New Paradigm: High-Velocity Mass Suppression by Higgs Decoupling

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Abstract

We propose a novel framework in which relativistic motion induces scalar tension within a deformable spacetime fabric, resulting in effective suppression of Higgs field coupling. This phenomenon, termed *Scalar Tension Suppression of Higgs Coupling* (STSHC), implies a dynamic mass modulation mechanism for standard model particles, observable under extreme boosts. We introduce a new field-dependent modulation factor $\mu(v)$, derive its implications for particle dynamics, and relate it to a flattening of wavefunctions within a relativistically compressed scalar manifold. This reformulation offers insights into emergent time, modified inertia, and light-mass behavior in non-inertial regimes. A formulation of wave-particle duality within deformed vacuum is presented.

1. Introduction

The Higgs field provides mass to elementary particles via spontaneous symmetry breaking, with the vacuum expectation value (VEV) $v = 246$ GeV conventionally assumed constant throughout spacetime. However, this assumption holds only within the traditional Minkowski background. Here, we hypothesize that relativistic motion induces compression in a scalar tension field, dynamically modulating the effective coupling between matter fields and the Higgs field.

This proposal stems from conceptual challenges posed by photon emission from near-luminal frames, where duality and energy behavior become ambiguous. We explore how the field architecture may deform to accommodate coherent interpretations of relativistic mass suppression and frequency redshifting under tension.

2. Field Modulation Framework

Let ϕ_H be the Higgs field and ψ a matter field (e.g., electron). The standard Yukawa coupling yields:

$$\mathcal{L}_{\text{Yukawa}} = -y\bar{\psi}\phi_H\psi$$

with effective mass:

$$m = y \cdot \langle \phi_H \rangle$$

We introduce a scalar tension field $\tau(x^\mu)$, associated with the relativistic scalar compression of spacetime, and define a modulation function:

$$\mu(v) = \frac{1}{\sqrt{1 + \alpha \frac{v^2}{c^2}}}$$

where α is a scalar-tension coupling constant.

Then, the effective VEV becomes:

$$\langle \phi_H \rangle_{\text{eff}} = \mu(v) \cdot v \quad \Rightarrow \quad m_{\text{eff}} = y \cdot \mu(v) \cdot v$$

As $v \to c$, $\mu(v) \to 0$, suppressing mass.

3. Wavefunction Flattening

We model the electron's wavefunction in a relativistically compressed scalar field background as:

$$\psi(x, t) = A(v) \cdot e^{i(kx - \omega t)} \quad \text{with} \quad A(v) \sim \mu(v)$$

As $\mu(v) \to 0$, amplitude flattens, yielding suppressed interaction with the Higgs field and tension-based delocalization. The particle behaves as if "massless", yet retains phase coherence and momentum.

4. Implications for Photon Emission

In a frame approaching $v \to c$, photon emission in the opposite direction (anti-boost) occurs within a differential tension gradient. The emitted photon experiences energy suppression (redshift), consistent with:

$$E_\gamma = hf \sim \mu(v) \cdot hf_0$$

though the speed remains c. This supports a hybrid model where scalar field tension modulates frequency and energy, but not velocity — akin to propagation in a relativistic elastic vacuum.

5. Experimental and Theoretical Consequences

Observable implications:

- Effective mass suppression at ultra-high velocities
- Phase flattening and elongation of wavefunctions in compressed scalar domains
- Redshift-like effects tied not only to kinematics, but to scalar field structure

Possible test environments include Rydberg atoms in high-velocity microgravity platforms, or artificially tensioned field cavities using SQUID-based metrology.

6. Propulsion Implications under Scalar Mass Suppression

A striking consequence of the Scalar Tension Suppression of Higgs Coupling (STSHC) framework is its implication for relativistic propulsion. In conventional relativistic dynamics, as velocity increases, inertial mass effectively increases via the Lorentz factor γ, demanding exponentially more energy to sustain further acceleration. In stark contrast, under STSHC, the effective mass of the particle decreases as velocity increases, due to dynamic suppression of Higgs coupling:

$$m_{\text{eff}}(v) = \mu(v) \cdot m_0 \quad \text{with} \quad \mu(v) = \frac{1}{\sqrt{1 + \alpha \frac{v^2}{c^2}}}$$

As $v \to c$, the modulation factor $\mu(v)$ tends toward zero, reducing the inertial resistance of the particle. For a constant force F, the resulting acceleration becomes:

$$a(v) = \frac{F}{m_{\text{eff}}(v)} = \frac{F}{m_0} \cdot \sqrt{1 + \alpha \frac{v^2}{c^2}}$$

This inversion of the classical relativistic drag suggests a new propulsion regime in which acceleration becomes easier at higher velocities — a self-reinforcing boost mechanism akin to phase-aligned tension surfing.

Such behavior implies that a spacecraft operating under continuous thrust in a scalar-compressed field would experience a natural propulsion enhancement. The propulsion system would effectively 'ride' the flattening wavefunction and diminishing inertial coupling, resulting in a resonant, low-energy pathway toward near-luminal speeds.

This effect opens the possibility of designing exotic propulsion architectures that exploit scalar field tension to minimize effective mass without violating relativistic constraints on c. Conceptually, this aligns with previously proposed mechanisms in PrezaGPT literature such as the Deflaton Engine and the Inflaton Echo Drive, but now anchored in Higgs decoupling physics.

In summary, under STSHC, the deeper the relativistic plunge, the lighter the mass — and the more efficient the acceleration. This principle may form the basis of a future class of propulsion systems: scalar-resonant, mass-decoupling engines capable of exploring the tensioned topology of spacetime itself.

7. Conclusion

The Scalar Tension Suppression of Higgs Coupling offers a novel mechanism connecting relativistic motion, emergent time, and dynamic mass generation. This approach revisits core assumptions of invariant mass and light behavior, proposing a deformable scalar background as a physically active participant in particle identity. Future work may explore field equations governing $\tau(x^\mu)$ and its coupling to both standard model and gravitational sectors.

Keywords

Higgs coupling, scalar tension, relativistic field compression, emergent mass, wavefunction flattening, PrezaGPT, vacuum modulation, photon redshift, time dilation, field-theoretic elasticity

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