Spirits in Circular Time - Message of Quanta

Mathematical Formulation and Physical Implications of Godly Knowledge - II

1. Introduction.

In this article, we consider the relationship between Godly Knowledge and fundamental unsolved problems at foundations of quantum mechanics. We will be arriving at following conclusions -

(1) The notion of causality evident from EPR experiments is compatible with causality in circular time, but not linear time.

(2) Quantum Measurement Process requires existence of observres; therefore, theory of evolution, which presupposes an era, in which the observers were non-existent is incompatible with quantum mechanics; whereas the Godly knowledge world view, namely eternal existence of observers, earth, sun, stars etc., is compatible with this requirement of quantum mechanics.

(3) Quantum Measurement Problem (QMP) can be solved by attributing a specific set of properties to observers. These properties are - (i) Observers are nonphysical systems distinct from body, brain, senses, and are the only feasible measurement apparatus, (ii) recorded with in each observers is the role played by the observer in quantum measurement process. This second property is remniscient of the Godly Knowledge point that recorded with in each soul is its part within World Drama.

Existence of Neuro-Biological version of Quantum Zeno Effect is predicted in which when the relevent neurons of a group of subjects are monitored at very short time intervals (pico-seconds) subjects report - (a) perception failure, when presented with a normal stimulus, (b) failure of ability to execute freewill, such as moving one's hands, etc.

2. Quintessence of Quantum Mechanics.

In Quantum Mechanics (abbreviated as QM hence forth), a object is described by a so called wave function. This wave function is supposed to contain all possible information about that object, such as its mass, charge, energy, momentum etc. One is able to obtain the information that one wants regarding that object by asking questions to that wave function, in the form of certain mathematical operations. For obtaining energy of the object, one operates on it using the energy operator and the result of this operation equals the energy of the object multiplied by the wave function. This equality is the so called Schrodinger's equation. Now the Schrodinger's equation is what the mathematicians call linear. What this means is that, if one particular energy value is satisfying Schrodinger's equation, and another particular energy value is also satisfying Schrodinger's equation, then, the new wave function formed by adding the two wave functions corresponding to the two energy values also satisfies the Schrodinger's equation.

All this is fairly simple, but now starts the problem, with which the phycists have been living right since the conception of Quantum Mechanics, for more than a half century. The problem is as follows.

You see, Schrodinger's equation is unable to tell in which particular state that particle is in. All that it is able to provide us is, the set of all possible states in which the particle can be, along with the probability associated with that state. For example, given a system such as a hydrogen atom, Schrodinger's equation can tell us, the various possible energy levels of the electron in the hydrogen atom, however, it cannot predict, as to in which energy level, the electron is actually in. Not only that, the so called Copenhagen Interpretation of Quantum Mechanics, propounded by Neil Bohrs, goes so far as to assert that, such a question is meaningless without an attempt to actually observe the state of the hydrogen atom. As far as quantum mechanics or Schrodinger's equation is concerned, the hydrogen atom could be in all possible states simultaneouly. In the jargon of Quantum Physics, such a system is said to be in a coherent state, i.e., a imagination defying superposition of all possible states (see

figure 1). Therefore, the only way to determine the state of a particle is to actually perform a measurement, i.e., actually observe the state of particle. So after measurement, one finds that particle is in one particular state, and not a coherent (superposed) state. This is called as 'collapse of wave function' in quantum physics jargon. It has been suggested by Scientists like Wigner and von Neumann, that it is the conscious ego, which causes the collapse of wave function, when it performs the measurement, i.e., the act of observing the state of the particle. That is why quantum mechanics is of so much interest to spiritualists, philosphers and religous people alike, for it hints that the science is on the verge of acknowledging the metaphysical soul, and the soul-matter interaction.

Initially, it was thought that quantum mechanics, and superposed or coherent states existed only for microscopic objects; that for macroscopic objects, such things as a cat being both dead and alive were not possible (see figure 2). However, in recent years, Legget, who is a physicist at University of Illinois, has shown that even for macroscopic objects, the coherent or superposed state is possible. This so called macroscopic quantum state has also been experimentally confirmed in experiments involving superconducting Josephsons juctions. So you see, why quantum mechanics, has been a source of conceptual perplexity.

Though we have discribed only the puzzle of collapse of wave function, but their exist other puzzling aspects of the quanta, such as the wave particle duality, the quantum zeno effect, EPR paradox, Schrodinger's cat paradox and Wigner's friend. Our aim is to resolve these scientific issues on the basis of points of Godly knowledge. Thus not only is the scientific problem resolved, but also the Truth of Godly Knowledge is established, and such an exercise has the utility of being more than merely academic, in the sense that it is a path to revelition of Gyan Sagar and his Gyan. Next we consider the resolution of EPR paradox in terms of circular time.

3. Notion of Casuality in EPR Paradox and in circular Time.

EPR was a paradox formulated by Einstein and two co-workers, Rosen and Podolsky, in 1937, with an aim of showing incompleteness of quantum mechanics. It is abbreviated as EPR, after the first letters in the names of its formulators. The reader must be aware, that Einstein also formulated the theory of relativity, and that one of tenets of relativity is that nothing physical can travel faster than light. In EPR paradox, it was shown that quantum mechanics implies that a message is being exchanged between two particles at a speed greater than that of light. EPR can be stated as follows (see figure 3).

Let an electron and its anti-particle, a positron collide and anhilate each other. Since the energy is conserved, in process of anhilation of the electron and positron, two photons (the particles of light) are created, which move into opposite directions at speed of light. Now the photons are spinning, and the spins of the two photons are correlated in such a manner that, the directions of their spins are opposite. However, each photon can be spinning either clockwise or anti-clockwise direction. Thus the requirement is that if photon A is spinning clockwise, photon B should be spinning anti-clockwise, and vice-versa. Now the paradox starts. Quantum mechnics says, that till one observers, the wave function of photon A, it is in both states, and the same holds for photon B. However, when we observe the state of photon A, its wave function collapses to either clockwise or to anti-clockwise state. The paradox is, that at the same moment, wave function of photon B also collapses to the corresponding state, which is compatible with that of photon A. This experiment has actually been done, and two things have been verified - (i) That the wave functions are indeed in a coherent (superposed) state before observation, (ii) That the wave function indeed collapse into compatible states. Thus the EPR paradox is how does the photon B know to which state the photon A has collapsed, and does so at a time, when even a light signal from A cannot reach B.

You see this is paradoxial if time is linear. However, if the time is circular as has been revealed by Shiv Baba, then things are different as follows. Since events are repeating in identical cycles, therefore, the same experiment had been done in the previous cycle. Further, the same photon A had collapsed to the same state in the previous cycle. So now, when the experiment is being repeated within the present cycle, even though information of collapse of wave function of photon A cannot reach photon B, however information of collapse of wave function of photon A in past cycle can reach photon B in the present cycle. Thus EPR paradox can be resolved in circular time. This suggests that quantum mechanics is possible only in circular time, and not in linear time.

Notion of causality, i.e., cause and effect, or more colluqially, "what causes what", are quite different in linear time and circular time. For example, if time is linear, a point or event once past is past, and can never come again. Thus all possible causes of an event lie in its past, and not in future. However, if the time is circular, notion of causality is different. In fact, it can be shown that causal relationship between events in circular time has following three remarkable properties -

(i) Each event causes itself.
(ii) If event A causes event B, then event B also causes A.
(iii) If event A causes B, and event B causes C, then event A also causes C.

These three properties are known as reflexivity, symmetry, and transitivity respectively, in high school mathematics, familiar to all school boys and girls. These three properties make causality an equivalence relationship between events in circular time. By, contrast, in linear time, only the last property, that of transitivity holds, and leads to EPR paradox, which is resolved only if time is circular. We will be coming back to this latter.

4. Incompatibility of Quantum Mechanics with Theory of Evolution:

In light of Legget's work and experimental confirmation of macroscopic quantum state, one can consider wave function of the whole universe, to arrive at a quantum mechanical version of evolutionary hypothesis. This quantum mechanical version of evolutionary hypothesis can be stated as - The wave function of the universe as evolved from a state in which life, consciousness, and observers were non-existent, to a state in which they are existent. However, this hypothesis runs into serious troubles, for all interpretation of quantum mechanics, and in final analysis is incompatible with quantum mechanics. The source of this incompatibility is the non-existence of observers and hence the measurement process, till a certain epoch, in the evolution of universe.

There are about six interpretations of quantum mechanics, with varying numbers of followers and proponents. These interpretations are - (1) Everett's many worlds interpretation, (2) Wigner's interpretation, (3) von Neumann's interpretation, (4) Broglie-Bohm interpretation, (5) Copenhagen interpretation, and (6) Transactional interpretation. Of these six, Broglie-Bohm interpretation has recently been refuted by experiment, and will not be discussed here. We will briefly discuss the evolutionary hypothesis, in each of these interpretation, and show that the evolutionary hypothesis is incompatible with all of these. The explanation of (2), (3) and (5) has been briefly provided in section 2; this leaves (1) and (6) whose explanation follows. In 1950s, Everett working on his Doctoral thesis under Wheeler, proposed the many World Interpretation of Quantum Mechanics. In his interpretation, at each measurement process, the universe splits into a number of universes, and in each of these split universes, one of the possible outcomes materializes. Thus, it tries to avoids, the quantum measurement problem, as to why and how only one particular outcome is selected from the all possible outcomes, by proposing that, actually all outcomes are materializing, but in different universes. Though this interpretation has its appeal to those of a particular philosphical taste, but mostly the phycists have looked upon it as extravagent and uneconomical from a conceptual view point. The transactional interpretation looks upon the measurement problem as a sort of exchange or transaction between different systems such as two particles (in EPR) or between a system and a measurement apparatus (in quantum measurement process). It is the latest (1980s) interpretation, and takes inspiration from Richard Feynmann's use of describing electromagnetic interactions in terms of advanced (coming from future into past) waves and retarded waves (going from past into future). (However, the concept of advanced wave solutions is another problematic area in physics, whose solution appears to lie again in circular geometry of time). With this background, lets proceed with showing incompatibility of quantum mechanics with the evolutionary hypothesis.

For this purpose, consider the evolution of wave function of universe in form of a tree, whose root correponds to Big-Bang (see figure 4). The branches of this tree can be regarded as - branching of the universe in Everett's interpretation; collapse of wave function in Wigner's, Neumann's, and Copenhagen interpretation; and transactions in the Transactional interpretation. The branches of this tree can be associated with various hypothesized phenomena, such as vacuum symmetry breaking, star formation, inflationary scenario, etc; which

have been hypothesized to occur in evolution of universe. It is clear that each branch actually corresponds to a measurement process, and quantum mechanics tells us that measurement is not possible without the observers. On one hand the evolutionary hypothesis implies that the wave function of the universe did not collapse till the appearence of observers. But on the other hand, various processes such as, vacuum symmetry breaking, star formation, etc., require wave function of the universe to collapse to certain states, which however is a phenomenon which does not appear till appearence of observers and measurement (see figure 4). Thus in its attempt to explain the origin of universe, the evolutionary hypothesis is lead to a 'chicken and egg' situation as follows. The wave function cannot collapse till observers appear, observers cannot exist till stars exist, stars cannot exist till observers measure their wave function, and so on...

Contrast this situation with a model with eternal existence of life, consciousness, observers and measurement, a truth revealed by Shiv Baba. The answer to 'which came first, the chicken or the egg' is that both were always there, and that the events are repeating in identical cycles (see figure 5).

5. Operational Properties of Observers. Neuro-Biological Quantum Zeno Effect - SQUID solution to Mind-Body Enigma.

Though the term 'observers' is used in almost all works and treatise in quantum mechanics, nowhere has an attempt been made to give an operational definition of this term. It appears to have escaped attention, that the quantum measurement problem, (QMP) i.e., collapse of wave function, or selection of a particular outcome, from the set of all possible outcomes, could be because of an inaccurate or incomplete knowledge of properties of observers. In fact, from a logical point of view, it is possible to resolve QMP by assigning a 'set of specific properties to observers'. This set will be abbreviated as 'OM', O-Observers, and M-Measurement. The reason for choice of letters 'O', and 'M', for this set must be evident to the reader - for Om stands for the true nature of self as an eternal soul. Thus, we can construct OM, with an apriori aim of resolving QMP. Let's see what are the element of the set OM, or the true properties of observers, which resolve QMP.

Let's consider Hepp's mechanism for collapse of wave function. Hepp uses the mathematical concept of a Cauchy series to resolve QMP (see figure 6). A Cauchy series is a countably infinite set of points (i.e. the number of points is same as the number of integers) in a space, such that distance between the two adjacent points tends to zero, as one approaches the infinite-th term. Hepp associates the coherent state of the system (the uncollapsed state of wave function), as the first term, and the infinite-th term as a pure state (the out come of measurement). Hepp imagines that, if a measurement apparatus, which is being used to observe the state of the system, is consisting of an infinite number of particles, then as the system interacts with the apparatus, all the infinite terms of Hepp's Cauchy series will be generated, and the wave function of the combination (of system and apparatus), will tend towards a pure state, i.e., an unsuperposed state. Hepp then insists that since the macroscopic apparatus consist of a very large number of particles, therefore, he can use them as an approximation for a system with infinite number of particles. This view is consistent with the view prevalent during the formative period of quantum mechanics in 1920s-30s, namely, that one gets classical behaviour from a system, as the number of particles becomes large; that quantum mechanics was a science only for very small systems. However, as mentioned earlier, existence of macroscopic quantum state, and Legget's work refutes this view. All physical apparatus actually consist of a finite number of particles. Therefore, all physical systems are incapable of collapse of wave function, and actually themselves go into a coherent state during the measurement apparatus. The collapse of wave function occurs, only when the conscious observers observe the position of macroscopic pointer (dials, gauges etc.) of the measurement apparatus. Thus observer's senses, brain, neurons etc., are inescapably intertwined within the measurement apparatus. However, the brain and neurons, themsevles are systems of finite degrees of freedom, and they also are nothing but links in the 'quantum measurement chain', which starts from the system whose state is to observed, and which ends at the 'observer'. Thus during the measurement, the brain and the relevant neurons should also be in a coherent state, and the 'observer' or the 'soul', must be driving, this 'coherent brain state' into a 'pure state'. For this to happen, therefore, the observers, must be nonphysical systems with infinite degrees of freedom, for only then will they be capable of generating the infinite terms of Hepp's Cauchy series. These conclusions suggest that the psychological concept of perception is actually synonymous with the quantum mechanical concept of measurement. Thus we have following statements as elements of OM - the set of properties of observers, which resolves the quantum measurement problem -

(1) The observers are non-physical systems of infinite degrees of freedom and are the only realistic measurement apparatus. All physical apparatus are systems of finite degrees of freedom and go into a coherent state during the measurement process.

(2) The observers are distinct from the senses, brain and body, which are but links within the quantum measurement chain, and go into a coherent state during the measurement process.

Next we consider the question of experimental verification of these ideas. This leads to prediction of a neuro-biological version of quantum zeno effect. But to explain that, first the reader is given an account of the quantum zeno effect. Zeno was a Greek philospher, who wondered how sum of an infinite number of terms could be a finite quantity. However, now all those who have studies high school mathematics know that one can have an infinite number of terms, yet there sum can be a finite quantity. One such example is -

$$2 = 1 + 1/2 + 1/4 + 1/8 + ...$$

Zeno was lead to his paradox, by considering an imaginary race between a tortoise and a hare. The tortoise was given a head start by the hare. Zeno reasoned, that by the time hare reaches the spot at which tortoise was on, at the start of the race, the tortoise would have advanced a few steps. Again, by the time, the hare reaches that particular spot, the tortoise would again have advanced some distance. Thus every time, the hare reaches the spot on which tortoise was previously, the tortoise would be slightly ahead. So Zeno wondered, how could the hare overtake the tortoise, in finite amount of time, as is seen to actually practically occur (see figure 7). The solution to this paradox, is now well known. The time taken by hare to cover the distance remaining between the hare and tortoise, actually is a convergent Cauchy series. Though there are infinite terms in the series, yet their sum is finite. And so the hare comes out the winner.

Now for the quantum zeno effect. This had been acticipated in 1940s- and 50s, developed further during 60s-70s by, among others, the Indian Physicist E.C.G. Sudarshsan, Director of MATSCIENCE, Madras; who also gave the phenomenon its name as 'quantum zeno effect'. The advanced technology of 80s saw to its experimental verification by Fano and others. Briefly, the quantum zeno effect is as follows. Supposing a group of atom is in one particular state, and all of can spontaneously go into another state within one second. So if after, one second, one observes their state, all of them are in the other state. In the process, the atoms spend some time in a coherent state, i.e., a superposition or simultaneous existence in both state. Now lets say, that instead of one second, one is observing them after every 1/10th of a second, and after one second we make a check, as to how many of the atoms have gone into the other state. To our surprise, we find that instead of 100 %, say only 99 % have gone into the other state. If we still decrease the time interval, say check them every thousand-th of a second, and take stock after 1 second, and check how many have gone into the other state. Lo, to our surprise, only 90 % have gone. Extrapolating this further, one finds that if one i observing them after every billion-th of a second, the number of atoms able to go into the second state is still lesser, only about say 50 %. And if we are observing every trillion-th of a second, then even after one second only about say 20 % would have gone into the other state, and so on. The conclusion is that if one is observing their state continously, not a singly atom would be able to go into the other state. The reason for this is that, to go from one state to the other, the atoms have to spend some time in a coherent state, which is an observable. By observing them continously, one prevents the atoms from assuming the coherent state, and therefore fewer and fewer of them are able to make the transition. Next we come to the 'neuro-biological quantum zeno effect' which is a prediction of the author, and whose existence verifies the truth of element of OM.

Neuro-Biological Quantum Zeno Effect or NBQZE (its abbreviation), is a simple extension of quantum zeno effect applied to the quantum measurement problem and human perception. If our reasoning in generating the two statements which are elements of OM are correct, then it follows that brain and neurons spend some time in a coherent state during any quantum measurement process, which is equal to phenomenon of perception. Thus lets say that the neurons are in one particular state before a stimulus is given to a group of subjects. Than, when the perception has occured, the neurons are in another state. OM suggests that, inbetween the neurons will have to spend some time in a coherent state. Thus if the relevant neurons of a group of subjects is being continously monitored, then as the time interval of observation is decreased, more and more subjects will report perception failure, following an ordinary stimulus (see figure 8). This is the 'Neuro-Biological Quantum Zeno effect', whose

existence is predicted on the basis of OM, which requires the conscious observers, to be non-physical systems distinct from bodies.

Another version of NBQZE is as follows. Consider the phenomenon of executing one's free will, such as moving one'a hands. Eclles has reported, that there occur changes in states of neurons, following such a mental desire. Thus, let the neurons be in a particular state before the desire, and let them assume, another state, while executing the free will, i.e., moving the hand. Again the OM suggests that the relevant neurons will have to spend some time in a coherent state. Therefore, if they are being monitored at very short time intervals (pico-seconds -the thousand-th trillion-th of a second), more and more subjects will report failure in ability to execute free will. Thus these, two phenomenon are predicted on basis of OM. This also gives the experimental proceedure for resolving the age old mind-body enigma; a problem which has fascinated top scientists and philosphers alike. These considerations also suggest the design principles based on which, physical realization of concepts such as 'fly by thought systems' and 'music by mood', can be obtained.

6. Conclusions:

The conclusions were mentioned in the introduction, with a view of preparing the reader and giving a flavor of things to come. The title also summarises these conclusions, which we repeat for the sake of completeness -

(i) EPR paradox can be resolved in circular time.
(ii) Evolution theory is incompatible with quantum mechanics, which requires eternal existence of observers, for measurement to occur.
(iii) Observers are non-material souls, distinct from bodies or brain. Quantum measurement chain is incomplete without these souls, which cause 'collapse of wave function'.

Having completed a survey of relationship of quantum mechanics, with points of Godly Knowledge; in the next article of this series, we will re-examine a host of physical phenomenon, such as -

(1) Non-observability of proton decay,
(2) High solar corona temperatures, and low solar neutrino counts,
(3) Distribution of galaxies on thin spherical shells, etc.,

in light of Godly Knowledge, and find that many of these puzzling features are explainable, in terms of an eternally existing cosmos.