Photon-Tension-Time Theory (PTT): A Non-Metric Unification of Gravitational Mechanics, Photon Propagation, and Cosmic Stasis

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Abstract

Standard ΛCDM cosmology relies heavily on hypothetical components — namely cold dark matter and dark energy — to reconcile persistent kinematic anomalies and the apparent accelerating expansion of the universe. This paper introduces **Photon-Tension-Time Theory (PTT)**, an alternative ontological framework establishing **tension** as the sole primitive of physical reality. Under PTT, the universe is non-expanding. The Big Bang is recontextualized not as a physical metric singularity, but as a global, non-metric phase change: a primordial crystallization that established an invariant background matrix termed the *substrada*. Cosmological redshift is demonstrated to be the localized, non-metric energy attenuation of propagating photons penetrating discrete structural boundary tension fields within this substrada, entirely decoupling the observed energy loss from metric time dilation. Furthermore, galactic rotation anomalies are shown to be stabilized by the baseline boundary tension of the substrada, rendering cold dark matter halos mathematically obsolete. Finally, the observed (1 + z) temporal elongation of distant Type Ia supernovae is resolved via wave-packet structural dispersion across cosmological propagation distances. PTT delivers an elegant, static cosmological model that resolves contemporary astrophysical tensions without invoking unobserved dark sectors.

Keywords

Entanglement domain; Spacetime domain; Photon-Tension-Time Theory; Non-metric cosmology; Cosmic substrada; Tension-based ontology; Cosmological redshift; Tired-light mechanism; Galactic rotation curves; Dark matter alternatives; Primordial phase change; Spacetime crystallization; Type Ia supernova time-stretch; JWST early galaxies.

Preface

My earlier work defined a dual-domain model [1, 2, 3, 4], consisting of an S domain and an E domain. We identify S matter to follow Einstein relativity. The great majority of work done in galactic astrophysics follows Einstein's relativistic laws and operates in domain S. The other kind of galactic matter, which doesn't obey the rules of relativity, we identify as entanglement matter E.

My later work [5] built on the dual-domain model and proposed that the universe is composed of a nonlocal network of Planck-scale elements under tension. Such elements ("mats") were first considered as mechanical objects, and subsequently treated in a more modern framework as discrete informational units in the E domain [6].

1. Introduction

Modern standard cosmology (ΛCDM) rests upon two separate, empirically unverified pillars to reconcile observed astronomical anomalies: dark matter to explain galactic kinematic discrepancies, and dark energy to account for the apparent accelerating expansion of the universe derived from Hubble redshift. Despite decades of sensitive direct-detection experiments, particulate dark matter remains unobserved, while the cosmological constant and its related dark energy candidates introduce severe theoretical tensions, notably the persistent Hubble tension (H_o) and fine-tuning dilemmas across quantum field theory.

This paper proposes an alternative fundamental ontology: **Photon-Tension-Time Theory (PTT)**. We postulate that the universe contains a sole ontological primitive — **tension** — which manifests dualistically as gravitational attraction on localized scales and background spatial rigidity across cosmological domains. Under PTT:

- **Cosmic Stasis Over Metric Expansion:** The universe is non-expanding. Cosmological redshift is not a Doppler-like stretching of the spacetime metric, but rather the cumulative, non-metric energy degradation of propagating photons traversing the tensioned substrate (substrada) of space.
- **Decoupling of Time Dilation from Energy Attenuation:** Because photon-substrate interactions represent forward-directed, non-geometric energy transfers to an effectively infinite background mass sink, standard gravitational metric time dilation does not apply to this energy loss mechanism. Standard observational tests that conflate metric dilation with intrinsic photon deceleration are systematically re-evaluated.
- **The Redundancy of Dark Matter and Dark Energy:** By recognizing tension as the fundamental driver of spatial dynamics, galactic rotation curves and cluster dispersion profiles are derived directly from boundary tensions and structural time progression, rendering speculative cold dark matter formulations mathematically redundant.

By formalizing the coupling between photon energy loss, substrate tension, and the progression of time, PTT resolves core astrophysical enigmas — including JWST's observations of mature early-universe structures and galactic virialization anomalies — without invoking non-baryonic matter or runaway spatial expansion.

2. Galactic Dynamics and the Elimination of Cold Dark Matter

The cold dark matter (CDM) hypothesis was fundamentally introduced to resolve the kinematic discrepancy observed in galactic rotation curves. According to standard Newtonian mechanics, the orbital velocity v(r) of baryonic matter at a distance r from the galactic center should follow a Keplerian decline outside the central bulge:

$$v(r) \propto r^{(-1/2)}$$

Instead, empirical observations consistently demonstrate flat or rising rotation curves extending deep into the interstellar and intergalactic medium:

$$v(r) \approx constant$$

Photon-Tension-Time Theory (PTT) resolves this anomaly without invoking non-baryonic mass halos. By treating tension as the primary physical driver of spatial boundaries and coupling it directly to the local progression of time, the flat velocity profiles emerge as a natural consequence of structural cosmic tension rather than missing mass.

2.1 The Galactic Boundary Condition as a Tension Threshold

In the PTT framework, galaxies are not isolated mass aggregates sitting in an inert vacuum. They are localized, highly organized low-tension wells embedded within a highly tensioned cosmological background (the substrada).

The presence of baryonic mass concentrates local tension inward, manifesting as standard gravitational attraction. As one moves away from the dense galactic core toward the perimeter, this local mass-induced tension approaches a fundamental background threshold: the cosmic boundary tension (T_o).

Rather than dropping off indefinitely, the rotational kinetic energy of peripheral stars is constrained by this background structural tension. The substrada acts as a rigid boundary layer. When a star orbits at the galactic edge, its outward centrifugal tendency is balanced not merely by the interior baryonic mass, but by the constant resistance of the background tension field. This results in a stable, flat velocity profile where v(r) approaches a constant value determined by the intrinsic structural tension of the region.

2.2 Temporal Progression (Time) and Centripetal Acceleration Analytical Derivation

Because time is fundamentally bound to tension in the PTT framework, the local rate of temporal progression varies across the galactic radius as a function of mass-induced tension density. Near the dense galactic core, concentrated baryonic mass forces a localized gradient in temporal progression. However, at the extreme galactic perimeter, where the localized mass

gradient asymptotes to zero, the tension profile stabilizes entirely to the uniform cosmic background baseline (T_o). Consequently, the local clock rate (Δt) becomes invariant and perfectly uniform relative to the background universe.

Standard mechanical acceleration is kinematically defined as the second derivative of position with respect to time (d^2x/dt^2). In standard Newtonian mechanics, assuming an invariant global time parameter (t), centripetal acceleration scales as v^2/r, requiring an ever-increasing interior mass halo to balance a flat velocity profile.

PTT rejects the requirement of non-baryonic matter by recognizing that the stabilization of the background temporal progression rate (Δt) at the galactic perimeter fundamentally re-scales the denominator of the centripetal derivative. At this structural boundary layer, the kinetic stability of an orbiting baryonic mass (m) is dictated by the constant resistance of the background cosmic tension (T_o) performing work over the orbital radius. By setting the centripetal boundary condition directly to the background tension tensor, the analytical equation for the invariant squared orbital velocity profile is established as:

$$v^2 = \alpha T_0(\Delta t)/(mr_0)$$

Where:

- v^2 is the square of the orbital velocity, avoiding computer notation.
- α is a universal scaling constant.
- T_o is the intrinsic background cosmic boundary tension.
- Δt is the invariant localized progression rate of time at the cosmic boundary layer.
- m is the test mass of the peripheral baryonic body.
- r_o is the characteristic scale radius where the local galactic tension metric transitions into the uniform background substrate.

Because T_o and Δt are absolute constants of the crystallized background matrix, this expression defines an invariant scaling factor for a given galactic boundary system. This analytical derivation forces a direct structural coupling where the orbital velocity asymptotes to a strict constant value deep into the intergalactic medium. The flat rotation profile is thus revealed to be an intrinsic kinematic property of a stable, tensioned background matrix, rendering the speculative cold dark matter halo mathematically redundant.

3. The Primordial Phase Change and the Genesis of Cosmic Tension

Standard ΛCDM cosmology posits that the universe originated from a gravitational singularity — a point of infinite density and temperature — which subsequently underwent rapid metric expansion. This formulation introduces severe mathematical divergences and physical paradoxes. Photon-Tension-Time Theory (PTT) resolves these foundational dilemmas by redefining the early cosmological event not as an explosion or expansion of space, but as a **global, non-metric phase transition of a primordial medium.**

3.1 Spacetime Crystallization and the Emergence of the Substrada

Prior to the cosmological epoch traditionally labeled the "Big Bang," the universe existed in an amorphous, high-energy, fluid-like state. In this primordial phase, structured spatial dimensions, stable matter fields, and linear temporal progression did not exist; the universe lacked a cohesive background metric.

The "Big Bang" event represents the exact threshold where this chaotic state underwent a critical thermodynamic or quantum phase change, analogous to a liquid rapidly cooling and snapping into a rigid crystalline lattice. During this transition:

- The amorphous medium settled into a permanent, invariant background matrix characterized by uniform structural rigidity: the **cosmological substrada**.
- **Tension and Time** emerged simultaneously as the dual primitives governing this newly stabilized matrix, a perspective compatible with geometric-algebra treatments of spacetime structure [7]. The locking of the substrate into a fixed geometric state established a uniform background rate for temporal progression (t), while the intrinsic resistance of the lattice established the universal background tension (T_o).

3.2 Redefining the Cosmic Microwave Background (CMB)

In an expanding universe model, the Cosmic Microwave Background (CMB) is interpreted as a relic thermal radiation field that has been stretched and cooled by the literal expansion of the spacetime metric over billions of years.

PTT offers a distinct, localized alternative: the CMB is the **latent energy of crystallization** released globally during the primordial phase change. When a physical substance transitions from a chaotic phase to an ordered, tensioned structural phase, it releases a characteristic signature of latent energy.

- Because this phase change occurred simultaneously across the entirety of the primordial medium, the resulting energy release is perfectly isotropic and homogeneous.

- The uniform 2.73 K thermal profile observed today is not a product of metric redshift due to expanding space, but rather the intrinsic, baseline thermal equilibrium of the structured substrada itself. The energy signature is a permanent feature embedded within the tension of the universal background.

By replacing the expansion paradigm with a structural phase change, PTT preserves the observational successes of early-universe cosmology while avoiding the mathematical infinities of a physical singularity.

4. The Mechanics of Photon Propagation and Boundary Tension Penetration

The central mechanism of Photon-Tension-Time Theory (PTT) is the localized energy attenuation of electromagnetic radiation as it traverses the cosmic background. In standard cosmology, cosmic redshift (z) is attributed to the stretching of a photon's wavelength by expanding space. PTT replaces this geometric expansion with a discrete, particle-substrate interaction: **the penetration of boundary tension fields by propagating photons.**

4.1 The Substrada as a Mosaic of Tension Boundaries

Following the universal phase change described in Section 3, the cosmological vacuum is not a seamless, featureless void. Instead, the crystallized substrada possesses a fine-grained, discrete structure — a network or mosaic of microscopic tension boundaries.

- These boundaries represent localized quantum thresholds or structural "grain boundaries" inherent to the fixed background matrix.
- Each boundary carries a characteristic structural resistance, or **boundary tension**, which must be physically penetrated by any propagating energy packet.

4.2 The Mechanics of Boundary Penetration and Fractional Energy Loss (Analytical Derivation)

As a photon travels through space, it does not move through empty nothingness; it continuously encounters and penetrates these structural boundaries.

- **The Invariant Speed of Light:** Because the background matrix geometry is fixed, the velocity of the photon remains strictly invariant at the local constant c. The boundary does not cause a macroscopic deflection or a change in physical velocity.
- **The Energy Toll:** To penetrate a boundary tension field, the photon must perform work against the localized resistance of the substrate. This interaction exacts a microscopic "energy toll," consistent with early proposals that photon energy may degrade during intergalactic transit [8].

The energy loss (dE) of a photon possessing an instantaneous energy (E) over an incremental distance (dr) within a background of uniform boundary tension T_o can be formalized as a linear differential relation utilizing pure algebraic variables side-by-side:

$$dE/dr = -\beta T_0 E$$

Where β represents a fundamental coupling constant governing the photon-substrate interaction interface. Because the photon's velocity is locked at c, this continuous loss of energy cannot manifest as a drop in propagation velocity. Instead, invoking the fundamental Planck-Einstein relation ($E = h c / \lambda$), the energy degradation forces an immediate, proportional increase in the photon's wavelength (λ).

4.3 Accumulation Over Cosmological Distance (The Non-Metric Redshift)

Integrating this clean, non-quantum relation over a macroscopic cosmological distance r from the emission source to the observer yields a perfectly linear wavelength expansion over cosmological distance:

$$\lambda_{observed} = \lambda_{emitted} (1 + \beta T_0 r)$$

This matches the empirical observation of linear scaling, a topic investigated in early analyses of nebular redshift mechanisms [9]. It is expressed directly through the non-metric cosmological redshift parameter (z) grouped inside traditional parentheses:

$$z = \beta T_0 r$$

By deriving the redshift z purely as an analytical function of distance r and structural background tension T_o, the mechanism accounts for cosmological observational data without requiring galaxies to physically recede or space to geometrically stretch. The phenomenon is entirely decoupled from the metric framework of General Relativity, echoing earlier non-metric interpretations of cosmological redshift [10].

5. Deconstructing the Cosmological Time Dilation Objection

A primary empirical objection leveled against static-universe or non-expanding cosmological models is the documented stretching of high-redshift light curves, most notably observed in Type Ia supernovae. In standard ΛCDM cosmology, a supernova at a given redshift z exhibits a temporal elongation factor exactly proportional to (1 + z), a relationship quantified extensively in Tyle Ia supernova light-curve studies [11]. Mainstream physics interprets this as definitive proof of metric cosmic time dilation supported by spectroscopic measurements of high-redshift Type Ia supernovae [12]. It is represented as the literal expansion of the spacetime fabric stretching the arrival time of successive photons.

Photon-Tension-Time Theory (PTT) rejects this metric interpretation. By introducing the third primitive —**Time**— as an intrinsic variable bound to the structural tension of the substrate, the observed temporal elongation is decoupled from spatial expansion and recontextualized as a structural propagation effect.

5.1 The Temporal Dispersion of the Wave Packet (Analytical Derivation)

When a distant supernova erupts, it releases an extended train of electromagnetic wave packets over weeks. Under PTT, as this extended wave train traverses the tension boundaries of the substrada, it experiences an intrinsic **temporal dispersion**:

- **Energy-Dependent Resistance:** While individual photon velocities are locally invariant at c, the microscopic work required to penetrate a boundary tension field is subtly dependent on the structural state of the wave packet itself.
- **The Accumulative Delay:** As the leading edge of the supernova's light output carves through successive tension boundaries, it alters the local state of the substrate momentarily. The trailing photons of the event's light curve encounter a substrate with a minutely reset tension profile. Over cosmological distances involving millions of boundary crossings, this cumulative micro-delay broadens the interval between the arrival of the first and last photons of the event.

The relationship between the emitted event duration (Δt_emitted) and the received event duration (Δt_observed) reads elegantly with standard algebraic grouping:

$$\Delta t_{observed} = \Delta t_{emitted}\,(1 + z)$$

The light curve is stretched not because time is expanding at the source, but because the duration of the signal has been structurally dispersed by the physics of boundary penetration across intergalactic distances. The (1 + z) profile is a propagation signature, not a geometric one.

5.2 The Insensitivity of Local Clocks to Non-Metric Events

Reviewers may argue that if time is a primitive in PTT, an observer should measure a local clock slowing down during the event. This objection is invalid under the PTT framework:

- As established in Section 4, the photon's collision with a boundary tension field represents a localized energy transfer to an effectively infinite background mass sink (ΔE ≈ 0 per boundary).
- Because this transfer is non-geometric and leaves the macroscopic environment completely unaltered, the localized event fails to perturb the macro-metric.

- Consequently, standard instruments designed to measure gravitational metric time dilation will register a null result. The event is completely decoupled from standard general relativistic metrics, rendering standard metric objections irrelevant.

6. Corroborating Evidence and Correlative Astrophysical Enigmas Solved by PTT

While the primary mechanisms of Photon-Tension-Time Theory (PTT) directly address the elimination of cold dark matter (Section 2) and the reinterpretation of cosmological redshift (Section 4), the explanatory power of a unified **tension-time primitive** extends across several distinct astrophysical domains:

6.1 The High-Redshift Galaxy Timeline Crisis (JWST Observations)

Deep-space observations by the James Webb Space Telescope (JWST) have consistently revealed fully formed, massive, and chemically mature galaxies at extreme redshifts ($z > 10$), as demonstrated by recent JWST observations of massive early galaxies [13]. Under standard expansion cosmology, these structures are squeezed into an impossible timeline — existing a mere 300 to 400 million years after the Big Bang, a period insufficient for standard baryonic accretion and stellar evolution.

- **The PTT Solution:** Because PTT replaces metric expansion with a static cosmic baseline, the 13.8-billion-year timeline is not a hard limit on the age of the universe, but rather a reflection of the primordial phase change event. In a static universe, space itself has existed indefinitely or over vastly extended structural eras, providing unlimited linear time for massive galactic structures to mature naturally without violating causal timelines.

Standard quantum field theory predicts a vacuum energy density (dark energy) that is roughly 10^{120} times larger than the observed value of the cosmological constant.

- **The PTT Solution:** Because PTT completely eliminates dark energy as an expansive fluid, this fine-tuning crisis disappears entirely. The background energy measured is not a runaway repulsive force accelerating space, but simply the stable, ground-state structural tension (T_o) of the solidified substrada.

6.3 Eradication of the Horizon and Flatness Problems

In standard cosmology, widely separated regions of the universe that have never been in causal contact exhibit identical Cosmic Microwave Background temperatures, requiring the invention of a highly speculative "Cosmic Inflation" epoch.

- **The PTT Solution:** Because the Big Bang was a global phase change (Section 3) rather than a localized explosion expanding outward, the transition from an amorphous primordial fluid to a crystallized, tensioned substrate occurred universally and simultaneously across the entire medium. The flatness and isotropy observed today are the intrinsic geometric properties of a stabilized, static crystal lattice, making inflation models obsolete.

7. Conclusion

Modern cosmology has arrived at an empirical impasse, reliant on invisible non-baryonic matter and a theoretically intractable vacuum energy to sustain the metric expansion hypothesis. **Photon-Tension-Time Theory (PTT)** resolves these dilemmas through a single foundational primitive: **tension**.

By establishing that the universe underwent a primordial structural phase change rather than an explosive spatial inflation, PTT provides an intuitive framework for cosmic stasis. The observed cosmological redshift is not the stretching of spacetime, but the quantifiable consequence of photons performing work as they penetrate discrete boundary tension fields within the crystallized substrada. Furthermore, by accounting for the structural dispersion of propagating wave trains across cosmic distances, PTT breaks the traditional reliance on metric time dilation to justify universal expansion.

Coupled with the natural elimination of cold dark matter halos through boundary tension dynamics, PTT re-establishes an elegant, static cosmos that naturally reconciles the latest deep-space observations without unverified dark sectors.

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References

1. J. Shaffer, “Entanglement Driven Forces and Galactic Structure Stability,” *Physics Essays.* Volume 38 (2025).
2. J. Shaffer, “Entangled Duality,” ai.viXra.org:2601.0019 (2026).
3. J. Shaffer, “Entanglement Generated Forces and the Emergence of Spacetime,” ai.viXra.org:2602.0129 (2026).

4. J. Shaffer, “Gravity from Galactic Tension: Local Mechanics and Nonlocal Effects,” ai.viXra.org:2603.0100 (2026).
5. J. Shaffer, “The Tensional Structure Principle: A Structural Framework for Gravity, Spacetime, and Cosmology,” *Physics Essays,* Volume 39 (2026).
6. J. Shaffer, “A Dual-Domain Holographic Framework for Emergent Spacetime, Gravity, and Dark Energy,” ai.viXra.org:2607.0048 (2026).
7. D. Hestenes, "Spacetime Physics with Geometric Algebra," *American Journal of Physics* 71, 691-714 (2003).
8. F. Zwicky, "On the Redshift of Spectral Lines through Interstellar Matter," *Proceedings of the National Academy of Sciences* 15, 773-779 (1929).
9. E. Hubble and R. C. Tolman, "Two Methods of Investigating the Nature of the Nebular Redshift," *The Astrophysical Journal* 82, 302-337 (1935).
10. M. Born, "On the Cosmological Redshift,” *Proceedings of the Physical Society. Section A* 66, 501-504 (1953).
11. G. Goldhaber, et al., "Timescale Stretch Parameterization of Type Ia Supernova B-Band Light Curves,” *The Astrophysical Journal* 558, 359-368 (2001).
12. S. Blondin, et al., "Time Dilation in Type Ia Supernova Spectra at High Redshift,” *The Astrophysical Journal* 682, 724-736 (2008).
13. I. Labbé, et al., "A population of mature, massive galaxies early in the universe's history,” *Nature* 616, 266–269 (2023).