The Nature of Space and Time

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Abstract

This paper presents a novel perspective on the nature of space and time, arguing for the coexistence of both absolute and relative aspects at the classical level and the existence of only absolute aspects at the quantum level. We propose using various arguments that the static space-in-itself exists as absolute space and the universal objective present moment with an infinitesimal duration continuously exists as absolute time in the universe since its creation until the present, along with the measured space being relative space and the measured time being relative time. We also prove the continuous nature of absolute and relative space, absolute and relative time, and relative spacetime and, thus, challenge all theories that use discrete relative space or discrete relative time or discrete relative spacetime, such as loop quantum gravity and causal set theory, among others.

This framework dissolves several fundamental problems: the quantum gravity question by proving its impossibility due to the absence of reference frames at quantum scales, the unified field theory question by proving its impossibility by showing gravity's classical-only nature, whereas electromagnetic force being present at quantum and classical level both, and the wave-particle duality through establishing universal quantum fields/waves as the sole quantum reality with each of these fields being one singular reality with varying level of intensity at different spatial regions in the universe and with continuous non-deterministic interactions explaining quantum phenomena without randomness while preserving causality and particles being just the emergent reality at the classical level. We also disprove string theory and any potential higher spatial dimensional theory using fundamental logic. Thus, this comprehensive framework completes Einstein's unfinished revolution in understanding space, time, and physical reality at both quantum and classical levels.

1 Introduction

The nature of space and time has been a subject of intense debate in physics and philosophy. Newton postulated absolute space, absolute time, relative space, and relative time [1]. While Einstein's theories of relativity have led to widespread acceptance of the relativity of space and time [2, 3], this paper argues for a more nuanced view, incorporating both absolute and relative aspects. This framework proves gravity as well as the particles to be the emergent phenomena at the classical level, whereas at the quantum level, the only reality is various universal quantum fields, with each quantum field being one singular reality without any parts/divisions due to the impossibility of the existence of zero-dimensional points in physics at the fundamental quantum level which any strict boundary will imply. Despite being one singular reality, every quantum field has different field intensities at different spatial regions, which change continuously due to interaction with other quantum field(s). This framework dissolves all major open problems like quantum gravity, unified field theory, and wave-particle duality, and by proving the continuous nature of absolute space, absolute time, and, hence, relative space, relative time, and relative spacetime, we disprove all discrete theories like loop quantum gravity, causal set theory, etc. also. Further, we disprove string theory at the fundamental level and any potential higher dimensional theory postulating more than three spatial dimensions.

2 Absolute Space: The Static Space-In-Itself

We propose the existence of absolute space as a static, underlying substrate with the following properties:

- Ontological/Existential necessity: immovability and immunity to the fundamental cause/container from its effects/contents

- Expansion at its boundaries without any internal motion

- The thought experiment of all reference frames at rest

2.1 Arguments for the Static Space-In-Itself Being Absolute Space

2.1.1 Ontological/Existential Necessity: Immovability and Immunity to the Fundamental Cause/Container From Its Effects/Contents

The existence of the physical phenomena necessitates a fundamental substrate in which they occur [1]. When everything else, including all fields, particles, radiations, forces, laws and reference frames exists inside the space-in-itself, the space-in-itself that already exists cannot move because what will move it because the contents or the effects (here, the existence of everything else) by logical necessity cannot influence its fundamental cause (the space-in-itself) on which they depend for their own existence.

2.1.2 Expansion at Its Boundaries Without Any Internal Motion

The expansion of the universe[4] is due to the creation of new space-in-itself at the boundaries rather than the expansion of the existing space-in-itself which is static as already proved above in the argument of the ontological/existential necessity.

2.1.3 The Thought Experiment of All Reference Frames at Rest

Consider a thought experiment where all reference frames in the universe are at rest relative to each other. In this hypothetical scenario, the effects of relativity as we observe them would not manifest, leaving only the underlying static space-in-itself as absolute space. While physically unrealizable, this thought experiment helps illustrate the concept of absolute space that underlies our theory, existing independent of the relative motions of various reference frames that give rise to the relativistic effects in our observable three-dimensional universe at the classical level.

3 Absolute Time: The Universal Objective Present Moment With an Infinitesimal Duration

We propose that absolute time has continuously existed in the universe since its creation until the present in the form of the universal objective present moment, characterized by:

- An infinitesimal duration
- The foundation for the causal relationships for various physical processes

3.1 Arguments for Absolute Time

In the universe, some physical process - defined as one or more cause events causing one or more effect events - has always existed in the universe since its creation until the present. If no physical process were to exist at any moment in the universe after its creation, then no physical process would exist later also because then an event in the universe will have to exist without any cause, which is a logical impossibility. Thus, there is a continuous causal chain in the universe since its creation until the present through continuous physical processes and will continue.

Also, the universe is bound to always have some physical process continuously as long as it exists because of the following reasons:

- **Causality and the Laws of Physics:** Every physical process involves cause-and-effect relationships. The absence of any physical process implies that no events occur and no changes happen, which contradicts the very nature of the universe as an evolving system governed by physical laws.
- **Continuity and Existence:** For the universe to exist, something must maintain it. Without processes, the concept of a "universe" becomes meaningless because there would be no way to distinguish it from non-existence.
- **Logical Necessity of Processes:** If at any point no physical process exists, then no subsequent process could logically emerge without

violating causality. A processless state would entail absolute stasis or non-existence, and once established, it would prevent any further development, making the universe itself impossible.

- **Initial Conditions and Singularities:** Even theoretical discussions regarding the universe's origin, such as the Big Bang or initial singularity, involve physical processes. The expansion from a singularity, the transition from quantum fluctuations, or any proposed origin still depend on some fundamental process.

Every physical process, by its fundamental nature, has one or more effect events preceded by one or more cause events, with there being the gap of a moment with an infinitesimal duration between them to ensure their causal relationship as well as separation because by the very nature of causality, the cause event (s) has to precede the effect event (s) rather than being absolutely simultaneous with it but this gap should be minimum possible to establish causality which can be only of an infinitesimal duration. Since the causal laws of physics are invariant across all reference frames as per the fundamental principle of physics, this moment separating one or more effect events from one or more cause events with an infinitesimal duration exists in the universe in all reference frames continuously in the universe since reference frames emerged after the size of the universe crossed quantum spatial scale (related to Planck length as per the current knowledge of physics) until the present. This moment is the universal objective present moment with an infinitesimal duration.

And at quantum level, absolute time exists to separate continuous effect event (s) from its cause event(s) even when only quantum reality existed in the beginning of the universe and even after quantum and classical realities co-existed after the emergence of classical reality upon the expansion of the initial universe beyond quantum spatial scale (related to Planck length as per the current knowledge of physics)

The concept of causality is foundational in both classical and quantum physics. While classical mechanics presents a deterministic universe where the state of a system at one time completely determines its state at all future times, quantum mechanics introduces probabilistic outcomes. However, even in quantum mechanics, these probabilistic events are governed by the underlying causal laws. We expand on the key aspects of causality in quantum mechanics below:

1. **Probabilistic Causality:** In quantum mechanics, the outcomes of measurements are inherently probabilistic, a feature that distinguishes it from classical mechanics. However, this probabilistic nature does not imply a lack of causality. The evolution of the quantum system, governed by the Schrödinger equation, is deterministic. The wave function of a quantum system evolves deterministically over time and this evolution determines the probabilities of different outcomes. Even though we cannot predict the exact result of a single measurement, the causal laws dictate the statistical distribution of results over many measurements [5].

2. **Quantum State Evolution:** The evolution of quantum states follows strict causal rules, even if the outcomes of measurements are not deterministic [6].

3. **Heisenberg Uncertainty Principle:** While this principle limits our ability to simultaneously know the specific pairs of physical properties precisely, it does not negate causality. Causality is preserved because the uncertainty principle applies uniformly across the quantum system, meaning that even though we cannot measure both properties precisely, the evolution of the quantum system is still governed by the causal laws [7].

4. **Quantum Field Theory:** In Quantum Field Theory (QFT), the quantum fields mediate the fundamental interactions, and these interactions are described using the causal propagators. These propagators ensure that the effects propagate in a manner consistent with causality — no signal or influence can travel faster than light. QFT preserves the causal structure, ensuring that the cause event precedes the effect event at all scales, even when dealing with the creation and the annihilation of the particles [8].

Thus, the existence of the universal objective present moment with an infinitesimal duration or absolute time continuously in the universe since its creation until the present is across all scales in this universe and is an invariant property of the universe.

3.2 The Continuous Nature of the Static Space-In-Itself or Absolute Space: A Logical Necessity Due to the Continuous Nature of Absolute Time

Since the universal objective present moment with an infinitesimal duration or absolute time has continuously existed in the universe since its creation until the present and since the universal objective present moment exists in the static space-in-itself or absolute space, hence, the static space-in-itself or absolute space is also continuous by logical necessity. If the static space-in-itself or absolute space were discrete, it would make everything existing in it, including the universal objective present moment, also discrete, which is not the case, as the universal objective present moment with an infinitesimal duration has existed continuously in the universe since its creation until the present, as already proved earlier.

4 The Impossibility of the Existence of Zero-Dimensional Points in Physics or the Universe Implying No Reference Possible at the Quantum Level

4.1 Zero-Dimensional Points Cannot Exist in Physics or the Universe: Proving the Continuous Nature of Absolute Space and Disproving String Theory

A zero-dimensional point, by definition, has no extension in any dimension, and, thus, it occupies no space. Something that occupies no space cannot exist in the physical reality or space. Thus, zero-dimensional points cannot exist in physics or the universe at any spatial level, be it quantum or classical. This is a fundamental logic. This proves the continuous nature of absolute space as a discrete nature of absolute space will imply the illogical existence of zero-dimensional points along with the continuous nature of absolute time already proved in the very arguments for the existence of absolute time in the earlier section.

- One-dimensional lines or line segments or physical objects also cannot exist in physics or the universe at any spatial level, be it quantum or classical, because of their ontological/existential dependence on the existence of zero-dimensional points.

- Extending it further, two-dimensional planes or planar segments or physical objects also cannot exist in physics or the universe at any spatial level, be it quantum or classical, because of their ontological/existential dependence on the existence of one-dimensional lines or line segments.
- And any strict boundary also cannot exist in physics or the universe at any spatial level, be it quantum or classical, because of their ontological/existential dependence on the existence of zero-dimensional points at the boundary level inside any part of the universe.

This disproves the fundamental premise of string theory, where the fundamental reality of the universe is one-dimensional strings, thereby, disproving string theory itself. This being a logically sufficient disproof of the string theory, the below logic is just for the sake of the completeness at the factual level rather than out of any logical necessity for disproving string theory which stands disproved by the very premise of one-dimensional strings requiring the impossible existence of zero-dimensional points in physics or the universe.

4.1.1 The Compactification of the Spatial Dimensions Is a Mathematical Property That Has No Relation With Physics

The various analogies of the compactification of the spatial dimensions that the string theory produces are also illogical because, in physics or the observed three-dimensional universe, everything is always three-dimensional and, so, a three-dimensional doughnut cannot be compactified into a two-dimensional circle nor a three-dimensional cylinder can be compactified into a one-dimensional line segment in physics or the observed three-dimensional universe. The compactification of the spatial dimensions is a mathematical truth that has no relationship with the physical universe inhabited by us, which we all know to be three-dimensional through direct as well as indirect evidence. Also, the analogy of not seeing a cylinder from the eyes after it reaches far enough distance from us used in string theory to explain the compactification of the spatial dimensions does not make sense because a cylinder remains three-dimensional whether an observer sees it or is unable to see it due to being at a far enough distance from it. All our senses have their lower and upper range, but the space experienced by all our senses and physical movements is always three-dimensional.

All the analogies used by string theory to explain why we do not experience extra spatial dimensions beyond the observed three spatial dimensions confuse a concept of mathematics, namely, the compactification of mathematical spatial dimensions, with physics or the observed universe, which has three spatial dimensions and, thus, the string theory is not logical on theoretical grounds themselves.

4.2 Challenges for All Higher Spatial Dimensional Physical Theories Including String Theory

4.2.1 The Logical Impossibility of Any Direct Experimental Verification

Since all fields, particles, radiations, forces and laws that have been experimentally verified are based on the observed three-dimensional space, hence, every physical measurement, whether directly by the observer or indirectly through some physical process, will give the direct experimental verification for the three-dimensional space only. Thus, any physical theory that uses more than three dimensions of space will never have any direct experimental verification, and any supposed indirect verification will also not be foolproof because some other physical theory based on the three-dimensional space that will explain the measured results will have to be given more credence over any physical theory using more than three dimensions of space even if both of them explain the measured results because of the observed three-dimensional nature of the universe making the former's experimental verification direct and the latter's experimental verification indirect.

4.2.2 The Fundamental Challenges of an Infinite Number of Three-Dimensional Universes and the Complexity of the "Up," or "Down," or "Both" Directions

If we introduce even one extra spatial dimension to the observed three-dimensional universe, we will have an infinite number of parallel three-dimensional universes, with each infinitesimal movement along the fourth spatial dimension causing a new three-dimensional universe. This will have the following fundamental challenges:

1. There is no way to experimentally verify directly or indirectly an infinite number of three-dimensional universes existing together, making this a theoretical construct.

2. From the reference frame of the observed three-dimensional universe, a complex question will arise: whether the fourth spatial dimension is in the "Up," or "Down," or "Both" directions, which would be impossible to directly or indirectly verify through any observation.

3. Nor can there be any proper argument to introduce an infinite number of three-dimensional universes in physics in light of the fact that various theories using the observed three-dimensional space, such as Einstein's theory of special relativity, Einstein's theory of general relativity, quantum mechanics and quantum field theory have already very strong experimental validation.

4. Violation of Parsimony: The existence of an infinite number of three-dimensional universes drastically violates the principle of parsimony (Occam's Razor). It introduces enormous unobservable and unnecessary complexity to our understanding of the universe.

5. Conservation Laws: The existence of infinite three-dimensional universes would complicate our understanding of conservation laws. Energy, momentum, and other conserved quantities must be considered across infinite three-dimensional universes, leading to paradoxes or untestable hypotheses.

6. If we assume the fourth spatial dimension, we will have to completely reformulate existing highly successful three-dimensional theories like Einstein's special relativity, general relativity, quantum mechanics, quantum field theory, the cosmological model based on the Big Bang, and the evolution of the universe, among others, with the three possibilities of the assumed fourth spatial dimension being in the "Up," or "Down," or "Both" directions from our observed three-dimensional universe. All these may bring a high level of complexity without any clear benefits in light of the impossibility of any direct or indirect experimental verification of this supposed extra fourth dimension and any logical basis available to choose between the three possibilities for the assumed fourth spatial dimension.

7. If this is the level of complexity introduced by assuming just one extra spatial dimension beyond the observed three spatial dimensions, the complexity will only keep getting worse, bringing more and more fundamental challenges without any logical resolution by assuming even more than one extra spatial dimensions beyond the observed three spatial dimensions of the universe.

4.2.3 Difference between Mathematics and Physics

Now, we will discuss the difference between mathematics and physics or the observed three-dimensional universe. Mathematics is a logical reality that exists in our mind, some parts of which correspond to physics or the observed three-dimensional universe, and the rest exist just in our mind. A zero-dimensional point, a straight line, a plane or "more than three"-dimensional space exists in mathematics but in physics or the observed universe, only three-dimensional space exists. For example, a point is a mathematical object with no length, width, or height, meaning a point is a purely mathematical concept and does not exist in the observed three-dimensional universe. Similarly, a line or line segment is a mathematical object that has only length, no width and no height, and consists of an infinite number of points. But, since the point itself does not exist in the observed three-dimensional universe, a line or line segment will also not exist in the observed three-dimensional universe. Similarly, a plane or a plane segment is a mathematical object made of two intersecting lines. But, since the line itself does not exist in the observed three-dimensional universe, the plane or planar object will also not exist in the observed three-dimensional universe. Similarly, a strict boundary will also not exist in the observed three-dimensional universe because that will imply the illogical existence of zero-dimensional points in the observed three-dimensional universe. While mathematical points, lines, planes and strict boundaries do not have direct physical counterparts, they are useful idealizations or approximations in describing the physical phenomena in the observed three-dimensional universe.

One-dimensional string, postulated by string theory as the fundamental building blocks of the universe, violates the logic given above by postulating the illogical existence of zero-dimensional points in physics. Further, at the given universal objective present moment with an infinitesimal duration, the string will not have any movement and needs to exist, requiring the illogical existence of zero-dimensional points in physics or the observed three-dimensional universe. Even any vibration of a one-dimensional string can create only a strict boundary, which again requires the illogical existence of zero-dimensional points in physics or the observed three-dimensional universe.

4.3 At the Quantum Level, Universal Quantum Fields Are the Sole Reality Each Being an Indivisible/Singular/Whole Universal Reality Without Any Constituent Parts

From the arguments given in the earlier section, it follows that at the quantum level, universal quantum fields are the sole reality, each being an indivisible/singular/whole universal reality without any constituent parts because otherwise, it will imply the presence of some strict boundary (-ies) which is already disproven in the above section based on its ontological/existential dependence on the impossible existence of zero-dimensional points in physics or the universe.

Having established this, we will consider its implications in a new section for the sake of clear presentation for the various questions on the nature of reference frames and, hence, relative space, relative time, relative space-time, and its implications for the questions of gravity and, hence, quantum gravity and unified field theory, the wave-particle duality and the real non-deterministic and probabilistic but causal and hence, non-random nature of the quantum level.

5 Fundamental Implications of the Universal Quantum Fields Being the Fundamental Indivisible/Singular/Whole Universal Realities

5.1 No Reference Frame or Particle Can Exist at the Quantum Level: Proving Relative Space, Relative Time and Relative Spacetime Being Purely Classical Level Reality and, Thereby, Solving the Question of Gravity and Dissolving the Questions of Quantum Gravity and Unified Field Theory

As proven earlier, universal quantum fields are the fundamental indivisible/singular/whole universal realities. Hence, at the quantum level, there is no local/non-universal reality, which disproves the very possibility of the existence of any reference frame or particle at the quantum level, proving that both reference frames as well as particles are the local/non-universal emergent rather than fundamental reality as perceived at the spatially larger classical level which itself is the emergent reality with the quantum level being the foundational/constituent reality of the spatial larger classical reality as well.

This implies that both special relativity and, hence, general relativity, which depends on the existence of reference frames, do not exist at the quantum level but exist at the classical level only as the emergent features. That is the same as saying that relative space is the measured space existing at the classical level only and relative time is the measured time existing at the classical level only, which means even relative spacetime, which is the combined effect of relative space and relative time, exists only at the classical level. Now, since Einstein's Theory of General Relativity establishes logically and whose conclusions have been empirically verified that gravity arises due to the curvature in relative spacetime, it proves that gravity exists at only the classical level and that there is no gravity possible at the quantum level. This dissolves the very question of quantum gravity and unified field theory, the former due to the absence of gravity at the quantum level it, being an emergent classical rather than a fundamental quantum phenomena, and the latter due to the mutual incompatibility of gravity and electromagnetic force which exists at the quantum level as the fundamental force with its range of effect visibly present at even the classical level.

5.2 Compatibility With the Relativity of Simultaneity in Einstein's Theory of Special Relativity

Einstein's theory of special relativity shows that simultaneity is relative to the observer's reference frame [2]. However, this relativity of simultaneity is about two unrelated events rather than the cause and effect events. Further, the simultaneity of two events cannot be practically established in any reference frame as every measurement of two events will always have discreteness because every measurement uses the detection and differentiation of at least two events as per the fundamental principle of measurement.
This fundamental principle of measurement implies that there will be a minimum value of measurement for every physical quantity, which further implies that the continuity of any physical quantity, even if it exists, cannot be established directly through its measurement. Therefore, the simultaneity of two events cannot be measured or directly established through any experiment.

Just like the universal objective present moment with an infinitesimal duration is absolute time, the measured time - which, as per the fundamental principle of measurement already discussed earlier, is always finite (of more than zero as well as of more than an infinitesimal duration) - is relative time of Einstein's theory of special and general relativity. The universal objective present moment with an infinitesimal duration cannot be measured by any physical instrument that measures only the finite relative time.

5.3 The Continuous Nature of Relative Space, Relative Time and hence, Relative Spacetime: Disproving All Discrete Physical Theories

5.3.1 The Continuous Nature of Relative Space, Relative Time and hence, Relative Spacetime Logically Proved

Since every measurement will measure only a minimum finite value of relative space, relative time and even any other physical quantity as per the fundamental principle of measurement, no direct experimental logic can be given for establishing the continuity of relative space, relative time, and hence, relative spacetime.

Since absolute space and absolute time are continuous, hence, relative space and relative time are also continuous due to the following fundamental logic independent of the need for any corroboration by any experimental results of even indirect type:

1. **Property Inheritance/Conservation:** Since absolute space and absolute time are the underlying reality, and relative space and relative time are their respective measured manifestations at the classical level, hence, relative space and relative time must inherit and conserve the fundamental properties of absolute space and absolute time respectively. Continuity is a fundamental property of absolute space and absolute time. Therefore, relative space and relative time must inherit and conserve the property of continuity.

2. **Subset Principle:** Relative space and relative time can be considered a subset of absolute space and absolute time respectively, as they represent the measurable portion of absolute space and absolute time respectively. In mathematics, a subset of a continuous set is itself continuous (within the bounds of the subset). Therefore, relative space as a subset of continuous absolute space and relative time as a subset of continuous absolute time must also be continuous.

3. **Causal Chain Preservation:** Absolute time ensures a continuous causal chain in the universe. Relative time must preserve this causal chain to maintain the validity of the physical laws in a reference frame. Preserving a continuous causal chain requires relative time to be continuous, and the continuity of relative time establishes the continuity of relative space because if relative space were discrete, relative time would also become discrete due to its dependence on the relative spatial measurement (s) in Einstein's theory of special and general relativity.

Since relative space and relative time are continuous, relative spacetime, which is their combined effect, is also continuous by the fundamental property of the combination of two continuous quantities also being continuous. The measurement of relative space, relative time, and relative spacetime will always have a minimum finite value as per the fundamental principle of measurement.

For the sake of the completeness of factual details rather than any logical necessity, we give indirect experimental logic based on the experimental evidence for special relativity, general relativity and quantum mechanics, all of which use continuous relative space and continuous relative time.

Special relativity assumes continuous relative space and continuous relative time. Its key equations, such as the Lorentz transformation, are continuous functions:

$$t' = \gamma(t - vx/c^2), \quad x' = \gamma(x - vt) \tag{1}$$

where $\gamma = 1/\sqrt{1 - v^2/c^2}$ is the Lorentz factor [2].

Numerous experiments have validated special relativity to high precision. For example:

- Michelson-Morley experiment: Demonstrated the constancy of the speed of light, a key postulate of special relativity. [11].
- Kennedy-Thorndike experiment: Confirmed time dilation and length contraction [12].
- Ives-Stilwell experiment: Verified the relativistic Doppler effect [13].

These experiments consistently align with the predictions of special relativity, indirectly supporting the underlying assumption of continuous spacetime.

General relativity extends the concept of continuous spacetime based on continuous relative space and continuous relative time to curved geometries. The Einstein field equations describe this relationship:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \tag{2}$$

where $G_{\mu\nu}$ is the Einstein tensor, Λ is the cosmological constant, $g_{\mu\nu}$ is the metric tensor, G is Newton's gravitational constant, and $T_{\mu\nu}$ is the stress-energy tensor [3].

Key experiments validating general relativity include:

- Gravitational lensing: First observed during a solar eclipse by Eddington, confirming the bending of light by massive objects [14].
- Gravitational waves: Detected by LIGO, confirming the propagation of gravitational disturbances through spacetime [15].

- Gravity Probe B: Measured frame-dragging and geodetic effect, confirming predictions about the nature of spacetime around rotating masses [16].

The success of these experiments in confirming general relativity's predictions indirectly supports the theory's underlying assumption of continuous relative space, continuous relative time and continuous spacetime.

While quantum mechanics introduces discreteness in certain physical quantities, it still relies on continuous relative space and continuous relative time in its formulation. The Schrödinger equation, a fundamental equation in quantum mechanics, assumes continuous relative space and continuous relative time:

$$i\hbar \frac{\partial}{\partial t} \Psi(x,t) = \hat{H} \Psi(x,t) \tag{3}$$

where $\Psi(x,t)$ is the wave function and $\hat{H}$ is the Hamiltonian operator [17].

Quantum mechanics has been validated by numerous experiments, including:

- Double-slit experiment: Demonstrated wave-particle duality and the probabilistic nature of quantum mechanics [10].
- Stern-Gerlach experiment: Confirmed the quantization of angular momentum [9].
- Quantum entanglement experiments: Verified the non-local nature of quantum correlations [18].

The success of these experiments in confirming quantum mechanical predictions indirectly supports the theory's underlying assumption of continuous relative space and continuous relative time. The Planck length and Planck time do not contradict the fundamental continuity of relative space and relative time; they are rather the current limits of our measurement capabilities, which align with the fundamental principle of measurement, allowing only for a minimum finite value of the measurement of every physical quantity.

5.3.2 All Discrete Physical Theories Assuming Discrete Relative Space or Discrete Relative Time or Discrete Relative Spacetime Stands Disproved

1. Loop Quantum Gravity (LQG) [19]: LQG is an attempt to merge quantum mechanics and general relativity. It proposes that relative space and relative time are quantized at the Planck scale, represented by spin networks and spin foams, and, thus, relative spacetime has a granular structure composed of discrete units. LQG suggests that relative space is composed of finite loops woven into an extremely fine fabric with a minimum measurable area.

2. Causal Set Theory [20]: Causal set theory proposes that relative spacetime is fundamentally discrete and that the relative spacetime continuum emerges from a vast collection of discrete elementary events connected by causal relationships. It aims to reconcile quantum mechanics with gravity by discretizing relative spacetime while maintaining Lorentz invariance.

3. Quantum Graphity [21]: Quantum graphity proposes that relative space emerges from a more fundamental, discrete graph-like structure. It proposes that the universe started in a highly connected state and evolved to its current state through a phase transition.

4. Cellular Automata Models of Universe [22]: These models propose that the universe operates like a vast cellular automaton, with relative space and relative time discretized into a grid of cells that evolve according to simple, local rules. This approach attempts to explain complex physical phenomena emerging from simple, discrete underlying mechanisms.

5. Regge Calculus [23]: This theory uses a method for approximating general relativity using piecewise flat simplicial complexes, thus, treating relative spacetime as discretizable. It is originally a classical (non-quantum) approach.

6. Simplicial Quantum Gravity [23]: This theory approximates curved relative spacetime with flat simplices, creating a piecewise linear manifold. It aims to provide a discrete formulation of general relativity that could be more amenable to quantization.

7. Causal Dynamical Triangulations (CDT) [24]: A approach to quantum gravity that discretizes relative spacetime into simplicial complexes and uses Monte Carlo simulations to study the resulting quantum geometry, aiming to show how classical relative spacetime might emerge from quantum fluctuations of geometry. Simplicial Quantum Gravity does not inherently enforce a causal structure, but CDT explicitly maintains a causal structure by distinguishing between relative space like and relative time like edges in the simplicial complex.

8. Digital Physics [25]: This theory hypothesizes that the universe is fundamentally information-based and that all physical processes can be viewed as computations. It suggests that reality might be discrete at its core, analogous to the discrete nature of digital information processing.

9. Some Formulations of Quantum Einstein Gravity [26]: Some formulations of quantum Einstein gravity suggest an effective discreteness of relative spacetime at very small scales due to quantum effects. This approach uses renormalization group techniques to study how gravity behaves at different energy scales.

10. String-net Condensation [27]: While primarily a theory of emergent gauge fields and fermions, string-net condensation suggests that continuous relative space itself might emerge from the condensation of extended objects in a discrete spin model, providing a potential mechanism for the emergence of relative spacetime from discrete structures.

5.3.3 Quantum Gravity Theories Using the Continuous Nature of Relative Space, Relative Time, and Relative Spacetime Disproven due to the Dissolution of the Question of Quantum Gravity itself

Since we dissolved the question of quantum gravity by proving the essential nature of gravity as a classical reality only which cannot exist at the quantum level at all in the earlier part of this paper, we mention other wrong theories using the continuous nature of relative space, relative time, and relative spacetime below for the sake of the completeness of the factual details.

- Quantum Foam [29]: This theory suggests that at extremely small scales, spacetime has a dynamic, foam-like fluctuating structure due to quantum fluctuations, with virtual particles and miniature black holes constantly appearing and disappearing. This is part of the attempt to reconcile general relativity with quantum gravity. Quantum foam can be interpreted as continuous spacetime that experiences quantum fluctuations at extremely small scales rather than being composed of discrete units.

- Twistor Theory [30]: This theory aims to unify quantum mechanics and general relativity by representing spacetime points using mathematical objects called twistors. Twistor space is continuous. The theory reformulates physics in terms of holomorphic functions in complex projective space, which is a continuous mathematical structure. Twistor theory provides an alternative description of spacetime rather than discretizing it. It relates points in Minkowski space to certain geometric objects (twistors) in a complex space. Twistor theory does not inherently contradict the notion of continuous spacetime. It offers a different mathematical framework for describing spacetime events, but this framework is itself continuous.

- Group Field Theory (GFT) [31]: GFT is a quantum field theory, but instead of being defined on spacetime, it is defined on a group manifold (hence the name). The fundamental entities in GFT are fields that live on several copies of a group manifold. The excitations of these fields represent the quanta of space. The excitations of these fields are localized, but that does not mean these excitations being an indivisible part of the group fields will necessarily make the relative space or spacetime discrete. It is possible to interpret GFT in a way that maintains the underlying continuity of the relative space and spacetime, with the quanta representing indivisible excitations of a continuous group field.

5.4 Implications for the Questions of the Wave-Particle Duality and the Nature of Quantum Measurement

5.4.1 The Wave-Particle Duality Does Not Really Exist Except as an Appearance at the Classical Level

As proven earlier, no reference frame or particle can exist at the quantum level. Hence, the wave-particle duality is not the fundamental duality of the quantum level but is the emergent duality of the classical level due to the nature of the measurement process itself influencing the underlying quantum field, which creates enough excitation(s) in its intensity to give the apparent emergence of particles from the perspective of the classical observers and their observation process. But, if the measurement process happens in a different way, there is not enough excitation(s) in the intensity of the underlying universal quantum field to create the emergent particle (s), leading to the appearance of the wave behavior at the classical level.

5.4.2 The Quantum Measurement Is Non-deterministic and Probabilistic Rather Than Random/Spontaneous

The universal quantum fields being the fundamental indivisible/singular/whole universal realities imply that the quantum measurement by nature is not about the quantum reality in itself but the quantum reality when perceived from the classical level by the observers and their observation process. The very concept of randomness/spontaneity present at the quantum level is illogical because randomness/spontaneity implies the acausal nature of the quantum level, which violates the fundamental principle of causality itself. Actually, since the quantum reality is inherently the universal quantum fields interacting continuously with one another, any local/non-universal measurement process is bound to be non-deterministic because it cannot measure the universal data of universal quantum field (s) due to being local/non-universal itself. This non-deterministic nature is probabilistic in the actual observation at the classical level, but that is still within the causality and not at all random/spontaneous, as already proved. So, there is actually no dice, meaning, randomness/spontaneity at play at the quantum level, neither inherently nor even when measured from the classical level, which also establishes the causality but in a non-deterministic and probabilistic manner.

5.4.3 The Emergent/Apparent Interaction(s) Between the Different "Parts" of the Same Universal Quantum Field or Between Different Universal Quantum Fields as Observed at the Classical Level

The universal quantum fields being the fundamental indivisible/singular/whole universal realities imply that at the quantum level, there is no interaction possible between different "parts" of the same universal quantum field because at the quantum level, different "parts" do not even exist with each universal quantum field being an indivisible/singular/whole universal reality with different levels of field excitations at different spatial regions. But, at the quantum level, there is continuous interactions between various quantum fields which changes their field intensity at different spatial regions instantly in one moment with an infinitesimal duration based on the fundamental logic of each universal quantum field being indivisible/singular/whole universal reality without any "parts" at the quantum level. Whether a particular universal quantum field interacts or does not interact with any other universal quantum field and, in case, of the interaction what is the mutual effect can be approximately determined from the observations made at the classical level only due to very nature of observations requiring a reference frame which being local/non-universal makes it a classical level determination of an approximate or non-deterministic and probabilistic nature as already explained earlier.

But, at the classical level, when we see any emergent/apparent interaction between different "parts" of the same universal quantum fields such as two or more than two electrons, that only means that such emergent/apparent interaction at the classical level is itself due to one or more other universal quantum fields mediating such interaction or the process of our measurement at the classical level itself causing enough change in the excitation patterns of the concerned universal quantum field showing such apparent/emergent interaction at the classical level or a combination of these two.

6 Conclusion

This paper establishes through pure fundamental logic that:

1. Absolute time exists continuously in the universe since its creation until the present as the universal objective present moment with an infinitesimal duration and proves the existence of absolute space as the static space-in-itself which is the substrate for all other physical realities including absolute time and universal quantum fields.

2. Zero-dimensional points cannot exist in physics or the universe because something that occupies no space cannot exist in physical reality. Hence, at the quantum level, universal quantum fields are the sole reality, each being an indivisible/singular/whole universal reality without any constituent parts, which proves that no reference frame or particle

can exist at the quantum level. This dissolves the questions of quantum gravity and unified field theory by proving gravity as classical-only emergent reality, resolves the wave-particle duality by establishing particles as emergent classical reality, and proves quantum measurement to be non-deterministic and probabilistic but causal rather than random. Thus, reference frames themselves are only classical level reality with both relative space, relative time and relative spacetime existing only at the classical level due to the local/non-universal nature of any reference frame making it impossible for it to exist at the quantum level where only universal quantum fields exist as the fundamental level due to the impossibility of the existence of zero-dimensional points in physics or the universe.

3. Applying above logic and other fundamental logic proves the continuous nature of absolute space, absolute time, relative space, relative time and relative spacetime, and, thus, disproves all discrete theories including quantum loop gravity and causal set theory and also disproves string theory.

This framework of pure logic completes Einstein's unfinished revolution in understanding space, time, and physical reality at both quantum and classical levels. All apparent paradoxes and problems in current physics arise from violating these fundamental logical necessities. The framework establishes the true nature of physical reality, dissolving decades of theoretical misconceptions and pointing physics back to its logical foundations.

The implications of this work extend far beyond theoretical physics, providing a solid logical foundation for understanding the fundamental nature of our universe. This understanding will guide future research and technological development in the right direction, avoiding the logical impossibilities that have hindered progress in theoretical physics for decades.

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