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Quantum Measurement Theory: The Science behind Consciousness and Experiences

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Abstract: The basics of quantum physics and quantum measurement theory are reviewed to show how a scientific theory of consciousness and experiences derives from them. It is pointed out that materialist theories of consciousness including the much touted one by Penrose and Hameroff[1] do not address even the most basic aspect of consciousness as we experience it, namely the self/subject of an experience. The most important new achievement reported here is about how the ideas of consciousness are embodied in the material bodies of the living and sentient. Experiments are cited that provide verification of the model.

Key words: consciousness, quantum, measurement, experiences, brain, mind, life

Amit Goswami discovered the solution to the quantum measurement problem and developed a science of experience. He developed a theory of reincarnation and integrated conventional and alternative medicine within the new quantum science of health. He is the author of numerous books. Amit started the quantum activism movement, establishing a transformative education institution, Quantum Activism Vishwalayam, based on quantum science and primacy of Consciousness.

Introduction

Most scientists today believe in an idea called scientific materialism according to which the old everything-is-matter philosophy is scientific. While this idea works for all practical purposes for physics, chemistry, and engineering (including bio-engineering), it does not seem to have the ability to explain the distinction of non-living and living, nor does it give us a theory of our consciousness and experiences in general.

And when it comes to basics, scientific materialism cannot explain logical paradoxes of quantum physics, the basic physics of sub-microscopic matter. Often, thinking in this line *creates* the paradox.

These quantum paradoxes have led to speculations that they have something to do with the human observer—consciousness. Let's call this idea the observer effect.

The mainstream consensus is that since it can be generally argued that quantum physics reverts to Newtonian physics for bulk matter, and life and consciousness are phenomena of the macrocosm, quantum physics and the observer effect have nothing to do with these phenomena.

I, on the other hand, have not only shown that all the paradoxes of quantum physics can be solved by taking the observer effect seriously but also over the course of several decades have developed the quantum science of consciousness and conscious experiences based on the paradigm-shifting idea that consciousness, not matter, is the ground of all being. This metaphysical idea is called monistic idealism.

Like the materialist metaphysics, the metaphysics of primacy of consciousness—monistic idealism--is also millennia old. All spiritual wisdom traditions propound it. Unfortunately, this spiritual/religious association of this metaphysics evokes an unease from rational-thinking scientists. Many scientists reject monistic idealism because it is "irrational." But of course, these early researchers of consciousness were discovering truth about reality in the same way that we do today, via intuitions and creative insights.

In the final reckoning, reality *is*. We have to explore its nature via consistent paradox-free verifiable theory backed up by experimental data.

The main problem for the metaphysics of primacy of matter is the explanation of life and consciousness; the main problem with the spiritual metaphysics of primacy of consciousness has been to explain how consciousness which is proclaimed to be one and only produces experiences for which there is subject-object distinction.

The wisdom traditions of Vedanta and Kabbala correctly intuited that our experiences span from purely objective (material) to progressively subjective—feeling (vital energy), thinking (meaning), intuiting (archetype) ending up with the self (or pure subject). But how does One consciousness divide itself into a part that sees itself separate from the other part? Without a solution of this problem, the metaphysics of primacy of consciousness seems to be dualism—the idea of matter and consciousness as dual separate independent entities--in disguise. Dualism is easily discarded as a viable metaphysics by raising the question of interaction: how does matter and nonmaterial consciousness interact without a mediator which has been elusive to find?

On closer examination, materialist metaphysics has the same problem: how to explain subject-object distinction of all experiences—one pole of experience (the experiencer/subject) looks at the other pole (object) as separate from itself. Materialists try to pretend that everything belongs in the category of objects, including subjective qualia[2] ; but of course the dualism remains implicit as demonstrated by the physicist Henry Stapp[3].

The problem of distinction is sometimes expressed in another way: defining unconscious brain actions and conscious brain actions and looking for a trigger for the latter[1]. But here again, one has to explain the subject-object duality of experience; without such an explanation, the assumption of dualism remains implicit.

In my earlier work, I first solved the problem of finding a paradox-free interpretation of quantum physics; this requires the metaphysics of monistic idealism. Simultaneously, I solved the problem of embodiment of consciousness in the human brain[4.5] **;** this explains the subject-object split of conscious experience as well as provides a distinction between the unconscious (where there is no subject-object split) and the conscious. Later I used the same solution as an explanation of the distinction of life and nonlife[6].

Finally, there is also the problem of embodiment of the ideas of consciousness in matter that gives rise to the variety of subjective experiences of the living and the conscious (feeling, thinking, intuition) in the

form of memory/software. In my earlier work, I have formulated the basic framework of a quantum theory of our experiences based on the philosophy of psychophysical parallelism: in quantum physics, objects are possibilities of consciousness to choose from; matter and ideas of the psyche both consists of quantum possibilities of consciousness; consciousness chooses and collapses (making memory) parallel movements of the ideas **and** matter producing embodiment. Repeated recall of the memory produces conditioned software.

However, the details have been left vague. These details have to do with the materialists' legitimate question: does quantum physics apply to macro-matter, and if so, how?

The purpose of this paper is threefold: 1) to show that the observer effect and quantum measurement theory—which is the theory behind how quantum possibilities become actualized experiences of an observer—necessitates our subjective experiences of thinking and feeling; And 2) to provide the details and to demonstrate how a theory of embodiment of the ideas of consciousness in matter can be formulated; finally 3) how intuitions and creative insights bestows purpose to human life.

Since this journal is intended for a general audience, hard scientists (biologists), soft scientists (healers, psychologists), as well as non-scientists (philosophers), I will begin with the discussion of some basic concepts of quantum physics and point out how the paradoxes arise. I will then summarize the legitimate approaches that have been taken to deal with the paradoxes. Only then I will develop the quantum measurement theory in the manner that explains our basic experiences. I will solve the problem of embodiment of the ideas of consciousness and discuss how intuitions and creative insights introduce purpose in our lives.

Basic Ideas of Quantum Physics

The elementary building blocks of energy are called quanta, plural of quantum; the discovery that radiant energy consists of discrete quanta was the beginning of the new physics; hence the name quantum physics.

Light is energy. Does it really act like a particle? Yes, when light is incident on a piece of metal, it dislodges electrons from the metal as in a photoelectric device, just like a particle would, for example a billiard ball knocking another billiard ball out of a pack.

But light is undoubtedly a wave as well. When light passes through a double slitted screen, it splits into two waves that interfere and makes what is called the wave interference pattern, an unmistakable signature of wave nature.

So, initially, there was a lot of confusion: how can the same object be both particle and wave? Particles are highly localized objects; even when they move, they move in localized trajectories. Waves on the other hand can be at many places at the same time; that is how sound waves can reach a whole bunch of people in an audience all at the same time. That is how light bends around an obstacle instead of being totally blocked by it!

Later, elementary particles of matter that were initially thought to be particle turned out to have wave behavior as well. So, the wave-particle duality is a characteristic of all elementary objects, of light or of matter. This was called a paradox, the wave-particle paradox. A paradox is a logical inconsistency telling us that something is wrong in our thinking. There is.

We are assuming that reality is matter moving in space and time; there is only one domain of reality. When quantum mathematics was discovered, we found that it dictated unambiguously that quantum objects *are waves*, they are *not simultaneously* both wave and particle, there is no paradox. There is still a puzzle, because when we measure the waves we do see them as particle; how come?

Resolution. 1) the quantum waves are not ordinary waves of space and time, like water waves which are travelling disturbances of water molecules. Instead, they are waves of possibility; they reside in a *domain of potentiality* outside of space and time.

And 2) When these waving objects are measured by an observer, the measurement converts them or *collapses* them into particles in space and time. The collapse is instantaneous! The problem is, nothing can happen instantaneously in space and time where there is a speed limit, the speed of light, according to the theory of relativity.

One paradox of logic is replaced by another. Except now it is a challenge to an entire worldview. Scientists have become used to thinking of space and time as the one and only domain of reality. Quantum mathematics is imposing upon us another domain of reality—the domain of potentiality--to resolve the wave-particle paradox.

The collapse of the wave to particle is part of any formulation of quantum physics. Technically, it is called the reduction of the wave packet of many possible facets to one

facet. This gives us another puzzling question, What causes instantaneous collapse that cannot be a cause in space and time? How we respond to this question is crucial to how we see reality--our worldview.

What Causes Instantaneous Collapse?

Let's recap. Quantum objects are both waves and particles. This is a logical paradox if you think in the way of scientific materialism because waves can be in many places at the same time whereas particles can be only at one place at one time. Quantum mathematics helps; according to the mathematical equation of quantum physics, quantum objects are waves, unequivocally. When we measure them however, they collapse into particles instantly. Quantum mathematics enables us to calculate only the probability as to where the particle will appear upon the collapse of the wave, not the actual position.

What causes instantaneous collapse? What determines the actual position where the particle will land? These questions are also paradoxical if you think strictly in accord with scientific materialism.

There are only two legitimate possible ways this paradox can be resolved. The one favored by most scientists is called the statistical interpretation: The collapse of waves into particles is random and acausal; this is why only the probability of collapse to a particular position can be calculated. This resolution of the paradox has the advantage that the metaphysics that matter is everything does not have to be challenged.

But causality is part and parcel of science. In causal terms, these scientists are assuming random (and nonmaterial causes, see below) for the collapse which provoked Einstein's famous reaction: God does not play dice.

Ok, this interpretation holds if we exclude any answer for what happens for a single quantum object. This is okay for physics and chemistry where we always deal with zillions of objects but not for biology and psychology where we have to deal with single objects. The materialist answer is feeble—there is no quantum biology or psychology. It is based on the assertion that at the macrolevel where living and sentient beings exist, quantum physics gives way to Newtonian deterministic physics. This assertion is dubious. First, there is a vast amount of experimental evidence of quantum effects at the macrolevel of experience as codified by researchers especially in the fields of evolutionary biology and transpersonal psychology. Second, this assertion relegates quantum physics, inferentially all science, to be merely instrumental (the philosophy of instrumentalism).

The other way is to adapt the spiritual ontology—consciousness is the ground of all being--in the language of quantum physics: Quantum objects are objects (waves) of possibility within consciousness for consciousness to choose from. When consciousness via an observer/experimenter chooses/measures, the possibility wave collapses and becomes a particle in the manifest experience of the observer. Consciousness chooses where the particle will show up when the wave collapses.

Let's review once again! Consciousness and the waves of possibility within it reside in a domain outside of space and time, the domain of potentiality; this domain is akin to Freud's conceptualization of the unconscious in psychology. Although quantum measurement involves an observer, it really is a choice from consciousness in the form of the unconscious that collapses a quantum object's possibility wave. Finally, in the process of the quantum measurement, choice, and collapse, consciousness identifies itself with the observer's brain creating a distinction between self and the object in the experience of the observer.

Behold! Collapse is not just collapse of the object's wave aspect into its particle aspect; collapse is a product of choice and distinction; the effect of collapse is a split of consciousness into a subject and an object.

In the book The Self-Aware Univers[5], I solved the problem of how the embodiment of consciousness in matter takes place in this quantum science of consciousness; in this way I removed the major argument against the theory of a spiritual universe. The theory's main prediction that we have a nonlocal (having the capacity for signal-less instantaneous communication) self-identity beyond ego at the cortex has found support in neuroscience data, see later. In this article, I will further demonstrate how the ideas of consciousness can be embodied in matter as well.

Quantum textbooks usually mention a third compromise solution of the wave particle paradox called the Copenhagen Interpretation. In Bohr's way of stating this interpretation the wave and particle are two complementary aspects of the quantum object; we can measure only one aspect at a time, each with a suitable experimental arrangement. It is up to the human observer to choose to measure

either of the two aspects. The collapse event itself is acausal; no cause can be given of it.

But the complementarity principle that Bohr uses to hide the domain of potentiality is manifestly false. Both particle and wave measuring arrangements give away the secret of the wave-particle duality upon clear analysis. Read for example[7], The Feynman Lectures on Physics, vol. 3.

I will not discuss the much touted many worlds interpretation because it is not a legitimate scientific theory; *the idea of parallel many worlds cannot be verified*.

The ancient researchers of consciousness—the exponents of spiritual wisdom traditions—did try to explain how consciousness is embodied as a self in us. The writers of Vedanta did intuit correctly that any distinction of oneness into two must be an appearance except that they thought the appearance is illusory and defined the purpose of life as removing the illusion producing much societal mischief. The Buddhists introduced the concept of dependent co-arising of subject and object. In my work, I have shown that both mechanisms are needed: the first—a tangled hierarchy in the brain between its two functions perception and memory (fig. 1)—leads to the appearance of the quantum self of our present-centered experiences; subsequent reflection in the mirror of past memory leads to the dependent co-arising of the usual experience of the conditioned ego-self as well as conditioned experiences of the objects. The details are given in my book *The Self-Aware Universe* as well as in the more recent The Everything Answer Book[8] which I will not repeat except to say that all this means is that quantum physics is giving us a scientific answer to that age-old spiritual inquiry: how does the oneness split into subject-object separateness and forgetfulness of oneness that we experience?

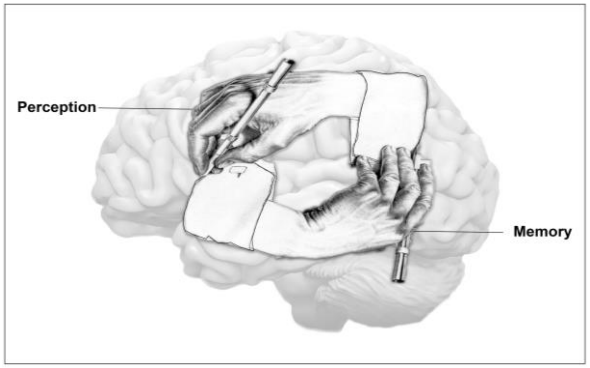

Figure 1 The perception and memory apparatuses tangled hierarchically, like the Escher's hand creates the appearance of circularity and self-identity.

Quantum Nonlocality

Another revealing paradox raised its beautiful head having been discovered by Albert Einstein, Boris Podolsky, and Nathan Rosen. The paradox is this. When two quantum objects interact briefly by coming close, they achieve a state of *correlation,* also called *entanglement*. What this means is that subsequently, until measured, they have the paradoxical ability of communicating instantly; this is so even though they may not be interacting anymore, even though they move away galaxies apart.

Why is this a paradox? Material objects in space and time always communicate or interact with signals (the locality principle). And as already stated, Einstein's relativity theory says, signals have a maximum speed, the speed of light, 300, 000 km/sec. Nothing can travel in space and time faster than the speed of light. So how are those correlated quantum objects doing it? That is the paradox.

But it does not have to be a paradox if we allow that these quantum objects are possibility waves; they do not reside in space and time! The law of relativity, signals and their speed limit are only for the space-time reality. EPR discovery is a beauty because it is showing us how to discern between the domain of potentiality and the domain of space and time. In the former, any two objects can correlate by close interactions and communicate instantly, which is called nonlocality--communication without signals; in the latter, communication requires signals, hence speed limit, hence impossibility of instant communication. It fits.

Of course, the believers of one domain of reality did not like this at all (even Einstein, one of the discoverers of the idea!). Their hope? Maybe quantum theory itself is wrong; it needs to be replaced by a theory of new "hidden" variables that would explain the nonlocal weirdness without having to postulate a new domain of reality.

In 1982, the physicist Alain Aspect and his collaborators (Aspect got a Nobel prize for this work in 2022), with help from theoretical research by another physicist John Bell, resolved the issue in favor of quantum physics. Quantum objects of potentiality, when correlated do communicate faster than the speed of light. Quantum nonlocality is legit; hidden variables are a red herring.

Now let's go deep. Realize that we can only communicate with ourselves without signal instantly and see that correlated possibility objects of nonlocal connection have

become a oneness. *The domain of potentiality is a domain of potential oneness.*

Whenever there is action at a distance, physicists always posit a field that is mediating the action. If we do that then this nonlocal *quantum field* in potentiality, a oneness, must pervade the domain of potentiality. This concept was first given by the systems theorist Ervin Laszlo[9]. Nonlocal cause giving a nonlocal effect, that's how the mystery of nonlocal collapse is solved.

Question. What is the nature of this quantum field of potential oneness? Hope you notice the mystical/spiritual sound of the word oneness! The plot has thickened.

Materialists at this point will ask, Is all this discussion even relevant? Does quantum physics apply to our consciousness, to our everyday life? This is a question that materialists ask to quench your enthusiasm about my discovery of the meaning of quantum physics and about the new quantum science that I have developed, for example the domain of oneness—consciousness—and conscious choice creating the manifest world of all of our experiences which is developed below.

Why is this work important? It is important for human beings, you the reader. With a science of experience to help your thinking you can judge for yourself which experiences you want to choose and how.

More formally, it is also important for biology and psychology. A related scientific question is, Can the brain, being a macro-object, and macro-objects at room temperature are known to be notoriously Newtonian, develop macroscopic quantum possibilities for consciousness to choose from? There are some speculative theories about a quantum brain. Below, I give a definitive explanation of how consciousness can connect with the brain even though the material brain remains Newtonian for many practical operations.

A Brief History of the Quantum Measurement Theory

Let's now return to the subject of collapse of the quantum wave into a particle upon measurement. The paradoxes discussed so far are paradoxes created by the doctrine of material monism and its assumption of locality; resolving them opens the door for a paradigm shift. The paradox of quantum measurement via collapse is a paradox that shows us the needed shift.

All material objects, large and small, are quantum in principle; when in bulk, a material object no longer can produce a single *coherent* macroscopically distinguishable superposition of possibilities for consciousness to choose from; this is called decoherence. But notice that *decoherence is not collapse*: the individual decohered parts of a macroobject remain as possibility waves, albeit moving incoherently with one another, until the whole object (that is, its center of mass) is collapsed. The external movement of the center of mass of a macrobody is always quantum and is accessible to consciousness, although the movement is drastically subdued due to the large masses of macroobjects. When consciousness collapses the center of mass, the internal movements of the object correlated with the center of mass also collapse.

Note: if you are puzzled by the word *coherent*, it refers to the phase relationship of the waves with one another. If the phases are all the same as in the dancing movement of girls in a chorus line, the waves are coherent; if their movements are in random phase with one another as in rock and roll dance, the waves are de-cohered.

It was mostly the physicist John von Neuman's genius[10] that led us to recognize that:

1) *von Neuman's theorem: No material interaction can transform the quantum possibility wave to actuality—this is an irrefutable dictate of quantum mathematics. To create collapse and manifest experience of reality, nonmaterial interaction is needed*.
2) the so-called measurement apparatus for a quantum object—a photographic film for example or a bunch of Geiger counters (that a human observer must use to amplify the signal before observing it) placed all over the arena of quantum wave expansion—becomes the same coherent superposition of possibilities as the quantum object, say an electron that the observer is trying to measure. *The so-called measurement apparatus does not "measure" a quantum object, only amplifies it; it is an amplifying apparatus.*
3) The macroscopically distinguishable amplified quantum possibilities of the amplifying apparatus and the quantum possibilities of the electron both collapse when the observer completes the measurement and sees (perception) and records the result in his brain (as memory).

From this analysis, it is easy to conclude, as von Neuman did, that the *observer's consciousness is the agent of the outside nonmaterial interference that collapses possibility into actuality by choosing from among the different facets of the possibility wave.*

One essential step has been taken in this manner; consciousness has been shown to be an essential component of quantum physics as soon as the measurement question is addressed. But it is not a new paradigm yet; because many paradoxes can be raised. The most famous is the paradox of Schrödinger's cat.

Schrödinger's Cat

Physicists have always been clever in putting up paradoxes; some of them turn out to be red herrings; others lead to new thinking. There was an unfortunate historical diversion that none other than Erwin Schrödinger, one of the co-discoverers of the quantum equation, himself introduced: the paradox of Schrödinger's cat. Imagine that we put a radioactive atom with a half-life of 1 hour (which means that after the hour, the probability that the atom will decay is fifty percent) in a cage with a cat along with a Geiger counter, a hammer, and a poison bottle so arranged that that if the counter ticks, the hammer is activated and breaks the poison bottle killing the cat. At the top of the hour an observer opens the cage. What does he find?

Schrödinger argued this way: at the top of the hour the atom becomes a superposition of two possibilities—it has decayed and it has-not-decayed—each with fifty-fifty probability. The Geiger counter picks up the possibility ambiguity of the atom: to tick or not to tick. If it ticks, the hammer is activated, breaks the poison bottle releasing the poison and the cat dies; on the other hand, if the Geiger counter does not tick, none of the subsequent steps can happen and the cat lives. So, after the hour, the cat should be in a state of coherent superposition of half dead and half-alive. How absurd it sounds! And how awkward is that a human observer has the power to decide the life and death of a cat?

The decoherence theorists called Schrödinger's bluff. This cannot happen. The cat is a macro-object and cannot develop a macroscopic coherent state of superposition for the observer to choose from! Since Von Neumann's measurement theory creates absurd paradoxes like the Schrödinger's cat it must be cancelled.

But von Neuman's theory applied the right way as stated above does not create paradox of the half-dead half alive cat! The fallacy of the whole thing of course is that we assume Schrödinger's scenario that an entire chain of quantum superpositions are there when the observer decides to look. Instead, construct the scenario in the correct way: at the top of the hour, the atom is in a state of coherent superposition, no doubt; however, only the Geiger counter—being an amplifying apparatus—picks up the atom's state of dichotomy. Only when the observer opens the cage and observes, choice happens. If the choice is "atom decays," the Geiger counter detects the decay product and ticks, which the observer hears, all this taking place simultaneously. Only then the collapse is completed with a 50-50 chance. By the way, *observer's consciousness has to be lawful; it always chooses in obeyance of the probabilistic law of quantum physics*.

Only as the collapse is complete, the hammer is activated, the poison bottle is broken, the cyanide is released killing the cat. None of these objects, ever becomes macroscopically quantum. The macroscopic cat never becomes an absurd half-dead half-alive one. The cat still dies on the average fifty percent of the time as the poison is released whenever the counter ticks (with a fifty percent chance at the top of the hour), but the observer's choice has nothing directly to do with it.

The paradox was a red herring based on the false assumption that any interaction with a quantum object propagates its possibility-ambiguity because all objects, even the macro are fundamentally quantum. The assumption isn't correct for macro objects because of decoherence. The only exceptions are apparatuses that amplify the signal.

More Paradoxes

However, we are not finished yet with the von Neuman resolution of the measurement problem; there still are many unanswered paradoxical questions; for example, the previously raised question of dualism, Is consciousness a dualistic entity separate from matter? Then how does it interact with matter without a mediator? A paradox, nobody has ever found such a mediator. Another paradox: Suppose an observer and his friend measure the electron simultaneously. Who gets to choose its position when collapsed? On what criterion is one observer the chooser and not the other observer? This one is called the

paradox of Wigner's friend, named after the originator the physicist Eugene Wigner.

Finally, still another paradox: Without collapse, there is no manifest brain for an observer to observe with; but without the manifest brain to observe and record the result, there is no collapse. Which comes first, collapse or brain? Seems to be a problem of circular causality.

The solution I discovered is this: *consciousness is the ground of all being* including matter*; matter consists of possibilities for consciousness to choose from*. Consciousness is not a dual object along with matter as a partner; *It is all there is*. This is a monism based on consciousness rather than one based on matter. There is only one consciousness for everyone to choose with: this solves the paradox of *Who gets to choose* when there are multiple observers for the same measurement event.

The making of an Observer

But even choice cannot create collapse of possibility into actuality; if oneness remains, who is to act as the subject pole of the experience of the object? For collapse and experience we need additionally a *distinction* of one part of oneness from another part—the observer--that sees itself separate from the first. My solution is this. Distinction is simulated by a *tangled hierarchy* in the brain of the observer between its perception and memory apparatuses; perception needs to be collapsed to produce memory, but without memory, there is no perception. This circularity creates a trap for consciousness to *appear momentarily* to identify with the brain, and as a result, it manifests as a *quantum* subject/self in the *observer's* brain and looks at objects (such as the amplifying apparatus and the amplified image of the electron in the case of quantum measurement or a rose in case of ordinary perception) separate from itself (fig. 2). Subsequent reflection in the mirror of past memory leads to the dependent co-arising of the ego-self in conditioned experiences. In this way, in quantum measurement consciousness, looking through an observer's brain creates the observer's self-identity in the brain and the world the self experiences in one fell-swoop. The paradox of circularity above is also addressed.

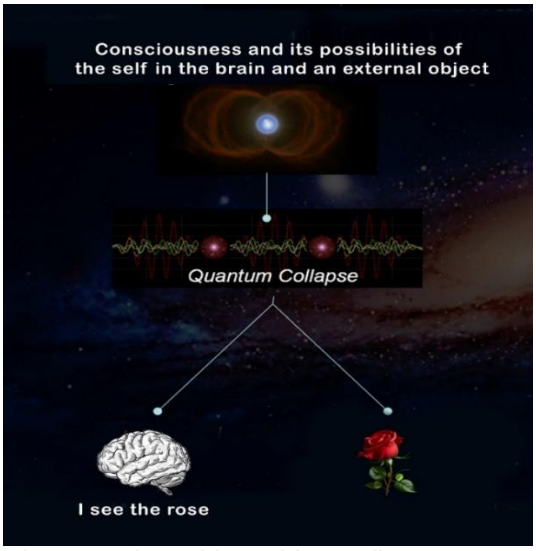

Figure 2. The subject-object split upon collapse

However, there is still the cognitive paradox—how does cognition of a rose happen from the ink-blot like electrical image that the brain creates? Materialist neuroscientists assume that the brain itself somehow has the ability to cognize. Is this valid? Brain in the rational thinking mode works like a computer by all reckoning. It has been demonstrated by the philosopher John Searle [11] and physicist-mathematician Roger Penrose[12] that computers being processors of symbols can only process information--representation of each of the aspects of meaning which itself always has ambiguity—many facets like a quantum object should. So the brain cannot cognize.

Quantum science of measurement theory solves the cognitive paradox of perception because the whole package of possibilities of consciousness comes not only with material but also mental movements. The latter are non-material and quantum, there is no micro-making-up-macro problem for the mind. *In the quantum measurement situation, the external objects—the electron and its amplifying apparatus—plus the brain's amplifying perception apparatus create ambiguous electrical images in the brain. Two questions arise. The first, Who is looking at the image? is answered by the tangled hierarchical creation of self-identity as explained above. The second question is, How does consciousness give meaning to the electrical image? The answer is: by using the quantum mind as the organizing field, while memory of it is made tangled hierarchically. Then collapse.*

How do we know that mind is quantum? The easiest way to see this is that we cannot normally share mental experiences;

they remain private and subjective. This is due to the incessant quantum movement of the mind; the possibilities go on changing so fast that two people cannot ordinarily choose the same actuality at the same time; each mind's possibility structure becomes so different in a matter of moments. In contrast, the movement of the center of mass of macro-matter is sluggish and approximately Newtonian and so material experiences of sensing are more or less the same for different people and are sharable.

In the case of nonlocal psychic experiences like mental telepathy, we do share them. But that too proves the quantum nature of the mind since nonlocality is a quantum phenomenon.

So far we have been talking about human cognition. By all indication, animals—mammals at least—can cognize, not with the capacity of meaning-giving but with the distinguishing capacity of feeling—like or dislike. This requires consciousness to have the use for more basic organizing fields for survival-oriented living. See below.

What is Life?

Along the same line of how the brain get a self-identity, we now can define a living cell as the smallest living body with a tangled hierarchy and thus acquiring a self, an identity of consciousness that sees itself separate from its environment. In this way, a living cell has an irreducible integrity which the non-living lacks. Its survival motive comes from the necessity of preserving its integrity. The living cell also has subject-object split experiences which the non-living cannot have. These are the main points of distinction between the living and the non-living. See also**,** Goswami[6]**.**

The Problem of Embodiment of the Ideas of Consciousness via Organizing fields of Living and Thinking

According to the psychologist Abraham Maslow[13], the ideas of consciousness serves two kinds of our (human) needs: 1) survival needs; 2) higher needs. What constitute higher needs? Those of meaning and purpose that bring satisfaction in our lives.

For animals lower than humans in the evolutionary totem pole, only survival needs are important.

Is survival an idea of consciousness? Darwin's theory of evolution (and its offshoot Neo Darwinism) is based on organisms' drive for survival against environment changes. Modern biology, however, is molecular biology: the idea that biology is chemistry. Establishment biologists subscribing to scientific materialism are tacitly assuming that survival is a molecular property!

Ordinary molecules of chemistry do not display survival as one of their properties. Is survival and emergent property of complex molecules like DNA, RNA, and protein then? This kind of thinking contradicts the very notion of the philosophy of reductionism that seems to hold for matter. There has been no theoretical demonstration of such emergence either. On the experimental front as well, no one has been able to produce a survival-oriented molecule from scratch in the laboratory.

In view of the above, it is safe to conclude, as is *a priory* obvious, that survival is an idea of consciousness. Darwin's theory's even partial success shows that organisms evolve driven by the survival motif. And then the important question to address is: how is an idea of consciousness embodied in matter?

In quantum science based on the primacy of consciousness, as previously mentioned, a breakthrough philosophical alternative to interaction dualism that makes the embodiment of ideas of consciousness in matter possible is called *psychophysical parallelism* first conceived by the philosopher Gottfried Leibniz. The organizing principles of life and matter are all quantum possibilities of consciousness to choose from. As consciousness chooses actuality from possibilities of the organizing field, it also chooses appropriate function of an appropriate organ in the living body, that is, the organ's physiology (fig. 3).

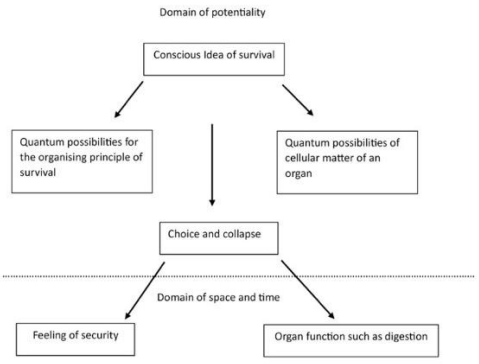

Figure 3 How the ideas of conciseness are embodied in living matter

At once the organism has an experience of the movement of the organizing field that is mapped into the physical body as an organ function. For example, the idea of survival comes to us via the organizing fields for cell

differentiation in organs and is implanted in various physical body organs as the physiological function of digestion (stomach, liver, gall bladder, pancreas), elimination (intestines, kidney), reproduction for species survival (sex organs), defense (immune system), etc.

We can go further using the discovery of epigenetics—the mechanism that turns on the genes (which has the code for making proteins) for producing proteins appropriate for an organ function is outside the nuclear genes. *These gene activators must be quantum; it is through them that consciousness connects to living matter. In parallel with this, consciousness uses a nonmaterial organizing field--the morphogenetic field proposed by the biologist* Rupert Sheldrake [14]*—to organize its ideas.* Sheldrake's original theory, however, is dualistic; but in the consciousness-based quantum science the dualism is easily avoided using psychophysical parallelism as noted above. The movement of the morphogenetic field correlated with an organ is what we feel as vital energy, discovered millennia ego in India, called *prana* in Sanskrit and China where it is called *chi* in Chinese.

Can it be the cellular environment as opposed to consciousness and its morphogenetic field be the epigenetic mechanism for determining organ function as some theorists propose? This is unlikely, because, every living cell has physical integrity on its own.

Organs, Feelings, and the Chakras

The idea that our organ functions have associated movements of vital energy that we feel have been incorporated in yoga psychology millennia ago via the concept of chakras—seven centers of feeling located along the spine and it imaginary extension continuing in the brain (fig. 4). Notice the relationship of the feelings at each chakra (those shown on the left in fig. 5) and the corresponding organ function and how that fits beautifully with the ideas developed here. Also, see below.

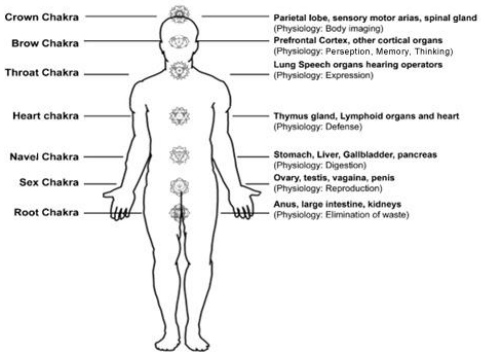

Figure 4. The chakras along the spine and their associated organs

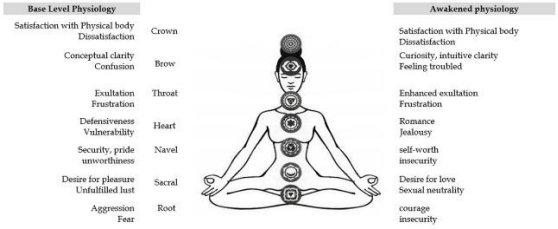

Figure 5. The chakras and how their associated feelings change when the brow, heart, and navel selves awaken. Feelings for the base-level physiology are shown on the left; feelings for the awakened physiology are shown on the right. For each chakra, the top feeling signifies positive feeling when the chakra-organs are functioning well; the bottom feeling indicates negative feeling when the chakra-organ function is disrupted.

Quantum in the Brain

For psychophysical parallelism to effectively operate, however, undeniably, there has to be quantum operation in the neurons of a brain organ; it is the epigenetic agents of gene activation that turns on the appropriate genes for making proteins suitable for the functioning of the brain organs' physiology that are quantum.

One of the most novel functions of the brain is thinking at the prefrontal cortex. Consciousness uses the additional organizing field that we call the mind to organize mental meaning in its operation of thinking. When we understand something or think meaning of stimuli presented to us via the brain's prefrontal cortex, consciousness is collapsing a specific mental meaning (that we call information), and the neurons in the cognitive area (prefrontal cortex) via their quantum gene-regulators are activating suitable genes to make the needed proteins to produce new

perception as well as new neuronal memory that are correlated with the mental meaning; for a familiar stimulus, this involves making new synaptic connections between neurons in a brain circuit. For previously unprocessed new stimulus, consciousness uses new neurons (stem cells)—a process called neurogenesis.

As consciousness collapses the physical neurons, simultaneously, it also collapses the correlated meaning which is what we experience in our mind's sky—that is how psycho-physical parallelism works. For ordinary conditioned thoughts when we are not paying attention the process becomes entirely mechanical; that is, the brain memory is used to create our thoughts randomly. And this is why it seems that thoughts are mechanical, controlled by the brain.

However, when we are aware and pay attention, the thoughts cease to be random; they become focused on where we intend them to go, even toward new meaning. This is when our thoughts involve mental understanding.

Mind, Meaning, and Illusions

This mind giving meaning is what makes illusion possible. For example, take the case of the famous cartoon that W. E. Hill created (fig. 5), *My wife and my Mother in Law*. You begin seeing one meaning, either the wife or the mother in law. Then you experiment with changing your perspective of looking by shifting your head this way or that way. You are looking at the same lines, but the perspective from which you look changes the brain electrical configuration and the mind gives a different meaning. You see the other picture.

Figure 6. My Wife and my mother in law (artist's rendition of original cartoon by W. E. Hill)

And nowhere is the meaning giving necessity for the mind more clear than how we see the so-called moon illusion: the horizon moon looks bigger to us. If you take a picture with a camera, the difference of size from the overhead moon disappears. If the brain were like a camera, then you would not see the illusion, but you do. Your mind constructs the illusion since an object perceived across a large terrain—the horizon moon--is also interpreted by your mind to be at larger distance than the overhead moon seen through empty space. And so mind makes the horizon moon look bigger just as it makes the upper rectangle in fig. 7 look bigger. The latter is called the size illusion.

Figure 7. The size illusion

Intuitions and Purpose

In this way, quantum measurement theory explains our sensory as well as our vital and mental experiences.

How about intuition? The archetypal organizing principles cannot be directly embodied in matter; we do not have organs of the appropriate physiology. However, consciousness manages to give mental representation to the intuitive archetype in the form of intuitive thinking while the brain parallelly represent it in brand new neurons (stem cells) and make memory, and we cognize a new intuitive thought. In the same way, consciousness collapses new intuitive feelings in the brain and elsewhere in the body called chakra points.

Can archetypes be quantum possibilities for consciousness to choose from? Yes, they can, they are with one exception: truth which is absolute. In this way different person's creative insight of the same archetype can be different and yet have truth value. However, the archetype of truth ultimately must be absolute since the laws of

science which are a significant part of the territory of the truth archetype do not change over time.

Notice! When you are inattentive, brain randomly and probabilistically throws thoughts at us, and we routinely collapse them; no play of purpose in that. We can be attentive and do purposive things, like get a hair-do—ego's purpose. Finally, intuitions; they bring us archetypes. Archetypes are how consciousness brings higher purpose in our lives (read also, Goswami[15]**.**

Biological evolution proceeds from simple to complex as more and more of conscious purpose is embodied in the physical. As both Aurobindo[16] and de Chardin[17] have theorized, the more we embody the archetypes of purpose, the more we build heaven on earth.

Our archetypal experiences of intuition, if we follow them up using the creative process that creativity researchers have uncovered, leads to discontinuous creative insights. In my earlier work, I have already identified these discontinuous movements of creativity as quantum leaps akin to those that atomic electrons take when they jump from one atomic orbit to another (for a summary, read Goswami[18], 2014).

Back to the Question of Quantum in the Brain

There has been many attempts to provide a model for looking at the brain as a macroscopic quantum system beginning with the work of E. Harris Walker[19]. More recently, Penrose and Hameroff[1] , have proposed a much publicized quantum theory of the brain based on quantum vibrations of the microtubules in individual neurons and developed a theory of consciousness by invoking a new theory of the onset of quantum gravity in the brain (!) as the trigger for conscious arousal.

There is also another problem: in a conscious experience more than one area of the brain is involved and yet we don't experience the self in each of these areas; somehow all the experiences are bound together; in other words, there is a unity of experience that smacks of nonlocality. Penrose and Hameroff[1] assume additional mechanisms of how the quantum movement in a single neuron can correlate with other neurons. It is also claimed that coherent quantum movement depicting quantum vibrations of the microtubules have been found by Penrose and Hameroff[1], ; however the data is indirect. This theory is too complex to discuss here. Moreover, it has nothing to say about the subject-object split of our conscious experiences. In this way, as a science of consciousness, this theory, as all materialist theories, is inadequate. All these theories treat consciousness as an object. The theories materialists propose most likely have not much to do with consciousness that we experience. The new data attributed to quantum vibrations of microtubules could very well be explained in other ways than invoking gravity.

What quantum science of consciousness formulated here demonstrates is that the brain does not need to be quantum all over for its ordinary ego-mode functioning for which the mere quantum mechanism of the gene activators in a few correlated neurons in what neuroscientists call the (ego-)self agency area is enough. Then there is also the binding problem; this is easily explained as a play of nonlocality with consciousness connecting the few neurons through intentionality to provide the observed unity of experience.

What is remarkable in the quantum approach is the prediction that when we take a quantum leap of intuition or creative insight, the brain 's cortex also does take a quantum leap as a whole from the ego-mode to the quantum-self mode and many brain areas do become involved. Such discontinuously arising of coherent movements in the brain corresponding to our experience of the quantum self, have been experimentally detected as well by Kounios and Beeman[20]**.** What is happening now is coherent quantum movement of the cellular quantum gene activators virtually all over the cortex.

In truth, quantum-self experience happens whenever an external stimulus is perceived by the brain. Neuroscientists have learnt how to put microelectrodes deep inside the brains of epileptic patients. This has given us a surprise **[21].** These measurements by microelectrodes reveal a sudden burst of approximately 40 hertz oscillation (called a gamma brain wave) immediately following the usual P300 event related potential. This is the signature of conscious awareness of the primary quantum self. Why? This is because, apparatuses in distant areas of the brain are simultaneously communicating in synchrony which confirms quantum non-locality of the quantum self-experience. I will quote the late biologist Francisco Varela. In a report to the Dalai Lama about recent progress of neuroscience he said this:

> When we perform a cognitive act, for example, we have a visual perception, the perception is not a simple fact

of an image in the retina.
There are many, many sites in the brain that become active.
The big problem, Your Holiness, is how these many, many active parts become coherent to form a unity.
When I see you, the rest of my experience, my posture, my emotional tone, is all a unity. It is not dispersed, with perception here and movement there.
How does that happen?
Imagine that each one of the sites in the brain is like a musical note. It has a tone.
Why a tone? Empirically, there is an oscillation. The neurons in the brain oscillate all over the place. Each goes *whoomph* and then *ffhhh*. The *woomph* is when different places in the brain oscillate, and these become harmonised. When you have a wave here, a wave there, from different parts of the brain, several become harmonised, so they oscillate together.
When the brain sets into a pattern, to have a perception, or to make a movement, the phase of these oscillations become harmonised, what we call phase-locked. The waves oscillate together in synchrony…
Many patterns of oscillations in the brain spontaneously select each other to create the melody; that is the moment of experience. That is the *whoomph*. But the music is created with no orchestra conductor. This is fundamental.
You don't have a little man there saying, "Now you, and you, and you."[22]

How is the symphony in the brain happening? Consciousness is identifying with the brain's correlated collection of quantum gene activators in many brain areas while trying to see the external object through it, and getting captured in the brain's tangled hierarchy and becoming the quantum self. Only the quantum measurement theory as elucidated in the previous pages can explain the quantum self-experience.

The quantum self-experience is a momentary experience and the brain becomes quantum momentarily all over to accommodate the quantum self—nonlocal binding happening on a large scale. Can the brain become coherent all over on a permanent basis? For long term meditators of loving kindness, indeed the brain changes showing coherence all over (read the book *Altered Traits* by Goleman and Richardson who also collected the data). It takes not physical mechanisms like so-called quantum gravity of a neuronal mass in the brain but ongoing creative experiences to produce macroscopic quantum coherence in the brain.

Can there be Self-Identities in other Organs of the Human Body?

One general prediction of the quantum theory of consciousness is that wherever there is perception and memory making capacity, the resulting tangled hierarchy should give rise to a conscious self-identity. There is now evidence of "little brains" both at the heart and the navel chakras and so the quantum model predicts self-identities at these two chakras beside that at the brow chakra—the site of the cortical self-identity. There is now data supporting the additional self-identity at the heart[23]**.** The common experience people report of their falling in romantic love always refer to the heart; this new theory and data are showing that this popular perception is not wrong.

The importance of this discovery should not be missed. It shows that the physiology of the organs and the associated feelings in humans can be changed via quantum leaps of vital creativity (fig. 5). The ancient system of Ayurveda had suggested it; now we have verified the idea [23]**.**

In Order to Better Theorize, Scientists Need to Experience the Entire Spectrum of Conscious Self-experience

The idea of spiritual transformation of our self-experience is millennia old. In modern psychology, it was proposed by transpersonal psychologist Ken Wilber[24]**.** In a book, *The Quantum Brain*[25]**,** we have given an explanation of the spectrum of self-experiences based on the concept of the preconscious domain between the quantum self-experience and the ego-experience; for the preconscious we have found plenty of neuroscientific verification. The signature of

the states of consciousness beyond ego is the feeling of an expanded consciousness that has the ability of caring for others; in other words, the transformed people's expanded consciousness is inclusive of others whereas the ordinary ego-consciousness is me-centered and contracted.

The psychologist David Hawking[26] has suggested that there may be as large as fifteen percent of the world's population today that practicees meditation on a regular basis. A substantial number of these people experience higher states of consciousness with expansion.

My personal experience with materialist researchers of consciousness is that they have a systemic deficiency in how they experience consciousness—always me-centered and contracted. This gives them the idea that consciousness is me, the I behind the me is illusory. In this way, when they theorize they unabashedly depict consciousness as an object.

Should we take experiences seriously in science, as scientific, they being subjective and all? As the physicist Bernard D'Espagnat[27] has pointed out that thanks to quantum physics we have to change our Newtonian concept of strong objectivity—observer independence--to weak objectivity—observer invariance which is the idea that in order to count as scientific an experience should be similar from one observer to another. Quantum physics already demands it, even cognitive psychology.

The experience of expansion of consciousness in response to certain stimuli such as in intimate relationships certainly passes the criterion of weak objectivity. It behoves scientists to pay attention to this kind of well-known phenomenon of consciousness before they theorize about it.

Summary and Conclusions

In summary, we have demonstrated that quantum measurement theory alone leads us to an interpretation of quantum physics on the firm foundation of the metaphysics of monistic idealism—consciousness is the ground of all being. Additionally, it gives us a new paradigm of quantum science of consciousness and all living and human experiences. Most importantly, in this paper we have shown how consciousness and its ideas are embodied in the material bodies of the living and the sentient. The problem of how there can be quantum in the brain and other organs of the body even at the macrolevel in spite of the phenomenon of decoherence has also been solved.

In conclusion, I would like to say that the integration of science and spirituality that began with the publication of my book *The Self-Aware Universe* is now basically complete. In their avoidance of the spiritual nature of consciousness and the world of experiences, materialist researcher of consciousness and neuroscience are ignoring another veritable source of information about consciousness: human experience. A clever combination of three unsolved problems of science—quantum measurement, consciousness, and quantimizing gravity—is tantalizing to the intellect, but it says nothing about how we experience consciousness itself in a spectrum of increasingly expanded quantum nonlocal nature starting from the almost Newtonian ego-me.

The propounders of the wisdom traditions did not propose the idealist ontology based on rational mind gymnastics; they did it on the basis of direct experiences that all pass the test of weak objectivity. To demonstrate the acuity of their observation, let me cite another example: they also had a framework in mind for how consciousness comes down to the gross macrolevel of our experience; they proposed the sequence Causal level to subtle level to gross level. Over millennia, this depiction has had many misleading interpretation. Now quantum measurement theory is clarifying the idea. The subtle level constitute possibilities including nonmaterial possibilities. The causal level (consciousness) acts on the subtle possibilities to produce the gross experience of embodied self and software of experience.

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