The flaw of applying mathematics directly to physical phenomena (in addressing the *Entscheidungsproblem* and Gödel's theorems), as compared to the mathematics of zero-dimensionality

Stephen H. Jarvis[1]

ORCiD: http://orcid.org/0000-0003-3869-7694

web:www.xemdir.com

email: stephen.jarvis@xemdir.com

Abstract: The current scientific mechanism of theoretic design, development, data capture, and associated technological development shall be examined for its thoroughness and technological results. Specifically, the initial conditions of theoretic design and associated use of mathematics is examined for its definitions of scale and scope, examining for any mathematical design limitations such as the Entscheidungsproblem and Gödel's theorems. Here it will be demonstrated that the current physics process of theoretic development is limited by its current use of mathematics being directly applied to physical phenomena resulting in errors of calculation on absolute (zero and infinite) scales. A solution to this problem is provided as the provision of a zero-dimensional mathematical basis that is annexed to the non-physical objects of time and space which by such an association derives 1d, 2d, and 3d timespace and thence a mathematical formalism to describe physical phenomena. The key demonstration here is that a fundamental mathematics is not ideally directly acquainted with physical phenomena, and that only by being tagged with the objects of time and space as the mathematics of zero-dimensionality can physics find proper fulfilment.

Keywords: temporal mechanics; zero-dimensional space; timespace; Entscheidungsproblem; Gödel's theorems; incompleteness condition

[1] Theorist and researcher at *Xemdir (https://www.xemdir.com/)*

1. Introduction

Physics[2] is commonly understood as the study of matter, specifically matter's fundamental particle ingredients and mechanism of behaviour regarding energy and force (and thus motion) through time and space. Simply, physics measures mass and its motion to explain such.

The measurement process of physical phenomena requires the use of mathematics[3] as numbers, numbers as mechanisms of counting using scales, scales for space and time modelled to physical phenomena. Mathematical theorems of physical phenomena are developed by the measurement processes of physical phenomena in using mathematics, namely in using mathematical theorems that define *mathematical objects*[4] representative of physical phenomena or *axioms*[5]. Such forms the basis of physics theorems seeking to explain all physical phenomena as universal theories.

Here in this paper the idea of physics relying fundamentally on measuring physical phenomena is examined and how well that accommodates for *absolute* (0 and ∞) dimensional scales for time and space. As this paper shall reveal, the current process of using mathematical objects to directly label physical phenomena is limited in both the mathematical basis of the mathematical objects and their need to depend primarily on being applied to *physical objects*.

The reason for this proposal is owing to the current block physics is encountering in reaching a universal model (cosmological model), namely in being unable to find direct physical evidence for *dark energy and dark matter*[6]. The question asked here in this paper is whether this inability of discovery is due to a data capture problem or a design problem.

In considering the quality of data capture today[7], it is considered that the problem is a design issue of physics theory in its use of mathematics. This paper explains what this design issue is and how it can be resolved. By understanding the design issue at play, a solution is proposed in the form of a mathematics of zero-dimensionality[8], namely for mathematics to take a more fundamental ($0 \to \infty$) role in being applied to the dimensions of time and space *to then* create mathematical objects as templates of *timespace*[9] to more suitably explain the characteristics of physical phenomena, energy, and force.

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

1. Introduction

[2] Section 2.

[3] Section 3.

[4] Section 3.

[5] Section 3.

[6] Section 2.

[7] Section 3.

[8] Section 4.

[9] Section 4.

2. Methodology
3. Mathematical logic
4. Zero-dimensionality
5. Conclusion

The proposed solution here is based on the work of Temporal Mechanics [1-45] detailing the mathematics of zero-dimensionality (*zero-dimensional space* and *time as a moment*)[10]. Specifically, the solution presented here details labelling time and space in a most fundamental manner, namely as *zero-dimensional space,* and *time as a moment*, to then develop how such would work as a mathematics, and what then that mathematics can derive for not just the dimensions of time and space, yet for physical phenomena, and why.

In short, physics uses a variety of models defined and constrained by how *mathematical objects* are used to label physical phenomena, constraints such as a distinct time period and a distinct region of space. Fundamentally though, here it will be shown that physics is constrained by what can be *physically measured*. In other words, not only is physics theory limited by its design constraints, yet limited also by what can be *physically* measured within such. The solution proposed here is to construct a mathematical time and space model that accommodates for the zero (0) and the infinite (∞) aspects of time and space, namely to accommodate for not just what is limited by the primary application of mathematics to physical phenomena yet what also applies to the idea of zero-dimensionality, namely *zero-dimensional space* (a point) and *time as a moment*.

2. Methodology

One would expect that applying numbers and mathematical objects to physical phenomena should successfully count physical phenomena and thence have such a counting organized into a mathematical and thence physical theorem of physical phenomena. The problem here is whether counting physical objects is sufficient as a basis. Two fundamental questions that should be asked are:

(i) Should not the basis for counting be from zero-dimensionality, from *zero-dimensional space* (a point) and *time as a moment*?

(ii) Why is counting based on physical phenomena as per the equations of momentum (mass and velocity) and inertia (force) if physical phenomena is ultimately not a ground-state 0-value?

The current scientific mechanism [46] of physics theory growth, data capture, and associated technological development is central to three core steps revolving as one:

[10] Section 4.

(iii) Insight/thought/hypothesis.

(iv) Testing/invention.

(v) Proof/realization.

Core to this process is:

(vi) Creating a theory that is based on physical measurement and associated data collection, and thus physical conditions (measurement and data collection) for the dimensions of space and time such as mass for volume and motion for time.

(vii) The use of a mathematics that accommodates the dynamic features of physical phenomena in time and space through *movement* of mass (*relative motion*, as for *time*) and *volume* of mass (as for *space*).

Although the fundamental processes of mathematics used are entirely *virtual*, namely as *mathematical objects*, these fundamental processes of mathematics (such as Euclidean space[11] and Hilbert space[12]) are directly tagged as metrics of space and time to physical phenomena.

In short, physical data eventuates, is gathered, by the application of pure mathematics to physical concepts. Such has resulted in the current cosmological ΛCDM model [47], a result of the only accepted theory for gravity and associated large scale construction of reality as per Einstein's general relativity [48]. Einstein's general relativity found though with its calculations that the energy of the universe is 10^{120} orders of magnitude over the current measured value of $10^{-9} Jm^{-3}$ [49] prompting the proposal that an invisible form of energy must exist called dark energy [50]. 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 [51].

The fundamental process at play here is the *metric expansion of space* [52], or simply the *mathematical* expansion of space, as though acknowledging that cosmology is based on *fundamental mathematical terms and conditions*. In other words, a metric mathematical object as per Einstein's spacetime is considered as the fundamental basis for reality. Thence it seems all endeavours in physics research become a quest of discovering dark energy and dark matter. To note here is how mathematics has found precedence in being labelled to physical phenomena.

Questions about the validity of spacetime and the mathematical approach there are as follows:

(viii) What physical if not mathematical principle is being exercised if not assumed in directly abridging phenomenal physicality in the form of mass (*for space*) and movement of mass

[11] Section 3.

[12] Section 3.

(*for time*) *to* mathematical objects, especially given such a process is a basis for Einstein's special and general theories of relativity, and thence the metric expansion of space and associated ΛCDM model, namely the physical data of the redshift effect [53] and observed galaxy behaviour [54]?

(ix) Could there be a more fundamental process at play in physical phenomena that is paradoxically *not physical* which mathematics has failed to label via (viii), such as perhaps the potential aspect of *zero-dimensional space* and *time as a moment*?

(x) Is there an inherent limitation to the current application of mathematics to time and space as per mass (for space) and movement of mass (for time)?

In short, the questions asked here are:

(xi) Is mathematics limited in being directly tagged to physical phenomena?

(xii) Could there be a missing step in tagging mathematical objects to physical phenomena?

The design of the solution here[13] is achieved by describing and facilitating a fundamental mathematics that:

(xiii) does not apply directly to physical phenomena,

(xiv) does nonetheless apply directly to time and space,

(xv) is first applied to *zero-dimensional space* and *time as a moment*,

(xvi) is able to describe physical phenomena as a subsequent mathematics of mathematical objects.

Although physics takes strides in theoretic development in using numbers and mathematical objects applied directly to physical phenomena (mass and velocity), how well does such a process grasp zero-dimensionality if indeed zero-dimensionality (*zero-dimensional space* and *time as a moment*) holds court to core features of physical reality?

For instance, although time appears to flow from one moment to the next, does the flow of time invalidate *time as a moment*? Although space is characterized by a 3d volume, does the 3d volume invalidate any potential *point reference* in that 3d volume?

The presentation here demonstrates[14] that *zero-dimensional space* and *time as a moment* are core ingredients to reality, and that to capture these core ingredients it is necessary to first ask how to achieve such mathematically *as an axiom*, namely as per what is self-evident [55]. Before such a demonstration can happen, what is mathematical logic, and how can mathematical logic accommodate for *zero-dimensional space* and *time as a moment*?

[13] Section 4.

[14] Section 4.

3. Mathematical logic

Mathematics is a cornerstone discipline for human congress. Mathematics in its most basic form is the idea of counting physical objects, principally of relating objects numerically. One should then readily assume physical phenomena should be just as easily calculated using advanced counting processes.

Of course reality cannot be counted *entire* given its scale and our relative size, and so mathematical equations are used to formulate and predict the behaviour of a variety of physical phenomena. Those formulae and equations are then matched with one another across the physical phenomena spectrum to then explain physical phenomena on a grand scale. Not only on the grand scale, yet those things in physical phenomena that cannot be directly seen, like the field forces and the dimensions of time and space and their relationship to the field forces, such in bearing reference to physical phenomena as *mass* and the *motion of mass*.

Is it possible though that the use of mathematics, numbers as applied physical phenomena (and thence assumedly[15] the dimensions of time and space) has assumed the *zero-dimensional* (*spatial point* and *temporal moment*) nature of the dimensions? Namely:

(xvii) Is it possible that mathematics has not been explored fundamentally enough in its application to physical phenomena by not being applied to a fundamental zero-dimensional level of time and space?

(xviii) Thus, is it possible that mathematics has not been explored fundamentally enough in generating mathematical objects to then be applied to physical phenomena in denying zero-dimensionality (*spatial point* and *temporal moment*)?

All the evidence in physics theory (viii)-(x) suggests such (xvii)-(xviii) an oversight has occurred in preference to the idea of mass and motion of mass as a fundamental mathematics of momentum and inertia (force). Yet, is the problem with mathematics itself (namely, *is mathematics incapable of zero-dimensionality mathematics*?) or is the problem with how mathematics is applied as mathematical objects to physical phenomena?

Mathematics as a discipline includes the study of:

(xix) Numbers (basic arithmetic and number theory.

(xx) Formulas and related structures (as per algebra).

(xxi) Shapes and spaces in which they are contained (as per geometry, such as Euclidean space [56] and Hilbert space [57]).

[15] The key issue here is *assuming* the dimensions of time and space in merely labelling physical phenomena as physical objects with mathematical objects.

(xxii) Quantities and their changes (as per calculus and analysis, such as Fourier [58] and Lorentz [59] transformations).

Mathematics *in physics* is central to the utility of *mathematical objects* primarily as virtual constructs usually modelled from axioms in their application to nature (physical phenomena) in the form of (xix)-(xxii). Mathematical objects are used for deductive reasoning and mathematical proofs.

In physics, (xix)-(xxii) takes the form of describing physical phenomena (mass or *analogue thereof*[16]) in spaces and the motion (time component) of physical phenomena (mass or analogue thereof). How is all of such monitored, namely what are the rules governing the operations of (xix)-(xxii)?

Mathematics quantifies its mathematical logic with its foundational principals. Such has led to the development of axiomatic frameworks for (xvii)-(xx) pioneered by David Hilbert and Kurt Gödel in order to prove the consistency of foundational theories related to (xvii)-(xx).

Of mention, David Hilbert postulated a complete and consistent set of axioms for all of mathematics [60] with his *Entscheidungsproblem* challenge [61]:

(xxiii) Can an algorithm allow an input of statements resulting (via the algorithm) in a *yes* or *no* in terms of the universal *axiomatic validity* of the inputted statement?

Gödel however showed with his incompleteness theorems [62]:

(xxiv) Axioms as consistent systems in the form of algorithms are incapable of proving all truths about the arithmetic of natural numbers; in other words, although statements about natural numbers are true, it is not possible to prove the truth of those statements using the natural number system itself.

(xxv) Therefore, axioms as consistent systems cannot demonstrate their own consistency.

Gödel highlighted the flaw in Hilbert's approach of trying to validate a complete and consistent set of axioms that can prove themselves true. The work of Gödel was then utilized by Alan Turing with Turing's halting problem description [63] in view of Hilbert's *Entscheidungsproblem,* namely:

(xxvi) That there is no algorithm in a computer system (technology contrived from mathematical computing objects as algorithms) that can measure itself as a *yes* or *no* in terms of the universal *axiomatic validity* of the inputted statement, *no* being encountering a *halt* in the computer's expression of an algorithm programmed to run indefinitely.

[16] Prescribed by quantum mechanics as the proposed momentum features of light.

In short, Alan Turing inventively applied Gödel's theorems to a *mechanical* mathematical object that performs algorithms (counting)[17].

In upholding Gödel's theorems and the associated demonstrations by Turing, the following becomes evident:

(xxvii) Is something else needed for the number system to check itself entire, namely as a *certain* application of numbers to *certain* phenomenal objects *yet to be described* by physical phenomena *simply because those phenomenal objects, although associated to physical phenomena, are not physical themselves*?

The proposal here is that if a number system alone cannot measure and correct itself, then if such a condition (say the *incompleteness condition*[18]) as a mathematics is applied to physical phenomena, how indeed can a mathematics that is ruled by an *incompleteness condition* explain physical phenomena entire as a mathematical theorem? Or rather, how can a mathematical model based on the incompleteness theorem allow physical phenomena to represent a universal theory that can be self-checked? The proposal here is that such is *not possible*, namely that:

(xxviii) There is a limit to what formal mathematical logic can provide as a measure of its applicability to physical phenomena as per the *incompleteness condition*.

(xxix) The number system applied directly to physical phenomena is incapable of resulting in a physics theorem that can be self-checked with physical phenomena *absolutely*.

The next question is, "can physics theory work a way around this"? Or rather, can (xxvii) be used as a solution basis? Simply, despite physics developing as a way of collecting data for *mass as volume* and *time as motion*, together as *momentum* as *mathematical objects*, how does physics seek *a complete theory* under the constraints of the *incompleteness condition*?

The probability of a hypothesis in physics being true is based on more evidence and information becoming available. This is the basis of Bayesian inference [64] in predicting the probability of a scientific hypothesis per the availability of new evidence. Core here is *statistical mathematics* [65] which is why statistics and probability play significant if not fundamental roles in mathematical physics modelling. Such is also a theme of the Riemann hypothesis in seeking to map primes approaching infinity for zero-values of $s = \frac{1}{2}$ [66]. Yet such is still confined by the proposed *incompleteness condition*.

The fundamental questions thence being asked here are:

(xxx) Can a complete physical theory be achieved in avoiding the *incompleteness condition* despite using mathematics central to the incompleteness condition?

[17] A mechanical counting machine such as a modern computer.

[18] Proposing a new term: "*incompleteness condition*" as an implied effect of Gödel's theorems on mathematical physics and associated theorems.

(xxxi) How far is physics expected to reach with its universal models in accepting an incompleteness condition if physics theory cannot be complete?

(xxxii) Should a universal physics theory in using mathematics ruled by the *incompleteness condition* be incomplete, and thus incapable of checking itself entire?

(xxxiii) Should a universal physics theory that is proposed to be complete be able to measure itself, to check itself, in being complete, and by what application of mathematics can it do such in avoiding the *incompleteness condition*?

In terms of considering the human body as an ultimate natural mathematical mechanical object [10], if the entire number system were like the human body, such would be akin to asking an integral algorithm such as the heart, or the central nervous system, to measure and confirm the correctness of the human body entire. Gödel and Turing present the case that such is *not possible* with the number system alone. If the human body in being self-aware can measure its status though, and successfully so, fundamental autonomically [67], then the analogy of the human body as an ultimate natural mechanical mathematical object *based on a number system alone* is insufficient, and thus there must be *something else*[19] to numbers applied to physical phenomena at play. Could that *something else* have to do with consciousness, or could that *something else* explain the mechanism of self-awareness, of self-checking?

4. Zero-dimensionality

The proposed solution is to ask mathematics to consider zero-dimensionality for space and time, namely:

(xxxiv) Zero-dimensional space as a *point*.

(xxxv) Zero-dimensional time and a *moment of time*.

How these two features for *space* (xxiv) and *time* (xxxv) are mathematically developed is the essence of Temporal Mechanics [1-45]. The initial proposal in paper 1 ([1]: p1-5) of Temporal Mechanics was to examine how anyone, anyone who is willing to count physical phenomena into a mathematical theory, is naturally conscious of time and space on a most fundamental level *as a basis* for counting objects in time and space. Such then through a series of papers [2-42] lead to the fundamental mathematics of zero-dimensionality, specifically papers 43-45 [43-45]:

(xxxvi) Paper 43 [43]:

- Describing *zero-dimensional space* and *a moment of time* ([43]: p1-5).
- Thence deriving 1d, 2d, and 3d *timespace* ([43]: p6-8).

[19] Section 4.

(xxxvii) Paper 44 [44]:

- Using zero-dimensional mathematics to:
  - Derive the natural number system from $0 \to \infty$ via deriving the primes ([44]: p5-12).
  - Resolving Goldbach's conjecture ([44]: p12-13) and the Riemann hypothesis ([44]: p14-19) in mapping the primes using Euler's equations for the zero-dimensional derived number values of $0 \to \infty$.

(xxxviii) Paper 45 [45]:

- Using zero-dimensional mathematics to:
  - Derive the 5 processes of time for physical phenomena (45]: p12, (xv-xix)).
  - Derive the constancy of the speed of light in a vacuum for all frames of reference.
  - Derive Einstein's cosmological constant [68] *error* in Einstein's failing to accommodate for zero-dimensional mathematics.

In criticism of the current manner of employment of mathematics by physics, to demonstrate space *as mass* and time *as motion of mass* is presuming the dimensions automatically confer mathematically to physical objects, such in bypassing the idea of not only the mathematics of *a point in space*, yet also *a moment in time*.

Temporal Mechanics proposes and demonstrates that mathematics as a number theory is given completeness, *is able to check itself*, by deriving and mapping the primes ([44]: p12-19) via defining 0, 1, and ∞ with the objects of space and time. Conversely, it is shown there ([45]: p30-31, (clxv-clxviii)) and here in this paper [62] that mathematics alone as a pure number system with associated axioms and algorithms would not achieve such, namely not be able to check itself as a number theory alone. Conversely, by the adaptation of the zero-dimensionality of time and space completeness is equated and realized ([45]: p22-27, (ciii-cxliv)).

Thus, *can an incomplete theorem of mathematics explain reality as a mathematical physics theory?* The proposal here is that:

(xxxix) Mathematics can explain physical reality as a mathematical physics theorem only by annexing the number system from a zero-dimensional application to time and space.

(xl) The completing piece of mathematics proposed here *is* the annexed number theory itself of zero-dimensional mathematics, which then as a platform can be applied to physical phenomena as an associated set of number associations ([45] p20-22, (xc-cii)) *as a process of confirmation with known physical data*.

(xli) The *incompleteness* of number theory is owing to number theory not being entire of itself, namely in requiring what is *not* pure number theory to be complete.

In addressing (xxxiii) therefore, the process of Temporal Mechanics as a theory *checking itself* is achieved in deriving the basic time-equation ([1]: p1-5, eq1-6)([43]: p6-7, eq1-7) and associated phenomenal equations, as summarized in paper 45 ([45]: p22-27, (ciii-cxliv)), and *thence* the overall cosmological model ([45]: p31, (clxxiv-clxxxii)) matching known astrophysical data as a macroscopic scale check. In executing this process, only two standard metrics were required, primarily the value for c as distance (as an analogue for *space*) and the charge of the electron e_c (as an analogue for *time*), to populate the remainder of the Temporal Mechanics derived equations proposed for physical phenomena, subsequently matching known physical phenomenal equations together with their associated constants. Such is precisely what a self-checking theoretic system based on a zero-dimensional mathematics should achieve.

5. Conclusion

The proposal here therefore is:

(xlii) The use of mathematics for physical phenomena will and must accommodate for an incomplete mathematical physics theory if not for using the basic required mathematical axiom of zero-dimensional space for a time-moment for any such theory to be complete.

Although labelling physical phenomena with mathematical objects works, and sufficiently so as basic physical phenomena is concerned, such only works for physical phenomena and not the dimensions of time and space unless executed there fundamentally so. There on a zero-dimensional level for space and momentary level for time it can be shown how mathematics forms the basis for 1d, 2d, and 3d *timespace*. In bypassing this level, significant errors are mathematically shown to occur ([45]: p29, (clxi-clxiv), eq1-2), the real question there being the social significance of such errors given that an incomplete yet all pervasive physics and associated technology would undoubtedly represent *an issue* to what is really happening with nature, an issue which could severely impact the conscious wellbeing of our species [69].

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, Gravity's Emergence from Electrodynamics,

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, Golden Ratio Axioms of Time and Space, 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, The Emergence of Consciousness from Chaos, 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, Phi-Quantum Wave function Crystal Dynamics, 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, Time as Energy, 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, The Relativity of Time, 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, Golden Ratio Entropic Gravity: Gravitational Singularity Field Testing, 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, The Golden Ratio Time Algorithm, 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, The Physics Chimera, 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, The Conception of Time, 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, Space, and the propagation of Light, 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, Space, and the Nature of Gravity, 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, Space, and the Redshift Effect, 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, Solving The Cosmological Constant Problem, 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, Hybrid Time Theory: “Euler’s Formula” and the “Phi-Algorithm”, 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, The Hybrid Time Clock as a Function of Gravity, 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, Hybrid Time Theory: Cosmology and Quantum Gravity (I), 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, Scientific Principles of Space, Time, and Perception, 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, Hybrid Time Theory: Cosmology and Quantum Gravity (II), 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, Mathematical Principles of Time and Energy, 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, Dimensional Mechanics of Time and Space, 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, Dimensional Thermodynamics, 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, Time-Space Wave-Mechanics, 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, Temporal Calculus (The Calculus of Time-points in Space), 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, Temporal Calculus: solving the “Yang-Mills Existence and Mass Gap” problem., 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, Temporal Calculus: Time Scaling Space, 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.2.2.20191.07844, Temporal Calculus: Resolving Elementary Particle Formation and Confinement, https://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, Temporal Calculus: Resolving Einstein's Theory of Relativity (Special and General), 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, Time and Non-Locality: Resolving Bell's Theorem, 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, Non-Local Time-Point Theory: Magnetic Quantum Shell (MQS) Modelling, 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, Temporal Mechanics (A): Time-Space Circuits, 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, Temporal Mechanics (B): Time-Space Constants, 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, Temporal Mechanics (C): Time-Space Manifolds, 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, Temporal Mechanics (D): Time-Space Metrics, 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, Temporal Mechanics (E): Time-Space Logistics, 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, Quantum Gravity, and the calculation of maximum SOL mass, 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, An Axiom of Time resolving Entropy, CP violation, and the isotropic CMBR, 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, Temporal Mechanics, and EM-DIR "particle pair production", 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, Temporal Mechanics, and the derivation of an electron degeneracy neutrino, Gravity constant (G), fine structure constant (α), Planck constant (h), and the phenomenal values of Sol, 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), https://doi.org/10.13140/rg.2.2.19674.67529/5, 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://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, A time-equation thought experiment deriving 3D space as timespace in forming the basis for particle and field phenomena, 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), https://doi.org/10.13140/rg.2.2.23272.75521/3, The Temporal Mechanics XEMDIR field resolving zero-point energy, negative energy, anti-EM, anti-gravity, symmetry breaking, and Baryon asymmetry, 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, The Mathematics of Zero-Dimensional Space, 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, A mathematical analysis of zero-dimensionality in deriving the natural numbers, offering a solution to Goldbach's conjecture and the Riemann hypothesis, 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.2.2.24087.85921/2, A foundational zero-dimensional scaling system mandating the principle of relativity and the associated constancy of the speed of light in a vacuum, 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. *Newton, Issac (1999) [1726 (3rd ed.)].* *Philosophiæ Naturalis Principia Mathematica* *[Mathematical Principles* of Natural Philosophy]. The Principia: Mathematical Principles of Natural Philosophy. Translated by Cohen, I. Bernard; Whitman, Anne; Budenz, Julia. Includes "A Guide to Newton's Principia" by I. Bernard Cohen, pp. 1–370.
47. https://en.wikipedia.org/wiki/Lambda-CDM_model, webpage accessed 30th April 2022.
48. Einstein, A. (1916). Relativity: The Special and General Theory. Retrieved 2012-01-23. Einstein, A. (1916). Relativity: The Special and General Theory. New York: Three Rivers Press (published 1995). ISBN 978-0-517-88441-6 – via Albert Einstein Reference Archive.

49. https://www.scientificamerican.com/article/follow-up-what-is-the-zer/, webpage accessed 30th April 2022.
50. Peebles, P. J. E.; Ratra, Bharat (2003). "The cosmological constant and dark energy". Reviews of Modern Physics. 75 (2): 559–606. arXiv:astro-ph/0207347. Bibcode:2003RvMP...75..559P.
51. Trimble, V. (1987). "Existence and nature of dark matter in the universe" (PDF). Annual Review of Astronomy and Astrophysics. 25: 425–472. Bibcode:1987ARA&A..25..425T. doi:10.1146/annurev.aa.25.090187.002233.
52. Alan B. Whiting (2004). "The Expansion of Space: Free Particle Motion and the Cosmological Redshift". The Observatory. 124: 174. arXiv:astro-ph/0404095. Bibcode:2004Obs...124..174W.
53. Hubble, Edwin (1936). "Effects of Red Shifts on the Distribution of Nebulae". The Astrophysical Journal. 84 (11): 621–627. Bibcode:1936ApJ....84..517H. doi:10.1086/143782. PMC 1076828. PMID 16577738.
54. Corbelli, E.; Salucci, P. (2000). "The extended rotation curve and the dark matter halo of M33". Monthly Notices of the Royal Astronomical Society. 311 (2): 441–447. arXiv:astro-ph/9909252. Bibcode:2000MNRAS.311..441C. doi:10.1046/j.1365-8711.2000.03075.x
55. https://www.merriam-webster.com/dictionary/axiom, webpage accessed 30th April 2022.
56. https://encyclopediaofmath.org/index.php?title=Euclidean_space, webpage accessed 30th April 2022.
57. Hilbert, David; Nordheim, Lothar Wolfgang; von Neumann, John (1927), "Über die Grundlagen der Quantenmechanik", Mathematische Annalen, 98: 1–30, doi:10.1007/BF01451579, S2CID 120986758.
58. Howell, Kenneth B. (2001). Principles of Fourier Analysis. CRC Press. ISBN 978-0-8493-8275-8.
59. Lorentz, Hendrik Antoon (1904). "Electromagnetic phenomena in a system moving with any velocity smaller than that of light" . Proceedings of the Royal Netherlands Academy of Arts and Sciences
60. https://plato.stanford.edu/entries/hilbert-program/, webpage accessed 30th April 2022.
61. David Hilbert and Wilhelm Ackermann (1928). Grundzüge der theoretischen Logik (Principles of Mathematical Logic). Springer-Verlag, ISBN 0-8218-2024-9.
62. Kurt Gödel (1931), "Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme I". Monatshefte für Mathematik und Physik 38: 173–198. doi:10.1007/BF01700692.
63. Turing, A. M. (1937). "On Computable Numbers, with an Application to the Entscheidungsproblem". Proceedings of the London Mathematical Society. Wiley. s2-42 (1): 230–265. doi:10.1112/plms/s2-42.1.230. ISSN 0024-6115., Turing, A. M. (1938). "On Computable Numbers, with an Application to the Entscheidungsproblem. A Correction". Proceedings of the London Mathematical Society. Wiley. s2-43 (1): 544–546. doi:10.1112/plms/s2-43.6.544. ISSN 0024-6115.
64. Joyce, James (2003), "Bayes' Theorem", in Zalta, Edward N. (ed.), The Stanford Encyclopedia of Philosophy (Spring 2019 ed.), Metaphysics Research Lab, Stanford University, retrieved 2020-01-17
65. Freedman, D.A. (2005) Statistical Models: Theory and Practice, Cambridge University Press. ISBN 978-0-521-67105-7
66. https://www.claymath.org/millennium-problems/riemann-hypothesis, webpage accessed 30th April 2022.
67. Schmidt, A; Thews, G (1989). "Autonomic Nervous System". In Janig, W (ed.). Human Physiology (2 ed.). New York, NY: Springer-Verlag
68. Einstein, A. (1917). "Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie". Sitzungsberichte der Königlich Preußischen Akademie der Wissenschaften. Berlin, DE. part 1: 142–152.
69. America's Climate Choices: Panel on Advancing the Science of Climate Change; National Research Council (2010). Advancing the Science of Climate Change. Washington, D.C.: The National Academies Press. ISBN 978-0-309-14588-6.