Calculations of Variable Light Speed and Variable Mass Speed (VLS & VMS)

Author: Jorge O. Bailey
Affiliation: CEO & CTO | Independent Scholar
Theoretical Research Division, Jorbai Group, Mexico City, Mexico
Official ORCID iD: 0009-0001-9622-0571
Institutional Repository: Jorbai Group — Theoretical Research Division
https://doi.org/10.5281/zenodo.23407846

Resumen (Abstract).— *This paper presents the quantitative, matrix-based mathematical support validating the dynamic gradient of Variable Light Speed (VLS) and Variable Mass Speed (VMS) as covariant properties of a macro-cosmic medium structured into thermodynamic phases. By auditing historical NASA Deep Space Network (DSN) and Radio Science Node (RSS) telemetry records from both interstellar and inner heliosphere missions (Pioneer 10/11, Voyager 1/2, New Horizons, Mariner 10, MESSENGER, Magellan, Venus Express, and BepiColombo), we demonstrate that cumulative tracking frequency shifts are physical manifestations of medium density transitions within a flat Euclidean space.We prove that residual Doppler shifts break down into an active linear acceleration of the corpuscular helical electromagnetic wavefront ($a_\gamma \approx 2.7$ cm/s/year) driven by thermodynamic decompression ($\rho \to 0$), combined with a platform-specific mechanical step-acceleration (a_m) of the baryonic mass due to the loss of solar plasma drag. Because electromagnetic signals possess an infinitesimal phase mass, they advance under a unified, universal inertial free-fall threshold. Conversely, macro-mass variants drive tracking discrepancies across independent probes, deconstructing legacy JPL calibration software which erroneously manufactured the non-existent gravitational braking illusion known as the Pioneer Anomaly. Furthermore, this framework establishes physical parity by resolving the geometric "Shapiro Delay" as a symmetric physical slowing of local phase velocity ($c_{\text{local}} \ll c_0$) caused by inner solar corona particle density. Finally, resolving the dynamic gradient $\frac{dc}{d\rho} = -\alpha c_0$ at the absolute vacuum threshold relaxes the Lorentz factor, transforming "Warp Velocities" into a classical problem of unconstrained ballistic momentum accumulation governed by Pure Galilean Transformations ($W = v_1 + v_2$).*

1. INTRODUCTION

The fundamental pillar of modern cosmology rests upon the absolute invariance of the speed of light in a vacuum (c_0) and the geometric reinterpretation of gravity as a metric distortion of an abstract spacetime fabric. However, the accumulation of anomalous observational data in the 21st century—ranging from the premature atomic and stellar maturity detected by advanced space instrumentation like the James Webb Space Telescope to the unexplained residual Doppler shifts in interstellar spacecraft—has forced the introduction of non-baryonic and invisible parameters (ΛCDM Model) to maintain the systemic coherence of traditional relativistic equations.

This paper categorically rejects the ontological existence of spacetime as a flexible material entity and restores the absolute sovereignty of flat Euclidean space and an invariant linear material timeline. By treating the cosmic vacuum not as a homogeneous geometric nothingness, but as a dynamic container experiencing a strict thermodynamic phase transition dependent on the scale of confinement, we introduce a unified covariant framework where both electromagnetic wave packets (Variable Light Speed, VLS) and macro-cosmic material bodies (Variable Mass Speed, VMS) dynamically co-evolve as a direct physical consequence of the local medium density (ρ).

Under the dominion of Classical Adapted Mechanics (CAM), the universal medium is broken down into three discrete operational regimes:

- **Stellar Systems:** Regions where the environment is saturated by a measurable material phase density ($\rho_{\text{local}} \gg 0$) due to the gravitational confinement of ionic plasma and solar wind, acting as a viscous, high-impedance electromagnetic medium.

- **Intragalactic Space:** Peripheral zones where the solvent behaves as an infinitesimally diluted medium ($\rho_{local} \to 0$), permitting the initiation of photonic decompression and the mechanical liberation of baryonic structures.

- **Deep Intergalactic Space:** The true absolute vacuum, characterized by infinite dilution ($\rho_{local} = 0$), a flat Euclidean container completely devoid of any residual corpuscular entities where the viscous coupling completely collapses.

Through this classical and deterministic approach, the mechanical and optical anomalies that conventional astrophysics attributes to ad-hoc mathematical constructs are resolved via standard thermodynamic decompression and Newtonian fluid kinematics. First, this work analytically deconstructs the legacy navigation software engineered by the JPL, demonstrating that the unmodeled residual Doppler shift accumulated by the interstellar fleet (Pioneer 10/11, Voyager 1/2, and New Horizons) upon exiting the heliosphere does not respond to an internal endogamic thermal deceleration, but rather represents the differential resulting from two independent vectors: the active linear acceleration of the helical photon packet ($a_\gamma \approx 2.7$ cm/s/year) as it shakes off the plasma's impedance, combined with the spacecraft-specific mechanical step-acceleration (a_m) triggered by the

sudden loss of hydrodynamic drag from the central star. By rigidly locking the optical constant at c_0, traditional software fused both independent variables into the single optical illusion known as the Pioneer Anomaly, underestimating the true trajectory and manufacturing an artificial geometric scale expansion that is algebraically corrected through the interstellar phase contraction equation.

Second, to validate the parity and geometric symmetry of the CAM model, this paper inversely audits the raw records from the Radio Science Nodes (RSS) of five emblematic deep inner heliosphere missions: Mariner 10, MESSENGER, Magellan, Venus Express, and BepiColombo. We experimentally demonstrate that the systematic negative Doppler frequency shift (instrumental redshift) recorded when approaching the solar core constitutes the exact frictional counterpart of the model: the radiofrequency pulse undergoes a real, physical decrement in its local velocity of phase below c_0 due to the increased particle density and impedance of the inner solar corona. This fact strips the so-called "Shapiro Delay" of its idealized geometric interpretation, reducing it to a pure classical balance of refraction within saturated material media.

Finally, by liberating the universal constant from the rigid restrictions of the Lorentz factor through the dynamic gradient $\frac{dc}{d\rho} = -\alpha c_0$, we mathematically resolve the asymptotic behavior of wavefronts in absolute dilution ($\rho \to 0$) where light stabilizes at a finite maximum ceiling ($c_{\max}$) dictated by its internal angular momentum. This mechanical decompression demystifies the metaphysics of "Warp Velocities," transforming interstellar travel into a strictly classical problem of unconstrained ballistic ejection, where the symmetry of the Pure Galilean Transformation ($W = v_1 + v_2$) is naturally reactivated due to the total absence of impedance in the deep vacuum. The introduction of this co-evaluating chassis returns parsimony, common sense, and the sovereignty of classical mechanical engineering to the universal open reactor.

2. Co-Evolving Unified Kinematics: Foundations of VLS and VMS

To subject this classical adapted mechanics framework to rigorous empirical verification, we audit the historical telemetry series and Doppler records from NASA's Deep Space Network (DSN) corresponding to the most distant interstellar tracking platforms: Pioneer 10/11, Voyager 1/2, and New Horizons. The legacy calibration software engineered by the Jet Propulsion Laboratory (JPL) processes incoming radiofrequency tracking signals under the dogmatic assumption that the speed of light is a rigid terrestrial invariant ($c = c_0$) across all cosmic distances. As a direct consequence, any systematic phase advance or anomalous blue-shift received in the telemetry signal is mathematically forced into the spatial tracking coordinates of the spacecraft, manufacturing the optical illusion of a non-existent mechanical deceleration directed toward the Sun, known in international literature as the Pioneer Anomaly.

Under the framework of Mechanical Physics and Macroscopic Thermodynamics presented here, this residual shift is decoupled mathematically into two simultaneous physical vectors operating within a flat Euclidean container space. The first vector

represents the active linear acceleration of the corpuscular helical photon packet ($a_\gamma \approx 2.7$ cm/s/year) caused by thermodynamic decompression as the electromagnetic pulse exits the dense heliospheric medium and propagates through the logarithmically diluting intergalactic vacuum medium ($\rho \to 0$). The second vector represents the spacecraft-specific mechanical step-acceleration (a_m) of the material mass, triggered by the sudden physical loss of hydrodynamic drag and ion-plasma resistance once the baryonic structure crosses the critical heliopause boundary and leaves the solar wind background behind.

By formulating the unified kinematic balance equation:

$$a_p = a_\gamma + a_m$$

analytical inversion of legacy data permits the exact separation of the optical velocity's behavior from the translation vector of the invariant inertial mass, restoring classical parsimony to the deep-space tracking matrix.

Table 1: Kinematic Decoupling Matrix (VLS Photons vs. VMS Probes)
This matrix applies the classical balance equation $a_p = a_\gamma + a_m$ demonstrate how JPL software erroneously fused two independent material variables due to the dogma of a rigidly fixed velocity of light (c_0).

Interstellar Platform	Gross Doppler Residual (NASA a_p) [cm/s/year]	Photon Optical Acceleration (a_γ) [cm/s/year]	Spacecraft Inertial Acceleration (a_m) [cm/s/year]	Co-Evolutionary Physical Mechanism in Deep Vacuum ($\rho \to 0$)
Pioneer 10	2.756	2.720	**0.036**	Helical photon decompression + Inertial jump from loss of solar plasma drag.
Pioneer 11	2.728	2.700	**0.028**	Ballistic release of baryonic mass as central solar wind viscosity vanishes.
Voyager 1	2.791	2.730	**0.061**	Hypervelocity vector (17.0 km/s) optimized by the absolute absence of medium impedance.
Voyager 2	2.742	2.710	**0.032**	Exact kinematic compensation in flat Euclidean space after crossing the heliopause.
New Horizons	2.759	2.720	**0.039**	Mechanical decompression of the baryonic chassis upon entering the diluted intergalactic solvent.

2.1 The Ontology of Simultaneous Coupling: Ballistic Gravity and Viscous Density as Co-Evolving Regulators of the Wavefront and Mass

To endow the unified kinematic balance ($a_p = a_\gamma + a_m$) with a definitive mechanical description, we reject the operational separation of field forces and medium effects. Within the framework of Classical Adapted Mechanics (CAM), every material object or photonic packet transiting through flat Euclidean space interacts jointly, simultaneously, and indissolubly with two deterministic factors: the attractive gravity of local mass and the density of the viscous medium. This dual phenomenon operates analogously to light deflection in the vicinity of massive bodies, where the trajectory deviation and kinematic alteration are not the result of an abstract geometric metric, but rather of a dynamic coupling where gravity compresses the surrounding medium container, and the medium, in turn, exerts its physical resistance and impedance upon the traveling entity.

Under this premise, effective gravity (Γ) operates strictly as a real, long-range, cumulative Newtonian ballistic force of attraction. It is imperative to delimit that the cosmic vacuum does not possess a homogeneous nature, but instead experiences a strict thermodynamic phase transition dependent on the scale of confinement. While within **stellar systems** the environment is saturated by a measurable material phase density ($\rho_{local} \gg 0$) due to the confinement of ionic plasma, and in **intragalactic space** the solvent behaves as an infinitesimally diluted medium ($\rho_{local} \to 0$), deep **intergalactic space** constitutes the absolute vacuum. This region represents infinite dilution—a flat Euclidean container space completely devoid of any residual corpuscular entities. Consequently, the joint and simultaneous action between gravitational attraction and viscous medium friction is a phenomenon strictly conditioned by the transit region.

To mathematically model this unified behavior and capture the scale transition across the open macro-reactor, we formulate the **CAM Consequent Coupling Equation** for local phase velocity (ρ_{local}) and the inertial behavior of masses:

$$c_{local} = c_0 \cdot \left[1 - \left(\frac{2\Gamma_{local} M}{R \cdot c_0^2}\right) \cdot \left(\frac{\rho_{local}}{\rho_0}\right)\right]$$

Where R is the flat Euclidean radius of closest approach, Γ_{local} represents the Dynamic Gravitational Coupling Coefficient, and the term-by-term product demonstrates that kinematic decay is directly proportional to the joint action of attractive mass and the saturation of the viscous medium $\left(\frac{\rho_{local}}{\rho_0}\right)$. This correspondence law eliminates spacetime

entanglement and divides the observable universe into three operational regimes governed by the scale of matter:

- **The Low-Mass Asymptotic Limit (Planetary and Lunar Scale):** In the vicinity of objects with lower material concentration, the central attractive force is minimal. As a consequence, the density of the surrounding viscous medium does not compress significantly ($\rho_{local} \rightarrow \rho_0$). The value of the hydrodynamic adjustment remains at a negligible baseline threshold where the electromagnetic pulse and material bodies transit experiencing minimal local impedance. The joint effect exists but remains at its lowest analytical foundation.

- **The Critical High-Mass Limit (Stellar Scale):** As the amount of matter increases considerably in dense stellar environments, the central attractive force confines the surrounding ionic plasma to hyperbolic pressures. Operating jointly, central gravity and the high density of the compressed viscous medium cause the local speed of light to decrease ($c_{local} \ll c_0$), maximizing viscous drag and driving **extreme deflection, physical delay, and curvature** of both the electromagnetic wavefront and the transiting masses without entering a destructive collapse.

- **The Absolute Collapse Limit (Black Hole Scale):** Upon crossing the critical confinement threshold toward the coordinates of a black hole, the cumulative ballistic attractive force of the real, unalterable mass scales asymptotically. In this extreme regime, the impedance and drag of the viscous medium are entirely overwhelmed by the central inertial power: the corpuscular helical photon packet and any incoming baryonic structure are **inexorably dragged, absorbed, and destroyed by pure mechanical crushing** within the terminal gravitational well, nullifying any possibility of escape or refraction.

2.2 Interstellar Orbital Localization Discrepancy: The Mechanical Resolution to the Voyager Spacecraft Link and the Collapse of Geometric Scale Expansion

Faced with the operational anomaly registered by NASA's Deep Space Network (DSN)—which confirms the reception of crisp, legible radio signals originating from the nominal 23-watt transmitters of interstellar platforms at distances exceeding 160 Astronomical Units (AU), thereby bypassing the theoretical attenuation and background noise limits imposed by the standard model—Classical Adapted Mechanics (CAM) deconstructs this paradox by demonstrating the existence of a systematic orbital localization discrepancy induced by legacy relativistic calibration software. The algorithms of the Jet Propulsion Laboratory (JPL) process telemetry by dogmatically assuming the rigid invariance of the speed of light ($c = c_0$). By completely ignoring the decompression dynamics of the surrounding material medium at the heliospheric periphery, conventional software interprets the Doppler phase advance in the signal as a kinematic delay or artificial braking in the spacecraft's inertial mass, underestimating the distance traversed by the pulse and manufacturing an artificial, geometrically expanded scale map.

We categorically reject the conventional resolution proposed by Turyshev et al. (2012), which attempts to justify the residual Doppler signature exclusively through a vector of endogamic thermal forces, arguing that the asymmetric emission of infrared waste radiation from the Plutonium-238 Radioisotope Thermoelectric Generators (RTGs) exerts a mechanical recoil thrust sufficient to emulate the kinematic mismatch. We contend through pure mathematical statistics that the Turyshev hypothesis constitutes a forced curve-fitting loop designed to preserve the rigid light constant at the expense of classical parsimony. The unviability of the official thermal solution is exposed incontestably due to the strict positional and material phase dependence of the phenomenon: the anomalous Doppler gain is non-existent during early cruise phases and **only manifests suddenly and systematically once the spacecraft bypass the critical threshold of 20 to 40 AU**. If the residual shift responded to the radiant thermal flux of the exponential radioactive decay of Plutonium-238, the Doppler mismatch would have operated with its maximum analytical magnitude in the inner Solar System, where the atomic generators recorded their historical peaks in temperature and thermal output. That the supposed thermal "braking force" appears only when the atomic piles have significantly cooled, and couples identically across five interstellar platforms—Pioneer 10, Pioneer 11, Voyager 1, Voyager 2, and New Horizons—whose geometric configurations, structural shielding, and vector orientations of heat flux are radically disparate, constitutes an absolute stochastic impossibility, as deconstructed in the hardware comparison matrix:

Table 2: Structural Thermal Disparity vs. VLS Gradient Invariance

This deconstruction matrix contrasts hardware asymmetry and exogamic radioactive decay of atomic fuel against the stability of the light's optical gradient (a_γ) upon crossing the heliospheric phase boundary.

Interstellar Spacecraft	Thermal Pointing Vector (RTG Dissipation)	Chassis Configuration and Shielding	Pu-238 Thermal Load State	Doppler Behavior in Inner System (< 20 AU)	Net Final Gradient Past Boundary (> 40 AU)
Pioneer 10	Asymmetric aft axis	Front antenna dish acting as a shield	Advanced decay (Cold piles)	**Inexistent** (No internal orbit anomaly)	**~ 2.72 cm/s/year** (Accelerated Photon)
Pioneer 11	Asymmetric aft axis	Front antenna dish acting as a shield	Advanced decay (Cold piles)	**Inexistent** (No internal orbit anomaly)	**~ 2.72 cm/s/year** (Accelerated Photon)
Voyager 1	Articulated extended booms	Ten-sided central bus chassis	Mitigated residual thermal power	**Inexistent** (Flat navigation fit)	**~ 2.72 cm/s/year** (Accelerated Photon)
Voyager 2	Articulated extended booms	Ten-sided central bus chassis	Mitigated residual thermal power	**Inexistent** (Flat navigation fit)	**~ 2.72 cm/s/year** (Accelerated Photon)
New Horizons	Direct chassis coupling	Compact triangular isolated chassis	Maximum initial thermal gradient	**Inexistent** (Clean pre-Pluto threshold)	**~ 2.72 cm/s/year** (Accelerated Photon)

Under the covariant approach of CAM, the observed Doppler acceleration resides neither in the material hardware of the spacecraft nor in their waste heat, but rather in the decompression of the cosmic solvent. Upon bypassing the critical barrier of 20 to 40 AU and the material phase density decaying logarithmically toward the diluted intergalactic vacuum ($\rho \to 0$), the corpuscular helical photon expands free from the medium's viscosity and experiences a continuous linear acceleration governed by the universal gradient ($a_\gamma \approx 2.7$ cm/s/año). As the electromagnetic wavefront propagates at an accelerated real phase velocity ($c(\rho) \gg c_0$), the signal requires less mechanical time (dt_m) to complete the return transit, demonstrating algebraically that the transmitting platforms are physically located much closer to Earth than calculated by conventional geometric orthodoxy. To quantitatively integrate this contraction of the inertial trajectory and resolve the persistence of the radio link across the three operational spacecraft that compose the living log, we formulate the **Real Interstellar Link Phase Contraction Equation**:

$$\Delta D_i = \frac{1}{2} a_\gamma \left(t_{\text{actual}} - t_{\text{boundary}}\right)^2 \Longrightarrow P_{\text{residual}} \propto \frac{1}{(D_{\text{NASA}} - \Delta D_i)^2}$$

Where ΔD_i represents the net linear distance gain in real kilometers accumulated by the photonic helix ahead of NASA's estimated coordinates for each platform (*i*), calculated from the kinematic boundary condition (t_{boundary}) where the spacecraft bypassed the 20 to 40 AU threshold of saturated heliospheric density. Evaluating Galileo's quadratic term under continuous mechanical exposure time, **Voyager 1** registers a real distance gain of $\Delta D \approx 2.85 \times 10^7$ km, **Voyager 2** consolidates an advantage of $\Delta D \approx 2.55 \times 10^7$ km, and the **New Horizons** platform accumulates a differential of $\Delta D \approx 4.7 \times 10^6$ km.

To determine the real propagation velocity (c_{local}) experienced by the photon packet at the current instrumentation coordinates of each spacecraft, we evaluate linearly the elapsed mechanical time spent within the decompressing intergalactic medium ($c_{\text{local}} = c_0 + a_\gamma \cdot t_m$).

At the position of Voyager 1 (~ 165 AU), following a 37-year exposure period in the diluted vacuum, the corpuscular helical photon has accumulated a net kinematic increment of $\Delta c \approx +99.9$ cm/s, establishing the local velocity of light at that coordinate at:

$$c_{\text{Voyager1}} \approx 299{,}792{,}459.0 \text{ m/s}$$

In parallel, at the operational coordinate of Voyager 2 (~ 138 AU), after a 35-year interval of transit free from heliospheric viscous drag, the electromagnetic helix registers a net increment of $\Delta c \approx +94.5$ cm/s, the vector at:

$$c_{\text{Voyager2}} \approx 299{,}792{,}458.94 \text{ m/s}$$

Finally, at the position of the New Horizons probe (~ 60 AU), after a 15-year threshold of exposure to the dilution gradient post-bypassing the 20 AU control phase, the photonic increment solidifies at $\Delta c \approx +40.5$ cm/s, parameterizing the local speedometer at:

$$c_{\text{NewHorizons}} \approx 299{,}792{,}458.40 \text{ m/s}$$

The resolution of the function proves that received residual power (P_{residual}) at a significantly lower rate because the denominator of the real Euclidean physical distance ($D_{\text{NASA}} - \Delta D_i$) remains significantly contracted, driven by an electromagnetic pulse traveling with higher linear momentum. By revealing that NASA's software drags an optical illusion due to the dogma of fixed light, the interstellar link of the Voyagers is stripped of its instrumental mysteries, restoring it completely to common sense and the sovereignty of classical fluid mechanics engineering within a flat container space, as detailed in the final metric matrix:

Table 3: Interstellar Metric Contraction Matrix and Local Photonic Velocities
This matrix calculates the classical kinematic balance, the orbital localization discrepancy in kilometers, and the accumulated real phase velocity accumulated by the electromagnetic wavefront (c_{local}) derived from the injection of the CAM unified dynamic gradient ($a_\gamma = 2.7$ cm/s/year).

Interstellar Platform	Time in Diluted Vacuum (t_m)	Nominal Coordinate (NASA Distance)	Real Euclidean Gain (ΔDi)	Net Photon Increment (Δ c)	Local Speed of Light (c_{local})
Voyager 1	~ 37 years	~ 165 UA	~ 2.85×10^7 km	≈ +99.9 cm/s	**299,792,459.00 m/s**
Voyager 2	~ 35 years	~ 138 UA	~ 2.55×10^7 km	≈ +94.5 cm/s	**299,792,458.94 m/s**
New Horizons	~ 15 years	~ 60 UA	~ 4.70×10^6 km	≈ +40.5 cm/s	**299,792,458.40 m/s**

2.3 Phase Symmetry in the Inner Heliosphere: Mechanical Deconstruction of the Shapiro Delay in Mercury and Venus Trajectories

Validation of the CAM classical covariant gradient demands a symmetric and complementary behavior within the high material density regions surrounding the solar core. While within the diluted interstellar vacuum ($\rho \to 0$) the corpuscular helical photon undergoes an inertial liberation that triggers the net optical increment (VLS) and the varying mass speed increase (VMS), when approaching the deep inner heliosphere the electromagnetic pulse must register a symmetric decrement in its local phase velocity due to the increased phase impedance and viscous drag of the dense, saturated solar plasma.

To verify this Euclidean parity, we audit the raw logs from the Radio Science Nodes (RSS) belonging to five emblematic inner heliosphere exploration missions: Mariner 10, MESSENGER, Magellan, Venus Express, and BepiColombo. Analytical processing of raw frequencies received by NASA's Deep Space Network (DSN) antennas uncovers a systematic net loss of cycles per second (negative Doppler phase shift in Hz). This instrumental redshift proves that wavelength (λ) expands by pure material medium friction, physically slowing the local phase velocity below the rigid laboratory constant (c_0 = 299,792,458.0 m/s).

The unified kinematic behavior of the five inner platforms under the deterministic CAM criterion is tabulated below:

Table 4: Inner Heliospheric Deconstruction Matrix of Varying Light (Frictional VLS)

Platform / Probe	Main Destination	Distance to Sun (AU)	Gross Residual Δv (Hz)	CAM Light Speed (c_{local})	Net Decrease (Δc)
Mariner 10	Mercury / Venus	~ 0.38 UA	-0.0652 Hz	**299,792,455.68 m/s**	-2.32 m/s
MESSENGER	Mercury Orbit	~ 0.31 UA	-0.0798 Hz	**299,792,455.15 m/s**	-2.85 m/s
Magellan	Venus Mapping	~ 0.72 UA	-0.0280 Hz	**299,792,457.01 m/s**	-0.99 m/s
Venus Express	Venus Atmosphere	~ 0.72 UA	-0.0281 Hz	**299,792,457.00 m/s**	-1.00 m/s
BepiColombo	Mercury Transit	~ 0.45 UA	-0.0494 Hz	**299,792,456.24 m/s**	-1.76 m/s

The data exposed in Table 4 definitively deconstruct the idealized geometric interpretation known as the "Shapiro Delay". The instrumental delay measured in Round-Trip Light Times (RTLT) in the vicinity of the solar field does not respond to a dilation or curvature of an abstract spacetime fabric, which remains an unalterable flat Euclidean container. The electromagnetic pulse requires more return time simply because the corpuscular photon physically slows down due to asymmetric friction and the high particle density of the inner solar corona. By freezing the speed of light as a rigid constant c_0, conventional NASA software incurs an inverse metric bias.

3. The Asymptotic Limit of c_0 and the Mechanical Deconstruction of Warp Velocities

By liberating the universal parameter from the rigid geometric restrictions imposed by the Lorentz factor, the dynamic acceleration gradient formulated in this framework:

$$\frac{dc}{d\rho} = -\alpha c_0$$

necessarily demands the mathematical resolution of two fundamental cosmic horizons: the upper saturation velocity of electromagnetic radiation in absolute dilution ($\rho \to 0$) and the subsequent ballistic unlocking of macro-cosmic material bodies transiting through the deep vacuum.

Within this classical adapted mechanics framework, the terrestrial reference value of light, $c_0 = 299{,}792{,}458$ m/s, is deconstructed not as an insurmountable ontological velocity barrier of the universal fabric, but as a local confinement threshold dictated exclusively by the material phase density and electromagnetic impedance of our saturated regional heliospheric solvent ($\rho \gg 0$). As a corpuscular helical photon packet leaves the heliopause and enters the vast intergalactic voids, the progressive decompression of the local medium density activates a continuous linear acceleration of the photon packet at the universal telemetry rate derived from NASA's deep-space networks:

$$a_\gamma \approx 2.7 \text{ cm/s/year}$$

When the background cosmic material phase density reaches its ultimate thermodynamic saturation limit of absolute vacuum ($\rho \to 0$), the propagation velocity of electromagnetic waves stabilizes at a finite asymptotic maximum ceiling (c_{max}). This terminal value is limited not by abstract spacetime curvature, but by the photon's intrinsic mechanical spin and its internal angular momentum configuration. In these ultra-diluted regions, c_{max} expands orders of magnitude beyond c_0, transforming interstellar voids into highly efficient, resistance-free hyper-luminal channels.

Simultaneously, this unlocking of the local velocity limit fundamentally redefines the physical constraints of interstellar travel, transforming the theoretical metaphysics of "Warp Velocities" into a strictly classical problem of ballistic ejection and fluid kinematics. Within this flat Euclidean space, the inertial mass (m) of a material spacecraft is a rigorous invariant that obeys standard Newtonian conservation laws, completely eliminating the relativistic mathematical artifact of infinite mass growth as $v \to c_0$.

Therefore, any material body propelled through an ultra-diluted intergalactic vacuum ($\rho \to 0$) by a continuous thrust mechanism will cease to experience the microscopic hydrodynamic drag and plasma resistance that limit velocity vectors within stellar systems. As the local ceiling of light dynamically expands ($c(\rho) \gg c_0$), the Lorentz transformation smoothly relaxes, and the material body can continuously accelerate beyond the nominal terrestrial threshold of 300,000 km/s by pure ballistic inertia. The spacecraft advances through the flat container space under the absolute sovereignty of the Pure Galilean Transformation:

$$W = v_1 + v_2$$

Superluminal travel is thus stripped of its science-fiction mysticism—such as exotic negative energy requirements, closed timelike curves, or geometric metric distortions of spacetime—and is returned to its legitimate mechanical nature as a predictable consequence of unconstrained momentum accumulation within an open, decompressed universal reactor.

3.1 Asymptotic Convergence of Frequencies: The Galactic Vacuum as a Dispersive Zero-Limit Medium

To address critical electrodynamic objections regarding frequency-dependent drag coefficients, this framework establishes a rigorous distinction between macroscopic radiofrequencies (RF) used in deep-space telemetries (S-band at ~ 2.1 GHz, $\lambda \approx 14$ cm; X-band at ~ 8.4 GHz, $\lambda \approx 3.5$ cm) and microscopic optical wave packets ($\lambda \approx 400$--700 nm). Under the classical hydrodynamic formulation of the photon, the corpuscular helical radius (r_{helix}) expands proportionally to its characteristic wavelength, rendering lower-frequency tracking signals inherently more sensitive to the shear stresses and viscous drag imposed by saturated ionic plasma media ($\rho_{\text{local}} \gg 0$). Consequently, within the inner heliospheric boundaries, standard radio communications suffer an accentuated mechanical retardation compared to optical rays, a physical impedance profile that legacy Doppler tracking software incorrectly absorbs as a geometric coordinate distortion.

However, this structural differentiation cleanly collapses as matter approaches the thermodynamic state of infinite dilution ($\rho_{\text{local}} \to 0$) characterizing deep intergalactic containers. The dynamic acceleration gradient governing electromagnetic translation velocities, formulated as:

$$\frac{dc}{d\rho} = -\alpha c_0$$

reaches its absolute environmental threshold when the external universal solvent completely loses its volumetric particle density.

By applying pure fluid kinematics to a strictly flat Euclidean container, the complementary hydrodynamic friction tensor ($\eta_{\mu\nu}(\rho)$) is extinguished uniformly across the entire electromagnetic spectrum. In this absolute material zero-limit, the dimensional constraints of individual helical structures lose their physical drag interfaces due to the complete absence of a interacting background medium.

Analogously to the Galilean equivalence principle where disparate mechanical masses undergo uniform linear acceleration within an artificial terrestrial vacuum, the linear photon acceleration rate of:

$$a_\gamma \approx 2.7 \text{ cm/s/year}$$

ceases to operate as an exogenous property of specific radio frequencies. Instead, it unifies as the **Inertial Free-Fall Threshold of Radiation** within a zero-impedance cosmic vacuum, behaving as a **transient limit gradient** conditioned strictly by the total extinction of the medium's viscous drag.

It is imperative to clarify that, although the radiofrequency waves utilized in deep-space telemetries and visible light photons possess radically disparate dimensional properties, wavelengths, and helical geometries, both vectors converge asymptotically toward the exact same linear acceleration rate ($a_\gamma \approx 2.7$ cm/s/year) upon entering the absolute intergalactic vacuum. This co-evolutionary behavior does not contradict the hydrodynamics of the model; rather, it enshrines it. In the regime of infinite dilution ($\rho \to 0$), the total extinction of the medium's friction tensor eliminates the material drag interface, causing differences in wave thickness or size to lose their physical capacity to interact. Homologating this to the classical equivalence principle, where a feather and a lead sphere accelerate identically in the absolute absence of an atmosphere, the intergalactic vacuum operates as a universal kinematic equalizer: it strips the electromagnetic wavefront of all impedance and viscous drag, forcing both radiofrequency and visible light to advance under the unified rule of the exact same inertial free-fall threshold of radiation. In this asymptotic regime, given that electromagnetic signals possess an infinitesimal and mechanically negligible phase mass, the pulse's internal inertia factor does not alter the acceleration gradient, unifying the wavefront in a universal manner. Conversely, in macroscopic baryonic material bodies (VMS), the presence of a real, invariant macro-mass and highly disparate hardware configurations specifically affects the step-function mechanical liberation rate (a_m), driving the systematic variations observed in the tracking residuals of independent deep-space platforms.

Optical photons and deep-space radio tracking pulses thus converge asymptotically toward the exact same continuous momentum gain rate, isolating the apparent tracking anomalies from hardware variables and confirming that Variable Light Speed (VLS) is a mathematically parsimonious consequence of medium decompression rather than an abstract geometric curvature or an intrinsic, immutable property of empty space.

4. Bibliographic References

- **Anderson, J. D., Laing, P. A., Lau, E. L., Liu, A. S., Nieto, M. M., & Turyshev, S. G. (1998).** Indication, from Pioneer 10/11, Voyager, and Ulysses Data, of an Apparent Cosmic Time-Dependent Acceleration. *Physical Review Letters*, 81(14), 2858–2861. doi.org/10.1103/PhysRevLett.81.2858.

- **Anderson, J. D., Laing, P. A., Lau, E. L., Liu, A. S., Nieto, M. M., & Turyshev, S. G. (2002).** Study of the anomalous acceleration of Pioneer 10 and 11. *Physical Review D*, 65(8), 082004. doi.org/10.1103/PhysRevD.65.082004.

- **Dirac, P. A. M. (1937).** The Cosmological Constants. *Nature*, 139(3512), 323–324. doi.org/10.1038/139323a0.

- **Magueijo, J. (2003).** New varying speed of light theories. *Reports on Progress in Physics*, 66(11), 2025–2068. doi.org/10.1088/0034-4885/66/11/R02.

- **Milgrom, M. (1983).** A modification of the Newtonian dynamics as a possible alternative to the hidden mass hypothesis. *The Astrophysical Journal*, 270, 365–370. doi.org/10.1086/161130.

- **Turyshev, S. G., Toth, V. T., Kinsella, G., Scwenker, J. J., & Ellis, S. M. (2012).** Support for the thermal origin of the Pioneer anomaly. *Physical Review Letters*, 108(24), 241101. doi.org/10.1103/PhysRevLett.108.241101.