

Some reflections on “*Quo vadis Quantum Mechanics?*” Extending Science further! Let us see where?

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The Center for Frontier Science, Temple University, USA and its director Nancy Kolenda deserve kudos for organizing the conference (2002) on the future of Quantum Mechanics and publishing (2005) the book, “*Quo vadis Quantum Mechanics?*”¹ through Springer, as one of the important Frontier collections.

Seminar’s notion could be found in A. J. Leggett’s paper (Ch. 6) where he cites the “reasons for speculating that the linear formalism of standard quantum mechanics may break down at some stage between the level of the atom and human consciousness.” (p. 83). The contributors have responded differently to this stated notion and the issue revolves around whether nature is deterministic or probabilistic and whether we are dealing with a closed or open system. This is what this book is about with opinions favoring the notion, and the opinions on the contrary.

In this one Volume one could observe a collection of papers on quantum mechanics from sixteen of today’s most eminent theoretical physicists, two of them are already Nobel winner. The contributions are studded with introspection, conservatism, disinterested search for the root of quantum mechanics in classical theories, incisive formulation (L. Smolin, D Aerts and S. Aerts), openness (Avshalom Elitzur), creative and cautious proposition (Gerard ‘e. Hooft) and application of QM in biological system (Fritz-Albert Popp). A *Foreword* by Roser Penrose is the crown in this beauty.

Let us take the application aspect first, biophoton emission from quantum phenomena of biological systems (Ch. 19) by Fritz-Albert Popp. Popp is one of the pioneers of this terrain. Biofields are the fields surrounding the living biological objects² and could have thermal, magnetic, electromagnetic and nonthermal photonic components³. DNA activities and metabolic activities in mitochondria are principal source of emitted biophotons, which if measured in controlled conditions could help in diagnosis and prognostification of conditions like stress, injury and healing and even malignant transformation. It will have numerous applications in twenty first century’s medicine. Katherine Creath and Gary E. Schwartz⁴ have recently reviewed various biophoton-imaging techniques.

Coming back to the subject of QM itself. Quantum mechanics is the most successful theory of twentieth century. However, on its own it is incapable of accommodating (assimilation is far away) the paradox of probabilities and determinism of nature and badly needs some ‘windows’ for survival from suffocation. On its own, that it is a theory of closed system, or a ‘closed-off theory’, has been admitted even by Heisenberg.

How can a completely closed system create puzzles and paradoxes? Puzzles and paradoxes could arise only when the boundary of the system is ill defined and porous! Therefore, a quantum system cannot exhibit all its puzzles unless there is a porous boundary of its domain of activities. Such a system will have three kinds of problems and therefore mysteries, paradoxes and puzzles. Namely those are (i) within the bounds problems and its paradoxes and puzzles, those could be categorized as ‘horizontal’ (H), (ii) across the boundary or the vertical problems and its paradoxes and puzzles (V), and (iii) a combination of two (V-H), the hybrid ones. The vertical problems (V) are of two kinds, superficial (V-s) and deeper (V-d). Superficial problem is how microscopic quantum phenomena are related to emergence of macroscopic reality! V-d mysteries/puzzles are how microscopic reality emerges from submicroscopic or sub-quantum realities! The deeper problems are somehow related to openness of the domain to a deeper reality.

It is the H-puzzles that are described by Penrose (in the “Foreword” of the Volume) as *Z-mysteries* (‘Z’ comes from ‘z’ in puzzle). For example, wave particle duality, multiple superposed states, uncertainty in measuring conjugate properties which are canonically opposite in Hamiltonian sense etc. These puzzles have rooting in Hilbert’s space formalism. Penrose’s *X-mysteries*, ‘X’ comes from ‘x’ of paradox of measurement, are V-s mysteries, the unknown point in the scale where the classical properties end and the quantum properties begin or the reverse. Nonlocality might be cited as an example of Vd mysteries. Some of what we consider as H-puzzles, might have contribution from a V-component and may be actually a hybrid puzzle (H-Vs or H-Vd). Different interpretations of Q.M. that indicate remarkable intellectual ascent of twentieth century, in fact, has been advanced to resolve the above-mentioned mysteries, puzzles and paradoxes.

James Hartle (Ch. 5) points out that “the authors of this book have jointly identified as many as thirteen different interpretations of QM.” “The defining thread connecting interpretations of quantum theory is their agreement on the probabilities for the outcomes of measurements, at least to an excellent approximation”, says Hartle (p. 73). But what is this probability? In quantum physics it is in the context of measurement. However, probability remains an issue for physicists, philosophers and mathematician alike. Then is it not that the issue of probability “strikes to the heart of other foundational problems”? “What distinguishes measurements from other physical processes?” Simon Saunder raises these questions, explains what is this Probability in Ch. 12 and responds to queries raised.

In chapter 11, Diederik Aerts and Sven Aerts try to explore the wonder why the microscopic effects, predicted and experientially verified in QM, remain irreconcilable with macroscopic reality! They offer a model for emergence of classical world from quantum world (p.181). The interesting part of their paper is the role of experience with a ‘happening’ aspect and a ‘creative’ aspect, and how we penetrate, clothe and decorate reality from our experience. This proposition almost brings us to the views expressed by Kant, neo-Hegelian philosopher like Bradley, and also Sri Aurobindo from India, who all distinguish ‘experience’ from ‘appearance’ of the reality. Experience of reality, according

to them, is primary and the appearance of reality is secondary, the result of intervention by mind and intellect on the virgin ‘memory’ of the experience.

While Hans-Peter Durr (Ch. 2) suggests “liberation and purification from classical prejudice” to become “radically quantum” and cautions us not to put “classical egg shells in quantum physics today”, Jeremy Butterfield (Ch. 13) elaborates on “Hamilton–Jacobi Theory as a classical root of quantum theory”. The issue of wave-particle duality in Q.M. could not be resolved by any experiment. In Ch. 16, B.J. Hiley, the co-author of *The Undivided Universe* with David Bohm, ‘traces the mathematical origin’ of the wave particle duality and shows the connection between classical and quantum mechanics in symplectic symmetry. Non-commutative algebra that describes the behavior of dynamic operators carrying symplectic symmetry in Q.M. was the source of notion of implicate order of Bohm, comments Hiley. Beginning from there, he develops noncommutative quantum geometry and explains the classical-quantum transition by *lifting* the ‘classical phase space’ behavior onto a ‘covering space’. One could account for particle properties at the level of ‘underlying phase space’ and wave properties at the level of the ‘covering space’. Yakir Aharonov and Shahar Dolev (Ch. 15) use two-vector formalism from which arises the concept of weak measurement and weak values. This resolves Hardy’s paradox and brings new insights into quantum entanglement.

Three important highlights in this collection are *Time travel*, *pilot-wave*, and *hidden variables*.

Daniel Greenberger and Karl Svozil (Ch. 4) look at the paradox of time travel with their model and conclude that one can travel into the past quantum mechanically but see only those alternatives consistent with world left behind him. There is no possibility to change the past. In the same vein, the future is open and probabilistic to us till we choose to collapse it into one and then that becomes inevitable, – totally consistent with common sense experience. They like to explore further whether the present could change the future by a feed-forward mechanics.

Both pilot wave and hidden variable theories originate to explain some kind of determinism. Simon Saunders however points out (p. 277) that “no one to this day produced a single model of pair creation or pair annihilation events using the pilot wave formalism.” Round table discussion continued on how the issue of pair creation could be handled. Notwithstanding the various views on pilot waves expressed in this Volume, it would be worthwhile to quote another view from William Tiller. “If we choose the electron as our physical particle, then its pilotwave will be defined as the magnetic monopole or “magnon”. Because the magnon is traveling so fast, it weaves a pilotwave shape around the electron and, since it is non-observable by our present instruments, it is located in the vacuum reality and can thus have negative energy and negative mass. The detailed shape of the pilotwave envelope (magnon) will be the Fourier Transform of the detailed electron shape.”⁵

Let us take the issue of hidden variables originally conceptualized by Einstein to explain that God does not play dice with the Universe. Elitzur finds both ‘t Hooft and Smolin to “go to great lengths to preserve determinacy by assuming hidden variables of one kind or

other” (p. 334). Obviously they do it from different point of view. For Elitzur, “hidden-variable theories are forever-hidden-variable theories” (p.333). However, the hidden variables could also be looked as follows. The scientist’s task is to make the hidden variables, if any, revealed. It requires a clear description of the variable and then to predict events on assumption of the existence of the unobservable variable. If prediction comes true, hidden variables are demystified, although they may remain unobservable for the time being. Information glares as one of such demystified hidden variables. Randomness is antithesis of information. Forwarding of a proposal that there are different ontological categories of information, it is possible to reduce discontents that might arise out of making information as one of the demystified hidden variables.

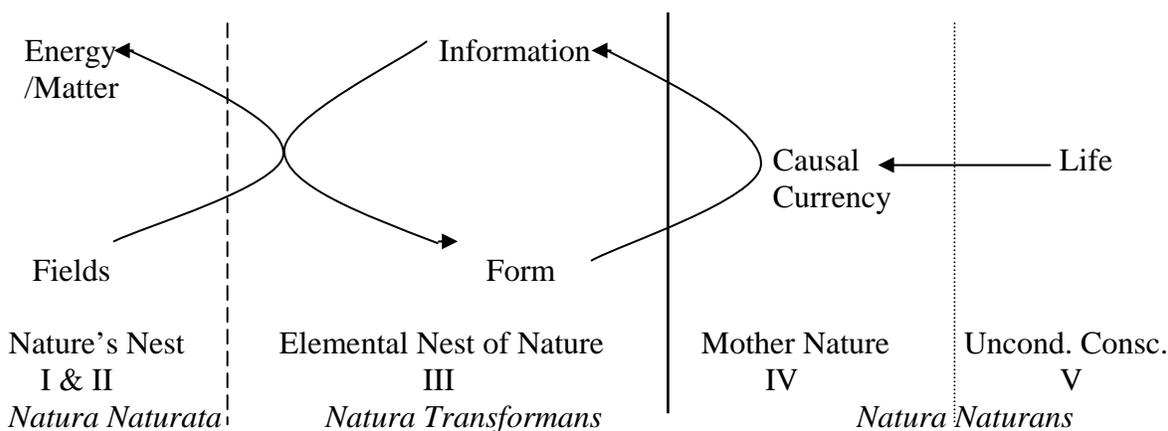
Two other major contributions in this Volume are Carlo Rovelli’s relational interpretation of quantum theory (Ch. 9) and matrix models of Lee Smolin (Ch. 10). While Rovelli indicates the ‘jump’ by stating, “all contingent properties of any physical system are taken to be meaningful only as relative to a second physical system”, Smolin argues, “that the fundamental theory is a theory of matrices”. There is a strange similarity in character of the two proposals. Both proposals show a kind of inescapability although of different kinds. While Rovelli is relativizing any quantum measurement, and it seems this intertwining endless, Smolin is reminded by Anton Zeilinger (p. 125) that the degree of freedom in matrix relationship when quantized, again leads to a bigger matrices. “A matrix of matrices is just a matrix!” You cannot avoid matrices (or quantizing!). A similar endless intertwining could also be observed between ‘happening’ and ‘creation’, as stated by Aerts (Ch. 11. p. 188 and 195), in building up an experience.

Smolin seems incisive to state that the “final fundamental theory will be a theory of matrices.” However, to get a ‘ground’, independent of any background where do we stare at? It seems we have no alternative but to accept *unconditional consciousness* as non-negotiable imperative and also Mother Nature as its trusted custodian. Having accepted *consciousness-as-such* as the ground reality, which would be the great *assumption* for science, it is possible to formulate a unifying worldview, the relational matrices involving consciousness, information, self, mind, space, time and energy in one hand and consciousness, life, information, self, mind, memes and genes on the other.⁶ This sets the major part of the agenda for twenty first century’s science.

There are a few remarkable contributions in this collection which fall outside the realm of any stated or new interpretation of Q.M. Elitzur and Dolev try to put quantum phenomena within a new Theory of Time (Ch. 17). Quantum interaction involves ‘rewriting’ of the evolution in spacetime, - is their hypothesis (p. 344). “The wave function evolves beyond the ‘now’, i.e. outside of spacetime, and its ‘collapse’ due to the interaction with other wave functions creates not only the events, but also the spacetime within which they are located in relation to one another” (p. 346). There one smells a kind of new approach! It is admitted that if we understand ontological origin of Time, many paradoxes could be resolved or assimilated. A freshening newness is felt from the contribution of Caslav Brukner and Anton Zeilinger (Ch. 3) when they try to project quantum physics as a science of information. The door of a closed system is opened up with entry of fresh air. This freshness is strengthened from the contribution of Gerard ‘t Hooft where he asserts on the determinism beneath quantum mechanics (Ch. 8). To him information does not

obey the boundary of the ‘closed box’ of science. However, for him the most “difficult thing is to find out a Hamiltonian that is bounded from below, and whose ground state is a vacuum that exhibits complicated vacuum fluctuations, as in the real world.” (p. 99). Does it not sound like an echo of a great spiritual saying, the Grace is omnipresent but how many of us are in the ‘State of Grace’ to acknowledge, accept and actualize its effect?

Let us share here some reflections from my published view on ‘information’ in *The Millennium Bridge*⁷. That information could cross the ‘boundary’ is a radical view indeed. The view could be supported by evidence from black hole. Nothing could pass across a black hole except information! It is proposed that information has a mechanics of its own which is independent of quantum mechanics. The issue is in which recess of nature, information could have an independent mechanics? How it is connected to quantum mechanics? To get into that, it is imperative to look into the nature as an extension of consciousness and as having a nested hierarchical organization. The coil of a spring on lateral view looks like level. So does the nature in relation to consciousness. Nature looks ‘nested’ because its one level is within the other, not above or below (unlike in pyramidal hierarchy). ‘Hierarchy’, because all of the ‘superficial’ is within the ‘deep’ but not vice versa. It is this ‘not vice versa’ which offers a sense of hierarchy. From surface to deep, those are classical nest (nest I), quantum nest (nest II), elemental nest (nest III), Mother Nature’s nest (nest IV) and the nest of *unconditional consciousness* (nest V). While macroscopic classical nest (Nest I) somehow, at some point of scale, transits into microscopic quantum nest (Nest II), it is logical to infer that penetrating through quantum discontinuity or quantum void, microscopic quantum domain communicates with submicroscopic sub-quantum nest of nature (nest III) for elementary phenomenology which includes de-conditioning and reconditioning of existential properties. Consciousness, on the other hand, is indissolubly wedded with nature and this nature (nest IV) that is most intimate to *unconditional consciousness* (nest V) may be called nascent nature, nature of all natures or Mother Nature. While in nests II and I, one sees *natura naturata* (created nature), and in nests IV and V *natura naturans* (creative nature), nest III is the domain of *natura transformans* (nature in transformation) (Fig. 1).



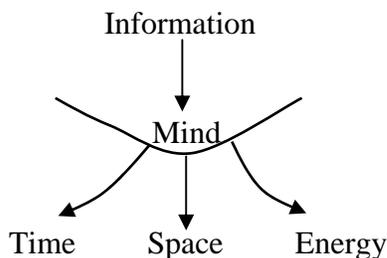
Pentaune model of nature-consciousness

Fig. 1

(Modified from *The Millennium Bridge*, 2000, p. 90)

While the transition boundary between nests I and II is not known, that between nests II and III is porous at quantum discontinuity and quantum void. The transition between III and IV is the toughest since the entry into nest IV demands ‘surrender’ of all properties and for getting back into nest III, there occurs an inside-out phenomenon. The most flimsy boundary is encountered between nest IV and nest V. When one’s nature becomes Mother Nature, one is consciousness. Every nest has a mechanics of its own, run by a specific currency. In the elemental nest (nest III) of nature, information acts as a currency. Consciousness (nest V) plays its mechanics with currency of ‘life’. The ‘life’ as currency in nest V and the information as currency of nest III are connected by an intermediate currency, that might be called ‘information manifold’ or ‘causal currency’, the currency of nest IV. A non-living entity can never generate new information. For all practical purposes, the origin/source of new information is ‘life’. Attila Grandpierre⁸ has recently elaborated the link between ‘life’ and information. The inescapable challenge to twenty first century’s scientists is the nest III of nature and information mechanics therein. Without gaining mastery of mechanics in nest III it is not possible to assimilate the puzzles and paradoxes in nest II and it is impossible to connect it (QM) with mechanics of nests IV and V.

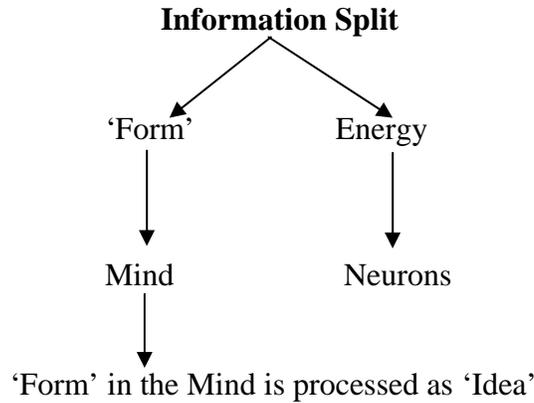
In a paper on the composite Model of Psyche⁹, there is a sketch indicating relationship between information, mind, space, time and energy. To sum up the idea in the paper, specific information gets selected by a mind that is primed and prepared. The selected information impregnates the receptive mind. The pregnant mind delivers the ‘form’ inside information by an inside-out phenomenon. Form is made of space and time. The process is accompanied by release of energy as well (Fig. 2).



Mind ‘conceives’ information and delivers space, time and energy

Fig. 2

All that our sense experience could tell us of is form and movement. Therefore, the message in information needs to be translated into ‘form’ and energy. Mind or a mind like structure and process in nature, could only execute it by an inside-out phenomenon. The purpose of this inside-out phenomenon on information executed by the mind is to deliver ‘form’ (space and time) and energy. ‘Form’ goes back to mind as ‘idea’ and is processed there. Energy is used by neuron. This ‘information-split’ explains the basis of psychosomatic connection (Fig. 3).



The basis of psychosomatic connection: Information split

Fig. 3

The proposition makes a compelling case to look into the *relational matrices* of the extraordinary family members, information as father, mind as mother, and space, time and energy as three children in the family!

The relational matrices constantly remind us of aesthetics and values. A relationship continues to work only in accordance with mutually agreed value-systems of its constituents. This axiology of values observed in relationship of space, time, energy, form and information, emanates without violating the ontologic consciousness that forms the ground, independent of any background. Phenomenology of consciousness, i.e., not-happening, 'happenings' and the 'set of happenings', (for example creation of information, mind, space, time and energy) are subject to acceptance of this ontologic status of consciousness. This also requires 'surrender' to its axiology i.e. the phenomenology of consciousness requires approval of axiology emanating from its ontologic status. There are, it is admitted, epistemic constraints to realize this agenda of consciousness in the brain. And, these epistemic constraints are introduced by *perception of uncertainty* – the root or origin of all probabilities encountered in epistemology. There are perception-independent bifurcations in nature. However, on the ground of consciousness, those appear as divisions of the Indivisible.

The chapter one brought me much joy with Elitzur laying down brilliantly all the expectations from an anticipated theory. He deserves congratulation for his imagery, for he retains sanity and clarity, and balances the 'sacrifice' and 'unexpected dividends' observed in the genesis of a new theory. A new theory would be appealing to persons who expected it to come. Its 'beauty', 'unity', 'continuity' and the ability for novel prediction (which could not be done by any other existing theory) would be alarming. I pray Elitzur's imagery comes as real in our lifetime that Elitzur has also hoped for!

I was wondering why Nancy sent me the book and marked in the covering letter as a 'review copy'. She knows me as one who coined the term and concept of *supracortical consciousness* in 1985 and is engaged in the expansion of this concept since then. Is there any connection between experience of supracortical consciousness and the material utility or demise of quantum mechanics? To get an answer, one has to go to the last paper of the Volume (Ch. 20) where Henry Stapp responds, "Quantum theory will go where it is most

needed, which is into the effort to understand ourselves and in particular the connection of our minds to our bodies” (p. 397). Stapp’s proposition stands like a visionary’s statement.

Let me explain bit the terms like consciousness, conscious experience and mind. Consciousness forms the background of all experiences. It is the ground Reality of Nature. Consciousness is like the spider, which weaves the net but itself is outside the net. Conscious experience is in the context of a brain or a brain-like structure and process in nature. Three attributes of consciousness that it is impenetrable, a leveler, and purposeful are reflected in conscious experience, which is¹⁰ respectively subjective, unitary and intentional. Gerald Edelman’s characterization¹¹ of any conscious states as being private, integrative and differentiating is consistent with the above statements. Mind, on the other hand, originates with duality of consciousness. In monism, materialistic, idealistic or monism of consciousness, there is no mind. “Mind is that which cuts consciousness into two” (Sri Aurobindo). Mind separates two conscious systems. Mind is the gap. End of Mind is the beginning of consciousness. Mind acts as an organ of communication between two conscious systems. As there are different levels of consciousness, so there are various layers of mind in between.

Other than consciousness or its phenomenal hands, what else could assimilate paradox of closed and open system in one hand and probabilities and certitude on the other? Consciousness assimilates those paradoxes through information, often by creating new information. Information is that what reduces uncertainty (Shanon). Following the principle of *simila similibus* information originates out of uncertainty in conjugal relation of nature (mostly ‘life’) and consciousness. New information is the language consciousness speaks. Along the evolutionary scale, consciousness is seen to get ‘concentrated’ in neurons, especially in the organized conglomerate of neurons. However consciousness is not merely neurocentric. It is also independent of neurons. Consciousness is there where no neuron could be found. Consciousness certainly could be also brain-independent. Evidence for existence of brain-independent consciousness could be cited from neurophenomenology (e.g. out of body experience, autoscapy etc.) and neurobehaviorism (e.g. love, altruism, disinterested search for Truth).

Supracortical consciousness as a being-consciousness is the first milestone of a stable experience of brain-independent consciousness by a brain-trapped consciousness by means of self-consciousness. It seems to be the first visible result of the effort of an ever-evolving brainstem-limbico-cortical brain to internalize, systemize and rather ‘biologize’ the universal or even transuniversal consciousness. The existence of supracortical consciousness nullifies the view that there is nothing above or outside the cerebral cortex in the context of neuroscience. It also affirms that the present cerebral cortex is not the last mantle of the brain. Further evolution of the organ brain in this case is a natural expectation!

The concepts of multiple universe(s) and supracortical consciousness are so intimately related that the two may be looked as a pair of twin. We all try to figure out the boundary of the universe under constrain imposed by the cerebral cortex. For scientific pursuits recognized as ‘successful’ so far, there is one and only one universe. English dictionary

does not offer a plural for the universe assuming that the universe is only one. In *Conquering the Brain*¹² (1995) the plural for universe has been taken as multiverse. Multiple universe(s) form a system, the “Multiversity”. In scientific cosmology the suggestions for existence of multiple universe(s) come from (i) Black hole theory (e.g. Wheeler’s white hole and worm hole; baby universe and Black hole within black hole multiverse of Lee Smolin¹³), (ii) Inflation theory (e.g. Alan Guth¹⁴ and ‘Eternal Inflation’ multiverse of Andrei Linde¹⁵) and (iii) the String theory (according to Shamit Kachur, a Stanford theorist, the number of potential universe may be nearly one followed by hundred zeroes). ‘Eternal inflation’ multiverse is based on quantum fields theory (QFT) and black hole within black hole is grossly based on general theory of relativity. The theory of multiple universe(s) is an open-ended theory. So is the theory of supracortical consciousness. The meaning of transcortical could be transuniversal as well.

Could this supracortical consciousness be expressed in a language the physicists may find easier to understand? Probably yes. To do this let us understand Penrose’s position first. To quote from his “Foreword” in the Volume,

“It is a striking fact that almost all the interpretations of quantum mechanics, that do not involve an actual change in the quantum formalism, depend to some degree on the presence of consciousness for providing the ‘observer’ that is required for effective realization of the **R** procedure and the consequent emergence of a classical-like world. My own position is to take issue with this, and to regard some form of an objective *physical* **R** procedure to be a necessary ingredient of an improved theory of quantum mechanics. This is not to say that I believe that the admittedly mysterious phenomenon of consciousness has no connection with the measurement paradox of quantum theory. Far from it; but my belief is that this phenomenon *depends* upon an objective form of quantum **R** procedure – not that it is *responsible* for **R**”.

This ‘R’, as envisaged by Penrose, is an objective **R** (**OR**).

J. Andrew Ross, a writer and the philosopher and the author of *Lifeball* has posted his new book, *Mindworlds. Consciousness and Related Studies*¹⁶ in the Net. In the last chapter (Ch. 16) titled, “Roads to Realty”, subtitled “Penrose and Wolfram Compared”, (pp. 283-299) he reviews Penrose’s work and position, as Penrose himself clarified it in the Foreword of this Volume. Near the end of the chapter, Andrew Ross quotes Penrose, the last few lines of his quote add further relevance to the subject.

“.....I envisage that the phenomenon of consciousness – which I take to be a *real* process, arising ‘out there’ in the physical world – fundamentally makes use of the actual **OR** process.”¹⁷

Following this, Andrew Ross expresses his wonders, “How cortical processes can relate to **OR** is obscure, but **OR** is a quagmire issue that nobody expects to solve in the near future”. Continues he, “It seems to me that the Emperor’s new mind, regarded as the subjective entity that reflects or complements *reality as a whole*, at least as we currently understand it, deserves to instantiate its own named variant of consciousness. I would like to suggest that we call this variant *supracortical* consciousness, to exapt a term I first met

in the works of A. K. Mukhopadhyay, an Indian professor of Medicine who is also an accomplished mystic philosopher.” Andrew Ross defines supracortical consciousness in his own term, “Supracortical consciousness may be described to a first approximation as a unified state of phenomenal reality that quangles with the omnium from moment to moment and thus enables us to regard ourselves as living in a superficially classical physical world.” (p. 297). J. Andrew Ross is the first one to make a connection between supracortical consciousness and Penrose’s position.

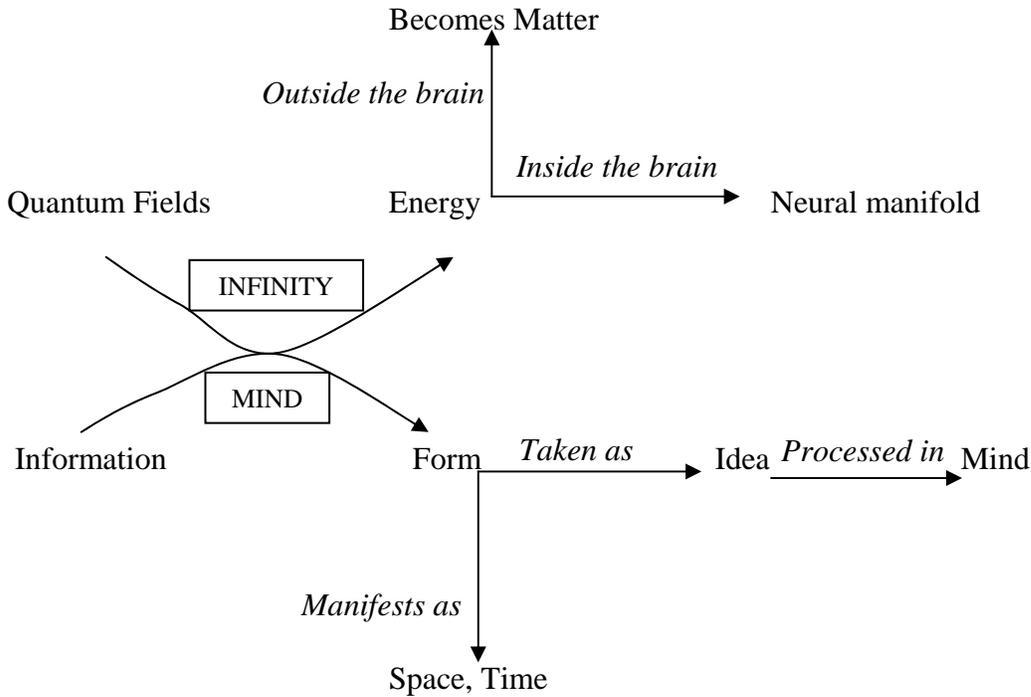
Penrose, although, admits the subtlety of the concept of information and is ‘out there’ for a solution, not only experiences Emperor’s new mind but also recognizes a dangerous quagmire and finally is seen to bounce back to what is safe and is his favorite, the Relativity and, therefore, misses the spirit of creativity. It is difficult, although not impossible, to catch creativity in the language of mathematics, the language Penrose is familiar with! Similarly if someone follows Penrose and collapses *omnium* in preference to multiverse, one proves too hasty to catch the ultimate, and as a consequence, again misses the phenomenal and creative hands of consciousness! Creativity involves a bit of love (sharing), sex (desire to continue), ego (conditioning) and existential issues of life and death. It also requires what we need to get into the multiverse, the relational matrices of consciousness, information, space, time, matter and energy.

Being ‘out there’ is, however, the first inescapable step to make a new beginning. This new beginning sets a demand from the scientists, the exploration of a new system, “The Multiversity” with pluralism at the highest intellectually comprehensible level. For the humanist it seems equivalent to exploration of supracortical consciousness. It certainly offers a new frontier to neuroscientist, the context of further evolution of the human brain.

We have yet to address what is the ‘quagmire’, which Andy Ross points out! Its location is ‘out’ there, in nest III of nature. Penrose uses the word ‘quanglement’ (probably meaning quagmire of quantum entanglement) to describe it. In the language of mathematics, the nearest approximation of the issue is the ‘problem of infinity’ encountered in quantum fields theory. The issue interests us since it is related to generation of space and time from information by quantum fields!

It has been stated that mind makes information’s inside out to create space, time and energy. This may be true in the context of human activities but how can it explain creation of space, time and energy inside this universe or for space time energy for the universe itself? What could be the equivalent of structure, properties and process of mind in nature? In *The Millennium Bridge* it is proposed and argued that nature’s ‘mind’ is in the nest III. Nests IV and V are independent of mind. No mind, which is formed to act as organ of communication between two conscious systems, could be found out there in nest IV or V. Mind ends at the boundary of nest III and IV of nature. What could be the mind-equivalent structure and process, which might execute ‘inside-out’ operation on information? Taking cue from Fig.1, it may be said that it is done by ‘fields’ in the nest III. The recognized ‘fields’ in nest III of nature are quantum fields. The quantum fields which are studded with the ‘problem of infinity’ are suggested to play the role of mind.

The above statement has a link with the quagmire which is apparent because of a gross twist in the fact of the mathematical statement that says, quantum fields theory faces the problem of Infinity. To untwist and straighten out the fact there is this suggestion, a radical indeed. It is *to reverse the directionality of connection of quantum fields with infinity* i.e. to look at the quantum fields as they really are, as the ‘messengers’ of infinity! When *quantum fields are messengers of infinity* (consciousness!) and a human mind realizes those *as such* the person does not observe a quagmire, but looks at the fountainhead of creativity (Fig. 4). The fountainhead is at the meeting point of answers of three fundamental questions addressed in *Prasna Upanishad* and *Brihadaranayk Upanishad*; who am I?, what is this world?, what is *consciousness-as-such*? What follows this realization in the brain is a cascade of reversal in the steps of conceptualization caused by the glimpse of supracortical consciousness. The whole neuraxis behaves as an inverted tree with branches down as peripheral nerves and the roots of the tree are open to infinity (Inverted Neuraxis)!



The Point where Mind, World and Infinity meet
Fig. 4

Having gone through this Volume, *Quo vadis Quantum Mechanics?*, I may further stretch out to respond to the physics of supracortical experience in a more affirmative way. Supracortical consciousness is the sense that keeps the brain open at the boundary of the universe. The remarkable feature of supracortical consciousness is that it brings human being from the center to the boundary of the universe, where the brain remains informationally ‘open’. And, you, me all know that exciting things happen at the boundary, be it a discovery, a new creation or terrorism! If one looks carefully at the physics of relational matrices in supracortical consciousness, I believe, it would appear

similar, may be identical, to that of multiple universe(s). Supracortical consciousness co-exists with multiple universe(s).

Suparcortical experience is the experience of that ground which is independent of any background. The grounding of this background-independent-reality is, however, done in the brain. We call it experience of supracortical consciousness. Supracortical consciousness is not the end, nor the *omnium*. It is a new beginning for the brain, the beginning of realization of the experience of an experience-independent reality, the Reality of consciousness and its nature (Mother Nature). In addition to oneness, a new kind of pluralism is its outcome. Here, there is “multiplicity without derogating from its own unity”, “All and the One are the same existence.” It is a “unity which no play of multiplicity can abrogate or diminish” (Sri Aurobindo).¹⁸

For quantum mechanics to be general operational and to have a realistic framework where hypothesis of an independent existing reality is taken seriously one has to consider the reality as happenings and set of happenings, – asserts Diederik Aerts and Sven Aerts in Ch. 11 of the Volume. In supracortical worldview too, space is no longer the ground for events and time is not merely a recorder of happenings. Space and time, like energy, are themselves happenings. ‘Happenings’ and the ‘set of happenings’ in turn, are constituents of a reality we call consciousness and its nature (Mother Nature). If quantum mechanics were to be ‘global,’ it has to be event based, opines Geoffrey F. Chew as well in Chapter 18 (p. 352) of this Volume. He also suggests for an ‘information reservoir’ in nature. If information really does not obey the boundary (‘t Hooft) of present science (cerebral cortex and the universe), then why can’t we consider that this information reservoir in nature (Geoffrey Chew) is in dynamic communication with information in the ‘global workspace’ (Bernard J. Barr¹⁹) inside the brain?

The experience of supracortical consciousness realizes within the brain, oneness of different information found in nests III, II and I of nature. In experience of supracortical consciousness there occurs a fusion of different personal realities and realities in nature’s nests I to V. The presence of different categories of information makes the situation probabilistic. At the same time, oneness of several information categories makes it deterministic. Supracortical consciousness, therefore, could be the ‘resonance’ of probabilities and certitude. It is the most intimate image of intertwined arrow of time and probabilities²⁰. This openness to information warrants an extraordinary integrity of the system, which would be both axiological and phenomenal, in addition to classical and quantum integrity as we are familiar to ordinarily.

The proposition opens up new frontiers for neuroscience! Could the brain behave as ‘t Hooft’s “Hamiltonian that is bounded from below and whose ground state is a vacuum that exhibits complicated vacuum fluctuations as in the real world”? If it were not the brain as a whole could the candidate, be at the microscopic level, the free dendritic spines of cerebral cortex? Or, could those be the synaptic clefts in the superficial neuronal layers of the cortex? Could this Hamiltonian be *Phonon*, concentrated in the dissipative structure in and around these free dendritic spines of the cerebral cortex so that the system, although remains informationally open, could explore, in association with

Photon, the possibilities of different scopes for materializing it at classical level with the help of a password obtained from 'conformon'? (Conformon is the wave package of energy that maintains *conformity* of DNA, enzymes and other macro structures. Ilya Prigogine relates conformon with life. Penrose too finds conformal operator in Twister's space). The picture remains incomplete without Neutrino since without its intent it is impossible to change the old conformity upheld by conformon. What we ordinarily call different states of consciousness could then reflect the selective and gating status of a network of neurons sorting out information bouncing on the boundary of the system brain! Selective and gated informational openness of any system (including brain) could, therefore, assimilate its both horizontal and vertical puzzles. Selective exchange of information across the boundary could account for V- and V-H puzzles, and gated arrival/departure of the selected ones may explain H-puzzles of the system.

Are we near the probability of a fusion of Evolution and Creation? Most likely! When the *self (consciousness)* of the system wills to come out of conditioned existence (*ego*) of *life* and, the desire (*sex*) is so intense that the system is ready to pay the price equivalent of *death*, the system may be called to be at evolutionary threshold. Such a primed system could get engaged with the *creative poise* of Mother Nature. Her hands extend as an extraordinary constellation of Neutrino, Conformon, Photon and Phonon. Superposition of creative poise of Mother Nature on the system at evolutionary threshold could change the meaning, context and the purpose of the system altogether.

Could the experience of supracortical consciousness be translated into an experience of space-time? Probably yes! Supracortical consciousness is experienced when for the being the *time* as fourth coordinate of Minkowski's space, *time* as fourth coordinate of Hilbert's space and the causal *time* ('t Hooft) (?in spacelessness) reach the point of singularity in personal time. Corresponding three spaces merge in personal space. Could it ever happen realistically? Of course, yes! And, it is the occasion when further evolution of the brain gets initiated. Probably it initiates somatic mutation and/or recombination of neuronal genes. Probably it also brings a stir in the stem cell pool of the brain! All these processes contribute in creation of new space and new time according to necessity of a new brain-consciousness! The experience of supracortical consciousness is, therefore, not the end. It is a new beginning. This openness, information selection, information gating and a stir in stem-ingredients could be applied to all systems in which we observe evolution.

Supracortical consciousness becomes an experience when the quantum 'discontinuity' (the 'sink' of quantum nest of nature) and the quantum 'void' (the fountainhead of quantum nest of nature) superpose in the perception of the being in such a way that the person is able to answer in one voice simultaneously two questions; (i) *Quo vadis* (where are you going) quantum mechanics? (ii) *Unde venis* (where do you come from) quantum mechanics? And the answer is, I suppose, classical mechanics, quantum mechanics, information mechanics and causal mechanics are mechanics in their own rights, independent but interconnected, and are ontologically governed by the mechanics of consciousness. Let me conclude that this is the agenda for twenty first century's science. This agenda is not merely scientific, but artistic and humanistic as well. It is not less spiritual either!

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