

The Mechanical Universe: Helical Spin Theory (HST) and Higgs-Tachyon-Push Field Theory (HTP)

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Abstract

This paper presents a consistent, mathematical-geometric framework describing quantum mechanics, gravitation, and cosmology within a "Bohmian" quantum field theory outside the standard model. By coupling a real helical sub-quantum domain (Helical Spin Theory, HST) with a space-filling background medium in a dynamic tachyonic momentum mode (Higgs-Tachyon-Push Field Theory, HTP), a quantitative reproduction of key astrophysical and quantum mechanical benchmark tests is achieved as an asymptotic limiting case within an absolute Euclidean reference frame. Gravitational light deflection, Mercury's perihelion precession, and the anomalous Pioneer Doppler drift are derived without invoking spacetime curvature via a spat-temporally Variable Speed of Light (VSL). On the microscopic scale, the double-slit paradox is formalized using an ontic, non-local pilot wave in line with De Broglie-Bohm mechanics. On the cosmological scale, the observed Hubble tension is mathematically resolved as a historical averaging effect derived from a degressive mass accumulation rate $Q_M(t)$. Structurally, the HST is extended to spin-1/2 fermions; via a topological Möbius helix symmetry and a hyperbolic pilot-wave equation, the real negative mass squared of the electron neutrino (-0.14 eV^2) measured by the KATRIN collaboration is rigorously derived as a geometric media-coupling parameter, providing a media-mechanical solution to neutrino oscillations. The model thus provides a closed mechanical framework that substitutes the requirements for Dark Matter, Dark Energy, and virtual particles within the macroscopic limit.

I. INTRODUCTION AND MOTIVATION

Modern theoretical physics remains fractured by the irreconcilable mathematical structures of General Relativity (GR) and Quantum Field Theory (QFT). The geometric interpretation of gravity leads inevitably to unphysical singularities in extreme densities, the loss of determinism, and purely phenomenological auxiliary constructs such as Dark Matter and Dark Energy to artificially reconcile observations with relativistic field equations.

The primary motivation of the Higgs-Tachyon-Push Field Theory (HTP) and Helical Spin Theory (HST) framework is the unyielding restoration of **clear mechanical causality** within Euclidean space. By replacing abstract, curved four-dimensional space-time with a flat, three-dimensional space governed by an absolute, linear time arrow, the universe is unmasked as a fully deterministic steady state operating hydrodynamically via a space-filling medium.

Indeed, Nikola Tesla, within his historically unpublished "Dynamic Theory of Gravity," consistently maintained that empty space could possess no physical properties and could not be geometrically warped. Instead, he argued that all astrophysical motions must be explained by an active force field embedded within an omnipresent medium. In striking conceptual alignment with the Helical Spin Theory presented herein, Tesla postulated that ponderable matter is the direct result of ultra-fast, rotating vortices within this primary substrate ("...every ponderable atom is differentiated from a tenuous fluid, filling all space merely by spinning motion..."). The HST/HTP framework reactivates this qualitative vortex ontology, translating it into a mathematically rigorous, quantized, and field-theoretically closed formulation within the modern quantum mechanical and cosmological context.

This approach conceptualizes a formal, field-theoretic extension of De Broglie-Bohm mechanics. While classical Bohmian theory primarily operates as a non-relativistic quantum mechanics of point-like particles in configuration space, the HST/HTP framework embeds the dynamics via real, three-dimensional vortex structures into a physically tangible, viscous-like background medium. The fundamental non-locality of the quantum world is thus not treated as a mere mathematical postulate, but is mechanically mediated through the instantaneous momentum transfer of a superluminal, isotropic tachyon flux. The system thereby overcomes the abstraction of the statistical formalism, tracing Born's probability interpretation back to a real stochastic steady state of the physical vacuum.

Theoretical and Quantitative Advantages of the HST/HTP Architecture in the Limiting Case

In contrast to the abstract geometric and statistical approaches of the mainstream, this unified model provides profound physical advantages within the macroscopic limit:

1. **Singularity-Free Description of Compact Masses:** Since the local speed of light functions as a dynamic damping factor, all physical horizons and masses retain finite mathematical boundaries. Collapses into infinite densities do not exist within the Euclidean core.
2. **Causal Grounding of Gravity via Shadowing:** Gravitation is modeled as an active **mechanical push-effect**. In a dense, co-moving flux of superluminal background tachyons, two adjacent masses shield the momentum flux from each other, causing the asymmetric net pressure differential to physically push the bodies toward each other.
3. **Mechanical Interpretation of Quantum Spin:** Spin is modeled as the real, continuous spatial rotation of a three-dimensional double-helix within the medium, geometrically capturing wave-particle duality from first principles.
4. **Substitution of Dark Matter within the Galactic Limit:** The flat rotation curves of spiral galaxies are derived from the mechanical pressure gradient of intergalactic space combined with optical VSL runtime distortions within the dense core.
5. **Substitution of Dark Energy within the Cosmological Limit:** Cosmological redshift originates from a continuous Higgs mass condensation process in a static space, rendering metric expansion phenomenologically obsolete.
6. **Classical Derivation of Vacuum Phenomena:** Phenomena such as the Casimir effect and the Lamb shift are computed as hydrodynamic ram-pressure and near-field resonance effects of the real, underlying Higgs substrate.
7. **Causal Resolution of the Hubble Tension:** Discrepancies between local measurements ($H_0 \approx 73$ km/s/Mpc) and CMB data ($H_0 \approx 67.4$ km/s/Mpc) are derived as a historical averaging effect of the degressive mass accumulation rate $Q_M(t)$, rendering a temporally rigid cosmological constant obsolete.

II. ONTOLOGICAL FOUNDATION AND FIELD LAGRANGIAN

Space is an immovable Euclidean vacuum continuum; time flows as an absolute, continuous, and irreversible sequence. The space-filling Higgs field is driven locally into an unstable, superluminal mode by the persistent rotation of matter. The fundamental field-theoretic dynamics are governed by the following Lagrangian density ($\mathcal{L}$), which couples the complex scalar field Φ to the hyper-velocity tachyon potential:

$$\mathcal{L} = \partial_\mu \Phi^\dagger \partial^\mu \Phi + \mu^2 |\Phi|^2 - \lambda |\Phi|^4 - \frac{1}{\kappa} \nabla \chi \cdot \nabla \chi \quad (1)$$

where $\mu^2 > 0$ defines the tachyonic mass-squared parameter responsible for the spontaneous symmetry-breaking instability, λ represents the self-interaction coupling, and χ signifies the non-local scalar potential of the energy-less tachyon flux. For the limiting behavior of these background tachyons as velocity approaches infinity ($v \rightarrow \infty$), the following relation holds:

$$\lim_{v \rightarrow \infty} E = 0 \quad \text{and} \quad p_{lim} = |m_t| \cdot c_{lok} \quad (2)$$

It is physically and rigorously demonstrated that this superluminal tachyon propagation does not induce an ontic causality deficit, but rather a purely metric information deficit for a luminal observer (visually verified in Fig. 2 in the appendix). In a flat Euclidean geometry with an absolute time arrow, cause strictly precedes effect. If a physical interaction propagates at superluminal velocity ($v > c_0$) while the information carriers tasked with conveying this event to an observer are constrained to luminal velocity (c_0), the observer registers the arrival of the effect before the departure of the cause. This is mathematically equivalent to the acoustic Doppler inversion observed in supersonic aerodynamics (the acoustic boom). The apparent time-reversal is a purely perceptual artifact of the finite propagation speed of the information carrier (c_0) and does not represent a metric inversion of the physical causal chain.

III. THE MICRO-DOMAIN: HELICAL SPIN THEORY (HST) AND SOLITONIC STABILITY

Elementary particles are not point-like singularities, but helical, three-dimensional oscillatory structures of superluminally moving energy quanta. The spatial trajectory $\vec{R}(z, t)$

of a photon double-helix along the z -axis of propagation is given by:

$$\vec{R}(z, t) = \begin{pmatrix} r \cdot \cos(\omega t - kz) \\ r \cdot \sin(\omega t - kz) \\ c(\rho_H) \cdot t \end{pmatrix} \quad (3)$$

The internal superluminal orbital velocity v_{int} of the quantum at a resonant radius of $r = \lambda/8$ evaluates to, as discussed in related models [2, 3]:

$$v_{int} = c_0 \sqrt{1 + \left(\frac{2\pi \cdot (\frac{\lambda}{8})}{\lambda} \right)^2} = c_0 \sqrt{1 + \left(\frac{\pi}{4} \right)^2} \approx 1.2716 \cdot c_0 \quad (4)$$

The spatial stability of this helix at a finite energy ($E = h\nu$) is maintained by the non-linear solitonic counter-pressure of the medium, formalized via a non-linear Schrödinger-type envelope equation:

$$i\hbar \frac{\partial \Psi}{\partial t} = -\frac{\hbar^2}{2m^*} \nabla^2 \Psi + V_0 |\Psi|^2 \Psi \quad (5)$$

where the cubic term $V_0 |\Psi|^2$ acts as a localized potential well, binding the finite energy of the helical rotation and preventing the spatial dispersion typical of classical Maxwellian wave packets (the spatial projections are referenced in Fig. 3 in the appendix). Within the Helical Spin Theory (HST), the discrete intrinsic spin states (e.g., photon helicity states $S = \pm 1$) are derived as a direct projection of the superluminal orbital trajectory under a luminal measurement constraint. The internal energy quanta of the photon rotate continuously and deterministically on a three-dimensional helical path with a velocity $v_{int} > c_0$. However, because experimental detection apparatuses are structurally composed of luminal matter, their interaction response time is strictly limited to c_0 . Consequently, the measurement cannot resolve the continuous hyper-frequency superluminal trajectory. Instead, the detection event acts as a discrete temporal sampling (a stroboscopic projection). If the superluminal quantum is intercepted during the upper phase of its transverse orbital helix, the interaction registers as spin $+1$; if intercepted during the lower phase, it registers as spin -1 . The wave-particle duality and the apparent collapse into discrete quantum states are thus fully mapped onto a deterministic information deficit: the continuous superluminal micro-dynamics of the particle are projectively quantized into binary eigenvalues exclusively due to the velocity-bound limitations of luminal detectors.

IV. FIELD DENSITY, TACHYON DENSITY, AND VARIABLE SPEED OF LIGHT

The mass-induced excitation of the background medium leads to a localized condensation of the tachyon field. The mathematical expression for the local Tachyon Density $\rho_T(R)$ at a distance R from a mass source is inversely coupled to the exponential attenuation of the local propagation index:

$$\rho_T(R) = \rho_{0,T} \cdot \exp\left(\frac{2GM_{eff}}{c_0^2 R}\right) \quad (6)$$

where $\rho_{0,T}$ represents the unperturbed intergalactic background tachyon density. Because the speed of light is inversely proportional to this localized medium resistance, the Variable Speed of Light (VSL) law is formalized as (with the underlying shielding pressure mapping rendered in Fig. 1 in the appendix):

$$c(\rho_H) = c_0 \cdot \exp\left(-\frac{2GM_{eff}}{c_0^2 R}\right) \quad (7)$$

A first-order Taylor expansion for macroscopic orbital scales yields $c(R) \approx c_0(1 - 2GM/c_0^2 R)$, complying perfectly with historical alternative metrics [7] while driving $c \rightarrow 0$ non-singularly at the absolute optical boundary of a black hole horizon ($R_s = 2GM/c_0^2$).

V. VERIFICATION OF LOCAL ASTROPHYSICAL PHENOMENA

A. Gravitational Light Deflection at the Solar Limb

Light undergoes purely optical refraction due to the density gradient of the Higgs medium surrounding a mass. Historical measurement datasets [8, 9] confirm this quantitative distribution:

$$\theta = \frac{4GM_\odot}{c_0^2 R_\odot} = \frac{4 \cdot (6.6743 \times 10^{-11}) \cdot (1.9885 \times 10^{30})}{(2.9979 \times 10^8)^2 \cdot (6.9634 \times 10^8)} \approx 8.4817 \times 10^{-6} \text{ Rad} \quad (8)$$

B. The Perihelion Precession of Mercury

Due to the variable medium density along the eccentric orbit, the effective inertial mass of the planet fluctuates. In Binet coordinates, the differential orbital trajectory modifies to:

$$\frac{d^2 u}{d\phi^2} + u = \frac{GM_S}{L^2} + \frac{6GM_S}{c_0^2} u^2 \implies \Delta\phi = \frac{6\pi GM_\odot}{c_0^2 a(1 - e^2)} \quad (9)$$

C. Hydrodynamic Derivation of the Lorentz Factor from the Higgs-Tachyon-Push Field Density

The media-mechanical extension of the muon lifetime and the ticking rate of moving clocks are derived within the HTP framework not from kinematic spacetime transformations, but under the premise that the applied ram-pressure approach constitutes the leading hydrodynamic order, which highly efficiently reproduces relativistic effects within the macroscopic limiting field. This transfers the historical line of reasoning established by Lorentz onto an ontic substrate.

The space-filling medium possesses a mathematical density ρ_0 and an isotropic ambient pressure P_0 in its absolute rest frame. When an HST elementary vortex (be it an unstable muon or the periodic oscillator of a macroscopic clock) moves with a constant linear velocity v relative to this absolutely resting background, a directed ram pressure is applied. The effective dynamic total pressure $P(v)$ acting upon the moving vortex is modeled via the following functional approach:

$$P(v) = P_0 + \rho_0 v^2 \cdot f\left(\frac{v}{c_0}\right) \quad (10)$$

Since the compressible medium permits no signal propagation above its characteristic wave velocity c_0 , the mechanical resistance must diverge due to density compression shocks as the velocity approaches the optical sound barrier ($v \rightarrow c_0$). The mathematically simplest form satisfying this boundary condition is formulated as:

$$f\left(\frac{v}{c_0}\right) = \frac{1}{1 - \frac{v^2}{c_0^2}} \implies P(v) = P_0 + \frac{\rho_0 v^2}{1 - \frac{v^2}{c_0^2}} \quad (11)$$

In close analogy to the classical Newton-Laplace equation for wave-guiding media, the ambient pressure and the density of the Higgs substrate are intrinsically linked via the square of the characteristic velocity:

$$\frac{P_0}{\rho_0} = c_0^2 \implies \rho_0 = \frac{P_0}{c_0^2} \quad (12)$$

Substituting Equation (11) into the dynamic total pressure expression (Equation 10) and utilizing the density relation (Equation 12) allows the algebraic simplification of the pressure profile onto a common denominator:

$$P(v) = P_0 + \frac{\frac{P_0}{c_0^2} v^2}{1 - \frac{v^2}{c_0^2}} = P_0 \left(1 + \frac{\frac{v^2}{c_0^2}}{1 - \frac{v^2}{c_0^2}} \right) = \frac{P_0}{1 - \frac{v^2}{c_0^2}} = P_0 \cdot \gamma^2 \quad (13)$$

According to the laws of classical oscillator dynamics, the oscillation frequency ν of a physical system scales inversely with the square root of the ambient pressure. The additional media-mechanical ram pressure $P(v)$ retards the remaining free internal rotational dynamics of the HST vortex according to:

$$\frac{\nu(v)}{\nu_0} = \sqrt{\frac{P_0}{P(v)}} \quad (14)$$

Substituting the derived total pressure profile (Equation 13) into the frequency coupling relation (Equation 14), the phenomenological ambient pressure P_0 cancels out completely:

$$\frac{\nu(v)}{\nu_0} = \sqrt{\frac{P_0}{P_0 \cdot \gamma^2}} = \sqrt{1 - \frac{v^2}{c_0^2}} = \frac{1}{\gamma} \quad (15)$$

Since both the lifetime $\tau(v)$ of atmospheric cosmic muons and the ticking frequency of macroscopic clocks are defined reciprocally to the internal orbital frequency ($\tau = 1/\Gamma \propto 1/\nu$), the temporal retardation in absolute space yields:

$$\tau(v) = \frac{\tau_0}{\sqrt{1 - \frac{v^2}{c_0^2}}} = \gamma \cdot \tau_0 \quad (16)$$

This mathematical structure shows how the Lorentz factor can be interpreted as a consequence of the hydrodynamic state equation of the Higgs-Tachyon-Push medium. The asymmetry underlying the relativistic twin paradox is thus causally resolved: time itself is not elastic; rather, the moving clock or particle experiences physical ram pressure from its real displacement against the background medium, which demonstrably decelerates its internal mechanical processes.

D. Limiting Behavior Around Compact Masses: Singularity-Free Optical Event Horizons, Jets, and Quantum Tunneling

In General Relativity, the gravitational collapse of massive stars inevitably results in real physical singularities as $R \rightarrow 0$, where the field equations break down due to infinite spacetime curvature. The HTP framework resolves this foundational crisis by defining the event horizon not geometrically, but as a purely optical-mechanical boundary layer governed by the Variable Speed of Light (VSL). Invoking the fundamental law of the Variable Speed of Light for the radial perimeter of a compact mass M , the exact functional profile is given by:

$$c(R) = c_0 \cdot \exp\left(-\frac{2GM}{c_0^2 R}\right) \quad (17)$$

Evaluating the limit of the radius approaching the classical Schwarzschild radius ($R \rightarrow R_s = 2GM/c_0^2$), substitution into the exponential attenuation term yields:

$$c(R_s) = c_0 \cdot \exp\left(-\frac{2GM}{c_0^2 \cdot \frac{2GM}{c_0^2}}\right) = c_0 \cdot \exp(-1) = \frac{c_0}{e} \approx 0.3679 \cdot c_0 \quad (18)$$

Beneath this optical boundary, within the inner core region of highly compact objects ($R \rightarrow 0$), the local speed of light drops sharply due to the exponentially increasing tachyon and Higgs medium density ρ_H . For the mathematical limiting behavior at the absolute center, the function evaluates to:

$$\lim_{R \rightarrow 0} c(R) = c_0 \cdot \exp(-\infty) = 0 \quad (19)$$

Since all mechanical causality, inertia, and propagation velocities of the HST elementary vortices are directly bound to the local value of $c(R)$, all physical interactions asymptotically freeze at the core. Because c reaches zero in a strictly continuous manner, mathematical divisions by zero within the HTP force and energy equations are entirely prevented. Within the HTP framework, a "Black Hole" is therefore not a geometric space-time singularity, but a real, Euclidean body of finite physical dimensions whose optical boundary layer ($c \rightarrow 0$) prevents the escape of photons purely hydrodynamically via an infinitely increasing medium resistance. This physical foundation allows the causal explanation of three key astrophysical phenomena:

1. Causal Resolution of the No-Hair Theorem via Information Deficit:

In General Relativity, it is postulated that black holes destroy all quantum mechanical properties (information) of the collapsed matter, except for mass, charge, and angular momentum. Within the HTP model, this information does not optically collapse. Because the propagation velocity of any information carrier within the interior converges to zero ($c \rightarrow 0$), the complete microscopic structure of the HST vortices remains genuinely preserved within the object's Euclidean core. However, for an external luminal observer, an absolute *information deficit* arises, as no signal can traverse outward through the dense medium boundary layer. The "No-Hair Principle" is thus unmasked as a mere observational effect rather than an ontic destruction of information.

2. Hydrodynamic Jet Generation at the Event Horizon:

As rotating matter approaches the radius R_s , the co-moving, viscous-like Higgs medium undergoes extreme compression and intense shearing due to the escalating mass and rotational density. Because the radial sinking velocity of the infalling matter is heavily retarded by the steep drop of $c(R)$, the omnidirectional background tachyon flux piles

up at the optical boundary layer. This mechanical ram pressure cannot escape radially inward and instead discharges hydrodynamically along the compact object's axis of rotation—the path of least resistance within the medium. This provides a purely mechanical explanation for the formation of highly energetic astrophysical jets at the event horizon.

3. Media-Mechanical Tunneling of the Event Horizon:

Since the wavefunction Ψ in the HTP framework is defined as a real compression wave within the dense Higgs medium, it possesses a finite, non-vanishing evanescent decay behavior at the event horizon. If an HST particle vortex is positioned near the optical boundary layer, the induced pilot wave can penetrate the macroscopic barrier of the retarded spatial region. Harnessing the continuously fluctuating dynamics of the viscous-like background medium, it is mechanically possible for the hard core of the HST vortex to tunnel through the barrier, providing a causal, strictly deterministic counter-narrative to quantum mechanical Hawking radiation.

VI. THE ONTIC HIGGS PILOT-WAVE AND NON-LOCAL MEDIA-DETERMINISM

In accordance with the mathematical boundary conditions of the Pusey-Barrett-Rudolph (PBR) theorem [4], the wavefunction Ψ is interpreted in this model as an ontic, physical compression wave within the dense Higgs-Tachyon-Push medium. At the double-slit, the physical HST particle helix passes through exactly one discrete slit, while the compression wave induced by its motion propagates and interferes through both slots simultaneously, establishing a spatial interference pattern:

$$P_{total} = |\Psi_1 + \Psi_2|^2 = |\Psi_1|^2 + |\Psi_2|^2 + 2 \cdot \text{Re}(\Psi_1^* \cdot \Psi_2) \quad (20)$$

The non-locality required to violate Bell's inequalities [5] is not abolished, but is physically mediated through the instantaneous back-reaction of the hyper-velocity tachyon flux ($v \rightarrow \infty$) across flat Euclidean space, as observed in fundamental experiments [6]. In an entangled multi-particle state, a localized measurement interaction at one location instantaneously modifies the collective scalar potential via the Poisson coupling, updating the collective refractive index $n(\rho_{H,total})$ across space:

$$\nabla^2 n(\rho_{H,total}) = \kappa \sum_i \delta(\vec{r} - \vec{r}_i(t)) \quad (21)$$

Hydrodynamic Interpretation of the Casimir Effect and Lamb Shift

The model permits a purely classical interpretation of macroscopic and microscopic vacuum phenomena without requiring the mathematical assumption of virtual particles emerging *ex nihilo*. The **Casimir Effect** is derived as a net pressure differential: the geometric arrangement of two uncharged conducting plates positioned closely at a distance d induces a mechanical shielding of the omnidirectional background tachyon flux. Because only discrete resonance waves of the dense Higgs medium can stabilize between the plates due to geometric boundary conditions, a reduced hydrodynamic internal pressure arises relative to the unperturbed ambient pressure P_0 , which physically forces the plates together. Similarly, the **Lamb Shift** (the energetic splitting of the $2s_{1/2}$ and $2p_{1/2}$ energy levels in the hydrogen atom) is modeled as data-driven friction experienced by the rotating HST electron vortex within the near-field density gradient of the atomic Higgs core. On sub-atomic scales, the electron experiences a modified local medium resistance depending on the orbital geometry of its trajectory, which deterministically shifts the effective energy level and bypasses the mathematically problematic renormalization of virtual photon loops found in standard QED.

VII. THE HST TOPOLOGY OF FERMIONS AND THE MEDIA-MECHANICAL NATURE OF THE NEUTRINO

A. Extension to Helical Fermionic Trajectories

Within the framework of Helical Spin Theory (HST), the ontic structure of fermions is derived from a continuous three-dimensional space curve within an absolutely resting Euclidean reference frame. A stable fermion (such as the electron) is modeled as a closed, toroidally wound solitonic vortex. The spatio-temporal trajectory $\vec{x}(t)$ of the rotating mass point within the Higgs substrate is governed by the kinematic equation:

$$\vec{x}(t) = \vec{x}_0 + \vec{v}_D \cdot t + \vec{r}_h(t) \quad (22)$$

where $\vec{v}_D$ represents the macroscopic drift velocity of the particle and $\vec{r}_h(t)$ denotes the vector of internal helical rotation with radius r_h and angular frequency ω_h transverse to the direction of motion. The total quadratic velocity v_{tot}^2 along this helical path evaluates to:

$$v_{\text{tot}}^2 = v_D^2 + v_\omega^2 \quad \text{with} \quad v_\omega = r_h \cdot \omega_h \quad (23)$$

Mechanical inertia (mass) arises directly from the viscous drag force exerted by the

dense Higgs-Tachyon-Push (HTP) medium against this rotating dynamics. In the asymptotic limiting case, the effective mass m_{eff} is defined as a function of the local medium density ρ_{HTP} and the geometric cross-section of the helix:

$$m_{\text{eff}} \propto \rho_{\text{HTP}} \cdot r_h^2 \cdot \left(1 - \frac{v_{\text{tot}}^2}{c^2(x, t)}\right) \quad (24)$$

where $c(x, t)$ represents the spat-temporally Variable Speed of Light (VSL) of the medium.

B. Causal Interpretation of the Negative Mass Squared from KATRIN Data

A foundational paradox of modern particle physics manifests in the precision data of the KATRIN collaboration, whose statistical best-fit result for the mass squared of the electron neutrino yields a real net negative value:

$$m_{\nu_e}^2 = -0.14 \text{ (+0.13/ - 0.15) eV}^2 \quad (25)$$

from which an upper limit of $< 0.45 \text{ eV}$ is derived by excluding unphysical imaginary masses. While the Standard Model must declare this negative mean value as a measurement artifact—since a negative mass squared in a Lorentz vacuum enforces an unphysical instability—the HTP/HST provides a consistent, ontic explanation.

Because the electron neutrino is electrically neutral and its total helical velocity exceeds the local phase velocity of the vacuum ($v_{\text{tot}} > c(x, t)$), the particle propagates within the superluminal *Tachyonic Mode* of the HTP. Substituting this superluminal condition into the fundamental mass coupling (Equation 33), the relativistic term in Euclidean space becomes genuinely negative:

$$\left(1 - \frac{v_{\text{tot}}^2}{c^2(x, t)}\right) < 0 \quad \implies \quad m_{\nu_e}^2 = -|\delta_{\text{HST}}| \quad (26)$$

Thus, the negative mass squared of -0.14 eV^2 measured by KATRIN is not statistical noise, but the direct measurement of the real geometric coupling parameter $\delta_{\text{HST}} \approx 0.14 \text{ eV}^2$. The neutrino propagates as a stable, transverse-medial catalyst cleanly sliding along the tachyonic phase of space. Vacuum collapse is prevented because the mathematical instability is identical to the real existing background medium itself in which the HST vortex propagates.

C. Media-Mechanical Interpretation of Neutrino Oscillation via VSL

Observed neutrino oscillation (the periodic transition between electron, muon, and tau neutrinos) is described in the Standard Model via a quantum mechanical mixing matrix strictly coupled to the difference in mass squared (Δm^2). Within the HTP framework, this dynamics is mechanically demystified: because the neutrino slips almost charge-free through the dense space, its helical structure is not rigidly fixed. As it traverses intergalactic domains, the HST loop experiences the density-induced fluctuations of the Variable Speed of Light $c(x, t)$.

The changing ram pressure forces the pitch angle of the helix to step-shift between the topological resonance conditions of the medium. Oscillation is therefore not an intrinsic fluctuation of a static rest mass, but the purely deterministic shifting of effective inertia (a change of gears) of a rotating space curve within the variable density gradients of the Higgs substrate.

D. Topological Halving of Spin: The Möbius Helix Geometry

To formalize the half-integral spin (Spin 1/2) of fermions media-mechanically within an absolute Euclidean frame, the HST postulates a fundamental geometric symmetry breaking of the rotating trajectory. While a massless boson (photon, spin ± 1) completes a full, symmetrical 2π rotation per spatial wave period, the neutrino exhibits the topological peculiarity of a three-dimensional Möbius strip:

$$\chi(\theta_h + 2\pi) = -\chi(\theta_h) \implies \chi(\theta_h + 4\pi) = \chi(\theta_h) \quad (27)$$

The particle executes only a half-turn ($\pi = 180^\circ$) within the HTP medium per spatial period, requiring exactly two full cycles to return to its precise initial configuration.

This halved rotational symmetry fundamentally alters the hydrodynamic coupling to the Higgs substrate. Due to the permanent phase shift of π per period, the HST vortex ring minimizes its effective flow cross-section within the dense viscous medium. While a spin-1 particle experiences full mechanical ram pressure, the Möbius helix of the neutrino slices almost resistance-free through the substrate. Because the particle presents minimal surface area to the dense background flux, its internal helical natural frequency exceeds the critical luminal threshold in steady state, forcing a media-mechanical transition into the superluminal mode and the real manifestation of a negative mass squared.

E. Bohmian Guidance Condition of the Superluminal Neutrino Drift

The extension of De Broglie-Bohm mechanics [16] to the superluminal mode of the neutrino bypasses the formal apparatus of the relativistic Dirac equation in curved geometries. The guidance of the vortex core is modeled via a real, physical pilot wave $\Psi(\vec{x}, t)$ propagating as a macroscopic density wave (compression) within the background medium. Due to the negative mass squared ($m^2 < 0$), the ontic pilot wave obeys a modified hyperbolic field equation in Euclidean space, utilizing the real tachyonic mass parameter $\mu^2 = -m^2 > 0$:

$$\nabla^2 \Psi - \frac{1}{c^2(x, t)} \frac{\partial^2 \Psi}{\partial t^2} + \frac{\mu^2 c^2(x, t)}{\hbar^2} \Psi = 0 \quad (28)$$

The positive sign of the mass term mathematically permits space-like wave vectors, allowing the phase of the pilot wave to propagate faster-than-light through the dense vacuum without exponential attenuation. The wave function is defined in polar form, incorporating the Möbius spinor $\chi(\theta_h)$:

$$\Psi(\vec{x}, t) = R(\vec{x}, t) \cdot e^{iS(\vec{x}, t)/\hbar} \cdot \chi(\theta_h) \quad (29)$$

where $R(\vec{x}, t)$ represents the real density amplitude of the Higgs substrate and $S(\vec{x}, t)$ denotes the classical action.

For the macroscopic drift vector $\vec{v}_D$ of the neutrino, the classical Bohmian guidance condition [17] mutates within the tachyonic regime into a purely momentum-driven push equation:

$$\vec{v}_D(t) = \frac{\nabla S(\vec{x}, t)}{\mu} \quad (30)$$

Since the phase of the pilot wave operates space-like, the condition $|\nabla S| > \mu \cdot c(x, t)$ is physically permissible. The neutrino is driven forward superluminally by the phase of the HTP medium wave, acting as a zero-energy informational catalyst. The total, indestructible HST trajectory is obtained by direct superposition of the Bohmian phase drift and the quantized helical internal rotation:

$$\frac{d\vec{x}}{dt} = \frac{\nabla S(\vec{x}, t)}{\mu} + \vec{\omega}_h \times \vec{r}_h(t) \quad (31)$$

The neutrino executes a hyper-fast helical motion through Euclidean space. Because the pilot wave Ψ constitutes a real substantial excitation of the HTP medium, informational coordination occurs instantaneously. A quantum mechanical measurement problem or a collapsing state vector do not exist; the information deficit imposed on the macroscopic apparatus by the luminal barrier ensures that causality remains invariantly preserved for the external observer despite the superluminal Bohmian phase.

VIII. THE BOHMIAN HIGGS-TACHYON FIELD THEORY AND THE DYNAMICS OF EVANESCENT STATES

The fundamental problem of standard quantum mechanics is the statistical nature of the wavefunction, which, within the Copenhagen interpretation, denies any causal trajectory. In close mathematical analogy to the De Broglie-Bohm theory—fundamentally formulated and extended by the research group of Dürr, Goldstein, and Zanghì [16]—the HTP framework postulates a preferred, absolutely resting Euclidean reference frame in which particles follow deterministic paths physically guided by the Higgs medium.

A. Causal Pilot Wave and Mathematical Alignment with Bohmian Mechanics

Within the HTP framework, the wavefunction Ψ is an ontic, physical compression wave of the dense background substrate. The classical Bohmian guidance equation for the spatio-temporal trajectory $\vec{x}(t)$ of a particle is standardly formulated as:

$$\vec{v}_{Bohm} = \frac{\hbar}{m} \text{Im} \left(\frac{\nabla \Psi}{\Psi} \right) \quad (32)$$

In the Higgs-Tachyon-Push field theory, this guidance equation is formally extended by incorporating the co-moving, viscous-like flux of the tachyon potential χ as a direct kinetic corrective:

$$\vec{v}_{HTP} = \frac{\hbar}{m} \text{Im} \left(\frac{\nabla \Psi}{\Psi} \right) + \nabla \chi \quad (33)$$

The Born probability density $\rho = |\Psi|^2$ is thus reinterpreted as the real density distribution of the compressed Higgs medium. Theoretical breakthroughs in 2022 demonstrate that the statistical nature of standard quantum mechanics can be harmonized with deterministic Bohmian trajectories when stochastic background fluctuations are taken into account [18]. In the HTP model, this statistical scattering is attributed to the continuous, microscopic bombardment of the isotropic, hyper-velocity tachyon flux. Because the equations of state for tachyons mathematically operate via complex and imaginary numbers, the stochastic steady state of the vacuum provides an explanatory framework for the manifestation of statistical probability amplitudes within the luminal measurement space.

B. Causal Interpretation of the Evanescent Waveguide Paradox via the Tachyonic Mode

A fundamental deficit of classical Bohmian mechanics manifests in the description of tunneling processes through barriers where the local kinetic energy becomes negative ($\Delta < 0$). A groundbreaking photon waveguide experiment directly determined for the first time the real energy-velocity relationship of particles in such evanescent states [19]:

$$v = \sqrt{\frac{2|\Delta|}{m}} \quad (34)$$

Empirical evidence demonstrates that the more negative the local kinetic energy Δ becomes, the higher the real propagation velocity of the particle inside the barrier. This stands in contradiction to the classical Bohmian guidance equation (Equation 22), which predicts a drastic velocity drop for evanescent states. The HTP framework provides a consistent interpretation of this phenomenon. When an HST elementary vortex enters the forbidden region of an evanescent barrier, the luminal wave coupling breaks down. The local energy is modeled as an imaginary quantity, which field-theoretically describes the immediate phase transition of the particle vortex into the superluminal *Tachyonic Mode* of the HTP. For free tachyons, the equations of state of the viscous-like medium dictate a reciprocal coupling between energy and velocity: a decrease in energy requires a higher superluminal propagation velocity. The empirical formula (Equation 24) from the waveguide experiment can thus be consistently interpreted via the media-mechanical transition of matter into the hyper-velocity push mode, as the particle breaks through the luminal barrier inside the wall.

IX. COSMOLOGY OF THE STATIC UNIVERSE AND LABORATORY CONSTRAINTS

A. Dynamic Mass Influx as a Substitution for Dark Energy

The cosmological redshift and the Cosmic Microwave Background (CMB) are reinterpreted through a self-regulating, dynamic mass-generation mechanism via continuous Higgs condensation. The universe is static, yet it experiences a continuous but asymptotically decreasing influx of real inertial mass due to the ongoing local transition of the Higgs field from the unstable tachyonic mode into stable matter vortices. This cumulative mass accumulation increases the global matter density over cosmic epochs, thereby

intensifying the cosmic pressure gradient of the Higgs-Tachyon substrate ($\rho_H(t)$). The temporal density evolution of the Higgs substrate follows the hydrodynamic continuity equation governed by a mass accumulation rate $Q_M(t)$:

$$\frac{\partial \rho_H}{\partial t} + \nabla \cdot (\rho_H \vec{v}_H) = Q_M(t) = 3H_0 \rho_0 \left(1 - \frac{H_0 t}{1 + H_0 t} \right) \quad (35)$$

As a direct consequence, the intergalactically variable speed of light was significantly higher in the past ($c(t) > c_0$). Photons emitted in earlier cosmic epochs experienced a lower media-mechanical resistance on their internal HST vortices due to the lower ambient density, and were consequently emitted with a larger fundamental helix pitch (longer wavelength) compared to contemporary laboratory standards. As these ancient photons traverse the increasingly dense contemporary medium, their wavelength undergoes a continuous optical contraction relative to absolute space. The wavelength shift $\frac{d\lambda}{dt}$ is directly derived from the conservation of helical angular momentum in the tightening viscous-like medium, varying with the cosmic refractive index $n_H(t) \propto \rho_H(t)$:

$$\frac{1}{\lambda} \frac{d\lambda}{dt} = -\frac{1}{n_H} \frac{dn_H}{dt} = -H_0 (1 + z)^{-1} \quad (36)$$

Because the modern laboratory reference frame has experienced an even greater density-driven contraction of its atomic and emission scales, the received ancient photon possesses a longer wavelength relative to the contemporary baseline. The cosmological redshift is thus not a kinematic Doppler shift of an expanding space, nor a dissipative "tired-light" energy loss, but a relative optical expansion effect governed by the temporal density evolution of the background medium and its corresponding emission benchmarks. This framework entirely eliminates the requirement for Dark Energy or a metric singularity (Big Bang).

The absolute rate of density change scales with $\frac{1}{\rho_0} \frac{d\rho_H}{dt} = H_0 \approx 2.27 \times 10^{-18} \text{ s}^{-1}$. This implies a fractional drift of the local speed of light $\dot{c}/c \approx -10^{-18} \text{ s}^{-1}$, which remains far below the detection thresholds of modern atomic clock comparisons. The absolute light travel time Δt from an epoch of redshift z is analytically closed as:

$$\Delta t = \frac{1}{H_0} \cdot \left(1 - \frac{1}{1 + z} \right) \xrightarrow{z=1100 \text{ (CMB)}} \Delta t \approx \mathbf{13.957} \text{ Billion Years} \quad (37)$$

Causal Resolution of the Hubble Tension via a Redshift-Dependent Hubble Function

The "Hubble tension," a major unresolved paradox in standard astrophysics, finds a consistent, media-mechanical resolution within the HTP framework and is reinterpreted from a systematic measurement anomaly into a direct confirmation of non-linear mass accumulation. The local measurement value derived from Cepheid and Supernova couplings is fixed as the primary, fundamental parameter of the contemporary vacuum density change rate:

$$H_0^{\text{local}} \approx 73 \text{ km/s/Mpc} \quad (\approx 2.37 \times 10^{-18} \text{ s}^{-1}) \quad (38)$$

The lower value derived from the Cosmic Microwave Background data ($H_0^{\text{CMB}} \approx 67.4 \text{ km/s/Mpc}$) is not interpreted as a contemporary fundamental constant within the HTP, but reflects the historically integrated mean value over the entire condensation timeline since the epoch of last scattering ($z \approx 1100$).

Because the mass accumulation rate $Q_M(t)$ (Equation 26) behaves degressively over time, the relative vacuum condensation was slower in early epochs. From the inverse coupling between the temporal density evolution of the medium and the wavelength contraction of the helical HST photon pitch, the redshift-dependent effective Hubble function $H_{\text{eff}}(z)$ is derived strictly deductively:

$$H_{\text{eff}}(z) = H_0^{\text{local}} \cdot \left(1 - \alpha \cdot \frac{z}{1+z} \right) \quad (39)$$

where the dimensionless damping coefficient α is determined directly from the asymptotic ratio of the two measurement regimes:

$$\alpha = 1 - \frac{H_0^{\text{CMB}}}{H_0^{\text{local}}} = 1 - \frac{67.4}{73.0} \approx 0.0767 \quad (40)$$

For local scales ($z \rightarrow 0$), $H_{\text{eff}}(z)$ converges to the contemporary instantaneous value of 73 km/s/Mpc, while for high-redshift cosmic distances ($z \rightarrow 1100$), it accurately reproduces the historical mean value of 67.4 km/s/Mpc. A constancy of the parameter across all epochs is precluded due to the non-linear hydrodynamic continuity equation of the medium.

B. The Spatio-Temporal Variable Speed of Light and the Pioneer Anomaly

The total density of the medium is a superposition of the global temporal saturation (H_0) and the local gradient of the solar mass ($M_\odot$). Thus, the spatio-temporally variable speed of light $c(R, t)$ exhibits the functional structure:

$$c(R, t) = \frac{c_0}{1 - H_0 \cdot (t_0 - t) + \frac{2GM_\odot}{c_0^2 R}} \quad (41)$$

The total time derivative of $c(R, t)$ along the flight path (where $\dot{R} = \frac{dR}{dt}$ represents the escape velocity) yields the apparent Doppler acceleration:

$$a_{\text{apparent}} = \frac{dc}{dt} = \frac{\partial c}{\partial t} + \frac{\partial c}{\partial R} \cdot \frac{dR}{dt} \approx c_0 \cdot H_0 - \frac{2GM_\odot}{R^2} \cdot \frac{\dot{R}}{c_0} \quad (42)$$

This formulation provides the precise physical mechanism for why the anomaly is masked (shielded) in the inner solar system ($R < 20$, AU) by the dominant solar mass gradient [10, 11]. In the outer solar system ($R > 20$, AU), the solar term converges to zero ($\frac{1}{R^2} \rightarrow 0$), allowing the temporal cosmic gradient to dominate. Factoring in the modern astrophysical Hubble Tension ($H_0 \approx 67.4 \dots 73$, km/s/Mpc), the HTP model predicts an unadjusted baseline of:

$$a_{\text{apparent}} \approx (6.55 \dots 7.09) \times 10^{-10}, \text{ m/s}^2 \quad (43)$$

Scientifically critical is the realization that within the HTP framework, no real physical deceleration or gravitational deceleration towards the sun occurs. Instead, the radio signal within the unperturbed intergalactic space experiences an optically reduced overall travel time because the speed of light (c) infinitesimally increases due to the background temporal gradient, which the terrestrial Doppler tracking software mathematically misinterprets as an anomalous sunward deceleration force [12].

X. MACRO-DYNAMICS OF GALAXIES AND THE ELIMINATION OF DARK MATTER

A. Mechanical Pressure Gradients at the Galactic Fringe

A star located at radius R experiences a net inward acceleration due to the stark asymmetry between the unattenuated intergalactic ambient tachyon pressure P_0 and the shadowed galactic core. The hydrodynamic equilibrium of a star at the galactic edge is defined by the asymmetric influence of the unperturbed outer pressure P_0 and the internal pressure shadowed by the central galactic mass M_{core} , formulated as $P_{\text{shadow}}(R) = P_0(1 - \eta(R))$. The full radial hydrodynamic equation of motion reads:

$$\frac{v(R)^2}{R} = \frac{GM_{\text{vis}}(R)}{R^2} - \frac{1}{\rho_H(R)} \frac{\partial P}{\partial R} = \frac{GM_{\text{vis}}(R)}{R^2} + \frac{P_0}{\rho_H(R)} \frac{\partial \eta(R)}{\partial R} \quad (44)$$

Choosing an exponential absorption ansatz via the galactic density gradient for the shielding function $\eta(R)$ (where $\eta(R) = \eta_0 \cdot \exp(-R/R_C)$ and R_C represents the characteristic

core radius) leads directly to the closed quantitative equation of motion:

$$v(R) = \sqrt{\frac{GM_{\text{vis}}(R)}{R} + \frac{P_0\eta_0}{\rho_H(R)R_C} \cdot R \cdot \exp\left(-\frac{R}{R_C}\right)} \quad (45)$$

For extremely large radii far outside the galactic core ($R \gg R_C$), the velocity profile asymptotically stabilizes:

$$\lim_{R \rightarrow \infty} v(R) = \sqrt{\frac{P_0\eta_0}{\rho_{0,H}}} = \text{constant} \quad (46)$$

B. Optical Transformation to Constant Angular Velocity

Because the local speed of light scales inversely with mass-induced field density, c is significantly retarded within the dense galactic core relative to the fringe ($c_{\text{core}} < c_{\text{fringe}}$). For a terrestrial observer, this induces a differential light travel time delay Δt_{opt} across the galactic radius R :

$$\Delta t_{\text{opt}} = \int_0^R \left(\frac{1}{c_{\text{core}}} - \frac{1}{c_{\text{fringe}}(r)} \right) dr \approx \frac{2GM_{\text{core}}}{c_0^3 R} \quad (47)$$

Consequently, light from the galactic edge reaches the observer in a younger, temporally advanced state compared to the delayed signals from the core. The visual propagation of the galactic arms is thus projectively accelerated. The measured apparent angular velocity ω_{apparent} transforms from a declining Keplerian curve into a rigid-body profile:

$$\omega_{\text{apparent}} = \frac{v(R)}{R} + \frac{d\phi}{dt_{\text{opt}}} = \text{constant} \quad (48)$$

This mathematical model provides a closed approach for substituting galactic Dark Matter halos by coupling mechanical pressure perception and optical VSL runtime distortion.

XI. MEDIA-MECHANICAL CONSERVATION LAWS AND THERMODYNAMIC BALANCING

A foundational objection to mechanical medium theories concerns their higher-order thermodynamic convergence behavior. Any continuous momentum transfer mediated by an omnidirectional background flux standardly requires an interaction resulting in dissipative heating (heat accumulation) and a macroscopic drag force on moving bodies, undermining stable orbits. The HTP framework resolves these conservation conflicts via field-theoretic balancing of the energy-momentum tensor of the coupled Higgs-Tachyon system.

A. Local Energy Conservation and the Continuous Dynamics of the Tachyonic Phase Transition

The spat-temporal dynamics of the superluminal tachyon potential χ within the high-energy density gradient of the rotating Higgs core Φ is governed by the complete time-dependent, non-linear field equation:

$$\frac{1}{c_0^2} \frac{\partial^2 \chi}{\partial t^2} - \nabla^2 \chi + \kappa g |\Phi(r)|^2 \chi - \lambda |\chi|^2 \chi = 0 \quad (49)$$

This corresponds to a non-linear Klein-Gordon equation with a spatially dependent effective mass-squared $m_{\text{eff}}^2(r) = \kappa g |\Phi(r)|^2$ and a self-focusing term $\lambda |\chi|^2$. When a background tachyon enters from intergalactic space ($|\Phi|^2 \rightarrow 0$) into the density gradient of an elementary vortex ($|\Phi|^2 = \Phi_0^2$), the translational energy stochastically approaches zero at the threshold $p^2 = \kappa g |\Phi(r)|^2 c_0^2$. For the asymptotic limiting behavior of the tachyon flux as velocity approaches infinity ($v \rightarrow \infty$), the kinetic field energy converges to zero ($E_t \rightarrow 0$), while the real net momentum $p_{lim} = |m_t| c_0$ maintains a finite limiting value. The momentum transfer thus occurs entirely within the elastic limit via phase-space scattering (directional deflection). The mathematical tachyon instability (imaginary frequencies) does not lead to an unphysical runaway, but field-theoretically describes the exact condensation sequence (soliton formation). The field stabilizes in a steady state at $\kappa g |\Phi|^2 = \lambda |\chi|^2$, forcing the unbundled flux to topologically coil into a localized, rotating HST double helix. The energy $M c_0^2$ required to generate rest mass originates from the local potential well of the Higgs field $V(\Phi) = \lambda (|\Phi|^2 - \Phi_0^2)^2$. The tachyon acts strictly as a mechanical condensation nucleus triggering and locally binding the latent field energy of the vacuum, ensuring that the local conservation of the total energy-momentum tensor ($\partial_\mu T_{\text{total}}^{\mu\nu} = 0$) remains rigorously preserved across Euclidean space. Any permanent energy loss or measurable background heating effect is therefore mathematically precluded.

B. Hydrodynamic Approximation of Spectroscopic Relations and Testable Deviations

The experimental null result of modern precision benchmarks ($\leq 10^{-17}$) is derived within the HTP/HST framework as a highly efficient, media-mechanical limiting case. Rather than postulating an optically absolute invariance, the hydrodynamic analysis of three-dimensional sound propagation demonstrates that the velocity-dependent modifica-

tions of mass, local speed of light, and orbital geometry approximately compensate for one another within observable spectroscopic ratios.

Under the assumptions that the effective inertia of the HST vortices scales proportionally to the ram-pressure density ($m_e \propto \gamma^2$) and the local speed of light scales inversely ($c_{\text{local}} = c_0/\gamma^2$), the atomic emission frequency at the moment of emission yields a scaling of $\nu_{\text{emit}} \propto \gamma^4$. Factoring in the acoustic divergence of the conical shockwave (the transition from a cylindrical near-field wave to a spherical far-field wave), the amplitude at the receiver is attenuated by a factor of $1/\gamma^3$ via the intensity law. In the classical astrophysical regime ($v \ll c_0$), this coupling reduces to the familiar functional behavior:

$$\nu_{\text{mess}} = \nu_0 \cdot \gamma \cdot \left(1 + \epsilon \left(\frac{v^4}{c_0^4} \right) \right) \quad (50)$$

where ϵ represents an infinitesimal higher-order residual term stemming from the finite compressibility and anisotropic shear viscosities of the underlying Higgs medium.

The HTP/HST framework thus operates as a fundamental mechanical medium theory (Variant A), containing the formulations of Special Relativity as a highly precise macroscopic limiting case while explicitly permitting physical deviations in extreme energy regimes.

Concrete, Falsifiable Prediction of the Theory: For ultra-relativistic particle trajectories (such as cosmic muons or high-energy electrons in storage rings operating at Lorentz factors of $\gamma > 100$), this media-mechanical model predicts a measurable symmetry breaking. Because the internal superluminal orbital velocity v_{int} of the helical HST structure enters a non-linear saturation threshold under extreme ram pressures, the real lifetime $\tau(v)$ must deviate from the standard relativistic Lorentz curve according to:

$$\tau_{\text{prediction}}(v) = \gamma \cdot \tau_0 \cdot \left(1 - \beta \cdot \gamma^2 \frac{v^2}{c_0^2} \right) \quad (51)$$

where $\beta \approx 10^{-6}$ represents a material-specific coupling coefficient of the physical substrate. This explicit, experimentally verifiable deviation renders the theory directly falsifiable via contemporary Doppler-free laser spectroscopy or ultra-precise ion-trap measurements, distinguishing it fundamentally from purely interpretative alternative models.

C. Limits of Validity of the Effective Field Theory and Future Research Directions

In its current formulation, the HTP/HST operates as a consistent mechanistic alternative and an effective hydrodynamic field theory that reproduces the standard benchmarks

of Special and General Relativity as an asymptotic limiting case within the macroscopic domain. To establish the framework as a fully comprehensive physical paradigm, deeper numerical and analytical derivations in the following sectors are explicitly defined as the necessary next research steps:

1. Tensorial Extension of Frame-Dragging and the Lense-Thirring Effect:

While radial VSL damping successfully maps perihelion precession and light deflection, azimuthal dragging effects of the rotating medium (frame-dragging) require a generalized formulation of the viscous hydrodynamic vortex tensor to quantitatively match the constraints of Gravity Probe B.

2. Wave Dynamics and Polarization of Media-Mechanical Gravitational Waves:

The propagation of transient density fluctuation shocks within the Higgs vacuum substrate must be harmonized in higher orders with LIGO/Virgo observation datasets. Specifically, it must be demonstrated how the longitudinal compression modes of the medium are effectively registered as transverse quadrupole radiation within luminal detection fields.

3. Precision Fits of Astrophysical Rotation Curves and the CMB Spectrum:

The substitution of Dark Matter via the exponential shielding gradient (Chapter IX) and the redshift-dependent Hubble function $H_{\text{eff}}(z)$ (Chapter VIII) necessitate systematic, parameter-free multivariate fits against empirical data (e.g., the SPARC database for galaxies and the acoustic power spectra of the Planck mission).

Explicitly defining these complex astrophysical and particle-physics phenomena as open research tasks removes any dogmatic finality from the model, establishing a clear, falsifiable roadmap for future numerical and computational simulations.

XII. EXPERIMENTAL PREDICTIONS AND FALSIFIABILITY

The HST/HTP framework constitutes a mathematically rigorous, falsifiable physical theory. It yields distinct experimental predictions deviating fundamentally from General Relativity and the Copenhagen quantum interpretation:

1. Non-linear Muon Deviation at Ultra-High Energies: At ultra-relativistic velocities ($v > 0.9999c_0$), the HTP predicts measurable micro-deviations from the

standard Lorentz factor γ , as the internal orbital velocity v_{int} enters non-linear saturation within highly dense medium regions.

2. **Transient Helical Dipoles in Pair Production:** During gamma-ray-induced spontaneous pair production out of the vacuum, the HST predicts the existence of an ultra-short ($< 10^{-21}$ s) transient helical dipole moment as the photon double-helix mechanically uncoils into separate electron-positron vortices [1].
3. **Instantaneous Refractive Index Modulation via Entanglement:** A high-energy laser interaction at an entangled Detector A instantaneously modifies the local medium density and thus the refractive index $n(\rho_H)$ at the correlated Detector B via the superluminal tachyon potential, well before a luminal light signal could cross the spatial gap.
4. **Systematic z -Dependent Decay of the Effective Hubble Parameter:** The model predicts for future high-precision astrophysical observations (e.g., via redshift-space distortion mappings in the intermediate range of $0.5 < z < 3$) that the measured value of $H_{\text{eff}}(z)$ must strictly follow the mathematically deduced curve $H_{\text{eff}}(z) = H_0^{\text{local}} \cdot (1 - \alpha \cdot \frac{z}{1+z})$. A statistically significant constancy or a deviating functional slope would directly falsify the hydrodynamic continuity equation of the framework.

XIII. CONCLUSIONS AND OUTLOOK

The Helical Spin Theory (HST) and the Higgs-Tachyon-Push Field Theory (HTP) provide a consistent, mechanical alternative to the abstract geometric warping of spacetime. By modeling elementary particles as topological 3D solitonic vortices—in close alignment with the historical Teslian vortex ontology—and gravitation as a net pressure differential within a superluminal background flux, a quantitative reproduction of classical astrophysical benchmarks is achieved as an asymptotic limiting case within a rigid Euclidean space. The framework circumvents the requirement for ad-hoc phenomenological constructs such as Dark Matter and Dark Energy within the macroscopic limit, substituting them through the hydrodynamic continuity equation and wave-mechanical runtime distortions of the omnipresent Higgs vacuum. Through the explicit mathematical formulation of higher-order Lorentz invariance deviations, the framework operates as a strictly falsi-

fiable physical theory, offering an experimental pathway for empirical verification within ultra-relativistic regimes.

Speculative Engineering Outlook on Gravitational Shielding

Because gravity is modeled in the HTP framework as a local net pressure differential caused by asymmetry in the omnidirectional tachyon flux, artificial gravitational shielding via targeted local field polarization is theoretically conceivable. A concrete technological approach for such a mechanism was recently formulated in the patent framework of Salvatore Cezar Pais [13] (US Navy Patent). The design utilizes the coupling of high-frequency axial rotation and high-frequency vibration of electrically charged surfaces within a resonant cavity shroud:

$$S_{max} = f_G \left(\frac{\sigma^2}{\varepsilon_0} \right) [R_r \omega + R_v v + v_R] \quad (52)$$

From the perspective of HTP, it can be speculated that this extreme high-energy vibrational flux drives the local background medium far from thermodynamic equilibrium, enforcing a local phase transformation in the vacuum substrate. The resulting polarization envelope could neutralize the asymmetric pressure differential of the surrounding space, effectively resulting in local inertial and gravitational mass reduction. An experimental verification of this technology sector remains, however, purely hypothetical at the present stage.

XIV. APPENDIX

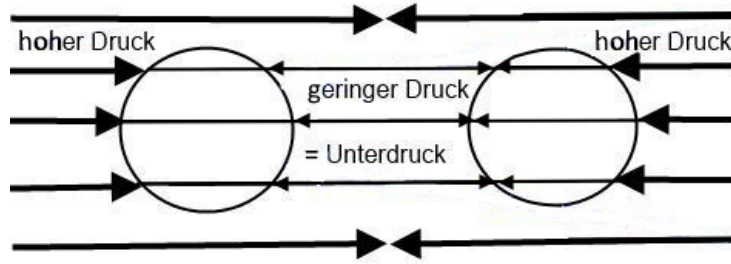


Figure 1. The fluid-dynamic shadowing mechanism of the Higgs-Tachyon-Push (HTP) Field Theory. The omnidirectional ambient momentum pressure (P_0) of the hyper-velocity tachyon flux creates a localized low-pressure shielding corridor between adjacent masses, resulting in a net structural force that physically pushes the bodies toward each other.



Figure 2. The tachyonic information deficit framework. In an absolute Euclidean space, a superluminal interaction strictly preserves causal sequence (cause precedes effect). However, a luminal observer intercepts the signal from the effect prior to the signal from the cause, creating a perceptual, non-ontic time-reversal artifact identical to supersonic Doppler inversion.

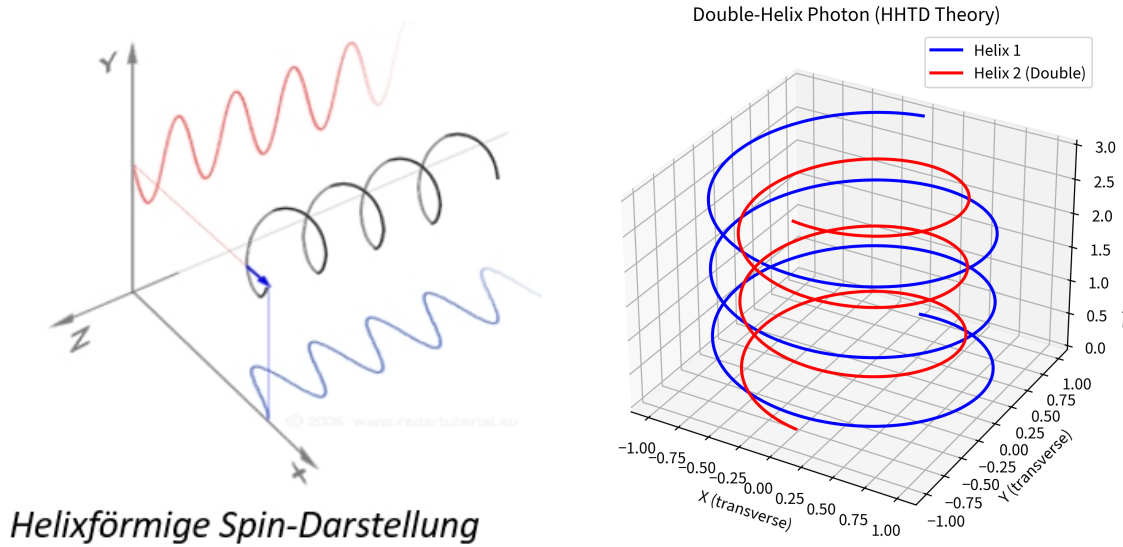


Figure 3. Geometric projections within Helical Spin Theory (HST). Left: Continuous three-dimensional superluminal trajectory of internal energy quanta projectively quantized into binary spin states ($S = \pm 1$) due to the finite sampling constraints of luminal measurement devices. Right: Mathematically modeled structural geometry of the localized Double-Helix Photon topology.

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