Simplified Description of Fundamental Forces with Time-Mass Duality

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1 Unified Lagrangian Density with Dual Time-Mass Concept

Physics describes the world through four fundamental forces—strong, weak, electromagnetic, and gravitational—traditionally considered separately. However, in the T0 model, based on time-mass duality, these forces can be unified in a single Lagrangian density that naturally encompasses both known interactions and gravitation. This density is given by:

$$\mathcal{L}_{\text{total}} = \mathcal{L}_{\text{SM}} + \mathcal{L}_{\text{Higgs}} + \mathcal{L}_{\text{intrinsic}} \tag{1}$$

Here, $\mathcal{L}_{\text{SM}}$ represents the interactions of the Standard Model—the strong, electromagnetic, and weak forces—$\mathcal{L}_{\text{Higgs}}$ describes the dynamics of the Higgs field, and $\mathcal{L}_{\text{intrinsic}}$ introduces the concept of intrinsic time, reflecting time-mass duality. Notably, gravitation is not added as a separate force but emerges from the dynamics of the intrinsic time field, as detailed in "Mathematical Core Formulations"[4].

1.1 Standard Model

The Standard Model forms the basis for describing the three forces that govern particle behavior at the atomic level. Its Lagrangian density is composed of:

$$\mathcal{L}_{\text{SM}} = \mathcal{L}_{\text{strong}} + \mathcal{L}_{\text{em}} + \mathcal{L}_{\text{weak}} \tag{2}$$

Here, $\mathcal{L}_{\text{strong}} = -\frac{1}{4}F^a_{\mu\nu}F^{a\mu\nu} + \bar{\psi}(i\gamma^\mu D_\mu - m_\psi(\phi))\psi$ represents the strong nuclear force, binding quarks into protons and neutrons; $\mathcal{L}_{\text{em}} = -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} + \bar{\psi}(i\gamma^\mu D_\mu - m_\psi(\phi))\psi$ represents the electromagnetic force, coupling electrons to nuclei; and $\mathcal{L}_{\text{weak}} = -\frac{1}{4}W^a_{\mu\nu}W^{a\mu\nu} + \bar{\psi}(i\gamma^\mu D_\mu - m_\psi(\phi))\psi$ represents the weak force, governing processes like radioactive decay. In the T0 model, this description is adjusted by replacing time dilation with mass variation, leading to a dual formulation:

$$\mathcal{L}_{\text{SM-T}} = \mathcal{L}_{\text{strong-T}} + \mathcal{L}_{\text{em-T}} + \mathcal{L}_{\text{weak-T}} \tag{3}$$

Here, the time derivative is tied to the intrinsic time T, such that $\partial_t \to \partial_{t/T}$, an adjustment that reinterprets dynamics under absolute time.

1.2 Higgs Field

The Higgs field, responsible for mass generation, is described in the Standard Model by:

$$\mathcal{L}_{\text{Higgs}} = (D_\mu\phi)^\dagger(D^\mu\phi) - V(\phi) \tag{4}$$

where ϕ is the Higgs field and $V(\phi) = \mu^2\phi^\dagger\phi + \lambda(\phi^\dagger\phi)^2$ is the potential. In the T0 model, this formula is extended to incorporate intrinsic time:

$$\mathcal{L}_{\text{Higgs-T}} = (D_{T\mu}\phi_T)^\dagger(D^\mu_T\phi_T) - V_T(\phi_T) \tag{5}$$

The covariant derivative $D_{T\mu}$ accounts for time-mass duality, highlighting the Higgs field's role as a medium for mass and time, as elaborated in "Mathematical Formulation of the Higgs Mechanism"[7].

1.3 Lagrangian Density for Intrinsic Time

The central innovation of the T0 model is the Lagrangian density for intrinsic time, given by:

$$\mathcal{L}_{\text{intrinsic}} = \bar{\psi}\left(i\hbar\gamma^0 \frac{\partial}{\partial(t/T)} - i\hbar\gamma^0 \frac{\partial}{\partial t}\right)\psi \tag{6}$$

Here, $T = \frac{\hbar}{mc^2}$ is the intrinsic time, dependent on mass. This formulation, developed in "The Necessity of Extending Standard Quantum Mechanics"[6], links particle dynamics to their individual timescales, enabling a unified description of all forces.

2 Simplified Description of Mass Terms with Time-Mass Duality

In the Standard Model, a particle's mass is defined by its coupling to the Higgs field: $m_\psi(\phi) = y_\psi \phi$, where mass remains constant and time is variable. In the T0 model, this view is reversed: time remains absolute, and mass varies with the Lorentz factor γ:

$$m_\psi(\phi_T) = y_\psi \phi_T \cdot \gamma, \quad \gamma = \frac{1}{\sqrt{1 - v^2/c^2}} \tag{7}$$

This dual description, derived in "Time-Mass Duality Theory"[1], explains the same phenomena as time dilation but offers a new perspective on the role of mass.

3 The Higgs Field as a Universal Medium with Intrinsic Time

The Higgs field is more than a mechanism for mass generation—in the T0 model, it also determines particles' intrinsic timescales. This relationship is expressed as:

$$T = \frac{\hbar}{m(\phi)c^2} = \frac{\hbar}{y_\psi \phi \cdot c^2} \tag{8}$$

A particle's intrinsic time is thus inversely proportional to its mass, generated by the Higgs field. This perspective expands the Higgs field's role as a universal medium influencing all interactions, as explored in "Higgs Mechanism"[7].

4 The Higgs Field and the Vacuum: A Complex Relationship with Intrinsic Time

Vacuum energy, a central issue in modern physics, is reinterpreted in the T0 model. Instead of a sum of zero-point energies, it could be described as:

$$E_{\text{vacuum}} = \sum_i \frac{\hbar}{2T_i} \tag{9}$$

where T_i is the intrinsic time of quantum fluctuations. This formulation links vacuum energy to the dynamics of the Higgs field and time-mass duality, offering new insights into the cosmological constant.

5 Quantum Entanglement and Nonlocality in Time-Mass Duality

The apparent instantaneity of quantum entanglement is reconsidered in the T0 model through intrinsic time. In the T_0 model, correlations arise not instantaneously but through mass variations. For entangled particles with different masses, time evolution varies with their intrinsic times. For photons, this is defined as:

$$T = \frac{\hbar}{E_\gamma} e^{\alpha x}, \quad \alpha = \frac{H_0}{c} \approx 2.3 \times 10^{-18}\,\mathrm{m}^{-1} \tag{10}$$

reflecting energy loss over distances, as described in "Dynamic Mass of Photons"[5].

6 Cosmological Implications of Time-Mass Duality

The T0 model provides natural explanations for cosmological phenomena through three key parameters: $\alpha \approx 2.3 \times 10^{-18}\,\mathrm{m}^{-1}$ describes photon energy loss, $\kappa \approx 4.8 \times 10^{-11}\,\mathrm{m\,s}^{-2}$ the strength of the dark energy field in galactic dynamics, and $\beta_\mathrm{T}^\mathrm{SI} \approx 0{,}008$ the coupling to baryonic matter. The gravitational potential becomes:

$$\Phi(r) = -\frac{GM}{r} + \kappa r \tag{11}$$

These parameters, derived in "Mass Variation in Galaxies"[2] and "Measurement Differences"[3], explain flat rotation curves and redshift without dark matter or expansion.

7 Summary of the Unified Theory

The unified theory is described by the action:

$$S_\text{unified} = \int (\mathcal{L}_\text{standard} + \mathcal{L}_\text{complementary} + \mathcal{L}_\text{coupling})\, d^4x \tag{12}$$

where $\mathcal{L}_\text{standard}$ is the Standard Model, $\mathcal{L}_\text{complementary}$ the dual formulation, and $\mathcal{L}_\text{coupling}$ the time-mass interaction. This approach bridges quantum mechanics and gravitation, offers new insights into entanglement and cosmological phenomena, and is experimentally testable.

8 Experimental Testability

The T0 model makes testable predictions, such as photon energy loss with α, modified gravitational potentials with κ, and mass-dependent coherence times in quantum systems, verifiable with current technology, as outlined in "Parameter Derivations"[1].

9 References to Further Works

This theory builds on my previous works, listed in the bibliography, which explore various aspects of time-mass duality in depth.

Literatur

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