

Exploration of General Systems Theory (GST) with Quantum Physics, Theory of Relativity and Neurophysiology may provide new frontiers of knowledge, and evolution

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Abstract:

Conservation laws of physics developed to study isolated closed physical systems cannot describe biological and human systems, since these systems are open, dynamic, strictly irreversible and are Goal directed systems where effect determines the cause. They are better studied using General Systems Theory, where entropy/order and information are more important than say energy [1,2]. It is also argued that methodology of science itself needs to be examined critically [4], as one studies only a limited set of parameters in the laboratory, but a number of parameters gets added up when results of the study are taken out of laboratory and generalized to large scale. It is also argued that Godel's incompleteness theorems indicates stringent limitations on the capability of the modern science to know the truth [3]. Hence one has to talk of the concept of consciousness, and which takes a specific meaning, in the light of General Systems Theory. A number of models involving quantum physics as applied to brain sciences are then summarized, which may act as parts of this grand General Systems approach for better understanding of the concept of consciousness. It appears that even telepathy and clairvoyance may exist but may not obey the space-time invariance conditions of the modern science.

I. INTRODUCTION:

As per climatologists, only six years are left, before beginning of irreversible processes on the Earth, which may dramatically influence the life support systems on our planet. Hence, it is suggested to critically examine the fundamental laws of the modern science and their limitations when they are used to study the human-environment interaction. Actually one finds that scientific methods developed to study the physical systems are not adequate when human systems are included, because all biological systems are essentially irreversible in nature, are open and dynamic systems compared to the physical systems which are

closed systems. Also they have memory, free will, creativity, tendency to interact strongly with other fellow beings and the environment. Furthermore, there are micro controls in the form of thought processes having a property of infinite amplification which makes it difficult to study them in a strictly scientific way. Now as per the latest research, they also follow quantum physics like rules. Thus standard process of scientific experimentation is not possible to study such systems in a perfect way. Not only this even, the basic parameters used in science like energy, mass, linear momentum and angular momentum, used to describe closed physical systems [5], may not be the best choice for describing the biological and human systems. General Systems Theory (GST) is used for better understanding of these systems, because GST can give a better picture of the interconnectedness of various components of the Human systems and human-environment system. The limitations of scientific methodology is also being described by the Godel's incompleteness theorems. Hence it appears that it will be necessary to explore the concept of consciousness for better handling of the current problems and new concepts might be required to handle the current problems of the society.

In this context, we describe various models developed to study different aspects of brain sciences and psychological phenomena also involving quantum physics [6]. They include Bose-Einstein condensation in biological systems, tunneling of electrons through synapses and neurotransmitters, implicate order, Fantappiè's argument about involvement of retarded and advanced waves in the living systems, Penrose model of objective reduction, Penrose and Hameroff model of Orchestrated Objective Reduction [7]. Finally, it is argued that General Systems Theory should be invoked for better understanding of these models to understand consciousness and its evolution.

II. Science, Technology, Economic development and Entropy:

With the advancements of science and technology, a huge industrial revolution took place in the world, through the concept of economic development. These activities started polluting the natural resources in a highly damaging way, resulting into a large increase in the entropy (disorder) in the biosphere and the society. Some examples [8] are given below to illustrate this:

(a). Mixing of hydrocarbons like petrol and diesel with air and water, which are otherwise distinctly separate, (b). Spread of industrial chemicals and other pollutants in rivers and ponds, (c). Flow of millions of tons of fertile soil in the sea every year, (d). Adulteration of food and medicines and many industrial products, (e). Spread of electromagnetic pollutions, surrounding us and in atmosphere due to very large increase in use of mobiles, internet and other electric gadgets, (f). Decrease in orderliness in music and increase in noise, (g). Mixing of roles of men and women, (h). Increase in corruption and black money and use of multiple credit cards, due to which unaccounted money is diverted from main economy to accounts which are not counted in GDP and so on.

Creation of the so called non-biological ordered systems (say concrete jungles, industries, machines which do not carry any form of life) in the name of economic development has basically led to generation of huge entropy in the biosphere. Such ordered systems can be called as “Non-biologically ordered systems”. Now to understand the root cause of these problems, one has to closely examine the basic laws of science and find out whether this type of analysis can provide better alternatives and new directions of development.

III. LIMITATION OF THE SCIENTIFIC METHODOLOGY AND ITS EXTENSION:

Any phenomenon is called scientific if it can be verified in a laboratory under given set of controlled conditions and is reproducible at any other point of time and place. This condition is called space-time invariance condition. In all scientific experiments, one measures a small set of parameters and then correlate them to get some relations, which then turn out to be rules and laws, which can be used for welfare of the public. Thus when high yielding varieties of wheat were introduced in the country then experiments were conducted in small plots under “controlled condition” by selecting those varieties and confirming the claims that they do give higher yields. These results were then recommended for large areas, which has happened in Punjab and other parts of the country. Now over years, this has ultimately resulted into degradation of the soil on a large scale and depletion of the ground water in Punjab. This has happened because while conducting the experiments (laboratory scale), such long term consequences are not looked upon. Means some parameters like extra use of water and fertilizer is not taken into account. These factors then

become important when large scale extension is made in the long run. There is a need now to closely examine these “benefits of science” to the society in general and their links with the scientific truth.

IV. LIMITATIONS OF SCIENTIFIC METHODOLOGY DUE TO CONSERVATION LAWS:

In addition, we define conservation laws in physics which are foundation of all scientific measurements. Thus we have conservation laws for energy, linear momentum, angular momentum etc. Now all these conservation laws are defined for isolated closed systems, thus approximating the nature. Thus energy is defined as that variable of a closed isolated system which does not change over time. But in principle we can never have a totally closed isolated system. Similarly linear momentum is defined as that property of a closed isolated system which remain invariant with any spatial displacement and so on. Hence the mere definitions of conservation laws are not perfect because they first divide the world and then try to define it. The interaction among these systems is then studied by considering the nature and magnitude of the interaction among them. However, in case of biological systems, these interactions are very important.

V. CAN SCIENCE EXPLAIN HOW A PERSON CAN LIVE WITHOUT FOOD AND WATER FOR 75 YEARS: ROLE OF CONSCIOUSNESS

Prahalad BhaniJani, (Male) popularly known as Mataji (Mother) has not taken any water or food from last 75 years. He is a disciple of Mother Ambe and lives



in a cave in Gujarat (India). He was tested for 10 days by a medical team of 21 doctors, but they could not understand anything. His physiological parameters were almost same as that of an ordinary man. Details are available on the site [9]. Now this is a challenge to the modern science. What is the

mechanism of his survival ? The author had an opportunity to meet him two times.

VI. GODEL'S INCOMPLETENESS THEOREMS

The most attractive aspect of scientific knowledge is its mathematical basis. We generally feel that this mathematical representation of various scientific facts makes our knowledge more precise and accurate. However, from the following theorems which have been put forward by the great mathematician Kurtz Gödel, we find that any mathematical representation of any physical reality limits our knowledge of that reality. Not only has this but the theorem also implied that none of the languages or representation can express the reality of nature with perfection. Complete knowledge must necessarily have its foundation in an unexpressed, unmanifest field of intelligence. See []. These two theorems clearly show a need for a concept of consciousness which may provide a better description of reality.

VII. WAVE FUNCTION OF IGNORANCE: HOW THE PROCESS OF MEASUREMENT IN QUANTUM PHYSICS TAKES AWAY THE INFORMATION FROM US:

With the developments of quantum physics, which explains the properties of microscopic particles of matter, it is too well known that a Schrodinger equation describes the wave function of a system. But the wavefunction contains a number of Eigen states of the system implicitly such that in a given measurement, system reduces into only one eigen state whose probability is given. However, this process of measurement takes away information about other Eigen states. So essentially the process of measurement takes away information from us.

VIII. PHYSICAL SYSTEMS VERSUS LIVING SYSTEMS AND THE GENERAL SYSTEMS THEORY:

For biological systems which are so strongly interacting with each other, interactions can be more important than the individual characteristics of the systems. In fact these individual qualities are constantly changing with time due to interactions at different levels. Also all living beings are essentially irreversible in nature, that is they grow and decay and they are also open systems compared to the physical system's which are being treated as closed systems (with some approximation, [5]). They constantly interact with the environment, say like human beings, who take oxygen from atmosphere and release carbon di-oxide. In addition, human systems have memory, free will, creativity, tendency to interact strongly with other fellow beings and the environment and also have some goal which defines their evolution. Also there are micro controls in the form of thought processes which cannot be easily adjusted in any planned "scientific experiment", which makes it impossible to

do any scientific experimentation on them. Hence biological and social systems cannot be subjected to the strict process of physical measurement and hence they are not exactly describable in the strict terminology of the physical sciences. Therefore such systems are studied in a different way by using statistical procedures. In such methods only some rough trends or patterns are found.

Hence to handle all the above problems, General Systems Theory (GST) has been developed [2]. Different sets of rules are there to describe and understand such systems. As per this theory, all systems are characterized by transfer of information. Here knowledge and order (entropy) are more important than other attributes. Even energy comes next to them. Another most important issue in this analysis is that pure physical sciences are now categorized as hard systems and subjects like sociology, religion, psychology, biology etc are classified as soft systems. It is observed that even religion also falls in this domain as some type of system in which there is information and knowledge transfer going on continuously. Thus religion and science can be put together in this formalism. It is in this perspective that the problem of consciousness should be viewed from a General Systems Perspective. Because here also information and order are very important [3].

IX. NEED TO LOOK AT THE PROBLEM OF QUANTUM CONSCIOUSNESS IN A GENERAL SYSTEM'S PERSPECTIVE:

Antonella Vannini [6] has summarized a number of attempts made to understand consciousness using quantum physics, theory of relativity and neurophysiology. They are given here. The interpretation of Copenhagen proposed by Niels Bohr and Werner Heisenberg, suggests a direct link between consciousness and Quantum Mechanics. This interpretation attributes to Consciousness an explicit role, through the act of measurement and observation, forcing the wave function to collapse into a particle or a wave and determining in this way, reality itself. According to Bohr and Heisenberg consciousness would be an immanent property of reality which exists before the creation of reality

Fantappiè, starts from the Klein-Gordon's relativistic generalization of Schrödinger's wave equation and says that this has two solutions: *retarded waves* which diverge from the past to the future and *advanced* or *anticipated* waves which diverge from the future to the past, and which for us, moving forward in time, correspond to converging waves. Fantappiè observes that the diverging waves are governed by the law of entropy, whereas the converging waves are governed by a symmetrical law, which concentrates energy, produces differentiation, structures and order, and which Fantappiè named syntropy. Fantappiè recognized the properties of the law of syntropy in the living systems, and concluded that living systems are a consequence of anticipated waves.

Walker argued that electrons can tunnel between adjacent neurons, thereby creating a virtual neural network which can actually overlap the real neural network. It is this virtual nervous system that can produce consciousness which can then govern the behavior of the real nervous system. So it was argued that although the brain works on the basis of classical physics but consciousness can work on the principle of quantum physics.

Prof. Herbert Frohlich in 1986 suggested that biological systems can have property of Bose Einstein condensation due to the presence of Biological oscillators which are there in a non-equilibrium state at constant temperature, due to the presence of external source of energy like Sun light. Such biological oscillators are present in all living matter due to the presence of water and biomolecules which have dipoles. These biological oscillators like laser can amplify signals and can also encode information, generated by some external stimuli.

Luigi Maria Ricciardi and Horoomi Umezawa suggested a model of consciousness based on Quantum Field Theory (QFT). Here, the functions of the brain are seen as a consequence of collective quantum order states. For example, memory is associated to "vacuum states". Umezawa and Ricciardi underline that one of the properties of vacuum states is that of developing correlations and order which can extend to the macroscopic level, producing fields which can effect the neural system. Thus consciousness would be the result of the sum of quantum processes, while the neural systems would be limited to the transmission of macroscopic signals.

According to Herbert consciousness is a property which pervades all nature, a basic force of the universe. Herbert reaches this conclusion analyzing the probability principle, the existence of matter (objects are formed only when they are observed) and interconnection (entanglement). According to Herbert, these three principles are directly linked to the fundamental characteristics of consciousness: that is free will, ambiguity and interconnection.

Culbertson believes that memory which is at the basis of consciousness, is a consequence of the change of state of matter in time. In other words, memory is equivalent to different states of matter in time. From this point of view memory is not formed by data stored in the brain, but by links between different states of space-time, and consciousness would therefore be located outside the brain, in the space-time.

Karl Pribram suggested a holographic hypothesis of memory and mind.

David Bohm introduces, an implicate order present in nature, where space and time are no longer the dominant factors determining the relationships of dependence or independence of different elements. Rather, an entirely different sort of basic connection of elements is possible, from which our ordinary notions of space and time, along with those of separately existent material particles, are abstracted as forms derived from the deeper order. These ordinary notions in fact appear in what is called the "explicate" or "unfolded" order, which is a special and distinguished form contained within the general totality of all the implicate order. In Bohm's conception of order, then, primacy is given to the undivided whole, and the implicate order inherent within the whole, rather than in parts of the whole, such as particles, quantum states, and continua. This idea is similar to what is being talked in GST. [8].

X. PENROSE AND HAMEROFF MODEL OF CONSCIOUSNESS DEVELOPED USING QUANTUM PHYSICS, NEUROPHYSIOLOGY AND CONCEPT OF OBJECTIVE REDUCTION:

The material world is composed of atoms and subatomic particles. But atoms (10^{-8} cm) are mostly empty space, as is the space between atoms. If we go down in scale from atoms, eventually we reach the basement level of reality that is Planck scale geometry at 10^{-33} cm,

Objective reduction is an attempt at unifying Relativity Theory and Quantum Theory [7]. Penrose extended Einstein's general theory of relativity, in which matter is essentially space-time curvature, to the Planck scale (10^{-33} cm), the most basic level of the universe, with coarseness, irregularity, and information. Actually loop quantum gravity depicts space-time geometry as quantized into volume pixels, that is Planck scale polygons whose edges may be considered as irreducible spin. Planck volumes evolve and change with time, conveying information as a 3-dimensional spider web of spin. This space-time geometry is nonlocal, as revealed by entanglement experiments.

A particle in one state or location would be a specific curvature in space-time geometry, and the same particle in another location would have curvature in the opposite direction, extending downward to the Planck scale. Superposition of both locations can then be seen as simultaneous curvatures in opposite directions, and hence, according to Penrose, a separation, bubble, or blister in the very fabric of reality. Penrose has suggested that such space-time separations are unstable and will reduce, or collapse to one particular state at a particular time due to an objective threshold intrinsic to the fine structure of the universe. Penrose also suggests that each OR, or self-collapse essentially a ripple in fundamental space-time geometry, which results, in a moment of conscious experience.

Penrose OR is nothing but consciousness Thus Penrose OR is the only worldview incorporating consciousness into the universe. The selections in Penrose OR are not random, but influenced by information embedded in fundamental space-time geometry, and hence are different from subjective reduction discussed under Copenhagen interpretations.

On a much higher level, that is at neuron level, Penrose and Hameroff, believes that consciousness is a manifestation of the quantum cytoskeletal state. Thus they argue that inside neurons there is a "cytoskeleton", the structure that holds cells together, whose "microtubules" control the function of synapses. Microtubules are cylindrical polymers of the protein "tubulin," and major components of the cell cytoskeleton which self-assembles to configure intracellular architecture, create and regulate synapses, and communicate between membrane structures and genes in the cell nucleus. In addition to bone-like support, microtubules and other cytoskeletal components seem to act as the cell's nervous system, its "on-board computer," continually reshaping and differentiating. Actually these microtubules further consist of millions of still smaller structures called tubulins, which behave like quantum mechanical systems and they are the candidates for quantum equivalents of "0" and "1" binary digits used in ordinary computers. In quantum case, they are called qubits. This opens the door to consciousness being nonlocal.

"Orch OR." Microtubule quantum superpositions are proposed to extend and entangle from neuron to neuron through gap junctions (which mediate gamma synchrony), enabling selective brain-wide quantum coherence among microtubules. Actually millions of these tubulins from thousands of neurons can collectively interact through neurotransmitters and gap junctions and can generate group of several different quantum states, known as a quantum superposition state (not directly observable). Such states are however unstable and reduces to one of the state (which is observable) in certain time which is decided by the gravitational self-energy of say two quantum states of the superposition. This process of reduction is called Orchestrated Objective Reduction (Orch OR). This Orch OR is being termed as consciousness. Here Orchestrated means well organized. It means that this transition from quantum reality to classical reality is called consciousness. Decoherence is suggested to be avoided through coherent pumping, actin gelation, ordered water and topological resonances. Entanglement with the future may enable real-time conscious action, and rescue consciousness from the unfortunate role of epiphenomenal illusion. This concept of consciousness seems to be closer to the concept of Chetna (Awareness) as mentioned in Indian systems of thought.

X1. PENROSE'S ARGUMENT THAT HUMAN UNDERSTANDING IS NEITHER DETERMINISTIC NOR RANDOM BUT IS NON-COMPUTATIONAL:

Another interesting consequences of this development is the proposal that human understanding is neither deterministic nor random but is Non-computable, and contradicts the concept used in artificial intelligence that human understanding is completely computable.[10] It presupposes that space-time geometry can have information in spin foams at Planck's level when we consider quantum gravity. Reduction of quantum superposition at this level is governed by this information, which we cannot control. A similar objective reduction occurs at brain level through "tubulins", the quantum systems operating within neurons through microtubules, governed by gravitational self energy and this information at Planck's level.

XII. EXPLORING GENERAL SYSTEMS THEORY TO ORGANIZE VARIOUS INFORMATION SYSTEMS DEVELOPED TO UNDERSTAND CONSCIOUSNESS FROM DIFFERENT PERSPECTIVES:

Methodology of General Systems Theory [11] can better explain the interrelationships among various information layers visualized to understand concept of consciousness using quantum physics, theory of relativity and neurophysiology. A schematic diagram is given below. Although one has to make a beginning from quantum gravity like level, but because of completeness, implicate order is assumed to be the ultimate reality. Various block diagrams are self-explanatory. Some arrows indicate inter connection among different levels. Four different levels are mentioned starting from neuro-synapses level, tubulin level, space-time geometry level and then finally going to implicate order of quantum mechanics. Some more linkages like holographic memory, and those of retarded and advanced waves will also come somewhere in this hierarchy.

XIII. QUANTUM ENTANGLEMENT, QUANTUM INFORMATION AND EXTRASENSORY PERCEPTION:

Quantum entanglement is very important property of a quantum mechanical system. As per Einstein, Podolski and Rosen filed (EPR) paradox, if there are two coupled electrons moving away from each other and are with net spin zero then if spin of one electron is measured and is found to be $+1/2$ in certain direction then the other electron will automatically take a $-1/2$ spin value, if measured at some other time. It is now confirmed that this does occur upto a distance of 149 kilo meters. Means the other electron knows (even at a great distance from the first electron) that measurement has taken place on the first electron. To explain such experiments, it is now suggested that quantum information can propagate backward in time. Such properties are also found in some experiments in psychology and they indicate that processes can take place in brain which imply backward propagation of information in time. These ideas and experiments are again at

very preliminary stage, but strongly indicate that processes like telepathy and clairvoyance may exist in living systems. But this is happening at such levels that they need not follow the spatio-temporal invariant conditions of classical physics, due to irreversible characteristic of living systems and memory.

XIV. CLASSICAL INFORMATION, QUANTUM INFORMATION VERSUS VIDHYA AND PARA VIDHYA:

It is now well established that classical information is very different from the quantum information. Thus classical information flows only in positive time direction, whereas quantum information [12] can flow both in positive as well as negative direction. Means backward propagation of quantum information is possible [10]. It also has properties of entanglement that is information at two different spatial and temporal levels can be strongly related with each other as in EPR paradox. Due to this qubits situated at different places can have strong connectivity resulting into huge capacity to process information and at very high speed. Finally, for a quantum system in a superposition state, if a measurement is carried out to know the state of the system, then, only partial information is obtained (available in the eigen state into which a superposition state has reduced due to measurement process) whereas some information is lost which was available in the other eigen states of the superposition state. As quantum systems are extremely sensitive systems, they are easily disturbed by the so called "decoherent factors" or noise.

In Indian philosophy also two types of knowledge are discussed. They are known as vidhya (ordinary knowledge) and para vidhya (superior knowledge). It appears that vidhya may be the classical information of today and the para vidhya may be the quantum information. The recent arguments that subconscious mind works on the basis of quantum information (working as a quantum computer), so it may be in agreement with the ancient literature that actual knowledge is structured in the consciousness and is hidden from us and is much more than what appears at the observable level. Also one gets classical information from quantum information through the process of objective reduction, hence the ultimate source of information or knowledge could be paravidhya,

XV. CONCEPT OF REBIRTH, KARMA THEORY, PAAP AND PUNYA IN THE LIGHT OF RECENT WORK OF PROF. PENROSE AND HAMEROFF:

Theory of past karmas and that of pap and punya also seems now to fall in the domain of science now since information stored in the space time geometry of a person may have records of all the past births and can influence the working of

brain at very micro level and similarly the activities performed in the present birth also leave some information in its space time geometry, which will influence the next births and so on.

India has great spiritual traditions and our rishi munies and aacharyas have gone into vast details and have practically experienced several dimensions of reality, which modern science is now touching. Once the mechanism of information flow between human brain and the space-time geometry is understood properly, theory of karmas and pap punya could find more rational way.[13]

XVI. DO SPIRITUAL PROCESSES INVOLVED IN EVOLUTION OF CONSCIOUSNESS HELP TO REDUCE ENTROPY PRODUCTION AND RESOURCE CONSUMPTION IN THE BIOSPHERE:

From this analysis, it appears that Indian monks have spiritually ordered mind and the higher stages of consciousness, are associated with less noise and better control of mind, that is in a more orderly state. We seriously feel that the various religious and spiritual practices developed by the ancient Indian seers like Yoga, Meditation, Sadhna and others also results into an overall increase in the order in their brain, and hence a decrease in the rate of entropy production in their brain. If we look at their behavior and daily practices then we find that they consume minimum resources and hence generate least entropy in the environment.

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Appendix 1. General Systems Theory can better explain the information systems existing at various levels in nature.

