Static Time, a Cosmological Uncertainty Rule, and a Quest for a Beginningless Kalam Cosmological Argument

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Abstract

A simple solution to the problem of time is proposed by postulating that if the Universe is time-like, stationary, and bounded then it could be divided into static temporal gradations or contours. Hence, an energy diffusion flux (EDF) equation was established from which the Planck and the Hubble times have been derived. It is then found that time is unimportant after applying Gauss's Law on EDF when looking for a characteristic length of the Universe ℵ*. An uncertainty rule was also found that may limit our simultaneous information between the scope of looking into space and the masses that it comprises. The paper concludes that if the Universe was in a stationary state and bounded, then, it did not begin to exist when compared to a vast and, probably, timeless Background. It appears to begin to exist because the information is largely mediated by optics. Thus, time is more epistemological in nature rather than ontological because of the limit that light imposes against instantaneous access to information. For this reason, the beginninglessness of the Universe should not preclude one from saying that the Universe does have a cause.*

Keywords: Kalam Cosmological Argument, static time, the problem of time, time-like Universe, stationary state, energy diffusion flux, EDF, Plank time, Hubble time, Gauss’s Law on EDF, length of the Universe, uncertainty rule, information limit, timeless Background, ontology, epistemology, and beginning-lessness

I. Introduction: Presentist vs. Eternalist Perspective

Presentists like W.L. Craig (since 1979) advance the idea that whatever begins to exist has a cause. The Universe is said to have begun about 13.8 billion years ago via a mechanism called the Big Bang. Thanks to the discovery of red-shifted galaxies as first reported by Edwin Hubble (1929) led astrophysicists to give us that value. Arno and Penzias’ discovery (1965) of a ubiquitous microwave background radiation with an average temperature of 2.728 K (Young and Freedman 2012) further advanced the concept that the Universe had a beginning. If those two premises were true, we must conclude that the Universe has a cause. Causeists are wont to lucubrate a further premise that an uncaused witting Creator is the source of these effects. Dynamic time philosophers like W.L. Craig suggest that the cosmological beginning is an event

(Craig and Moreland 2009). For physicists like Stephen Hawking, this implies that time and space are *a priori* for such an argument to be true (see Hawking 1988, 116, 136). That is to say that Craig and his presentist camp presuppose the existence of *a priori* physical fabric upon which time or space grew.

Eternalists – either non-theists or theists alike – will argue on the contrary that the beginning may even be nonphysical and, thus, obviates a valid temporality, much less, a beginning. Hawking reminded the dynamic time proponents that the finite Universe has no prior spacetime boundaries and, hence, lacks a singularity and a literal beginning. For him, temporal-beginning-less means that the Universe requires no Causer at all for it to be here. Conversely, such an event – a literal beginning of the Universe – presents no problem for A-theorists provided that the Causer should be conceived as being atemporal and ideas can be made of atemporal causation (Reichenbach 2021). This could mean that these philosophers take the beginning as a growth or emergence of the Universe from a non-physical background.

And B-theorists find this confusing how something as the Universe grows from a supposedly non-spatial and non-temporal background. Craig (1979) himself agrees that without space, there would be no time given the assertion that the Causer must be spaceless to be timeless before Creation. So, if the background is spaceless and timeless, we should not expect the Universe to be growing in time since there are no reference frames to base such a growth; or that there have been prior and posterior states. To maintain its spaceless and timeless background, the Universe must both be unchanging and unique against this sort of backdrop.

It should be mentioned that many B-theorists (or eternalists) likewise believe that there was a cosmic beginning before the expansion or inflation of the Universe (e.g., Metcalfe 2013, 23, 25) and argue for a non-Craigan Kalam Cosmological Argument (KCA). Metcalfe's argument runs as follows with a context that there is a beginning to the expansion of the Universe:

1) If there is no beginning to the expansion of the universe, then an actual infinite exists.

2) An actual infinite does not exist.

3) Therefore, it is false that there is no beginning to the expansion of the universe.

4) Therefore, there is a beginning to the expansion of the universe.

Arguments like this commonly presume for beginnings to be literal and are based on the optical dependence for information and expect that information is marked exclusively by its appearance or disappearance from an empty background. Observational data tend to keep a feedback loop in support of this dependency as information from distant pasts or locations are carried by EM waves (or waves that have limited speeds, usually at the speed of light *c*) towards our optical sensors. Yet, this should rather be hinting at optics as being a delimiter to our access to information and not as the absolute arbiter of the ontology of information itself. Metcalfe's argument (see p. 13) also presupposes that the B-series suddenly appears from nothing, which is again hinting that such information has an optical necessity. As if luminal appearance is the mark of any beginning or growth of all existence.

Nevertheless, in 2001 or 2003 Borde, Guth, and Vilenkin (BGV theorem hereon) encouraged support for a beginning when they argued that any spacetime that is inflating or expanding sufficiently fast on average must be incomplete in null and negative time-like directions. Using this as a voucher, Kalamists seem to have won the day. For them, the Big Bang suddenly grows within supposedly non-physical environments and causes are always associated with appearances being nonvisible. What theists from either camp could agree together is that since spacetime originated with a beginning and, therefore, similarly has a finite past, the Causer of the Universe's existence must transcend it. This means that the Causer must be non-physical or have existed non-spatially and, when there was still no Universe, temporarily – an immaterial cause (Craig and Moreland 2009).

The 1979 classic Kalam formulation strictly assumes a "tensed theory of time" or Presentism (i.e., the A-theory), as opposed to its alternative B-theory – also known as the "tenseless theory" (see McTaggart 1908), which allows for the Universe to exist without tenses as a spacetime continuum (see also Minkowski 1908). For the B-theorists, especially for its theist advocates, the Universe is a fully matured or completed block where the past, the present (which could be thought of as a very thin slice segment across its temporal vector), and the future exist simultaneously in God's consciousness or some rather refer to as the *eternal now* (see Rogers 1994; Stump and Kretzmann 1981). Under Eternalism, the Universe would not "begin to exist". It just exists from a tenseless state of affairs – being a 4D spacetime "block" that extends finitely – where events could be described as indices or in the earlier than direction (see Craig and Moreland 2009).

Yet, presentists cannot reconcile in simpler terms the success of the Special Theory of Relativity (see Einstein 1905a), where Minkowski spacetime heavily relies on, common sense, linguistic interpretation, and the basis for sequential time (Balashov 2007). If we apply Rogers' (1994) timelessness without duration, God does not need to go in phase with the temporal sequence to know timelessly what event transpired in 2030 AD, for example. Such a timeless observer can recall information atemporally like how our computers can determine – without having to count from the beginning – what the 1-billionth term is in a geometric sequence.

Yet, if the Eternalists (or B-theorists) are right that time is just an illusion, then what does the current estimation of the age of the Universe mean? Why does there seem to be uniform microwave radiation with a peak intensity of 1.063 mm that can be measured from all directions under the sky? How do we say that something began to exist? When did it start to appear out of nothing? And why must appearance be an arbiter for something to begin to exist? This paper is motivated to show that the Universe may have already existed timelessly even though the supposed beginning is 13.8 billion years ago.

Beginnings or time exists because our consciousness is limited by the action of electromagnetic waves around us, which, in turn, directs our epistemology. This paper wants to advance the idea that there are limits to the extent of the spread of light across space and that anything beyond this limit, information could be lurking and may be deemed timeless. If this is true, lights should not be the final arbitrator to assess whether information does exist without beginnings. If internal time is static (see Page and Wooters 1983), the Universe, then, is not growing from a singularity but appears to be so since our consciousness is largely modulated by the travel of information via optics.

This study will try to derive equations to solve for the smallest possible time interval and the largest possible age of the Universe. It is believed here that for every distinct change within spacetime, an invariant or static proper time could be represented as contours or gradations (i.e., time wrinkles) along the time-like directions. These static temporal contours or gradations are just useful fiction to depict degrees of changes along the spacetime history of the Universe. Time appears because, practically, information is carried by light, which does not travel infinitely fast. As of 2018, the Universe is 13.787±0.020 billion years old according to the Lambda-CDM concordance model reported in the Planck Collaboration report published in 2020. This age is suggested by EM waves traveling from a distant past and to our contemporary sensors and interpreted by us.

Here, we will attempt to combine two distinct ideas from two divergent camps: that (1) time exists, which is a presentist position. (We take this idea to be true *but* only for all internal observers within the Universe [e.g., Moreva et al. 2014, 2017] where access to information is light-mediated.) And (2) time could be considered as static isometric contours (which should be consistent with eternalists; also see Page and Wooters 1983) relative to an external and timeless background. This is because of the nature of how energy diffuses (temporal) and what geometry (atemporal) this hypothesis will lead us into, which will be shown later. We hope to derive the values of the largest (Hubble) and smallest possible time (Planck) using a common equation to justify our postulates. Let us proceed to our methods.

II. Approaches, Postulates, and Rationales

A. The Universe as a Distinct Time-like Point Amid a Vast Timeless Environs

This chapter will try to offer a very simple solution to the problem of time and what time may be. To do this, let us suppose a "beginning" for the Universe (U hereon). This beginning is represented by a point $\Delta r \rightarrow 0$ (see BGV Theorem, 2001, 2003) at initial time t_0 (see Figure 1) with Eq. 1 below describing its spacetime interval:

$$\textbf{1.} \quad \Delta s^2 = c^2 \cdot \Delta t_1^2 - \Delta r_1^2$$

The spacetime quantity Δs is at its smallest at the "beginning" if $\Delta r_1 = 0$ or $\Delta s^2 > 0$. At any rate, Eq. 1 describes a time-like Universe (U hereon) and that it could be considered a point and be expressed as

$$\textbf{2.} \quad \Delta s^2 = c^2 \cdot \Delta t_1^2$$

If we were to maintain that U is a closed and static system (see Page and Wooters 1983) and that it is time-like as insinuated by Eq. 2, we could say that $\Delta r_i = 0$ should be an enduring description of U throughout its history. How is this possible? First off, the expression $\Delta r_i = 0$ could indicate the limited geometry and uniqueness of U when compared to its vast background. If the Universe started as a point (i.e., $\Delta r \rightarrow 0$), then it must be a closed system. Otherwise, there would be no distinction between U and its environs (TEO hereon), and our future mathematical derivations will not be simple. Such a point or closed system can then be described by Eq. 3 – its whole geometry has a time-like diameter of

$$\textbf{3.} \quad \Delta s_{tot} = c \cdot \Delta t_{tot}$$

TEO or the Timeless External Observer around U, if the latter is internally time-like (Eq. 2), must be dissimilar. Another way to clarify this is that if the Universe is finite that it has to have boundaries, then, the external Background (i.e., TEO) must be so immense to render the former comparatively infinitesimal. This means that U's radius Δr is practically point-like relative to TEO's size and, thus, maintains its time-like status.

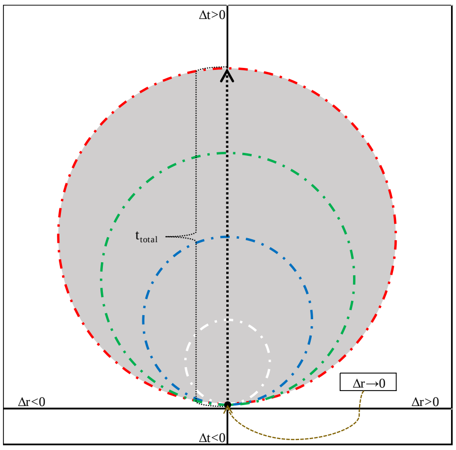

Figure 1. This figure shows the Universe as a holistic spherical spacetime at age t_{total} when compared to TEO. Compared to the vastness of the surrounding non-spacetime environs, it appears to be a time-like static sphere in multi-layered isotemporal curves.

For an internal observer fixed at a position along the time-like axis from Δt = 0 to t_{total}, as U "inflates" from being a point to its final size, her trajectory would follow the small points along the timeline in Figure 1. All surfaces of the sphere for each point along the time-like axis should belong to a single static equitemporal curve Δt (which this study quips as time wrinkles). If the eternalists are correct, then, at a reference frame outside of the Universe, the whole spacetime should be static or in a stationary state, finite and bounded. If we could designate gradations on a solid and finite box, we could also do the same for a finite and stationary Universe.

If eternalism is true and Einstein (1905a), Page and Wooters (1983), and Borde, Guth, and Vilenkin (2003) are right about the speed of light being the maximum speed limit in the Universe, that time is static, and the Universe does not exist in the negative time-like direction, respectively, we suggest that: *"If the Universe is static, time-like, and finite then, it could be divided into gradations that are orthogonal to a universal time-like axis and the resulting intervals should equal to a maximum internal speed and be considered invariant."* It will be referred to herein as the *invariant time postulate* or simply ITP, which is a nod to the eternalist's perspective. Another way to describe this postulate is: *if spacetime ds could be divided equally by time dt, the result would be the speed of light but only if time were static or invariant*. ITP proposes that the total sum of the static gradations along the time-like direction is what we refer to as the age of the Universe. Later we will explain why time must only be internal within a closed system and does not extend beyond the geometry of the said system. We could also interpret the postulate to mean that dividing the stationary and finite Universe at equal intervals will yield a constant of proportionality and that is the speed of light.

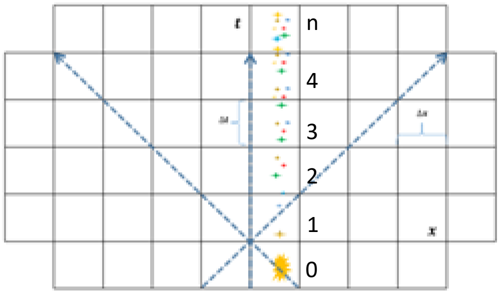

Figure 2. ITP says that if the whole spacetime is finite, then it could be divided so that each resulting segment could be thought of as time. This means that no internal elements could move out between two temporal levels. Each level of time corresponds to one universal space-like surface or the current Universe. Note also that light only moves forward along with time segments.

The maximum internal speed decides how observers within the system see the information. Also, the position of electrons and galaxies in each temporal interval is not the same when compared to the preceding gradation. The dissimilarity between each segment creates contrasts, and, thus, the appearance of time and progression. The proper time or age of the Universe is made up of a set of succeeding static isometric lines (or equitemporal contours or gradations) that for an external observer should appear unchanging or invariant. That is, an external observer would agree that the Universe is finite and has an internal age that is static.

In contrast, time appears to be flowing for all subluminal internal observers. Yet, at the very peak of the Universe, when it "reaches" its maximum time gradation, the time finally "stops" – a final head against spaceless and timeless environs. That describes the concept of a finite Universe. Externally, spacetime shows gradations and can be designated with segments of isometric lines or curves (see Fig. 2). Each is a unique set of spatiotemporal configurations relative to other segments. Yet, if the idea of static time is true, the whole length of the timeline itself must be adynamic and externally processless. And, thus, the cumulative measure of the spacetime gradations per se is invariant and contains a holistic spatiotemporal history of the Universe.

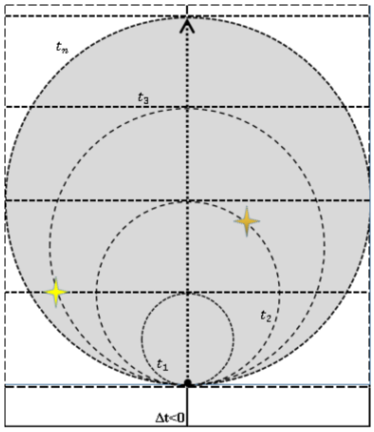

Figure 3. Relative to an external observer, the Universe contains static equitemporal contours (isometric lines) – setting boundaries between each segment that contains unique configurations in spacetime. Each static isocurve (contour) is globally equitemporal. The Universe U has a proper time, assuming ITP to be true.

To illustrate, observers in index 4 (see Fig. 2, previous page) would say that they have seven stars while observers in index 1 would say they have two. It is possible that there are no two intervals that are exactly alike and so contrasts or boundaries could be assigned. A negative interpretation of ITP says that variations will appear dynamic for all internal observers if and only if the information is acquired gradually and via optics. Thus, each moment corresponds to a boundary or contour (see Figure 3) and so the appearance of time or spacetime contrasts. This means that each internal change corresponds to a different contour or isometric curve within the time-like Universe.

For TEO, the contrasting stages do not flow but are rather understood as a series of isometric boundaries (or contours) designated out of the static spacetime geometry. Since each contour lies 90° from the time-like axis, assuming ITP to be true, then, the universal coordinate time Δt (the timeline) must also be the proper time Δτ (see Fig. 1 or 3). ITP could be inferred from either Eq. 2 or Eq. 3 with the speed of light setting the rhythm for each succeeding temporal curve and, thus, should create isometric line boundaries rated as

$$\textbf{4.} \quad \Delta \mathbf{t} = \frac{\Delta \mathbf{s}}{\mathbf{c}}$$

Note that time is dependent on the speed of light and is limited by it. Eq. 4 implies that if we divide the whole spacetime Δs by *c* as the limiter and if that results in a series of intervals, then, isometric contours of time should set the boundaries for each succeeding Universe. That is, one interval equals one space-like level or gradation equals one current Universe, see Figure 2 or 3. If each segment of a time-like Universe has a proper timeline (Eq. 4), then, it is finite or the designated timeline is rendered invariant. If ITP is true, then, the implication is that we could divide now Δs from Eq. 3 with either Δτ (proper age) or Δt (time interval) and the result would always be *c*:

$$5. \quad \frac{\Delta s}{\Delta t} = c$$

Eq. 5 implies that internal observers could always agree about the speed of light being the same for all as it flows within spacetime. However, relative to TEO, the length of each segment is static from start to finish of the spacetime overall geometry. Another way of looking at it (see Eq. 6) is that the ratio of Δs of the Universe over its age Δτ is the speed of light *c*, which is another way to describe ITP:

$$6. \quad \frac{\Delta s}{\Delta \tau} = \frac{\Delta s_1}{\Delta t_1} = \frac{\Delta s_2}{\Delta t_2} = \ldots = \frac{\Delta s_n}{\Delta t_n} = c$$

Setting Δr→0 (i.e., Δs > 0 or time-like) describes a point of singularity "moments" before the Big Bang "event". The idea of time is true for all internal observers whose information sensing is largely dependent on light. Δr→0 should be true if and only if the size of the Universe is insignificant enough as compared to its external environs; implying that the Universe is time-like. Given ITP, Eq. 5 could also be expressed as

$$7. \quad \frac{\Delta s^2}{\Delta t^2} = c^2$$

Since we are dealing with a point-like Universe (i.e., BGV theorem) with infinitesimal time dt being invariant (i.e., if ITP is true), Eq. 7 should evolve into

$$\textbf{8.} \quad \frac{ds^2}{dt^2} = c^2$$

Note: Δs^2 is somewhat the ambiguous shorthand for $(\Delta s)^2$ but will be used in this way throughout this paper.

B. Energy Diffusion Acceleration

If ITP is true, then we could say that Eq. 8 has a unit similar to thermal diffusivity, which measures the rate of heat transfer of a material from its hotter to cooler segments. Also related is kinematic viscosity, which is defined as the ratio of a fluid's viscosity against its density. Thermal diffusivity is the conductivity of a material divided by its density and its specific heat capacity given a constant pressure (Lide 2009, 2-65). Both of the said quantities have an SI-derived unit of $m^2 \cdot s^{-1}$. If spacetime has a similar pervading diffusive energy ε, then, it could be possible that if we divide the minute intervals of this quantity (dε) by the minute changes of spacetime ds, then, the result should simply describe ITP (i.e., Eq. 9) similar to Eq. 5 or 8:

$$\textbf{9.} \quad \frac{d\varepsilon}{ds} = \frac{ds}{dt} = c$$

Quantity dε could be interpreted as a measure of how much energy spreads in time per unit mass (with a unit of J·s/kg). Such a quantity has a dimension of $[L^2 \cdot T^{-1}]$ and could be expressed in $m^2 \cdot s^{-1}$ – the same unit as that of thermal diffusivity κ (see Hancock 2006) or kinematic viscosity ν. Since its unit is similar or reduces to the unit of κ, we shall call it, hence, energy diffusion with a symbol ε (epsilon) to differentiate it from κ (kappa) or the heat diffusivity within materials. It is also a sort of *kinematic viscosity*, only cosmological in nature.

From Eq. 9, the rate of change of this energy diffusion dε vis-à-vis ds is the speed of light *c*. We can treat ds itself as a spacetime interval upon which energy flows in a diffusive manner dε. In effect, combining Eq. 8 and 9 will describe a quantity called the thermal heat capacity (unit is $m^2 \cdot s^{-2}$ or J/kg) and should be equal to the speed of light squared:

$$10.\quad \frac{ds^2}{dt^2} = \frac{d\varepsilon}{ds} \cdot \frac{ds}{dt} = \frac{d\varepsilon}{dt} = c^2$$

And Eq. 10 can be further reduced to

$$11.\quad d\varepsilon = c^2 \cdot dt$$

Eq. 10 and 11 may hint at the mass-energy equation (see Einstein 1905b), which points to a possibility of an energy diffusion rate of change concerning (w.r.t.) time by taking the ratio of energy ΔE to its equivalent rest mass Δm (see Eq. 12):

$$12.\quad c^2 = \frac{\Delta E}{\Delta m}$$

Eq. 11 implies that the speed of light *c* is proportional to the acceleration of energy diffusion within the time-like Universe if and only if time is invariant (ITP). We can say that c^2 could be interpreted also as an acceleration of energy diffusion or simply as the Universe's thermal heat capacity. If these are all valid, we could reckon that: *"The Universe can be thought of as an accelerated energy diffused space equal to the speed of light squared if its total internal energy is proportional to its entire rest mass*." Or that a closed spacetime's overall thermal heat capacity is equal to the square of the speed of light if its total internal energy is equal to its entire rest mass. This is the *dynamic time postulate* (or DTP hereon).

C. A Cosmological Uncertainty Principle?

Following DTP and Eq. 12, energy ΔE given a rest mass Δm can be expressed as proportional to the rate of change of energy diffusion dε w.r.t. the proper time dt. To generalize Eq. 11, let us assume that we have not settled yet on the value of the proper time and that it is integrable. Integrating for dε and dt, then, an energy diffusion interval Δε within an invariant isometric curve Δt appears as

$$13.\quad \Delta\varepsilon \equiv c^2 \cdot \Delta t$$

Combining Eq. 12 and 13, given DTP, we will come up with

$$\textbf{14.}\quad \Delta\varepsilon \cdot \Delta m = \Delta E \cdot \Delta t$$

Since we dealt with dr→0, the right-hand side (RHS) of Eq. 14 could be an energy uncertainty equation and it should simplify to

$$\textbf{15.}\quad \Delta\varepsilon \cdot \Delta m = \frac{h}{4\pi}$$

Eq. 15 should be called the Uncertainty in Matter-Energy Diffusion (or, the Cosmological Uncertainty Rule) and should, at the very least, reduce to Eq. 16 (see below):

$$\textbf{16.}\quad \Delta\varepsilon \cdot \Delta m = \frac{\hbar}{2}$$

where $\hbar$ is the reduced Planck constant.

Eq. 16 seems to agree with the BGV theorem (2003), which suggests that the expansion rate of the Universe never gets below some nonzero value, no matter how small. The uncertainty limit equation (Eq. 16) suggests that the greater the scope of spacetime we know, the less certain we are of the masses that it comprises. Or, the more certain we are of an astrophysical mass, the less certain we are about its spatiotemporal history including its age. Could Eq. 16 describe why it is hard to determine the dark matter or dark energy every time we observe a distant galaxy?

D. Gauss' Law on Energy Diffusion Flux

If ITP is true that the Universe is a closed system, finite, and static, then we can treat its energy diffusion as a measure of the rate of transfer of energy from its hot region (i.e., at the beginning) to its cold end. This diffusive energy could be treated as a kind of heat flux and should be treated as a vector quantity extending from its starting point (i.e., Δr→0). And from there, assuming Page and Wooters (1983) are correct, then, we can subject the fluxes under an enclosing area to estimate the average. If the energy diffusion field $\boldsymbol{\varepsilon}$ is at right angles to a spatial element dA, then the former should be directed at each point of spacetime. Energy diffusion flux is a surface integral of time dt over a closed surface dA, analogous to how gravitational flux is a surface integral of a gravitational field and should have its own Gauss's law.

As the initial rest mass is transformed into energy, heat diffusion is also created. Hence, we could solve for the total age of the Universe, assuming $\Delta s^2 > 0$. To do this, we have to hold the Universe to be time-like or assume the BGV theorem or ITP to be true. We also need to test how its diffusion flux appears or assume internal processes to be dynamic by applying Gauss's Law on fluxes (see Young and Freedman 2012, 732). Since the starting geometry is a point or $\Delta r^2 \rightarrow 0$, a sphere is a probable progression for the Universe's advanced structure given the shape's preponderance amongst stellar bodies. Later, even without this assumption, we can still deduce that the whole Universe must be spherical (see Eq. 38 and 41).

Let us assume a spherical area that perfectly describes this point with a radial element d$\aleph$. Eq. 17 describes the diffusing energy fluxes through that spherical area dA as:

$$\textbf{17.}\quad \Delta\varphi = \oiint_{\partial V} \vec{\varepsilon} \cdot d\vec{A}$$

where the lower boundary ∂V is any closed surface (the boundary of an arbitrary volume V); dA is a vector whose magnitude is the area of an infinitesimal piece of the surface ∂V and whose direction is the outward-pointing surface normal. Quantity ε is the energy diffusion flux vector directed away from the singularity and never goes back in time. That is, the solution for the energy diffusion flux Δϕ for a closed sphere with radius d$\aleph$ should be

$$\textbf{18.}\quad \Delta\varphi = 4\pi c^2 \aleph^2 \Delta t$$

where c^2 is the speed of light squared and $\aleph$ is the average radius of the Universe at time t (or the total time enclosed within the surface ∂V). (NB: a closed integration was performed for Eq. 17 with an assumption that it can be integrated from 0 to $\aleph$.) Hence, Gauss's Law on Energy Diffusion Fluxes (or GLEFD hereon) states that: *"Energy diffusion fluxes flow in one direction within the Universe from its singularity towards its maximal boundary and are proportionate to the system's total internal time and characteristic radius."*

Similarly, if the distance from the point source is not important, we could interpret the energy diffusion flux Δϕ that is normal (90°) and passing through an area A as

$$\textbf{19.}\quad \Delta\varphi = \Delta\varepsilon \cdot A = \Delta\varepsilon \cdot \ell^2$$

where area A is agnostic about the distance of the source point. If ITP and the idea that the Universe is finite and static are true, coupled with the Gaussian Law on Diffusion Flux (GLEFD), Eq. 13 will imply then that Δε has a uniform energy diffusion throughout Δs. If ITP and GLEFD are true, we then can claim that a quantity Z describes the rate of change of energy diffusion flux dφ w.r.t. time dt:

$$\textbf{20.}\quad \frac{d\varphi}{dt} = Z$$

Generalizing and integrating Eq. 20 will give us

$$\textbf{21.}\quad \Delta\varphi = Z \cdot \Delta t$$

Combining Eq. 18 and 21, we will arrive at Δt to be

$$\textbf{22.}\quad \Delta t = \frac{\Delta\varepsilon}{Z} \cdot \left(4\pi\aleph^2\right)$$

By the way, the Energy Uncertainty Equation (Eq. 16) for Δt is at least

$$\textbf{23.}\quad \Delta t = \frac{\hbar}{2 \cdot \Delta E}$$

Eq. 23 is important for postulate DTP in that it shows that time started to make sense from (a presentist's perspective) once an energy ΔE was created within a very short time interval Δt and was accelerated at a diffusion rate of Δε (see Eq. 15 or 16 for the connection). If this energy started off the Big Bang, the time it took for that to be possible is virtually and extremely minute. Since energy diffusion is strictly internal, time must be part of an internal system.

To find an expression for the total length of the Universe whose origin is where the Big Bang energy ΔE took off, we need to combine Eq. 22 and Eq. 13. Incidentally, Eq. 13 can be used to solve for the mean energy diffusion flux of the entire Universe U. The total length of the Universe ℵ is, thus,

$$\textbf{24.}\quad \aleph = \frac{1}{2c} \cdot \sqrt{\frac{Z}{\pi}}$$

where $\aleph \geq \ell_P$. Aleph length can stand for the smallest or the largest stretch of the Universe depending on the nature of Z. Note that time drops out of the calculation when we try to look for this length. Eq. 24 supports our case for timeless external environs (i.e., the Background) where time is nonexistent (since the term cancels out for all lengths of U). Anything external of U, time ceases to exist or becomes unessential. In the next chapter, we will try to discuss what Z could be to solve for a possible value of ℵ.

III. Results and Discussions

A. What Z May Stand For?

Z, from Eq. 20, can stand for the rate of change of energy diffusion flux w.r.t. to a proper time. We may call Z the *diffusion flux factor*. To determine what Z is, suppose an energy ΔE is created at a very short time Δt somewhere in the Universe and, thus, started energy diffusion acceleration (assume DTP) that passes through a characteristic area A. To solve for Z, we know that energy diffusion flux Δε (see Eq. 19) passes through an area A and can be expressed as

$$\textbf{25.}\quad \Delta\varphi = \Delta\varepsilon \cdot A$$

So, combining Eq. 25 and 21 will yield

$$\textbf{26.}\quad Z \cdot \Delta t = \Delta\varepsilon \cdot A$$

From DTP, the ratio of Δε/Δt is c^2 – the speed of light squared – and, therefore, Eq. 26 could be used to express for Z as

$$\textbf{27.}\quad Z = c^2 \cdot A$$

The minimum possible value of ℵ, from Eq. 24, if A is equal to the Planck Area ℓ_P^2, would be $0.3\ell_P$. Now, since ℓ_P is the smallest length scale and anything below it means that no current experimentally corroborated models of physics can make meaningful statements, then, $0.3\ell_P$ has no physical description. That is, a $0.3\ell_P$-singularity would not make any sense or singularities should at least be ℓ_P. Note that dr→0 means that the Universe is time-like (see Borde, Guth, and Vilenkin 2003). We can also say that if A in Eq. 27 is the Planck Area ℓ_P^2 then Z has the smallest possible measure of

$$\mathbf{28.}\quad \mathbf{Z = c^2 \cdot \ell_P^2}$$

B. A Connection to the Bekenstein Information Limit?

Could Z have a possible connection to the information? We know that the Bekenstein-Hawking Entropy for a blackhole S_{BH} (see Bekenstein 1981) as reported by Freiberger (2018) is given as

$$\mathbf{29.}\quad \mathbf{S_{BH} = \frac{1}{4} \cdot \frac{A_+}{\ell_P^2}}$$

where the horizon area A_+ will increase if new masses Δm are added by

$$\mathbf{30.}\quad \mathbf{A_+ \geq \frac{8\pi \cdot GR \cdot \Delta m}{c^2}}$$

(where R is the radius of a sphere that can enclose a black-hole system given GLEFD). Does adding more uncertainty in the mass Δm, make A_+ more certain? Combining Eq. 29 and 30 will make Z to appear as a denominator if A in Eq. 27 happens to be the Planck Area ℓ_P^2 (either a triangle or a square, see Eq. 28):

$$\mathbf{31.}\quad \mathbf{S_{BH} \leq \frac{2\pi \cdot GR \cdot \Delta m}{Z}}$$

And, thus, from Eq. 31, the maximum value of Z would be

$$32. \quad \mathbf{Z = \frac{2\pi \cdot GR \cdot \Delta m}{S_{BH}}}$$

If the Bekenstein-Hawking entropy S_{BH} is equal to the Shannon Information Entropy

$$33. \quad \mathbf{S_{BH} = I \cdot k_B \cdot \ln 2}$$

(where I stands for information and k_B is the Boltzmann constant), then, in terms of information limit I, combining Eq. 32 and 33 will result to

$$34. \quad \mathbf{I \leq \frac{2\pi \cdot GR \cdot \Delta m}{Z \cdot k_B \cdot \ln 2}}$$

Is it possible that Z (the energy diffusion flux rate of change) in Eq. 34 is connected to Information and Entropy physics? If U has a constant energy diffusion acceleration rated at c^2 in Z given a constant 2D area A of equal length ℓ_H^2, then, the maximum Bekenstein information load for the Universe – assuming the Z-Hubble area and using Eq. 34 – is about about 20 trillion gigabytes. Equally, with Z-Planck pixels of side ℓ_P^2 as aggregates of the Universe, the maximum information load would be about 1.0×10^{145} bits (or 1.3×10^{135} GB).

C. A Spherical Time-Like Universe

From Chapter II, we arrived at a Gaussian Law on Energy Diffusion Flux. And since energy diffusion ε has a similar dimension to that of a spatial area change over time (i.e., $L^2 \cdot T^{-1}$), we could think of the quantity as such (i.e., dA/dt = ε). Following the same modus, assuming ITP (i.e., time is invariant for an external observer) and DTP (i.e., the Universe is an accelerated energy diffused spacetime for internal observers) to be true, we should have:

$$35. \quad \mathbf{\frac{dA}{dt} = c^2 \cdot t}$$

If we multiply Eq. 35 by dt and integrate both sides with their respective lower and upper bounds (from 0 to A_{total} for dA and from 0 to t_{total} for dt) will lead us to

$$36.\quad \mathbf{A_{tot} = \frac{1}{2}c^2 \cdot t_{tot}^2}$$

Eq. 36 is the total area of a mature Universe from beginning to end (i.e., assuming ITP that the Universe is finite). We need to know this total area from the absolute past (where the beginning is) and absolute future using two light cones as a tool (see Fig. 4A or the Universal Light Cones). We will use this tool because it could infer the overall area upon which light has spread throughout the entire history of the Universe and is a very simple one. The absolute past and future light cones have equivalent 2D circular areas that when combined, we would have Figure 4B. The equation below describes this entire area:

$$37.\quad \mathbf{A_{tot} = \pi \cdot R_{past}^2 + \pi \cdot R_{future}^2 = 2\pi \cdot R_C^2}$$

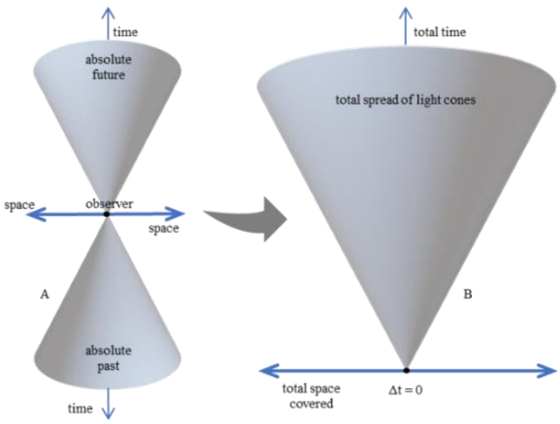

Figure 4. (A) The Universal Light Cones (i.e., the two nappes being equal) are the path that a flash of light, emanating from a single event (i.e., the Big Bang singularity at the center), travels in all directions. (B) The total light spread from beginning to end – covering the entire history of the Universe.

where A_{past} = A_{future}. A_{tot} is the full area upon which the Universal energy diffusion flux ε has saturated through. The acceleration of energy diffusion fluxes should have followed the trajectory of light as it moved through spacetime, given Eq. 5 and 9 and postulate DTP. To solve for total time t_{total}, we will take the cue from Eq. 36 and Eq. 37 and so equate them together – taking R_C to be the radii of the cones. This scheme should result to

$$38.\quad \mathbf{c^2 \cdot t_{tot}^2 = 4\pi \cdot R_C^2}$$

Eq. 38 tells that squaring c and multiplying it by the square of the total time of the Universe t_{tot} describes a spherical surface area. We take that to mean *that the shape of the Universe is spherical* while the total time (maximum age of the Universe) should be

$$\textbf{39.}\quad \mathbf{t_{tot} = \frac{2R_C}{c} \cdot \sqrt{\pi}}$$

R_C should come from Eq. 24, which describes the radius of a spherical Universe. As a side note, $\sqrt{\pi}$ could be the area under the curve of the function f(x) = e^{-x^2}, which is none other than but a *Gaussian function*. If R_C is substituted to ℵ in Eq. 24, then, the total time in Eq. 39 for light to move from the origin to the edge of the spherical Universe is

$$\textbf{40.}\quad \mathbf{t_{tot} = \frac{\sqrt{Z}}{c^2}}$$

We saw in Eq. 24 that time could be missing outside of spacetime. We also said that the smallest possible radius for the Universe should not be less than the Planck Length. If ITP and DTP were true, time should be dynamic for any internal observer yet invariant for an external one. From the right-hand side (RHS) of Eq. 38, U's total time is described by a spherical geometry – a spherical 4D cosmos – that grows from a singularity (absolute past) to its maximum size (absolute future). We can derive a time-like static expression (i.e., combining Eq. 2 and 38) for a spherical Universe with a radius R_C:

$$\textbf{41.}\quad \mathbf{\Delta s^2 = 4\pi \cdot R_C^2}$$

Eq. 41 infers that the total surface area of a 4D spherical Universe is as a time-like spacetime interval given the left-hand-side (LHS) is related to $c^2 \cdot t$. Likewise, it shows that if static time is true (assuming ITP or see Page and Wooters 1983), we could arrive at a spherical Universe (Eq. 38). And Eq. 40 will be suitable if we wish to arrive at the values of Planck and Hubble times. The total time within a Planck Area that experiences a Z-energy flux can be solved by combining the smallest possible Z (see Eq. 28) with Eq. 40. The result would be :

$$42.\quad \mathbf{t_P = \frac{\ell_P}{c}}$$

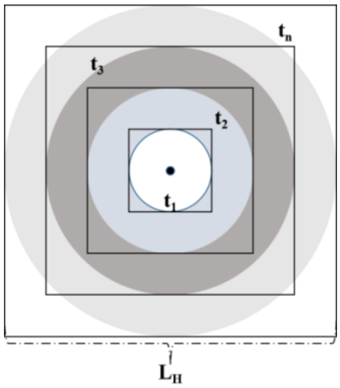

Figure 5. The possible suggestions of the Z-energy flux rate with the side of the frame equal to the Hubble Length (i.e., the Z-Hubble, see Eq. 44). Could Z be describing a pixel or a projector where energy diffusion flux occurs? The view here is eye-level with the arrow of time towards the viewer. Also notice that temporal gradations are enclosed. The time-like, static Universe is made up of multi-layered shells of space-like contemporaneous Universes of time t_1, t_2, up to t_n.

If you noticed, Eq. 42 is the exact expression for Planck Time. Figure 5 shows that Z can describe a 2D plane where the rates of change of diffusion flux w.r.t. time occurs. The Planck Area (see Fig. 6) could be the smallest polygon in the Universe since anything smaller would mean physically undefined. Doing the same procedure using Eq. 27 for the Hubble Length will give us

$$43.\quad \mathbf{Z = c^2 \cdot L_H^2}$$

Eq. 43 and 40 will eventually lead us to the expression for the total age of the Universe:

$$44.\quad \mathbf{t_H = \frac{1}{H_0}}$$

Eq. 44 is the expression for Hubble Time and we have just derived it. The reader is invited to check the process to know how this study arrives at Eq. 42 and 44. The Z-energy flux functions (Eq. 28 and 43) are deemed important in the derivations.

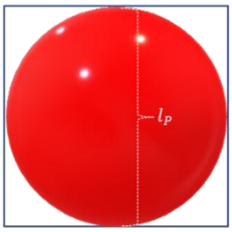

Figure 6. The smallest geometry in the Universe is the Planck Area, here illustrated as a sphere. The corresponding Z-Planck is given by Eq. 28.

D. A Possible Cosmogony?

How did the Universe begin to exist? And if it began to exist, what caused it? If time is assumed to be adynamic or as static spacetime isometric contours (or time wrinkles) internal to a time-like and a closed finite Universe (see ITP and BGV 2003; see also Figs. 1 and 3), *beginnings* should be redefined to be independent of information influxes or from being optical occurrences; due to light having no infinite speed. This study has found that time is immaterial for Eq. 24 when solving for a Gaussian radius. Yet, when solving for the smallest and largest temporal contours, we learned that both the Planck and Hubble times are proportional to the square root of their respective Zs (see Eq. 28 and 43). Note that from Eq. 27, Zs are proportional to a 2D area (see also Figures 5 and 6). If Eq. 40 is true, then the determination of the total temporal contours of the Universe could be simply dependent on a 2D, flat polygon.

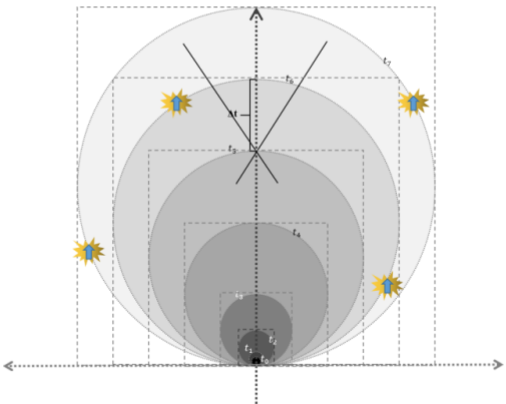

Figure 7. Top view: The Universe is ballooning with time where each circular line is equitemporal. Quantum entanglement may be an equitemporal form of communication (i.e., always along the equitemporal line, say, t_4) that does not travel between or at an angle with the time-like direction.

From Eq. 28, we can infer that the smallest area (Planck Area) could either be a pixel or a triangle (but this would be more complex than a square pixel). In contrast, note that a Z-Hubble implies a square and is a simpler polygon. What if the 2D polygon that a Z-Hubble implies may only represent a singular facet of a cube? Could this mean that the Universe be imagined as a sphere (Eq. 41) inscribed within a box? (Please refer to Fig. 7 to see what this may look like.)

Yet, the enclosing box is non-wrinkled (non-contoured or non-graded) compared to the concentric, contoured Universe inside it. What does it contain? If the Universe is like a ballooned sphere inside a box (see Fig. 7), then, the whole physical existence is just within a cube (a Hubble cube)! In contrast, since the smallest 2D Z-energy flux (i.e., the Z-Planck) might be a square of side ℓ_P, could it be possible that the whole spherical Universe itself is made up of cubic voxels or 2D mini pixels? Imagine a sphere that is an energy aggregate of Planckian cubes or 2D pixels. Are we existing in a pixelated or voxelated Universe? And given Eq. 40, *time must be a pixel function* (see also Eq. 46). It could also be deduced that time exists because information sensing of internal observers is, in essence, mediated by light. The idea of time may have arisen from information being acquired via light. No internal observer could ever witness the Universe in its entirety.

E. Isotemporal Spaces and Quantum Entanglement

How do we interpret that time should be taken as static isometric curves or as wrinkles of time? This paper takes Page and Wooters' idea of *static time* (1983). They proposed conditional probabilities interpretation to address the problem of time in systems like general relativity and quantum mechanics. The author is inviting the readers to see that 1983 paper for further studies. Here, we used the idea for ITP, which we could define this way: *if time were static, then, it must be finite and bounded*. The age of the Universe should be finite if that statement were to be taken as true. ITP is useful because it provided insight into the possible shape of the Universe (see Eq. 2, 38, and 41).

The study has to also affirm the BGV theorem (2003) which deduces that any universe that has, on average, been expanding throughout its history cannot be infinite in the past but must have a past space-time boundary at its null point along its time-like axis. This was the rationale behind Eq. 2 and 3 that allows for all subsequent equations and even for DTP to be proposed regarding the idea of an expanding Universe. The BGV theorem (2003) also took us to affirm that if the Universe was to be time-like, then, it could be thought of as a point amid a vast *Background.* If the Universe must be time-like (BGV Theorem 2003), then, its $\Delta s^2>0$ or its Δr^2 is practically 0.

The Universe may look like a bubble of temporal layers within and along its entire history beginning in its null point up to its final age (see Fig. 1, 3, and 7). The surface of each bubble is what the static temporal isometric curves wish to depict – all particles that are on the same temporal curve belong to one single history. Note that the material or the gravitational mechanism of why the Universe has to be spherical is not suggested in this paper. With ITP assumed true, the Universe must have a proper timeline or age (see Fig. 7).

Again, we can take all the points along an isometric curve belonging to an *equitemporal present* – an isocurve or being at the same temporal level. If this is true, we can suggest that communication via *quantum entanglement* (QE) may only be observed when two particles are deemed equitemporal or when they belong or ride the same space-like axis however distant their separation is. QE communication may work only when the particles are iso- or equitemporal and do not travel at an angle with the time-like direction relative to the other. That is, both particles should always be equitemporal or belong to the same temporal surface.

If one of the particles were to travel at a relativistic speed near the speed of light while the other is at rest or moving at a normal pace, QE may not be observed. If this is true, then, two quantum entangled particles separated at extremely distant locations would have instantaneous communications if and only if they belong to an equitemporal contour. Traveling at relativistic speeds destroys the equitemporality of two supposedly quantum-entangled particles.

In Fig. 7, you would notice that moving at the speed (at a 45° light line) makes one move a significant *arc displacement* along the isotemporal line from the initial timeline, and time dilation happens. This may also explain why quantum mechanics seems time-dependent as time becomes characteristic of the particles once the measurement started. Whenever we do experiments, we allocate an initial value (e.g., initial time) to register our data. We register a quantum measurement to a present temporal curve that is common to both the measurer and the one being measured. This is one of the underlying reasons why ITP assumes that time is observer-designate and inherently an artifice.

Given ITP, time can be portrayed as isometric, *actually invariant*, but finite and no one could escape the final contour of time. Objects riding a common temporal level or time surface within the Universe can have different locations in space. Yet, all are just traveling on isometric levels that are moving toward the future at a certain rate.

F. Could Blackholes be Micro Universes?

Could we say that black holes have the same mechanism as the Universe – being energy diffused spacetimes (see Fig. 8)? Could they be micro universes that have their own distinct internal spatiotemporal systems, which sizes indicate their outermost limit and their intra-temporal system looks unchanging when viewed externally?

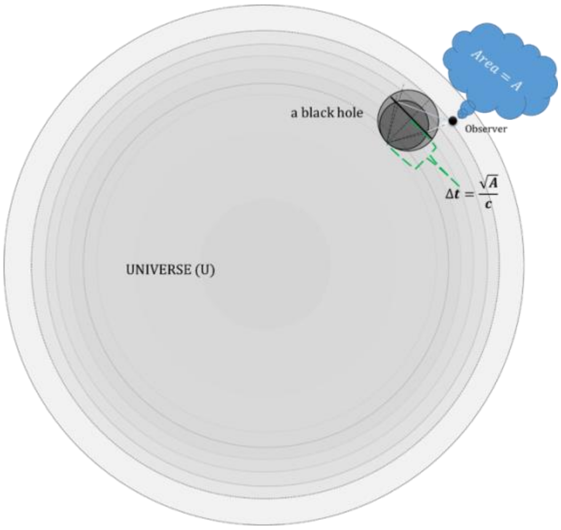

Figure 8. A simplified side view of the static 4D Universe hosting a black hole – a possibly micro-universe itself. We could estimate the time for the blackhole's Schwarzschild radius to reach its size by simply dividing its diameter by c (see Eq. 45). Notice that the origin of the black hole is depicted to originate below its observed area A just like the Universe that has its point of beginning relative to internal observers.

To know how long a black hole gets to its diameter, say, the Messier 87*, which has a Schwarzschild radius (SR) of 1.9×10^{13} m (or 5.9×10^{-4} parsecs or 1.9×10^{-3} light-years), we only need to double its SR and divide the result by the speed of light. Applying Eq. 40 to blackholes, we only need to get the square root of its corresponding Z-value equal to $c^2 \cdot A$. Eq. 45 is the simplest expression to solve for a blackhole's proper time (see Fig. 8 below). The side of the square inscribing the Schwarzschild circle is, thus, equal to its diameter, which is 3.8×10^{13} m. So, Messier 87* took only about 35 hours to completely become a black hole. This means that for any observer inside Messier 87*, no lifetime can exceed 35 hours. Another expression of Eq. 40 to get the time for a black hole to reach its present state is

$$\textbf{45.}\quad \mathbf{t} = \frac{\sqrt{\mathbf{A}}}{\mathbf{c}}$$

where A is the 2D square area enclosing a stellar body. One can use Eq. 45 to solve for the internal proper time of a black hole if they are simply micro universes and may as be a good example of time being stationary. If Eq. 16 is valid, we cannot know with high certainty together a certain stellar mass and the spatial area that immediately surrounds it. Thus, we cannot express area A in Eq. 45 in terms of mass.

G. A Timeless Reality Outside Spacetime

As per Eq. 24, time is inconsequential outside the smallest possible radius ℵ of the Universe – given Eq. 13 and Eq. 23 (Energy Uncertainty Principle). Even if we assume the energy diffusion of the Universe (see Eq. 16) to be dynamic, Eq. 24 still stands. Thus, from the smallest to the largest lengths, time is insignificant. And so, back to the question: *How did we begin to exist*? The answer, since time is just trivial outside of the whole universal boundary and given the results of our equations, it would be best to say that there is no external spacetime for the Universe to begin to exist.

Thus, since there are no processes (i.e., timeless) outside of its limits, the Universe could be timeless information with defined boundaries. And unlike blackholes which resides within spacetime, the Universe exists out of nothing. It is a spatiotemporal island existing from a timeless and spaceless background. This Background could neither be penetrated by any physical means nor material objects could move through it. Therefore, it is a boundless non-spacetime. It must be immense in size but it neither is space nor time.

If postulates ITP (invariant time postulate) and DTP (dynamic time postulate) are both true, we must accept that the Universe is limited. And if we have to maintain that it is an energy-diffused, spatiotemporal body that is finite, small, statically temporal, or wrinkled, then, it needs to be unique relative to the Background. Otherwise, there would not be any differentiation and the aforesaid assumptions crumble. If this Background is wrinkled too or has equitemporal contours, the Universe (U hereon) could not be distinguished and this will make our assumptions false and our derivation of the Planck and Hubble Time to be invalid.

Since U is wrinkled or temporal, then, the Background should be noncontoured or timeless. If the internal Universe has processes, then, the background should be without process or unchanging. If it is small and finite, then, the Background should be vast or possibly infinite. To differentiate U from this Background (APO hereon), to maintain that $dr \to 0$ or U is time-like, since we also hold this assumption to be valid as suggested by the Borde, Guth, and Vilenkin paper (2003), then, we could infer that APO may have the following characteristics:

a) To be an immense background;

b) To be unchangeable as opposed to the internal temporality of U, which means

c) To be not experiencing a change in size and contents; and,

d) To be contourless (i.e., simple) relative to U's temporal levels.

Note that these are necessary descriptions for APO to maintain the idea that dr→0 or U is time-like given it is static or stationary (Page and Wooters 1983). Incidentally, Classical Theism (CT) (see Craig, E. 1998) defines God this way.

So relative to APO – as its contents and size do not change – the temporal contours inside U are invariant and static. We are wont to think of U as if it started to appear from nothing or being-not there (see Fig. 9A). But this presupposes that information or what APO "contains" changes and is solely optical (i.e., from being invisible to visible). Every assumption from here on out about APO depends on the veracity of dr→0 or U as being time-like, which is quite similar to how classical theism defines God. To answer whether the entire timeline of the Universe began to appear or not at all, let us first discuss its uniqueness.

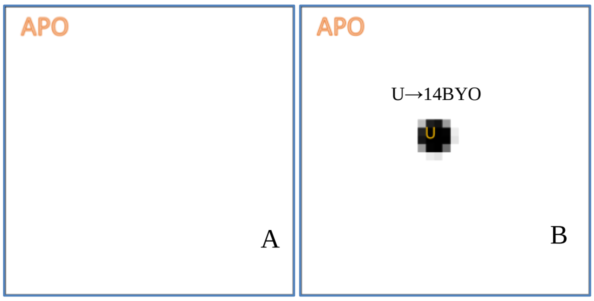

Figure. 9. The usual assumption for the Universe: APO at (A) pre- and (B) post-appearance of U of age 14 billion years old (BYO). The point-sized Universe U is exaggerated in B for emphasis. The immense APO is illustrated as the larger square for simplicity. APO stands for "absolutely processless observer".

H. The Universe is Uniquely Contoured

If the temporal contours (illustrated as pixel U in Fig. 9 and 10) are internal only for U and nothing of these describes the vastness of APO, then static time does not extend beyond U and must appear to flow for all internal observers whose velocity and information access is less than and dependent on the speed of light (ITP). If ITP is true that APO is simple (i.e., contourless) and does not change timeless), then, its reality should not sum up to A+B. Thus, Fig. 9 is not a sound illustration. Fig 9 caricatures the prevailing idea amongst creationists of how the Universe began to exist. And it fails, at least, in two aspects: (1) APO's contents and (2) size did change if APO's traits stand. So, to correct Fig. 9, APO *should always have U* and its size should not have changed to A+B (see Figure 10).

Since APO is timeless or unchanging, U as information should always be present before APO (Fig. 10). Notice that APO is not rated as 14 billion years old because it is not contoured, and experiences no sequences as A to B. We should always remember that even if APO "contains" U, it must be different from U (since U is finite) and not be the same as the latter. The uniqueness comes from the fact that APO is unwrinkled while U is, which implies a difference in their substances.

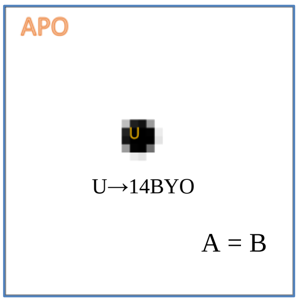

Figure 10. APO timelessly contains U. If U is wrinkled and since APO is smooth and simple, APO must be timeless and processless. Notice that APO is not sequential to be A+B and U is eternally wrinkled as ~14 billion years old (i.e., 14 billion 1-sec static gradation) because the contours are invariant or increasing.

If APO>>>U in terms of size (assuming dr→0, see Eq. 2), then, the absolute ratio of U vis-a-vis APO is practically zero:

$$\mathbf{46.}\quad \left|\frac{\mathbf{U}}{\mathbf{APO}}\right| = \left|\frac{\mathbf{dr}^2}{\mathbf{APO}}\right| \equiv \mathbf{0}$$

Eq. 46 is another implication of ITP and should make sense. If time were in the B-series (see McTaggart 1908), then, the age of U is constant due to its static internal temporal contours, which is not shared by its noncontoured Background. This means, that even if U has always been with

APO, APO would not have any age since it simply has no contours. Or, if we referenced its age to that of U, would still be more than 14 billion years old simply because of its immense size. It would render APO's years uncountable and has no known boundary or point of beginning unlike U as long as U's dr→0 or ITP is true.

And APO must be noncontoured (i.e., because U is wholly other, given the assumption that dr→0 or U is time-like) and, thus, it does not change contents or information and size. Hence, if APO has no contours, then that means that it is processless or unchanging. As suggested by our three postulates, U is also timeless information to APO yet only 14 billion years old in its internal contours. Temporal contours or wrinkles make U to be aged but APO is not. However, should APO be also 14 billion years old? Not at all, because

1. APO does not have temporal contours;
2. Its size is immense and not the same as that of U, and so,
3. If 1 and 2 are true, APO is not the same as U.

And even if we insist on extending the contours of U to APO, APO would still have uncountable contours, relatively speaking. Yet, that violates the idea that U is time-like and dr→0. If APO was also wrinkled, U becomes indistinguishable and dr ≠ 0, a violation of the BGV theorem (2003). If that is the case, the Universe (U) would have no external boundaries and not be rendered to be time-like.

The Universe seems to begin to exist for internal observers as information is not given instantaneously and access to information is mediated by the limitations of the speed of light. For emphasis, if we extend the contours to APO from U, this would violate the initial assumption that dr→0 and the idea that U is time-like. The negatives of these are the bases for postulate ITP. If everything is externally timeless vis-à-vis wrinkled universes like U, this means that their existence does not need a literal time. APO's contents or information are not dependent on optics, and thus, independent of time (see Eq. 40). That is, universes are timeless contents in APO. Lagged information exists due to optics being what subluminal agents are dependent on.

I. Is Time an Optical Function?

Temporal contours can be thought to exist (given postulate ITP) due to internal processes in U and can act like bumps that impede the acquisition of data or information. Thus, for a processless APO, no information begins to exist. If Eq. 40 is true, beginnings are limited by a factor of c^2 – as time is inversely proportional – and must imply that it is rooted in optics. A beginning only appears when light carrying the data travels and later informs an observer. If information is conveyed by light, U, then, must appear to have a beginning for all subluminal internal observers. A little argument may help:

P1. Any access to information, distant or not, is mediated by light.

P2. The beginning of time is a piece of distant information.

P3. P1 and P2 are true.

C1: Thus, access to the beginning of time is mediated by light.

We know that light does not travel to any point within the Universe instantly. Access to distant information is not instantaneous but requires a gradual flow of data. The information does not come all at once and so this made us think that time is ontological. Yet, the data has been there all along. Our limited epistemology only fails to inform us. Thus, the Universe appears to have a beginning not because it is its nature but because of our characteristic epistemological limit, which is our massive dependence on light. Time may just be an optical consequence due to light's limited speed. Our consciousness cannot be weaned from this dependence.

J. A Quest for an Eternalist Kalam Cosmological Argument

ITP implies that if the Universe is finite and static, time can be assigned over a static spacetime as invariant gradations or isometric curves (i.e., time wrinkles). Since information acquisition is generally optical, we can further say that time only appears to flow (i.e., non-invariant) for all observers that move at way less than the speed of light ($v \lll c$). Thus, an eternalist could further argue that:

P4. If ITP is true, then U has static initial and final temporal gradations.

P5. If $dr \to 0$ or U is time-like, U alone and not APO has temporal gradations.

P6. If P4 and P5 are true, U must have an initial temporal gradation (or beginning).

P7. P4 and P5 are both true.

C2: Therefore, U must have an initial temporal gradation (or beginning).

This is the background for an *eternalist* Kalam Cosmological Argument (or e-KCA). The initial static temporal curve is what temporal agents know and insisted on as the *beginning* as that data is not acquired instantaneously from its distant spatiotemporal location. For a non-optical agent that moves way below the speed of light, information arrives with a lag along the time-like direction. “Beginning” here, eventually, should not be misconstrued as the first appearance of the Universe because a finite and static U’s contours or time does not extend beyond its geometry and acts like a temporal island before a massive background that does not share that characteristic. So, such environ is unwrinkled or timeless. Then, such environ or Background must be unchanging. If information extends beyond the Universe, then, it should be unchanging, too. Thus, presupposing both ITP to be true and Eq. 4, which states that the speed of light limits or controls time, then C1 and C2 can be combined into:

P8. U is made up of initial (beginning) and final (ending) temporal gradations.

P9. Any optical data is acquired non-instantaneously.

P10. If the initial temporal gradation (beginning) is optical data, then, it will be acquired non-instantaneously.

P11. P8 and P9 are true, thus,

C3: U's initial temporal gradation (beginning) will be acquired non-instantaneously.

Hence, if one agrees that time or beginnings are just optical appearances or effects, we could accept that the Kalam Cosmological Argument is an adequate argument for a Causer (see Craig, W.L. 1979).

We combined the eternalist's and presentist's views of time – we identify that time arises due to our epistemological dependence on light and yet we believe that information transcends the Universe and should be timeless. Moreva et al. in 2014 and 2017 demonstrated that time is an emergent phenomenon for internal observers but could be absent for external observers, proving the Wheeler-DeWitt Equation paradox to be true. This could be a justification for the claim in ITP and our entire arguments thereafter.

IV. Conclusions and Other Remarks

A. Physical Conclusions

In this study, we postulated (ITP) that if a time-like spacetime interval could be divided into contours, and if each contour has a maximum allowable speed rated at the speed of light *c* (Einstein 1905a), then, each or later contours have unique configurations of objects and must be related from earlier ones. Or we can designate contours of time along the time-like direction of the Universe given the BGV theorem (2003) and if Page and Wooters' (1983) idea of static time is true. These contours or gradations could be described as temporal isometric curves (or, static temporal contours) and could be considered invariant or static to an external observer but flowing for internal ones (whose access to information is primarily mediated by the speed of light). With

ITP as a leeway, this study divided Δs with Δt and so arrived at equations 13, 16, 24, and 27, down to Eq. 45.

Indeed, combining ITP and DTP, we derived the Planck (Eq. 42) and Hubble (Eq. 44) times using an equation that is directly proportional to a factor called Z (see Eq. 41). We also learned that Z could either be a Planck Length or a Hubble Length dependent factor (Z-Planck and Z-Hubble, respectively) with a general expression of $c^2 \cdot \ell^2$. Also, from ITP, we arrived at an Energy Diffusion Uncertainty Equation (Eq. 16), which is related to the Energy Uncertainty Equation and Einstein's mass-energy equivalence (see Einstein 1905b), which makes Eq. 12 possible. Could Eq. 16 solve the dark matter and dark energy dilemmas? The disparate values of H_0 between the theoretical and experimental could come from an uncertainty limit given by Eq. 16.

Also, given DTP, the rate of energy diffusion ε is observed to accelerate at the speed of light squared c^2. Perhaps, relative to internal observers, this energy diffusion acceleration (that we found to be related to the rate of the Hubble expansion, see Eq. 35 to 44), maybe more than enough to drive spatial area changes that make future events or configurations within the Universe to be undetectable by current observers. This means we cannot observe future events that are even just 1 second away from the present given Gauss's Law of Energy Diffusion that treats energy fluxes that drive the spatial area change to be a one-directional vector – always away from the hotter beginning towards the cold dead end. The invariant time postulate (ITP) provides an idea about the size or the limits of the Universe while the dynamic time one (DTP) relates to how the Universe could reach that size.

Yet, even if time is assumed invariant if the postulate ITP was true, we found that time ultimately drops out of the equation when looking for a possible value for the characteristic radial length ℵ (where $\aleph \geq \ell_P$) while using Gauss' Law for Energy Diffusion Flux (postulate GLEFD) over an enclosed sphere. Thus, it is found that time is irrelevant for such scales beyond ℵ or L_H.

The rate of change of energy diffusion flux Z as $c^2 \cdot \ell$ can be noticed to be similar to the denominator of the Bekenstein Limit for information or information entropy if we take ℓ as the Planck Length ℓ_P. Also interesting is the factor ℓ^2 that could be considered as a 2D window area through which the energy diffusion flux can occur. Our cosmogony for the Universe is that it could be imagined as a set of static spheres (see Eq. 41) that has initial and final temporal curves. Time, including Planck's and Hubble's, is considered a synthetic label to assign gradations over a static Universe. Planck's represents the minimum possible gradation we can assign to the Universe and Hubble's represent the largest possible one. If this paper is to be believed, the Hubble time is its maximum possible age.

In conclusion, the derivation of the Planck and Hubble times via a single equation (Eq. 40) appears to have been successful because of the assumption that the Universe is made up of invariant isometric curves (i.e., the invariant time postulate, ITP). Inadvertently, this somehow *united both the presentist and eternalist views.* The Z factor needs to be further explored for its possible connection to information physics, especially with Bekenstein's optimal information theory.

The synthetic time wrinkles or temporal contours along the time-like direction can be described by either Eq. 4, 40, or 45, which supports ITP. The space-like direction must be considered as equitemporal zones in parallel to each current version of the Universe. Flat spacetime grids (0° or in parallel to the isotemporal curves) are not the synthetic gradations mentioned. And two internal observers that are not on the same contour planes have different times. That is, two observers have simultaneous time if they occupy the same isometric curve. A perfect light-like motion intersects the equitemporal lines from a 45° angle. An application of isometric curves (or the static temporal contours) as equitemporal surfaces may be related to quantum entanglement where the travel speed of communication is instantaneous if and only if the particles are riding the same temporal contours.

B. Other Remarks

If Page and Wooters's idea of static time (1983) is true, we can say that the Universe is finite and whose age is static and unique when compared to the timeless and spaceless Background that surrounds it. ITP and Eq. 46 show that the Universe's age should not affect the Background because (1) the Universe alone is wrinkled with static temporal contours and (2) their sizes are not the same. We have also tried to show that accepting ITP and dr to be zero (i.e., the Universe is time-like), assuming the BGV theorem (2003) is true, we could say that time is simply a designation since information is (1) transcendental and it is (2) not fundamentally dependent on optics. Thus, we say that the Universe is like a timeless record of every action of every object within its spatiotemporal history where information is carried and moderated by EM waves. Subluminal consciousness (i.e., human) is dependent on its delivery by these waves across space. And that creates the illusion of time.

An optically-reliant observer would have delayed information access and so believes that beginnings or time is ontological instead of simply being epistemological in nature. And given Eq. 4, time must appear to be dynamic instead of static for such an observer. Yet, relative to the external environs (i.e., the Background), time simply is an artificial designation to separate different incidents across the geometry of a static Universe. The Background is different from the latter since It can never be assigned with wrinkles, gradations, or contours. A universe is practically nil compared to the Background's immensity – ultimately, all universes are point-like relative to Their size. Existence should not be dependent on visibility or optics and should not dictate the presence of information that is shouting out loud that it is transcendental.

Hence, the Universe does not need a literal beginning. Just like a gramophone record that has edges, the Universe has a beginning and an end that existed timelessly. Our consciousness is directed only in a forward direction like the vector of energy diffusion fluxes (see Eq. 17 and 18), so the logical flow of events carried by light is interpreted unidirectionally. Again, information carriage via the speed of light is causing us to think about pauses or intervals and, finally, time. The phrase “whatever begins to exist has a cause” does make sense only for subluminal minds because information can never be acquired infinitely fast within the Universe. Time is but a consequence of light and useful fiction. For that matter, a timeless beginning (a static spatiotemporal edge) does still have a cause. And the cause must be processless or timeless.

Let Bryce DeWitt summarize this whole paper when he said in the 1960s that (as reported by D. Deutsch in 2014, 240)

"Other times are just special cases of other universes."

There is no temporal becoming because the information is light-independent yet subluminal agents acquire information gradually. Light paved the way for time to be created in our minds (see Eq. 4 and 40). And so, the beginninglessness of the Universe should not preclude one from saying that the Universe does have a cause.

V. Acknowledgment

I dedicate this study to Christine whose motivation and support encouraged me. I dedicate this study to Ian, my brother, who first heard of this idea way back in 2007 and who encouraged me to publish the idea. I dedicate this study to my sister Steph and mother Ellen for their support. I dedicate this work to all the theists who labor to show that a good God exists. Ultimately, I dedicate this study to that good God for inspiration.

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