A MATHEMATICAL FRAMEWORK FOR A UNIFIED THEORY OF EVERYTHING THAT MODELS THE EXPERIMENTAL RESULTS OF GENERAL RELATIVITY, QUANTUM MECHANICS, AND MAXWELL'S EQUATIONS WITHOUT THE NEED FOR MORE THAN 3 DIMENSIONS

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ABSTRACT

This paper proposes a novel conceptual framework for understanding the fundamental nature of the universe, based on the idea of a three-dimensional grid like structure composed of fundamental particles. Departing from traditional notions of spacetime, this framework posits that the universe exists as a lattice of interconnected points, with entities and phenomena interacting within this grid. The presence of mass and energy compresses the grid, resulting in the variation in the propagation of the fundamental force carriers. This compression effect gives rise to a varying index of refraction, leading to gravitational lensing phenomena. Furthermore, the framework suggests that the speed of light remains constant locally while varying universally, as it dilates proportionally with the fundamental forces that operate the clock. By reducing the dimensionality of the universe down to 3, and providing a unified description of physical interactions with the grid, this theory offers a simpler and more elegant approach to understanding the universe in a way that unifies the various fields within physics.

INTRODUCTION

Understanding the fundamental nature of the universe has been a central goal of physics for centuries. From the elegant equations of classical mechanics to the intricate mathematical formalisms of quantum field theory and general relativity, physicists have strived to uncover the underlying principles governing the cosmos. However, existing theories often face challenges in reconciling the fundamental forces of nature and incorporating quantum phenomena into a unified framework. It is assumed that such complications arise from unnecessarily incorporating higher dimensions into the model.

In this paper, the author proposes a new conceptual framework that departs from traditional notions of spacetime and introduces a fundamentally different perspective on the structure of the universe. The theory posits that the universe exists as a three-dimensional gridlike structure, with each point on the grid representing a fundamental particle. This grid, composed of particles from a set R, forms the foundational fabric of our reality, within which all physical interactions occur. While this might appear counterintuitive, it is a logical necessity as derived herein.

One of the unique features of this framework is the concept of compression effects induced by the presence of mass and energy. As mass and energy interact with the grid, they compress its structure, leading to variations in the propagation of fundamental forces locally. This compression effect has profound implications, including the emergence of a varying index of refraction within the universe. Quantum processes can exchange information with the grid resulting in phenomena like wave-particle duality, virtual particles, and quantum tunneling. Likewise, gravitational waves propagate through the grid.

Furthermore, the theory suggests that the speed of light remains constant locally, despite variations universally. This is attributed to the dilation of light speed proportionally with the other fundamental force carriers that operate the clock, ensuring that the speed of light appears constant regardless of local conditions. In the following sections, we will explore the implications of this framework for gravitational lensing, black holes, gravitational waves, and the unification of fundamental forces, presenting a new perspective on the nature of reality.

HISTORY OF UNIFYING PHYSICS

General Relativity (GTR) predicts that the universe is four-dimensional, where time is integrally connected to three dimensions of space. In an endeavor to unify Quantum Mechanics (QM) with GTR, relativistic quantum mechanics (RQM) was developed by applying the principles of QM to the spacetime manifold. While RQM has exhibited remarkable success, it falls short in accurately modeling phenomena such as the gravitational force and high-temperature experimentation. Consequently, theories such as loop quantum gravity and string theory have been proposed to address these limitations.

During the time of Niels Bohr's investigation into atomic structure, the prevailing understanding in classical physics suggested that a moving electron would continually radiate energy, eventually collapsing into the nucleus. Bohr proposed a novel approach, suggesting that electrons could only occupy specific energy levels within the atom, during which they behaved according to classical physics. This explained the discretization of matter and light that perplexed scientists of his time. By reconciling the electric and centripetal forces governing the hydrogen atom, Bohr's work laid the foundation for the derivation of what came to be known as the Bohr magneton which helped to explain certain phenomena observed in spectroscopy and the behavior of electrons in magnetic fields. Erwin Schrödinger, building upon Bohr's quantized states, developed the Schrödinger Equation, which forms the cornerstone of quantum mechanics. Despite its remarkable success, the equation posed challenging questions about the nature of particles. How could a particle exist in multiple states simultaneously? How can a particle exist without occupying any volume? How could it transition instantaneously between states? How could it tunnel through seemingly impassable barriers? These enigmas underscored the revolutionary yet perplexing nature of quantum mechanics. The perplexity surrounding quantum phenomena was epitomized by Richard Feynman, who famously remarked, "I think I can safely say that nobody understands quantum mechanics." Subsequently, numerous scientists opted to focus solely on the calculations, irrespective of whether the outcomes aligned with intuitive understanding or not. The inability to reconcile quantum events with formal logic has led many scientists to conclude that logical coherence may not always apply in the quantum realm. This paper contends that formal logic cannot be violated and therefore it remains consistent even at the quantum level.

In GTR, the concept of existence is intimately linked with the spacetime manifold. Consequently, if the universe has a beginning, it implies that existence itself originates at that point. This presents two possibilities: either the elements of R composing the universe are eternal, devoid of a temporal origin, or they emerge from a state of non-existence. Assuming the constancy of formal logic, an eternal universe appears as a plausible inference. However, the notion of an eternal universe inevitably leads to entropy-driven decay, resulting in the eventual demise of stars, galaxies, and life forms. To reconcile this issue, three potential scenarios have been proposed: Firstly, the universe may operate in a cyclic fashion, undergoing an infinite series of cycles, with our observable universe representing the current cycle. Alternatively, the universe might be part of a multiverse, where numerous universes emerge continuously, collectively forming the multiverse. Lastly, it is plausible that the universe was designed. This article aims to delve into the analysis of these three concepts.

DEFINITIONS

Existence: Ontological existence refers to the inherent state of being, independent of its observable or measurable characteristics. For the purposes herein, unless specified otherwise, existence refers to fundamental components, not some object comprised of them.

Suppose squareness is the sole measurable property: Four line segments of equal length may exist individually, yet their measurement remains indefinite until they converge. This illustrates why existence cannot be exclusively linked to measurability.

R: R is the multiset $[a^i, a^j \ldots]$ of fundamental components comprising the entirety of everything that exists.

G: G is the subset of R that forms the grid-like structure of the universe.

Free-Will: The ability to act independent of physical laws (logic always holds though).

RF: Reference Frame

S: Is a coordinate RF (zero-g, zero-velocity).

A: Any RF.

GTR: General Theory of Relativity.

STR: Special Theory of Relativity.

QM: Quantum Mechanics

PLS: The theory disclosed herein.

t: This is the time as it passes in the S RF.

c: This is the measured speed of light in all RFs locally.

t_0: This is the time as it passes in the A RF.

c_0: This is the speed of light in the A RF (measured relative to t: $[c_0] = \frac{dist}{t}$).

M(z): Measured value for the quantity z.

R(z): Real value for the quantity z.

THE DERIVATION OF TIME, SUPERPOSITION, NOTHINGNESS, AND THE STRUCTURE OF THE UNIVERSE

Defining nothingness poses a formidable challenge across physics and philosophy. Despite its abstract nature, a thorough comprehension of nothingness holds profound potential to reshape our understanding of the universe. Therefore, deriving its meaning becomes imperative, prompting a meticulous exploration of its conceptual depths. Consider the case were only two particles a^i and a^j exist ontologically ($R = [a^i, a^j]$). If space itself is composed of elements of R, a “fabric of space” if you will, then there cannot be a void between the elements, thus necessitating that everything that exists form one (solid) object: this does not match observation. On the contrary, if space itself is not composed of the elements of R, then it doesn’t exist, and therefore:

$$Nothing\ (N) \equiv Empty\ Space$$

Notice that you cannot remove the spatial component of N without contradiction, and therefore it is necessary to describe it mathematically which is most easily done with vector spaces. To do so, suppose that $N \subsetneq \mathbb{R}^n$. It follows that $\mathbb{R}^n \backslash N$ is neither something (elements of R) nor nothing resulting in a contradiction. It follows that N is unbounded spatially, and therefore, for some $n \geq 3$:

$$N \equiv \mathbb{R}^n$$

Let $R = [a^i]$. In order for a^i to be produced from nothing, it must be constructed out of points in space. Since any collection of points in space don't form an ontological object, a^i cannot be produced from them. Thus, something cannot be produced from nothing. It follows that the elements of R can only be organized or rearranged to produce composite objects, therefore referencing them as fundamental is justified.

If time were to commence at a specific point, denoted as $t_0 = 0$, then for the transition from $t_0 = undefined$ to $t_0 = 0$, a preceding property of change is necessary. Thus, change inherently characterizes existence. Alternatively, if time lacks a definitive beginning, coexisting with the elements of R, then existence persistently unfolds within time, further affirming change as an intrinsic property of existence. Since change is a property of existence, and the elements of R cannot be produced from nothing, this aligns logically with the concept of eternal time (T), where T is conceptualized not as a dimension but rather as a reference to perpetual existence.

Assuming the validity of general relativity, the spacetime manifold must consist of elements of R, arranged in a grid-like structure, to differentiate it from nothingness. Consequently, spacetime is inherently discrete, and entities within our observable universe, such as galaxies, planets, and photons, traverse this grid-like structure. Hence, even the apparent "empty space" between galaxies retains the elements of R comprising the manifold. Quantum processes can introduce or eliminate particles from this manifold, elucidating the presence of virtual particles in intergalactic space. Consequently, quantum processes operate exclusively within the confines of the manifold. While this article does not propose the spacetime manifold is necessary, this serves as an example illustrating that whatever the real structure of the universe is, it must be composed of the elements of R in a grid-like fashion that exists in infinite nothingness ($\mathbb{R}^n$).

Since existence exists, $R \neq [\,]$. Therefore, let $a^i \in R$; and let the state of a^i be $S^i(\boldsymbol{\chi})$ for some parameter $\boldsymbol{\chi}$, where $\boldsymbol{\chi}$ is not assumed to be synonymous with time. However, if a^i is in the state $S^i(\boldsymbol{\chi})$, then $\forall\, \varepsilon \in \mathbb{R}$, $S^i(\boldsymbol{\chi} + \varepsilon)$ must exist in order to adhere to the previous assertions preventing existence from nonexistence. It follows that $S^i(\boldsymbol{\chi})$ must be continuous, and $D_S = \mathbb{R}$. It is important to clarify that the parameter $\boldsymbol{\chi}$ doesn't have an axis within empty space, thus $\boldsymbol{\chi}$ doesn't exist ontologically: it is just a convenient parameter.

There are two forms of superposition proposed by this model: **A)** $S^i(\chi)$ undergoes rapid changes, creating the impression of existing in a superposition of states. In this scenario, the various states produce waves along the grid which interfere with each other; **B)** Alternatively, a^i is composed of sub-components $a^{i,1}, a^{i,2} \ldots , a^{i,q}$, collectively being fundamental, wherein each corresponding sub-state $S^{i,1}(\chi), S^{i,2}(\chi) \ldots , S^{i,q}(\chi)$ contributes to $S^i(\chi)$ in a manner akin to how sines and cosines in a Fourier transform contribute to the value of a function. Particle a^i cannot exist in both $S^i(\chi_1)$ and $S^i(\chi_2)$ unless $S^i(\chi_1) = S^i(\chi_2)$ without violating the assertion that something cannot be produced from nothing.

Let $S^i(\chi) = S^i(\chi + P)\ \forall\, \chi \in \mathbb{R}$ and some constant $0 < P < \infty$. Then the states of a^i form a causal loop. To prove this, let $\chi = x + \frac{P}{n}$ for $n \in \mathbb{N}$. A discretized series of states S^i can be written as $S^i(x) \to S^i(x + \frac{P}{n}) \to S^i(x + \frac{2P}{n}) \ldots \to S^i(x + \frac{(n-1)P}{n}) \to [S^i(x + P) = S^i(x)]$, where each state cannot occur without the prior state first occurring (first meaning relative to x), and where the states form a cycle wherein each state directly or indirectly causes itself. Thus the discrete form satisfies the definition of a causal loop, and in the limit, $n \to \infty$, S^i also becomes continuous. Thus, a^i is self existing, and the states $S^i(\chi)$ are self-causing.

Suppose that $R = [a^i, a^j]$, where $S^i(\chi)$ and $S^j(\chi)$ are their respective states. In order to not violate causality, any interaction Ĩ between a^i and a^j must result in a^i and a^j being in states of their own causal loops. That is, the interaction $\tilde{I}(a^i, a^j)$: $[S^i(\chi) \to S^i(\chi_{1i})] \wedge [S^j(\chi) \to S^j(\chi_{1j})]$ for some $\chi_{1i}, \chi_{1j} \in D_S$: the interaction causes a skip in states. It follows that $S^i(\chi)$ and $S^j(\chi)$ represent all possible states of each respective element.

Since $0 < P < \infty$, and $D_S = \mathbb{R}$, the number of state cycles is infinite. Without any interaction Ĩ, $S^i(\chi) = S^i(\chi + P)\ \forall\, \chi \in \mathbb{R}$, thus the order in which the states occur doesn't change. Statistically this isn't possible by chance, thus $\exists$ some law Ĺ acting on each state ensuring the preceding one. In this case Ĺ is also self existing (Ĺ must be intrinsic to a^i).

Suppose that $R = [a^m] \mid S^m(\chi) \to \{ S^m(A) \vee S^m(B) \}$ where $S^m(A) \neq S^m(B)$. In this case, the law Ĺ DNE, and a choice is required at each state change. Therefore, the absence of law introduces the notion of free-will (FW). That is, if a particle has always existed, changes states, and does not have an intrinsic law, said particle has free-will. Now, it is not claimed that a particle actually has free-will, only that if it does, this is why.

Removing the restriction that $P < \infty$ still results in each state either being determined by some law Ĺ, or by some free-will choice C. For this reason, the elements of R bound by Ĺ will be designated as a^i_L and all other elements will be designated as a^i_{FW}.

Define a_L^1 as having a causal loop of states $S_L^1(\boldsymbol{\chi})$ | $S_L^1(\boldsymbol{\chi})$ results in a forward motion of a_L^1 through $\mathbb{R}^n$. Furthermore, assume that a_L^2 also exists, and that the interaction $\tilde{\mathrm{I}}(a_L^1, a_L^2)$ results in a_L^1 traveling less distance (relative to $\boldsymbol{\chi}$) then would otherwise occur. Therefore, the greater the particle density ρ in which a_L^1 is moving, the slower a_L^1 moves. A measurement between two events can be made by observing the distance D_1 that a_L^1 travels between their occurrence (i.e D_1 is the distance that a_L^1 travels between the start and finish of a race). Instead of using distances, a_L^1 can be reflected between two mirrors, and the number of reflections can be used as the measurement. This will be important in the assessment of time.

With that said, since light has the greatest speed within the context of the universe, define $a_L^1 \equiv Photon$, and $\boldsymbol{\chi} \equiv Time$ (notice that the equation of the photon is cyclic as $S_L^1(\boldsymbol{\chi})$ requires). It is important to clarify that a photon might not be fundamental and in such case a_L^1 would represent the composite. Since $\boldsymbol{\chi}$ DNE ontologically, time doesn't exist either, thus spacetime doesn't exist. Photons travel independent of time, yet we measure time based on the distance that they travel (or the number of passes inside of a light clock). This necessitates that all clocks are logically equivalent to light clocks in which all of the fundamental forces slow down proportionally with light speed dilation. Each RF measures their own local speed of light to be the same because both the light being measured, and the fundamental force carriers in the clock slow down proportionally. In order to explain observations pertaining to STR, GTR, and QM, the universe must have a manifold composed of the elements of R in a grid-like structure, in which the density ρ of the manifold itself changes as a function of energy density present, and this change in ρ results in light speed dilation due to a change in index of refraction of the grid. Black holes represent a region of space in which ρ is so great that statistically the number of interactions prevents forward motion of a photon. Thus the speed of light at the event horizon is, on average, zero.

There are many 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 inflation model posits that each universe within the multiverse forms its own space time bubble, each having arbitrary laws of physics; and some multiverse theories do not depend 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.

The multiverse M is defined herein such that $M = \{U_1, U_2 ... U_q\}$ for some $q \in \mathbb{N}$, where U_i represents some universe within the multiverse M | $\forall\, U_i \subseteq M$, U_i is comprised of the elements $e_i \subseteq R$. Regardless of what exists in M, there is always an infinite amount of nothing beyond it. It follows that if one multiverse exists, an infinite number of multiverses exist within the entirety of nothingness. Therefore, define the set of multiverses $\dot{M} = \{M_1, M_2,... M_\infty\} \mid \forall M_i \subseteq \dot{M}$, M_i is comprised of the elements $E_i \subseteq R$. Furthermore, define the boundary of each multiverse | $E_i \cap E_j = 0$ when $i \neq j$, and $E_1 \cup E_2 ... \cup E_\infty = R$. That is, all of the elements of R are contained in the elements of $\dot{M}$ and no two multiverses contain the same specific element. It follows that the space between the elements of $\dot{M}$ cannot contain any elements of R, and thus there isn't any form of Lorentzian manifold (or otherwise) separating them. Thus over the infinite period T, statistically the elements of $\dot{M}$ cannot be causally separated. Applying the same logic within each multiverse results in each universe being causally connected to the others (any manifold is composed of the elements of R or it doesn't exist). Remarkably, these interactions have yielded no discernible evidence in cosmological data over the period T, a statistical anomaly if universes emerge solely through natural processes. Consequently, it is reasonable to infer that the emergence of our universe is a controlled, or "unnatural," process—occurring only by design, thereby explaining the absence of such data. While one might argue that a designer would face similar statistical contradictions as a naturally forming universe, dividing T into two infinite periods, T_1 and T_2, resolves this issue. In this model, T_1 precedes T_2, implying that a designer must statistically arise from the elements of R during T_1 to exist eternally (for $T_2 = \infty$). Such a scenario maintains logical coherence and aligns with cosmological data, offering a compelling explanation for the observed absence of evidence.

THEORETICAL FRAMEWORK

The predictions of the General Theory of Relativity (GTR) consistently align with observational data. However, the four-dimensional spacetime manifold used in GTR is not fully compatible with quantum mechanics, and theories involving more than four dimensions can become overly complex. Therefore, it is necessary to explore the potential of producing the same predictions of GTR using a finite three-dimensional grid.

In this model, the grid is composed of the elements $G \subsetneq R$, giving it an ontological existence that distinguishes it from nothingness. Everything observable to us is composed of the elements of R that move within this grid, distorting it in such a way as to produce the same observable phenomena predicted by GTR. Since everything in the universe moves within the grid, what is typically referred to as empty space still contains the particles of G, and therefore Quantum Mechanics (QM) models the exchange of visible particles with those existing on the grid. Wave-particle duality is thus modeled by a particle producing waves that propagate through the grid, and these waves interfere with each other, producing interference patterns when interacting with the particle. Quantum tunneling is an exchange of a real particle with a particle of G that is exterior to the potential well. Virtual particles emerge in a vacuum of space because of the ontological existence of G, suggesting that quantum processes are restricted to the grid as there isn't a means of exchange exterior to it.

As derived above, all the elements of R have always existed, and they each move through a change of state that is independent of time and that forms a causal loop. These particles interact with each other, resulting in a skip in their causal loops, after which the particles continue as if nothing happened. Interactions between R\G and G result in a structured occurrence of events that we associate with the universe moving along the time dimension of the spacetime manifold. The grid therefore acts as a regulatory entity wherein the density ρ of the grid determines the propagation rate of all of the force carriers uniformly. Therefore, when the electromagnetic force slows down, the other fundamental forces slow down proportionally. It is important to clarify that terms like "slow down" or "speed" do not actually describe what occurs: they are more of a convenience. To explain this, briefly consider using a light clock to measure the speed of light. Regardless of how much the speed of light changes locally, both the light in the clock and the light in the experiment change by the same amount, thus the number of passes inside of the light clock remains the same. Since all fundamental forces dilate proportionally, the same result occurs if you use an atomic clock or a watch. It follows that the measurement for the speed of light is a geometry relationship (the span between the mirrors relative to the length light travels in the experiment), not an actual measurement of a dimension. Particles move through their causal loop independent of time, and we as humans have invented a means of measuring the occurrence of one event relative to another and we call this time. Now take observer A in flat space, and observer B near an event horizon. The distance that light travels in the A RF is greater than the distance that light travels in the B RF. However, according to observer B, all events in their RF are occurring as if they are near observer A, and this is caused by all fundamental forces slowing down proportionally for B. At the event horizon, everything in B's RF comes to a stop relative to A but according to B nothing changes (ignoring the fact that everything may get crushed). This explains why the amount of information contained in a black hole is proportional to the surface area of the event horizon as all of the information is "frozen" there relative to A.

In this model, the rationale behind the speed of light's value becomes clear when we examine it from the perspective of an external observer, represented by clock K, situated outside of the grid. From K's viewpoint, the speed of light must hold some value. However, since all fundamental forces undergo proportional changes within the system, this particular value becomes inconsequential. The reason being that, despite any alterations, events within the system unfold consistently in the same sequence. This analogy likens the universe to a VHS tape, where, regardless of the VHS's play rate relative to K, the chronological order of events in the "movie" remains unchanged. This is not intended to imply the absence of free-will, it is just intended to show that regardless of the change in the speed of light relative to k, nothing is noticed by us within the grid.

Since our concept of time in this model is integrally connected to the distance that light travels, the speed of light must dilate in the same manner that time in GTR dilates. That is $c_0 dt = c\, dt_0$, and since $cdt_0 = \sqrt{g_{\mu\nu} dx^{\mu} dx^{\nu}}$ in GTR, it follows that:

$$c_0 dt = \sqrt{g_{\mu\nu} dx^{\mu} dx^{\nu}} \qquad (1)$$

Now, as a photon moves through its forward motion causal loop there is a proportionality constant that people have invented that converts the distance to our concept of time. That is, $t = \alpha X$ where X is the distance that light travels between the events in free space, and α is a scalar. Likewise, $t_0 = \alpha X_0$ where X_0 is the distance that light travels in the proper RF. From equation (1) it follows that:

$$c_0 = \frac{1}{\alpha}\sqrt{g_{\mu\nu} \frac{dx^{\mu}}{dX} \frac{dx^{\nu}}{dX}} \qquad (2)$$

Where $dx^0 = \alpha dX$, [c] = [v] = [distance], and the geometry of space is time independent. Since $0 \le c_0 \le c$, and $0 \le \sqrt{g_{\mu\nu} \frac{dx^{\mu}}{dX} \frac{dx^{\nu}}{dX}} \le 1$, $\alpha = 1/c$. From equation (2) it follows that the index of refraction (n) of the grid is:

$$n = 1/\sqrt{g_{\mu\nu} \frac{dx^{\mu}}{dX} \frac{dx^{\nu}}{dX}} \qquad (3)$$

Therefore, the grid has this non-local property that causes it to deform just right so as to produce an index of refraction that causes the results of GTR without the need for time. This non-local behavior further aligns the theory with principles of quantum mechanics.

Take the nucleus of an atom and envision it as a sphere in which virtual photons (instead of gluons) are exchanged from point to point internally. Just analyzing two photons opposing each other along the same diameter, it is easy to see that in free space, any exchange of momentum cancels out. Moving that same atom into the grid with a non-uniform index of refraction (n) results in an imbalance of the force produced, and this net force very closely models that of gravity. Since light tends to curve towards the higher index of refraction, the photon leaving a point closest to a massive object doesn't travel along the diameter: it curves resulting in even less force counteracting its initial push. If this theory is valid then the force of gravity is caused by the exchange of force carriers inside of a nonuniform grid, and these exchanges occur due to quantum processes, thus gravity is written in terms of quantum events.

It is important to clarify that if two theories A and B both match the evidence, then the evidence cannot be used to determine which of the two theories are valid regardless of which theory is universally accepted. In this case, all of the evidence supports GTR, but GTR sends us down a rabbit hole of seemingly infinite confusion. Perhaps the PLS theory is worth a shot since it also matches the data and eliminates the complexity. PLS, produces a framework in which all of the results of GTR are produced, and since GTR is compatible with Maxwell's equations when written using differential geometry, such equations are also compatible with PLS. Additionally, PLS defines time in which quantum particles are not restricted by it, and where quantum phenomena are modeled in a way that doesn't necessitate any violations of formal logic. Additionally, PLS allows one to reproduce the force of gravity in terms of the other fundamental forces that are caused by quantum events. It should also be clarified that this theory doesn't imply that concepts like relativistic quantum mechanics are wrong as long as the time terms are dealt with in the metric as done above.

ASSESSMENT OF PLS AND STR

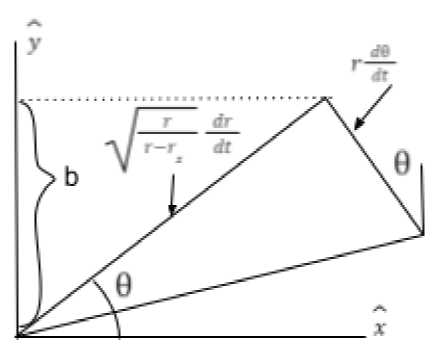
Using the Schwartzchild metric without rotationals, $c_0^2 = \frac{r-r_s}{r}c^2 - \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2$. In zero-g this reduces to $c_0^2 = c^2 - v^2$, and restructuring yields:

$$\frac{c_0}{c} = \sqrt{1 - \left(\frac{v}{c}\right)^2} \quad (4)$$

so 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. According to STR, the muon experiences time dilation, and it also experiences length contraction to prevent it from exceeding the speed of light in its own RF. In the PLS model, the measured velocity of the muon can be infinite as long as the real velocity is bounded by c, so length contraction is not necessary. Additionally, the faster the muon moves, the slower its proper speed of light, and thus all of the quantum interactions involved in its decay take longer relative to S. Light speed dilation takes the place of both time and length contraction.

DERIVATION OF THE GRAVITATIONAL REDSHIFT

Figure 1: This figure shows how the components of the Schwarzschild Metric fit geometrically. For a mass positioned at (0,0), a photon released in the x-direction from (x=0, y=b > 0) will curve downwards.



From the Schwarzschild Metric, for a photon traveling in a plane containing the COM of some object of mass M we get ($\varphi = 0$):

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

From Figure 1, adding up the components in the $\hat{x}$ and $\hat{y}$ directions result in:

$$< \frac{dx}{dt} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta), \frac{dy}{dt} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}sin(\theta) + r\frac{d\theta}{dt}cos(\theta) > \quad (5)$$

where

$$\frac{dy}{dx} = \frac{\{\sqrt{\frac{r}{r-r_s}}\frac{dr}{d\theta}\}sin(\theta) + rcos(\theta)}{\{\sqrt{\frac{r}{r-r_s}}\frac{dr}{d\theta}\}cos(\theta) - rsin(\theta)} \quad (6)$$

The polar coordinate transformation dy/dx is:

$$\frac{dy}{dx} = \frac{\{\frac{dr}{d\theta_p}\}sin(\theta_p) + rcos(\theta_p)}{\{\frac{dr}{d\theta_p}\}cos(\theta_p) - rsin(\theta_p)} \quad \text{(polar, 7)}$$

Comparing equations (6) and (7), implies that $\frac{dr}{d\theta_p} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{d\theta}$. Therefore:

$$\theta = \sqrt{\frac{r}{r-r_s}}\,\theta_p + B \quad (8)$$

$$r^2 = x^2 + y^2 \quad (9)$$

$$x = rcos(\theta_p) \quad (10)$$

$$y = rsin(\theta_p) \quad (11)$$

Dividing the x-component in equation (5) by dx, squaring both sides, and multiplying by $\partial^2 E$ yields:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta)\right]^2\frac{\partial^2 E}{\partial x^2} = \frac{\partial^2 E}{\partial t^2} \quad (12)$$

Notice that when $r_s = \theta = 0$ equation (12) yields $\frac{\partial^2 E_x}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 E_x}{\partial t^2}$. Repeating the same process for the y-component we get:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}sin(\theta) + r\frac{d\theta}{dt}cos(\theta)\right]^2\frac{\partial^2 E_y}{\partial y^2} = \frac{\partial^2 E_y}{\partial t^2} \quad (13)$$

Now, let us consider Maxwell's equations where the charge and current density are zero (since the S-metric pertains to such). The derivation of these equations does not depend on μ or ε being constant so we can start directly with Maxwell's Equations and calculate με. Therefore:

$$\nabla \cdot E = 0, \nabla \cdot B = 0, \nabla \times E = -\frac{\partial B}{\partial t}, \text{ and } \nabla \times B = \mu\varepsilon\frac{\partial E}{\partial t} \quad (14)$$

Deriving the wave equation in free space using equations (14) yields:

$$\nabla \times \{ \nabla \times E \} = \nabla \times \{- \frac{\partial B}{\partial t}\}$$

$$\nabla\{\nabla \cdot E\} - \nabla^2 E =- \frac{\partial}{\partial t}\{\nabla \times B\}$$

$$\nabla^2 E = \frac{\partial}{\partial t}\{\mu\varepsilon \frac{\partial E}{\partial t}\}$$

$$= \frac{\partial(\mu\varepsilon)}{\partial t}\frac{\partial E}{\partial t} + \mu\varepsilon\frac{\partial^2 E}{\partial t^2} \quad (15)$$

Comparing equations (12), (13), and (15):

$$\frac{\partial(\mu\varepsilon)}{\partial t} = 0$$

$$\frac{1}{(\mu\varepsilon)_x} = [\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta)]^2 \quad \text{(x-direction, 16)}$$

$$\frac{1}{(\mu\varepsilon)_y} = [\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}sin(\theta) + r\frac{d\theta}{dt}cos(\theta)]^2 \quad \text{(y-direction, 17)}$$

Therefore, Maxwell's equations take the form of equations (14), subject to the constraint in equation (16) and (17), in which equations (8) - (11) convert variables into one coordinate system. Notice that, with $\Theta = 0$, equation (12) reduces to $[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}]^2 \frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial t^2}$. Using the Schwarzschild Metric, $\frac{r}{r-r_s}(\frac{dr}{dt})^2$ can be replaced with $\frac{r-r_s}{r}c^2$, therefore:

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

Setting E = R(r)$\mathbf{T}(t)$, and solving for R(r) yields:

$$\frac{d^2R(r)}{dr^2} =- [k^2\frac{r}{r-r_s}]R(r) \quad (18)$$

Therefore:

$$k\sqrt{\frac{r}{r-r_s}} = \frac{2\pi}{\lambda} \quad (19)$$

Thus:

$$\lambda = \frac{2\pi}{k}\sqrt{\frac{r-r_s}{r}} = \lambda_\infty\sqrt{\frac{r-r_s}{r}} \quad (20)$$

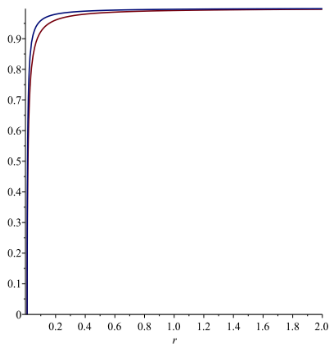


Figure 2 :This is a plot of $\lambda = \lambda_{\infty}\sqrt{\frac{r-r_s}{r+r_s}}$ from GTR (red) vs $\lambda = \lambda_{\infty}\sqrt{\frac{r-r_s}{r}}$ from PLS (blue). The Schwartzchild radius used is 0.0088m.

In figure 2, the gravitational redshift equation of GTR ($\lambda = \lambda_{\infty}\sqrt{\frac{r-r_s}{r+r_s}}$) (red) is plotted alongside equation (20) for $r_s = 0.0088m$ (the Schwartzchild radius of earth).

ASSESSMENT OF PLS AND GTR

Since lengths don't contract $R(c) = R(f)\lambda$, and using equations (20) yields:

$$R(f) = \frac{\sqrt{\frac{r-r_s}{r}}\,c}{\lambda_{\infty}\sqrt{\frac{r-r_s}{r}}}$$
$$= \frac{c}{\lambda_{\infty}} \quad (21)$$
$$= const$$

However, $M(c) = c = M(f)\boldsymbol{\lambda}$. Using equation (20) again, this results in:

$$M(f) = \frac{c}{\lambda_{\infty}\sqrt{\frac{r-r_s}{r}}}$$
$$= \frac{c}{\lambda_{\infty}}\sqrt{\frac{r}{r-r_s}} \quad (22)$$

It follows that the real and measured energy (E) are:

$$R(E) = \frac{c}{\lambda_{\infty}}h \quad (23)$$
$$M(E) = [\frac{c}{\lambda_{\infty}}h]\sqrt{\frac{r}{r-r_s}} \quad (24)$$

The $R(E)$ is constant: even though the wavelength decreases with a decrease in radius, R(c_0) slows down and those differences cancel. Notice that R(E) is quantized by h, and M(E) is smooth and continuous for $r > r_s$. From equations (23) and (24), it follows that:

$$M(E) = R(E)\sqrt{\frac{r}{r-r_s}} \quad (25)$$

PROPERTY VALUES OF A **PHOTON** AS r DECREASES					
	Speed of light	Clock Speed	λ	f	Energy
Real (R_s RF)	Decrease $\sqrt{\frac{r-r_s}{r}}c$	Decrease d$\boldsymbol{\tau} = \sqrt{\frac{r-r_s}{r}}dt$	Decrease $\lambda_\infty\sqrt{\frac{r-r_s}{r}}$	Constant $\frac{c}{\lambda_\infty}$	Constant $[\frac{c}{\lambda_\infty}h]$
Measured (R_s RF)	Constant c	Constant Change t	Decrease $\lambda_\infty\sqrt{\frac{r-r_s}{r}}$	Increase $\frac{c}{\lambda_\infty}\sqrt{\frac{r}{r-r_s}}$	Increase $[\frac{c}{\lambda_\infty}h]\sqrt{\frac{r}{r-r_s}}$
Table 1: Shows the relationship between the given quantities as r decreases. Notice that both the speed of light and the proper time scale the same.					

How the real and measured quantities for a photon change with a decrease in r-value is clarified in table 1.

Balancing the gravitational and centripetal forces yields $\frac{M_{AS}(mv_\theta^2)}{r} = \frac{M_{AS}(GMm)}{r^2}$ therefore:

$$M_{AS}(v_\theta) = \sqrt{\frac{M_{AS}(GM)}{r^2}} \quad (26)$$

Therefore:

$$R(v) = \sqrt{\frac{M_{AS}(GM)}{r^2}}\,\frac{c_0}{c}$$

This suggests that the real values for G and M are such that $R(GM) = M(GM)(\frac{c_0}{c})^2$ where the subscripts are dropped. Therefore either:

$$R(M) = M(M)(\frac{c_0}{c})^2 \quad \text{(Case 1, 27)}$$

OR

$$R(G) = M(G)(\frac{c_0}{c})^2 \quad \text{(Case 2, 28)}$$

Where $M(M)$ and $M(G)$ must be constant. It follows that the Einstein equations have to model the measurables, not the reals, otherwise G could not be considered constant in their derivation. We shall briefly consider each case, and some advantages to each:

Case 1: Mass is an emergent property in which the real value is determined by the local speed of light. This is interesting because if we insert equation (40) into the gravitational force equation, there are two points in which to evaluate $\frac{c_0}{c}$: one for M and one for m. It seems logical to assume that since $\frac{c_0}{c}|_{r=r_s} = 0$, the force of gravity would need to be zero but this is not correct. Since $c_0 = v = 0$ at the EH, the mass never gets there and thus we can treat the $M(\frac{c_0}{c})^2$ as constant non-zero in which the value of M has to be substantially greater than expected in order to account for the $(\frac{c_0}{c})^2$ term. The real gravitational force becomes:

$$R(F_g) = \frac{G*R(Mm)}{r^2}$$

$$= \frac{G*M(Mm)}{r^2}(\frac{c_0(r1)}{c})^2(\frac{c_0(r2)}{c})^2 \quad (29)$$

If two masses are in a gravitational field, r1 is the radial component of mass M in the gravitational field, r2 is the radial component of mass m in the gravitational field, and r is the distance between them. Additionally, the measured gravitational force becomes:

$$M(F_g) = \frac{G*M(Mm)}{r^2} \quad (30)$$

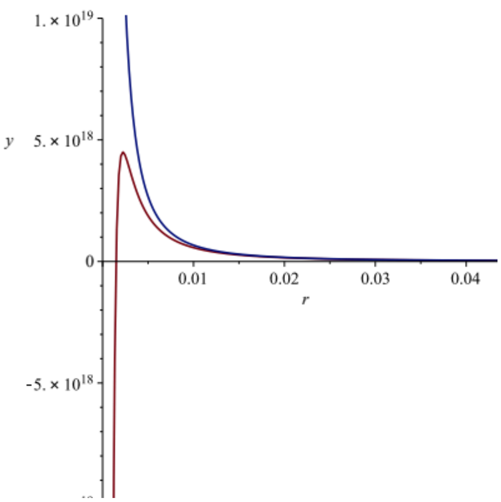


Figure 3: The real gravitational force (red) is plotted vs the measured gravitational force (blue). The real gravitational force tapers off, then drops to zero before becoming negative. Since the velocity at the event horizon is zero, particles never get there. Anything inside of the event horizon is pushed outwards.

A plot of equations (29) and (30) are shown in figure 3 with $(\frac{c_0(r1)}{c})^2 = 1$. Notice that if the particles could reach the event horizon (which they can't), the real force (red) becomes zero. Additionally, the real force inside of the EH is negative meaning that any particle contained inside of the EH is forced outwards. This resolves any issues with singularities.

Additionally, in regards to QM, the real and measured energy values would be:

$$R(\bar{E}) = [M(M)(\frac{c_0}{c})^2]c^2$$

$$= [M(M)]c_0^2 \quad (31)$$

and

$$M(\bar{E}) = mc^2 \quad (32)$$

Case 2: In this case, the gravitational "constant" has a slight fudge factor resulting in:

$$R(F_g) = \frac{R(G)Mm}{r^2}$$

$$= \frac{M(G)Mm}{r^2}\left(\frac{c_0}{c}\right)^2 \quad (33)$$

And

$$M(F_g) = \frac{M(G)Mm}{r^2} \quad (34)$$

Equations (33) and (34) produce the same curves as that in figure 3 so the real force becomes negative inside the EH pushing matter outwards, and the real force at the EH drops to zero. Thus, this case also resolves all of the conflicts at the singularities.

Since all of the matter inside of a black hole is forced outwards, all of the information inside of the black hole is at the event horizon. It therefore makes sense that the amount of information inside of a black hole is proportional to the surface area of the EH as Bekenstein suggested.

THE QUANTUM NATURE OF GRAVITY

Photons In A Relatively Stationary RF: The momentum p of a photon is $\frac{h}{\lambda}$. Using equation (20), the measured momentum of k photons is:

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

$$= \frac{hk}{\lambda_\infty}\sqrt{\frac{r}{r-r_s}} \quad (35)$$

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

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

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

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

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

Since M(F) is a measurement, $\frac{dr}{dt} = c$. Additionally, since r_s is the Schwartzchild radius it can be replaced with $\frac{2GM}{c^2}$. Therefore:

$$M(F) = \frac{-GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}(r-\frac{2GM}{c^2})^{1.5}}\right) \quad (36)$$

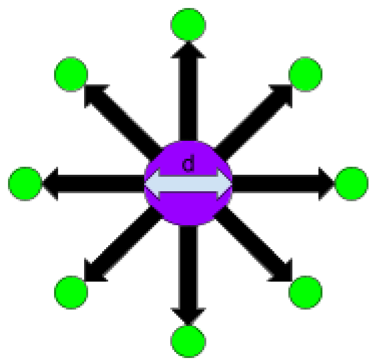


Figure 4: An object O (purple) of diameter d radiates a uniform field of virtual photons (green) in all directions. All of the photons produce the same momentum on O uniformly resulting in a net acceleration of zero for O.

In Figure 4, 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.

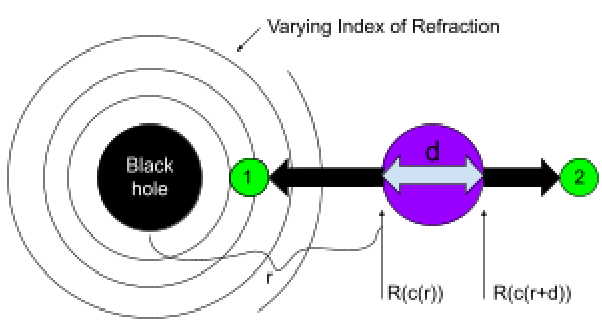


Figure 5: Object O from Figure 4 is placed into a non-uniform gravitational field that is produced by the presence of a black hole. The momentum produced by virtual particle 1 is greater than the momentum of virtual particle 2 producing a type of anti-gravity.

In Figure 5, object O is placed into a gravitational field. From equation (36), the measured force exerted on O due to virtual photon 1 being emitted is:

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

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

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

The magnitude of the net force is therefore the difference:

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

$$= \frac{GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}(r-\frac{2GM}{c^2})^{1.5}} - \frac{1}{\sqrt{r+d}(r+d-\frac{2GM}{c^2})^{1.5}}\right) \quad (37)$$

Notice that $M(F_{net})$ is 0 for a point particle ($d \rightarrow 0$). 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 due to fewer interactions 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.

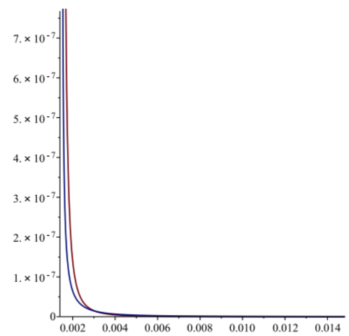


Figure 6: This graph shows $\left|M(F_{net})\right|$ (red) and $R(F_g)$ (blue). $\left|M(F_{net})\right|$ is not compatible as is with $R(F_g)$.

Figure 6 shows a comparison between the gravitational equation, and the force produced through these quantum processes.

FUNDAMENTAL PRINCIPLES AND PROOFS

P_1: For an isolated system **A** characterized by having a finite set of distinct possible states, any event E_n that remains possible will inevitably happen (A variation of the Poincare Recurrence Theorem.).

Proof: Let B = $\{B_1, \ldots B_m, B_{m+1}\}$ be the set of distinct states of **A** (which is in state B_j), and let $E_j \equiv B_j \rightarrow B_{j+1}$ be an event with a probability $P_1(E_j) = \varepsilon_j$ of occurring, where $0 < \varepsilon_j \leq 1\ \forall\ j \in [1, m]$. It follows that $P_1(\neg E_j) = 1 - \varepsilon_j$, and $P_k(\neg E_j) = (1 - \varepsilon_j)^k$ where k is the number of opportunities. Since $|B| < \infty$, $1 < m < \infty$, and thus we define an infinite period T = $\{T_1, T_2, \ldots T_m\} \mid [\ T_j = \frac{T}{m} = \infty$ and $T_i \cap T_j = 0\ ]\ \forall\ i \in [1,m]$ where $i \neq j$. We also define some minimal unit of time $\infty > t_{min} > 0$ in which a state change can occur | $k = \lfloor \frac{t}{t_{min}} \rfloor$. Since $\lim_{t \rightarrow T_j} P_{\lfloor \frac{t}{t_{min}} \rfloor}(\neg E_j) = 0\ \forall$ j, all of the states of **A** have a 0 probability of not occurring in T. Since T is arbitrary, this holds for any infinite period. If such a t_{min} doesn't exist, then $\varepsilon = 0$.

Clarification: *Suppose that A and B are 2 mutually exclusive events each with a non-zero probability of occurring | once either A or B occurs, the probability of the other event occurring becomes 0.*

Let t_a and t_b ∈ [0, t) be the respective time periods in which events A and B remain possible. We let A represent the event that occurs, and since A and B are mutually exclusive, they cannot occur at the same time. Thus, $0 \le t_b < t_a \le t$. Thus event B not occurring doesn't violate P_1 even as $t \to \infty$ since $t_b < t_a$.

P_2: The entirety of All that Exists (AE) has always existed at the fundamental level, and each state within the realm of AE is finite in continuous duration.

Proof: Let **A** represent an isolated system in the state A_{n+1} where A is the set of all states of **A** in order of occurrence; A_n and $A_{n+1} \in$ A; n ∈ Z; and $A_{n+1} \neq \varnothing$. Let $\check{T}(A_i)$ be the length of time in which **A** is in state A_i.

1) Prove that if $A_c \in$ A, then $A_c \neq \varnothing$:

   Since $A_{n+1} \neq \varnothing$, and **A** is isolated, then by P_2, $A_c \neq \varnothing$.

2) Prove that $A_{n-1} \in$ A:

   a) Suppose that $\check{T}(A_n) = \infty$. Since $|\{A_n, A_{n+1}\}| = [2 < \infty]$, by P_1, state A_{n+1} isn't possible, contradicting the premise that $A_{n+1} \in$ A. Since **A** is isolated and P_2 holds, by contradiction, $\check{T}(A_n) < \infty$, thus $A_{n-1} \in$ A.

   b) Suppose that $\check{T}(A_n) < \infty$. Since P_2 holds, $\exists\ A_{n-1} \in$ A.

3) Prove that the $|A| = \infty$:

   Since A_n and A_{n+1} being elements of A proves that $A_{n-1} \in$ A, A_{n-1} and A_n being elements of A proves that $A_{n-2} \in$ A. It follows that $\exists\ A_{k+1} \in A\ \forall\ k \le n$, where $k \in Z \Rightarrow |A| = \infty$.

AE is isolated because P_2 holds, and it has at least 2 states that are not ∅. The association **A** = AE can therefore be made.

1. Since $\exists\ A_{k-1}$ (cause) $\forall\ A_k$ (effect), every effect has a cause, and the property of time has always existed.
2. From 2) $\check{T}(A_n) < \infty\ \forall\ A_n \in \mathbf{A}$.

CONCLUSION

In conclusion, this model posits that the elements of R persist within an infinite void, undergoing permutations without creation or destruction. This eliminates almost every theory in physics that models the structure of the universe. To delineate the universe from this void, its underlying manifold comprises elements from R arranged in a grid-like structure. Quantum processes within this manifold facilitate particle exchange. Despite the nuanced challenges posed by quantum mechanics concerning notions such as nothingness, time, superposition, and space, clarity is achieved through adherence to formal logic. This model serves as a unified framework that harmonizes quantum mechanics, gravity, and Maxwell's equations into one consistent system in which gravity is caused by quantum events. By imposing constraints on this framework, a theory of everything can emerge, akin to specifying initial conditions to an ordinary differential equation, leading to a specific application. The structured manifold wherein events unfold within our universe hints at a designed architecture.

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