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INFINITY IN SPACE AND GNOSIS

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Key words: *intuition, variability, space*

Abstract: *Knowledge can be arrived at analyticaly or indirectly through intuition and contemplation on the paradoxes of the outer world. A critical interdisciplinary analysis of the causes for imperfection and discrepancy in the created and tested concepts about the Universe is made.*

БЕЗКРАЙНОСТТА В КОСМОСА И ПОЗНАНИЕТО

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Ключови думи: *интуиция, изменчивост, космос*

Абстракт: *Познанието се постига аналитично или непряко чрез интуиция и промисъл за парадоксите на околния свят. Представен е критичен интердисциплинарен анализ на причините за и несъответствие в създаването и използването на основни концепции за Вселената.*

The Vedic view of India (spanning a long period that goes back to at least 2000 BCE) classifies knowledge in two categories: the higher or unified and the lower or dual. Higher knowledge concerns the perceiving subject (consciousness), whereas the lower knowledge concerns objects. Higher knowledge can be arrived at indirectly through intuition and contemplation on the paradoxes of the outer world. Lower knowledge is analytical and it represents standard science with its many branches. There is a complementarity between the higher and the lower, each being necessary to define the other. This complementarity mirrors the one between mind and matter.
”Science is a continuous process of ‘truthing’ without ever claiming that you have the ‘whole truth.’”
Lay people often misinterpret the language used by scientists. And for that reason, they sometimes draw the wrong conclusions as to what the scientific terms mean. Three such terms that are often used interchangeably are "scientific law," "hypothesis," and "theory." In layman’s terms, if something is said to be “just a theory,” it usually means that it is a mere guess, or is unproved. It might even lack credibility. But in scientific terms, a theory implies that something has been proven and is generally accepted as being true. Here is what each of these terms means to a scientist: Scientific Law**:** This is a statement of fact meant to describe, in concise terms, an action or set of actions. It is generally accepted to be true and universal, and can sometimes be expressed in terms of a single mathematical equation. Scientific laws are similar to mathematical postulates. They don’t really need any complex external proofs, but are accepted at face value based upon the fact that they have always been observed to be true. Specifically, scientific laws must be simple, true, universal, and absolute. They represent the cornerstone of scientific discovery, because if a law ever did not apply, then all science based upon that law would collapse. Hypothesis**:** This is an educated guess based upon observation. It is a rational explanation of a single event or phenomenon based upon what is observed, but which has not been proved. Most hypotheses can be supported or refuted by experimentation or continued observation. Theory: A theory is what one or more hypotheses become once they have been verified and accepted to be true. A theory is an explanation of a set of related observations or events based upon proven hypotheses and verified multiple times by detached groups of researchers.

Unfortunately, even some scientists often use the term "theory" in a more colloquial sense, when they really mean to say "hypothesis." That makes its true meaning in science even more confusing to the general public. In general, both a scientific theory and a scientific law are accepted to be true by the scientific community as a whole. Both are used to make predictions of events. Both are used to advance technology. In fact, some laws can also be theories when taken more generally. The basic law is intact, but the theory expands it to include various and complex situations involving space and time. The biggest difference between a law and a theory is that a theory is much more complex and dynamic. A law describes a single action, whereas a theory explains an entire group of related phenomena. And, whereas a law is a postulate that forms the foundation of the scientific method, a theory is the end result of that same process.
Some scientific theories are well documented and proved beyond reasonable doubt. Yet scientists continue to tinker with the component hypotheses of each theory in an attempt to make them more elegant and concise, or to make them more all-encompassing. Theories can be tweaked, but they are seldom, if ever, entirely replaced. A theory is developed only through the scientific method, meaning it is the final result of a series of rigorous processes. Note that theories do not become laws. Scientific laws must exist prior to the start of using the scientific method because, as stated earlier, laws are the foundation for all science.
Here is an oversimplified example of the development of a scientific theory:

a. Start with an observation that evokes a question. Why?
b. Using logic and previous knowledge, state a possible ansser, called a Hypothesis.
c. Perform an expierment or Test.
d. Then publish your findings in a peer-reviewed journal. Publication
e. Other scientists read about your experiment and try to duplicate it. Verification
f. In time, and if experiments continue to support your hypothesis, it becomes a Theory

<u>Useful Prediction</u> Note, however, that although the prediction is useful, the theory does not absolutely *prove* that the next result will be the same. Thus it is said to be falsifiable. Real scientific theories must be falsifiable. They must be capable of being modified based on new evidence.
The general meaning of the anthropic principle is that what we observe must be compatible with our existence or, more generally, with the existence of advanced life. Humans can occupy only a universe like ours, and this explains in a sense why the universe is as it is. Today the anthropic principle is often seen as a selection principle operating in the context of the multiverse.
There are two opposing scientific views on the origin of life. Adherents to "panspermia" hold to the position that life is everywhere throughout the cosmos and that life on Earth came from other planets. Some believe the universe may be infinite and eternal, and that life may have no origins, and is an intrinsic feature of the living, infinite universe. Adherents of panspermia tend to view consciousness as an integral feature of the cosmos; as a collective consciousness, which may come to be fragmented and individualized within the brain. Therefore, be it panspermia or abiogenesis, human consciousness can be viewed as an offshoot of the evolution of the human brain. Consciousness can evolve.
Quantum physics revealed an inevitable interaction between observer and observed in the microcosm. Thus, human consciousness entered the realm of physics. Physicists began to consider the role of humans in the appraisal of the physical world. *John Wheeler* said "We are not only observers. We are participators." Whereas the early quantum physicists spoke in broad terms about a conscious observer and an insentient objective reality, later ones began to propose theories to explain how this comes about, by appealing to specific quantum phenomena and to neuroscience. *David Bohm* was one of the first to suggest that consciousness is intrinsic to matter at a deeper level (*implicate order*) of which mind and matter are different manifestations (*explicate order)*. *Roger Penrose* argued that that the human brain is capable of discovering truths which cannot be derived through logic alone. His thesis was that “the brain’s organization would have to be geared to take advantage of non-computable action in physical laws, whereas ordinary materials would not be so organized. With *Stuart Hameroff*, he proposed a theory of consciousness involving microtubules which are important elements of the cytoskeleton. In this theory, consciousness arises when the microtubules induce collapses of quantum coherence. *Henry Stapp* regards consciousness as resulting from the fact that the brain determines itself in a way that defies external representation. Every neural excitation is a quantum code, and consciousness arises when one of the codes is selected. In the view of *Amit Goswami* there are ‘archetypes of mental objects” in the mind which are subject to the laws of quantum physics. He formulates a series of equivalences between position and momentum in physics on the one hand and content and association in the world of thought. *Freeman Dyson* published calculations to the effect that consciousness may not be subject to entropy increase and energy conservation, and could therefore exist *ad infinitum* in the universe.

Some mental phenomena are not explainable in the framework of what we call "classical" mechanics. Let us cite, among others, the phenomenon of awareness, the correlations at a distance between individuals, and more generally the synchronicity phenomena.

Synchronicity phenomena are characterized by a significant coincidence which appears between a (subjective) mental state and an event occurring in the (objective) external world. The notion was introduced by the Swiss psychoanalyst Carl Gustav Jung and further studied together with Wolfgang Pauli. Jung referred to this phenomenon as "acausal parallelism" which are linked by an "acausal connecting principle." Synchronicity effects show no causal link between the two events that are correlated. We can distinguish two types of synchronicity phenomena. The first one is characterized by a significant coincidence between the psyche of two individuals. The significant coincidence appears as a correlation between the psyche of the two subjects, suggesting some type of psychic communication. The second type of synchronicity phenomena, which is closer to what was advocated by C.G. Jung, happens when the significant coincidence occurs between a mental state and a physical state. In this case the physical state is symbolically correlated to the mental state by a common meaning. They appear not necessarily simultaneously but in a short interval of time such that the coincidence appears exceptional. Jung referred to these events as "meaningful coincidences." Synchronistic events between mind and matter seem difficult to explain in terms of correlations between conscious or unconscious minds. For Jung, synchronistic events are remnants of a holistic reality - the *unus mundus* which is based on the concept of a unified reality, a singularity of "One World" from which everything has its origin, and from which all things emerge and eventually return. The *unus mundus,* or "One World" is related to Plato's concept of the "World of Ideas," and has its parallels in quantum physics. Thus, the *unus mundus* underlies both mind and matter. As already stressed, in a synchronicity effect, there is no causal link between correlated events localized in space and time. Synchronicity effects are global phenomena in space and time. They cannot be explained by classical physics. However, in the case of a significant coincidence appearing between the psyche of two individuals one can see an analogy with quantum entanglement.

Synchronicity phenomena, especially those involving a correlation at a distance between several individuals, lead to postulate non-localized unconscious mental states in space and time. Although different regions of the brain subserve specific functions, mental states are not exclusively localized in the human brain. They are correlated to physical states of the brain (possibly via quantum entanglement) but they are not reducible to them. The correlations at a distance between individuals (synchronicity phenomena of type I) could be explained with quantum entanglement, and synchronicity phenomena of type II - with the classical illusion of the collapse of the wave-function. Since the analogy between synchronistic events and quantum entanglement is investigated, mental states (conscious and unconscious) are treated as quantum states, i.e. as vectors of a Hilbert space, moreover- as vectors of a Hilbert space of information. Quantum mechanics rests upon two fundamental properties. First it is based on the superposition principle (superposition of vector states of an Hilbert space). Second it is based on a fundamental phenomenon called quantum entanglement. The quantum system describing the two particle system is a global system, a non-local one. Moreover, in such a system, the particles are heavily correlated, but this property is not determined beforehand, i.e. before measurement. Quantum entanglement and the property of "nonseparability" are properties that are fundamentally quantum, that do not exist in "classical physics". Let us notice that the existence of synchronicity phenomena prevents the mental states to be reducible to physical states of the brain. The mental states are correlated to such states, probably via quantum entanglement, but they are not reducible to those states. Quantum physics is a non-local and non-realistic theory. The projection of our subjectivity in the environment in which we live (synchronicity phenomena of type II), in agreement with quantum mechanics, refutes the local hypothesis ("each individual is in his parcel of space-time") as well as the realistic hypothesis ("the object has a reality well defined independent of the subject who observes it"). Some outcomes of another quantum effect, the Bose- Einstein condensation, in which each particle looses its individuality in favour of a collective, global behaviour, can have important consequences in mental phenomena, for example for awareness (for the emergence of consciousness).

Over the course of the past 75 years there has been a gradual accumulation of empirical evidence in support of a direct connection between mentally expressed intention and physical manifestation. Much of this research has been done using random event generators (REGs) in laboratory settings. Even when overall effects of intention are not found or are small in size, there are meaningful secondary characteristics in the database revealing the apparent agency of the participant. Large scale effects have been noted under a variety of conditions.

The most obvious access point within quantum theory for the effects of intention on physical manifestation would be given by the *Kochen-Specker theorem*, which addresses the consequences of assuming that physical variables have definite values prior to their selection for measurement. Indeed, one way of understanding the theorem is to say that either physical variables have no values before the observables to be measured are selected, or that *contextuality* exists. Contextuality refers to the idea that the values measured for observables would differ depending upon which other observables were also being measured. Quantum theory itself does not appear to determine the selection of observables, so that there is room for human intention to act in choosing which of them is to be measured. In another strategy it has been supposed that intention affects stochastic processes, thereby, in effect, removing actual randomness. In collapse-type quantum-mind theories, the supposition is made that whatever collapses the state vector during measurement in formal experiments in subatomic physics must carry over to the activity of individual people experiencing the reality that they do. The idea is that it is unreasonable to suppose that quantum events can distinguish between the irreversible acts of amplification associated with formal experimentation and everyday observation and that, hence, they must occur informally for everyone. That means that whatever process collapses the state vector, including any decoherence mechanisms, must be extracted from the notion of observation in the context of subatomic experimentation and applied to the situation of everyday life. And whatever that process is, it cannot just occur once in a while, but must be ongoing. The watched pot never boils theorem states that a quantum system cannot change if it is being continuously observed, so that these volitional acts of observation must be closely-spaced, iterated, discrete ones. If, by the Kochen-Specker theorem, observables cannot have fixed values before they are selected for observation, and acts of observation are discrete, then is there anything physically present at all between observations? On a positivist interpretation, the answer is no.

One of the characteristics of transcendent experiences is their noetic quality. And, while we can, of course, question the validity of knowledge stemming from altered states of consciousness, nonetheless it can be fruitful to examine some of the contentions arrived at therein when a whole world seems to be coming fresh-minted into existence moment by moment. The idea is that perhaps the universe flickers, such that the implicate order remains, but its explication as the experiential stream and physical manifestation is constantly being constructed and deconstructed. With regard to the latter, it is not just that the substance of physical manifestation appears and disappears but, given the Einstein equation, so do space and time, as we ordinarily conceptualize them. From the point of view of physical manifestation in spacetime, the flicker rate could be once per Planck time. We can conceptualize a spacetime lattice (with Planck length spacelike separation and Planck time timelike separation) which, in effect, disappears between explications of the implicate order.

Our thoughts are rather continuous. because our experience flickers along with physical manifestation, what appears to be a continuous stream is actually more like a chain whose individual loops become blurred as they occur for us as intentional mental acts.

From a conventional point of view, the usual problem is to understand how the mind can affect a physically closed material system made up of continuously existent matter. Now the inverse problem presents itself, namely, if physical manifestation flickers on and off, what provides for any continuity at all between its iterations? The answer might lie in the notion of morphic fields, patterns that are not themselves physical, but that physical manifestation follows (Sheldrake). There is some empirical evidence for the existence of such fields. The idea is that the morphic fields are present at the level of the prephysical substrate from whence they shape physical spacetime manifestation. And they can be not only selected, but also created, by volition acting at the level of deep consciousness. Hence, while in the nonmanifest state, a selection of a different morphic field can be made, resulting instantaneously in a different physical outcome through the activity represented by the creation and annihilation operators.

There are, of course, many unanswered questions. One is the relation of the flicker rate to changeable rates of observational acts and the consequent timing of intention. Intention, at the level of deep consciousness, persists across iterations of the universe, but that changes in intention could be registered within a single Planck time between instances of manifestation. However, intention expressed within the experiential stream of subjective consciousness could require longer time periods to synchronize with deep consciousness. But this just raises the problem of the relationship of subjective consciousness to deep consciousness and the degree to which it can function autonomously from deep consciousness. Subjective consciousness does not exist on its own, but that its functioning could be largely synchronized with the same "automatic" mechanisms that support morphic fields and only sometimes coincide with creative volitional acts that manipulate the automatic processes. It is also possible that this scheme is too simple and that the mechanisms that maintain the "laws" and patterns of physical manifestation do not stem from the same domain as intentional acts. In particular, creative volitional acts could stem from a deeper level of reality than the automatic processes that sustain morphic fields.

Some hypothesize that all objects in our Universe retain evidence of each event that has occurred to them, recorded chiefly in their particle spin numbers and polarities. They further propose that this information is stored in a holographic form- that is, numerical values referring to the frequency, magnitude, phase, and orientation of the fringes of the wave-interference pattern which is formed when a coherent wave encounters the object and is partly absorbed, reflected and deflected by the object. Being holographic it is located partly everywhere in the Universe as standing waves. The potentially countably infinite capacity of our Universe to store such "quantum holograms", by turning our attention to the celestial objects often called "black holes". Because of the relativistically-continuous contraction and continuous acquisition of more mass, they can serve as "Nature's hard-drives", holding copies of the quantum holograms generated by each new moment of human experience, as well as by each new event which occurs to non-living objects. The "event history" can be accessed by an appropriately-tuned "phase conjugate adaptive resonance" established by outgoing coherent waves produced by the human mind when it "attends to" or "focuses its attention towards" a particular object. Quantum mechanics' original equations included terms which described such phase-modulated wave-conveyed information. But because those terms could increase towards infinity, quantum scientists eventually discarded them, agreeing to arbitrarily subtract infinity from infinity and to call that subtraction 're-normalization' of the equations. Although re-normalization does not cause major inaccuracies in QM equations for total energy, it does eliminate attention to the phase-variation of waves which would account for their enormous information carrying capability. Paul Dirac critiqued renormalization with these words: "Neglecting infinities … in an arbitrary way is just not sensible mathematics. Sensible mathematics involves neglecting a quantity when it is small --- not neglecting it just because it is infinitely great and you do not want it."

Leonhard Euler's $e^{ipi} + 1 = 0$ unites the five fundamental constants of mathematics. "…it is absolutely paradoxical, we cannot understand it, and we don't know what it means. But we have proved it, and therefore we know it is the truth..." Benjamin Peirce.

Large cardinals have been studied by logicians for a century, but their intangibility means they have seldom featured in mainstream mathematics as in the case with the assumption for the the existence of a type of large cardinal known as an inaccessible cardinal, technically overstepping the bounds of conventional arithmetic. In the 1920s, David Hilbert laid down a grand challenge to his fellow mathematicians: to produce a framework for studying arithmetic, meaning the natural numbers together with addition, subtraction, multiplication and division, with Giuseppe Peano's axioms as its backbone. Such a framework, Hilbert said, should be consistent, so it should never produce a contradiction such as 2 + 2 = 3. And it should be complete, meaning that every true statement about numbers should be provable within the framework. Kurt Gödel's first incompleteness theorem, published in 1931, killed that aspiration dead by encoding in arithmetical terms the statement "this statement is unprovable". If the statement could be proved using arithmetical rules, then the statement itself is untrue, so the underlying framework is inconsistent. If it could not be proved, the statement is undeniably true, but that means the framework is incomplete. In a further blow, Gödel showed that even mere consistency is too much to ask for. His second incompleteness theorem says that no consistent framework for arithmetic can ever be proved consistent under its own rules. The coup de grâce was delivered a few years later, when Alan Turing and Alonzo Church independently proved that another of Hilbert's demands, that of "computability", could not be fulfilled: it turns out to be impossible to devise a general computational procedure that can determine whether any statement in number theory is true or false. Gödel's triumph has arrived: the final proof that if there is a universal grammar of numbers in which all facets of their behaviour can be expressed, it lies beyond our ken.

What does this mean for mathematics, and for fields such as physics that rely on the exactitude of mathematics? In the case of physics, probably not much. According to Freeman Dyson "…mathematics and physics are both open systems with many uncertainties, and I do not see the uncertainties as being the same for both." The clocks won't stop or apples cease to fall just because there are questions we cannot answer about numbers.

The most severe implications are philosophical. The result means that the rules we use to manipulate numbers cannot be assumed to represent the pure and perfect truth. Rather, they are something more akin to a scientific theory, our best approximation to reality, well supported by experimental data, but at the same time manifestly incomplete and subject to continuous and possibly radical reappraisal as fresh information comes in. The problems highlighted start when they consider infinite collections of objects and realise they need ever more grotesque infinite quantities to patch the resulting logical holes. Is the concept of infinity itself wrong?. "Infinite mathematics is meaningless because it is abstract nonsense" said Doron Zeilberger. But can we dismiss infinity that easily? Many mathematicians believe not, but we now know that even by accepting even the lowliest, most manageable form of infinity- that embodied by the "countable" set of natural numbers- we usher in a legion of undecidable statements, which in turn can only be tamed by introducing the true giants of the infinite world, the large cardinals. The debate will rage on. The two possible conclusions are equally unpalatable. We can deny the existence of infinity, a quantity that pervades modern mathematics, or we must resign ourselves to the idea that there are certain things about numbers we are destined never to know.