

On Time and Dynamics: A 4D Space Time Topology within 3D Space: *The Virtual Edge of Vector Time*

A. V Herrebrugh, 
Independent Researcher, Netherland
avherrebrugh@gmail.com

ABSTRACT

This paper introduces a conceptual 4-dimensional space time model that departs fundamentally from Einstein's relativity. Unlike observer dependent systems, this framework emphasizes true simultaneity, distinguishing objective reality from perceived events. It defines a 4D orthogonal vector coordinate system, combining 3D Cartesian space with a fourth dimension of virtual time surfaces, which represent instantaneous temporal slices across space. These time surfaces are curved within an otherwise flat 3D space, forming a dynamic, evolving "present" enclosed at the boundary of the space time system. Time is modeled as an independent scalar magnitude, making it fully orthogonal to spatial dimensions and immune to external influences like gravity. This redefines the role of time as a pure sequence of events, without the curvature or distortion proposed in general relativity. By projecting 3D space onto this new virtual topology, the model offers a unique geometric view of space time. It challenges conventional gravitational space time interactions and repositions time as an unlinked, autonomous coordinate within a unified but orthogonal framework.

Keywords: space time topology, true simultaneity, virtual time, orthogonal coordinates, scalar time

©2025 The Authors, Published by Hyperscience International Journal. This is an open-access article under the CC BY-NC
<https://creativecommons.org/licenses/by-nc/4.0/>

INTRODUCTION

Einstein's theories of Special Relativity (SR) [1] and General Relativity (GR) [2] are built on the foundation of observer dependent simultaneity, where the perception of time and events is shaped by the reception of electromagnetic radiation typically photons as carriers of information. This led to the idea that events only become real once observed through what Einstein termed the "light agency" [3]. Consequently, an event not witnessed such as one whose radiation is absorbed by a black hole would be deemed nonexistent, regardless of its objective occurrence. This observer centered framework presents conceptual and mathematical challenges, especially in astrophysical contexts. Events that have occurred but remain unobserved due to radiation delays or absorption still possess objective

reality. Yet, within Einstein's model, they are excluded from the physical narrative. This paper argues that such exclusion contradicts growing astrophysical evidence [6], and that a new model of time based on universal simultaneity or absolutivity is needed to address this limitation.

To that end, we introduce a 4D orthogonal vector space integrating conventional 3D Cartesian space with a virtual, independent time dimension, modeled through curved time surfaces embedded in flat 3D space. These surfaces represent dynamic layers of simultaneity, evolving with each new influx of information. As light-based information arrives (e.g., through telescopic observation), these virtual surfaces are updated filling in previous gaps and reducing

temporal uncertainty. This concept is consistent with the idea that information is a structured sequence carried by energy, reducing uncertainty about reality [4].

A key tenet of this model is that time is treated as a fully independent scalar magnitude, orthogonal to space and unaffected by gravity. This opposes relativity's foundational principle, which allows time to be bent by gravitational fields [2, 5]. In contrast, this framework removes the "dead time" introduced by light propagation delays effectively projecting objective events onto virtual time surfaces. This enables a clearer separation between observed events and true simultaneity.

Additionally, traditional relativistic models introduce scalar vector ambiguities. The parameter t , commonly used to represent time, often influences spatial coordinates in ways that violate true orthogonality. These dependencies can distort the mathematical integrity of the coordinate system [6, 7]. By comparison, the model proposed here applies a vector-based approach to time, aligning with rigorous mathematical conventions and preserving coordinate independence.

Despite decades of research, there is still no empirical evidence for a physically existing 4th spatial dimension. Yet time continues to be modeled as such frequently without respecting the orthogonality required in proper vector space algebra [8]. This results in models where time affects space inappropriately, causing localized topological shifts with limited consistency. This paper challenges that trend by asserting that time must be modeled as a directional vector not merely a scalar giving rise to the revised principle that "time may take any direction," rather than the traditional "time has no direction."

The model thus introduces a vector based virtual time dimension embedded in 3D space, capable of producing unique, orthogonal space time datapoints. These points represent objective, observer independent events and resolve longstanding inconsistencies in space time modeling. By integrating absolutivity into this framework, the model provides a path toward a coherent, scalable, and truly objective representation of physical reality at all scales.

2. ABSOLUTIVITY: SIMULTANEITY, INDEPENDENCE & CLOCK TIME

In this framework of virtual time surfaces representing absolute simultaneity, the observer dependent logic of relativity is replaced by a model where true simultaneous events are projected onto mathematically structured surfaces in a 4D topology embedded within 3D space. This construction allows for a clean conceptual separation between observer-oriented simultaneity (what is measured) and actual simultaneity (what objectively exists). Measurement tools such as clocks remain valid in their experimental and practical contexts but are understood as limited representations, not definers, of time itself.

In this virtual framework, time is modeled as an orthogonal coordinate, distinct from spatial variables and immune to physical influences such as gravity, velocity, or material density. This approach builds on earlier discussions of independence in vector coordinate systems (such as those described by Herrebrugh in *Gravity – Merging of Quantum*

& Classical Physics) and asserts that true time cannot be altered by any property of energy or space. Time, therefore, acts as a sequential identifier, not just a background parameter it becomes a dynamic label for unique space time datapoints that capture the evolution of energy and events at any scale.

Although we experience time subjectively in daily life, this experience is not direct. Our perceptions sight, sound, touch are transformed into electrical signals, processed in the brain, and reconstructed into what we consider conscious experience. As Anil Seth discusses in *Being You: A New Science of Consciousness*, this internal model of reality is an inference engine filling gaps, interpreting signals, and giving us the illusion of an unbroken temporal and spatial world. In this sense, time is experienced as a constructed narrative, not a direct measurement. The natural world reinforces this with recurring environmental sequences day and night, seasonal cycles, celestial motions that anchor our biological and cognitive understanding of time. These patterns are likely encoded in memory and biological systems such as DNA. Over time, these cycles became internalized as expectations, guiding behavior, survival, and knowledge development. Even before the invention of clocks, humans operated on a sense of order and causality understanding, for example, that one must gather water before drinking it. This points to a deeper role for time: it is not a force, nor a field, but the administrator of change. It structures causality and facilitates the emergence of information in dynamic systems. Unlike space coordinates, which refer to tangible dimensions, time cannot be grasped or isolated, except through artificial devices clocks.

A clock, however, does not truly measure time. It translates oscillatory motion from pendulums, crystals, or atomic transitions into a readable sequence. This sequence is displayed using a mechanism, but it is ultimately a measurement of frequency, which is the inverse of time.

As discussed in classical mechanics and quantum systems (see Lagrange's *Mécanique analytique* and work by Schwarzschild and Droste on gravitational fields), these systems are always affected by their physical conditions temperature, motion, electromagnetic fields, and gravity. No matter how advanced, clocks remain devices embedded in space and thus, vulnerable to the very variables that the concept of true time must be independent.

By contrast, the model of time introduced here is resilient to distortion. It treats time as a virtual, structured layer an evolving informational surface that is not altered by seasons, planetary motion, or even spacetime curvature. This time exists within our conscious awareness, much like spatial perception, and is reinforced through our constant referencing of schedules, aging, and memory.

In physical terms, clock time is always an observation. It is not identical to real time, but a localized approximation. As Einstein showed in his 1905 paper on Special Relativity, and further in General Relativity, local time can shift under velocity and gravitational influence. These shifts are quantifiable through the Lorentz transformations, but they do not reflect a change in absolute, observer independent time only in how it is measured. Thought experiments imagining an idealized, environment isolated clock show

that even under perfect isolation, a clock remains an instrument not the thing being measured. This brings us to the core proposal of this paper: time should be treated as a vector quantity a dimensional coordinate in its own right rather than a dependent scalar.

Herrebrugh, in his works on deterministic perspectives in quantum mechanics, has emphasized the limitations of relativistic time when applied to systems involving information flow and entanglement. Building on this, we present a model in which time exists as a projected vector surface, embedded in 3D space, and capable of capturing true simultaneity without reliance on a hypothetical 4th physical dimension. Since no experimental evidence has confirmed the existence of a real 4th dimension, this virtual vector framework is not only more consistent with 3D physical reality it also maintains mathematical consistency in operator logic, resolving ambiguities introduced by conventional treatments of time in relativistic equations. In this model, time becomes the clean, orthogonal complement to space immune to distortion, free from scalar entanglements, and defined not by what is measured, but by what is logically and physically invariant in the structure of causality itself.

3. VECTOR AND TENSOR SPACE TIME, DIMENSIONS, AND COORDINATE SYSTEMS

While mathematics readily allows the extension of space with an additional parameter t as in the commonly used (x, y, z, t) formulation of space time this introduces challenges when it comes to preserving the independence and orthogonality required for vector spaces.

The conventional 3D rectangular coordinate system (with scalar axes x, y, z) operates within a true vector space, consisting of three fixed directions and independent scalar magnitudes. Scalar algebra applied in this 3D space yields exact and consistent results, provided that coordinate independence is strictly maintained. Extending this system to higher dimensions, particularly to four with the addition of time, necessitates the full orthogonal implementation of the time axis. Without explicitly enforcing this orthogonality, as often occurs in scalar algebra and many tensor descriptions, mathematical ambiguity arises.

A 4D vector space contains six possible planes formed by pairs of vectors, but only four independent directions. Operations such as the dot product and cross product can become ill defined or contradictory unless careful mathematical structure is preserved. In many descriptions particularly those relying on conventional relativity the time parameter t is included without proving its mathematical independence. As noted in Herrebrugh's recent analysis of quantum determinism, scalar time treatment often assumes orthogonality without validating it, which leads to subtle but critical inconsistencies.

In contrast, a proper vector space formulation demands that each coordinate be orthogonal and covariant, ensuring both mathematical integrity and physical realism.

The 3D space dimensions function as a coordinated vector system, defined by three perpendicular directions with variable scalar magnitudes. Any position in space is defined by a unique triplet of values. For a coordinate

system to maintain this mathematical rigor, the inner (dot) products of the base vectors must equal zero across all dimensions this principle holds universally, including within complex vector spaces, where imaginary components can encode phase information or other system properties. Introducing an additional parameter t to represent time does not automatically preserve uniqueness or independence unless time is orthogonalized against the spatial dimensions. For instance, a journey that returns to the same point in space does not return to the same point in time. This shift "time goes by" represents a transformation in the space time datapoint. Removing time from the description might preserve spatial consistency, but it would collapse dynamic event descriptions into static form unsuitable for modeling real world physics where evolution and causality matter.

The Lorentz transformation introduced by Einstein in his 1905 and 1916 papers, while elegant for localized observations, embeds time within the spatial coordinates, especially along the x axis. This structure lacks explicit 4D orthogonality and thereby falls short of forming a consistent vector framework. While it provides valid localized results, it remains fundamentally scalar based, not fully compatible with vector or tensor-based treatments of dynamic energy flow. To illustrate a properly coordinated 4D vector system, consider space time dynamics using the following motion equations i.e. the causality relations based on vector components of distance d over time t :

$$\begin{aligned} d_x &= x' + v_x t + \frac{1}{2} a_x t^2 \\ d_y &= y' + v_y t + \frac{1}{2} a_y t^2 \\ d_z &= z' + v_z t + \frac{1}{2} a_z t^2 \end{aligned} \quad (1)$$

These expressions establish the role of time t across all three spatial dimensions. They describe space time datapoints in a manner consistent with causality, where velocity vectors and accelerations may vary, particularly in cosmological models of expansion. Here, the term $|v| \cdot t$ becomes a dynamic radius of expansion, conceptually linked to the Hubble constant and the ongoing inflation of the universe. In the simplified case of linear expansion (where a_x, a_y, a_z are equal to 0), the position vector evolves linearly:

$$\vec{R}_t = \vec{v} \cdot t \quad (2)$$

The derivative of this expression shows that the rate of change of position is the velocity vector $\vec{v}$, and the magnitude of this vector represents the rate at which the surface of time expands. To maintain vector orthogonality, time must be implemented as a fourth, fully independent axis. Only then does it function properly within a 3D vector space, resulting in a virtual 4D model where no higher experimental dimensions are needed. The velocity vector may be written as:

$$\vec{v} = v_x \hat{i} + v_y \hat{j} + v_z \hat{k} \quad (3)$$

And its magnitude as:

$$|\vec{v}| = \sqrt{v_x^2 + v_y^2 + v_z^2}, \quad \text{with } |\vec{v}| < c \quad (4)$$

This inequality reflects relativistic limits. Where quantum effects are significant and v approaches the speed of light c , the Lorentz factor must be applied:

$$|\vec{R}_t| = \frac{(v \cdot t)}{\sqrt{1 - v^2/c^2}} \quad (5)$$

Such a treatment underscores the shortcomings of the Lorentz transformation when considered in higher dimensional or vectorial terms. If velocity is present only along one axis (e.g. v_x), then relativity theory operates within a 1D framework mathematically insufficient to model full space time trajectories. In contrast, vector-based modeling offers an 3D embedded, fully dynamic formulation that remains predictive and accurate across continuously curved paths. The Lorentz framework, while historically foundational, is limited to isolated, static solutions and localized observations. It cannot, for instance, describe the entire trajectory of an orbit in a gravitational field without interpolation. In contrast, a full vector approach integrates time across all directions, enabling real predictive modeling. Historically, this concept isn't new. Isaac Newton's original gravitational equations expressed in vectorial form and considered unsolvable at the time remain valid in 3D space and were later refined through solutions such as those by Karl Schwarzschild and Johannes Droste. Their general relativistic work, derived using Einstein's spacetime curvature, can also be recovered within a Hilbert vector space using Newtonian mechanics without tensor formalism, as demonstrated in Herrebrugh's exploration of quantum classical unification. In vector mathematics, energy conservation is inherently preserved through operator symmetry and covariance.

Finally, in this model, the expanding time surface forms a spherical topology. As time increases, its radius grows, continuously and instantly updating the shell of reality. This surface not only records projections from outside but may also carry events emerging from within, created later in the unfolding of the universe. Thus, time surfaces serve as evolving data membranes, structuring the causal order of reality while remaining embedded in a mathematically consistent, observer independent system.

4. ORTHOGONAL SPACE TIME AND UNIQUE DATAPOINTS

As previously established, the conventional parameter t used in space time formulations is not inherently coordinated with the three spatial dimensions. This absence of structural integration means that time, as typically represented, fails to create a true orthogonal reference system. To resolve this, the proposed model introduces a 4D topology composed of virtual spherical surfaces, each representing a layer of true, simultaneous events projected across the universe.

The standard 3D Cartesian coordinate system, defined by scalar parameters x, y, z functions as a vector coordinate space with fixed directional axes and independent scalar magnitudes. Algebraic operations in this space yield consistent results due to the strict orthogonality between these three dimensions. However, to preserve this mathematical integrity, any extension beyond three dimensions such as the addition of time must also satisfy the condition of independence. This requires the incorporation of an independent temporal axis, anchored at the origin of the system, and governed by its own reference clock.

In this framework, virtual time surfaces are layered concentrically, extending outward from the origin toward what is perceived as the present. Each surface defines a boundary of simultaneity, encompassing all events occurring at the same moment across the cosmos regardless of whether those events are observable. These events are then projected onto their corresponding spherical surface, and their positions are marked as unique space time datapoints, consisting of three spatial components and one orthogonal temporal label. This method allows the model to track evolving events by identifying a chain of causally connected datapoints across successive time surfaces. As each time surface recedes into the past, new events are captured at the expanding frontier the dynamic "edge" of time. In this way, space time is not a continuum in the abstract but a structured, layered collection of unique datapoints each reflecting the configuration of the universe at a specific temporal boundary.

The composition of space time in this model is thus:

- A three-dimensional vector space describing spatial location
- An orthogonal fourth dimension represented by virtual, imaginary, spherical time surfaces
- A continuously evolving "present" surface acting as the system's dynamic edge
- A boundary beyond which lies the undetermined future

From a physics standpoint, it might seem more intuitive to rely on real, continuous time axes. After all, physics strives to describe nature as it truly is, across all scales from the cosmological down to the quantum. However, the model proposed here integrates real events into unquantized, spherical virtual time surfaces, forming a mathematically consistent structure that preserves the essence of continuity without requiring a linear, scalar time coordinate. The use of vector and tensor mathematics ensures that this model remains compatible with physical laws, even in higher dimensional extensions or under covariant transformations. To formally validate such descriptions, any multidimensional framework must adhere to the strict definitions of orthogonality and independence in vector spaces. The curved, closed time surfaces serve this function by embedding time in a magnitude bearing vector, aligned with how we perceive time's flow measured, directional, and continuously evolving. Crucially, the time vector must be defined perpendicular to the spatial axes, preserving the system's orthogonality. This allows the full integration of

space and time into a true 4D coordinate system, where each dimension maintains independence, yet collectively supports dynamic event modeling. Through this configuration, the distinct topologies of space and time are unified. Space, with its rectilinear coordinates, and time, with its spherical layering and unidirectional flow, become fully embedded within a logically consistent framework. This model not only supports the causal evolution of events but also provides the mathematical structure necessary to describe reality as a continuous, predictive, and independent system of space time datapoints.

5. THE TIME VECTOR

To construct the time vector within the orthogonal 4D framework developed in earlier sections, it must be defined both geometrically and functionally in relation to the virtual time surfaces. The direction of the time vector lies within the tangent plane of the time surface specifically aligned with a unit tangent vector $\vec{T}$, ensuring orthogonality with the location vector describing the expanding universe. Its magnitude is provided by the true time distance R_t , which corresponds to the vector from the origin to the surface radius at the present moment, as described earlier in the form:

$$R_t = (v_x t)\hat{i} + (v_y t)\hat{j} + (v_z t)\hat{k} = \mathbf{v} \cdot t \quad (6)$$

Given this formulation, the magnitude is:

$$|R_t| = |t \cdot \vec{v}| = R_t \quad (7)$$

The time vector $\vec{t}$ is then defined as:

$$\vec{t} = R_t \cdot \vec{T} \quad (8)$$

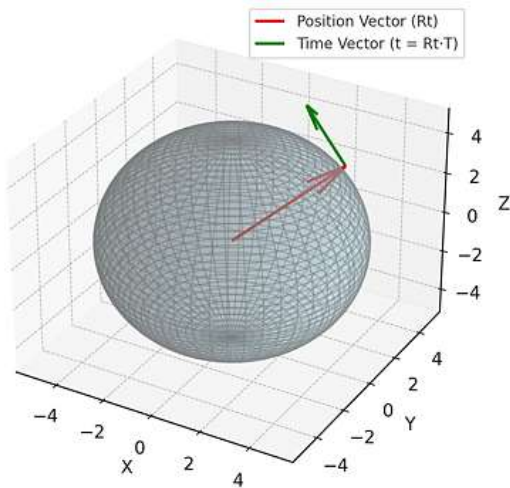


Figure 1 – A virtual time-surface with an expanding position vector $\vec{R}_t$ and a time vector $\vec{t} = R_t \cdot \vec{T}$ orthogonal to space, lying in the tangent plane.

Here, $\vec{T}$ is a unit tangent vector on the virtual time surface, such that $|\vec{T}| = 1$, ensuring directionality without altering magnitude. This expression captures the essence of time as

a vector: its magnitude reflects the system's evolution (i.e. the radius of the time surface), while its direction ensures orthogonality to the expanding spatial position vector. This model holds under the assumption of sub relativistic expansion speeds (i.e., speeds significantly less than the speed of light, c), as previously addressed in the context of Lorentz correction factors. The time vector, defined on a spherical surface, enables description of energy evolutions events that unfold across time and registers the progression of such events as sequences of space time datapoints.

This formulation is embedded within the triad (trihedral) vector system introduced earlier, where three spatial dimensions and one temporal dimension together form a complete orthogonal basis. Importantly, the direction of the time vector is not constrained to point along the normal to the time surface as one might intuitively assume but can lie anywhere on the tangent plane, offering a degree of directional freedom in describing evolving physical systems. This flexibility allows it to adapt to the evolving nature of energy-based phenomena, which may progress in any spatial direction. Although the time vector is defined on a surface, it retains consistency when translated parallel to the origin. Its magnitude and direction remain unchanged, preserving its geometric and physical meaning. In doing so, the time vector shares the same origin with the spatial coordinate system and serves as the temporal axis in the complete 4D space time model. The rate of change of the time vector's magnitude is directly tied to the expansion speed of the universe:

$$\frac{d}{dt} |\vec{R}_t| = |\vec{v}| \quad (9)$$

This dynamic growth supports our intuitive experience of time flowing, modeled here as the expansion of the spherical time surface over time. This results in unique and orthogonal space time datapoints essential for modeling the evolution of both macroscopic stellar systems and microscopic quantum events.

The time surfaces act as instantaneous snapshots of reality. Each surface contains all events occurring at the same universal moment and immediately becomes part of the past as the system progresses. Despite their imaginary and virtual nature, these surfaces carry critical structural and causal significance: they separate the past from the future, structure the “present,” and define causality such as Earth's rotation producing the day night rhythm, or cyclical stellar interactions shaping phases of time. Since the time vector operates independently of gravity, movement, or physical distortions, it is immune to the measurement distortions that affect traditional timekeeping devices.

Clocks, as argued in Section 2, are physical systems susceptible to temperature, motion, electromagnetic interference, and gravitational fields. The time vector, by contrast, is a mathematically pure concept, representing time's true nature observer independent and structurally embedded.

This conception of time diverges from relativity by replacing observer dependence with a coordinate defined objectivity. The model allows for clocks to be synchronized or administrated through systems referencing

the true time vector e.g., using a “mother clock” at the origin or adjusting frequency based on known velocity, gravity, or trajectory data. This framework is particularly relevant in technological systems such as GPS, where time synchronization is critical and already requires relativistic corrections. The proposed model shows that, in principle, such systems could align with a true, vector defined time surface, using predefined velocity profiles or adjusted frequency control to account for relativistic distortion. Although this time surface model cannot be realized on a universal scale due to observational and engineering limitations, it remains practically applicable in localized systems. For instance, within Earth orbiting satellites or interplanetary systems, clocks can be calibrated or adjusted relative to a modeled true time vector based on known trajectories and gravitational influences. This facilitates observer independent time registration and enhances the precision of dynamic system modeling, whether for navigation, cosmology, or experimental physics. In summary, the time vector formalized here:

- Operates orthogonally in a 4D vector system
- Aligns with a tangent direction on evolving virtual time surfaces
- Has a magnitude linked to cosmic expansion
- Defines unique, objective space time datapoints
- Functions as an independent temporal reference for physical systems
- Maintains compatibility with local physical models, such as GPS
- Offers an observer independent basis for universal dynamics modeling

This definition strengthens the foundation for an orthogonal, mathematically consistent understanding of space time as a 4D system grounded in vector mathematics rather than observer-based relativity.

6. CAUSALITY, THE TRIAD SYSTEM, AND ENERGY STATES

Although time is often perceived as an active component of natural evolution, it plays no physical role in altering the processes of nature itself. Instead, time serves purely as an enabler a passive but essential parameter that allows for the sequencing of events. Within this framework, vector time becomes an identifier of causal order, critical for understanding how events unfold, interact, and create informational patterns such as those stored in DNA. Time does not cause change it allows change to be recorded, structured, and interpreted. In this model, causality is encoded through energy states evolving in space time, each event representing a transition along a path governed by energy propagation. The time vector, introduced earlier, supports this by pointing in the direction of event evolution and energy transfer.

To describe curved trajectories particularly geodesics on the virtual time surfaces a moving triad system is introduced. This consists of:

- $\vec{T}$: The unit tangent vector (direction of motion along the curve)
- $\vec{N}$: The principal normal (indicating curvature)
- $\vec{B} = \vec{T} \times \vec{N}$: The binormal, forming the third orthogonal direction

This triad structure enables the precise tracking of energy motion across the time surface. Accordingly, the time vector can now be reformulated as:

$$\vec{t} = \vec{R}_t \cdot \vec{B} \quad (10)$$

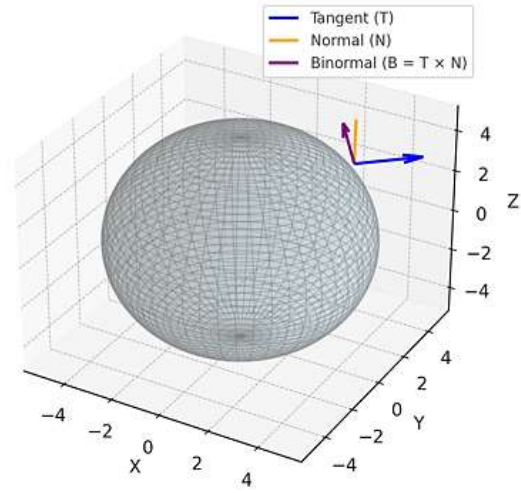


Figure 2 – Triad vector system of Time-Surface. Triad system on a time-surface showing tangent (T), normal (N), and binormal ($B = T \times N$) vectors that define energy evolution paths.

Here, $\vec{B}$ represents the direction of energy propagation through space time, orthogonal to both $\vec{T}$ and $\vec{N}$.

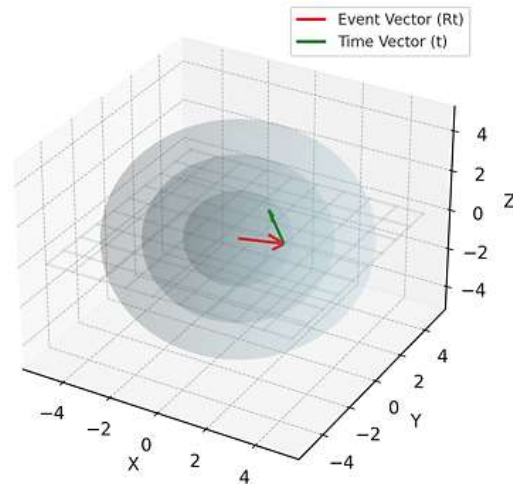


Figure 3 – 4D space-time structure conceptualized in 3D space with expanding virtual time-spheres and orthogonal space-time datapoints.

Its magnitude is once again given by the time surface radius $\vec{R}_t$, and it lies in a fully orthogonal trihedral space. This configuration leaves one degree of freedom in choosing the

direction of $\vec{T}$, allowing the triad system to form a right-handed coordinate frame.

This is essential for describing energy flow along any spatial curve straight, curved, torsional, or otherwise. As events propagate from the surface of the "present," their trajectory through space is governed by the triad, and their position and timing are tracked with inherited time marks from the expanding virtual time surfaces. Thus, energy evolvment can be described across any path in the continuum, from subatomic distances to stellar trajectories, with the system remaining synchronized in true time either by the magnitude of $\vec{R}_t$, or through synchronization with a reference origin ("mother clock"). This framework allows causal chains to unfold with full continuity, providing the mathematical infrastructure to track and model evolving energy states in space time.

7. TIME TOPOLOGY AND HUMAN PERCEPTION

The proposed model transforms our understanding of space time by introducing curved, Riemann like time surfaces that build the historical structure of the universe from the origin (Big Bang) to the ever advancing "present" surface. These surfaces can be labeled by a universal reference clock, theoretically starting at $t = 0$, and expanding outward with each successive time layer.

Although impractical to apply universally due to the vastness of cosmic time, this system becomes highly functional in localized physical models. For practical applications (e.g., experiments, GPS systems, orbital mechanics), we can adopt locally synchronized time marks, inherited from the global surface model, to track event progression with high precision. The growth rate of the radius of the time surface, $\frac{d}{dt}|\vec{R}_t| = |\vec{v}|$, aligns with our intuitive perception of time "flowing." As the surface expands, we move ever further from the origin, reinforcing the irreversibility and asymmetry of time. In both physics and lived experience, traveling backward in time is not possible: negative clock frequencies or reverse evolution have no meaningful application, even in abstract mathematical treatments. This inherent asymmetry is encoded geometrically: the direction of the time vector $\vec{t}$, while defined within a tangent plane, remains oriented by the evolution of energy and thus always reflects forward causality, regardless of where it's anchored on the time surface. While we may "look back" to understand history by reducing R_t , true motion through time is unidirectional: forward and expanding. Because time surfaces are spherical and continuous, any single point on a surface is simultaneously valid across all spatial coordinates, which challenges our 3D centric visual perception. Our minds are conditioned to interpret space in flat, linear terms; the curvature of time is thus difficult to visualize, even though it defines how events evolve and interact universally.

In practical systems local clocks, experimental setups, dynamic simulations life and physics unfold on these surfaces. We operate "within the present," and past time surfaces are left behind.

Due to their immense radius, the curvature of these time surfaces is often perceived as flat, supporting the everyday experience of time as a linear scalar. A measurable time

interval is represented by the difference in radii between two surfaces. The familiar expression $v = dR_t/dt$ still applies to local systems, where time is experienced via counting of time surfaces using synchronized clocks. In this model, time always increases positively, and the passage of time is represented by the expansion of the system outward from the origin. Together, the surfaces of the past form a virtual volume of history, while all motion and energy transfer remain confined to an uncurved 3D space. This dual structure curved time, flat space reconciles our empirical observations with the theoretical topology of time.

Curved energy trajectories observed in flat 3D space emerge not from curved space itself, but from energy fields and mass distributions, as captured in standard physics. These phenomena accelerations, gravitational fields, quantum effects result from causal relationships rather than geometrical curvature alone. As Herrebrugh has shown in his gravity model (2024), even general relativistic geodesics can be derived using Newtonian principles when vector space volumes and surfaces are properly applied, without requiring tensor formalism or asymptotic treatments. By grounding all physics including quantum mechanics in a unified 4D system of time surfaces and spatial volumes, this model avoids the need for separate curved dimensional spaces or manifold topologies. It preserves consistency across scales and remains compatible with both classical and quantum theory, including Heisenberg's uncertainty principle, which remains intact even at the smallest scales within this framework. Finally, the universal "mother clock" positioned at the origin of this system acts as the master time reference. Unlike typical clocks that move with systems or require constant recalibration (as in GPS networks), this reference point remains fixed and global, simplifying the entire architecture. Local clocks, embedded within triads or experimental setups, can be synchronized, offset, or administratively adjusted based on this reference leaving implementation to practical engineering.

8. SUMMARY & CONCLUSIONS

This conceptual exploration presents an updated model of space time in which time is incorporated as a curved, orthogonal, and virtual fourth dimension within uncurved 3D space. Here, spatial location vectors remain orthogonal to the tangent vectors of spherical time surfaces, and time evolves geometrically as a continuum of expanding layers. These virtual surfaces represent projected, simultaneous events and allow time to function as a vector-based identifier of causal order within evolving physical systems. The model treats each time surface as a dynamic sphere, fully independent of spatial directions, enabling true orthogonality among the four coordinates. While all four axes are embedded within a conventional 3D spatial setting, the time vector is mathematically independent and defined through its magnitude (the radius R_t) and its direction (a tangent vector on the surface). This structure produces a 4D reality model within a 3D coordinate system, supporting predictive modeling of energy-based dynamics.

Within this framework, any causal relation mathematical, physical, or energetic can be described as an evolving vector in a triad system (tangent, normal, and binormal vectors), allowing for the continuous tracking of space time datapoints. These datapoints, anchored to the time surface, evolve in direction, magnitude, and state, and allow deterministic modeling of complex events across the continuum. The implications and conclusions from this model include:

- Absolutivity theory offers an observer independent description of space time that fundamentally differs from the observer-oriented relativity theory developed by Einstein [1, 2].
- The model redefines time as a vector, not a scalar. This aligns with human time perception asymmetric, continuously flowing, and functionally unidirectional[9].
- Causal dynamics are embedded within a vector space time system, where time emerges as a result of cosmic expansion. This framework extends beyond the 1D Lorentz based relativistic approach, enabling a fully dynamic state description.
- A conventional 4D rectangular coordinate system with four vector axes creates inherent ambiguities. Specifically, six planes formed by pairs of four vectors cannot maintain full orthogonality, revealing algebraic contradictions in many higher dimensional scalar tensor frameworks [6].
- This model overcomes those limitations by implementing time as a virtual surface with a radius $R_t = |\vec{v}| \cdot t$, growing linearly with time. For relativistic scenarios, corrections via the Lorentz factor may be applied.
- Time surfaces are treated as continuous and unquantized components of the continuum. This

contrasts with discrete spacetime models and offers compatibility with deterministic interpretations of quantum evolution [4].

- Orthogonality ensures full independence of the time vector from spatial and material variables. Time is unaffected by gravitational or electromagnetic influences contrary to clock-based time distortions experienced in relativity.
- The triad-based modeling system enables predictive tracking of energy propagation, including curved, torsional, or quantum level trajectories.
- Phenomena such as "space time warping" within black holes are not supported under this model, as truly independent time cannot affect space coordinates or form interspatial connections. This conclusion is consistent with the elimination of singularities in recent gravity unification work [10].
- The so called "time dilation" observed in relativity theory is reinterpreted here as clock time dilation a property of local measurement systems subject to motion, temperature, material composition, and gravity, not of time itself [1, 6].

This model ultimately proposes a self-consistent, scalable, and predictive structure for space time that integrates causal dynamics, observer independent time, and vector mathematics into a singular framework. It offers compatibility across physical scales from quantum systems to cosmology and avoids the need for artificial manifold topologies or higher dimensional artifacts. By anchoring time to virtual surfaces and energy to evolving triads, the model unifies dynamic physics within a flat spatial geometry and a curved time topology effectively laying the groundwork for reinterpreting general relativity, quantum behavior, and information propagation in a unified orthogonal system.

REFERENCES

- [1] A. Einstein, "Zur elektrodynamik bewegter körper," *Annalen der physik*, vol. 17, no. 10, pp. 891-921
- [2] A. Einstein, "Die Grundlagen der allgemeinen," *Relativitäts- theorie, Annale der Physic*, vol. 49, p. 769
- [3] S. P. Shapiro, "Agency theory," *Annu. Rev. Sociol*, vol. 31, no. 1, pp. 263-284
- [4] A. V. Herrebrugh, "The Invisible Reality of Quantum Mechanics: The Deterministic Perspective: Quantum Mechanics," *Hyperscience International Journal*, vol. 3, no. 2, pp. 5-16. doi: <https://doi.org/10.55672/hij2023pp5-16>
- [5] K. Schwarzschild, "Über das gravitationsfeld eines massenpunktes nach der einsteinschen theorie," *Sitzungsberichte der königlich preussischen Akademie der Wissenschaften*, pp. 189-196
- [6] A. V. Herrebrugh, "Determinism in Quantum Slit-Experiments: Quantum," *Hyperscience International Journal*, vol. 2, no. 3, pp. 115-121. doi: <https://doi.org/10.55672/hij2022pp115-121>
- [7] J. Droste, "The field of a single centre in Einstein's theory of gravitation, and the motion of a particle in that field," *Ned. Acad. Wet., SA*, vol. 19, p. 197, 1917.
- [8] A. Carpinteri and M. Paggi, "Lagrange and his Mécanique Analytique: from Kantian noumenon to present applications," *Meccanica*, vol. 49, pp. 1-11. doi: <https://doi.org/10.1007/s11012-013-9864-y>
- [9] A. Seth, *Being you: A new science of consciousness*. Penguin, 2021.
- [10] A. V. Herrebrugh, "Gravity; Where Quantum Physics and Classical Physics finally meet," *Hyperscience International Journal*, vol. 4, no. 1, pp. 1-9. doi: <https://doi.org/10.55672/hij2024pp1-9>