A foundational zero-dimensional scaling system mandating the principle of relativity and the associated constancy of the speed of light in a vacuum

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Abstract: The measurement standards of physical phenomena shall be accounted for and examined regarding clarity and consistency in their purely mathematical description and physical phenomenal applicability. Specifically, here shall be examined the measurement scales of time and space, examining for any inconsistency of theoretic design and application to the physical sciences. In uncovering inconsistencies and lack of clear definition, the mathematics of zero-dimensional space shall be proposed to resolve these issues. Here, this proposed mathematics shall derive 1d, 2d, and 3d timespace and thence have that new mathematics and associated geometry be applied to physical phenomena resolving the inconsistencies for the measurement standards of time and space. By such a process, it shall be demonstrated that the new zero-dimensional mathematics mandates the constancy for a speed of energy transmission as a temporal wave function for 3d timespace where at such a speed the passage of time is paradoxically 0.

Keywords: principle of relativity; temporal mechanics; zero-dimensional space; timespace

1. Introduction

Physics as a natural science studies the properties and behaviour of matter (and its associated features of energy and force) through time and space. The main goal of physics is to understand the nature of the universe, namely how it behaves. Ideally, to study matter and its associated features of energy and force requires an actual physical study of matter, energy, and force and not to assume such

exists in an associated model of the universe. Yet that is exactly what physics has today with the ΛCDM cosmological model in relying on the existence of dark matter and dark energy. How did physics get to this paradoxical situation?

The ΛCDM model is a result of perhaps the only contemporary accepted theory for gravity and associated large scale construction of reality as per Einstein's general relativity. Einstein's general relativity found with its calculations that the energy of the universe is 10^{120} orders of magnitude over the current measured vale of $10^{-9} Jm^{-3}$, prompting the proposal that an invisible form of energy must exist called dark energy. Together with this dark energy is proposed to be dark matter as a substance to hold the perceived galaxies together for the proposed metric expansion of space fuelled by dark energy, specifically to prevent galaxies from flying apart in the context of a presumed expansion.

Fundamentally, nothing has challenged Einstein's general relativity in explaining certain phenomenal characteristics of light. These characteristics include the constancy of the speed of light for all frames of reference, and gravitational time dilation. If it were possible to develop a theory of gravity that could properly calculate G, explain the constancy of the speed of light c for all relative frames of reference, together with explaining gravitational time-dilation, all without the need for dark energy and dark matter, that theory could pose a challenge to Einstein's relativity theory and thence the current cosmological model. The question is, "*how could that be achieved, is it possible, given physics has invested so much time and effort in proving Einstein's general relativity in presuming dark energy and dark matter exist*?".

Here in this paper such will be proposed, namely a theory that can derive the constancy of the speed of light for all frames of reference, how time is appeared to dilate as an object approaches c, gravitational time-dilation of light, the galactic redshift effect, and black hole phenomena, all of such without the need for dark energy and dark matter. No theory proposed today that challenges Einstein's general relativity has been able to satisfy all those requirements, and so the proposal here may appear to be in error as an extension of Einsteinian physics. Yet, the presentation here understands that to describe a new theoretic process of physics that replaces Einstein's relativity then *that new theoretic process must dive deeper than what Einstein achieved*. The proposed path here is to dive deeper with the idea of time, namely to reach a more fundamental definition for time than what Einstein achieved. Not just time though, yet the actual mathematics of a "point", of zero-dimensional space. The proposal here is to unite these two new definitions in developing a time-point theory that is able to conclusively present a case for the principle of relativity and the associated features of light, namely light's constancy of speed for any frame of reference and its temporal time-dilation features with gravity.

The process of the proof involved here requires reviewing a body of work termed Temporal Mechanics, a body of work thus far spanning 44 proposed preprint papers [1]-[44], a task simplified with specific references and citations, specifically paper 44 [44]. There, a solution was proposed for the Riemann hypothesis (namely mapping the primes from $0 \to \infty$) where it was considered that Temporal Mechanics could offer a basis for the principle of relativity as per its mathematics of zero-dimensional space and associated utility of time. Here in this paper is how such is achieved, namely the derivation for the principle of relativity and associated constancy of the speed of light in a vacuum for any frame of reference.

In presenting such, this paper is sectioned in the following manner:

1. Introduction
2. Methodology
3. Paper 44 review
4. Measuring time and space
5. Measurement standards
6. Measuring zero-dimensional space
7. Microscopic and macroscopic scaling systems
8. The energy and patency (gravitational shaping) of timespace
9. Predicting Einstein's cosmological constant Λ anomaly
10. Resolving the ΛCDM model
11. Conclusion

Here is not presented a direct criticism of physics or its methodology. Instead, here is a process of taking a step further with physics theory in diving primarily into the mathematics of zero-dimensional space and how such could relate to the idea of time.

Fundamentally, presented here is a foundational application of numbers to the physical phenomenal ideas of time and space. For clarity, all important points will be registered as the numbered values (i)-(clxxxii). Together with these roman numeral numbering annotations will be references made to the works of Temporal Mechanics [1]-[44], an unavoidable and yet efficient execution of theoretic presentation. Key references will be made to paper 44 [44] providing greater detail to the initially proposed time-equation $t_B + t_N 1 = t_A$ of paper 1 ([1]: p4) and its associated derivation of the prime numbers, thus upholding Goldbach's conjecture and the Riemann hypothesis as presented in paper [44].

2. Methodology

Here is proposed a new theoretic foundation of time and space as the mathematics of zero-dimensionality (a point) deriving 1d, 2d, and 3d *timespace.* The methodology of this process is in accommodating for the contemporary measurement scales of physical phenomena while also mandating the principle of relativity, namely the requirement that the equations describing the laws of physics have the same form in all admissible frames of reference. The process offered here represents:

(i) An analysis of mathematical theory and theoretical physics as mathematical processes of measuring physical phenomena.

(ii) Identifying theoretic inconsistencies and lack of clarity for those theories and processes.

(iii) Proposing a new mathematics as a fundamentally consistent and clear solution in upholding the principle of relativity.

(iv) Offering a verifiable measurement scaling process matching known microscopic (particle) and macroscopic (cosmological) physical phenomenal values.

(v) Specifically, the following four introductions/proposals are made:

a. A fundamental mathematical link between time and space as *timespace* as the basis for the principle of relativity.

b. A c-scaling factor for 3d *timespace*.

c. An electric-magnetic 12-scaling factor intrinsic to the proposed c-scaling factor.

d. An *extra-atomic* $E = hf \rightarrow E = f$ scaling factor for energy transmission in 3d *timespace*.

This paper is *based on papers 1-44 ([1]-[44])* of Temporal Mechanics, specifically paper 44 [44] where the following has been proposed:

(vi) Zero-dimensionality as a new mathematical discipline requires new descriptions.

(vii) Those new descriptions are simple to explain yet fundamental to how points in space relate to other points in space as much as "points" (zero-dimensional space objects) are central to the idea of measurement.

(viii) The new mathematics of zero-dimensional space leads to 1d, 2d, and 3d *timespace*.

(ix) The idea of *timespace* describes how a moment of time is defined for space (arbitrarily defined as *time-now=1*, namely $t_N 1$) which when tagged to zero-dimensional space leads to the idea of a time-point in space.

(x) These time-points can then relate to one another as locations in space according to a time-equation.

(xi) Locations in space relating to other locations in space thence also have a temporal component as *timespace*, describing a "principle of relativity" basis whereby both:

a. *a passage of time* is described for *timespace* between points in *timespace*,

b. and that *at the speed of energy transmission between points in timespace* there is *no passage of time*.

In short, the paradox of (xi) shall be explained in also describing the principle of relativity, namely the speed of EM transmission being a constant for any frame of reference. Not only will such be explained, yet how both are derived from a common underlying basis, namely the mathematics of zero-dimensionality. To present such therefore, the mathematics of zero-dimensionality shall be briefly now summarized in offering an excerpt of the previous paper where such was derived, supported by the derivation of the prime numbers in highlighting Goldbach's conjecture and the Riemann hypothesis.

3. Paper 44 review

The following is an excerpt from paper 44, sections 3-6 (*here as 44.3-44.6*), in presenting the fundamental basis for the mathematics of zero-dimensional space ([44]: p1-12).

44.3 Zero-dimensionality (0d)

Contemporary ideas of zero-dimensional space are as follows:

- *Zero-dimensional space as topological space having dimension zero with respect to other non-zero dimensions of topological space, simply put graphically as a point.*
- *There, the "metric" of zero-dimensionality is given as zero in comparison to what is not zero, namely in being associated to accompanying non-zero dimensional spatial topologies; there, are the various mathematical descriptions for how to define such zero-dimensional spaces (as points) with other associated non-zero topologies.*
- *The closest idea mathematics provides for a stand-alone zero-dimensional space is the idea of a zero-dimensional ball as a point(!).*
- *Mathematics also provides zero-dimensional space with the idea of the set of rational numbers as the idea of "subspace" topology. Yet such by definition is zero-dimensional subspace, not zero-dimensional space.*

The absence of contemporary literature into zero-dimensionality therefore supports the notion of a great assumption for the mathematics of zero-dimensionality having occurred. Incumbent to this, the literature of Temporal Mechanics [1-43] has revealed the key problem with the assumption of a point, namely in examining what presumably existed before the big bang, presumably zero-dimensionality in the absence of anything else, and thence also what would still exist ahead of the big bang shock front, also zero-dimensionality. There it is proposed that the problem is the scale, identified as the infinitesimal-infinite paradox of zero-dimensional space ([43]: p2-4).

Paper 43 ([43]: p2-12) thence delivered a mathematical description for zero-dimensional space, one that allowed a point as a 0-reference to be labelled for any reference in 3d space, provided that the infinitesimal-infinite paradox could be resolved. How such was achieved required defining zero-dimensional space with a new mathematics, specifically with new mathematical tags to accommodate for the ideas of 0 *and* ∞*, namely the infinitesimal scale (*0*) and the infinite scale (*∞*). Although such may appear to be creating new terms for mathematics and physics, the anomalous mathematical implications of the ΛCDM model nonetheless have required such to be so.*

The process here in providing fuller definition to zero-dimensionality is as follows:

- *The basis for numbers and associated scale, namely* 0*,* 1*, and* ∞*, needs to be described as a new proposal for this new zero-dimensional mathematics.*

In therefore cautiously approaching this process of definition for zero-dimensionality, the basic known and upheld ideas for numbers, time, and space shall be presented, which shall then pay attention to rectifying the infinitesimal-infinite scaling anomaly of zero-dimensionality (zero-dimensional space and time).

44.4 0, 1, ∞, space, and time

44.4.1 Numbers as objects

A number quite simply is a mathematical object used to count, measure, identify, and label. The natural numbers (positive integers) 1, 2, 3…, are the whole numbers used for counting.

From there are the relationships between numbers most simply as fractions which are termed rational numbers.

Those fractions that are not expressions of real numbers are the irrational numbers.

There are positive numbers and negative numbers, generally dependent on their reference to the value 0 or even more simply as per their utility for addition and subtraction in calculations.

There are also other numbers such as i ($\sqrt{-1}$) forming the basis of what are known as complex numbers.

In short, numbers quantify things, either as a basic process of labelling, or used in mechanisms of calculations in their association with each other (addition, subtraction, multiplication, division, and exponentiation). Calculations with numbers are performed with arithmetical operations, commonly addition, subtraction, multiplication, division, and exponentiation.

With all of such, in numbers being primarily mathematical objects, they do not specify anything exclusive or particular unless requested to, namely unless applied to something exclusive or particular. There is nonetheless a possibility that numbers (such as primes) may by their particular association with each other represent a foundation for objective phenomena, and such will be examined here by first addressing the number 0 as an ideal mathematical reference object.

44.4.2 The mathematical object of 0 as a spatial reference

As a mathematical object, the number 0 has an interesting past, only being formally employed as a mathematical object in the early Renaissance period. Traditionally 0 was considered as a type of void, an uncountable. Today 0 is considered as a reference point, namely the reference between the positive and negative numbers. 0 is also considered as a "0" result for calculations resulting in 0. 0 can also be arbitrarily defined as a baseline value for physical values (such as 0 Kelvin).

The question though this paper primarily asks is how the mathematics of 0 as a number can work for 3d space, namely how can a zero-dimensional point as zero-dimensional space relate with another zero-dimensional space in the context of 3d space?

The proposal in this paper is that the process of analysis and description for a zero-dimensional reference of space (a point) to relate with another zero-dimensional reference of space (another point) requires the idea of another universal reference not as space yet as that which is not space, proposed here as time, as the context of a universal moment, as a unit value, 1.

The proposal here is to consider this universal reference accompanying space as time, specifically as a unit value of time, not a 0 value for time, yet a unit value for time, as time-now=1, as $t_N 1$. Simply, $t_N 1$ is proposed to exist for a zero-dimensional spatial realm of any size, infinitesimal or infinite, for of course the scale of space in this context in being zero-dimensional space has yet to be defined.

Such is not an intuitive thing to imagine, as our imagination is adjusted to thinking in terms of 1d time and 3d space regarding small and large scales. Yet the basis here is proposing that any infinite number of zero-dimensional spatial points are related to one another temporally in being a part of the one moment, the one temporal realm as t_N1. The problem here is the following:

- *the scale at play for space (the infinitesimal-infinite paradox)*
- *and how indeed time as t_N1 relates with space.*

The next question therefore to ask is how one zero-dimensional spatial point can be related to another zero-dimensional spatial point in the context of t_N1, to relate time with space. To address this the idea of t_N1 as a mathematical object first needs to be addressed.

44.4.3 The mathematical object of 1 as a temporal reference

Here the value t_N1 will form a key link with zero-dimensional space, proposed as timespace, as per the following proposals:

- *The number 1 is to be primarily used with the idea of "time" as the concept of a moment, as t_N1, namely time-now=1.*
- *Such is not to be confused with a length of time, namely <u>not</u> to be confused with the idea of 1 second, yet here defined as a moment as a primary consideration for time and not a secondary consideration for time (as with addition and subtraction).*
- *The length of time between t_N1 time-points as $t_N1 - t_N1 = 0$ is a value of 0 time, namely a "0" passage of time.*
- *Here also t_N1 presents with the feature that if space as a fundamental consideration is a zero-dimensional construct, at its core, and time as a moment is proposed to represent the concept of 1, as t_N1, then t_N1 can be applied to any concept, any number, as with multiplication and division, and still have no effect on that any number's value.*
- *1 of course added to or subtracted from any value changes that value by an increment of 1, which is considered as a secondary application of the number 1. Yet here on a fundamental level of consideration, as an axiom, the idea of 1 is to be fundamentally considered for a process of the datum reference of time-now <u>for</u> zero-dimensional space as t_N1.*
- *Regardless of location in space, time <u>for</u> that space is always still existing as the moment <u>regardless of one's position or relative motion</u>, as t_N1.*

By such, the idea of t_N1 for zero-dimensional space can be considered as an axiom in being self-evident:

(A) <u>The temporal moment is given symbolic mathematical value as time-now=1 (t_N1) for any zero-dimensional point reference of space.</u>

The next question is how can this t_N1 realm <u>for</u> 0-space can lead to the idea of a position in space and thus determine a scale <u>for</u> 0-space?

44.5 0d and the $\odot_0^\infty$ realm

Zero-dimensional (0d) space (or nildimensional space) is space with no dimension, simply imagined as a point. Zero-dimensional space is the idea of something without scale as a point, usually and commonly considered to be the concept of an infinitesimally sized point, despite such having no scale of size in being 0d. Simply, a 0d point could be any size as a point, as it has nothing to bear reference to as an a priori, as a standalone entity.

Let this problem be considered as the 0-∞ paradox, namely whether zero-dimensional space as a point is infinitesimal (0) or infinite (∞).

To resolve this issue, let us consider the infinitesimal and infinite zero-dimensional realms as one, here proposed as $\odot_0^\infty$, a symbol of a point surrounded by a circle in between and including the mathematical scales of 0→∞, as a single overall infinite set of infinitesimal zero-dimensional points; the proposal here is to consider a continuum between the infinitesimal zero-dimensional reference and the infinite zero-dimensional reference, and nothing more just yet.

Consider this proposed model as the $\odot_0^\infty$ model.

The obvious issue here though is the idea of a point within a point, namely a lack of precise position/reference and scale.

If it were therefore required to find an infinitesimal zero-dimensional reference in that infinite zero-dimensional $\odot_0^\infty$ realm, a core infinitesimal point in that infinity, how would it be done?

The proposed process involves nominating that the entire $\odot_0^\infty$ realm represents a moment in time as the datum-reference of time-now. In other words, the concept of "time" is being employed to explain zero-dimensional space, nominated here as a moment (not a period) of time as the value of "1" noting that time by this description cannot be as "0" yet must represent a value, nominated as the value of 1, as $t_N = 1$ ($t_N 1$).

To be proposed is as follows:

(B) Infinitesimal time-points, namely $t_N 1$ associated to a zero-dimensional spatial object, as "timespace" objects, are proposed to exist anywhere and everywhere in the $\odot_0^\infty$ realm such that there would exist an infinite number of infinitesimal $t_N 1$ time-points in this $\odot_0^\infty$ realm.

It would therefore follow that timespace objects as a $t_N 1$ time-points ($t_N 1$ associated to zero-dimensional space) bearing reference to another $t_N 1$ time-point is still a moment in time in the context of an overall $t_N 1$ moment of time for the $\odot_0^\infty$ realm. The following then would hold true:

(C) For every infinitesimal $t_N 1$ zero-dimensional reference in the proposed $\odot_0^\infty$ realm, time is as a moment as though there is a universal moment entanglement of $t_N 1$ infinitely everywhere in the $\odot_0^\infty$ realm.

The question now arises as to how time and space as these timespace time-points can develop as dimensions and not infinitesimal zero-dimensional point-analogues merely associated as integer sets of $t_N 1$ time-points. Namely, how can an infinitesimal point in space as zero-dimensional space be located/positioned in reference to another infinitesimal point in time and space in the context of this entire

infinite datum-reference of t_N1 time-points, such to create sets or dimensional extensions of t_N1 time-points (timespace) represented by the natural numbers?

44.6 0d t_N1 positions as timespace objects

Here the idea of position enters the $\odot_0^\infty$ realm, which requires bearing reference from one t_N1 zero-dimensional reference to another t_N1 zero-dimensional reference as an altogether new event, as a spatial dimensional event, namely the spatial position of a nominated t_N1 zero-dimensional reference in the $\odot_0^\infty$ time-now (t_N1) realm compared to another t_N1 zero-dimensional reference point.

Time here though as an infinitesimal time-point (t_N1) bearing reference to another infinitesimal time-point (t_N1) is still a moment in time. Although the passage of time between one t_N1 time-point and another t_N1 time-point is by definition $t_N1 - t_N1 = 0$, and thus a 0 passage of time, here a scale for space is sought to measure passages of time that have a value other than 0, as what could only be found with spatial values other than 0.

Therefore, in order to generate dimensionality for space as distance, time must develop as a dimensional entity from its t_N1 status in order for space to also develop as a dimensional entity. The question is how.

The proposal here is to create two new temporal positions as time-before and time-after in regard to time-now (t_N1).

Why? Time-now must be time-now by definition of the general infinitesimal and infinite zero-dimensional reference realm ($\odot_0^\infty$), as a universal moment, and so to create another infinitesimal time-now is to herald to another t_N1 reference, and thus technically the same t_N1 reference, which is disallowed as that condition already exists, namely t_N1 existing anywhere and everywhere. Thus, a new concept of a position of time relative to time-now must be created.

Here is the proposed concept of time-after as a new reference of time, say t_A, time-after being that step beyond time-now.

What is the position of time-after? The position of time-after is proposed to be unknown, as much as space is still 0-space and the reference grid scale is still indeterminant other than space being a 0-space non-dimensional point reference in the context of time-points all representing a moment.

Therefore, as a proposal thus far, $t_N = 1$ (t_N1), and t_A=?.

To say though there is a time-after event is to imply a time-before event relative to t_N1, and thus there must be a time-before event also, somehow, say as t_B.

Thus, there would be three features for time, time-now (t_N), time-after (t_A), and time-before (t_B).

The proposal is that time-now (t_N) in alliance with this potential time-before (t_B) results in time-after (t_A).

The solution proposed here is that t_B in regard to t_N requires a negative sign for t_B (equation 1) given t_B would be a "backward/negative" step in reference to t_N if indeed time-after is a forward step ahead of time-now, namely t_B as a "before" concept in regard to t_N1 as a zero-dimensional space reference, and thus negative (-) in reference to 0. Thus:

$$(-t_B) + 1(t_N1) = fundamental\ property\ A \quad (1)$$

Yet, if time as t_N1 is the time-now basis, as a $\odot_0^{\omega}\ t_N1$ realm basis, t_N can also be per "$-t_B$" as another valid mathematical fundamental property, as technically t_B would already be positioned within the t_N1 reference, as tb would have already happened in the context of t_N1. Thus:

$$\frac{1(t_N1)}{(-t_B)} = \ fundamental\ property\ B$$

(2)

*Thus, if these two equations represent fundamental properties of time, and time itself is being defined as a $\odot_0^{\omega}\ t_N1$ realm, then fundamental property A **must equate** to fundamental property B:*

$$(-t_B)\ + 1(t_N1) = \frac{1(t_N1)}{(-t_B)}$$

(3)

From equation 3:

$$t_B^2 - t_B = 1(t_N1)$$

(4)

$$t_B + 1(t_N1) = \ t_B^2$$

(5)

Given there are only 3 proposed concepts for time, namely t_B, t_N, and t_A, then t_B^2 must be equivalent to t_A:

$$t_B + 1(t_N1) = \ t_A$$

(6)

Equation 6 is the proposed time-equation for timespace, noting that the quadratic solution to equation 5 as t_B is φ and $\frac{-1}{\varphi}$, the golden ratio.

These two values (φ and $\frac{-1}{\varphi}$) as the golden ratio are now proposed to function as two distinct references for time which can thence be used to formulate spatial dimensionality and thus positioning.

To now work with these features, let us take two Pythagorean algebraic vectors for t_B, one as φ the other as $\frac{-1}{\varphi}$, giving the hypotenuse as the value of $\sqrt{3}$, arriving at equation 7:

$$\left(\frac{-1}{\varphi}\right)^2 (t_A) + \ \varphi^2(t_A) \cong 3(t_N1)$$

(7)

How this 3 value manifests as spatial dimensionality is proposed to be how space is incorporated with time-now (t_N1) as a dimensional entity, namely 3d space associated to a universal time-now t_N1 event, simply as $3(t_N1)$.

Here the proposal is that $3(t_N1)$ *from equation 7 represents a 3d vector grid as the* $3\ t_N1$ *dimensions of 0-space serving as the dimensional definition of a 3d spatial position in regard to* t_N1*. This is proposed as a 3d timespace grid.*

To note is that the $\sqrt{3}$ *value can also be expressed with* t_N1 *as Pythagorean algebraic vectors resulting in a value of* 2 *as the hypotenuse; here it is proposed that the* 2 *value represents a double* t_N1 *as* $2(t_N1)$*, meaning there are proposed to be two* t_N1 *applications for each of the 3 dimensions of space. Of course, there are two golden ratio values, yet these two values have already been factored, thus a new concept must be considered when applying this* $2(t_N1)$ *factor to 3d space from a zero-dimensional (*0*d) reference point.*

Here regarding $2(t_N1)$*, 0-space is proposed to have* 3 *time-related dimensions (3d) incorporating* 2 *temporal outcomes for each of the 3 time-related axes; in creating a 0-space reference for each 3d time-spatial (timespace) vector grid, the* $2(t_N1)$ *value would represent the dual directions on each* t_N1 *vector axis from the* 0*d reference for 3d space.*

To note is that in this process both t_B *and* t_A *as non-localities (non-*t_N1*) are used together according to Pythagorean algebra to set a zero-dimensional reference for 3d space, as* t_N1 *points (zero-dimensional) in timespace. Although the values of the golden ratio are irrational, they are defined as being non-local in not being as* t_N1*, yet together via Pythagorean algebra they form the locality for time-now (*t_N1*) as 3d space for a zero-dimensional point reference* 0*.*

Thus, the idea of locality for zero-dimensionality comes by the golden ratio Pythagorean relationship in the context of the $\odot_0^{\varphi}$ *set.*

The product of golden ratio values can be considered as a "plane" (2d) value, and when added to t_N1 *results in* 0*, and thus by default a 0-dimensional reference of focus:*

$$\varphi \cdot \frac{-1}{\varphi}(t_B) + 1(t_N1) = \ 0(t_A) \tag{8}$$

This $(\varphi \cdot \frac{-1}{\varphi})$ *2d plane value is negative and thus would represent a natural complex number plane.*

As a complex number plane, the work of Leonard Euler has shown that $e^{i\pi} = -1$*, namely* $e^{ix} = cos\, x + i\, sin\, x$ *where* $x = \pi$*, and thus* $e^{i\pi}$ *also representing a complex plane of the same value of* $\varphi \cdot \frac{-1}{\varphi}$*.*

Thus:

$$\varphi \cdot \frac{-1}{\varphi} = e^{i\pi} \tag{9}$$

Thus, equation 8 becomes:

$$e^{i\pi}(t_B) + 1(t_N1) = \ 0(t_A) \tag{10}$$

The suggestion here is that the time-equation and its two golden ratio results of t φ *and* $\frac{-1}{\varphi}$ *represent the basis for a natural complex number 2d plane instructed by* $e^{i\pi}$*.*

Thus, on the one hand the time-equation presents a natural 3d spatial grid, and on the other hand there also exists a 2d complex number plane awaiting fulfilment and description with the varying complex plane features of $e^{i\pi}$.

The next question therefore is, "how do the 1d, 2d, and 3d timespace grids work?".

4. Measuring time and space

Further in paper 44 ([44]: p12-22) is the derivation of primes from the workings of the 1d, 2d, and 3d spatial grids. There it is shown how the primes form an integral system of numbers linking 1d, 2d, and 3d *timespace*.

Here though *in this paper* the following is proposed:

(xii) Spatial distance is scaled by using a standard of velocity/speed for any zero-dimensional time-point reference in 3d *timespace*, namely distance per unit of time, as the speed of the temporal wave function (EM) transmission c.

(xiii) c is derived to be a constant for any frame of zero-dimensional time-point reference.

(xiv) The passage of time between t_N1 time-points (ix) in space for c must be 0 according to $t_N1 - t_N1 = 0$.

In following on from paper 44, here the derived *fivefold* nature for time needs to be discussed, namely:

(xv) Time as a t_N1 time-point as a momentary time-point for zero-dimensional space.

(xvi) The general direction of time as the time-equation $t_B + t_N1 = t_A$, namely a forward direction of time utilizing the datum-reference of t_N1.

(xvii) Time as $t_N1 - t_N1 = 0$ time-points as time *at the speed of transmission between* t_N1 *time-points*.

(xviii) The resultant temporal relativity and associated temporal doppler effects ([30]: p11-15) of objects in 3d *timespace* in the context of c where at *c time=0* (xvii) (namely a 0 *passage* of time).

(xix) The standard observed *passage* of time being due to (xvi), namely the incremental cycles of the temporal wave function as *timespace* ([2]: p3-10):

a. Specifically as the on-off feature of the temporal wave function as the increment between a t_N1 time-point moment/loop and the absolute absence of a t_N1 time-point moment/loop.

b. Such, owing to the need to disallow *time-after→time-before* given (xvi) is a *time-forward* equation by its design ([43]: p2-8).

Although time can be observed to contract and lengthen owing to the relative motion of bodies (xviii), c is always a constant where at c *time=0* as a *passage* of time (xvii), and yet the moment is still a valid and non-0 concept for time as $t_N 1$ (xv).

What is relevant for the ordinary understanding of time though, namely its passage, has been described as the temporal component of the temporal wave function as presented in paper 2 ([2]: p3-10).

Thus, although Einstein was correct in considering c as a constant where at c time approaches the value of 0 (namely time not passing at c), together with attempting to uphold the principle of relativity, Einstein's spacetime (where time contributes to the curvature of space as gravity) is a fundamentally flawed proposal in failing to define the fundamental basis of time itself. By that failure, it can be shown in this paper if not predicted that there would eventuate with general relativity massive calculation incursions that warrant the invention/amendments of dark energy and dark matter. First, current notions of time and space in mathematics and physics shall be acknowledged.

4.1 Time

Time is generally considered as :

(xx) An abstract measurement of elemental changes over a non-spatial continuum.

(xxi) Being denoted by numbers and/or named periods such as hours, days, weeks, months, and years.

(xxii) An apparently irreversible series of occurrences within this non spatial continuum.

(xxiii) An interval between two relative points on this continuum.

More specifically, time is considered as:

(xxiv) A continued and irreversible sequence of events from the past, through the present, into the future.

(xxv) A component quantity of various measurements used to sequence events:

a. In comparing the duration of events or the intervals between them
b. to quantify rates of change of quantities .

(xxvi) A fourth dimension (associated to three spatial dimensions).

(xxvii) "What a clock measures ".

In physics, as according to 4d spacetime theory:

(xxviii) Every event can be assigned four numbers representing its time (1d) and position (3d, the event's coordinates), namely a point for the dimension of time and 3 dimensions of space.

(xxix) The numerical values for this 4d spacetime grid change for different observers and their motions relative to each other.

(xxx) The time required for light to travel a specific distance is the same for all observers, as first publicly demonstrated by the Michelson and Morley experiment.

General relativity however is unable to accommodate for the notion of time for extremely small intervals where quantum mechanics holds, simply because on the quantum level the idea of c is upheld where at c time is proposed not to pass, yet the general relativity approach for time is a result of taking a infinitesimal straight line Lagrangian time-frames and applying them to an infinite sequence to curve flat spacetime. As such, in quantum mechanical time-frames there is no generally accepted theory for general relativity.

The *measurement* features and processes of time include:

(xxxi) Time is one of the seven fundamental physical quantities in both the International System of Units (SI) and International System of Quantities.

(xxxii) The SI base unit of time is the second (s).

(xxxiii) Time is used to define other quantities, such as velocity (ms^{-1}).

Currently, time is measured by an *operational* definition of time, specifically in observation of consistent repetitions of the radioactive decay of the Caesium atom. The problem here by this method is that:

(xxxiv) The operational definition of time does not address what the fundamental nature of time *is*.

What can therefore address the fundamental nature of time?

If 4d spacetime is upheld as a *fundamental* feature of reality, the curvature of which is proposed to be gravity, then perhaps space can allude to the fundamental nature of time?

What therefore is space?

4.2 Space

Space is considered as:

(xxxv) The boundless three-dimensional extent in which objects and events have relative position and direction.

(xxxvi) A part of a boundless four-dimensional continuum known as spacetime.

The measurement features of space include:

(xxxvii) Space as distance for each of its 3 dimensions as measured using light (c).

(xxxviii) Distance being one of the seven fundamental physical quantities.

(xxxix) The SI base unit of distance is the metre (m).

(xl) The defining constant for distance is c, namely that time at c does not pass for each second of light distance *is measured* as the value of c.

The concept of space is naturally considered to be of fundamental importance to an understanding of the physical universe. However, disagreement continues over whether space is itself:

(xli) A primary entity.

(xlii) A relationship between entities (such as with time and/or mass).

(xliii) A part of a conceptual/theoretic framework for things to be explained in regard to.

4.3 Spacetime

From the 19th century mathematicians began to examine geometries that are *non-Euclidean*, namely where space is conceived as *curved* as opposed to *flat* (straight 3d). The key proponent of spacetime theory is Albert Einstein's theory of general relativity, namely that:

(xliv) The space around gravitational fields is proposed to deviate from Euclidean space and is thus curved as gravity.

Experimental tests of general relativity have confirmed that non-Euclidean geometries provide a better model for the shape of space and its relationship with time (temporal incursions with massive bodies and relative motions in regard to c). It should also be noted that spacetime theory is upheld as a standard for defining the idea of time in being able to:

(xlv) Accurately describe temporal anomalies associated with bodies in relative motion.

(xlvi) Accurately describe temporal incursions approaching the speed of light (namely time slowing to 0 at c).

(xlvii) Accurately describing temporal anomalies regarding apparent supermassive bodies (namely time slowing).

Although (xlv)-(xlvii) are derivations of Einstein's general relativity, these features could be explained more precisely by a more fundamental theory for time given general relativity theory is unable to define the fundamental nature of time.

4.4 Problems with spacetime theory

In presenting the measurement issues with time, space, and spacetime theory, the proposal here is to consider the constancy of the speed of light c as an accepted measurement scaling device for distance. Despite the fortitude of c as a constant as per known data measurements for c, the key features of time theory for general relativity are:

(xlviii) Time is proposed not to pass at c, namely *time=0* at c, presuming to offer time a 0 reference for c.

(xlix) Space is presumed to be 3d and not derived to be such from a fundamental mathematics.

(l) The notion of a "point" (zero-dimensional space) is not defined with 3d space.

(li) Zero-dimensional space as a mathematics is lacking, simply given the notion of an "infinitesimal point" as an empty set by proxy.

(lii) 1d time is tagged to 3d space as a proxy understanding of time in reference to c, yet at c *time=0* *and thus presumably non-existent*.

(liii) The passage of time is proposed to slow for super-massive objects as a *curvature* of 3d space, namely as the effect of 1d time on the otherwise Euclidean 3d space grid.

(liv) This curvature of 3d space as 4d spacetime is considered as gravity, the greater the curvature the greater the effect of gravity and thence greater mass involved.

(lv) Einstein's 4d spacetime theory then proposes a mass moving close to c must become supermassive.

There are thence issues which include:

(lvi) There is no evidence for any object gaining in mass approaching the value of c; for instance, cosmic rays in being close to c are not supermassive.

(lvii) Despite being a proxy theory, spacetime theory gives no fundamental definition to time other than being a proposed by-product of bodies in relative motion compared to the idea of time not passing at c resulting in (xlvii).

In short, the entire process (xlviii)-(lv) lacks cohesion of definition, and further still, requires a fundamental definition for time and space that mathematically defines:

(lviii) The known phenomenal features of c where the passage of time at c is 0.

(lix) The mathematics of zero-dimensionality for time (as a moment) and space (as a point).

5. Measurement standards

To be demonstrated here is:

(lx) The *proposed new application* of the mathematics of zero-dimensional space has no erroneous effect on the current measurement standards for physics.

(lxi) The mathematics of zero-dimensional space (the mathematics of a point) is a fundamentally more exact approach to defining measurement standards.

To consider here is how the different ideas, processes, and theories of measurement each lack an important and fundamental idea that can be otherwise collectively resolved in addressing a fundamental measurement issue if not problem with how the current approach to measurement for physical phenomena is being approached.

For instance, to measure is to:

(lxii) Ascertain the size, amount, or other scale of something (an object).

(lxiii) Use an instrument device marked with units standardized for that feature of an object that is being measured.

Likewise, a measure is

(lxiv) A standard unit to express the size, amount, or other scale of something.

In the classical definition, *measurement* is:

(lxv) The determination or estimation of ratios of quantities.

In short, measurement is:

(lxvi) The quantification of an object/event's attributes/features.

(lxvii) A process that involves a comparison of an unknown quantity with a known standard quantity.

The current measurement standards for an object's attributes are upheld by the International System of Units (SI), a system that reduces all physical measurements to a mathematical combination of seven base units, as follows:

(lxviii) Kilogram (kg).

(lxix) Metre (m).

(lxx) Candela (cd).

(lxxi) Second (s).

(lxxii) Ampere (A).

(lxxiii) Kelvin (K).

(lxxiv) Mole (mol).

Thus, ideally measurements are:

(lxxv) Standardized in order to compare quantifications between similar objects (and/or events).

(lxxvi) Labelled by numbers to quantify these attributes.

(lxxvii) Held in the context of mathematical equations with the aim of linking the formula for one defining constant attribute of an object to that of another defining attribute constant.

The methodology for taking measurements requires:

(lxxviii) The application of *precise* standards with *precise* measurement tools.

Standards of measurement have developed through time to reach efficient and agreed benchmarks. These benchmarks primarily revolve around known physical phenomenal constants. For instance, the metre is benchmarked by the speed of light c, and the kilogram is benchmarked by the Planck constant h. The following is a list (table 1) of the current physical phenomenal benchmarks:

Table 1

Phenomenal quantity	Phenomenal unit	symbol	Defining constant
time	second	s	Hyperfine splitting in *caesium-133*
length	metre	m	Speed of light, c
mass	kilogram	kg	Planck constant, h
Electric current	ampere	A	Elementary charge, e
temperature	kelvin	K	Boltzmann constant, k
Amount of substance	mole	mol	Avogadro constant, N_A
Luminous intensity	candela	cd	Luminous efficacy of 540 THz source K_{cd}

The classical definition of measurement, namely (lxiii) almost implies the requirement of mathematics to:

(lxxix) Abridge a common basis of numbers to the fundamental measures of time and space.

(lxxx) Thence abridge equations of physical phenomena and their associated defining constants to one another upon (lxxix).

The problem with a common basis of numbers is:

(lxxxi) defining the overall scales and context at play for numbers, primarily from 0 to ∞.

The other problem with a common basis of numbers being:

(lxxxii) how to label numbers with physical phenomenal objects and vice-versa.

Central to these two problems (lxxxi)-(lxxxii) is a third, namely:

(lxxxiii) to primarily define the objects of space and time with numerical values, namely how to define the measurement scale for space and thence time.

The issue with measuring space strictly should be in defining a point, namely zero-dimensional space, to then measure scales for the dimensions of space if not derive the dimensions of space from a successful mathematics of zero-dimensional space.

Contemporary ideas of zero-dimensional space are as follows:

(lxxxiv) Zero-dimensional space is considered as zero-dimensional topological space having *dimension zero* with respect to other non-zero dimensions of topological space, simply put graphically as a point.

(lxxxv) There, the "*metric*" of zero-dimensionality *is given as zero* in comparison to *what is not zero*, namely in being associated to accompanying non-zero-dimensional spatial topologies; there, are the various mathematical descriptions for how to define such zero-dimensional spaces (as points) with other associated non-zero topologies.

(lxxxvi) The closest idea mathematics provides for a stand-alone zero-dimensional space is the idea of a zero-dimensional *ball* as a *point*.

(lxxxvii) Mathematics also provides zero-dimensional space with the idea of the <u>*set*</u> of rational numbers as the idea of "*subspace*" topology. Yet such by definition is zero-dimensional subspace, not zero-dimensional space.

The literature of Temporal Mechanics [1-44] has revealed the key problem with the *assumption* of a point, namely ([43]: p1-5):

(lxxxviii) What presumably existed before the big bang according to the ΛCDM model (based on Einstein's general relativity), zero-dimensionality on an *infinitesimal* scale one could only consider.

(lxxxix) Thence what would still exist ahead of the big bang shock front, also a point yet on an *infinite* scale.

There, the problem is the *scale*, and Temporal Mechanics has identified this as the *infinitesimal-infinite* paradox (0-ω paradox) of zero-dimensional space ([43]: p1-5) in view of the ΛCDM model.

Paper 43 ([43]: p6-8), as with paper 44 ([44]: p8-13) thence delivered a mathematical description for zero-dimensional space, one that allowed a point as a 0-reference to be labelled for any reference in 3d space, provided that the *infinitesimal-infinite* paradox could be resolved. How such was achieved required defining zero-dimensional space with a new mathematics, specifically with new mathematical tags to accommodate for the ideas of 0 and ω, namely the *infinitesimal* scale (0) and the *infinite* scale (ω), which then proposed a new cosmological model in highlighting the flaw in the current ΛCDM cosmological model. Simply, by using the mathematics of zero-dimensionality the ΛCDM was demonstrated to be flawed.

6. Measuring zero-dimensional space

As with paper 44 and associated nominated sections, the process here in providing fuller definition to zero-dimensionality is as follows [44]:

(xc) Establish the mathematical basis of zero-dimensionality (0d) involving the objects of time and space for the conceptual number values of $0 \rightarrow \infty$ ([44], sections 3-6).

(xci) By (xc) to derive an equation for zero-dimensional *timespace* revealing the golden ratio time-equation (section 6).

(xcii) By (xci) to derive Euler's number e and the complex 2d plane for the 2d aspect of *timespace* (section 6).

(xciii) By (xc)-(xcii) to then highlight the golden ratio (φ and $\frac{-1}{\varphi}$) code for zero-dimensional *timespace* references as prime number sequences for 1d and 2d *timespace* (sections 7-8), namely:

a. how the golden ratio features of the mathematics of zero-dimensional space are highlighted in Goldbach's conjecture (section 7) for all prime values from $0 \rightarrow \infty$,

b. how the golden ratio features of the mathematics of zero-dimensional space are highlighted in the Riemann hypothesis (section 8) for all prime values from $0 \rightarrow \infty$,

c. and thence establishing a zero-dimensional reference for a vector of primes in 1d (section 7), 2d (section 8), and thence 3d (section 9) *timespace* for all prime values $0 \rightarrow \infty$.

(xciv) By such a process in deriving the prime numbers to present the case for a universal basis for numbers applied to the dimensions of time and space as 1d, 2d, and 3d *timespace*.

In short, here is presented the case for a mathematics of zero-dimensionality, the mathematics of a point, through labelling the objects of time and space with specific number values, namely 1 and 0 respectively. Such is then scaled as a mathematics from $0 \rightarrow \infty$ in revealing a golden ratio time-equation in deriving 1d, 2d and 3d *timespace*. Such is achieved by opening up the feature of time as an object for number representation beyond the time-domain of time-now. This mathematics is then presented to the Riemann hypothesis to then confirm that the Riemann hypothesis can be upheld for all prime values from $0 \rightarrow \infty$ along $s = ½$. It was then demonstrated that the mathematics of zero-dimensional space can derive phenomenal descriptors for EM and gravity ([44]: p20-22).

In short, Temporal Mechanics addresses five concepts of time (xv)-(xix), namely:

(xv) *Time as a t_N1 time-point as a momentary time-point for zero-dimensional space.*

(xvi) *The general direction of time as the time-equation $t_B + t_N1 = t_A$, namely a forward direction of time utilizing the datum-reference of t_N1.*

(xvii) *Time as $t_N1 - t_N1 = 0$ time-points as time at the speed of transmission between t_N1 time-points.*

(xviii) *The resultant temporal relativity and associated temporal doppler effects ([30]: p11-15) of objects in 3d timespace in the context of c where at c time=0 (xvii) (namely a 0 passage of time).*

(xix) *The standard passage of time being due to (xvi), namely the incremental cycles of the temporal wave function as timespace ([2]: p3-10):*

a. Specifically as the on-off feature of the temporal wave function as the increment between a t_N1 time-point moment and the absolute absence of a t_N1 time-point moment.

b. Such, owing to the need to disallow time-after→time-before given (xvi) is a time-forward equation by its design ([43]: p2-8).

By such, Temporal Mechanics developed:

(xcv) A temporal wave function for space (EM analogue) as a process of *timespace* communication between zero-dimensional references:

i. ([2]: p1-14).

(xcvi) Thence deriving the phenomenal nature of that EM communication process between references in *timespace* as a spatial scale and associated speed of communication transmission as the value of c:

i. ([2]: p15).

Therefore, (xviii) can be written as follows:

(xcvii) $t_N1 - t_N1 = t_c0$ where t_c0 represents the idea of time not passing (between any two t_N1 points) at c.

Although using c as a scale for distance is non-problematic for the constancy of the speed of light as much as that phenomenal data is universally evident, Einstein's relativity in primarily relying on *the passage of time being 0 at c* and *time being what a clock measures* is insufficient if not disjointed as a definition for time as per (xlviii)-(lv).

In resolving such, Temporal Mechanics has derived the following:

(xcviii) Objects approaching c do not become supermassive yet approach t_c0, as demonstrated in the derivation of the maximum speed of cosmic rays:

i. ([40]: p19-25, eq4-14).

(xcix) The phenomenal features of gravity can be derived from this new temporal definition basis as per the derivation of G (gravitational constant) on the elementary particle level:

i. ([42]: p3-16).

(c) Gravitational time-dilation is based upon equation $(\varphi \cdot \frac{-1}{\varphi})_{t_B} + 1_{t_N} = 0_{t_A}$ for mass-gravity:

i. ([42]: p18, eq19).

(ci) EM is affected by mass-gravity by the $\varphi \cdot \frac{-1}{\varphi}$, $e^{i\pi}_{t_B}$, geodesic:

i. ([42]: p40-50).

(cii) Concepts such as dark energy and dark matter are no longer required:

i. ([42]: p24-28).

The next feature to explain is how this overall 1d, 2d, and 3d *timespace* system can be scaled in accordance with known phenomenal data.

7. Microscopic and macroscopic scaling systems

The 3d *timespace* system is proposed to organize itself according to 7 fundamental scaling constraints central to the time-equation ($t_B + t_N1 = t_A$) as (ciii)-(cix):

(ciii) The temporal wave function (EM analogue) speed of transmission between zero-dimensional references in 3d *timespace*, derived as c (c-scaling constraint):

i. ([2]: p15-16, eq7-14).
ii. ([23]: p21-22).
iii. ([25]: p51,eq10).
iv. ([30]: p11-15).
v. ([32]: p15, eq1-5).
vi. ([35]: p29, eq3).
vii. ([36]: p25, eq6).
viii. ([39]: p42, eq14).
ix. ([40]: p20, eq6).

(civ) The derivatives of the temporal wave function:

a. $\varphi \cdot \frac{-1}{\varphi} = e^{i\pi}$:
   i. ([15]: p8-10, eq5-6).
   ii. ([40]: p16, eq2-3).
   iii. ([44]: p11, eq9).

b. $(\varphi \cdot \frac{-1}{\varphi})_{t_B} + 1_{t_N} = 0_{t_A}$:
   i. ([40]: p16, eq2-3).
   ii. ([42]: p18, eq19).

c. 12-scaling constraint (intrinsic to the c-scaling constraint):
   i. ([5]: p8-11, fig2-6).
   ii. ([25]: p51, eq10).
   iii. ([32]: p16-17, eq6-9).
   iv. ([35]: p29, eq3).
   v. ([37]: p18-31).

d. Fine structure constant α:
   i. ([2]: p15, eq7-9).
   ii. ([39]: p46-52, eq22-27).
   iii. ([41]: p33, eq4-6).

e. Planck constant h:
   i. ([3]: p3, eq1).
   ii. ([39]: p52-59, eq28-36).

(cv) (ciii)-(civ) on a microscopic scale ($\rightarrow 0$) for zero-dimensionality:

i. ([25]: p51, eq10).
ii. ([35]: p29, eq3).

(cvi) (ciii)-(civ) on a macroscopic scale ($\rightarrow \infty$) for zero-dimensionality:

i. ([13]: p9-11, eq1-8).
ii. ([32]: p8-20).
iii. [33].

iv. ([39]: 32-46, p59-67).

(cvii) A prime number scaling constraint for space:

i. ([35]: p27-28, eq1-2).

ii. [44].

(cviii) An over-arching $time = space$ scaling constraint:

i. ([36]: p18-21).

(cix) An energy-temperature scaling constraint

i. ([14]: p20-26, fig14).

ii. ([38]: p43-48).

iii. ([39]: p22-26, fig7).

These 7 described scaling constraints each have intrinsic/subsidiary and interlinking scaling constraints, such as π. For instance, the π-constraint entails:

(cx) the temporal wave function (EM) propagating in 3d *timespace* according to the constraint of a *spherical* (π-constraint) 2d propagation complex plane wave front:

i. ([1]: p4-8).

ii. ([2]: p1-14).

iii. ([13]: p9-11, eq1-8).

iv. ([44]: p8-12).

Indeed though, the propagation of a temporal wave function implies the idea of "energy". What is energy according to *timespace* and the temporal wave function?

8. The energy and patency (gravitational shaping) of *timespace*

The idea of the temporal wave function is the idea of energy in its most basic sense, namely the phenomenal feature of *timespace* relating between zero-dimensional references.

How zero-dimensional references relate with each other in 3d *timespace* is proposed to be a process of energy transference in the form of 2 basic process (cxi)-(cxii):

(cxi) The EM temporal wave function (EM analogue):

i. [2].

(cxii) The EM *destructive interference resonance* (DIR) phenomenal derivatives (mass-gravity):

a. EM^{DIR} field as the basic *destructive interference resonance* (DIR) of an EM field

i. [38].

ii. ([42]: p7-21).

b. EM_X^{DIR} field as the ***flatline*** *destructive interference resonance* (DIR) of an EM field
   i. ([42]: p21-55).

In the context of this proposed *timespace* scheme, energy as an EM phenomenon is constrained by the following principles:

(cxiii) Energy (E) as a fundamental property of the temporal wave function is in proportionality with the ratio of the two derived qualities of the temporal wave function, as the golden ratio variables $-\frac{1}{\theta}$ and θ.

(cxiv) The energy is proposed to be as $E \propto \frac{(-\frac{1}{\theta})}{\theta}$.

(cxv) These two golden ratio variables represent the electric $(e; -\frac{1}{\theta})$ and magnetic $(B; \theta)$ features of the temporal wave function:
   i. ([2]: p1-14).
   ii. ([5]: p3, fig1).
   iii. ([41]: p33, eq4-6).

(cxvi) By (cvi) the ratio of the electric $(e; -\frac{1}{\theta})$ and magnetic $(B; \theta)$ features of the temporal wave function can be represented as the frequency of the temporal wave function as $f \propto \frac{e}{-B}$.

(cxvii) That $f \propto -\frac{e}{B}$ is a property of c where $f = \frac{c}{\lambda}$.

(cxviii) The temporal wave function is thence the component of energy for 3d *timespace*.

(cxix) The basic value for the energy of *timespace* was derived to be that of $10^{-9} Jm^{-3}$.
   i. ([14]: p17-23).

(cxx) The temperature value of the energy of space was derived to be that of $2.725K$.
   i. ([14]: p23-25, eq13).

(cxxi) Energy is a conserved quantity in being an aspect of the dimensions of *timespace* in an overall $\odot_0^\omega$ system:
   i. ([14]: p17-23).
   ii. ([44]: p7-8).

(cxxii) Energy is a quantitative property that can thence, like c, be transferred to a body or a physical system in *timespace*:
   i. (cix).

(cxxiii) Energy is thus recognized in 3d *timespace* in the form of light (as EM) and temperature:
   i. (cix).

The energy unit scale of an EM temporal wave function is derived to be constrained by three key factors:

(cxxiv) The frequency of the temporal wave function, as f, where:

a. $f = \frac{c}{\lambda}$ (cxiv).
b. c as the speed of energy transmission (as the temporal wave function) in space (ciii).
c. λ is the wavelength of the temporal wave function.

(cxxv) "1" as a macroscopic scale (xcvi) constant for the overall $t_N 1$ realm (where $time = space$ (cviii) and thence $space = 1$ for a general macroscopic condition for $t_N 1$), and thus $E = f$.

(cxxvi) h (Planck's constant) as a microscopic (cv) scale constant, and thus $E = hf$.

Here temporal Mechanics proposes :

(cxxvii) The condition of h is based on a microscopic constraint for c.

(cxxviii) The condition for "1" is based on a macroscopic constraint for c.

(cxxix) A scale exists between microscopic $E = hf$ scale to the macroscopic $E = f$ scale that limits the propagation of energy (the temporal wave function) in space:
i. ([13]: p9-11, eq1-8).

Energy as an EM^{DIR} phenomenon is proposed to be constrained by the following principles:

(cxxx) ZPE_q:
i. ([42]: p16-21).

Energy as a EM_X^{DIR} phenomenon is proposed to be constrained by the following principles:

(cxxxi) ZPE_X:
i. ([42]: p16-21).

By all of such, the proposal here is that the *timespace* organizes itself, arranges itself, according to these key $EM,\ EM^{DIR}$, and EM_X^{DIR} constraints. This is proposed to result in:

(cxxxii) Subatomic particle level:
i. [2][3][4].
ii. ([23]: p12-31).

(cxxxiii) Proton/neutron mass:
i. ([23]: p22).

(cxxxiv) Electron mass:
i. ([36]: p14-18).

(cxxxv) Elementary particle level:
i. ([25]: p38-53).

(cxxxvi) Neutrino mass:

i. ([25]: p51, eq10).
ii. ([35]: p28, eq2).
iii. ([39]: p41-46, eq9-21).

(cxxxvii) Gravitational constant G:

i. ([39]: p42-44, eq10-14).
ii. ([41]: p38, eq7).
iii. ([42]: p7-16, eq1-18).

(cxxxviii) Solar system mass and associated solar values:

i. ([39]: 32-46, p59-67).

(cxxxix) Oort cloud distance from sun:

i. ([13]: p9-11, eq1-8).

(cxl) Heliopause distance from sun:

i. ([32]: p15, eq1-5).

(cxli) Bow shock:

i. ([32]: p16-17, eq6-9).

(cxlii) Black hole phenomena:

i. ([42]: p40-50).

(cxliii) Astrophysical phenomena and scales:

i. [32][33][34].
ii. ([39]: p30-67).
iii. ([42]: p24-29).

(cxliv) Isotropic CMBR:

i. ([14]: p23-25, eq13).
ii. ([37]: p29-31).

By all of such, it was then possible to propose a sound basis to measure and account for astrophysical phenomena [32][33][34][39][42].

9. Calculating Einstein's cosmological constant Λ anomaly

The ΛCDM (Lambda cold dark matter) cosmological model is the cosmological constant **Λ** (namely the required dark energy as based on Einstein's formulation for gravity and the proposed energy requirements there) **C**old **D**ark **M**atter model. The ΛCDM model is proposed to represent the basis for:

(cxlv) The cosmic microwave background (EM radiation).

(cxlvi) The large-scale structure of the universe as with the distribution of galaxies.

(cxlvii) The accelerating expansion of the universe observed in the light from distant galaxies and supernovae.

In short, the ΛCDM model assumes general relativity to be the correct theory of gravity on cosmological scales. A few points on general relativity:

(cxlviii) General relativity was Einstein's development upon special relativity.

(cxlix) The confidence in special relativity was nonetheless down to the fundamental idea of c being a constant for any reference in space where the passage of time approaches 0 at c.

(cl) Einstein by his calculations arrived at what he termed a cosmological constant value for energy as Λ, a value approximately $10^{111}\,Jm^{-3}$, well above by a factor of $\sim 10^{120}$ the known energy value of space $10^{-9}\,Jm^{-3}$.

(cli) Λ then required the invention of energy as dark energy, given the notation of Λ.

(clii) The idea of an expanding universe was created to explain this energy together with explaining the phenomena of the redshift of stars presumed to be due to a metric expansion of space.

Temporal Mechanics has identified a number of key flaws to the ΛCDM model:

(cliii) The 0-∞ paradox, namely what supposedly existed before the big bang and what would also supposedly exist ahead of a metric expansion of space:

i. ([43]: p1-5).

(cliv) What is dark energy? Dark energy has yet to be found other than being inferred.

(clv) What is dark matter? Dark matter has yet to be found other than being inferred.

(clvi) Einstein's calculations did not account for the elementary particle level:

i. ([39]: p3-10).

The solution Temporal Mechanics proposes is as follows:

(clvii) Resolving (cliii)-(clvi) in deriving 1d, 2d, and 3d timespace:

i. [43][44].

(clviii) Deriving the energy requirements for *timespace*

i. (section 8).

(clix) Determining the limit of energy for space:

i. ([13]: p1-11).
ii. ([14]: p17-23).
iii. (section 8).

(clx) Deriving the gravitational constant G for the elementary particle level:

i. ([35]: p27-32, eq3).
ii. ([36]: p24-25, eq4-8).
iii. ([39]: p41-46).

iv. ([42]: p7-16).

The proposal here therefore is that Einstein's energy error as his value for Λ ($\sim 10^{111}\, Jm^{-3}$) is by not accommodating for the neutrino-antineutrino particle pair and their relationship to the gravitational constant G, simply by not accounting for the Planck scale correctly.

To therefore identify the error of general relativity is to *improperly* account for the elementary particle level and Planck scale in regard to the idea of mass with space and derive Einstein's error by that route. Thus, the following is proposed in highlighting the mathematical flaw of general relativity:

(clxi) Identify and factor the derived spatial factor S_0 for G ([35]: p27-28, eq1-2) by adapting that equation ($S_0 = \frac{2^3+3^3+5^3}{3} = 53.\dot{3}$) to how Einstein considered mass-inertia as a more fundamental concept than space itself, as per replacing the first three primes (2, 3, and 5) with the value of the neutrino-antineutrino mass calculated as $\frac{lP}{S_0}$, and thus say as S_Λ:

$$S_\Lambda = \frac{(\frac{lP}{S_0})^3 + (\frac{lP}{S_0})^3 + (\frac{lP}{S_0})^3}{3} = 27.83 \cdot 10^{-111}\, m^3 \qquad (1.)$$

(clxii) Consider S_0 would represent a fundamental idea of averaged spatial temporality, namely a temporal relationship for space as energy, and thus *improperly* considered as a basic factor of $Joules$.

(clxiii) Renormalize S_Λ with the actual value of S_0 as $S_{0\Lambda} = \frac{S_0}{S_\Lambda}$. The idea here of renormalization is to consider the proposed error at play while also considering that there is a proper actual value for the energy of the vacuum derived to be $10^{-9}\, Jm^{-3}$ ([14]: p17-23).

(clxiv) Thus:

$$\frac{S_0}{S_\Lambda} = 1.9163 \cdot 10^{111}\, Jm^{-3} \cong \Lambda \qquad (2.)$$

Equation 2 is proposed to highlight how the Planck scale and elementary particle level could be improperly considered as according to general relativity, in replacing the prime numbers of the spatial factor S_0 with the mass of the neutrino-antineutrino particle pair.

In other words, the fundamental prime number feature of space in not being considered as a prime number feature would (according to general relativity) be considered as a basic value for mass. Calculating such resulted in Λ.

It should be noted that this prime number feature is by definition a relationship of numbers with the idea of space to then relate to a value of mass, and in general relativity not accounting for such then an error would be incurred in considering mass alone as a fundamental feature in space for space.

Thus, although general relativity was formulated via a different mathematical route to derive Λ, the result is the same, yet demonstrated here to be erroneous as a description for gravity.

To note is that in using only the mass of a neutrino and not neutrino-antineutrino mass, $\frac{S_0}{S_\Lambda}$ becomes $1.533 \cdot 10^{112}\, Jm^{-3}$.

Despite such, either value particularly eq.2 is to be expected, namely a factor of $\sim 10^{120}$ above the known energy value of space ($10^{-9}\, Jm^{-3}$).

As is demonstrated, the error with the calculations of general relativity is in giving priority to mass over *timespace*, and thus priority over the concept of a prime number feature of space ([44]: p20-22), as highlighted when such is performed for S_0, namely in replacing the prime number values with mass. To also note is that S_0 as a proposal in paper 35 ([35]: p27-28, eq1-2) was derived via the mathematics of zero-dimensional space in paper 44 ([44]: p20-22) in offering a solution to the Riemann hypothesis.

In short, when gravity is brought to attention for the Planck scale and associated elementary particle neutrino level as per $\frac{lP}{S_0}$ as the neutrino-antineutrino mass where $S_0 = \frac{2^3+3^3+5^3}{3}$ ([35]: p27-28, eq1-2) the cosmological constant problem is avoided, and thus dark energy and dark matter unwarranted. As derived in paper 42, the value for G is more accurately calculated to be $G = \frac{33}{2} E_{MG} \cdot c$ where E_{MG} is the neutrino energy ([42]: p15, eq18).

10. Resolving the ΛCDM model

As has been shown, Einstein's work of special and general relativity can indeed be superseded with a more fundamental description for time by addressing the mathematics of zero-dimensional space. Here with Temporal Mechanics time is given fundamental priority for the moment as *time-now=1*, as $t_N 1$, not primarily as a *length* of time relative to c, yet as a universal moment of time for zero-dimensional space, *fundamentally*. From there lengths/passages of time can be measured for bodies in relative motion.

Albert Einstein's special and general theories of relativity thus have been shown to merely describe the idea of time as relative temporal incursions between non-zero inertial mass bodies in regard to c, c being used as a measurement scale for distance, which essentially is a non-primary account of time (xviii).

Einstein's relativity thus executed:

(clxv) By-passing the description of time for zero-dimensional space (xv)-(xvii)(xix).

(clxvi) Thence needing to define spacetime from the level of (xviii), namely a non-fundamental description of time.

(clxvii) Thence missing fundamental detail to how time relates with space.

(clxviii) Thence failing to derive elementary particle formation and thence G being derived from mass.

In short, Einstein failed to define a ***point*** which then led to anomalies in his calculations for the gravitational constant G in respect to what was presumed to be certain astrophysical measurement scales based on astrophysical data, namely in assuming the scale of the phenomena of EM from stellar objects, leading to that mathematics to that presumed target cosmological scale.

Although Euler's mathematics and associated complex number planes were essential for Einstein's formulation of special and general relativity, Temporal Mechanics has found that the key underlying issue with special and general relativity and thence contemporary physics is in not accounting for the mathematics of zero-dimensional space. By such, special and general relativity, and associated models for light (quantum mechanics), have led to an incomplete understanding of time in regard to space, thence leading to anomalies in cosmology theory as per the ΛCDM model ([43]: p1-4). Indeed, time can be observed to dilate and contract for the EM phenomena of light with relative motion, yet the core processes missed by Einstein include:

(clxix) The mathematics of a point (zero-dimensional space).

(clxx) The fundamental nature of time (xv)-(xix).

(clxxi) The elementary particle level and associated equations for G as per the electron degeneracy process and associated astrophysical phenomenal realm of manifestation:

i. ([42]: p7-16)

(clxxii) The EM^{DIR} field effect:

i. ([42]: p7-21).

ii. [38].

(clxxiii) The EM_X^{DIR} field effect:

i. ([42]: p21-55).

An updated cosmological model is thence proposed in paper 42 according to the following 9 key principles ([42]: p11-49):

(clxxiv) ***CP1***: gravity and mass are localized to the solar system.

(clxxv) ***CP2***: the phenomenon of the stars is considered to be a part of the electron degeneracy process, namely as light being released in the process of the electron becoming degenerate.

(clxxvi) ***CP3***: the electron degeneracy process of the stars and thence associated quantum phenomena details gravity with its known phenomenal feature of negative energy.

(clxxvii) ***CP4***: the EM phenomena of the electron degeneracy process resulting in a neutrino and associated value for G is related to the equation $G = T_G \cdot a_e^0$.

(clxxviii) ***CP5***: the solar system scale extends to a value of $E = f$ as the proposed Oort cloud from the solar reference of $E = hf$.

(clxxix) ***CP6***: the electron degeneracy phenomena is scaled at the Heliopause and extends to the Bow shock ($z0 \rightarrow z11$) as the basis for a phenomenon of light at a sub-atomic/electron scale (X-rays) detailing a natural redshift effect.

(clxxx) ***CP7***: the shape and movement of the electron degeneracy EM phenomena of the stars as spiral galaxies would be due to the EM_X^{DIR} field effect.

(clxxxi) ***CP8***: the Hydrogen wall represents the primary/aetiological habitat of stellar phenomena as a process that scales the phenomena of stars and their associated spiral (galaxy) formations along a z0→z11 redshift.

(clxxxii) ***CP9***: the EM_X^{DIR} field underwrites the phenomena of black holes.

To be explored in an upcoming paper is the phenomenal network of black holes and what collective origin and process is responsible for such warranting their phenomena. Although such has been presented in paper 42 [42] according to the 9 cosmological principles, the question is how readily physics is able to misjudge the scales there at play, and thus the potential for a holographic display of EM being responsible, proposed as an overall 10th cosmological principle (***CP10***).

11. Conclusion

The principle of relativity requires the *upholding* of laws as certain symmetries for all frames of reference. To suggest that these laws can be slowly broken or suddenly emerge is the fundamental problem of the current ΛCDM model in its implication of a time when the laws of physical phenomena did not exist (pre big bang). Notwithstanding such, a fundamental axiom for time and space needs to encompass the definition of the minutest detail, namely the mathematics of a point, of zero-dimensional space. There, to demonstrate the utility of a proposed definition for zero and infinity in regard to time and space, the symmetries of physical laws must be demonstrated to be upheld if the discipline of physics is to be at all consistent, as presented here, the notable achievement here being deriving why c is a constant for any zero-dimensional reference in 3d *timespace* and not merely assuming such to be so despite being based on qualified data.

Conflicts of Interest

The author declares no conflicts of interest; this has been an entirely self-funded independent project.

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