Matter, Consciousness, and Causality

–Space, Time, Measurement, and more

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Abstract. In this article, we refine the elements of physics. We consider [primordial] matter and consciousness [1] as eternal and the causes of the creation of the universe via *causality*. We regard causality as the fundamental and ecumenical principle of the universe. Furthermore, we define space and time in terms of cause and effect, and revisit other important notions in physics.

[1] A word of caution here. A precise definition of formal terms such as consciousness, intelligence, energy, force, matter, etc. is not easily admissible or explicable due to semantics and semiotic character of any language. That is, there is often a conflict between the observer, experience, and narration (words and meaning). An observation is a perceptible or verifiable experience. A particular vocabulary may have a tidy semantics for one set of circumstances but may fail to do so for another set. Thus, no language or vocabulary enjoys a privileged status. Only a highly circular or cryptic language deriving on word-roots, for example Sanskrit, can render a brief definition.

who did create this
how and why
thou enlighten me
with what and where
don’t be shy
what is space and time
name the matter prime
am I dead why
and you’re alive
what we sow
so we reap
everywhere
above and below
everytime
no before no after
what is a particle
what is a wave
wave is a particle
particle is a wave
all is waves
nothing waving
all is particles
nothing still
what is moving
what is still
still is moving
moving is still
evolution is discrete
phases of time coexist
the whole is different
from sum of its parts
is sight right
sightedness is might

1 Introduction

There are numerous unexplained things in nature. We consider a few for illustration here. (i) I prefer nature to artificial constructions, veg to nonveg, oriental culture to western, dance and vocal to music and percussions; like Archi more than Alice and Bob; regard some person and disregard others, etc. I don't have sufficient reason to support these urges. (ii) Why are some people homosexuals? Why do some people undergo change of their genitals? Are these tendencies due to mental illness or bad exposure? (iii) Why are there transgenders? What useful purpose do they serve to society? (iv) While some kids are innate prodigies and creative, some are dead dumb. While some people break down easily after a few failures, others become more firm. This is not necessarily hereditary. (v) There are many stories of phenomenal success and failure in the world in the most (un-) likely places and (acute) favourable conditions. A judge's son can be a criminal; a doctor's son can be an artist; an illiterate person's son can be a renowned scientist or an educationist; an honest officer's son can be a cheat or bluffmaster, a patriot's son can be a traitor, a beggar's son can become a billionaire, etc. and vice-versa. Siblings, who share identical DNA composition, can have different blood groups, contra distinct looks, traits and tendencies, preferences, and life choices. These observations may not have anything to do with upbringing or genetic inheritance. (vi) Why do planets around the sun and electrons around the nucleus move in (fuzzy) circular or elliptic orbits?

It is hard to explain these observations with logic on the ground of nature and nurture alone. We work hard but sometimes fail; we love someone deeply in heart but our hearts break; luck seems not favour us, etc. Incidentally, scientists call such unexplained characteristics as 'inherent' and/or 'random'. An important question arises here: *should unexplained characteristics become self-explanatory by being called random?* It is no less than a magic how randomness and chance seems a better explanation. Rather, randomness, luck and chance explain little by way of a framework, a system, a concrete theory. Answer in terms of randomness is not very satisfying. The world and life seems random, uncertain and unpredictable because we do not know all the laws of nature and their mechanisms [2]. Remember that the word 'random' means *we have no clue for now; there is some unknown (hidden) reason behind.* The history of science, at least, supports and strengthens this stand. Many physical phenomena which were incomprehensible previously are now better understood. Moreover, necessity is the mother of all inventions and construction of theories.

The laws of natural sciences, discovered thus far, are not infallible. Rather, natural sciences are self-correcting. That is, if we learn that something is wrong, we need to find and correct our mistakes. From the history of science, we know that the current understanding of science is better than the previous versions. Thus, the progress or evolution

[2] *We do not yet know all the basic laws. There is an expanding frontier of ignorance.*–R. P. Feynman.

of science is not monotonic. A lot of crests and troughs have surfaced and subdued time and again. Hence, a holistic and radical approach is mandatory to apprehend reality and the universe. From this perspective, there should not be any classical, quantum, string, etc. worlds. These are only abstract mechanical descriptions appropriate under different scales and sizes [3], and there is a pressing need for patchwork. There must be some fundamental principle(s) underlying these worlds unifying the whole universe. The principle of causality [1, 2], in my opinion, is certainly such a candidate. While causality is a natural law in the classical domain, there seems some apparent inconsistency in the quantum domain [3, 4]. However, this is not really true [4]. Moreover, from the viewpoint of a more general physical theory, there should be an explanation for (the "emergence" of) the classical causality. In this article, we regard causality itself as the most fundamental principle of the universe.

2 Causality

The principle of causality comprises the following four laws:

(C1) **Law of causation.** There is some cause/reason for every effect.
Cause(s) can be subtle or gross, individual or common. Cause(s) can be known, unknown (hidden) or forgotten. Cause(s) can be from past, present or future; it doesn't necessarily say that past governs future. Future (in the form of a wish, a goal, fear, etc.) can be a cause in the sense that it can influence and change the course of action. Cause(s) can be purpose (why), sponsor (who), consumer (for whom), meaning (what), condition (when, where, which, in what order), mechanism (how), etc. There can be multiple causes for a single effect; though all causes contribute to the effect, some can be strong and others mild. Effects, in turn, become causes for other effects.

(C2) **Law of compensation.** Something cannot be obtained from nothing. The catchphrase can be *no before no after*. This implies eternity or perpetuity of some basic substance.

(C3) **Law of action and reaction.** There is similar (or resultant) reaction for every

[3] Time is assumed absolute in Newtonian mechanics. In everyday life, either things happen or they don't. There are no probability waves of an event. However, space (distance) and time are relative in relativity and probability waves exist in quantum mechanics, even if they don't affect in our ordinary lives. These are realities of two different realms, both "true" at their respective scales. Scientists have different models of science for different 'realms' depending on the scale of observation. The microscopic Plank sizes, the human cell size and the cosmological sizes respectively produce the models of Quantum mechanics, Newtonian mechanics and Relativity. These models don't overlap; their rules, forces and equations are different. However, the quest is on to discover the Theory of Everything, one which can encompass all these.

[4] *Cause and effect are still related in quantum mechanics, but what they concern needs careful interpretation.*–Arthur Beiser.

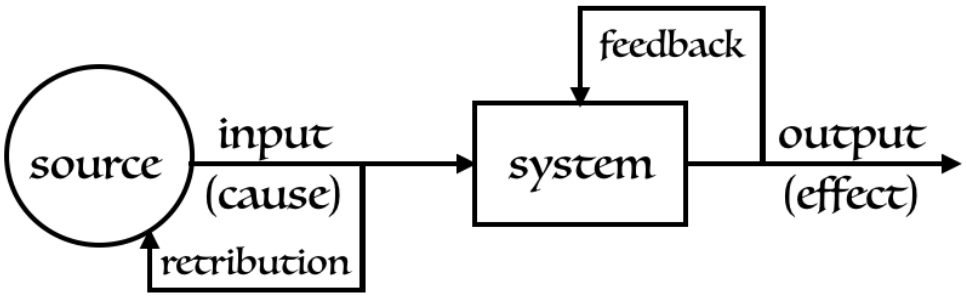

Figure 1: The schematic diagram of cause (input) and effect (output).

action [5]. In particular, action begets reaction [6]. Action is any thought, pronounced word or deed. Colloquilly, it says *what you sow so you reap*.

(C4) **Law of retribution.** Every action paybacks itself first to its source and then to its surrounding. That is, a system does not remain uninfluenced by its action. This is a subtle law. It essentially says that *one rewards or disregards (hurts) oneself before others*.

The causality has impeccable logic, is well-defined, and has internal consistency throughout. This law exists whether we are aware of this or not. A school student may not know of the forces holding together electrons and protons to a nucleus, but they exist, despite her/his ignorance or inability to see and feel them. Infrared rays on the electromagnetic spectrum exist even though we cannot casually detect them. If we refuse to acknowledge the law of gravity, it would not stop acting on us. Rather, we would simply victimize our own self. Gravity and other forces existed even before they were discovered. *Suffering comes from ignorance or misconceptions or violation of natural laws.* There can be no suffering when we align and harmonize with them.

3 Consciousness and Matter

For any purposeful creation, two types of substance or causes are required: (i) an efficient cause (potential and activity) and a material cause (matter). The efficient cause, as its name suggests, must be knowledgeable, intelligent and powerful.

[5] When you favor someone in some form (call this 'positive asset') and that person doesn't favor or acknowledge you in return (call this 'negative asset'), this does not mean that the law of action and reaction is violated. This only means that the negative asset outweighs the positive asset. For example, a body subjected to two unequal forces, one 5 N along the east and other 8 N along the west, will displace westward due to the net 3 N force along the west.

[6] Newton's third law states that *to every action there is an equal and opposite reaction*.

3.1 Consciousness

Consciousness or sentience (sometimes loosely stated as awareness) is the efficient cause of creation of the universe. It is the mind of matter, from elementary entities up to the cosmos. In past, consciousness was considered a myth but people have started believing in it recently. Consciousness and intelligence are closely related. Consciousness is the source or premise of intelligence meaning intelligence ceases to exist without consciousness. *What does consciousness do? It does nothing but everything. It notices, perceives, enquires, knows, understands, longs for, desires, remembers, and sleeps.* Objects have varying degree of awareness. That is, some objects are more aware than others. An object can be conscious without being intelligent, and can harvest intelligence under appropriate conditions.

3.2 Matter

Matter is anything in which "action" and "merit/virtue" take refuge [5]. It is the building material from which the whole universe is born [7]. "Nature" is the basic or elementary matter. It is insentient or inert. It is also an apprentice which portrays, after being initiated or awakened by the scient, a variety of portraits (shapes and forms). Nature reveals itself through "potential", "action" and "inertia" (see Sec. 3.3) which are in equilibrium before universe begins to build. In equilibrium of these three virtues, nature is non-manifesting. The non-manifesting state is the natural but inexplicable and incomprehensible state of matter. Breaking of this equilibrium is called "initiation" [8]. Nature is eternal. That is, energy, matter, etc. is conserved. It is neither created nor destroyed meaning it was, it is, and it will always be there. It just manifests in different forms.

However, information is not conserved because it can be materialised (harvested) and multiplied in the sense that it is not lost when given to others, and does not decrease when 'consumed': sharing information will almost always cause it to increase. In this sense, information is self-multiplicative. Information seems to have an unpredictable life cycle. Ideas come into, go out of, and finally come back into, fashion.

3.3 Trinity of Potential, Action and Inertia

Every entity (subject and object) has three physical aspects: "potential" (P), "action" (A) and "inertia" (I). These three aspects should not be taken literally; rather each represent a class of similar traits (see Table 1). These three attributes are fundamental meaning they are indivisible. They always co-exist. These aspects of matter undergo transformation

[7] *Who created matter?* There are two probable answers. (A1) No one. It is eternal. (A2) It is similar to a spider that is both the material of its web and the intelligence that shapes it.

[8] *When and how does the initiation or awakening occur* is beyond the reach of the author. However, the mechanism of initiation is claimed to be explained in Ref. [5].

from “unmanifest” (dormant or feeble) to “manifest” (dominant). The essence or reality of an object is due to their uniqueness of transformation. The difference between one thing and another lies in the varying preponderances of these properties. Thus, they are the characteristics of relativity, and there is hardly an equilibrium among them. Because of the **PAI-trinity**, all entities have both “veiling” and “projective” characters.

potential (to be)	**action (to do)**	**inertia (to yield)**
strength/capacity	activity/mobility	inactivity/stability
source/force/information	flow/field/energy	shadow/shape/matter
cognizer/perceiver/observer	cognizing/perceiving/observing	cognized/perceived/observed
meaning/knowledge	motion/transformation	manifestation/submission
process/input	processing	processed/output
calm/light	active/vibration	dull/darkness
creator/projector	creating/projecting	creation/projection
ontology/subjective	measurement/interaction	epistemology/objective

Table 1: Trinity of potential, action and inertia.

3.4 Creation of universe

To begin with, we consider the following two viewpoints regarding the creation of our universe:

(1) The cause manifests itself as the effect. The effect, before it is produced, exists as the cause. The universe was always there; it was not created and will not be destroyed. This viewpoint of the universe is not admissible on the ground that we see things undergoing change or transformations, though on different time scales.

(2) The universe did not exist before it was created. The effect is non-existent before it is produced. “Intelligence” and “matter” respectively are the efficient cause and the materialistic cause; creation is the effect.

Consider an entity which is both the cause and the effect itself. Then it verily has the following properties: (i) It is both cipher (dot) and whole. (ii) It is eternal and incomprehensible. Either it does not undergo transformations or its transformations are not manifest. (iii) It is still because nothing affects it. It is dynamic, ubiquitous, mighty and wise because it affects everything seated in it. (iv) It is both local and nonlocal. It is beyond space and time. It has both zero and infinite speed. In summary, this entity must be omniscient, omnipotent and omnipresent. Concerning the creation of the universe, consciousness and the primary matter together is such an entity. Matter is the “vehicle” and consciousness is the “driver”.

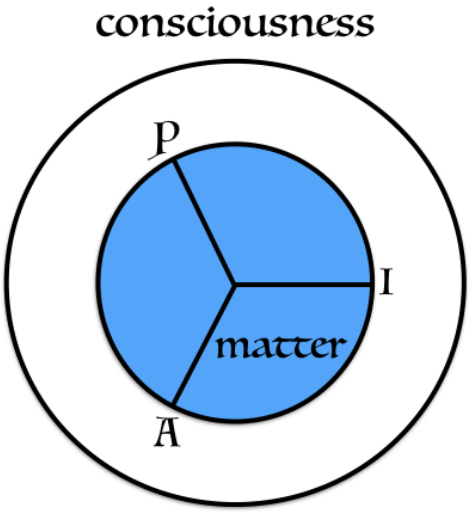

Figure 2: Consciousness (outer circle) transcends over and awakenes matter (inner circle). Matter has three physical aspects: potential (P), action (A) and inertia (I). The universe is the interplay of these three properties. When the PAI-trinity is in equilibrium, matter is unmanifest.

4 Space, Time and Void

Space and time [5–16] have been the subject of considerable interest and concern ever since humans have descended on earth. While space has been disregarded considerably, there are huge volumes of literature on time. Space is widely treated as a mathematical object, a collection of points and distances between them. A precise definition of space and time is still elusive, and remains to be discovered. Below, we propound a concise and precise definition of space and time in terms of cause and effect. We also reflect on quanta of space and time, feasibility of time travel, and connection between space and time.

4.1 Time

There is no consensus on the definition and nature of time. There is no precise and universal definition of time. Here we define time in terms of cause and effect. **Time is the *perpetual flow* of cause and effect**. In this sense, it is not an independent quantity. There is debate on its being real (physical) or unreal (nonphysical). There are some who opine that time is an illusion or unreal [7–10]. One may, however, argue that since this flow or transformation is of energy, matter, etc., it should be physical.

The flow of cause and effect (hence time) is "nonlinear" (circular) rather than linear becuase cause and effect can travel back and forth. However, the causal arrow of time

is linear. *It characterises dynamics (motion).*

When we consider time as the projection of our mind, it is relative. This is evident by the common experience that when one is enjoying time seems to move quickly and when one is in misery time seems to get prolonged.

4.2 Space

Space is the manifested *physical matrix* [9] wherein and whereby (i.e., in which, by which and through which) cause and effect are processed and accomplished (materialised). It is both the container and the contained simultaneously. It is the ethereal womb of universe. It pervades and sheaths the whole universe. Hence, space is not "nothing" but manifested matter matrix [10]. Space, by its composition, is not still. However, it resembles stillness or emptiness because the manifestation (vibration) is very subtle (sluggish). The "potential" aspect of nature is dominant in space. *Initially, space was homogenous and isotropic. It characterises location (place) and direction.* Physical space is more than a mathematical space, which is a set of points (vectors) equipped with a co-ordinate system (frame of reference).

Is space really expanding? No, its not. Here's why. From Rutherford's gold foil experiment, we know that an atom is almost 99 percent empty. If space is expanding, why does not a body composed of atoms inflate and burst up? Is there no space inside an atom and between atoms? There is *a priori* no reason [11] why intra-space (space inside an atom, a molecule or a planet) will preserve and interspace (space between two galaxies) will grow. After all, the laws of nature must be uniform for everyone and everywhere. It appears expanding for two reasons: (i) objects are translocating (sailing) in it, and (ii) sound, light, etc. and/or their sources are weakening in due course. *Recall that space transcends everything "standing" in it. Therefore, when an object moves from one place to another, the space it occupies does not move*. Reciprocal translocation is without gain or loss of the construction material, i.e., matter. On the contrary, if we consider space itself moving, various questions arise. Where or in what is it sailing? If it is sailing, does it contain the whole universe within it everywhere? If not, it will show some part of the universe and will hide the rest. It will no longer be homogeneous and isotropic. Matter will be created from and vanish in nowhere.

The whole matter can have, at most, a circulating flow, i.e., circular, elliptic or spiraling motion. Spins of all elementary particles and magnetic moments of charged ele-

[9] Here, "matrix" refers to the spread or span, and "physical" pertains to (elementary) matter. Matter does not manifest itself completely simultaneously, i.e., space does not illuminate the whole matter at once.

[10] If we consider General Relativity viewpoint that gravity is curvature of spacetime then space and time should be physical because gravity is physical.

[11] If there is some suggested reason, it would be interesting to know why that reason is active in intergalactic regions and not at smaller scales?

mentary particles are due to this circulating flow of matter [17–19].

It is asserted here that ***space and time cannot exist without matter and, in turn, matter cannot be perceived through the sensory organs and their mechanical aids without space and time***.

4.3 Void

Void or absolute vacuum is the non-manifested version of physical matrix. That is, void transcends space. *It characterises emptiness or stillness or annihilation.* In the state of non-manifestation, there is no cause and effect. There is absence of any interaction.

4.4 Quanta of space and time

In physics, when we say a *point in space* and a *moment of time*, they do not represent a single value. A point in space is not *zero distance*. Similarly, an instant of time is not *zero time*. Rather, they both represent an interval or a length or a *quantum*. A point in space is the smallest distance (volume) in space and a moment of time is the smallest period of time. Although a single-valued point or moment can exist in mathematics, there always exists a quantum of something in physics. *To approach zero* and *to be zero* are two different things. We believe that the quanta of space and time are yet to be ascertained [12]. In practice, we choose the unit of space and time according to the appropriateness of the physical situation and our convenience.

4.5 Time travel: witnessing past and future

A process is a series of moments (in relation to time) or occurrences (in relation to event). Though the change is going on every moment, we notice those changes only which are pronounced. A process is usually apprehensible in the end when it is complete. There are different states of this world in the form of events or processes. In terms of time, the world which we witnessed earlier is past, the world which exists now is present, and the world which is yet to come or manifest is future.

The passing of one moment after another constitutes an "order". The difference in the process of succession is the cause in transformation. By considering the order of cause and effect (various processes), it is possible to witness past and future (that is,

[12] We call **TatkAl** [meaning *that little (interval of) time*] the quantum of time, and **TatAdhAn** [meaning *that little (volume of) space*] the quantum of space. The Planck length $\left(l_P = \sqrt{\frac{\hbar G}{c^3}} \approx 10^{-35}\right)$ and the Planck time $\left(t_P = \frac{l_P}{c} \approx 10^{-43}\right)$ could be the viable figures. However, the definition of these Planck quantities are cyclic, i.e., one is defined in terms of another.

knowledge of past and future arises). Thus, travel in time is possible in principle [13]. It is asserted that ***past, present and future exist in their own essential form by difference of paths, i.e., causality***. They are not contaminated or confused; they are not mixed up or lost. Because if this were, time travel will not be possible. However, while past cannot be altered (within the same universe), future can be influenced and modified. At every instant of time, there are several possible paths owing to different physical conditions. ***Travelling back in time and altering the past, if it were possible, will require migration from one universe to other (parallel!) universe***. Thus, whenever we change the past, we branch out a new universe from the parent one. In general, changing the order of cause and effect creates a new universe. However, the new branched out universes may confluence under appropriate conditions.

4.6 Entanglement of space and time

Everything in this world is absolutely preplanned, through causality, in space and time. That is, space and time are inevitably entangled via cause and effect. In relativity theory, space (distance) and time are relative, and are functions of each other. This is because speed, a derived quantity of space and time, is assumed constant [14]. Speed of light is not the ultimate speed because causally-connected effects or influences, such as quantum entanglement, can "communicate" faster than light. However, transmission of information between distant bodies is argued to respect signalling [15]. Also, the speed of particles with non-zero *rest mass* cannot exceed that of light according to the relativity theory [16].

[13] Travelling back in time, i.e., evolving a state in a direction opposite to that of the *thermodynamic arrow of time* defies the second law of thermodynamics: the rule of physics which states that the flow of events is unidirectional–from the past (order) to the future (disorder or chaos). In other words, all energy must make the leap from usable to unusable in a closed system and entropy of the universe can only increase.

[14] For example, if $f(x,\ y) = \texttt{const} = f'(x',\ y')$, then x and y are necessarily constrained (with respect to their range of permissible values) and relative (with respect to different frames of reference). Relativity of space and time is true for any fixed finite value of speed.

[15] Information is any data useful for the recipient. Who knows if information does 'tunnel'?

[16] Is a photon really massless? If yes, how does it impart momentum ($p = E/c$) then? We consider two alternatives. (i) If $p = h/\lambda = \hbar k$ and $E = h\nu = \hbar\omega$ then $p = \frac{E}{\omega/k} = \frac{E}{v_{ph}}$, where v_{ph} is the phase velocity. (ii) $p = E/c$ results from the relativistic expression $E^2 = p^2c^2 + m_0^2c^4$ for the rest mass $m_0 = 0$. But then momentum should also vanish identically using the relativistic momentum formula $p = \frac{m_0 u}{\sqrt{1-\frac{u^2}{c^2}}}$. However, deflection of light (consisting of photons) from its rectilinear path by gravity suggests that a photon must have some *intrinsic mass*. What is that mass exactly? Moreover, how do we know that a photon has zero rest mass when it does not exist in rest? Is the rest mass of an object relative?

4.7 No cause and effect

When the flow of cause and effect ceases everywhere, after creation, the universe dissolves or becomes non-manifested. That is, the trinity of potential-action-inertia is in equilibrium again, and the material substance is inert nature. However, how long does this equilibrium prevails is inexplicable.

5 Elements of Physics

5.1 Object and Subject

Object is anything that can be perceived or cognised. It can be form, or a sound, or a thought, or a dream, or sleep. Thus it includes experiencing and thinking. Subject (observer) is one who perceives or cognises. ***Subject and object are always different. Knowledge arises when there are both subject and object; there cannot be knowledge if either one is missing***. When the subject undergoes a change or transformation, there is a similar change in the "seeing" of object. There are different strata of subjects and objects meaning that a subject can be an object for another subject; there is one-to-one correspondence between subject and object. If the whole universe is considered as an isolated object there must be a subject beyond the universe.

Objects are "fields" that sail on space. The objects in nature are neither particles nor waves but fields that share some properties of particles (they're generally countable and can be localized to some degree) and some properties of waves (a characteristic frequency and wavelength, some spread over space). Particle and wave aspects of any object are two mutually exclusive projections (phases) or revelations that are hidden or buried in potential (unmanifested) form of the object field. *All is waves, but nothing waving, over no distance at all. All is particles, but nothing still, at any point at all.*

5.2 System, State, Evolution and Measurement

System. It is an object or a collection of objects under analysis or investigation. The rest of the world constitutes its surrounding.

State of a system. It refers to the information or knowledge about a system in a moment or period of time. A physical system can rest in one of its many possible states. These possible stationary states of the system are projections/realisations of the reality (governed by the boundary conditions) that are buried in potential form in the most general state called the "fieldstate" or "wholestate" of the system. The fieldstate is a whole different thing [17]. In this context, quantum linear superposition does not describe the field-

[17] To be blunt, the mutually exclusive stationary states are like raisins in the pudding (fieldstate). Gravy

state and hence is not an exact principle of nature. *The whole (fieldstate) is different from the sum of its parts (stationary states).* Moreover, in the superposition-based approach, it is possible to miss some least-likely stationary states out of ignorance. Stationary states are the *optimized or round-off* states of the fieldstate. Measurement reveals the closest reality by "collapsing" the ever-evolving fieldstate to the nearest stationary state. Though, that a quantum system can exist simultaneously in all its stationary states is not a true statement, this explains why superposition is important and so successful. The linearity (superposition) is achieved at the cost of abandoning a causal (microscopic?) description and replacing it by some kind of a statistical average.

It should be noted that states of no two objects in this universe are identical in all aspects. Two objects are said to be indistinguishable becuase we don't have access to all the degrees of freedom.

Evolution of a system. Due to the quantum nature of space and time (consequently, other physical entities), *the evolution of a system is discrete*. Any physical system is described by a state which evolves in time. The possible values of observables that a system can have and can assume depend on the boundary condition(s) of the system (dynamics, constraints imposed on the system and configurations/options available to the system). In the case of seemingly continuous distributions, there is always a kind of underlying granularity. The seemingly classical continuity is a band due to overlap of quantum (discrete) values. Continuity/continuum is an emergent concept. In its true essence, *continuity implies invariance (conservation).*

Measurement. Measurement is the act of acquiring information or knowledge about a system. In general, the knowledge of an object depends on two factors: (i) identifying the object and (ii) the valid means of knowledge, such as the object should be present within the scope of perception and functioning of (proper) senses and mind. When mind is not connected with senses, they will not convey their impulses. Knowledge of an object arises only when there is reflection of the object in the mind of subject. In the absence of reflection, there will be no cognition even when the object and the mind are face to face. Precisely, knowledge can be gained either by interacting with the system or by reflecting/meditating on the essence of object. In quantum physics, measurement is the interaction of a system with its surrounding (including the measuring apparatus and/or the observer; the act of observation is also a measurement). The outcome of measurement, at any instant, depends upon the boundary conditions including the strength of interaction. When measurement is performed on a system to obtain information, we read projections. Quantum mechanical wave-function collapse [20, 21] is an emergent concept; it is very much deterministic but seems probabilistic because of the lack of complete knowledge. Collapse is not an alien thing. The measurement outcomes of

(finer details) of the curry (reality) is missing.

the same object, in a particular moment or period of time, are in general different for different observers (intelligent beings) because they pertain to different interaction conditions (the picture that emerges in the mind depends upon past impressions, beliefs and opinions). Also, the same object can be perceived differently at different times by the same observer because of difference in the instrument of cognition. In general, the measurement outcomes will be different when either system or observer changes. We should also remember that both the system and the observer evolve in time. However, the object of perception is not dependent on a particular cognizer. That is, when one cognizer is withdrawn or gets eliminated, the object continues to exist for other persons. *Moon is still there even if one doesn't see it.* Is the moon there when *no one* sees it? In this case, the best answer would be "I don't know" than rather blunt "no".

What about classical reality? We do not perform any measurement on classical systems to extract information. We warn the readers here that this is a huge misconception. In this case, measurement is made by the environment via boundary conditions. Here also we are reading the projections. Though the system is evolving (that is, the microscopic configurations are different), the classical reality is the same.

5.3 Observing an observer

In quantum mechanics, the measurement problem arises when observing an observer. This issue will not arise if (i) the former observer has a sound memory and s/he is not biased or manipulative, and (ii) the "sight of perception" of the latter observer is bigger than that of the former one. Otherwise, *observing one observer after another will lead to a long (may be an endless) chain of observers (cognition of cognitions) leading to absurdity and contamination or confusion or mixing up of memories*. Moreover, one cannot have a simultaneous comprehension of the perceiver and the perceived, the cognizer and the cognized. For example, when the mind is the perceiver it cannot be perceived.

6 Apparent phenomena

Non-locality. Is nature local, non-local or both [22–24]? If non-local, why does nature appear local? If both, how does locality arise from non-locality and/or vice-versa? A related question to this is: when or under what conditions a multivariable joint probability factorizes into single-variable probabilities? This occurs when correlations are neglected or negligible. Universe is nonlocal because of causality (the law of compensation). Symmetry, conservation laws, etc. can be the reasons for non-locality. Locality [18] is an emergent concept (due to our ignorance).

[18]The assumption of locality means that the outcomes of an experiment on a system are independent of the actions performed on a different system which has no causal connection with the first. On the

Randomness and Determinism. With causality, randomness in quantum mechanics is not intrinsic but illusive. The causes are unknown (hidden), and beyond the reach of our senses and current scientific technologies.

Determinism (or realism?) means that experiments or measurements performed on a system uncover properties that are pre-existing. That is, in an experiment the value of any observable is pre-determined, as governed by the evolution of the system. *Universe is only seemingly random.* It is deterministic because of causality. Probability is not real, not true but very important mathematical concept because we do not have access to or knowledge of all the causes of an effect [19].

Indeterminacy. There is indeterminacy (uncertainty) among incompatible variables. Two variables are incompatible when change in one is the cause for another. The indeterminacy between canonical or conjugate variables such as position and momentum, etc. is evident. There is momentum when position changes. There is release or transformation of energy (matter) in an interval of time.

Relativity. Although the physical laws are invariant and dynamics (evolution) is deterministic, universe is relative because every object experiences it differently based on ones knowledge, experience and surrounding (local) conditions. We agree for common experiences and disagree for disjoint ones. Moreover, there is knowledge beyond senses. Intuition (based on pure thought) is different from positivism and empiricism (observations/perceptions through experiments and senses).

7 Conclusion

That everything in our universe (i) is energy, (ii) is vibrating, changing and flowing, and (iii) is repeating or cyclic (via causality) reminds us of Teslas celebrated remark that *if you want to find the secrets of the universe, think in terms of energy, frequency and vibration*. Thus, universe is not permanent. It ages, decays and dies off.

The principle of causality is the root of all the above apparent/emergent principles. Causality is the primitive thought, plan or design of God that Einstein was looking for. It is a big consolation prize. The details (discovering the cause and the mechanism) are to be traced out. We believe that causality is the guide to the Theory of Everything. This ecumenical principle can be summarised in the catchphrase: *as above so below*. The laws of nature are the same for everyone and everywhere. Science, in its current form, is very much sincere and interested in finding the mechanism (how part). However,

other hand, Einsteins locality states that, even in the case of causal connection, causal influences cannot propagate faster than the speed of light.

[19] *The true logic of the world is in the calculus of probabilities.*–J. C. Maxwell.

we appeal the scientists to consider also the cause. Else, science may not achieve its intented goal of a unified theory and keep wandering in the wonderland.

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