Zero-dimensional number theory

Stephen H. Jarvis[1]

web:www.xemdir.com

email: stephen.jarvis@xemdir.com

Abstract: Examined here is a proposed zero-dimensional number theory as the process of labelling zero-dimensional space as a point and zero-dimensional time as a moment as the different mathematical values of 0 and 1 respectively. By such it can be shown how zero-dimensional time in being mathematically labelled as a unit can form relationships between zero-dimensional spatial points labelled as 0. Here, zero-dimensional time can be demonstrated to derive a suite of mathematical operators for zero-dimensional points that then relate with each other in the form of equations for 1d, 2d, and 3d timespace. By such, time can be shown to represent the fundamental basis for all mathematical equation operators (addition, subtraction division, multiplication, equality, exponentiation, etc) for points in space. Subsequently, it is proposed that the resulting time and space (timespace) equations are synonymous with the mathematical equations that describe both the physical phenomenal field forces and their associated particle activity. In this process, solutions can be shown for Goldbach's conjecture, the Riemann hypothesis, and Fermat's last theorem, together with the formulation of a physical theory matching known physics theory equations and associated constants. The result of such is a zero-dimensional number theory that both prescribes the basis for a mathematical theorem together with becoming a physical theory as a process of accounting for the equations of physical phenomena.

Mathematics subject classification: 11M26

Keywords: number theory; temporal mechanics; Goldbach's conjecture; Riemann hypothesis; Fermat's last theorem; zero-dimensional; timespace; golden ratio

[1] Theorist and researcher at *Xemdir*, Sydney, Australia.

1. Introduction

Where do numbers come from? Where do mathematical operators come from? By what intention of our perception ability do numbers and mathematical operators become evident?

Numbers are a way to scale the perceivable dimensions of time and space, and such has been the case from our earliest records. One could even say the idea of counting as a decimal system (1→10) took root from our having 10 fingers.

Here to be demonstrated is that counting can reach to the digits of time and space, specifically to and from a zero-dimensional scale for time and space.

From that absolute zero-dimensional scale for time and space shall be demonstrated the actual physical reality of time and space (physical phenomena and their associated field force equations) as a mathematical theorem.

To also be shown here is how standard number theory is incomplete if not for showing where all numbers and number-associations extend from, specifically here in demonstrating the fundamental zero-dimensional basis for time and space.

Although time and space as dimensions are employed as descriptors for physical theories[2], here a new proposal is made for the employment of time and space as descriptors, namely descriptors for a *number theory*. Specifically, time and space shall be used as fundamental objects for numbers *to explain* number theory. This will be achieved by proposing a new and required mathematics of zero-dimensionality, namely the mathematics of a point in space *and moment of time*.

By such, it will be shown that numbers have a primary function and co-dependency with the fundamental ideas of time and space via a proposed mathematics of zero-dimensionality (0d), or more simply the mathematics of a point of space in a moment of time. To achieve such, *new objectivity* for the number 0 is required in alliance with 1 and ∞ to describe zero-dimensional objects of time and space. Thence, *a new mathematical description base* for 0, 1, and ∞ is achieved for a new number theory system as a zero-dimensional number theory manner of relationship between the dimensions of time and space.

This paper follows on from the current work of Temporal Mechanics [1-48][3], specifically papers 43-48 [43-48] which have proposed the basic mathematics of zero-dimensional space (a *point* in space) and zero-dimensional time (a *moment* in time). There, the problem with assuming a point *as just a point* is highlighted and rectified by addressing:

(i) The scale of a point as a zero-dimensional marker for space ([43]: p4-5).

(ii) The measurement anomalies between any zero-dimensional points regarding the inclusion of zero-dimensional time ([43]: p4-8).

---

[2] For example, Einstein's special and general relativity theories are *physical theories* employing the use of the dimensions of time and space as spacetime

[3][1][2][3][4][5][6][7][8][9][10][11][12][13][14][15][16][17][18][19][20][21][22][23][24][25][26][27][28][29][30][31][32][33][34][35][36][37][38][39][40][41][41][43][44][45][46][47][48].

Here it will be demonstrated that time and space as zero-dimensional objects serve the fundamental basis for number theory, namely that a pure mathematics can form the underlying feature of the zero-dimensional phenomenality of space and time. Simply, the objective features of time and space will be shown to be suited entirely to number theory. Of note in this paper is how:

(iii) This new zero-dimensional time and space objectivity of numbers (fundamentally for 0, 1, and ∞) can thence derive the set of prime numbers from $0 \rightarrow \infty$.

(iv) A zero-dimensional number theory can thence be developed for all number types (real, natural, rational, irrational, complex) in having the dimension of time form the basis of all mathematical operator number relationships between zero-dimensional spatial positions as prime number derived labels.

(v) These zero-dimensional spatial number relationships thence can describe 1d, 2d, and 3d *timespace* and thence physical phenomena as a *mathematical theorem*.

Specifically of note is how the derived prime number label grouping can reveal physical phenomenal properties of 1d, 2d, and 3d *timespace*. In achieving such, this paper is sectioned as follows:

1. Introduction
2. Method of proof
3. 0d time and 0d space
4. 0d $t_N 1$ *positions* as *timespace objects*
5. 0d $t_N 1$ *processes* as 1d *timespace*: resolving Goldbach's conjecture
6. 0d $t_N 1$ *processes* as 2d *timespace*: resolving the Riemann hypothesis and Fermat's last theorem
7. 0d $t_N 1$ *processes* as 3d *timespace:* 0d mathematical theorem results
8. Conclusion

Given the mathematical operator feature of the dimension of time may not have been evident in this *volume 7*[4] series of papers on the mathematics of zero-dimensionality, here the dimension of time as the benefactor of mathematical operators shall be more pronounced.

2. Method of proof

It may be argued that a point in space and a moment in time cannot be proven, that such zero-dimensional objects are not real yet abstract. However, abstraction in mathematics is:

[4] [43][44][45][46][47][48].

(vi) The process of extracting an underlying mathematical structure from a physical object.

(vii) Generalizing that abstraction to apply elsewhere.

Yet with the zero-dimensional mathematics proposal here, no mathematical object is being extracted from a physical reality to be applied elsewhere. With zero-dimensional mathematics, the proposition is to consider thoughtfully the mathematics of a moment in time and a point in space as axioms[5]. The zero-dimensional number theory proposal here is therefore quite the reverse to the process of mathematical abstraction, namely:

(viii) The application of the mathematical value of 0 for space and the mathematical value of 1 for time to a proposed dimensional time and space reality as a fundamental dimensional template structure.

(ix) To then evaluate that fundamental dimensional template structure with known data.

(x) To thence uncover any scaling issues with physical theories that are not based on the zero-dimensional mathematical approach, specifically both curved spacetime theory (general relativity) and flat spacetime theory (quantum mechanics).

Fundamentally, proposed here is a new <u>zero-dimensional *number theory*</u> requiring rigorous diligence regarding definition and execution for the dimensions of time and space.

Indeed, if number relationships can be demonstrated using spatial geometry[6], then such is a basis, namely spatial geometry, as a hypothetical mathematical spatial realm. Here though a proposed geometry of not just space is employed, yet time, as per:

(xi) Defining a zero-dimensional spatial point as a value of 0.

(xii) Defining a dero-dimensional moment of time as a value of 1:

   a. "1" has the zero-dimensional feature of time represent a potential factor of relationship between spatial points.
   b. Time can then be used as a mathematical operator to derive the standard mathematical operators of addition, subtraction, division, multiplication, etc, and equality between zero-dimensional spatial points.
   c. Such can then derive/form number relationships as equations of *timespace*.

Here, zero-dimensionality for time and space is not proposed to be a spacetime singularity yet a zero-dimensional concept for space as a <u>*point in space*</u> and a zero-dimensional concept for time as a <u>*moment in time*</u>. Thence a mathematics is concorded to such, not as an abstraction of numbers to a physical reality, yet as a tool of choice to describe the non-physical zero-dimensionality for time and

[5] Self-evident to our perception ability with/of time and space.

[6] As per contemporary proposed number theory proofs such as for Fermat's last theorem (see section 6).

space. By such, the specificity of the interoperation of zero-dimensional spatial points using time as the mathematical operator shall be demonstrated to present the case that:

(xiii) The dimension of space is different to the dimension of time.

(xiv) The dimensions of space and time do not form a *singularity* in any point location or instance despite current physical theories suggesting otherwise[7].

(xv) Zero-dimensional space and zero-dimensional time are though intrinsic to 1d, 2d, and 3d *timespace*.

The result of this zero-dimensional number theory is the formulation of a mathematical *timespace* theorem that can be then checked with what is not only observed with physical phenomena yet calculated for physical phenomena as the basic field force equations and associated constants[8].

By this proposed process, Temporal Mechanics (*the mathematics of zero-dimensionality*) holds that the fundamental level for number theory is not just a theorization of space geometrically and thence mathematically, yet a theorization of time mathematically as well, time and space being different mathematical values (as they must be), zero-dimensional space as 0 and zero-dimensional time as 1.

Fundamentally, as the zero-dimensional number theory, the proposal is:

(xvi) The dimension of time represents the mathematical operator between zero-dimensional points in space, namely how zero-dimensional space (a point) can relate with other zero-dimensional points (namely, using *time* as the basic mathematical operator).

It can be argued that the limitation of number theory is by virtue of the operators it uses (addition, subtraction, division, multiplication, etc) and how the operators can be used to structure numbers with each other. Here though it shall be demonstrated that time represents the fundamental basis for *all* the essential mathematical operators, namely:

(xvii) Addition.

(xviii) Subtraction.

(xix) Division.

(xx) Multiplication.

(xxi) Exponentiation.

(xxii) Equality.

In doing such, the proposed time (1) and space (0) zero-dimensional numerical labelling sets a context for number[9] relationships to play out upon in a manner that is fortuitous to understanding how a

[7] Such as Einstein's spacetime theories.

[8] See section 7.

[9] All number types including natural, integer, irrational, rational, complex, and so on.

basic proposal for time and space as unique mathematical objects (0 for space and 1 for time) can relate with each other. In other words, here can be derived equations relevant to how spatial points are proposed to communicate with one another via the operator of time, and thence presumably equations that should match known equations for physical phenomena.

Here is presented:

(xxiii) An elementary number theory for time and space.

(xxiv) A derived analytic number theory for the interoperation of space via time as (using *timespace* dimensions) an algebraic number theory.

(xxv) A thence derived mathematical theorem for time and space.

(xxvi) A thence derived physical theory for physical phenomena in comparing the equations of the mathematical theorem with key physical data constants (such as the charge of the electron e_c and the speed of light c).

As shall be shown here, the zero-dimensional numbers for time and space, by the particularly proposed[10] association of time and space, branches off into the key streams of number theory. As can be demonstrated, this number theory becomes self-evident in deriving the natural numbers, primes, irrational numbers, and complex numbers, while utilizing the complex numbers with irrational numbers, specifically with the derived Fibonacci equation $t_B + 1 = t_A$ and Euler's equation $e_{t_B}^{i\pi} + 1_{t_N} = 0_{t_A}$.

By all of such, here it shall be shown that although Bernhard Riemann[11] constructed a 2d complex number and log-scale mathematical bridge between the two sides of Euler's zeta function equation (in bringing out the prime-numbers), the completeness of the complex number plane and log scale (namely its validity from 0→ω) was still in question[12]. Here though the proof for the absoluteness of Euler's number and Riemann's associated equations is executed by:

(xxvii) Establishing the basis of the mathematics of zero-dimensionality (0d) and its relationship to the conceptual number values for 0→ω by involving the objects of time and space for numbers as *timespace*[13].

(xxviii) Deriving an equation for zero-dimensional *timespace* as $t_B + 1 = t_A$ revealing the golden ratio features of that equation and thence relevance of those golden ratio features to a scale of natural numbers from 0→ω [14].

---

[10] Based on our perception ability of time and space.

[11] See section 6.

[12] Hence, there was uncertainty around Riemann's mapping of the primes requiring constant calculation approaching infinite prime values, and thus an endless endeavour of proof.

[13] See sections 3-6.

[14] See section 4.

(xxix) By (xxviii) to derive Euler's number e and the complex 2d plane for the 2d aspect of *timespace* [15] as the equation $e_{t_B}^{i\pi} + 1_{t_N} = 0_{t_A}$.

(xxx) To then expand that basis (xxvii)-(xxix) in highlighting the golden ratio (φ and $\frac{-1}{\varphi}$) code for zero-dimensional *timespace* references as prime number sequences for 1d and 2d *timespace*[16], namely:

a. how the golden ratio features of the mathematics of zero-dimensional space are highlighted in Goldbach's conjecture[17] 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[18] for all prime values from $0 \rightarrow \infty$,

c. and thence establishing a zero-dimensional reference for a vector of primes in 1d[19], 2d[20], and thence 3d[21] *timespace* for all prime values $0 \rightarrow \infty$.

d. The Pythagorean theorem being intrinsic to the fundamental mathematical operation of time.

e. Fermat's final theorem being limited to this Pythagorean theorem mathematical operator function.

From such, and by virtue of the proposed numerical relationship between zero-dimensional space (0) and zero-dimensional time (1), also proposed here therefore is the ***phenomenal reality*** of zero-dimensional space and zero-dimensional time (space as a point and time as a moment) scaled with known phenomenal values for time and space, specifically scaled with the charge of the electron e_c and the speed of light c.

3. 0d time and 0d space

As proposed in paper 43 ([43]: p4-10) and paper 44 ([44]: p5-12), the solution of relating time with space given $1 \neq 0$ is to use/propose the unreal dimensions of *time-before* and *time-after* as an accessory mathematical link around yet inclusive of the datum reference of *time-now* for zero-dimensional time (1) and zero-dimensional space (0).

Here in this interpretation of papers 43 [43] and 44 [44] will be described the idea of time as the mathematical operator for how zero-dimensional spatial points relate with each other. As with papers 43-

[15] See section 4.
[16] See sections 5-6.
[17] See section 5.
[18] See section 6.
[19] See section 5.
[20] See section 6.
[21] See section 7.

44[22], here the fundamental question to ask for the *time-now* time-domain ($t_N 1$) is how one particular zero-dimensional spatial point can be related to another particular zero-dimensional spatial point in the context of $t_N 1$, such to relate time with space. To address this, the idea of $t_N 1$ as a mathematical object first needs to be addressed.

As with papers 43-44[23], here the value $t_N 1$ will form a key link with zero-dimensional space, proposed as *timespace*, as per the following proposals:

(xxxi) The number 1 is to be *primarily* used with the idea of "time" as the concept of a moment, as $t_N 1$, namely *time-now=1*.

(xxxii) $t_N 1$ is not to be confused with a length of time, namely, *not* 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 (*secondary*, as with addition and subtraction of temporal values).

(xxxiii) The length of time between $t_N 1$ time-points as $t_N 1 - t_N 1 = 0$ is a value of 0 time, namely a "0" passage of time.

(xxxiv) Here also $t_N 1$ 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 $t_N 1$, then $t_N 1$ can be applied to any concept, any number, as with multiplication and division, and still have no effect on that any number's value.

(xxxv) The 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* *for* zero-dimensional space as $t_N 1$.

(xxxvi) Regardless of location in space, time *for* that space is always still existing as the moment *regardless of one's position or relative motion*, as $t_N 1$.

By such, the idea of $t_N 1$ for zero-dimensional space can be considered as an *axiom* in being self-evident:

(A) The temporal moment is given symbolic mathematical value as time-now=1 ($t_N 1$) for any zero-dimensional point reference of space.

The next question is how this $t_N 1$ realm *for* 0-space can lead to the idea of a *position in space* and thus determine a scale *for* 0-space?

Zero-dimensional (0d) space (or nildimensional space) is:

[22] ([43]: p4-10), ([44]: p5-12).

[23] ([43]: p4-10), ([44]: p5-12).

(xxxvii) Space with no dimension.

(xxxviii) Simply imagined as a point.

(xxxix) The idea of something without scale as a point.

(xl) Usually and commonly considered to be the concept of an *infinitesimally* sized point, despite such having no scale of size in being 0d.

Strictly, 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.

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

As per papers 43-44[24], to resolve this issue, let us consider:

(xli) The *infinitesimal* and *infinite* zero-dimensional realms *as one*:

a. Here the infinitesimal and infinite zero-dimensional scales are proposed as $\odot_0^\omega$, a symbol of a point surrounded by a circle in between and including the mathematical scales of 0→ω,

b. *Thus, $\odot_0^\omega$ as a single overall infinite set of infinitesimal zero-dimensional points*;

   i. 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 zero-dimensional spatial *model* as the $\odot_0^\omega$ 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 $\odot_0^\omega$ realm, a core infinitesimal point in that infinity, how would it be done?

The proposed process involves nominating that:

(xlii) The entire $\odot_0^\omega$ 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:

[24] ([43]: p4-10), ([44]: p5-12).

(C) <u>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.</u>

It would therefore follow that:

(xliii) A *timespace* object as a $t_N 1$ time-*point* ($t_N 1$ 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:

(D) <u>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.</u>

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 $t_N 1$ time-points, such to create sets or dimensional extensions of $t_N 1$ time-points (*timespace*) represented by the natural numbers?

4. 0d $t_N 1$ *positions* as *timespace objects*

As per papers 43-44[25], here the idea of *position* enters the $\odot_0^\infty$ realm for zero-dimensional references/points, which requires bearing reference from one $t_N 1$ zero-dimensional reference to another $t_N 1$ zero-dimensional reference as an altogether new event, as a spatial *dimensional* event, namely the spatial position of a nominated $t_N 1$ zero-dimensional reference in the $\odot_0^\infty$ *time-now* ($t_N 1$) realm compared to another $t_N 1$ zero-dimensional reference point.

Time here though as an *infinitesimal* time-point ($t_N 1$) bearing reference to another *infinitesimal* time-point ($t_N 1$) is still a moment in time. Although the passage of time between one $t_N 1$ time-point and another $t_N 1$ time-point is by definition $t_N 1 - t_N 1 = 0$, 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.

[25] ([43]: p4-10), ([44]: p5-12).

Therefore, to generate dimensionality for space as distance, time must develop as a dimensional entity from its $t_N 1$ status 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* regarding *time-now* ($t_N 1$).

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 $t_N 1$ reference, and thus technically the same $t_N 1$ reference, which is disallowed as that condition already exists, namely $t_N 1$ existing anywhere and everywhere. Thus, a new concept of a *position* of time relative to *time-now* must be created:

(xliv) 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*[26], 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 hypothetical time-points for 0d space all representing a moment.

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

To say though there is a *time-after* event is to imply a *time-before* event[27] relative to $t_N 1$:

(xlv) Thus, there must be a *time-before* event also, somehow, say as t_B.

Thus, there would be three features for time:

(xlvi) *Time-now* (t_N).

(xlvii) *Time-after* (t_A).

(xlviii) *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 $t_N 1$ as a zero-dimensional space reference, and thus negative (-) in reference to 0. Thus:

$$(-t_B) + 1(t_N 1) = fundamental\ property\ A \tag{1}$$

[26] In accordance with our perception ability of time.

[27] Once again, in accordance with our perception ability of time.

Here though to be highlighted that was not clearly described in papers 43-44 [43-44] is that *time* here with equation 1 as an aetiology of *mathematical operators* involves:

(xlix) Positive (+) and negative (-) sign labelling.

(l) Equality (=) with a *fundamental property* notion ($fundamental\ property\ A$).

(li) Thus, an equation (equation 1).

Yet, if time as $t_N 1$ is the *time-now* basis, as a $\odot_0^{\infty}\, t_N 1$ 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 $t_N 1$ reference, as t_B would have already happened in the context *of* $t_N 1$. Thus:

$$\frac{1(t_N 1)}{(-t_B)} = fundamental\ property\ B \tag{2}$$

Likewise, here though to be highlighted that was not clearly described in papers 43-44 [43-44] is that *time* here with equation 2 as an aetiology of *mathematical operators* involves:

(lii) Division and thence multiplication.

(liii) Equality (=) with a fundamental property notion ($fundamental\ property\ B$).

(liv) Thus, an equation (equation 2).

Thus, if these two equations (1-2) represent fundamental properties of time, and time itself is being defined as a $\odot_0^{\infty}\, t_N 1$ realm, then $(fundamental\ property\ A) = (fundamental\ property\ B)$:

$$(-t_B)\ + 1(t_N 1) = \frac{1(t_N 1)}{(-t_B)} \tag{3}$$

From equation 3:

$$t_B^2 - t_B = 1(t_N 1) \tag{4}$$

$$t_B + 1(t_N 1) = \ t_B^2 \tag{5}$$

Time here with equation 5 as an aetiology of *mathematical operators* generates:

(lv) A quadratic equation with the solution as is φ and $\frac{-1}{\varphi}$, the ***golden ratio***.

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:

$$t_B + 1(t_N 1) = t_A \tag{6}$$

Equation 6 is thus the proposed time-equation for:

(lvi) ***1d timespace***.

To note is 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:

(lvii) Function as two distinct *orthogonal* scales (at right angles to each other), namely:
 a. aligned as absolutely distracted as they can only be regarding each other,
 b. together with being linked by a zero-dimensional point in space,
 c. which can thence be used to formulate *spatial dimensionality* and thus *positioning*.

(lviii) Represent a Pythagorean algebraic relationship.

(lix) Thence represent ***2d timespace.***

To now work with these features, let us take two Pythagorean algebraic ***orthogonal*** 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 (fig.2):

$$\left(\frac{-1}{\varphi}\right)^2 (t_A) + \varphi^2 (t_A) \cong 3(t_N 1) \tag{7}$$

How this “3” value manifests as *spatial dimensionality* is proposed to be how space is incorporated with *time-now* ($t_N = 1$) as a dimensional entity, namely as per equation 7 and figures 1-3:

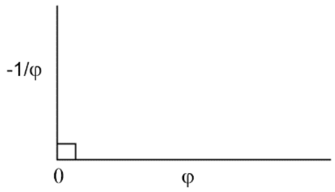

Figure 1: two t_B lengths of time as $\frac{-1}{\varphi}$ and φ.

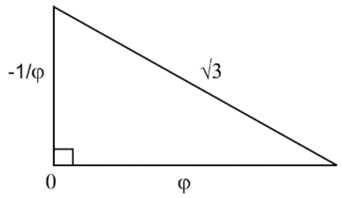

Figure 2: two lengths of time, $\frac{-1}{\varphi}$ and φ, which then result in the value of $\sqrt{3}$ (Pythagorean relationship), namely as $\left(\frac{-1}{\varphi}\right)^2 (t_A) + \varphi^2 (t_A) \cong 3(t_N)$

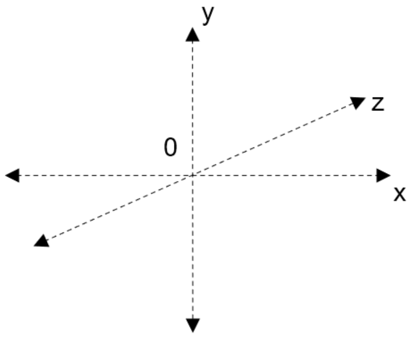

Figure 3: 3d *timespace*

Here the proposal is that the resultant "3" value of equation 7 represents:

(lx) The 3 dimensions of 0-space (fig.3) with an accompanying *time* component, as $3 \cdot t_N$.

(lxi) Thus, the dimensional definition of a 3d spatial position regarding $t_N = 1$.

(lxii) Thence the *basis* for ***3d timespace***.

To note is that the $\sqrt{3}$ value from figure 2 can also be expressed with $t_N 1$ (each as Pythagorean algebraic vectors) resulting in a value of 2 as the hypotenuse:

(lxiii) Here it is proposed that the 2 value represents a double $t_N 1$ as $2(t_N 1)$.

(lxiv) Proposed therefore are two (as per the hypotenuse value of 2) $t_N 1$ applications for each of the 3 dimensions of space:

a. Despite there being two golden ratio values, these two values have already been factored, and so:

i. A new concept other than φ and $\frac{-1}{\varphi}$ must be considered when applying this $2(t_N 1)$ factor to 3d space from a zero-dimensional (0d) reference point.

ii. Thus, $2(t_N 1)$ is proposed to be the two distinct 1d directions from the zero-point reference for 3d *timespace*.

Although such may appear contrived, yet the idea here is:

(lxv) To capture every type of number association with every type of temporal based mathematical operation that this proposal of zero-dimensional number theory *makes available for use*.

Therefore, here regarding $2(t_N 1)$, 0-space is proposed to have:

(lxvi) 3 $t_N 1$-related dimensions (3d *timespace*) incorporating 2 temporal outcomes for each of the 3 $t_N 1$-related 1d *timespace* axes where the $2(t_N 1)$ value would represent the *dual* directions on each $t_N 1$ 1d *timespace* vector axis from the 0d reference for 3d *timespace*.

(lxvii) Such, in creating a zero-dimensional spatial reference for each $t_N 1$ 1d *timespace* dimension being extended.

To note is that in this process both t_B and t_A as non-localities (non-$t_N 1$) are used together according to Pythagorean algebra to set a zero-dimensional reference for 3d space, as $t_N 1$ points (zero-dimensional) in *timespace*.

Although the values of the golden ratio are irrational number values, they are defined as being *non-local* in not being as $t_N 1$, yet together via Pythagorean algebra they form the locality for time-now $(t_N 1)$ as 3d *timespace* 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 $\odot_0^{\varpi}$ set.

The next step to note is that the product of golden ratio values can be considered as a "plane" (2d *timespace*) value which when added to $t_N 1$ results in 0, and thus by default a 0-dimensional *spatial* reference of focus:

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

This $(\varphi \cdot \frac{-1}{\varphi})$ 2d plane value is:

(lxviii) A negative (-) value as the value of -1.

(lxix) Proposed thence to represent a plane distinct from the natural 2d *timespace* plane and thus <u>a natural complex number *plane* for 2d *timespace*.</u>

As a complex number plane, the work of Leonard Euler[28] has shown that:

(lxx) $e^{i\pi} = -1.$

(lxxi) Namely, $e^{ix} = \cos x + i \sin x$ where $x = \pi$.

It therefore follows that $e^{i\pi}$ also would represent a complex plane of the same value of $\varphi \cdot \frac{-1}{\varphi}$. Thus:

[28] See section 6.

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

(9)

Thus, equation 8 becomes:

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

(10)

The suggestion here therefore is that:

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

Thus:

(lxxiii) On the one hand, the time-equation proposes its *own/natural* 3d *timespace* grid primarily with $t_B + 1 = t_A$.

(lxxiv) On the other hand, there also exists an equally valid 2d *complex* number *timespace* plane awaiting fulfilment and description with the varying complex plane features of $e^{i\pi}$ as primarily by $e^{i\pi}_{t_B} + 1_{t_N} = 0_{t_A}$.

(lxxv) Such (lxxiii)-(lxxiv) as a requirement of (lxv).

The next question therefore is, "how do the 1d, 2d, and 3d natural and complex *timespace* grids *work together*?"

5. 0d $t_N 1$ *processes* as 1d *timespace*: resolving Goldbach's conjecture

As proposed, there would exist an *infinite* number of *infinitesimal* zero-dimensional $t_N 1$ references (basic *timespace* references) in the proposed $\odot_0^{\varpi}$ realm.

To be now proposed for zero-dimensional *timespace* references in the 3d *timespace* realm is as follows:

(E) <u>The $\odot_0^{\varpi}$ realm is a prime number of timespace references in being divisible only by itself as ϖ or $t_N 1$.</u>

Why? This is what the 0-ϖ paradox requires, as per (xli), namely:

(lxxvi) If 0 is indivisible other than being represented by the value of “1” for time, then so must the idea of ∞ be indivisible other than being represented by the value of 1 for time.

(lxxvii) Thus, ∞ must be a prime number.

The importance of this *proposed* $ꝏ$-prime precedent becomes apparent for sets of t_N1 time-points (*timespace* objects) as primes forming all the integers, as shall be demonstrated.

Here, in the overall $\odot_0^{ꝏ}$ realm in being a prime, namely $ꝏ$-prime, it would follow that:

(F) <u>*The proposed $\odot_0^{ꝏ}$ realm would contain an infinite set of prime numbers, and thence the natural number system as mathematical object values from* 0→$ꝏ$.</u>

For any two primes added together along a hypothetical 1d *timespace* grid, the condition of those two t_N1 sets (each as primes) by that addition of primes must be upheld in the general context of an $ꝏ$-prime set being a prime.

It would naturally follow that in the context of $ꝏ$-prime, for the addition of two primes there would be a resultant value that must be divisible by 2 (two t_N1 sets, each as primes). Hence:

(G) <u>*Any prime number added to another prime number must result in an even number.*</u>

The key point to consider here is $ꝏ$ as a prime, and thus ultimately if any two scales of $ꝏ$ are added together as primes (which incorporates the set of primes), and thus any two primes added together, then that value of those two sets of t_N1 each as primes must still be divisible by 2 and thus together as a value must represent an even number:

$$\infty_{prime} + \infty_{prime} = 2\infty \ (even)$$

(11)

Even though $2ꝏ$ is beyond $ꝏ$, the only allowable condition for such must be *within* the $\odot_0^{ꝏ}$ *set of natural numbers*, namely as equation 11 where x can equal any value, including $ꝏ$:

$$xꝏ = ꝏ$$

(12)

This issue is underwritten by the $\odot_0^{ꝏ}$ realm, as presented in section 3.

In this way it is now possible to visualize a pattern of twin-primes, namely primes separated by the value of 2. For indeed, does $ꝏ + 2 = prime$? According to the logic of equation 12 equation $ꝏ + x = ꝏ$ must also be upheld for any value of x.

In short, the limit for infinity is set at $ꝏ$ by definition, and thus technically $ꝏ + x = ꝏ$ must be upheld where x is any number including $ꝏ$, noting $xꝏ = ꝏ$ (eq.12).

As much as zero (0) is proposed to be a unique number concept with attributes *unique for* addition and multiplication, infinity (∞) is also proposed to be a unique number concept with attributes *common to both* addition and multiplication.

As such:

*(H) Mathematical operators are proposed to only work from 0→∞ where at any value for ∞ mathematical operators (and thus **time**) are proposed to become irrelevant in reaching the ∞-prime level (∞ as a prime).*

Simply, as much as ∞ is unbound as a value, the mathematical operators derived from time (time as the proposed fundamental mathematical operator source) are proposed to serve no purpose for ∞ other than ∞ being (by the proposed *a priori*) a prime number holding an associated infinite set of primes.

It can thus be deduced that there would be an infinite number of twin-primes *in* an infinite set of primes if ∞ is a prime.

To be noted here therefore is that:

(lxxviii) Any two primes added together in that context of equation 11 must result in an even number, thus resolving Goldbach's conjecture [50] which states that any two primes added together result in an even number.

(lxxix) Goldbach's conjecture would be limited by ∞-prime given equation 12.

Here a 1d *timespace* vector is formed from the mathematics of zero-dimensionality for all primes and even numbers thence relating all the natural numbers by default.

The question now is whether the location of prime numbers as sets of $t_N 1$ *can be calculated*.

The proposal is that the location of primes on a *timespace* vector number line can be calculated in using Euler's equations [51] and Gauss' conjecture [52][53], particularly in using the 2d *timespace* complex number plane and associated log-scale for primes, an exclusive number theory mathematics as proposed by Bernhard Riemann, as per the Riemann hypothesis [54], which nonetheless translates directly to the zero-dimensional *timespace* number theory, as specified.

6. 0d $t_N 1$ *processes* as 2d *timespace*: resolving the Riemann hypothesis and Fermat's last theorem

Euler's number e is a tool of number relationships in describing how numbers relate in functions:

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = 1 + \frac{1}{1} + \frac{1}{1 \cdot 2} + \frac{1}{1 \cdot 2 \cdot 3} + \cdots . \cong 2.718282 \tag{13}$$

e forms the basis of Euler's other key achievement, namely $e^{i\pi} + 1 = 0$ where $i^2 = -1$. This was derived via his limiting function:

$$e^z = \lim_{n\to\infty} \left(1 + \frac{z}{n}\right)^n$$

(14)

$e^{i\pi} = -1$ is of significance to zero-dimensional mathematics, as per section 4 equation 10, namely $e^{i\pi}(t_B) + 1(t_N 1) = 0(t_A)$. There the golden ratio 2d plane equates to -1, mathematically as a complex grid expressed as $e^{i\pi} = -1$.

Euler also defined number relationships with functions as associated to a complex number plane, as per $e^{i\pi} = -1$.

The next achievement of Euler is the Euler-Riemann zeta function [55]:

$$\zeta(s) = \sum_{n-1}^{\infty} \frac{1}{n^s} = \frac{1}{1^s} + \frac{1}{2^s} + \frac{1}{3^s} + \cdots$$

(15)

Equation 15 applies for $Re(s) > 1$ as a mathematical function of a complex variable $s = \sigma + it$.

When $Re(s) > 1$ the function can be written where $\Gamma(s) = \int_0^\infty x^{s-1} e^{-x} dx$ as follows:

$$\zeta(s) = \sum_{n-1}^{\infty} \frac{1}{n^s} = \frac{1}{\Gamma(s)} \int_0^\infty \frac{x^{s-1}}{e^x - 1}\, dx$$

(16)

Euler then made the breakthrough step with his product formula in making a connection between the zeta function and prime numbers:

$$\sum_{n-1}^{\infty} \frac{1}{n^s} = \prod_{p\ prime} \frac{1}{1 - p^{-s}}$$

(17)

Here, $\zeta(s)$ as the left-hand side of equation 17 equates to the infinite product as the right-hand side of the equation for all prime numbers p termed as $Euler\ products$.

Here, both sides of the Euler product converge for $Re(s) > 1$.

When $Re(s) = 1$ the harmonic series diverges for infinitely many primes:

$$\prod_{p\ prime} \frac{p}{p-1}$$

(18)

The question then became one of how to predict the location of prime numbers from 0→∞, and thus *the infinite number of primes in the overall ∞-prime set*.

Thus, equation 17 is a way of relating the right-hand side of the equation as the zeta function $\zeta(s)$ with an infinite series of all the prime numbers from 0→∞. The issue though is finding where the primes appear as a progression from 0→∞.

One application is the Gauss prime-counting function [52][53], namely the function that counts the number of primes less than or equal to a real number x, denoted by $\pi(x)$:

$$\pi(x) \cong \frac{x}{\log(x)}$$

(19)

This estimate (≅) is held with the limiting function:

$$\lim_{n\to\infty} \frac{\pi(x)}{x/\log(x)} = 1$$

(20)

Riemann thus applied the prime counting function as a log scale to a *complex number plane* in attempting to extract the position of primes on right hand side of equation 17 to a complex number grid for $\zeta(s)$ to thence find a correlation with the estimate (≅) for $\zeta(s)$, and thus to event a more exact distribution locale of the primes on a number grid:

$$\pi(x) = \mathrm{Li}(x) + O\left(\sqrt{x}\ \log x\right)$$

(21)

In parallel with that proposal, Riemann with his *analytic continuation* method for the zeta function showed that from the right-hand side of equation 17 ($\prod_{p\ prime} \frac{1}{1-p^{-s}}$) the complex case can hold:

$$\left(1 - \frac{1}{2^{s-1}}\right)\zeta(s) = \sum_{n-1}^{\infty} \frac{(-1)^{n+1}}{n^s} = \frac{1}{1^s} - \frac{1}{2^s} + \frac{1}{3^s} - \cdots$$

(22)

Equation 22 is shown to converge where s has a positive real part. This is associated with equation 23 where the condition exists for a non-positive real part:

$$\zeta(s) = 2^s \pi^{s-1} \sin\left(\frac{\pi s}{2}\right) \Gamma(1-s) \zeta(1-s)$$

(23)

There, $\zeta(s) = 0$ is shown for negative even integers as $\sin(\pi s/2) = 0$ for those values.

Riemann showed that $\zeta(s) = 0$ for s being equivalent to the negative even integers $(-2, -4, -6 \ldots.)$, known as the *trivial zeros*.

The $\zeta(s) = 0$ result for all other values of s were considered as the *non-trivial zeros*.

The interesting feature about the non-trivial zeros is that they lay on the complex numbers with their real part value of $s = \frac{1}{2}$.

What Riemann then proposed was that all these non-trivial zeros for $s = \frac{1}{2}$ represent prime numbers, as was the intention in using a complex plane with $\pi(\mathrm{x}) \cong \frac{\mathrm{x}}{\log(\mathrm{x})}$ (eq.17) as per his version of that equation as $\pi(x) = \mathrm{Li}(x) + O\left(\sqrt{x}\, \log x\right)$.

Although equation 17 as $\pi(x) \cong \frac{x}{\log(x)}$ is an estimation (≅), the specificity of using a complex number approach to equation 21 as $\pi(x) = \mathrm{Li}(x) + O\left(\sqrt{x}\, \log x\right)$ is granted given that this approach is directly related to the specificity and ω-prime context of equations 8 and 10, namely $\varphi \cdot \frac{-1}{\varphi}(t_B) + 1(t_N 1) = 0(t_A)$ and $e^{i\pi}(t_B) + 1(t_N 1) = 0(t_A)$ respectively.

Such can now be presented in this Riemann hypothesis context.

The proposal *for the golden ratio result* of this Riemann hypothesis is in considering that the Riemann hypothesis should have analogous results for the golden ratio aspects of the mathematics of zero-dimensionality as what the Riemann hypothesis presents as 0 results (both trivial and non-trivial).

Here, zero-dimensionality mathematics and the resultant golden ratio equation (time-equation) presents 8 basic conditions (lxxx)-(lxxxvii) for the golden ratio analogue of the Riemann equations and associated hypothesis:

(lxxx) Each golden ratio value φ and $\frac{-1}{\varphi}$ instructs a prime number position.

(lxxxi) There is the real number golden ratio position: $\varphi + \frac{-1}{\varphi} = 1$.

(lxxxii) There is the complex plane golden ratio position: $\varphi \cdot \frac{-1}{\varphi} = -1$.

(lxxxiii) There is the zero-dimensional prime number reference as the addition of conditions (lxxx)-(lxxxi): $1 + (-1) = 0$.

(lxxxiv) If each golden ratio value pertains to a prime number position as per condition (lxxx) then the addition of these primes (including the value 1) results in a positive even integer as per equations 11-12.

(lxxxv) The overall context of the golden ratio values as per equation 8 requires condition (lxxii) as a complex plane 2d factor, and thus condition (lxxxiii) is factored with -1, thus resulting in a negative even integer value.

(lxxxvi) The overall ϖ-prime condition must be considered as per equation 8, and thus when applied to condition (lxxxi) the individual prime result there requires $\sqrt{\varphi \cdot \frac{-1}{\varphi}} = i = e^{\frac{i\pi}{2}}$

(lxxxvii) An overall limiting feature of $0 \to \varpi$ is required to position a prime zero-dimensional (zero result) result given the $\odot_0^{\varpi}$ model/set condition being a prime value (ϖ-prime).

These conditions and associated equations form the basis for how the complex plane of equation 9 as $\varphi \cdot \frac{-1}{\varphi} = e^{i\pi}$ comes into effect. Simply, the features of the mathematics of zero-dimensionality should be apparent for the Riemann zero results (both *trivial* and *non-trivial*).

What therefore can be extrapolated from the Riemann equations and associated hypothesis regarding the trivial and non-trivial zero results regarding conditions (lxxx)-(lxxxvii)?

Fundamentally:

(lxxxviii) The zero (0) results of the Riemann hypothesis pertain to the zero-dimensional reference of the golden ratio equations, as the same basis for 0 is being used for the Riemann equations and the mathematics of zero-dimensionality.

With those zero results:

(lxxxix) The additive feature of condition (lxxxi) begets condition (lxxxiv).

(xc) This thence ordains a list of negative even integers (as s) for a zero result, as what Riemann considers as the trivial zeroes.

(xci) The implication by such is that the addition of two primes (including the value $t_N 1$) as implicit in condition (lxxxi) results in an even number.

(xcii) Thence according to condition (lxxxi) a negative even integer results as prescribed by condition (lxxxiv), namely regarding the Riemann hypothesis as the value s.

Essentially, the mathematics of zero-dimensionality shows that Goldbach's conjecture is a feature of the Riemann hypothesis, a feature that has yet to be noted by contemporary mathematics, despite the negative even integer feature for s being self-evident, namely $\zeta(s) = 0$ being shown for negative even integers as $\sin(\pi s/2) = 0$ for those values.

To note is that condition (lxxxv) presents the case that $e^{i\pi}$ is raised to the power of ½, and thus an exponentiation value of ½ where s is that exponentiation factor in its portrayal in the Riemann equations. Therefore, there would exist another set of zero results for $s = \frac{1}{2}$ that represent the intended designed capture of the positioning of the primes *<u>and only primes</u>*.

The significance for $\zeta(s) = 0$ for the values where $s = \frac{1}{2}$ (the real part of the function) represents the idea that a prime location (0d) must be a square root ($\sqrt{}$) value of $\varphi \cdot \frac{-1}{\varphi}$ as per condition (lxxxv), namely the real-part exponentiation of ½ as per the use of s for equations 15-17, and thus the use of a 0d locale for the golden ratio values of equation 5, namely condition (c) where $s = \frac{1}{2}$.

Importantly, condition (lxxxi) specifies that for absolute specificity of the Riemann $s = \frac{1}{2}$ zero result then the plots need to embark to an infinite value, hence the issue with Riemann's hypothesis and the requirement to refine the resonance of the $s = \frac{1}{2}$ prime values in approaching ∞.

Thus, both sides of equation 17 can be considered as absolute functions given the values of the golden ratio (φ and $\frac{-1}{\varphi}$) are derived from an absolute basis of zero-dimensionality *in the context of an infinite scale* as ∞-prime.

In short, the question for Riemann was finding the absolute basis of the complex number plane and associated use of a logarithm for equations 20 and 21, namely the absolute basis of the Riemann hypothesis process of complex numbers and log scale for the Gauss counting function, such in understanding the approximation (≅) of the Gauss function as per equation 19. This approximation though is resolved in using the stricter Riemann mathematics in highlighting the primes of the right-hand side of equation 17, however his functions required the calculations of primes approaching ∞, and thus the requirement for a description of ∞ as a *prime* in the context of the $\zeta(s) = 0$ results for $s = \frac{1}{2}$.

Thus, with the Euler-Riemann zeta function:

(xciii) Euler's primes were embedded in fractions as a product driven log scale, namely the right-hand side of equation 17.

(xciv) Those fractions then became related to one another by Riemann using complex analysis, namely in using complex numbers and the prime number counting function logarithm scale with Euler's zeta function, allowing s to be a complex function.

(xcv) This logically created plots for the complex plane relevant to the distribution of primes.

(xcvi) There, when negative even integers are inputted for s they give a $\zeta(s) = 0$ result (as the zeta zeros) considered as the *trivial zeros*.

(xcvii) The other zeros are considered as the *non-trivial zeros* where $s = \frac{1}{2}$, and it is there where the proposal/conjecture is that all these non-trivial zeros at $s = \frac{1}{2}$ represent the distribution of primes as per the signature use of equations 19-23.

(xcviii) Riemann then needed to prove that every critical non-trivial zero lies on the $s = \frac{1}{2}$ line, the issue there being that either an endless and exhaustive computer-driven computational process generating primes to ∞ is required to resolve the Riemann hypothesis, or an accompanying mathematical proof is required, namely an associated equation backdrop to show the infinite prime number value scope of the Riemann equations.

(xcix) Therefore, only a *rigorous fundamental proof* for the Riemann hypothesis is considered to uphold the absoluteness of the link between the two sides of equation 17 in using complex numbers and log scales, namely in using the Riemann equations, or an accompanying mathematical proof for the prime values approaching if not including ω is required.

In short, the Riemann hypothesis adapts a complex number plane to a log scale to map the proposal by Euler for the connection between the zeta function (left side of equation 17) and that of the product of the primes in that function (right side of equation 17). Such was a logical thing for Riemann to consider, namely using a complex analytical system and then applying a logarithm (as per the prime number counting function) to pattern the primes of the right side of equation 17.

Here, the mathematics of zero-dimensionality finds:

(c) The Riemann hypothesis is demonstrated as a 2d *timespace* mathematical theorem, specifically from the derived zero-dimensional basis of $\varphi \cdot \frac{-1}{\varphi} = e^{i\pi}$ (equation 9).

In much the same way a solution to the Riemann hypothesis was approached using *timespace*, a solution to Fermat's Theorem (Last) [56] can be approached, namely that:

$$a^n + b^n = c^n \tag{24.}$$

where a, b, and c are positive integers only applies for positive integers of $n < 3$, simply given that in the proof for the Riemann Hypothesis the Pythagorean theorem of:

$$a^2 + b^2 = c^2 \tag{25.}$$

was demonstrated to be the core and albeit *limiting ingredient* of 1d, 2d, and 3d *timespace* (lx)-(lxii) *and thus physical 1d-3d timespace*[29], thence deriving the primes and natural numbers.

Here therefore proof for Fermat's theorem is intrinsic to the proposed proof for the Riemann hypothesis, as is the Goldbach conjecture. Of importance to note is how the current proof for Fermat's last theorem is given in an algebraic spatial geometric manner [56], yet here the proof is offered not in a spatial geometric manner, yet a *temporospatial* (*timespace*) geometric manner.

The associated proof and utility of that mathematics and associated $\odot_0^\omega$ realm is found with the accurate derivation of physical phenomena for 3d *timespace*[30] by scaling this mathematical theorem to two basic values, one for time as the charge of the electron e_c and one for space as the value of the speed of light c.

Indeed, if the self-evident nature of the 2d Riemann hypothesis is not sufficient in the context of equations 8-10 and associated conditions, the task is to understand how primes are linked with one another on the 3d *timespace* grid.

[29] See section 7.

[30] See section 7.

7. 0d $t_N 1$ *processes* as 3d *timespace:* 0d mathematical theorem results

The initial proposal in paper 1 ([1]: p1-5) of Temporal Mechanics (the mathematics of zero-dimensionality) was to examine how one is naturally conscious of time and space on a most fundamental level *as a basis* for counting objects in time and space.

This led to the derivation of the time-equation which was then scaled with the charge of the electron e_c and the speed of light c.

Such then through a series of papers [2-48][31] led to the fundamental mathematics of zero-dimensionality[32], specifically papers 43-47 [43-48] as volume 7 of Temporal Mechanics.

To be noted here is that Temporal Mechanics is a proposed new stream of number theory, and thus much of the work of Temporal Mechanics requires referencing the actual work of Temporal Mechanics, one paper to the next. Given the large amount of data available to physics theory, Temporal Mechanics in its adaptation process to that data has itself become a just as large body of work, as follows:

(ci) Volume 1 *(papers 1-7):*
   a. *Hypothesis*: the time-equation proposal and associated process of equation-data matching:
      i. [1-7].

(cii) Volume 2 *(papers 8-14):*
   a. *Adaptation*: following the revised mathematical time-equation formulation of paper 8, the required process was of equation and data matching with physical phenomena:
      i. [8-14].

(ciii) Volume 3 *(papers 15-21):*
   a. *Development*: the development of a dual time approach for EM and G as the Hybrid time-theory by deriving time to have different subsidiary equations for EM and G:
      i. [15-21].

(civ) Volume 4 *(papers 22-28):*
   a. *Derivation*: the interlinking mathematics of the hybrid time theory with microscopic and macroscopic data and equations:
      i. [22-28].

(cv) Volume 5 *(papers 29-35):*
   a. *Range*: determining what the microscopic and macroscopic limits are and why for the time-equation theory, presenting a basic scheme for time-equation cosmology.
      i. [29-35]

[31] The primary compass of theoretic design being the time-equation and its associated derived golden ratio (Fibonacci) feature.

[32] As initially presented in paper 43 [43] of Temporal Mechanics.

(cvi) Volume 6 *(papers 29-35):*

a. <u>*Refinement*</u>: a process of deriving the known and more refined subatomic and elementary particle values and associated field force equations and data, together with the known macroscopic values:

i. [36-42].

(cvii) Volume 7 *(papers 43-48):*

a. <u>*Zero-dimensionality*</u>: establishing the common underlying mathematics of physical phenomena and associated field force effects, particularly the basis for inertia and gravitational freefall:

i. [43-48].

ii. This paper being paper 49.

To then efficiently acquaint oneself with Temporal Mechanics, volume 7 has been designed with the benefit of hindsight of volumes 1-6, particularly though paper 42 of volume 6 where the gravitational analogue EM_X^{DIR} field was derived ([41]: p29-56), which then inspired volume 7 as a new overall approach to revising Temporal Mechanics with the idea of zero-point energy and thus presumably the mathematics of zero-dimensionality. The key issue found with paper 42 though was the need to thence derive the *timespace* zero-dimensional *timespace* <u>grid</u>, hence papers 43-47 [43-47]:

(cviii) Paper 43 [43]:

a. Describing *zero-dimensional space* and *a moment of time*:

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

b. Thence deriving 1d, 2d, and 3d *timespace*:

i. ([43]: p6-8).

(cix) Paper 44 [44]:

a. Using zero-dimensional mathematics to derive the natural number system from $0 \rightarrow \infty$ via deriving the prime numbers:

i. ([44]: p5-12).

b. Resolving Goldbach's conjecture:

i. ([44]: p12-13).

c. Resolving the Riemann hypothesis[33] in mapping the primes using Euler's equations for the zero-dimensional derived number values of $0 \rightarrow \infty$:

i. ([44]: p14-19).

(cx) Paper 45 [45]:

a. Using zero-dimensional mathematics to:

i. Derive the 5 processes of time for physical phenomena ([45]: p12, (xv-xix)).

ii. Derive the constancy of the speed of light in a vacuum for all frames of reference ([45]: p15-16).

[33] Solving the Riemann hypothesis noted as a key mathematical achievement according to the Clay Mathematics Institute [54].

iii. Derive Einstein's cosmological constant *error* in Einstein's failing to accommodate for zero-dimensional mathematics ([45]: p27-31).

(cxi) Paper 46 [46]:

a. A criticism of the current manner of employment of mathematics by physics of space *as a mass field* and time *as relative motion of masses*, as such assumes:

i. The dimensions automatically confer mathematically to physical objects.

ii. The idea of not only the mathematics of *a point in space*, yet also *a moment in time*, leading to dimensional scaling anomalies (stretching and bending).

(cxii) Paper 47 [47]:

a. Highlighting the flaw in Einstein's theory of general relativity:

i. Its stretching/bending flat spacetime using straight-line segments and thence:

1. Failing to derive Fermat's principle.
2. Failing to derive the stationary-action principle
3. Failing to derive the principle of inertia.

(cxiii) Paper 48 [48]:

a. A philosophical description of the zero-dimensional mathematical theorem:

i. Proposing a philosophical basis for the analysis of the dimensions.

ii. Identifying the current *physical theories* and those associated assumptions and flaws.

iii. Highlighting the zero-dimensional mathematical theorem approach in avoiding the assumptions and flaws of contemporary physical theories:

1. How such then leads to a physical theory model to be compared with known physical theory equations and associated data.

Preceding and yet also underwriting such, the process of paper 42 [41] was to:

(cxiv) Account for EM as the analogue of the temporal wave function.

(cxv) Thence describe the EM model as a process of destructive interference resonance (DIR) in two ways:

a. A partial destructive interference resonance (EM^{DIR}) resulting in particle pair production as a mass-field effect:

i. ([42]: p36-37).

b. An absolute *destructive interference resonance* (EM_X^{DIR}) resulting in a baseline zero-point field as the gravitational freefall field effect:

ii. ([42]: p38-41).

As presented in paper 40 ([40]: p9-19) Temporal Mechanics supports the known action (principle) equations (energy-momentum) for time by defining how bodies can be relative to one another in the datum reference solely of *time-now*, as what the *Lagrangian* system attempts to achieve through mathematical infinitesimal functions. Here, Temporal Mechanics exercises itself via a more precise zero-dimensional mathematical process not incurring the scaling problems of general relativity[34].

By the described mathematics of zero-dimensional time and space, the following were derived:

(cxvi) The arrow of time (*time-before* to *time-after* via *time-now*) as a golden ratio time-equation:

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

(cxvii) 1d, 2d, and 3d *timespace*:

i. ([44]: p12-19).

(cxviii) The derivation of the prime numbers from 0→∞ as the interlinking numerical entities of 1d, 2d, and 3d *timespace*:

i. ([44]: p12-19).

(cxix) The 5 processes of time for physical phenomena ([45]: p12, (xv-xix)):

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

b. 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.

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

d. 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* (namely a 0 *passage* of time).

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

i. 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.

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

(cxx) A *timespace* temporal wave function as an EM analogue:

i. ([2]: p2-15).

(cxxi) The *partial* EM *destructive interference resonance* (DIR) phenomenal derivative EM^{DIR} field as the basic *destructive interference resonance* (DIR) of an EM field as mass formation:

i. [38].

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

(cxxii) The *absolute* EM *destructive interference resonance* (DIR) phenomenal derivative EM_X^{DIR} field as the <u>*flatline*</u> *destructive interference resonance* (DIR) of an EM field, as gravity:

[34] As described in paper 47 ([46]: p8-11).

i. ([42]: p21-55).
ii. ([46]: p15-18).

As per (cxxii), Temporal Mechanics defines/derives gravity to be *a general result of all the features of physical phenomena, principally according to the following key equations*:

(cxxiii) $e^{i\pi} + 1 = 0$ (gravitational free fall and mass-mass attractivity):
i. ([15]: p11, eq6).
ii. ([40]: p16, eq3).

(cxxiv) $G_{AB<NEWTONS>} = \frac{M_C M_A M_B}{t_{AB} t_{BA}}\ (kg^3 t^{-2}), G_{AB<NEWTONS>} = \frac{M_C c^2 M_A M_B}{d^2}\ (kg^3 t^{-2})$:
i. ([1]: p10, eq10-12).

(cxxv) $F_{m_1 m_2} = \frac{m_1 m_2 v^2 c^2}{d^2}$:
i. ([40]: p20, eq4-10).

(cxxvi) $G = M_C c^2$ (where $M_C = \frac{2M_{C1+C2}}{3^2}$):
i. ([1]: p8-10, eq10-12).

(cxxvii) $G = 12 \cdot (\frac{2}{3})^2 \cdot (\frac{21.8}{22})^2 \cdot \pi \cdot c^3 \cdot M_{MG} = 6.67355 \cdot 10^{-11}\ kg\ m^3\ s^{-3}$:
i. ([35]: p29, eq3).

(cxxviii) $G = 1.39 \cdot c \cdot e_c$:
i. ([39]: p42, eq14).

(cxxix) $G = 1.39 \cdot e_c \cdot \varepsilon_0 \cdot \mu_0 \cdot c^3$:
i. ([39]: p44, eq19).

(cxxx) $G = \frac{33\ M_{MG}\ c^3}{2} = 6.6743 \cdot 10^{-11}\ kg\ m^3\ s^{-3}$:
i. ([39]: p44, eq20).

(cxxxi) $F_{m_1 m_2} = \frac{m_1 m_2 v^2 c^2}{d^2}$:
i. ([40]: p20, eq4-9).

(cxxxii) $G = v^2 c^2$:
i. ([40]: p21, eq10).

(cxxxiii) $G = T_G \cdot e_c \cdot \varepsilon_0 \cdot \mu_0 \cdot c^3$:
i. ([42]: p14, eq14).

(cxxxiv) $G = T_G \cdot a_e^0$:
i. ([42]: p19, eq21).

As the (cxxiii)-(cxxxiv) equations highlight, gravity is revealed to be:

(cxxxv) A *pan-phenomenon*.
(cxxxvi) Primarily, a *specific* DIR of the temporal wave function and the associated incursion event for electron mass [39].

(cxxxvii) Central to the fundamental prime number generator equation of $e^{i\pi} + 1 = 0$ and thence the derivation of the prime-number function feature of the lightest elementary particle ([35]: p27-28).

A list of the references for the temporal nature of the gravitational field force can be tracked as a zero-dimensional mathematical epistemology as follows:

(cxxxviii) EM and G temporal analogue equations of force:

i. ([1]: p9-14).

(cxxxix) Provisional gravity constant G for the gravitational force equation:

i. ([4]: p5, eq1).

(cxl) Negative energy proposal for gravity:

i. ([7]: p2-3).

(cxli) Linking EM with G:

i. ([21]: p14-23).

(cxlii) Gravity as entropy:

i. ([22]: p4-7, p13-17).

(cxliii) Proton/neutron mass from electron charge:

i. ([23]: p22).

(cxliv) EM^{DIR} field compared to EM:

i. ([23]: p23-28).

(cxlv) G constant from neutrino mass:

i. ([35]: p28-29, eq3).

(cxlvi) Entropy and enthalpy as features of time's arrow:

i. ([37]: p14-18).

(cxlvii) Particle pair production:

i. ([38], p17-22).

(cxlviii) The derivation of G:

i. ([39]: p43).

(cxlix) The features of gravity central to energy and momentum:

i. ([40]: p20-21, eq4-10).

(cl) The features of gravity as a zero-point energy basis:

i. ([42]: 16-60).

Although physics seeks to find the link between EM and gravity as per quantum gravity, as a melding of general relativity and quantum mechanics, Temporal Mechanics has found that such is too strong a proposal in given the dimensional disparity between general relativity and quantum mechanics.

To make the description simple yet hierarchical and thence more accountable:

(cli) Temporal Mechanics defines EM from the basis of the time-equation as the temporal wave function.

(clii) Temporal Mechanics then highlights how from that temporal wave function under the condition of π is organized an atomic locale that prescribes the idea of mass, as particles of the atomic locale, which are formed by a "*destructive interference resonance*" process of EM as the EM^{DIR} field.

(cliii) That EM^{DIR} field most fundamentally results in the derivation of the mass of the neutrino through a required prime number spatial scaling function ([35]: p27-28).

(cliv) Temporal Mechanics though investigated the DIR (*destructive interference resonance*) process further in paper 42, in describing two types of DIR, namely the partial DIR that results in mass ([42]: p36-37) as the EM^{DIR} field, and the *absolute* DIR responsible for the effect of gravity ([42]: p38-41) as the EM_X^{DIR} field.

The question therefore is, *"what determines how mass (EM^{DIR}) remains patent for destructive interference resonance process of EM?*" Fundamentally there are two conditions at play keeping mass (EM^{DIR}) patent:

(clv) The EM field and associated golden ratio *__time__* equation of $t_B + 1 = t_A$ (t_B as *time-before* where $t_B^2 = t_A$):

i. ([1]: p1-5).
ii. ([8]: p2-5).
iii. ([43]: p1-8).
iv. ([44]: p1-12).

(clvi) The EM_X^{DIR} field and associated $e_{t_B}^{i\pi} + 1_{t_N} = 0_{t_A}$ *__space__* equation:

i. ([15]: p8-10).
ii. ([40]: p16, eq2-3).
iii. ([44]: p10-12).

In between these two fields is the idea of mass (EM^{DIR}) which expresses itself as an interplay of the temporal wave function equation of $t_B + 1 = t_A$ (EM) and the fundamental $e_{t_B}^{i\pi} + 1_{t_N} = 0_{t_A}$ (EM_X^{DIR}) field condition.

The organization of mass (EM^{DIR}), mass as a light-making (EM) factory and how mass gravitates (EM_X^{DIR}) include the following derivations:

(clvii) Deriving the atomic locale and associated particle phenomena:

a. The subatomic particle level:

i. [2][3][4].
ii. ([23]: p12-31).

b. Proton/neutron mass:

   i. ([23]: p22).
  c. Electron mass:
   i. ([36]: p14-18).
  d. The elementary particle level:
   i. ([25]: p38-53).
  e. Neutrino mass:
   i. ([25]: p51, eq10).
   ii. ([35]: p28, eq2).
   iii. ([39]: p41-46, eq9-21).
  f. Electron radius:
   i. ([38]: p31-35).
  g. Proton radius:
   i. ([38]: p35-43).
   ii. ([40]: p19-25).
  h. Particle pair production
   i. ([38]: p17-21).
  i. Symmetry breaking, and Baryon asymmetry
   ii. ([42]: p51-56).

(clviii) Deriving Fermat's principle, the stationary-action principle, and the principle of inertia:
   i. ([46]: p15-18).

Mathematically, the process that has mass (EM^{DIR}) manifest, hold, and shape itself together is according to the two fundamental principles of EM and EM_X^{DIR} as the interplay of:

(clix) The golden ratio equation $t_B + 1 = t_A$:
   i. Equations 1-6.

(clx) The π condition for the golden ratio equation, and thus the $e^{i\pi}$ condition as the gravity equation $e^{i\pi} + 1 = 0$:
   i. Equations 8-9.

(clxi) The set of prime numbers derived from the *time=space* interplay of $t_B + 1 = t_A$ and $e^{i\pi} + 1 = 0$, as thence being fundamentally associated to the derivation of elementary particle mass:
   i. ([35]: p27-28).
   ii. ([44]: p12-19).

By such, <u>there exists a balance between EM and EM_X^{DIR} to keep physical reality (EM^{DIR}) together</u> as per:

(clxii) A general *<u>limiting</u>* *time=space* principle associated to a minimum and maximum mass phenomenal requirement:

i. ([36]: p18-22).

This *time=space* condition is then able to derive:

(clxiii) The solar phenomenal values derived from (clxiv):

i. ([36]: p22-26).
ii. ([39]: p59-67).

(clxiv) The solar system firmaments and scales:

a. Oort cloud firmament and its distance from the sun:
   i. ([13]: p9-11, eq1-8).
   ii. ([36]: p26-29).
b. Heliopause firmament and its distance from sun:
   i. ([32]: p15, eq1-5).
c. Bow shock firmament and its distance from the sun:
   i. ([32]: p16-17, eq6-9).
d. Black hole phenomena:
   i. ([42]: p40-50).
e. Astrophysical phenomena and scales:
   i. [32][33][34].
   ii. ([39]: p30-67).
   iii. ([42]: p24-29).
f. Isotropic CMBR:
   i. ([14]: p23-25, eq13).
   ii. ([37]: p29-31).

In short, physical phenomena is proposed to have *<u>a vast ecosystem of basic equations and constants</u>* all based on:

(clxv) The one zero-dimensional mathematical number theory.

(clxvi) The one resultant *<u>philosophical basis</u>*→*<u>number theory</u>*→*<u>mathematical theorem</u>*→ *<u>physical theory</u>* scheme.

Of note is how the idea of prime numbers[35] represent a feature of indivisibility as a value, namely a prime number being divisible by itself or 1, and how such a feature is instrumental in deriving the mass

[35] Noting how prime numbers were derived from the zero-dimensional number theory involving the dimensional objects of not just space yet also time, time being the proposed crib of mathematical operators, as described in sections 3-6.

of the lightest "non-divisible" particle, the neutrino, as presented initially in paper 35 ([35]: p27-28) and thence further described in paper 44 ([44]: p20-22) as per the proposed prime number space-factor S_0 which is facilitated in deriving the mass of the lightest particle pairs (neutrino and antineutrino) from the Planck length lP.

There, the prime feature of S_0 represents the addition of the first three primes (cubed) divided by 3, namely equations 1-2 from paper 35 ([35]: p27-28, eq1-2):

$$S_0 = \frac{2^3 + 3^3 + 5^3}{3} = 53.\dot{3}$$

([35]: p27, eq.1)

$$\frac{lP}{S_0} = 3.03048 \cdot 10^{-37}\, kg$$

([35]: p28, eq.2)

Paper 44 then proposed that given the primes 2, 3, and 5 are annexed in an algorithm for space in regard to mass, as the equation $S_0 = \frac{2^3+3^3+5^3}{3} = 53.\dot{3}$ ([35]: p27, eq.1) and its relationship to elementary mass on the Planck scale $\frac{lP}{S_0} = 3.03048 \cdot 10^{-37}\, kg$ ([35]: p28, eq.2), then it would follow that every prime number over 5 (namely 7 onwards) would be the result of the addition of any 3 of all the primes:

$1 + 1 = 2$ *(at fault in requiring 1)*

$1 + 1 + 1 = 3$ *(at fault in requiring 1)*

$1 + 2 + 2 = 5$ *(at fault in requiring 1)*

$2 + 2 + 3 = 7$

$3 + 3 + 5 = 11$

$3 + 3 + 7 = 13$

$3 + 3 + 13 = 19$ *etc*

The implication there is the uniqueness of the first three primes as:

(clxvii) Arbitrating by default the particle phenomenal consequence of $S_0 = \frac{2^3+3^3+5^3}{3} = 53.\dot{3}$.

(clxviii) Such, as the most fundamental feature of an elementary particle's mass (and thus gravity), the Planck length (and thus EM), *and space*.

Such is an entirely logical thing to consider, namely the relationship of primes (as *indivisible numbers*) guiding the fundamental relationship of physical phenomena (gravity and EM) *in space* for *indivisible particles*, a derived and yet axial correlation between this zero-dimensional number theory and physical phenomena.

The great utility of this process is that it opens new doorways to scientific research. For instance, the zero-dimensional logic process (Temporal Mechanics) has predicted and calculated the mass of the

X17 particle[36] and there also how electrons can be better utilized in electron shells behaving as virtual circuits ([30]: p19-24), together with successfully deriving the existence of elementary particles as per the mass of the lightest neutrino[37].

8. Conclusion

The following is a list of the achievements of this zero-dimensional number theory proposal:

(clxix) A zero-dimensional philosophical (specifically, perception based) appraisal of the dimensions of time and space.

(clxx) How such an appraisal can reason how time acts as a fundamental mathematical operator aetiological base for the relativity of zero-dimensional spatial points between each other.

(clxxi) Identifying the problem with zero-dimensional space as the mathematical value of 0 lacking dimensional scale as the 0-ϖ paradox.

(clxxii) In resolving this 0-ϖ paradox, the unreal dimensional localities of *time-after* and *time-before* in reference to *time-now* within that proposed zero-infinity ($\odot_0^\varpi$) set were proposed, thence deriving a time-equation as $t_B + 1 = t_A$.

(clxxiii) From that time-equation became the two results of the golden ratio, φ and $\frac{-1}{\varphi}$.

(clxxiv) This golden ratio was then applied to Pythagorean algebraic space to derive 3d space in the context of this universal *time-now=1* ($t_N 1$) and $\odot_0^\varpi$ (infinite-prime) proposal.

(clxxv) Together with 3d space were derived the 2d complex number plane and 1d number vector as per the equation $e_{t_B}^{i\pi} + 1_{t_N} = 0_{t_A}$.

(clxxvi) From there, it was possible to establish how primes can be identified in the ϖ-prime set and their proposed relationship to one another in that set as a 1d, complex 2d, and 3d relationship through using Euler's zeta function.

(clxxvii) From such was presented a case for the natural numbers and their associated primes to be a part of an overall zero-dimensional $\odot_0^\varpi$ derived set of natural numbers where ϖ is proposed to be a prime value (ϖ-prime).

(clxxviii) From such, it was then proposed that the Reimann hypothesis and thence Fermat's last theorem must be upheld in resolving the 2d complex realm of primes as a valid realm to ϖ for the non-trivial results of 0 for values of $s = \frac{1}{2}$ as an infinite-prime set ($\odot_0^\varpi$), as a set that is itself a prime.

(clxxix) Accompanying such was a solution for Goldbach's conjecture and the twin-prime problem.

---

[36] [57][58][59].

[37] ([35]: p27, eq1), ([35]: p28), ([41]: p13, eq12-13), ([41]: p20).

(clxxx) By such it is shown how numbers are objectified as equations on 1d, 2d, and 3d *timespace* grids.

(clxxxi) To then resolve the initial *time-now* time-domain problem of $1 \neq 0$ by using this *timespace* mathematical theorem to bring parity to time and space as *timespace* via this accessory mathematical route, namely around (*time-before* and *time-after*) yet inclusive of the time-domain of *time-now*.

(clxxxii) Subsequently, these number relationships (and thence equations) can be demonstrated as *being compatible with physical phenomena* in its various dimensional and associated physical phenomenal aspects, specifically in the zero-dimensional number theory being able to derive the equations of physical phenomena using the following scales for that mathematical theorem:

a. The charge of the electron e_c, such as the scaling component for time.
b. The speed of light c as the speed of transmission of a temporal wave function between spatial points, such as the scaling component for space.

The ΛCDM model is the current standard model of modern cosmology detailing a variety of theories each with their own unique mathematical formulation. In short, here is proposed:

(clxxxiii) A singular mathematical formulation basis for physical reality and thence a more consistent and complete cosmological model.

The significance therefore of deriving a solution for Goldbach's conjecture, the Riemann hypothesis, and Fermat's last theorem from the proposed mathematics of zero-dimensionality is that such unquestionably points towards new avenues for theory, research, and discovery for the physical sciences.

Conflicts of Interest

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

References

1. Jarvis S. H. (2017), https://doi.org/10.13140/rg.2.2.35132.28804/1, https://www.researchgate.net/publication/328738261_Gravity's_Emergence_from_Electrodynamics, https://vixra.org/abs/1704.0169
2. Jarvis S. H. (2017), https://doi.org/10.13140/rg.2.2.30099.12327/4, https://www.researchgate.net/publication/328738109_Golden_Ratio_Axioms_of_Time_and_Space, https://vixra.org/abs/1706.0488

3. Jarvis S. H. (2017), https://doi.org/10.13140/rg.2.2.23388.23683/2, https://www.researchgate.net/publication/328738518_The_Emergence_of_Consciousness_from_Chaos, https://vixra.org/abs/1707.0044
4. Jarvis S. H. (2017), https://doi.org/10.13140/rg.2.2.10045.10726/5, https://www.researchgate.net/publication/328738422_Phi-Quantum_Wave-Function_Crystal_Dynamics, https://vixra.org/abs/1707.0352
5. Jarvis S. H. (2017), https://doi.org/10.13140/rg.2.2.23466.88009/3, https://www.researchgate.net/publication/328738526_Time_as_Energy https://vixra.org/abs/1711.0419
6. Jarvis S. H. (2018), https://doi.org/10.13140/rg.2.2.13400.55044/4, https://www.researchgate.net/publication/328738389_The_Relativity_of_Time https://vixra.org/abs/1801.0083
7. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.27741.26089/2, https://www.researchgate.net/publication/332672475_Golden_Ratio_Entropic_Gravity_Gravitational_Singularity_Field_Testing, https://vixra.org/abs/1904.0485
8. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.35399.14246/2, https://www.researchgate.net/publication/332879052_The_Golden_Ratio_Time_Algorithm, https://vixra.org/abs/1905.0081
9. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.28499.02084/1, https://www.researchgate.net/publication/333668324_The_Physics_Chimera, https://vixra.org/abs/1906.0127
10. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.10258.71363/1, https://www.researchgate.net/publication/333972239_The_Conception_of_Time, https://vixra.org/abs/1906.0441
11. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.15833.67689/1, https://www.researchgate.net/publication/335232726_Space_and_the_Propagation_of_Light https://vixra.org/abs/1908.0388
12. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.17320.93443, https://www.researchgate.net/publication/336130560_Space_and_the_Nature_of_Gravity, https://vixra.org/abs/1909.0656
13. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.14287.43683/2, https://www.researchgate.net/publication/337019159_Space_and_the_Redshift_Effect, https://vixra.org/abs/1911.0064
14. Jarvis S. H. (2019), https://doi.org/10.13140/rg.2.2.25730.63686/2, https://www.researchgate.net/publication/338159068_Solving_the_Cosmological_Constant_Problem, https://vixra.org/abs/1912.0451
15. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.13078.91205/3, https://www.researchgate.net/publication/338548474_Hybrid_Time_Theory_Euler's_Formula_and_the_Phi-Algorithm, https://vixra.org/abs/2001.0233
16. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.27053.64487/3, https://www.researchgate.net/publication/338689227_The_Hybrid_Time_Clock_as_a_Function_of_Gravity, https://vixra.org/abs/2001.0401
17. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.20045.79847/2, https://www.researchgate.net/publication/340270768_Hybrid_Time_Theory_Cosmology_and_Quantum_Gravity_I, https://vixra.org/abs/2003.0659

18. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.16207.84648/1, https://www.researchgate.net/publication/340574420_Scientific_Principles_of_Space_Time_and_Perception, https://vixra.org/abs/2004.0260
19. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.23972.22405/1, https://www.researchgate.net/publication/341117279_Hybrid_Time_Theory_Cosmology_and_Quantum_Gravity_II, https://vixra.org/abs/2005.0053
20. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.34441.67683/6, https://www.researchgate.net/publication/341440377_Mathematical_Principles_of_Time_and_Energy, https://vixra.org/abs/2005.0179
21. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.21001.88169/1, https://www.researchgate.net/publication/341782076_Dimensional_Mechanics_of_Time_and_Space, https://vixra.org/abs/2005.0286
22. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.29715.71202/3, https://www.researchgate.net/publication/342343657_Dimensional_Thermodynamics, https://vixra.org/abs/2006.0194
23. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.10565.68320/3, https://www.researchgate.net/publication/343281767_Time-Space_Wave-Mechanics, https://vixra.org/abs/2007.0223
24. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.15362.09929/3, https://www.researchgate.net/publication/343678982_Temporal_Calculus_The_Calculus_of_Time-Points_in_Space, https://vixra.org/abs/2008.0111
25. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.33774.43843/3, https://www.researchgate.net/publication/343987838_Temporal_Calculus_solving_the_Yang-Mills_Existence_and_Mass_Gap_problem, https://vixra.org/abs/2008.0226
26. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.28539.75043/2, https://www.researchgate.net/publication/344221574_Temporal_Calculus_Time_Scaling_Space, https://vixra.org/abs/2009.0091
27. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.20191.07844https://www.researchgate.net/publication/344387016_Temporal_Calculus_Resolving_Elementary_Particle_Formation_and_Confinement, https://vixra.org/abs/2009.0177
28. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.12474.21447/2, https://www.researchgate.net/publication/344457690_Temporal_Calculus_Resolving_Einstein's_Theory_of_Relativity_Special_and_General, https://vixra.org/abs/2010.0017
29. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.12651.98086/1, https://www.researchgate.net/publication/345127477_Time_and_Non-Locality_Resolving_Bell's_Theorem, https://vixra.org/abs/2011.0002
30. Jarvis S. H. (2020), https://doi.org/10.13140/rg.2.2.11032.83206/4, https://www.researchgate.net/publication/346672010_Non-Local_Time-Point_Theory_Magnetic_Quantum_Shell_MQS_Modelling, https://vixra.org/abs/2012.0040
31. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.28879.10407/1, https://www.researchgate.net/publication/348184426_Temporal_Mechanics_A_Time-Space_Circuits, https://vixra.org/abs/2101.0022

32. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.31751.21925/5, https://www.researchgate.net/publication/348729069_Temporal_Mechanics_B_Time-Space_Constants, https://vixra.org/abs/2101.0148
33. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.30214.70720/5, https://www.researchgate.net/publication/349108810_Temporal_Mechanics_C_Time-Space_Manifolds, https://vixra.org/abs/2102.0047
34. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.17868.54403/5, https://www.researchgate.net/publication/350090036_Temporal_Mechanics_D_Time-Space_Metrics, https://vixra.org/abs/2103.0102
35. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.28496.84483/7, https://www.researchgate.net/publication/350512305_Temporal_Mechanics_E_Time-Space_Logistics, https://vixra.org/abs/2103.0201
36. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.34363.34082/5, https://www.researchgate.net/publication/353224312_Quantum_Gravity_and_the_calculation_of_maximum_SOL_mass, https://vixra.org/abs/2107.0086
37. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.20022.42563/5, https://www.researchgate.net/publication/353403592_An_Axiom_of_Time_resolving_Entropy_CP_violation_and_the_isotropic_CMBR, https://vixra.org/abs/2107.0146
38. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.28179.20007/6, https://www.researchgate.net/publication/354794575_Temporal_Mechanics_and_EM-DIR_particle_pair_production, https://vixra.org/abs/2109.0167
39. Jarvis S. H. (2021), https://doi.org/10.13140/rg.2.2.15658.13764/4, https://www.researchgate.net/publication/356039421_Temporal_Mechanics_and_the_derivation_of_an_electron_degeneracy_neutrino_Gravity_constant_G_fine_structure_constant_a_Planck_constant_h_and_the_phenomenal_values_of_Sol, https://vixra.org/abs/2111.0045
40. Jarvis S. H. (2021), http://dx.doi.org/10.13140/RG.2.2.19674.67529/6, https://www.researchgate.net/publication/356508902_Time-domains_as_the_foundation_for_classical_mechanics_the_relativity_of_moving_objects_and_the_known_field_forces_presenting_the_case_for_a_unified_field_theory, https://vixra.org/abs/2111.0131
41. Jarvis S. H. (2022), https://doi.org/10.13140/rg.2.2.17398.93763/5, https://www.researchgate.net/publication/357690054_A_time-equation_thought_experiment_deriving_3D_space_as_timespace_in_forming_the_basis_for_particle_and_field_phenomena, https://vixra.org/abs/2201.0043
42. Jarvis S. H. (2022), 10.13140/RG.2.2.23272.75521/5, https://www.researchgate.net/publication/358974090_The_Temporal_Mechanics_XEMDIR_field_resolving_zero-point_energy_negative_energy_anti-EM_anti-gravity_symmetry_breaking_and_Baryon_asymmetry, https://vixra.org/abs/2203.0018
43. Jarvis S. H. (2022), https://doi.org/10.13140/rg.2.2.23915.00808/4, https://www.researchgate.net/publication/359052099_The_mathematics_of_zero-dimensional_space, https://vixra.org/abs/2203.0030
44. Jarvis S. H. (2022), https://doi.org/10.13140/rg.2.2.33528.32000/6, https://www.researchgate.net/publication/359577367_A_mathematical_analysis_of_zero-dimensionality_in_deriving_the_natural_numbers_offering_a_solution_to_Goldbach's_conjecture_and_the_Riemann_hypothesis, https://vixra.org/abs/2203.0181

45. Jarvis S. H. (2022), http://dx.doi.org/10.13140/RG.2.2.24087.85921/3, https://www.researchgate.net/publication/360065326_A_foundational_zero-dimensional_scaling_system_mandating_the_principle_of_relativity_and_the_associated_constancy_of_the_speed_of_light_in_a_vacuum, https://vixra.org/abs/2204.0127
46. Jarvis S. H. (2022), http://dx.doi.org/10.13140/RG.2.2.11064.21768/2, https://www.researchgate.net/publication/360270193_The_flaw_of_applying_mathematics_directly_to_physical_phenomena_in_addressing_the_Entscheidungsproblem_and_Godel's_theorems_as_compared_to_the_mathematics_of_zero-dimensionality, https://vixra.org/abs/2204.0177
47. Jarvis S. H. (2022), 10.13140/RG.2.2.23165.44001/3, https://www.researchgate.net/publication/360588347_Zero-dimensional_mathematics_and_the_associated_timespace_Xemdir_field_geodesic_in_deriving_Fermat's_principle_the_stationary-action_principle_and_the_principle_of_inertia, https://vixra.org/abs/2205.0079
48. Jarvis S. H. (2022), 10.13140/RG.2.2.29238.57929/4, https://vixra.org/abs/2207.0135.
49. https://planetmath.org/zerodimensional, webpage accessed 2nd April 2022
50. https://mathworld.wolfram.com/GoldbachConjecture.html, accessed 26th March 2022
51. Leonard Euler (1748) Chapter 8: On transcending quantities arising from the circle of Introduction to the Analysis of the Infinite, page 214, section 138 (translation by Ian Bruce, pdf link from 17 century maths), accessed 26th March 2022
52. Bach, Eric; Shallit, Jeffrey (1996). Algorithmic Number Theory. MIT Press. volume 1 page 234 section 8.8. ISBN 0-262-02405-5.
53. Weisstein, Eric W. "Prime Counting Function". MathWorld, accessed 26th March 2022
54. Bombieri, Enrico. "The Riemann Hypothesis – official problem description" (PDF). Clay Mathematics Institute, accessed 26th March 2022.
55. Steuding, Jörn; Suriajaya, Ade Irma (1 November 2020). "Value-Distribution of the Riemann Zeta-Function Along Its Julia Lines". Computational Methods and Function Theory. **20** (3): 389–401. doi:10.1007/s40315-020-00316-x. ISSN 2195-3724.
56. Singh S (2002), “Fermat's Last Theorem”, Fermat's Last Theorem : Singh, Simon: Amazon.com.au: Books, ISBN-10: 9781841157917.
57. https://www.forbes.com/sites/drdonlincoln/2019/11/23/has-a-new-discovery-broken-known-physics/?sh=4bba266f65be, webpage accessed 7th December 2020.
58. https://arxiv.org/pdf/1910.10459.pdf, webpage accessed 7th December 2020.
59. https://journals.aps.org/prl/pdf/10.1103/PhysRevLett.116.042501, webpage accessed 7th December 2020.