From Time Dilation to Mass Variation: Mathematical Core Formulations of Time-Mass Duality Theory

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Zusammenfassung

This work presents the essential mathematical formulations of time-mass duality theory, focusing on the fundamental equations and their physical interpretations. The theory establishes a duality between two complementary descriptions of reality: the standard view with time dilation and constant rest mass, and the T0 model with absolute time and variable mass. Central to this framework is the intrinsic time $T(x) = \frac{\hbar}{\max(mc^2,\omega)}$, which enables a unified treatment of massive particles and photons. The mathematical formulations include modified Lagrangian densities that emphasize emergent gravitation and energy-loss redshift in a static universe.

Inhaltsverzeichnis

1 Introduction to Time-Mass Duality

The time-mass duality theory proposes an alternative framework:

1. Standard View: $t' = \gamma_{\text{Lorentz}} t$, $m_0 = \text{const.}$
2. T0 Model: $T_0 = \text{const.}$, $m = \gamma_{\text{Lorentz}} m_0$

1.1 Relationship to the Standard Model

The T0 model extends the Standard Model with:

1. Intrinsic Time Field: $T(x) = \frac{\hbar}{\max(mc^2, \omega)}$
2. Higgs Field: Φ with dynamic mass coupling
3. Fermion Fields: ψ with Yukawa coupling
4. Gauge Boson Fields: A_μ with $T(x)$ interaction

2 Emergent Gravitation from the Intrinsic Time Field

Theorem 2.1 (Emergence of Gravitation). *Gravitation arises from gradients of the intrinsic time field:*

$$\nabla T(x) = -\frac{\hbar}{m^2 c^2} \nabla m \tag{1}$$

with the modified potential:

$$\Phi(r) = -\frac{GM}{r} + \kappa r, \quad \kappa \approx 4.8 \times 10^{-11}\ m/s^2 \tag{2}$$

Beweis. From $T(x) = \frac{\hbar}{mc^2}$ for massive particles:

$$\nabla T(x) = -\frac{\hbar}{m^2 c^2} \nabla m \tag{3}$$

With $m(\vec{r}) = m_0(1 + \frac{\Phi_g}{c^2})$:

$$\nabla m = \frac{m_0}{c^2} \nabla \Phi_g \tag{4}$$

Thus:

$$\nabla T(x) \approx -\frac{\hbar}{m_0 c^4} \nabla \Phi_g \tag{5}$$

□

3 Mathematical Foundations: Intrinsic Time

Theorem 3.1 (Intrinsic Time).

$$T(x) = \frac{\hbar}{\max(mc^2, \omega)} \tag{6}$$

4 Modified Derivative Operators

Definition 4.1 (Modified Derivative)**.** The modified covariant derivative in the T0 model is:

$$\partial_\mu \Psi + \Psi \partial_\mu T(x) = \partial_\mu \Psi + \Psi \partial_\mu T(x) \tag{7}$$

5 Modified Field Equations

Theorem 5.1 (Modified Schrödinger Equation)**.**

$$i\hbar T(x)\frac{\partial}{\partial t}\Psi + i\hbar\Psi\frac{\partial T(x)}{\partial t} = \hat{H}\Psi \tag{8}$$

6 Modified Lagrangian Density for the Higgs Field

Theorem 6.1 (Higgs Lagrangian Density)**.** *The Lagrangian density of the Higgs field with coupling to $T(x)$ is:*

$$\begin{aligned}\mathcal{L}_{\textit{Higgs-T}} = |T(x)(\partial_\mu + igA_\mu)\Phi + \Phi\partial_\mu T(x)|^2 + \frac{1}{2}\partial_\mu T(x)\partial^\mu T(x) - V(T(x),\Phi),\\ T(x)(\partial_\mu + igA_\mu)\Phi + \Phi\partial_\mu T(x) = T(x)(\partial_\mu + igA_\mu)\Phi + \Phi\partial_\mu T(x)\end{aligned} \tag{9}$$

7 Modified Lagrangian Density for Fermions

Theorem 7.1 (Fermion Lagrangian Density)**.**

$$\mathcal{L}_{\textit{Fermion}} = \bar{\psi}i\gamma^\mu(\partial_\mu\psi + \psi\partial_\mu T(x)) - y\bar{\psi}\Phi\psi \tag{10}$$

8 Modified Lagrangian Density for Gauge Bosons

Theorem 8.1 (Gauge Boson Lagrangian Density)**.**

$$\mathcal{L}_{\textit{Boson}} = -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} + \frac{1}{2}\partial_\mu T(x)\partial^\mu T(x) \tag{11}$$

9 Complete Total Lagrangian Density

Theorem 9.1 (Total Lagrangian Density)**.**

$$\mathcal{L}_{\textit{Total}} = \mathcal{L}_{\textit{Boson}} + \mathcal{L}_{\textit{Fermion}} + \mathcal{L}_{\textit{Higgs-T}} + \mathcal{L}_{\textit{intrinsic}}, \quad \mathcal{L}_{\textit{intrinsic}} = \frac{1}{2}\partial_\mu T(x)\partial^\mu T(x) - V(T(x)) \tag{12}$$

10 Cosmological Implications

The T0 model has the following implications:

- Modified Gravitational Potential: $\Phi(r) = -\frac{GM}{r} + \kappa r$, $\kappa \approx 4.8 \times 10^{-11}\,\mathrm{m/s}^2$
- Cosmic Redshift: $1 + z = e^{\alpha d}$, $\alpha \approx 2.3 \times 10^{-28}\,\mathrm{m}^{-1}$
- Wavelength Dependence: $z(\lambda) = z_0(1 + \beta_\mathrm{T}\ln(\lambda/\lambda_0))$, $\beta_\mathrm{T} \approx 0.008$ (SI units)

11 Derivation of β_T in the T0 Model

The parameter β_T describes the coupling of the intrinsic time field $T(x)$ to physical phenomena such as wavelength-dependent redshift. In the T0 model, β_T is precisely derived as:

$$\beta_\text{T} = \frac{\lambda_h^2 v^2}{16\pi^3} \cdot \frac{1}{m_h^2} \cdot \frac{1}{\xi} \tag{13}$$

where λ_h is the Higgs self-coupling, v is the Higgs vacuum expectation value, m_h is the Higgs mass, and $\xi \approx 1.33 \times 10^{-4}$ is a dimensionless parameter defining the characteristic length scale $r_0 = \xi \cdot l_P$ (l_P: Planck length). In natural units, $\beta_\text{T} = 1$ holds, representing an exact theoretical prediction derived directly from the model parameters, as detailed in [11]. A comprehensive derivation and discussion of this parameter can be found in [11].

Literatur

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