The Precursor of Information, Life and Universe

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"Things should be as simple as possible, but no simpler." Albert Einstein

Abstract: To understand and perceive everything about the Universe, it will require a conscious system as big as the Universe, or every bit of information it possesses. But to understand and appreciate the basic truth and reality of the Universe, it may only require a system as simple as us, for simplicity is at the basis of truth and reality. Seeing information in its basic elementary form instead of composite form will unshroud our common sense or normal perception into reality.

John Wheeler's famous mantra "It from Bit" brings us deep into pondering existence as not wholly physical, in a sense that universe can be more aptly described as fabrics of information. Information itself implies that it is observable or definable, possesses some sort of meaning and exists for a purpose. This is where the journey of our inquiry and hypothesis begins. One way to start (it matters more how far one probes, than where one starts) is to ask question about existence, like "Does existence need to be observable or describable?", and to hypothesize "For information to be observable, the fixation of information carrying entity into a realm normally called space that leads to observable information, and players such as mass, force or energy, is necessary.

The search for the most basic constituent of matter is akin to the search for what constitute information. The information contained in the text in this sentence consists of a combination of technologies and physical matter, atomic in their nature. The information being observed and interpreted by an observer consists of a transfer of information between the text and the observer and the capturing of the information by the observer. Information can be transferred by means of photon, sound, pressure, electron, magnetic field (so far electromagnetic in nature) or by more exotic means that are nuclear, subatomic or gravitational in nature. For the transfer to be considered true or meaningful, the information needs to be captured by the observer into its own information database or representation system. The capturing of information can be organic (eg. animals, fauna, flora), inorganic (eg. camera, machine), atomic, subatomic or galactic in nature. Therefore what it implies is that to be considered or qualified as information, the prerequisite is that it has to be observable. *The definition of "Observable" that we used here refers to information (analogue or digital, deterministic or probabilistic, perceivable or undeterminable) that can be transferred from one form to the other*. For example imagine a scenario where there is a rabbit hole on Earth that leads to the fantasy land of your dream not found on Earth and the hole is about the size of a basketball and you wonder how to fit yourself through the hole. What you have just accomplished is that you have created some new pieces of information using your neurons, triggered by the text-based information you have read which can be transferred to another form of information, facilitated by visible light (if you are reading with your sight). However the information transferred will probably not be in its entirety and exact replica, and certainly such a scenario in reality is undeterminable. This beckons us to further unpack and distillate the definition of "Information" to be employed henceforth. To unravel the meaning of information, we need to take a rather bold step to differentiate information that are at the composite form, which typically consist of a myriad of particles, atoms, energies and forces, such as the organic information system involved in the thought experiment above, as well as in inorganic system such as photographs, and electronic or analogue devices, from *information at the simplest or*

essentially elementary-like form, which do not involve composite systems of particles, energies or forces. It is the latter simplistic definition of "Information" we are using hereafter in our hypothesis.

Statement 1

If A exists, A contains Information. If A contains Information, A needs to be Observable.

At first glance this may seem straight forward to some. Indeed like many people, I believe in the elegance and simplicity of the basic nature of all things.

"Simplicity is the ultimate sophistication." Leonardo da Vinci

At a subtle level, what Statement 1 implies is a co-dependent and co-existent nature of the observer and the observable information. For information to be not observable at all exterminates its own existence. Therefore it leads to the following statement.

Statement 2

If Information A exists, Observer of A exists.

Let's examine the statements made so far, using the basic constituents of matter discovered by scientists to date, namely the elementary particles (like quarks) in the families of fermion and boson from the Standard Model of particle physics. Quarks (up and down quarks) and leptons (electrons) are generally considered to be the basic building blocks of proton, neutron, atom and all known matter in the Universe. Quarks are shy creatures. They either exist inside protons and neutrons or they only appear very briefly under very rare and unique circumstances. When they exist inside protons and neutrons, they proclaim their existence and their rightful place in the realm of reality, through observable properties and probabilities. At first glance, a proton can exist by itself without an observer, and it contradicts with Statement 2. At closer examination, a proton exists because of its constituents, the quarks (roughly speaking, 2 up quarks and 1 down quark). The quarks inside the proton co-dependently co-existed. One cannot exist without the other. That sounds like a basis of the relationship between the information and its observer. In fact, one may argue that the informing quark is substantiated by the observing quark, and vice versa. This beckons us to the next statement.

Statement 3

Information A and Observer A are interchangeable.

Let's go back to the example of the quarks again, and on the exotic members of the quarks that don't exist in proton and neutron, but appear so briefly to be captured by the most sophisticated and expensive instrument ever built, the particle accelerators. As mentioned, unlike their fellow quarks (the up and down quarks), these quarks (with names like charm, strange, top and bottom) don't exist in our everyday matter. They are observed in particle accelerator like the one at CERN where particles are accelerated to collide at very high speed. Out of these collisions the original particles are dismantled or destroyed and new particles are created and observed. Some of them are our exotic members of the quarks. One reasonable question to ask is whether the circumstances during the man-made collisions have enabled

the creation and existence of the information of these exotic members and their fellow observers. The fact that these exotic creatures only appeared briefly and vanished quickly could be due to the fact that their co-dependent and co-existent partners could not be depended upon any longer.

Going back to the preceding Statement 3, to conjure such a thing as the two 'different' roles of the Information and Observer is simply a convenient way for us to make sense or quantify (including bit-wise). The Information and Observer in essence are one and the same, but depending on each other for their existence, because of the roles that they play. That probably explains why we often find or interpret elementary-like matter particles or information in pairs or more (refer to Standard Model of particle physics). If we are willing to look at it un-deterministically, the different roles that they play toward each other in their private domain are inconsequential in reality until they are interrupted by external player which is capable of substituting the Information and Observer role, or escalating the Information and Observer to the another level or form. Often such transformation is accompanied by the presence of energy carrying force, or force-carry particle normally refer to as boson. It would be interesting to ask where do the boson and energy come from and which come first, the matter particles (fermions) or the forces (bosons)? Well it may turn out that they may come into existence together (or close enough) as well, and that they are preceded by something else, the Precursor, to be discussed towards the end.

The ability to create new things and matter that are not normally created by nature (at this point we adopt a limited definition of nature as not man-made) is not something new or unattainable. Examples range from creating new elements to new artefacts and new ideas. *In fact new information is always created and since the beginning of our Universe, the only constant truth and pursuit is the creation of new information*. This seems analogous to the law of thermodynamics, and information is seen as entropic. Going back to the earlier point on particle creation, even though we may be creating new exotic particles like the charm and strange quarks, they are probably not truly elementary in nature. This may be the reason why we can keep on creating generation after generation of them, to the point that it has been referred to as the generation problem. Latest studies have been trying to probe what is inside quarks and one of the candidates is preon (Don Lincoln, Scientific American, Nov 2012). The possibility that there are sub-elementary particles to quarks does not eradicate the elementary-like role that quarks played in everyday matter. Just like the reader (the observer) of this text does not need to observe the text at the basic atomic physical constituent level but at the textual representation level, in order to make meaningful interpretation. So far, I have been alluding to the Model-Dependent Realism approach posited by Stephen Hawking et al, where the perception of reality is dependent on the frame of reference or set of rules governing it. Each level or realm of perception needs not overlap or interfere with the others, although there is an intrinsic transition from one to the other. Our aim here is to peek into the very naked core of reality, where information is considered to be at its elementary form. Perhaps at that fundamental level, information ceases to be, as it or bit.

Statement 4

Elementary information cannot be created nor destroyed without 'breaking' from the rules or creating new rules of its existence.

Statement 5

Elementary information can only be observed by the elementary co-dependent observer directly.

One of its implications is that we (as a conscious and non-elementary observer) may never be able to observe the elementary information directly and any direct observation of the information predicates that the information is not elementary information or that when we come to a point of observing it directly, the observer and the universe may have reached a sort of unitary state where the conscious observer is able to connect directly to elementary information.

Let's consider for a moment that if we reduce all matter in the universe to a single-point entity, its existence will cease to be meaningful because neither the mass nor the location will mean anything. For it to be meaningful, it has to exist in a state of co-existence with something else, i.e. one entity giving the other entity a way to be described, for example in terms of mass or distance. In fact the observer in this case should not be perceived as another external entity but as a co-existing and co-dependent entity. Together they give meaning and existence to each other without the need for another observer. They are the elementary observer and elementary information and any further observation made by an external observer should be considered as a separate type of observation. At this point we are differentiating the types of observation and making distinction between elementary and non-elementary observation. It is the elementary observation we are talking about in the above arguments and for non-elementary observation, additional considerations need to be applied. The universe is built upon both elementary and non-elementary information and observation, and our perceptions are usually based on the latter. The elementary observation defined here requires a re-interpretation of observation away from the living-centric perspective. Observation at the elementary level is defined as meaning making in order to exist. Using the previous scenario where the whole universe consisting of only a single entity, the meaning of the entity would cease to exist, henceforth its very existence. In order for it to exist and have meaning, the simplest way is to have another entity that gives meaning to it. Here lies the essence of elementary observation, which is to give each other a meaning.

Statement 6

Elementary observation is meaning making between two or more entities.

(It seems that for our Universe, three elementary-like entities, but not elementary, are the norm for everyday matter and space. Simplistically speaking, two point-like entities can only make a line-like displacement, whereas three make a space.)

Roughly speaking, we can see its resemblance in recent use in Variation Theory (Marton & Booth, 1997), where it takes seeing the difference in order to appreciate its meaning. We also see its manifestation from a more distant past, in the Taoism concept of Tai Chi and Ying Yang, where two basic and distinct yet complementary forces or principles create a diversity of other forces, matter and possibilities. As well as in the Buddhism concept of selflessness, where self has no meaning without considering the other and everything is connected through fundamental rules of existence. Hence in everyday affairs, it means not being too attached to personal gains or interests, and showing respect and compassion to others.

The Latin root of information, "informatio" a noun derived from the verb "to inform" is closer to the essence of observation than it is commonly used today. Nevertheless, normally we perceived information as something tangible, like symbol, signal, data, visual or even mental construct that is either perceivable or retainable by living or non-living things. However at the elementary level, information takes a supporting role and is a consequence of observation rather than a predominator.

Statement 7

Elementary information is the product of elementary observation.

So far I have not used the word or notion of time in the arguments. It was done intentionally because in the elementary realm, time is non-existence and inconsequential. Therefore if our instrument involve time as a direct variable for detecting the elementary information, it will most likely be futile. And it seems we can't run away from time in our current form of existence and experiment. Perhaps one way is to look for the absence of time. Quantum entanglement seems like a good place to look at, because of its disregard for time and distance.

Let's go back to our earlier discussion on what is the Precursor. Let's call the private party or union of Information and Observer as IO. When IO is left 'alone' and unperturbed, space and time are practically non-existence or meaningless. But we know space and time play a critical role in giving purpose and meaning to matter particles and the four known forces (namely gravity, electromagnetic, strong and weak forces). Well if it turns out that there are aplenty and a diversity of IOs, and when IOs start to party or interact with other IOs, with the right conditions, space and time could be created, and hence matter particles, forces and the laws of the present known Universe. There could be a dormant pool of IOs in the beginning of space and time. Somehow the parties broke out and gone viral and the so called Big Bang and its descendants followed. Earlier it was stated that IO is 'void' of space and time. Imagine if IOs 'intermingle' with the space and time of the universe. Will they distort the space and time, to such an extent that the effects are felt by nearby matters and energies? They seem like a potential candidate to account for the dark matter/energy hypothesis. One of the strong indicators for IOs to be accountable is the abundance of dark matter in the Universe and the likely effect on the expansion of the Universe. Afterall not all IOs had joined the parties. Perhaps most of them were not under the right conditions to interact and inert to the interacting IOs. Not long after the mass party, space and time had been created and they were 'scattered' all over the Universe.

Could there be a relationship between IOs and black holes? IOs when alone or in low 'density' may not have significant effect on the surrounding matters and energies under a relatively small scale compared to the cosmological scale. When the 'density' is high enough and hence the 'void' of space and time is great enough, it may exert significant effects on surrounding matters and energies, to such an extent that the nearer these matters and energies get to the great 'void', the greater the matters and energies are reduced toward their elementary form and union, under extreme curvature of spacetime. Essentially or simplistically, these matters and energies are returning to their primordial form, that of Information and Observer, or what we called IO. When they pass into the great 'void' (or beyond the event horizon), they are back to their IO form and spacetime has essential collapsed into oblivion. The law of thermodynamics or conservation of energy should still be conserved before the entry into the point of no return of the black holes or gateways to the

home of IOs. Afterall, these are the rules of existence for matters and energies, and they are still in the realm of spacetime before the entry. In the process of joining the great 'void', it may necessitate some expulsion of 'excess' energies not welcome by the IOs. There could be multiple 'no return points' or transition points into the event horizon depending on the nature of the energies to be expelled or IOs to be formed. When the scale is big enough, like at the cosmological scale, the presence and effect of IOs abound at plenty in our Universe may well be detected. It would be interesting if we can detect the changes in the 'amount' of matter and dark matter in the Universe and the changes in the overall number and size of black holes. If primordial IOs lead to current known matter and energy, what can we deduce from the known matter and energy about the IOs?

An interesting aspect of spacetimeless IOs may be found in Einstein's general relativity which describes the natural phenomenon of gravitation. When IO 'splits' apart or interacts with other IO, there should be a 'bond' that still 'connects' them in a timeless manner. When the IOs of the right condition interacted in the beginning of space and time, a widespread fabric of 'bonds' were created between the IOs, which laid the foundation for the web of gravitation and the creation of matters and energies. Mass is a commonly used term to account for gravity normally, but mass is a property describing the effect on the curvature of spacetime rather than a cause (ironically, we tend to describe the so called elementary or fermionic particles with their masses apart from charges etc.). In general relativity, gravity is not caused by mass but by the stress-energy tensor, which describes the density and flux of energy and momentum in spacetime. When IOs interacted to form spacetime, the conditions for gravity and rules for the matters and energies were set. Hence the creation and transfer of information need to involve the participation of energy, and thus the laws of thermodynamics, as well as govern by certain limits of spacetime, such as the speed of light and the Planck's scale. This leads us to the next statement.

Statement 8

Information need to be transferred or in a state of motion at a finite non-zero speed within the upper and lower limit of its system. (In our case the upper limit is the speed of light)

Statement 9

Information needs to have a finite displacement no smaller than the lower limit of its system.

What the last two Statements imply are that information cannot be at complete rest in all frames of references. To be at complete rest, they will no longer be at the state of being information and hence in existence in our reality, where existence and reality necessitate the possession of the quality of space and time. We have always been grappling with the concept and definition of mass and have been conjuring the concept of rest mass to explain certain concept of gravity. In special relativity, the invariant mass of a single particle is considered Lorentz invariant. But in a system of particles, in order for the mass to be Lorentz invariant, the system must either be isolated or have zero volume. No system can be truly isolated or have zero volume, except a candidate like the IOs, our prime for the Precursor.

Often we seem to put gravitation on par with the other three known forces (strong, weak and electromagnetic). However gravitation should not be interpreted as a force as it is acting rather as a fabric for forces, energies or matters to rely or propagate on. When IOs transform and exist in the forms of matters and energies, inevitably they are influenced by the underlying gravitational effect and platform created by them to stay 'connected'. If we see

energies like electromagnetic waves as a result of the effect on the spacetime or gravitation platform, we may be able to reconcile the known forces with gravitation.

As mentioned earlier, there is another side to Information, those 'playing' the Observer role, a role that return every bit of Information to its primordial form, a form that is 'void' of space and time. Let's explore the next statement which follows the last.

Statement 10

Two information cannot occupy the same space at the same time.

We often refer to black hole in term of its size and mass. That tends to give the connotation that back holes have mass or occupy space. Instead we should consider that there are simply only 'void' or IOs inside black holes, and what is responsible for its physical presence and influence is the result of the curvature of spacetime outside of the black hole. The nearer to the event horizon of the black hole, the more intense is the collapse of spacetime. Once the collapse crosses the boundary of the lower limit such as the Planck's scale and tends toward occupying the same space at the same time, it will 'disappear' into the void, back to their primordial form. One popular postulation of the formation of black hole is when very massive stars (like neutron star) collapse or implode under the crushed of its own gravity at the end of their life-cycle. Under such conditions, matters (or information) are squeezed toward each other, to a point that they almost occupy the same space at the same time, and are almost held to a stationary state (which will violate Statement 8 to 10). Under the right conditions, such as extremely close proximity (extreme curvature of spacetime), the 'Observer' character residing in every bit of matter or information takes over and seek out to unite with their co-existence partners. Once united, they 'rest' in spaceless and timeless peace, perhaps waiting for the next awakening.

If the transition from matters and energies to 'voids' or IOs happens at the event horizon (or the Schwarzschild surface), it would be interesting to see if IOs can transform into matters or energies at the event horizon too. Hawking's theory of black hole radiation predicts that black hole will shrink or evaporate over time because of loss of mass by emission of photons and particles. It is also postulated that there are numerous mini black holes in the Universe. Our 'voids' or IOs though spacetimeless, do have an impact on spacetime when spacetime try to 'engorge' on them, and it seems that it happens almost everywhere in the Universe.

If information, matters and energies are in a constant non-zero and non-rest state of motion or perturbation, it implies that the Universe needs to be in a state of 'expansion transformation'. It would seem paradoxical if it is possible for 'voids' (which are spaceless and timeless) to 'move' since they are 'engorged' by spacetime and the Universe is expanding. It is convenient for us to see the Universe to be in a state of expansion, although strictly speaking it can be a relative concept. Does a bigger 'occupied space' necessary mean a larger surface area, especially if we consider the multi-dimension of spacetime? An 'expanding' universe does not mean that it would not collapse or come to a cease. As alluded earlier, information or gravitation collapse can happen anywhere, when the condition is right. To resolve the paradox raise earlier on the expanding Universe and the 'motionless voids', we need to examine the perception of 'expansion' of the Universe. It is widely accepted that the Universe is under a matric expansion on a cosmological scale, whereby the scale of the space itself is changed or under an intrinsic expansion. In addition, the expansion rate of the Universe is believed to be accelerating due to the repulsive force of the dark energy. If the creation of IOs (through black holes or other conditions) increases the amount of dark energy, as well as the effect on spacetime, such that the gravitation platform got to be 'upgraded' to a

'denser network', it may explain the perceived expansion of the Universe. Earlier it was mentioned that IOs are 'interconnected', and if the 'amount' of IOs increases, the 'interconnection' increases. Hence it is the increase in the 'density' of the 'interconnected network' that resulted in the intrinsic expansion. The spaceless and timeless 'voids' did not move afterall and the paradox could be resolved.

Can we relate the non-zero non-rest state of information to uncertainty principle? The uncertainty principle (and entropic uncertainty) describes a fundamental property of quantum systems which states that there is a fundamental limit to the precision with which certain pairs of physical properties of a particle (eg. position and momentum) can be known simultaneously. If particle and information cannot be at complete still, neither the position nor the momentum can be determined beyond a certain point (near the Planck's scale) or below the 'Planck' speed (Diagram 1). Creating a motionless particle is akin to pushing it into oblivion.

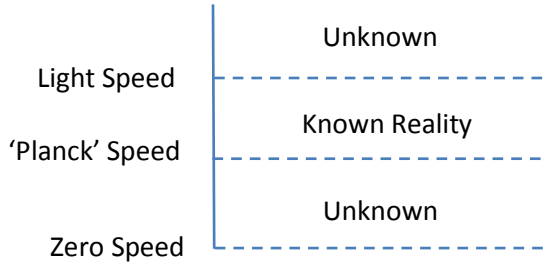

Diagram 1: A particle's motion affects its existence.

It is postulated that when a particle falls toward the event horizon of a black hole, it will seem to an observer that the particle will take an infinite time to reach the black hole which is seemed to be infinitely 'far' in the future. If the speed of the particle is slowing down towards zero, to an observer, it will take an infinite time to reach zero speed from 'Planck' speed or event horizon and vice versa. If the particle emerges from the other side of the event horizon, to another observer who is on this other side, the particle will seem to have reached here from an infinitely distant past and to have taken an infinite time, akin to travelling from an infinite speed to the present speed. Hence it leads us to the next diagram.

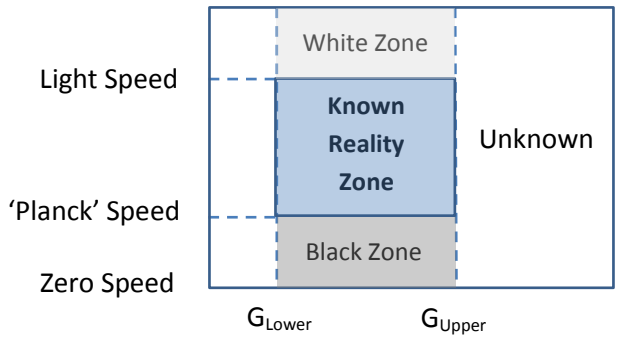

Diagram 2: Known reality in our Universe. Horizontal direction is related to spacetime and vertical direction is related to particle's state of motion or perturbation.

Diagram 2 is a hypothetical representation of the model expounded so far. The known reality in our Universe is bounded or governed by the region between the speed of light and 'Planck' speed, the upper and lower limit of spacetime and the boundaries of the black and white zone (general relativity postulated the presence of white hole). If dark energy lurks within the boundary of the black zone, it will likely be 'felt' in our spacetime. It would be worth to consider different universe or realities governed by a different set of rules (hence a different set of Speed and G values), as well as interesting to consider the point of convergence (or collapse) between the black and white zones. On one end is where the physical limits of speed and spacetime approach zero or null and on the other end is where the physical limits of speed and spacetime reach the same maximum upper limit as shown in Diagram 3.

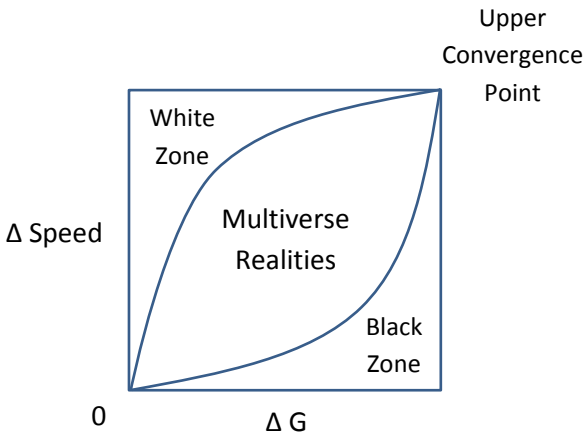

Diagram 3: A hypothetical model of Multiverse

In summary, seeing information in its elementary form and co-dependent state, as well as viewing it in a constant state of motion mediated by spacetime may be useful for us to unpack the shrouded mysteries of the universe. When every information slow down to the lower limit or speed up to the upper limit, the observable universe will implode or collapse. When spacetime decreases or increases to a certain point, all information will cease and the universe will recalibrate. This process by the Multiverse seems to go on and on in an eternal loop. Gravity sets the limit or boundary for spacetime and information, and information play out in many subsequent forms, offering unlimited potential of possibilities, probabilities and lives. Perhaps information in its 'living-form' is seeking the highest possible meaning of information. When information return to their primordial form (as IOs), they may become new IOs and need not be the same as before. This little bit of changes in the IOs is perhaps the precursor to the birth of a new universe.