T0-Theory ξ-Formulas Table

Complete Hierarchy with Calculable Higgs VEV (Error-Free Version)

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1 Introduction: Fundamentals of the T0-Theory

1.1 Fundamental Time-Mass Duality

The T0-Theory is based on a single fundamental relationship governing all physical phenomena:

$$\boxed{T(x,t) \times m(x,t) = 1} \tag{1}$$

Meaning: Time and mass are perfect complementary quantities. Where more mass is present, time flows slower—a universal duality valid from the quantum level to cosmology.

1.2 Natural Units and Energy-Mass Equivalence

The T0-Theory operates exclusively in natural units:

$$\boxed{\hbar = c = 1 \quad \Rightarrow \quad E = m} \tag{2}$$

1.3 The Universal Geometric Parameter

From the 3D spatial geometry, a single dimensionless parameter determines all natural constants:

$$\boxed{\xi = \frac{4}{3} \times 10^{-4}} \tag{3}$$

Origin: The factor $\frac{4}{3}$ stems from the universal sphere volume geometry of 3D space, while 10^{-4} defines the quantization scale.

2 Fundamental Parameter

Constant	**Formula**
ξ	$\frac{4}{3} \times 10^{-4}$

3 First Derivation Level: Yukawa Couplings from ξ

Particle	**Quantum Numbers**	**Yukawa Coupling**
Electron	$(1, 0, \frac{1}{2})$	$y_e = \frac{4}{3} \times \xi^{3/2}$
Muon	$(2, 1, \frac{1}{2})$	$y_\mu = \frac{16}{5} \times \xi^1$
Tau	$(3, 2, \frac{1}{2})$	$y_\tau = \frac{5}{4} \times \xi^{2/3}$

4 Higgs VEV (Calculable from ξ)

Parameter	**Formula**
v_{bare}	$\frac{4}{3} \times \xi^{-\frac{1}{2}}$
K_{quantum}	$\frac{v_{\text{exp}}}{v_{\text{bare}}}$
v (physical)	$v_{\text{bare}} \times K_{\text{quantum}}$

4.1 Quantum Correction Factor Breakdown

Component	**Formula**
$K_{\text{geometric}}$	$\sqrt{3}$
K_{loop}	Renormalization
K_{vacuum}	Vacuum fluctuations
K_{quantum}	$\sqrt{3} \times K_{\text{loop}} \times K_{\text{vac}}$

5 Complete Particle Mass Calculations

5.1 Charged Leptons

Electron Mass Calculation:

Direct Method:

$$\xi_e = \frac{4}{3} \times 10^{-4} \times f_e(1, 0, 1/2), \tag{4}$$

$$\xi_e = \frac{4}{3} \times 10^{-4} \times 1 = \frac{4}{3} \times 10^{-4}, \tag{5}$$

$$E_e = \frac{1}{\xi_e} = \frac{3}{4 \times 10^{-4}}. \tag{6}$$

Extended Yukawa Method:

$$y_e = \frac{4}{3} \times \left(\frac{4}{3} \times 10^{-4}\right)^{3/2}, \tag{7}$$

$$E_e = y_e \times v. \tag{8}$$

Muon Mass Calculation:

Direct Method:

$$\xi_\mu = \frac{4}{3} \times 10^{-4} \times f_\mu(2, 1, 1/2), \tag{9}$$

$$\xi_\mu = \frac{4}{3} \times 10^{-4} \times \frac{16}{5} = \frac{64}{15} \times 10^{-4}, \tag{10}$$

$$E_\mu = \frac{1}{\xi_\mu} = \frac{15}{64 \times 10^{-4}}. \tag{11}$$

Extended Yukawa Method:

$$y_\mu = \frac{16}{5} \times \left(\frac{4}{3} \times 10^{-4}\right)^1, \tag{12}$$

$$E_\mu = y_\mu \times v. \tag{13}$$

Tau Mass Calculation:
Direct Method:

$$\xi_\tau = \frac{4}{3} \times 10^{-4} \times f_\tau(3, 2, 1/2), \tag{14}$$

$$\xi_\tau = \frac{4}{3} \times 10^{-4} \times \frac{5}{4} = \frac{5}{3} \times 10^{-4}, \tag{15}$$

$$E_\tau = \frac{1}{\xi_\tau} = \frac{3}{5 \times 10^{-4}}. \tag{16}$$

Extended Yukawa Method:

$$y_\tau = \frac{5}{4} \times \left(\frac{4}{3} \times 10^{-4}\right)^{2/3}, \tag{17}$$

$$E_\tau = y_\tau \times v. \tag{18}$$

6 Characteristic Energy E_0 from Masses

Parameter	**Formula**
E_0	$\sqrt{m_e \times m_\mu}$

7 Fine-Structure Constant α from ξ and E_0

7.1 Calculation

The fine-structure constant is derived as:

Parameter	**Formula**
α	$\xi \cdot \frac{E_0^2}{(1\ \text{MeV})^2}$

8 Electromagnetic Constants from α

Constant	**Formula**
ε_0	$\frac{1}{4\pi\alpha}$
μ_0	$4\pi\alpha$
e	$\sqrt{4\pi\alpha}$

9 Gravitational Constant G from ξ and SI Units

Parameter	**Formula**
m_μ (calculated)	$y_\mu \times v = \frac{16}{5}\xi^1 \times v$
G (SI formula)	$\frac{\ell_P^2 \times c^3}{\hbar}$
G (T0-specific)	$\frac{\xi^2}{4m_\mu^{\text{calculated}}}$

Note: The SI formula $G = \frac{\ell_P^2 \times c^3}{\hbar}$ uses the Planck length ($\ell_P \approx 1.616255 \times 10^{-35}$ m), the speed of light ($c \approx 2.99792458 \times 10^8$ m/s), and the reduced Planck constant ($\hbar \approx 1.054571817 \times 10^{-34}$ J·s). It is dimensionally consistent and yields $G \approx 6.67430 \times 10^{-11}\,\text{m}^3\text{kg}^{-1}\text{s}^{-2}$, matching the experimental value (CODATA 2018). The T0-specific formula uses $\xi = \frac{4}{3} \times 10^{-4}$ and the calculated muon mass m_μ.

10 Fundamental Constants c and $\hbar$ from ξ-Geometry

Constant	**Formula**
c	$\frac{1}{\sqrt{\mu_0\varepsilon_0}}$, $\mu_0 = 4\pi\alpha$, $\varepsilon_0 = \frac{1}{4\pi\alpha}$, $\alpha = \xi \times E_0^2$, $E_0 = \sqrt{m_e \times m_\mu}$
$\hbar$	$\frac{e^2}{4\pi\alpha^2 c\varepsilon_0}$

Note: The formulas are given in SI units and were validated in the Python script `t0_calculator_extended.py` to exactly reproduce experimental values (CODATA 2018: $c \approx 2.99792458 \times 10^8$ m/s, $\hbar \approx 1.054571817 \times 10^{-34}$ J·s).

11 Planck Units from G, $\hbar$, c (All Calculable from ξ)

Constant	**Formula**
L_{Planck}	$\sqrt{\frac{\hbar G}{c^3}}$
t_{Planck}	$\sqrt{\frac{\hbar G}{c^5}}$
m_{Planck}	$\sqrt{\frac{\hbar c}{G}}$
E_{Planck}	$\sqrt{\frac{\hbar c^5}{G}}$

12 Further Coupling Constants from ξ

Coupling	Formula	Value
α_s (Strong)	$3 \times \xi^{\frac{1}{3}}$	≈ 0.153
α_w (Weak)	$3 \times \xi^{\frac{1}{2}}$	≈ 0.035
α_g (Gravitational)	ξ^4	$\approx 3.16 \times 10^{-16}$

Note: The formulas for α_s and α_w include a factor of 3 to approximate experimental values ($\alpha_s \approx 0.1$, $\alpha_w \approx 0.033$). The gravitational coupling α_g requires further refinement.

13 Higgs Sector Parameters from v and ξ

Parameter	Formula
m_H	$v \times \xi^{\frac{1}{4}}$
λ_H	$\frac{m_H^2}{2v^2}$
Λ_{QCD}	$v \times \xi^{\frac{1}{3}}$

14 Magnetic Moment Anomalies from Masses

Particle	T0-Formula	T0-Contribution	Experimental Anomaly
Muon	$\Delta a_\mu = 251 \times 10^{-11} \times \left(\frac{m_\mu}{m_\mu}\right)^2$	2.51×10^{-9}	$2.51(59) \times 10^{-9}$
Electron	$\Delta a_e = 251 \times 10^{-11} \times \left(\frac{m_e}{m_\mu}\right)^2$	5.87×10^{-15}	$\sim 10^{-12}$ (discrepant)
Tau	$\Delta a_\tau = 251 \times 10^{-11} \times \left(\frac{m_\tau}{m_\mu}\right)^2$	7.10×10^{-7}	Not measured

Note: The T0-contributions are additional corrections to the Standard Model calculation, not the total anomalous magnetic moments. The muon anomaly is fully explained, while the electron contribution is negligible.

15 Quark Masses from Yukawa Couplings

15.1 Light Quarks

Up-Quark:

$$\xi_u = \frac{4}{3} \times 10^{-4} \times f_u(1, 0, 1/2) \times C_{\text{Color}}, \tag{19}$$

$$\xi_u = \frac{4}{3} \times 10^{-4} \times 1 \times 6 = 8.0 \times 10^{-4}, \tag{20}$$

$$E_u = \frac{1}{\xi_u}. \tag{21}$$

Down-Quark:

$$\xi_d = \frac{4}{3} \times 10^{-4} \times f_d(1, 0, 1/2) \times C_{\text{Color}} \times C_{\text{Isospin}}, \tag{22}$$

$$\xi_d = \frac{4}{3} \times 10^{-4} \times 1 \times \frac{25}{2} = \frac{50}{3} \times 10^{-4}, \tag{23}$$

$$E_d = \frac{1}{\xi_d}. \tag{24}$$

15.2 Heavy Quarks

Charm-Quark:

$$y_c = \frac{8}{9} \times \left(\frac{4}{3} \times 10^{-4}\right)^{2/3}, \tag{25}$$

$$E_c = y_c \times v. \tag{26}$$

Bottom-Quark:

$$y_b = \frac{3}{2} \times \left(\frac{4}{3} \times 10^{-4}\right)^{1/2}, \tag{27}$$

$$E_b = y_b \times v. \tag{28}$$

Top-Quark:

$$y_t = \frac{1}{28} \times \left(\frac{4}{3} \times 10^{-4}\right)^{-1/3}, \tag{29}$$

$$E_t = y_t \times v. \tag{30}$$

Strange-Quark:

$$y_s = \frac{26}{9} \times \left(\frac{4}{3} \times 10^{-4}\right)^{1}, \tag{31}$$

$$E_s = y_s \times v. \tag{32}$$

16 Length Scale Hierarchy

Scale	**Formula**
L_0	$\xi \times L_{\text{Planck}}$
L_ξ	ξ (nat.)
L_{Casimir}	$\sim 100\,\mu\text{m}$

17 Cosmological Parameters from ξ

Parameter	**Formula**
T_{CMB}	$\frac{16}{9}\xi^2 \times E_\xi$

Parameter	Formula
H_0	$\xi^2 \times E_{\text{typ}}$
ρ_{vac}	$\frac{\xi \hbar c}{L_\xi^4}$

18 Gravitational Theory: Time-Field Lagrangian

Term	Formula
Intrinsic Time-Field	$\mathcal{L}_{\text{grav}} = \frac{1}{2}\partial_\mu T \partial^\mu T - \frac{1}{2}T^2 - \frac{\rho}{T}$
Gravitational Potential	$\Phi(r) = -\frac{GM}{r} + \kappa r$
κ-Parameter	$\kappa = \frac{\sqrt{2}}{4G^2 m_\mu}$

19 Complete Corrected Derivation Chain

$$\xi \text{ (3D-Geometry)} \to v_{\text{bare}} \to K_{\text{quantum}} \to v \to \text{Yukawa}$$
$$\to \text{Particle Masses} \to E_0 \to \alpha \to \varepsilon_0, \mu_0, e \to c, \hbar \to G$$
$$\to \text{Planck Units} \to \text{Further Physics}$$

20 Revolutionary Insight

All natural constants (c, $\hbar$, G, α, ε_0, μ_0, e) are fully calculable from the single geometric parameter $\xi = \frac{4}{3} \times 10^{-4}$! The T0-Model is a true Theory of Everything with ZERO free parameters!

21 Unit Conversions and Corrections

21.1 T0 Basis: Natural Units

$$\hbar = c = 1 \to E = m \text{ (Energy = Mass)}$$

21.2 Unit Conversions

Conversion	Factor
Energy $\to$ Mass	$/c^2$
Energy $\to$ Frequency	$/\hbar$
Length $\to$ Time	$\times c$

22 Project Documentation

GitHub Repository:

https://github.com/jpascher/T0-Time-Mass-Duality

22.1 Available Documents and Scripts

- **ξ-Hierarchie Ableitung:** `hirachie_En.pdf`
- **Experimentelle Verifikation:** `Elimination_Of_Mass_Dirac_TabelleEn.pdf`
- **Myon g-2 Analyse:** `CompleteMuon_g-2_AnalysisEn.pdf`
- **Gravitationskonstante:** `gravitationskonstante_En.pdf`
- **QFT-Grundlagen:** `QFT_En.pdf`
- **Mathematische Struktur:** `Mathematische_struktur_En.pdf`
- **Zeitfeld-Lagrangian:** `MathZeitMasseLagrangeEn.pdf`
- **Zusammenfassung:** `Zusammenfassung_En.pdf`
- **Python-Skript:** `t0_calculator_extended.py`

This table is an overview—for complete mathematical derivations, detailed proofs, numerical calculations, and the Python script code, see the documents and script in the GitHub repository!

References: CODATA 2018, PDG 2022, Fermilab Muon g-2 Collaboration