

Mass as Confinement: A Unified Framework for Relativistic Matter, Time, and Entropic Gravity

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Abstract

This paper proposes a theoretical framework based on “Total C-Velocity Conservation,” aiming to bridge the gap between classical kinetic intuition and modern quantum field theory. We posit that the fundamental constituents of the universe (elementary excitations) are inherently massless and propagate eternally at the speed of light, c . By introducing a microscopic mechanism of “chirality flip” or “Zitterbewegung,” we redefine rest mass as the topological confinement of light-speed motion at the quantum scale. Within this framework, time dilation emerges naturally as the Doppler shift of internal oscillation frequencies, while gravity is reinterpreted not as a fundamental interaction, but as an Entropic Force arising from the quantum vacuum’s statistical response to matter structure. This theory maintains mathematical consistency with Lorentz covariance and offers a kinetic perspective for Grand Unified Theories.

1 Introduction

In the Standard Model of particle physics, the mass of elementary particles is acquired via the Higgs mechanism. However, this mathematical description does not intuitively explain the *dynamical essence* of mass. Conversely, Special Relativity reveals mass-energy equivalence ($E = mc^2$), suggesting that mass may be a form of confined energy.

This paper constructs a theory based on the following core postulates:

1. **Initial Light-Speed Assumption:** All fundamental physical entities, in their undisturbed state, are massless and propagate at c .
2. **Velocity Transformation Mechanism:** The formation of matter is a process where directional light-speed flux is transformed into localized closed loops (vortices or oscillations).
3. **Emergent Gravity:** Gravity is not a fundamental force but a manifestation of macroscopic statistical effects exerted by the background quantum vacuum field.

This framework attempts to encompass Newtonian mechanics as a statistical limit while correcting the defects of early Ether theories, ensuring full compatibility with Lorentz invariance.

2 Conservation of Total Velocity and the Dynamical Origin of Mass

2.1 The Total Velocity Vector Equation

We define a complex vector space wherein the magnitude of the total velocity vector \vec{V}_{total} of any elementary particle is constantly c . This vector decomposes into two orthogonal components:

$$\vec{V}_{total} = \vec{v}_{ext} + i\vec{v}_{int} \quad (1)$$

Where:

- \vec{v}_{ext} is the **External Translational Velocity** (macroscopically observable velocity).
- \vec{v}_{int} is the **Internal Structural Velocity** (oscillation or vorticity in phase space).

According to the axiom of Total Velocity Conservation ($|\vec{V}_{total}| = c$), we derive:

$$|\vec{v}_{ext}|^2 + |\vec{v}_{int}|^2 = c^2 \quad (2)$$

2.2 Mass as “Curled Velocity”

In standard quantum mechanics, this corresponds to the “Zitterbewegung” (trembling motion) of the Dirac electron. We define rest mass m_0 as the energy confinement corresponding to the internal velocity:

$$m_0 c^2 \equiv \gamma \hbar \omega_{int} \quad (3)$$

When a particle is macroscopically at rest ($v_{ext} = 0$), all velocity vectors are directed towards internal degrees of freedom ($v_{int} = c$). In this state, matter possesses its maximal “existence” (rest mass).

When a particle accelerates ($v_{ext} \rightarrow c$), to maintain conservation, the internal velocity v_{int} must decrease. This implies a reduction in the internal oscillation frequency and a redistribution of “effective mass,” providing a dynamical derivation of the Lorentz factor:

$$\gamma = \frac{1}{\sqrt{1 - v_{ext}^2/c^2}} \quad (4)$$

3 The Physical Nature of Time

In this theory, time t is not an absolute background parameter, but a **counter of the internal periodic motion of elementary particles**.

Let τ be one period of internal oscillation (the fundamental unit of time):

$$\tau \propto \frac{1}{v_{int}} \quad (5)$$

From Equation (2), as the external velocity of an object v_{ext} increases, v_{int} decreases, causing the internal period τ to elongate.

Corollary: For a photon moving at light speed ($v_{ext} = c$), $v_{int} = 0$. The photon possesses no internal periodic variation; thus, **the photon experiences no time**.

Observer Effect: What is classically observed as “time dilation” is fundamentally a reduction in the “refresh rate” of the matter’s internal structure.

4 Gravity: From Screening to Entropic Force

Early Le Sage gravity theories hypothesized a screening effect caused by particle collisions, which inevitably led to a “drag paradox.” We revise this view by adopting a thermodynamic **Entropic Gravity** model.

4.1 The Vacuum Information Gradient

Assume space is permeated by quantum fields carrying information (the background field). The existence of matter (as curled light-speed structures) “displaces” or “locks” a portion of the vacuum’s degrees of freedom.

$$N = \frac{Ac^3}{G\hbar} \quad (6)$$

Where N is the number of bits on the volume surface, and A is the area.

4.2 Derivation of Entropic Force

When two objects approach each other, the area of their mutual “holographic screens” decreases, leading to a change in the system’s total entropy S . According to the Second Law of Thermodynamics, the system tends toward entropy maximization, manifesting as a statistical force attempting to minimize the separation between objects:

$$F = T\nabla S \quad (7)$$

Macroscopically, this force manifests as Newtonian gravity:

$$F_g \approx G \frac{Mm}{r^2} \quad (8)$$

In this perspective, gravity is not a “field line” emitted by an object, but the **osmotic pressure** of the surrounding quantum vacuum attempting to restore the “information deficit” caused by matter. Newtonian mechanics is the integral manifestation of this microscopic statistical process under the Law of Large Numbers.

5 Compatibility with Quantum Mechanics

This model circumvents the deterministic trajectory issues of classical particles by treating the “particle” as a wave packet.

- **Uncertainty:** Due to the existence of \vec{v}_{int} , the particle exhibits rapid oscillation in microscopic position, rendering the simultaneous precise measurement of position and momentum impossible, thereby satisfying the Heisenberg Uncertainty Principle.
- **Wave-Particle Duality:** \vec{v}_{ext} corresponds to the group velocity of the wave packet, while \vec{v}_{int} corresponds to the intrinsic component of the phase velocity.

6 Conclusion

The “Total C-Velocity Field Theory” constructed herein provides a concise physical image:

1. The **Ontology of the Universe** is pure motion at c .
2. **Matter** is the manifestation of this motion topologically confined (a phase transition of velocity).
3. **Time** is the measure of this confined oscillation.
4. **Gravity** is the entropic response of the quantum vacuum to the existence of material structures.

This theory not only preserves the intuitive beauty of “all energy originates from velocity” but also, through the introduction of chirality flipping and entropic force mechanisms, resolves the difficulties classical models face regarding relativistic covariance and thermodynamics, offering a potential pathway beyond the Standard Model.

A Clarifications on the Original Hypotheses

1. **On “Mass as Lost Velocity”:** We have formalized this as “**Vector Orthogonal Decomposition.**” Velocity is not lost but transformed from the spatial axes (x, y, z) to the imaginary axis (internal spin/oscillation dimension).
2. **On “Newtonian Mechanics as an Integral”:** We elevate this to a “**Statistical Mechanics**” perspective. Just as gas pressure is the statistical result of molecular collisions, gravity and inertia are the statistical results of underlying quantum field fluctuations.
3. **On “Time as Speed”:** This is strictly defined as “**Internal Frequency.**” This modification makes the theory fully consistent with the time dilation formula of Special Relativity.