creator to the experiencer (the observer). In life this appears also to be true. Sometimes under stress or meditative process one can experience that state of consciousness where one feels they are both observing themselves and experiencing themselves doing a life.

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APPENDIX I
IMPLICATIONS OF BELL'S THEOREM

I. Bell's Theorem

If the statistical predictions of the quantum theory are correct, then principle of local causes is false. A Tacit assumption is that the photon counter efficiencies are not limited, in principle.[35]

II. Principle of Local Causes

What happens in a space-time region, "A" does not depend on variables subject to the control of an experimenter in distant space-like-separated region, "B." H. Stapp terms this contra-factual definiteness and in addition to locality, CFD involves assigning reality to the quantum state wave function, Ψ, whether it is the state measured and observed or not.[35]

III. Some Possible Conclusions about Bell's Theorem Result

1. Counter efficiencies are limited in principle.

2. Statistical prediction of the quantum theory is not always correct.

3. Pragmatic Philosophy termed the Copenhagen View of Quantum mechanism should be accepted (John Clauser).[39] We should concern ourselves with relationships between observations and practicality and not with models of external reality.

Arguments For the Copenhagen View

a) Limitation on Mind of Man: Our minds are probably geared to the problem of human survival by forming expectations about future experiences on the basis of past ones (Pragmatist/ Mechanist).

b) Utility: To be useful science should concern itself with only experiential consequences.

c) Verifiability: We can know the "truth" only through experiments (J.A. Wheeler, "practical ontology").[40]

4. Contra-Factual Definiteness Fails

The concept "does not depend on hidden variable . . ." used in theories which involve "contra-factual definiteness," the assumption that what would have happened if the experimenter had done something that he in fact did not do is assumed to have some definite state which is an unknowable thing (epistemology).[41]

a) Does quantum philosophy rule out contra-factual definiteness? In the double-slit and similar interference experiments "quantum philosophy" Copenhagen View dictates that we not think simultaneously about "what did happen and what would have happened" if some alternative experiment had been performed.

However, quantum philosophy denies neither that the experimenter could have conducted another experiment (Bohr: "...our possibilities of handling the measuring instruments allow us to make a choice between the different complementary types of phenomena we want to study") nor that "the other experiment would have had some definite result if it had been performed." It denies, rather, the metaphysical interpretation that the particle always goes definitely through one slit or the other. Pragmatic quantum philosophy yields economy that is particles and waves become "unified"....but at a price: no description or reality is then possible from this approach, hence the quantum theory says nothing fundamental about the nature of reality.

b) Models of Reality that violate contra-factual definiteness and consideration of models of reality encompassing quantum phenomena is contrary to the "wisdom of elders of quantum theory" i.e. the Copenhagen View.[41]

i) One possible world: hence no hidden variable as (D. Bohm).[42] Ordinarily one thinks that either the experimenter has a choice, or if he/she has no choice i.e. if everything is strictly deterministic then at least one can conceive of a world in which the "other" possible experiments were performed. Bell's theorem then implies that it is not possible to even conceive of these other worlds, if they are required to conform to quantum theory and the results in "A" not "B" do not depend on which experiment is conducted in "B" not "A."

ii) All possible worlds exist: via Everett-Graham-Wheeler (EGW).[43] At each experiment Ψ_i the world breaks into, for example, 16 different worlds, each with an appropriate "weight." (This model is suggested by the Everet-Graham-Wheeler many-world interpretation of quantum theory.) Note: Wheeler told this author, in 1978 that he no longer subscribes to this model.

IV. Possible Interpretations of the Wave Function Ψ

1. The wave function represents one to one mapping to the real world or to the probabilities of possible states of occurances in the Schrödinger interpretation of quantum mechanics or $\Psi^*\Psi$ or the probability as a fictional mathematical symbol such as in classical statistical or stochastic mechanisms.

2. Quasi-Real (Potentia model of Heisenberg represented the possibilities of what could happen.[29,44]

V. Objections to the Reality of the Quantum Theory

1. Which Ψ represents the mathematical properties of probability function.

2. And the idea that the wave function, Ψ represents reality originates in misinterpretation of Copenhagen claim of completeness.

3. There is no fundamental relativistic form Ψ outside of the Dirac equation.

4. G. Chew put forward the concepts approximate completeness and objectivity.[14]

VI. Locality Fails

1. Nonlocal collapse of the (real) or actual wave function, Ψ.

   a) Collective coherent nonlinear term in the quantum wave equation.[33]

   b) Possible Psychokinetic Effects and telepathy (Gedunkenbertrangurg)[44]

2. Continuous Nonlocal Reality (Problem of time and space ordering and the nature and properties of causality).

3. Discrete Nonlocal Reality or the Theory of Events via H. Stapp, for example.[35]

4. Bell's theorem and the J. Clauser and A. Aspect experiment proves locality fails.[5,6]

VII. Concluding Remarks

1. This author holds the concept that the quantum theory holds true and locality fails.

2. That the wave function Ψ, in the theory of mathematical representation of physical properties, events and practices is valid.

3. That nonlocality is true of the physical world.

4. That consciousness is behind and operates through every physical event and hence, one can extrapolate to universal consciousness.[16,21,45]

5. The EGW model is only valid in a Wigner-Rauscher nonlinear quantum formalism. In a linear theory, neither the EGW model or Bohm's Hidden Variables cannot be proven and hence, are not practical.

6. All measurement observation or interaction proves consciousness exists and the self referential aspect of consciousness may imply that what is measured is aware of its change of state and is therefore conscious. Is a system that is constructed in a suitable manner as to be sensitive to a intentional interaction or a psychokinetic system[24-26] is effected by human consciousness, is such a system conscious? Is such a system and perhaps all systems a cat, rat, etc. conscious? It appears to be fitting to end this essay on a question.

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