

# T0-Theory $\xi$ -Formulas Table

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

J. Pascher

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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:

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

**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:

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

### 1.3 The Universal Geometric Parameter

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

$$\boxed{\xi = \frac{4}{3} \times 10^{-4}} \quad (3)$$

**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
$\xi$	$\frac{4}{3} \times 10^{-4}$

## 3 First Derivation Level: Yukawa Couplings from $\xi$

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 $\xi$ )

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

### 4.1 Quantum Correction Factor Breakdown

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

## 5 Complete Particle Mass Calculations

### 5.1 Charged Leptons

#### Electron Mass Calculation:

*Direct Method:*

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

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

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

*Extended Yukawa Method:*

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

$$E_e = y_e \times v. \quad (8)$$

#### Muon Mass Calculation:

*Direct Method:*

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

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

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

*Extended Yukawa Method:*

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

$$E_\mu = y_\mu \times v. \quad (13)$$

**Tau Mass Calculation:**

*Direct Method:*

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

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

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

*Extended Yukawa Method:*

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

$$E_\tau = y_\tau \times v. \quad (18)$$

## 6 Characteristic Energy $E_0$ from Masses

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

## 7 Fine-Structure Constant $\alpha$ from $\xi$ and $E_0$

### 7.1 Calculation

The fine-structure constant is derived as:

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

## 8 Electromagnetic Constants from $\alpha$

Constant	Formula
$\varepsilon_0$	$\frac{1}{4\pi\alpha}$
$\mu_0$	$4\pi\alpha$
$e$	$\sqrt{4\pi\alpha}$

## 9 Gravitational Constant $G$ from $\xi$ and SI Units

Parameter	Formula
$m_\mu$ (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  $G \approx 6.67430 \times 10^{-11}$  m<sup>3</sup>kg<sup>-1</sup>s<sup>-2</sup>, matching the experimental value (CODATA 2018). The T0-specific formula uses  $\xi = \frac{4}{3} \times 10^{-4}$  and the calculated muon mass  $m_\mu$ .

## 10 Fundamental Constants $c$ and $\hbar$ from $\xi$ -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 $\xi$ )

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

## 12 Further Coupling Constants from $\xi$

Coupling	Formula	Value
$\alpha_s$ (Strong)	$3 \times \xi^{\frac{1}{3}}$	$\approx 0.153$
$\alpha_w$ (Weak)	$3 \times \xi^{\frac{1}{2}}$	$\approx 0.035$
$\alpha_g$ (Gravitational)	$\xi^4$	$\approx 3.16 \times 10^{-16}$

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

## 13 Higgs Sector Parameters from $v$ and $\xi$

Parameter	Formula
$m_H$	$v \times \xi^{\frac{1}{4}}$
$\lambda_H$	$\frac{m_H^2}{2v^2}$
$\Lambda_{\text{QCD}}$	$v \times \xi^{\frac{1}{3}}$

## 14 Magnetic Moment Anomalies from Masses

Particle	T0-Formula	T0-Contribution	Experimental Anomaly
Muon	$\Delta a_\mu = 251 \times 10^{-11} \times \left(\frac{m_\mu}{m_\mu}\right)^2$	$2.51 \times 10^{-9}$	$2.51(59) \times 10^{-9}$
Electron	$\Delta a_e = 251 \times 10^{-11} \times \left(\frac{m_e}{m_\mu}\right)^2$	$5.87 \times 10^{-15}$	$\sim 10^{-12}$ (discrepant)
Tau	$\Delta a_\tau = 251 \times 10^{-11} \times \left(\frac{m_\tau}{m_\mu}\right)^2$	$7.10 \times 10^{-7}$	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 Neutrino Masses (with Double $\xi$ -Suppression)

Particle	Formula	T0-Value (meV)
$\nu_e$	$m_{\nu e} = k \times \frac{1}{\xi_{\nu e}} \times 10^6, \quad \xi_{\nu e} = \xi \times 1 \times \xi$	9.10
$\nu_\mu$	$m_{\nu \mu} = k \times \frac{1}{\xi_{\nu \mu}} \times 10^6, \quad \xi_{\nu \mu} = \xi \times \frac{16}{5} \times \xi$	2.84

Particle	Formula	T0-Value (meV)
$\nu_\tau$	$m_{\nu\tau} = k \times \frac{1}{\xi_{\nu\tau}} \times 10^6, \quad \xi_{\nu\tau} = \xi \times \frac{5}{4} \times \xi$	3.41

**Note:** Neutrino masses are dynamically calculated with  $k = 1.618 \times 10^{-13}$ , yielding values within experimental upper limits.

## 16 Quark Masses from Yukawa Couplings

### 16.1 Light Quarks

**Up-Quark:**

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

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

$$E_u = \frac{1}{\xi_u}. \quad (21)$$

**Down-Quark:**

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

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

$$E_d = \frac{1}{\xi_d}. \quad (24)$$

### 16.2 Heavy Quarks

**Charm-Quark:**

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

$$E_c = y_c \times v. \quad (26)$$

**Bottom-Quark:**

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

$$E_b = y_b \times v. \quad (28)$$

**Top-Quark:**

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

$$E_t = y_t \times v. \quad (30)$$

**Strange-Quark:**

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

$$E_s = y_s \times v. \quad (32)$$

## 17 Length Scale Hierarchy

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

## 18 Cosmological Parameters from $\xi$

Parameter	Formula
$T_{\text{CMB}}$	$\frac{16}{9}\xi^2 \times E_\xi$
$H_0$	$\xi^2 \times E_{\text{typ}}$
$\rho_{\text{vac}}$	$\frac{\xi \hbar c}{L_\xi^4}$

## 19 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	$\Phi(r) = -\frac{GM}{r} + \kappa r$
$\kappa$ -Parameter	$\kappa = \frac{\sqrt{2}}{4G^2 m_\mu}$

## 20 Complete Corrected Derivation Chain

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

## 21 Revolutionary Insight

All natural constants ( $c$ ,  $\hbar$ ,  $G$ ,  $\alpha$ ,  $\varepsilon_0$ ,  $\mu_0$ ,  $e$ ) 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!

## 22 Unit Conversions and Corrections

### 22.1 T0 Basis: Natural Units

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

### 22.2 Unit Conversions

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

## 23 Project Documentation

GitHub Repository:

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

### 23.1 Available Documents and Scripts

- $\xi$ -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