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THE PARTICIPATING MIND IN THE QUANTUM UNIVERSE[1]

Menas C. Kafatos & Keun-Hang S. Yang

ABSTRACT: The Orthodox interpretation of quantum mechanics, which followed the Copenhagen Interpretation but was enhanced by primarily Werner Heisenberg and John von Neumann into a fully developed theory, brought in, among others, the role of measurement, available choices and response of the quantum system. It is, more consistent and clear than other interpretations of quantum mechanics as it provides account of the interactions of observers with the external world. As such, the Orthodox interpretation does a lot more than just account for physical interactions in the atomic world, which was the original goal of quantum mechanics in the early part of the twentieth century. In this article we present several issues that may have been answered or need further development, such as measurement and observation, what is Nature and who the observer is. Extending Orthodox quantum mechanics, leading to universal non-dual Awareness may provide a consistent and integrated view of reality and is consistent with advances in mathematical theory. An issue of paramount importance is what are the philosophical underpinnings or ontological view of the quantum nature of the universe and the role of human minds, observations and choices.

KEYWORDS: Mind; Consciousness; Quantum mechanics; Copenhagen Interpretation; Orthodox interpretation; Brain science; Free will; Qualia; Subject; Object; Philosophy; Fundamental mathematics; Hilbert space; Measurement problem; Von Neumann; Universal Principles; Gödel's Theorem

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INTRODUCTION

Quantum mechanics (QM), and its modern evolution, quantum field theory (QFT), remain the most successful theories of matter and along with Einstein's general theory of relativity (GR) account for the microcosm and the macrocosm. Moreover, QM has many profound implications for the role of the mind in views of the universe and opens the door to the whole issue of the nature of consciousness. The nature of the mind, how it arises, whether consciousness exists beyond the mind and the physical brain, these questions continue to challenge all of science, including physics, brain science and biology. In addition, the vexing problem of subjective experience, is not accounted by current science and it may even be beyond physical processes. Even though QM is at the foundation of physics and biochemistry, many neuroscientists hold the view that the brain has nothing to do with quantum mechanics. Scientists in several polls when they are asked what are the top two most important and unsolved topics facing science, they respond, the nature of the universe, and the nature of conscious experience (Kafatos, 2015). There may be the case that these two profound issues could be closely related to each other.

QM opened the door to the view that the mind and observational choices play a fundamental role in the nature of reality. The quantum measurement problem remains a challenge for both theory and the interpretations of quantum experiments. In fact, as Kafatos (2015) pointed out:

> The problem of measurement in quantum mechanics and the role of the observer have been part of quantum theory from the very beginning of its founding but have still not been resolved and remains the central reason for having so many different interpretations of quantum theory, is how to take into account measurement and the so-called "collapse of the wave function". The standard von Neumann (1955) interpretation of orthodox quantum theory, is that the unitary time evolution of the quantum state is interrupted upon measurement and a particular value emerges, given by theoretical quantum probability. What specific value will emerge though, quantum theory cannot predict.

Observational choices in the laboratory are related to the context of what is to be observed, measured and concluded. As Richard Feynman, John A. Wheeler, Martin Rees and other physicists hold, without observation, quantum systems don't even have any properties. Wheeler (1981) stated, "no phenomenon is a phenomenon until it is an observed phenomenon", which forms the foundation of the participatory universe. On would conclude that the observer's choices play a fundamental role in the "external" reality that one observes and as such, theory cannot be divorced from observations: The observer is an integral part of the process of what is to be observed and understood. Quantum theory opened the door to consciousness but did not provide a

solution (Kafatos and Nadeau, 2000; Kafatos, 2015).

As such, what used to be in the domain of philosophy and metaphysics (cf. Kant, 1996; Morgan, 2002) the origin of the mind and in more general terms examining the nature of consciousness and how consciousness arises, can now be approached by a discussion between science and philosophy.

For example, in Immanuel Kant's philosophy (cf. Kafatos, 2015) experience is seen as fundamental. One important consequence of Kant's views is that "one never has *direct* experience of things, the so-called *noumenal* world, and that what we do experience is the *phenomenal* world as conveyed by our senses." (Ref. *Wikipedia)*. Kant's philosophy tied to experience, supports the idea that qualia, the attributes of experience, play a fundamental role in our views of reality. Idealism is also a central feature of the philosophy of Georg Wilhelm Friedrich Hegel cf. (Redding, 2014): "Hegel's principal achievement was his development of absolute idealism as a means to integrate the notions of mind, nature, subject, object, psychology, the state, history, art, religion and philosophy". Hegel's philosophy connects to modern complementarity, one of the three universal principles discussed further down.

The emergence QM had a profound influence in the philosophy of Alfred North Whitehead (1925, 1978). Although originally having developed ideas related to mathematics, in the 1910's and 1920's he turned his attention to philosophy of science and metaphysics, departing from most western philosophy. His ideas mesh well with the foundations of quantum mechanics, arguing that reality consists of events rather than matter, that "events cannot be defined apart from their relations to other events" This would reject the view that reality is fundamentally constructed by particles of matter, existing independently of each another. His *Process and Reality* (Whitehead, 1978) forms the foundation of process philosophy. In Whitehead, process philosophy and QM are intimately connected, directly tying philosophy to modern physics, perhaps yielding to a future merging of science with philosophy (Whitehead, 1925 and 1978).

ORTHODOX QUANTUM MECHANICS

The recently published book *Quantum Theory and Free Will: How Mental Intentions Translate Into Bodily Actions* is the latest, most eloquent and perhaps more ambitious book by Henry P. Stapp (2017), where he lays the thesis of the connection between the physical world and the mental world. Stapp (2017) makes the case that not is quantum mechanics not just a most successful theory of the microcosm but that it connects Reality, whatever that term may mean, to ourselves in a most fundamental way. Specifically, it gives meaning to observational choices to explore physical interactions, it puts these choices and free will that they presuppose into the very fabric of scientific

inquiry and in a sense connects all levels of experience. These points were of course brought out in the early versions of quantum mechanics (cf. Kafatos and Nadeau, 2000), what we now know and accept by the term Orthodox interpretation of QM. The specific version of QM we are talking about, and there are several such interpretations, is what developed from the original Copenhagen Interpretation through primarily the work of Werner Heisenberg and John von Neumann. The Orthodox interpretation developed into a view of the world that brings in the role of observation, measurement and free choices, to just mention some of the most important aspects of the quantum world, as important as specific predictions of dynamics and evolution of quantum systems. These predictions are so accurate and wide ranging, that physicists even today, more than a century after the beginning of the quantum revolution, focus on the scientific results and often bypass or ignore the profound implications of the quantum paradigm.

The Copenhagen Interpretation (CI), the Orthodox version which enhanced it and we would emphasize replaced it (cf. Tomonaga, 1946: Schwinger, 1951), is bringing in, among others, the role of measurement, choices and response of the quantum system. It is, more clear than other quantum views on the interactions of observers with the external world. As eloquently shown in numerous publications the Orthodox interpretation does a lot more than just account for physical interactions in the atomic world, as the original QM was striving to do in the early part of the twentieth century. To quote from Stapp (2017):

> That upheaval revised our idea of science itself, and thrust our conscious thoughts into the dynamical process that determines our physical future.

The Newtonian view that the universe operates like an intricate mechanical clock presupposes that an atom has at each instant of time, a well-defined location in 3D space. Kafatos and Nadeau (2000) showed that the one-to-one correspondence between physical aspects, assumed to be "real" and theory describing such physical aspects is an ontological assumption. As such, physical properties are completely determined by prior physical properties, and there is no input from our conscious thoughts. Werner Heisenberg emphasized that in the Newtonian universe "*mental*" realities completely determined by the *physically described* properties of the associated brains and nervous systems (Stapp, 2017).

In the Orthodox view, QM should be based on properties that we can choose to measure—this is where "free choices, not determined by "physical" laws alone, enter the picture. The mental aspects of psycho-physical observers are paramount, as Stapp (2007, 2009, 2017) emphasizes. The classical view seems unnatural (Stapp, 2017):

> According to that classical scenario, nature goes to the great length of creating a seemingly new kind of stuff, mental reality, which, however, has no physical

> function or effect. Such an arrangement seems unnatural.
>
> Quantum mechanics, on the other hand, assigns to mental reality a function not performed by the physical properties, namely the property of providing an avenue for our human *values* to enter into the evolution of psycho-physical reality, and hence make our lives meaningful.

Moreover, (Stapp, 2017):

> In classical theory all causal effects in the world of matter are reducible to the action of matter upon matter. In QM our conscious intentions and mental efforts play an essential and irreducible causal role in the determination of the evolving material properties of the physically described world.

Then Stapp (2017) states:

> An adequate basic scientific theory of reality must explain all of the regularities of human experience. That totality includes not only data pertaining to the motions of planets and terrestrial objects, and the evidence from atomic physics, but also the evidence concerning the observed effects in our everyday lives of our conscious intentional efforts upon our subsequent bodily behavior. These ubiquitous facts of everyday life exhibit a strong positive correlation between one's conscious intention to produce a desired bodily action—such as the raising one's arm or the moving one's finger—and a follow-up bodily motion of the intended kind. Thus my mental effort to raise my arm is normally quickly followed, if I focus my intention upon it, by the rising of my arm. An appreciation of this correlation between subjective mental intent and subsequent physically described reality is far more important to the normal living of one's life than the periodic motions of some tiny pin-points of light in the night sky. What matters most to us is what we are able do about our physical future, and how we are able do it. In this connection, the every-day-experience-based belief in the causal power of a person's mental effort to influence the subsequent physically described reality is rationally buttressed by the fact that contemporary (i.e., quantum) science supports that intuition, rather than diminishing us by claiming, as did classical physics, that the experienced causal effectiveness in the physical world of our mental intentions is "the illusion of conscious will".

In Heisenberg's view, quantum mechanics allows for "potentialities" for certain experiences to occur. As such, QM opened the door for observers to actively participate in the universe, rather than being separated from it, as classical physics assumed.

Modern neuroscience has made great strides in our understanding and treatment of neuronal disorders and syndromes, psychophysical conditions, well-being, mental health, assisting psychotherapy and by extension understanding the entire human

being which crucially depends on well-functioning brain. However, it has achieved precious little in our understanding how subjective experience, decision making, and free will arise and how they relate to the physical brain and our entire psychophysical existence.

NEUROSCIENCE, MEMORY AND FREE WILL

Neurologist Paul D. MacLean (1985a and 1985b) formulated the *Triune Brain* model, according to which the skull holds not one brain, but three components, each representing a distinct evolutionary stratum, namely: Primitive Brain (Reptilian Complex), The Limbic System (Old Mammalian Complex, or Paleomammalian), and The Neocortex (New Mammalian Complex, or Neomammalian). The division of the brain into three large components is a highly simplified conception, whereas functionally the connectivity between all three components is as important or more important. Distributed functionality is easy and natural in the quantum paradigm. Although the Triune Brain model is a highly simplified explanation of brain activity and organization, it formed a very influential paradigm, and forced a rethink of how the brain functions.

The three components have the following characteristics (cf. the Neuropsychotherapist, or NPT):

The Primitive Brain (Reptilian Complex) This part is responsible for the most basic survival functions, breathing, heart rate, body temperature, etc. and orientation in space. The functions of this part of the brain take precedence over other brain areas and functions.

The Limbic System (Old Mammalian Complex, Paleomammalian) Often referred to as the "emotional brain", it is the reactive part of the human brain responsible for "fight or flight" responses to present danger. The hippocampus, the amygdala and the hypothalamus form a very fast subconscious evaluation and response system designed for safety. "The amygdala makes very fast, albeit not always accurate, evaluations and has a fast track from the thalamus (incoming information) through to the hypothalamus that can initiate a stress response to forestall impending doom. The hippocampus plays an equally important role by encoding events in time and space and consolidating them from short-term to long-term memory".

The Neocortex (New Mammalian Complex, Neomammalian) The neocortex is responsible for all higher-order conscious activity such as language, abstract thought, imagination, and creativity, it is the advanced intelligence brain. It houses much of a person's memory, all of the automatic memories essential to talking, writing, walking, playing music, and many others. The prefrontal cortex is much slower in responding to

incoming information than the limbic system, but is much more sophisticated in its processing.

> Such "slow" thinking is the hallmark of our human intelligence. Complex and new thinking on technical, emotional, social, and logical planes takes place here. It is where we can be rational and logical, creative and inventive. But, significantly, the prefrontal cortex can be "hijacked" by the limbic system in the event of a perceived threat (whether imagined or real). Our prefrontal can "go offline" as blood flow is directed to the deeper limbic system, the first responder on a priority one mission to keep us safe.

Memory is distributed across the entire brain, depending on the functions, such as motor memory, higher order memory, etc. For example, the limbic system keeps memory of time and space as well as emotions, i.e. it is responsible for many qualia of experience.

Neuroscience presents a great opportunity to link the natural and social sciences, in a true interdisciplinary fashion. Ploog (2003) discussed possible connections between the natural and social sciences that could be pursued, particularly for mental disorders:

> Many mental illnesses are marked by severe deficits in social behavior and social communication. The social communication system disintegrates, especially in the major psychoses. The response choices to social or other external signals in a given situation become limited or even distorted, and reasoning is no longer part of decision making. The emphasis of this contribution is on the disintegration of social behavior in psychopathology, based on evolutionary psychiatry. MacLean's concept provides valuable insight for understanding the biological roots of human social behavior and communication. It is time to uncover the ties between the natural and the social sciences.

In further works "where" memory is associated in the brain (see Memory ref.), Karl Lashley (1890-1958), researchers and psychologists have studied where memory is associated. They have been searching for locating the engram, a hypothetical permanent change in the brain accounting for the existence of memory, a memory trace, the physical trace of memory. Lashley did not locate the engram, but he did suggest that memories are distributed throughout the entire brain rather than stored in one specific area. Three brain areas play significant roles in the processing and storage of different types of memories, namely the cerebellum, the hippocampus, and the amygdala, with the following emphasis in encoding: Cerebellum: procedural memories. Hippocampus: new memories. Amygdala: what memories to store and where based on the strength of the emotional response to specific events. Strong emotional experiences often trigger a release of neurotransmitters and hormones, which strengthen the corresponding memory although autobiographical memory is not

always accurate. We should note that Dewsbury (2002) compared, contrasted, and analyzed the work of psychobiologist Karl S. Lashley.

St Onge et al. (2012) discuss "where" decision-making takes place or more correctly how it is associated with the brain. In risk-based decision making, separate prefrontal-subcortical components mediate such decision making. Different biases enter the picture involving more certain or riskier options. Here choices (which would relate to what we can call "free will"),

> between smaller, assured rewards or larger, uncertain ones requires reconciliation of competing biases toward more certain or riskier options. We used disconnection and neuroanatomical techniques to reveal that separate, yet interconnected, neural pathways linking the medial prefrontal cortex (PFC), the basolateral amygdala (BLA), and nucleus accumbens (NAc) contribute to these different decision biases in rats…These findings provide novel insight into the dynamic competition between these cortical/subcortical circuits that shape our decision biases and underlie conflicting urges when evaluating options that vary in terms of potential risks and rewards.

What does neuroscience say about free will? MacLean's model of the brain provides valuable insight for understanding the biological roots of human social behavior and communication. However, it is not clear if it provided connections between the natural and the social sciences, which would seem necessary. We know that emotions, memory, which is affected by emotions, neuronal conditions, all affect choices and free will. How "free" is our will depends on what type of decisions we face, the context of such decisions and patterns that exist in the psychophysical human beings.

FUNDAMENTAL CONSCIOUSNESS AND QUALIA

Orthodox QM has produced a paradigm wherein the mind plays a fundamental, participatory role in understanding and interacting with the universe. It has gone much further than other quantum ontological views. The question remains, can we go beyond the implied dualities? Is the separation between object and subject fundamental? What is the ultimate "stuff" or reality? Where is the "Heisenberg Cut"? (the cut according to Stapp "being the transition between quantum events and an observer's information, knowledge, or conscious awareness. Below the cut everything is governed by the wave function; above the cut a classical description is used"). von Neumann (1955) was arguing that the cut is arbitrary. If it is arbitrary it means it is everywhere and nowhere.

Can we express in a mathematical formalism the fundamental relationships between subjects and objects? If yes, it is important to understand the common

framework that may be applicable to all levels of experience, as revealed primarily by the quantum nature of interactions but, by far, not limited to interpretations of QM. The world of experiences reveals three fundamental Laws of Nature applicable everywhere (Kafatos, 2015): *Complementarity, recursion and creative interactivity*.

Complementarity (or *Integrated Polarity*) is the principle where, ultimately, the *apparent opposites become unified at the deeper level* of universal Consciousness (Kafatos, 2017). Complementary relations are to be found everywhere, which point to a deep, generalized quantum reality and as such we have an indirect argument that QM is the starting point for developing a scientific framework of consciousness. Roy and Kafatos (1999) applied complementarity to the brain. A consequence of the generalized principle of complementarity is that horizons of knowledge exist (Kafatos and Nadeau, 2000; Theise and Kafatos 2013a; 2013b). Boundaries, or horizons of knowledge, *are not absolute*: In the Orthodox view, they depend on the act of observation (Kafatos, 2015).

The second Law is *Recursion* (or *Correspondence*), which allows knowledge to be gathered and persist, a universality linking all levels of existence together and simply stated, "as here, so elsewhere" (Theise and Kafatos, 2013b). Recursion assures that relationships and patterns extend beyond particular levels to all levels of existence. For example, all fields obey certain quantum rules; all physics laws apply everywhere; all electrons obey the Pauli Exclusion Principle, etc. The world operates through recursive relations at and between different levels.

The third principle, *Creative Interactivity*, provides a framework of interactions at many different levels. Interactions between subjects and objects; between sentient beings; between objects and objects; between cells and cells, etc.

The three Laws *give meaning to the universe*, they are the workings of how Consciousness manifests the universe and apply at all levels, beginning with the fundamental subject – object relationships and the mathematics of Consciousness (Kafatos, 2015; Kafatos and Kato, 2017).

The ontologic framework of Consciousness or fundamental non-dual Awareness is described by Theise and Kafatos (2016):

> Non-dual Awareness is foundational to the universe, not arising from the interactions or structures of higher level phenomena. The framework allows comparison and integration of views from the three investigative domains concerned with the understanding nature of consciousness: science, philosophy, and metaphysics. In this framework, Awareness is the underlying reality, not reducible to anything else. Awareness and existence are the same. As such, the universe is non-material, self-organizing throughout, a holarchy of complementary, process driven, recursive interactions. The universe is both its own first observer and subject. Considering the world to be non-material and

> comprised, a priori, of Awareness is to privilege information over materiality, action over agency and to understand that qualia are not a "hard problem", but the foundational elements of all existence. These views fully reflect main stream Western philosophical traditions, insights from culturally diverse contemplative and mystical traditions, and are in keeping with current scientific thinking, expressible mathematically.

Q*ualia* (from the Latin term *qualis,* which means "of what kind") are the fundamental components of how non-dual Consciousness projects out the universe and are at the heart of an experience-based philosophy of mind (Kafatos, 2015). The so-called "hard problem" (Chalmers, 1995) addresses the difficulty of accounting for experience in terms of physical theories and in itself implies the fundamental role of qualia. Erwin Schrödinger (2001) himself held the view that qualia are not material and cannot be accounted by material theories:

> The sensation of color cannot be accounted for by the physicist's objective picture of light-waves. Could the physiologist account for it, if he had fuller knowledge than he has of the processes in the retina and the nervous processes set up by them in the optical nerve bundles and in the brain? I do not think so.

The "hard problem" of consciousness, rather than being a desperate statement, is, instead, a statement that experience cannot involve just the physical and, certainly, not the physical world view of classical physics. It begs a psychophysical approach, a *mental quantum reality.* Experiences or qualia in the world (Kafatos and Kato 2017) are the glue that holds the five senses (vision, audition, somatic sensation, gustation, olfaction) as well many other modalities, together and gives the appearance of an "external" reality. All experiences, whether of the body or the outside world, consist of qualia. Our world only exists because we perceive it and act as conscious agents (Kafatos and Kato, 2017). Thus, all interactions with the universe are experiential and subjective. What we call "objective" in science is that which we can measure within patterns of qualia dictated by mathematical laws. Quantum mechanics is a mathematical model for formalizing and measuring what are nothing other than experiences (cf. Bohr's, 1934 and 1958, view of reality).

The field of pure awareness exists prior to qualia, while subjective experiences in Consciousness are qualia (Kafatos and Kato, 2017), which are sensations, images, feelings, thoughts (or SIFT, Siegel, 2016). Qualia are the experiential attributes of non-dual Awareness. To clarify:

There is no possibility of proving anything existing outside of qualia (Kafatos and Kato, 2017). Qualia are distinct and are tied to the experiencing individuals, they are *not* the same. They have *qualitative* differences, not subject to *quantitative* analysis. This is why qualia are associated with the "mental" realm (beyond physical, space and

time). In fact, space, time, particles, all objects are nothing other than qualia when they are reified, i.e. possible subjective experiences. Mathematics itself is the most *refined* form of qualia. Even our neuronal system is a product of a possibility in consciousness, which has evolved as a mode for interpreting consciousness from a perspective that makes humans unique (Kafatos and Kato, 2017). The underlying world is pure non-dual Awareness, with no qualities, being the pre-created state, in fact the ever-existing state.

Extending the successful Orthodox framework in our view requires going beyond the object-subject separation. This is at the heart of the issue of subjective experience, as the very idea of experience blurs the "boundary" between the subjective and the objective. Is it not, after all, the experience of the other itself an *experience?* Is not the case that the experience of something "out there", "outside" of us, is also an *experience?* Rather than chasing an outdated world view of fixed boundaries, "hard" particles which are after all manifestations of probable outcomes, does it not make sense to take a *reasonable* or *common sense* approach? Quantum theory opened the door to the mental universe *but* cannot account for the nature of the mind, or consciousness or awareness. Simply put, we cannot "take out" the subjective experience from the practice of science (Kafatos, and Kato, 2017). In the end, it boils down as to what the ontological assumptions (or axioms) of a system of thought are. Bohr in the CI argued that QM is silent on this. He opted for an epistemological approach instead. As in the Orthodox QM (Stapp, 2017), we argue that ontology is *implied* in QM (Kafatos 2015) and presents with a new vision of reality wherein qualia play a fundamental role (Kafatos and Kato, 2017):

> Qualia science," as we envision it, resolves the paradox by showing how the universe operates as the domain of consciousness (Kafatos 2011). An external physical universe as a given is untenable in the post-quantum era; it now requires radical revision as our frame of reference for what is really real and what is not, replaced by the participatory universe that all of us experience through qualia. The process of undercutting the five senses is valid, but we would urge that what makes any experience viable—consciousness—cannot be undercut. This distinction rescues objectivity and subjectivity at the same time, in a complementary relationship.

OPEN ISSUES AND FUTURE DEVELOPMENTS

We note here several issues and questions that need, we believe, to be addressed by Orthodox QM as well as by the extended view of non-dual Awareness, beyond the duality that Orthodox QM implies. Is it not after all that a mental view of reality asks for a non-dual framework? The subjective aspect of qualia renders dual insistence to be

outside the quantum framework itself. It is true that the separation between subject and object is required in the study of the cosmos but at the same time, qualia *implies* going beyond the separation, as only a mind-based ontology can achieve.

The vexing problem of collapse of wave function is a good starting point and in fact in the Orthodox QM it opens the door to mental view of the quantum universe, that competing versions such as the many-worlds interpretation and Bohm's ontology do not possess. However, the collapse may be a special case as the work of Narasimhan and Kafatos (2016) who examined the quantum retrocausal experiments implies. In fact, this work points to the important issue of the (mental, in the fundamental Consciousness sense) informational nature of reality and the illusion of a separate observer in space-time. The information "space" can be termed the *plenum-void* and would also account for the existence of a transcendent field of mathematical structures, where the Laws of Nature reside. Nature itself would be the immanent complementary part of the non-dual field of Awareness.

Werner Heisenberg emphasized that in the Newtonian universe "*mental*" realities are, supposedly, completely determined by the *physically described* properties of the associated brains and nervous systems (Stapp, 2017) but in fact, the Newtonian worldview never achieved that. However, Newton did not specifically state the things attributed to him, all these things about brains, mind being a physical outcome, etc. He could not have. These statements were assumed much later on. However, following Cartesian dualism, it is not clear that Newton and his contemporaries thought of the ability (or rather the inability) of classical physics to consistently account for the role of the mind. As Stapp (2017) emphasizes, in the "classical scenario, nature creates a mental reality, with no physical function or effect. QM assigns to mental reality a function not performed by the physical properties, an avenue for our human *values*, hence make our lives meaningful". Even though science is always based on ontological assumptions (i.e. its foundations are philosophical) most scientists are reluctant to consider the metaphysical assumptions of what they do professionally (Kafatos and Nadeau, 1991/2000).

The view proposed here and in previous works (Kafatos, 2011; 2015; Kafatos and Kato, 2017) is that working with physical theories alone will not lead to a unified framework addressing consciousness and such efforts are doomed to fail. The lesson from the quantum view of reality is that the implied world opens the door to mental phenomena through observational choices (cf. Bohr 1934; 1958; von Neumann, 1955; Kafatos and Nadeau, 1991/2000; Stapp, 2007, 2009, 2017). It also opens the door to a true dialogue and interaction with the monistic schools of the East, particularly Advaita Vedanta, Rāmānuja's version of Vedanta, Shaivism and Buddhism (Swāmī Prabhavānanda and Isherwood, 1975; Kafatos and Kafatou, 1991; Swāmī Muktānanda,

1997; Swāmī Shāntānanda, 2003; Singh, 1980, 2006; Swāmī Lakṣmaṇjoo, 2012; Mishra, 2012), as well in the great western philosophical systems of Spinoza, Kant, Hegel, and Whitehead and others; and in the ancient philosophies of Heraclitus, Plato, the Neo-Platonists and in the philosophy of the father of philosophy, Socrates himself (Kafatos, 2015).

Even though consciousness is *implied* in QM, the theory is *agnostic* as to the nature of consciousness. The justification for a mathematical approach suggested by Kafatos and Kato (2017) is that *any* theory in science is based on mathematics and, therefore, to get as close as possible to formulate, or at least to attempt to formulate, a scientific view of Consciousness, we must start from mathematics. Mathematics also provides powerful constructs such as sheaf cohomology that physics theories lack.

In the new quantum paradigm, the mind, human beings, all life, matter. We are faced with a lot of consequences from the new paradigm, consequences which will likely open new opportunities for humanity to advance beyond the current era of strife and division. We cannot deny the power of our minds but at the same time we should be careful to not over-depend on belief systems, which are products of the mind, that are outdated, inconsistent and in fact dangerous for the very existence of humanity. The quantum paradigm, taken to its logical conclusion, gives meaning of life as it makes us all participants and actors in the drama of existence. The inclusion of the quantum element of random chance rather than being a hindrance to the understanding of the cosmos, actually gives meaning to life as it empowers us to use our free will. Extending the quantum paradigm will involve interdisciplinary and transdisciplinary approaches, enabling dialogue between quantum physics and neuroscience, between physics and biology, between science and philosophy, between science and perennial philosophies of the East and the West, between sciences and social sciences.

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