THE NATURE OF EXISTENCE
AND
THE STRUCTURE OF THE UNIVERSE

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ABSTRACT

This theory establishes a structure for the universe based on the premises that classical logic always holds even if physical laws vary, and that scientifically verified results are true. It represents a framework that uses the minimal set of assumptions to explain observations related to General Theory of Relativity (GTR), Quantum Mechanics (QM), and the Michelson-Morley Experiment. Using logic alone, many of the processes that occur in nature such as superposition, and quantum tunneling are deduced. If validated, this theory could answer fundamental questions such as the nature of existence, how QM can be understood within a classical framework, and the origin of the gravitational force. While this is not a theory of everything, it may provide the proper framework for its development.

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DERIVATION AND DEDUCTION OF KEY TERMS

Based on the premises of this theory, everything that exists obeys classical logic even at the quantum level. Therefore, it is imperative to first derive the logical framework that establishes the boundary of all possibilities, and then use scientific observations to further impose limitations on said framework resulting in (hopefully) a theory that is both logical, and empirical. Consequently, deductions made within this framework may initially seem at odds with scientific findings, but when integrated into the broader theory, they become compatible with observations. The necessary terms are derived or deduced herein rather than assumed.

Consider an ontological object L of length 1 extending over $[0, 1] \subset \mathbb{R}^1$ (conceptualized as a rod). According to the Archimedean principle, L can be divided indefinitely into equal parts over the interval without the possible reduction to a summation of zeros [1]. This means that each segment has a length of $(\frac{1}{k}) > 0 \ \forall \ k \in \mathbb{R}^+$. Likewise, $\lim_{k \to \infty} \frac{1}{k} k \nLeftrightarrow 0\infty$ further establishing that L is infinitely divisible, but can't be produced from, or reduced to, nothing **(1)**.

By definition, something that doesn't exist cannot impose restrictions on something that does. Consequently, if nothing else exists along $\mathbb{R}^1$, then L can be moved indefinitely in either direction. Conversely, if L encounters something that imposes a restriction on it, that restriction indicates the presence of additional existence, and such logic can then be applied to it as well. Therefore, relative to L, $\mathbb{R}^1$ itself can be interpreted as nothingness, where anything that imposes a restriction is considered existence.

It could be argued that the ability to insert something (L) into nothing ($\mathbb{R}^1$) violates the fundamental premise of nothingness. Therefore, consider the alternative interpretation by defining a length X containing L | $\forall \ x \in X$, x exists ontologically, and therefore L exists in something, not nothing. However, what lies beyond X cannot be nothing, otherwise L would again exist within nothing. Thus, in this case $\mathbb{R}^1$ must exist as an ontological object that L moves within, and empty space DNE. Thus, in both cases, there must be infinite space, it is just that the initial definition of nothing streamlines the analysis by defining anything that doesn't impose restrictions on L as being non-existent relative to it.

Extending this concept to at least our 3-dimensions of space, it follows that nothing (N) can be defined as:

$$N \equiv \mathbb{R}^n \quad (for\ some\ n \geq 3,\ Definition\ of\ Nothing)$$

Since $(\frac{1}{k}) > 0 \; \forall \; k \in \mathbb{R}^{+}$ [1], point particles don't exist. Applying this principle in 3-space implies that existence necessitates at least a 3-volume of $(\frac{1}{k_x})(\frac{1}{k_y})(\frac{1}{k_z})$. Furthermore, since each segment of L exists over the length $\frac{1}{k}$, existence is characterized by a continuum having a property that distinguishes it from nothingness. For example, both a real and an imagined ball are geometric continuums, but only the real ball exists ontologically. The distinction is that the real ball has an additional property such as charge. Thus, the difference between epistemological and ontological existence lies in these "additional properties." Therefore, define the sets:

$$\mathbf{G} = \{g | g \; is \; a \; geometric \; continuum \; in \; \mathbb{R}^{n} \; with \; at \; least \; 3 - volume\}, \text{ and}$$

$$P = \{p | p \; is \; a \; non - trivial, \; non - geometric, \; non - spatial \; property\} \backslash Change$$

Existence can therefore be defined as:

$$\mathbf{E}(a) = (g, p_1, \ldots) \mid g \; is \; minimal \quad \text{(Definition of ontological existence of object a)}$$

Now, the imagined ball mentioned above can be morphed into a cube, but this would not change its epistemological status, thus properties such as change, speed, and position are not elements of (P), as they do not contribute to existence. Additionally, encapsulating an ontological object within some larger geometry would not imply that such larger object exists, therefore every point on g must have a property (p), thus g is minimal. The set ξ of everything that ontologically exists within $\mathbb{R}^{n}$ can thus be defined as:

$$\xi = \{a | a \in \mathbf{E}(a)\} \quad \text{(Definition of everything that ontologically exists)}$$

An element (a) from the set ξ that is infinitely divisible is complicated to analyze unless it can be considered as "stable". It is thus imperative to define a set E of elements that exist, having a volume that is quantized. This is justified because of the quantized nature of the universe. Thus:

$$E = \{a | a \in \xi, and \; the \; volume \; of \; g \; is \; quantized\} \quad \text{(Definition of quantized existence)}$$

The interactions Ĩ between elements of E are not themselves required to belong to E. For instance, the interaction Ĩ(electron, proton, ...) within an atom does not form a continuous structure, indicating that the atom itself does not exist (g is not minimal). The term "atom" describes how elements of E are configured, suggesting that the elements of E exist in that particular arrangement, but the atom itself is not an ontological object; rather, it is a collection of ontological objects. The interaction Ĩ(electron, proton, ...) generates the observable properties of

the atom. Hence, it becomes essential to define the set (I) of all potential interactions Ĩ among the elements of E as follows:

$$I = \{\tilde{I}(E)\} \quad \text{(All possible interactions Ĩ between elements of E)}$$

Assume (a) | g is a toroid, and p_1 is the property of charge. The charge could theoretically vary, and as long as it didn't become zero (before another property emerged) this would not change the overall existence. In other words, charge, like running, is a descriptive attribute rather than an entity that exists in itself. Therefore, an electron possesses the property of charge just as a person can possess the property of running, but charge and running do not exist as independent entities. Hence, properties (p) can theoretically vary without altering the totality of existence. As an example, imagine that charge is a property that emerges from the structure of g, so that as g morphs (while maintaining constant volume), the total existence remains constant. Therefore, the properties (p) can change, such as occurs during the electron-positron annihilation $[e^- + e^+ = \tilde{I}(e^-, e^+)] \rightarrow \gamma + \gamma$, but the total geometric volume (V) of existence must remain constant. That is:

$$V_{initial} = V_{final} \quad \text{(Conservation law of existence)}$$

In physics, particles are frequently characterized as being point-like, lacking internal volume or structure, although establishing this as universally accepted in reputable sources has proven challenging. It should be clarified that high-energy experimental results support this notion. However, based on the definition of existence, this would be the same as stating that such particles do not exist. From (1) existence can be infinitely divided and thus the elements of E can have internal structures well below even the Planck length allowing compatibility between logic and observation.

Establish the following sets:

$$E_u \subset E \mid \forall\ a_u^i \in E_u,\ a_u^i \text{ doesn't interact in a directly measurable way; and}$$

$$I_d \subset I \mid \forall\ a_d^i \in I_d,\ a_d^i = \tilde{I}(a_u^{i1}, a_u^{i2}\ldots) \text{ and is directly measurable.}$$

What does it mean to be directly measurable? If the elements of E_u fill the vacuum of space (as explained below), then any observation or experiment performed anywhere occurs within them and thus they typically cannot be detected. Likewise, if the elements of I_d form all of the detectable objects such as electrons, atoms, planets, and stars, then regions of space can be made devoid of such objects establishing a means of comparing a difference between their presence.

Since the elements E_u cannot be directly detected, they cannot be assumed to follow our known physical laws (**2**). In other words, all that is known experimentally is that the elements of I_d follow our physical laws, not the constituent components of E_u individually. With that said, the elements of E_u are directly undetectable (u), and the elements of I_d are constructed of the elements of E_u in such a way as to become detectable (d) through interactions Ĩ. Mathematically this is written as:

$$\tilde{I}(a_d^i, a_d^j) \rightarrow \{a_u^{ia}, \ldots, a_u^{ja}, \ldots\}$$
$$\tilde{I}(a_u^{ia}, \ldots) \rightarrow \{a_d^i\}, \text{ and}$$
$$\tilde{I}(a_u^{ja}, \ldots) \rightarrow \{a_d^j\}$$

The first equation states that the interaction of (some) detectable particles can reduce them to the undetectable constituent particles. The second and third equations state that the interaction of (some) undetectable particles can separately produce the detectable particles that are in the first equation. Therefore these equations represent the process of particle antiparticle pair production and annihilation. However, it is important to clarify that during annihilation, a photon is produced, and this would seem to imply that the right-side of the first equation is missing a a_d^x in the set, but this is not the case because the photon is detectible and is thus further composed of undetectable elements. It follows that the elementary particles β_d, of the standard model, can't be fundamental. That is:

$$\beta_d = \tilde{I}(a_u^i, a_u^j \ldots) \quad \text{(Composition of elementary particles in the standard model)}$$

Therefore, the electron $e = \tilde{I}(a_u^{e1}, a_u^{e2} \ldots)$, is caused by the interaction of more fundamental components. If these components interact in such a way as to form a continuum, then the electron exists, otherwise only the components exist and they do so in such a way as to result in the properties that we associate with the electron. As an electron encounters a potential barrier, there is a non-zero probability [2] that it will be in a reduced state existing as the constituent elements $a_u^{e1}, a_u^{e2} \ldots$. Since these elements are undetectable, they can traverse a potential well, and re-combined on the other side, thus modeling the process known as quantum tunneling [3]. Likewise, if two particles a_d^i and a_d^j are entangled, due to (2), there interaction $\tilde{I}(a_d^i, a_d^j)$ could be facilitated by a_u^k | information propagates faster than c, explaining Einstein's "spooky action at a distance" [4] (If quantum tunneling happens faster than c, this could explain why).

The transition $[t = undefined] \rightarrow [t = 0]$ necessitates that the property of change precedes time. Likewise, if time is without beginning, then the elements of ξ exist within it. Therefore, regardless of the duration of time, change is a property of existence **(3)** (just not an element of P). That is, (1) ⋀ (3) ⇒ $that\ \forall\ a^i \in \xi,\ a^i\ has\ the\ property\ of\ change$. Therefore **T** can be defined as an infinite period of time that has passed, where time is not necessarily a universal dimension, but is a reference to perpetual existence and change.

Let $S(\boldsymbol{\chi})$ be the state function of all of the elements of ξ collectively as the property of change (3) is expressed. From (1) it follows that $S(\boldsymbol{\chi})$ is continuous, and the $D_S = \mathbb{R}$. Therefore $\boldsymbol{\chi}$ is not assumed to be synonymous with time, but the previous implications align it with (T) above. In order to not violate causality, $\forall\ a^i \in E$ the respective state function $S^i(\boldsymbol{\chi})$ must form a causal loop, wherein interactions $\tilde{I}(a^i, E \backslash a^i)$ cause a change or skip in states. Therefore, a^i has always existed, it changes states through a causal loop, and interactions with other elements cause skips and changes in its next state. Furthermore, each element of ξ can only exist in one state (relative to $\boldsymbol{\chi}$) otherwise it would necessitate the production of additional existence from nothing violating (1). Therefore particles cannot exist in multiple states simultaneously **(4)**, contrary to some interpretations of quantum mechanics. It should be clarified that a state can be decomposed into a superposition, in the same manner that f(x) can be decomposed with a Fourier Transform, but this is not the same as saying that a particle exists exclusively in one of the decomposed states. The particle exists in the $S^i(\boldsymbol{\chi})$ state, and only in the $S^i(\boldsymbol{\chi})$ state. This theory offers a new interpretation for observation as explained below.

Consider particle a^i that is isolated from the rest of the elements of ξ. If a^i transitions through states cyclically, there must exist an intrinsic property, referred to as a law, ensuring the sequence of each cycle. Conversely, if a^i changes states in a non-cyclic manner, either the cycle is infinite, or each state change involves a choice, thereby illustrating the concept of free will (FW). To elaborate, if a^i is compelled to change states due to its causal nature, and the specific state isn't governed by a law, a^i possesses a degree of free will. Henceforth, such particles shall be denoted as a^i_{FW}.

It is imperative to formulate a structure of the universe that is compatible with the previous statements, in a manner that models observation. From the previous deductions, it becomes apparent that the universe contains both elements of E_u and elements of I_d that interact within some region of empty space (N). Without some ontological boundary restraining such elements, such a system is reasonably considered spherical although its shape has minimal

bearing on the logic. Therefore, let $\eta \subsetneq I_d$, $\mu \subsetneq E_u$, and $Sph(r) = \{x \in \mathbb{R}^3 \mid \|x\| \leq r\}$. The universe can can then be defined as:

$$U \equiv \eta \cup \mu \; existing \; within \; Sph(r) \quad \text{(Definition of the universe)}$$

In this model, the elements of μ fill the expanse of $Sph(r)$ like a compressible ether (**CE**) of density (ρ), and the elements of η form detectable objects like planets, stars, and atoms that move through it. The interactions $\tilde{I}(\eta, CE)$ are modeled by quantum mechanics in which particles are exchanged to and from the CE | $\eta \cup \mu = const$. The CE is the only existence in "the vacuum of space" and thus the cosmological constant is integrally tied to its properties. It is important to remember that from (2), there isn't a need to assume constraints on the elements of the CE, thus the expansion of U exceeding c should not be assumed an issue for such elements to cause. With the elements of η propagating through the CE, the CE acts as a regulatory body (via the interactions) wherein its density ρ determines the number of interactions per unit time: this will be important in the formulation of the theory below.

As a_d^i travels through the CE, it is theorized to produce waves that propagate through it such as to not violate (4). Therefore, as a_d^i transitions through its causal loop $S^i(\boldsymbol{\chi})$, it produces a series of superimposing waves in the CE, thus giving the illusion that a_d^i is existing in multiple states, and establishing an explanation for wave-particle duality. These same types of waves that explain the interference patterns of the double-slit experiment, are the same type of waves produced during black hole collisions (gravitational waves).

When a chemical reaction occurs, the property of energy is transferred from one element to another. The same is true for nuclear reactions, or any other reaction. Therefore, energy isn't something that exists, it is a property (p) of existence (at least within U), and that property can be transferred between elements of ξ resulting in a change of state $S^i(\boldsymbol{\chi})$. Our conservation laws therefore model that exchange.

COMPLICATIONS OF SPACETIME

Spacetime is considered the most viable option in cosmology, thus it is imperative to analyze it in terms of the aforementioned logic. The Whitney Embedding Theorem ensures that any smooth manifold M of dimension (m) can be embedded into $\mathbb{R}^{2m}$ [5]. Therefore let $\mathbb{R}^n \subseteq \mathbb{R}^{2m}$ be the minimal vector space containing M. It follows that if $M \ncong \mathbb{R}^n$, then $\mathbb{R}^n \backslash M \neq 0$

, and thus M must be ontological in order to distinguish it from nothingness ($\mathbb{R}^n$) **(5)**. Thus M must be a real object. *{For the sake of completeness, it should be clarified that the opposite could be true: it could be* $\mathbb{R}^n \backslash M$ *that is ontological, in which case existence within M is constrained by external existence.}* To comprehend spacetime, one of the three spatial dimensions can be eliminated, allowing one to visualize it as a cylinder or a similar shape that's easier to conceptualize. In this analogy, the axis of the cylinder represents time, and each perpendicular cross-section represents a moment in time during which the universe exists. Due to (5), the spacetime manifold can be analyzed in terms of the definition of existence above.

1) If time is considered a property (p) rather than the geometry (g), then elements within the universe have the property of time, but this doesn't explain why elements remain in the same cross-section essentially universally.

2) If time is considered as the geometry (g), or a component of the geometry, while properties (p) like charge and mass are associated with elements within it, anywhere that there isn't a property (p), spacetime wouldn't exist. This issue can be avoided by assuming that every point within spacetime has a property, just some of those properties are not detectable to us. However, there isn't any known means for which everything in the universe travels through the geometry of time in a coordinated manner.

3) Any other case would necessitate that spacetime doesn't exist as per the definition of existence above.

To resolve these issues, imagine removing a cross-section from spacetime (including matter) and shaking it to induce permutations within it. This shaking process can be compared to the progression along the time dimension. Now rather than shaking, envision each element a^i within it moving through its own causal loop Si($\boldsymbol{\chi}$), independent of a universal time dimension. In this scenario, everything within the cross-section effectively "shakes itself" to produce observable changes. As a result, the time dimension of spacetime loses its universal status, and its properties of change are transferred to individual elements a^i (3). Through the interactions $\tilde{\mathrm{I}}(\eta, CE)$, events are coordinated universally, creating the illusion of time without the need for more than 3-dimensions (in total).

THE PROPOSED STRUCTURE OF THE UNIVERSE EXPLAINED IN TERMS OF THE MICHELSON-MORLEY EXPERIMENT

The Michelson-Morley Experiment (MME) is perhaps the most notoriously referenced scientific measurement establishing the speed of light to be constant. Using its ingenious design, the following equations are derived.

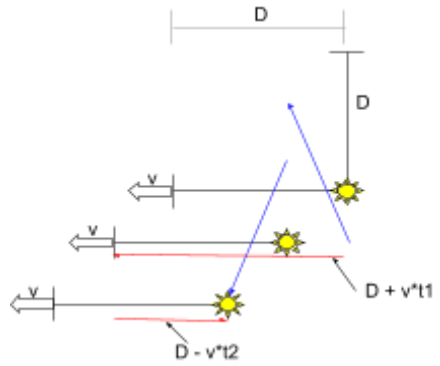


Figure 1: This diagram illustrates the Michelson-Morley Experiment (MME) apparatus moving to the left through the ether. The three stages depicted correspond to photon emission, photon reflection, and photon return. The total path length traveled by each photon is shown in red and blue, respectively.

In figure 1, the MME apparatus is drawn at 3 stages as it moves to the left at speed v: the red arrows indicate the total path length of the horizontal photon, and the blue arrows are the path lengths of the vertical photons. The equations are as follows:

$$D = (c - v)t_1 = (c + v)t_2 \quad \text{(Horizontal time components)}$$

$$\Rightarrow t_1 = D/(c - v) \quad \text{and} \quad t_2 = D/(c + v)$$

$$\Rightarrow T = t_1 + t_2 \Rightarrow T = 2Dc/(c^2 - v^2) \quad \text{(Total time)}$$

So the total distance traveled by the horizontal photon is:

$$\begin{aligned} D_{h-Total} &= (D + vt_1) + (D - vt_2) \\ &= 2D + v(t_1 - t_2) \\ &= 2D + v(D/(c - v) - D/(c + v)) \\ &= 2D + vD((c + v) - (c - v))/((c - v)(c + v)) \\ &= 2D + 2v^2D/(c^2 - v^2) \\ &= (2Dc^2 - 2Dv^2 + 2Dv^2)/(c^2 - v^2) \\ &= 2Dc^2/(c^2 - v^2) \end{aligned}$$

And the total distance traveled by the vertical photon (blue) is:

$$\begin{aligned} D_{v-Total} &= 2[D^2 + (vT/2)^2]^{1/2} \\ &= 2[D^2 + (vDc/(c^2 - v^2))^2]^{1/2} \end{aligned}$$

Now, compare the two path lengths $\alpha * D_{h-Total} = D_{v-Total}$ where α provides a ratio of the two equations. Solving for α yields:

$$\alpha 2Dc^2/(c^2 - v^2) = 2\,[\,D^2(c^2 - v^2)^2 + (vDc/(c^2 - v^2))^2]^{1/2}$$
$$\alpha 2Dc^2 = 2\,[\,D^2(c^2 - v^2)^2 + (vDc)^2]^{1/2}$$
$$\alpha = [(c^2 - v^2)^2 + (vc)^2]^{1/2}/c^2$$
$$\alpha = [(c^4 - 2v^2c^2 + v^4) + v^2c^2]^{1/2}/c^2$$
$$\alpha = [c^4 - v^2c^2 + v^4]^{1/2}/c^2$$
$$\alpha = [1 - v^2(c^2 - v^2)/c^4]^{1/2}$$

So, the two path lengths are not the same, but they are very close for $|v| << c$ (as a reference, for $v = 0.1c$, $\alpha \approx 0.995$). In order to resolve this difference in path length, time t first needs to be defined as:

t ≡ The time as it passes according to clock k positioned in $\mathbb{R}^n \backslash U$

Thus, time t does not register on one's clock, nor does it vary based on what happens in U. Everything within U thus moves at some speed relative to k with or without such measurement being possible.

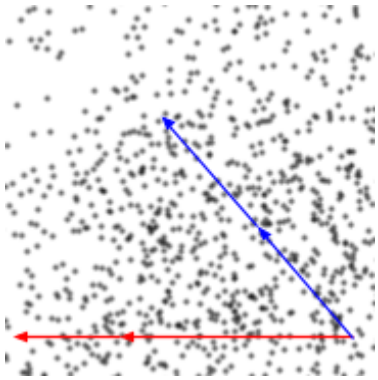


Figure 2: This diagram represents the total path length of each photon respectively through the CE.

Now, interpret the MME with the compressible Ether (CE) present as defined above, and as illustrated in figure 2. The number of interactions $\tilde{I}(CE, photon)$ is proportional to the path length traversed by each photon, not the length of each arm.

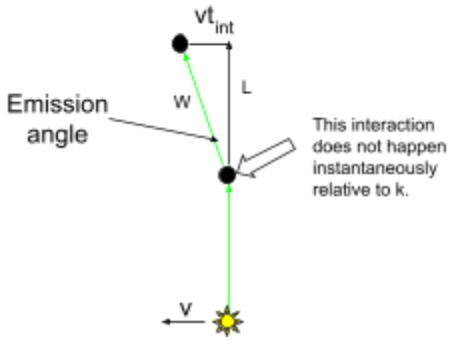


Figure 3: This diagram represents the vertical photon path (green) between the elements of the CE. The interaction takes time $t_{int} > 0$ to occur, and thus rather than being emitted along L, it travels path W increasing the overall distance traveled.

However, as illustrated in Figure 3, these interactions $\tilde{I}(CE, photon)$ are not instantaneous, resulting in a delay of t_{int} at each interaction. This delay increases the path length of the vertical photon between elements of the CE, from L to W, potentially increasing $D_{v-Total}$ to within undetectable difference of $D_{h-Total}$. For this to be possible a couple things must be true:

1. The interactions $\tilde{I}(CE, photon)$ must preserve information about the photon and the velocity v, in order for the emission angle to be correct. Therefore it is theorized that during the interaction $\tilde{I}(CE, photon)$, the photon dissociates into the constituent elements $\{a_u^{ia}, \ldots\}$ where in according to (2) momentum need not be assumed to be conserved until t_{int} later after the reverse process $\tilde{I}(a_u^{ia}, \ldots) \rightarrow \{photon\}$ occurs. Therefore, the information regarding v is preserved in the elements of $\{a_u^{ia}, \ldots\}$. While this sounds complex, if all of these processes are determined by unknown laws, then such can occur automatically. It should be clarified that $D_{h-Total}$ only needs to be equal to $D_{v-Total}$ within a detectable value over the velocities pertaining to earth through the CE so it cannot be stated that at higher velocities a phase shift wouldn't occur.
2. As theorized herein, U exists in infinite nothingness ($\mathbb{R}^n$), where the space between the elements of the CE is also nothing, and thus the emission speed of light c^+ between such elements should be the same value universally. However, since the interaction $\tilde{I}(CE, photon)$ takes time t_{int}, the average speed of light over the interval t would be:

$$c_{Ave} = d_0(n + 1)/[d_0(n + 1)/c^+ + t_{int}n] \quad \text{(average speed of light over interval t)}$$

where d_0 is the average distance between interactions, and n is the number of interactions. Therefore, as the density ρ (of the CE as defined above) increases, the average speed of light decreases (rel. to k), and therefore the speed of light is not a

universal constant. It follows that the value $c = 299792458\, m/s$ must be c_{Ave} based on the density ρ of the CE where measured.

With that said, a very similar process can be claimed to occur for all force carriers wherein their speed, relative to k, dilates for the same reason that the speed of light does potentially resulting in a light clock producing similar results to an atomic one (notice that this would no longer be a requirement though since time is just an arbitrary measurement). Therefore, a universal dimension of time doesn't exist, the elements of E composing the clock k simply transition through their individual causal loops $S^i(\boldsymbol{\chi})$, and through their interactions they produce a result that can be interpreted as time. The same is true for all of the elements of U in which the interactions $\tilde{\mathrm{I}}(CE, \eta)$ determine the rate at which events in the universe occur producing the illusion of time. Therefore time can be defined as:

Time $\stackrel{\text{def}}{=}$ The distance a specified force carrier propagates within a given reference frame multiplied by a conversion factor.

Since time doesn't exist, yet GTR matches observations really well, one can use the geniusness of Einstein by writing time in GTR as a linear function of the local speed of light c_{Ave}, and interpreting our concept of time as being proportional to the number of passes inside of a light clock. Therefore, as the speed of light slows down, the number of passes within the clock is reduced proportionally resulting in time dilation. In this sense, Einstein did the heavy lifting for this theory. Therefore, let $c_{Ave}dt = c\, dt_0$, and since $cdt_0 = \sqrt{g_{\boldsymbol{\mu\nu}} dx^{\boldsymbol{\mu}} dx^{\boldsymbol{\nu}}}$ in GTR [5], it follows that:

$$c_{Ave}dt = \sqrt{g_{\boldsymbol{\mu\nu}} dx^{\boldsymbol{\mu}} dx^{\boldsymbol{\nu}}}$$

Therefore:

$$c_{Ave} = \sqrt{g_{\boldsymbol{\mu\nu}} \frac{dx^{\boldsymbol{\mu}}}{dt} \frac{dx^{\boldsymbol{\nu}}}{dt}} \quad \text{(t is relative to clock k, 1)}$$

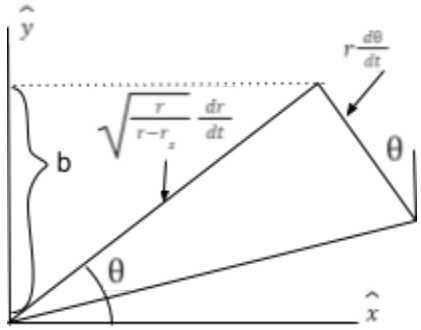
Where t is relative to clock k. Using the equation $c = nc_{Ave}$ it follows that the index of refraction (n) of space that is produced by the CE is:

$$n = 1/\sqrt{g_{\boldsymbol{\mu\nu}} \frac{dx^{\boldsymbol{\mu}}}{dt} \frac{dx^{\boldsymbol{\nu}}}{dt}} \quad (2)$$

Therefore, the CE changes density regionally just right so as to produce an index of refraction of space [7] that causes the results of GTR without the need for a universal dimension of time.

THE QUANTUM NATURE OF GRAVITY

Figure 4: This figure shows how the components of the Schwarzschild Metric fit geometrically..



From the Schwarzschild Metric, for a photon traveling in the plane φ = 0:

$$\frac{r-r_s}{r}c^2 - \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2 - r^2\left(\frac{d\theta}{dt}\right)^2 = 0 \quad (3)$$

From Figure 4, adding up the components in the $\hat{x}$ and $\hat{y}$ directions result in:

$$< \frac{dx}{dt} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta), \frac{dy}{dt} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}sin(\theta) + r\frac{d\theta}{dt}cos(\theta) > \quad (4)$$

Dividing the x-component in equation (4) by dx, squaring both sides, and multiplying by $\partial^2 E$ yields:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta)\right]^2\frac{\partial^2 E}{\partial x^2} = \frac{\partial^2 E}{\partial t^2} \quad (5)$$

Notice the similarity between equation (5) and $\frac{\partial^2 E}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 E}{\partial t^2}$. Additionally, notice that with $\theta = 0$, equation (5) reduces to $\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}\right]^2\frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial t^2}$ in which equation (3) allows one to replace $\frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2$ with $\frac{r-r_s}{r}c^2$. Therefore, equation (5) becomes:

$$\frac{r-r_s}{r}c^2\frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial t^2}$$

Setting E = R(r)**T**(t), and solving for R(r) yields:

$$\frac{d^2R(r)}{dr^2} = -\left[k^2\frac{r}{r-r_s}\right]R(r)$$

Therefore:

$$k\sqrt{\frac{r}{r-r_s}} = \frac{2\pi}{\lambda}$$

Thus:

$$\lambda = \frac{2\pi}{k}\sqrt{\frac{r-r_s}{r}} = \lambda_\infty\sqrt{\frac{r-r_s}{r}} \quad (6)$$

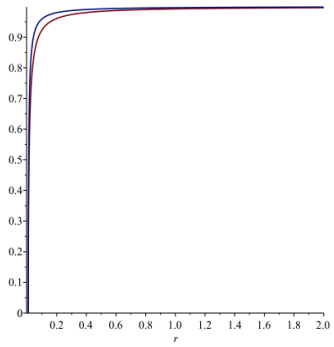


Figure 5:This is a plot of $\lambda = \lambda_\infty\sqrt{\frac{r-r_s}{r+r_s}}$ from GTR (red) vs $\lambda = \lambda_\infty\sqrt{\frac{r-r_s}{r}}$ (blue). The Schwartzchild radius used is 0.0088m.

In figure 5, the gravitational redshift equation of GTR ($\lambda = \lambda_\infty\sqrt{\frac{r-r_s}{r+r_s}}$) (red) is plotted alongside equation (6) for $r_s = 0.0088m$ (the Schwartzchild radius of earth).

In a relatively stationary reference frame: The momentum p of a photon is $\frac{h}{\lambda}$, and using equation (6), the measured momentum of k photons is:

$$M(p) = \frac{hk}{\lambda_\infty\sqrt{\frac{r-r_s}{r}}}$$

$$= \frac{hk}{\lambda_\infty}\sqrt{\frac{r}{r-r_s}}$$

Therefore the measured force exerted by the photon as it is omitted from an object O is:

$$M(F) = \frac{hk}{\lambda_\infty}\frac{d}{dt}\left(\sqrt{\frac{r}{r-r_s}}\right)$$

$$= \frac{hk}{2\lambda_\infty}\left(\frac{dr}{dt} = c\right)\left(\frac{1}{\sqrt{r(r-r_s)}} - \frac{\sqrt{r}}{(r-r_s)^{1.5}}\right)$$

$$= \frac{hkc}{2\lambda_\infty}\left(\frac{r-r_s}{\sqrt{r}(r-r_s)^{1.5}} - \frac{r}{\sqrt{r}(r-r_s)^{1.5}}\right)$$

$$= \frac{hkc}{2\lambda_\infty}\left(\frac{-r_s}{\sqrt{r}(r-r_s)^{1.5}}\right)$$

Additionally, since r_s is the Schwartzchild radius it can be replaced with $\frac{2GM}{c^2}$. Therefore:

$$M(F) = \frac{-GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}\left(r-\frac{2GM}{c^2}\right)^{1.5}}\right) \quad (7)$$

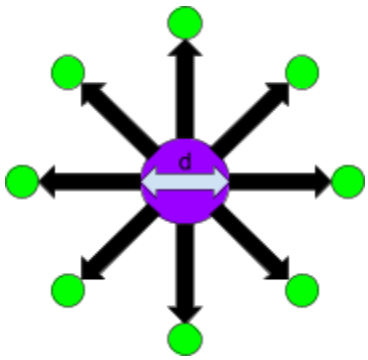


Figure 6: An object O (purple) of diameter d radiates a uniform field of virtual photons (green) in all directions. All of the photons produce the same momentum on O uniformly resulting in a net acceleration of zero for O.

In Figure 6, the mathematical framework is illustrated in which an object O, of diameter d, radiates a uniform field of virtual photons in all directions. This results in a force acting on O, but since the field is uniform the net force on O is zero.

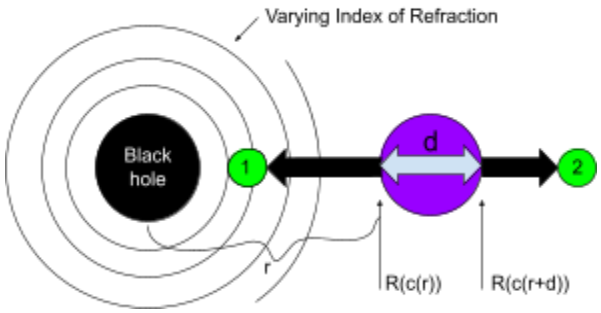


Figure 7: Object O from Figure 6 is placed into a non-uniform gravitational field that is produced by the presence of a black hole. The momentum produced by virtual particle 1 is greater than the momentum of virtual particle 2 producing a type of anti-gravity.

In Figure 7, object O is placed into a gravitational field. From equation (7), the measured force exerted on O due to virtual photon 1 being emitted is:

$$M(F_1) = \frac{-GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}\left(r-\frac{2GM}{c^2}\right)^{1.5}}\right)$$

And the force exerted on O due to virtual photon 2 being emitted is:

$$M(F_2) = \frac{-GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r+d}\left(r+d-\frac{2GM}{c^2}\right)^{1.5}}\right)$$

The magnitude of the net force is therefore the difference:

$$\left|M(F_{net})\right| = \frac{GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}\left(r-\frac{2GM}{c^2}\right)^{1.5}} - \frac{1}{\sqrt{r+d}\left(r+d-\frac{2GM}{c^2}\right)^{1.5}}\right)$$

$$= \frac{GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}\left(r-\frac{2GM}{c^2}\right)^{1.5}} - \frac{1}{\sqrt{r+d}\left(r+d-\frac{2GM}{c^2}\right)^{1.5}}\right) \quad (8)$$

Notice that $M(F_{net})$ is 0 for a point particle ($d \to 0$). Also notice that this force actually pushes O away from the black hole. This is resolved if the photons are omitted internally passing from side to side. Suppose that photon 1 is emitted traveling towards photon 2. The photon's wavelength increases as it moves towards 2 and thus its momentum is less upon absorption resulting in less force. Likewise, photon 2 decreases in wavelength resulting in a greater momentum upon absorption. While photons do not mitigate the strong force, applying this principle to the transfer of gluons within the nuclei might end up beneficial.

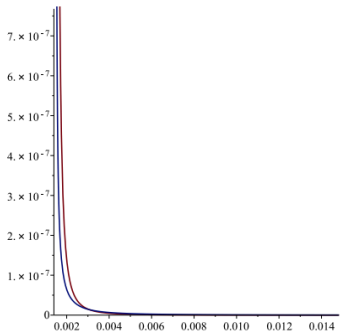


Figure 8: This graph shows the relationship between the Newtonian gravitational force equation and that of equation (8)

Figure 8 shows a comparison between the gravitational equation, and the force produced through these quantum processes. Please note that the values for the constants were selected, not derived, in order to make the graph fit. This was done simply to show the shape of the graph in a meaningful way, and is not intended to be misleading.

POTENTIAL CONTRIBUTIONS TO PHYSICS

It isn't a secret that quantum mechanics is complex and confusing, yielding seemingly paradoxical results. It is believed that the aforementioned theory provides a framework in which both classical logic, and observation remain compatible. It is also believed that such theory can offer a better explanation by producing a framework that is compatible with both GTR and QM. Such explanations are as follows:

Black Holes: From equation (1) it follows that the speed of light, relative to k, approaches zero at the event horizon. Since the total existence both before and after an interaction is the same, the total volume of existence entering the event horizon remains within it negating the potential for a singularity at the center.

Force Of Gravity: From equation(8), the force of gravity can be reasonably modeled by the interaction of force carriers interacting within a space that has a varying index of refraction (n) produced from the CE. This eliminates any infinite forces at the center of the black hole.

Gravitational Waves: The CE produces an ontological framework in which waves, such as those produced by colliding black holes, can propagate.

Gravitational Redshift: The gravitational redshift equation derived herein is very similar to that of GTR, and using such an equation to model the gravitational force through the quantum processes shown herein seems to be compatible with observation.

Gravitational Lensing: From equation (1), it follows that the same geodesics as those of GTR are produced, only for different reasons. In this model, the varying index of refraction of space results in gravitational lensing effects.

Time Dilation: Since time herein is a linear function of the local speed of light, and light dilates proportionally to how time dilates in GTR, it follows that our concept of time in this model changes as predicted by GTR. However, this model resolves some of the paradoxes associated with GTR, such as the Grandfather paradox, since time doesn't exist.

Quantum Tunneling: The elements of η are composed of particles more fundamental than electrons such that these fundamental components are undetectable to us. This theory offers an explanation for quantum tunneling that is both compatible with classical logic, and observation wherein particles can dissociate into their respective elements of μ, pass any necessary barriers, and recombine on the other side. In this way, quantum tunneling can be understood as a process where the electron leverages the underlying structure of the universe to bypass classical constraints.

Wave-Particle Duality and Superposition: According to (4), a particle only exists in one state at a time even though that state can be decomposed mathematically into a superposition of states. In this sense, Schrodinger's cat is either dead ⊕ alive, and cannot be thought of as dead and alive. As the particle transitions through its causal loop of states $S^i(\boldsymbol{\chi})$, it interacts with the elements of the CE producing waves similar to those of gravitation, and those waves interact giving the appearance of superposition, and establishing a mechanism for wave-particle duality.

Double-Slit Experiment: In the previous paragraph it is theorized that particles produce waves in the CE, and those waves then interfere with each other. When those superimposed waves propagate through the two slits along with the particle, said waves guide the particle producing the interference patterns.

Muon Decay: Using the Schwartzchild metric without rotations, $c_0^2 = \frac{r-r_s}{r}c^2 - \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2$.

In zero-g this reduces to $c_0^2 = c^2 - v^2$, and restructuring yields:

$$\frac{c_0}{c} = \sqrt{1 - \left(\frac{v}{c}\right)^2}$$

Therefore, all experimental results of STR are recovered, they are just explained in terms of light speed dilation not time or length contraction. As an example, consider **muon decay**: When muons are produced in the atmosphere, using the non-relativistic decay equation suggests that they should decay before reaching earth's surface. However, observation is consistent with the notion that the muon undergoes both time and length contraction. In this model, the faster the muon travels, the slower all of the fundamental forces propagate in its RF, and thus it decays slower relative to earth. Without spacetime, an object moving at a fast enough velocity, relative to a stationary observer, will therefore perceive their speed approach infinite.

ADDRESSING EXISTING PARADOXES AND UNRESOLVED PROBLEMS IN PHYSICS

While it is not claimed that this theory resolves such paradoxes, perhaps it sheds some light on them.

Grandfather Paradox: Since time is not an ontological object (at least universally), one cannot travel back in time.

Why is the speed of light what it is? The clock k has to have some value, and whatever it happens to be, the universe plays out at that rate. Just as the order of scenes in a movie are not dependent on how fast the movie plays, the events of the universe are not dependent on k. It should be clarified that this is not meant to imply the absence of free-will.

Cosmological Constant: In this model, the only existence in what we perceive to be empty space, are the elements the CE. Since such elements are not theorized to be constrained by known laws, they seem like a reasonable candidate for driving the expansion faster than c.

The Fermi Paradox: Without the potential for spacetime, the only options for intergalactic travel appear to be:

1) To try and distort the CE which does not appear to have merit.
2) To decompose an object into its constituent elements, transfer them at greater than c, and then recombine them elsewhere in the universe. The issue here is that even if all of the atoms are recombined correctly, there isn't anything to ensure that atoms themselves are arranged to reform the original object.

From this, it follows that perhaps a meaningful faster than light transfer isn't possible regardless of technology.

The Hierarchy Problem: If the proposed model for the force of gravity is valid, then the reason for it being so weak, relative to the other forces, would be due to the limited number of exchanges between force carriers.

The Black Hole Firewall Paradox: Since existence can neither be created nor destroyed, information cannot be lost in the sense that it always remains within the entirety of $\mathbb{R}^n$.

The EPR Paradox: This model proposes that entanglement is facilitated by a particle a_u^k that is undetectable directly and thus not bounded by c. Such cases are not excluded from Bell's Hidden Variables theory, and sheds light on a potential solution to the paradox.

The Olbers Paradox: This model establishes that existence has always existed, and that the logical equivalent of eternal time T has passed. So how does the cosmological data get aligned with such statements? This requires a section all to itself below.

A RESOLUTION FOR OLBERS PARADOX

While it is posited that the non-existence of spacetime has been established, including it in the following deduction adds clarity:

There are several models of the multiverse. The many-worlds interpretation posits that each possible outcome of a quantum measurement corresponds to a different universe within a single overarching spacetime. The inflationary model suggests that each universe within the multiverse forms its own space time bubble, each potentially governed by different laws of physics. Additionally, some multiverse theories do not rely on the framework of GTR. Regardless of the model, it is believed that the essence of all possibilities can be captured in the following statements. However, it is important to note that some models propose that universes within the multiverse are causally separated. However, point (1) established that existence cannot come from non-existence, and the deduction of the definition of nothing established that space itself doesn't exist. Therefore, everything that happens is merely a permutation of existing elements in the set ξ. Therefore, particles A and B can be causally separated by moving in opposite directions indefinitely, but in doing so, A and B must eventually interact with other elements within the set ξ at some point over time T, and thus A and B are not causally separated from everything. This is explained as follows:

The multiverse M is defined herein such that $M = \{U_1, U_2 \dots U_q\}$ for some $q \in \mathbb{N}$, where U_i represents some universe within the multiverse $M \mid \forall\, U_i \subseteq M$, U_i is comprised of the elements $e_i \subseteq \xi$. Regardless of what exists in M, there is always an infinite amount of nothing beyond it, and thus it follows that if one multiverse exists, an infinite number of multiverses exist within the entirety of nothingness ($\mathbb{R}^n$): This holds true unless M is infinite in volume.

Therefore, define the set of multiverses $\dot{\mathrm{M}} = \{M_1, M_2, \dots M_\infty\} \mid \forall\, M_i \subseteq \dot{\mathrm{M}}$, M_i is composed of the elements $E_i \subseteq \xi$. Furthermore, define the boundary of each multiverse | $E_i \cap E_j = 0$ when $i \neq j$, and $E_1 \cup E_2 \dots \cup E_\infty = \xi$. That is, all of the elements of ξ are contained in the elements of $\dot{\mathrm{M}}$ and no two multiverses contain the same specific element. It follows that the space between the elements of $\dot{\mathrm{M}}$ cannot contain any elements of ξ, and thus there isn't any form of Lorentzian manifold (or otherwise) that exists ontologically to separate them. Thus over the infinite period T, statistically the elements of $\dot{\mathrm{M}}$ cannot be causally separated unless $|\dot{\mathrm{M}}| = 1$ corresponding to M_1 being infinite. Applying the same logic within each multiverse results in each universe being causally connected to the others in which a form of cosmic recycling over time T occurs. Remarkably, these interactions have yielded no discernible evidence in cosmological data over the period T (or age of the universe if U isn't cyclic), a statistical anomaly establishing the importance of Olber's Paradox.

From the previous statement, the missing cosmological data associated with Olbers Paradox is a statistical impossibility without the following element: Define the existence of G, in which the properties thereof are determined statistically. Furthermore, define a finite volume V containing G | $\forall\, a^i \in \xi$, $a^i \in E$, and $\sum a^i = const$. Therefore, the number of possible

permutations within V is finite. The following statements are thus based on these statements pertaining to V, and the following assumptions:

1) G can exist | that G prevents their own non-existence.
2) G comprises elements of a^{i}_{FW} thus possessing the property of free-will.
3) It is possible to know ~ all things in V (based on finite permutations).

Frome 1-3 it follows that:

A) By dividing T into two infinite periods T_1 and T_2, where T_1 precedes T_2, any permutation within V that remains possible until it occurs, must occur in T_1 (at least once), and if possible still, also in T_2.
B) $1 \wedge A \Rightarrow$ G has existed for (at least) T_2.
C) $3 \wedge A \Rightarrow$ G knows (at least) ~ all things in V.
D) $A \wedge B \wedge 2 \Rightarrow$ G can reasonably be considered to have organized V.
E) $2 \wedge C \wedge D \Rightarrow$ G can reasonably be considered to know how to create U in V.
F) $E \wedge D \Rightarrow$ U can reasonably be considered organized because of G.

From F), G can reasonably be considered an explanation for the organization of U, potentially resolving Olber's Paradox.

CONCLUSION

It appears that even without any knowledge of physical laws, the processes that occur in nature, such as quantum tunneling and superposition, can be predicted from a purely logical framework. Experimentation then determines the extent that such processes occur, and therefore experimentation coupled with logic produces the complete picture regarding THE NATURE OF EXISTENCE AND THE STRUCTURE OF THE UNIVERSE.

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Declaration of generative AI and AI-assisted technologies in the writing process.

During the preparation of this work the author used ChatGPT and Gemini in order to check for errors, and reformat certain sections for clarity. After using these tool / service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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