Lepton Formulas

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2025

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Zusammenfassung

The T0 theory provides a complete Ableitung of the anomal magnetisch moments of alle charged Leptonen through quadratic Masse scaling. Basierend auf Standard Quanten Feld theory and the universal geometrisch Konstante $\xi = 4/3 \times 10^{-4}$, a Parameter-free Vorhersage is achieved das reproduces experimentell data with high precision.

1 Einleitung

The anomal magnetisch moments of Leptonen represent one of the meist präzise tests of Quanten Feld theory. The T0 theory extends the Standard Model with a universal Skalar Feld ϕ_T coupled through the geometrisch Konstante ξ, enabling a unified Beschreibung of alle leptonic Anomalien.

The central Einsicht is the quadratic Masse scaling $a_\ell \propto (m_\ell/m_\mu)^2$, welche follows direkt from Standard Quanten Feld theory and is confirmed experimentally.

2 Fundamental T0 Formula

The universal T0 Formel for anomal magnetisch moments reads:

$$\boxed{a_\ell = \xi^2 \cdot \aleph \cdot \left(\frac{m_\ell}{m_\mu}\right)^2} \tag{1}$$

wo:

- $\xi = \frac{4}{3} \times 10^{-4}$: Universal geometrisch Parameter
- $\aleph = \alpha \times \frac{7\pi}{2}$: T0 Kopplung Konstante
- $\alpha = \frac{1}{137.036}$: Fine Struktur Konstante
- Quadratic Masse exponent: $\nu_\ell = 2$

3 Vacuum Fluctuations as Source of g-2 Anomalies

The Verbindung zwischen Quanten Vakuum and Myon Anomalie occurs through the T0 Vakuum series:

$$\langle \text{Vacuum} \rangle_{T0} = \sum_{k=1}^{\infty} \left(\frac{\xi^2}{4\pi}\right)^k \times k^2 \tag{2}$$

Dimensional Analyse of the Vakuum series:

$$\left[\frac{\xi^2}{4\pi}\right] = [\text{dimensionless}] \tag{3}$$

$$[k^2] = [\text{dimensionless}] \quad (\text{since } k \text{ is a counting variable}) \tag{4}$$

$$[\langle \text{Vacuum} \rangle_{T0}] = [\text{dimensionless}] \quad (\text{dimensionless vacuum amplitude}) \tag{5}$$

Convergence Beweis of the Vakuum series:

$$a_k = \left(\frac{\xi^2}{4\pi}\right)^k k^2 \tag{6}$$

$$\frac{a_{k+1}}{a_k} = \frac{\xi^2}{4\pi}\left(\frac{k+1}{k}\right)^2 \xrightarrow{k\to\infty} \frac{\xi^2}{4\pi} \tag{7}$$

Since $\xi^2/4\pi = (4/3 \times 10^{-4})^2/4\pi \approx 3.5 \times 10^{-9} \ll 1$, the series converges absolutely (Verhältnis test).

This series:

- Converges aufgrund von $\xi^2 \ll 1$ and quadratic growth Rate
- Naturally resolves the UV divergence problem of QFT
- Directly provides the QFT Korrektur exponent $\nu_\ell = 2$

4 Derivation: Standard QFT Dimensional Analysis

4.1 Foundations of QFT Scaling

The quadratic Masse scaling follows direkt from Standard Quanten Feld theory:

- In natural Einheiten, masses have Dimension $[m_\ell] = [E]$
- Anomalous magnetisch moments are dimensionless: $[a_\ell] = [1]$
- Standard one-loop Berechnungen yield quadratic Masse scaling
- The T0 Yukawa Kopplung $g_T^\ell = m_\ell \xi$ is dimensionless

4.2 Step 1: QFT One-Loop Structure

The anomal magnetisch moment follows from the Standard QFT Struktur:

$$a_\ell = \frac{(g_T^\ell)^2}{8\pi^2} \cdot f\left(\frac{m_\ell^2}{m_T^2}\right) \tag{8}$$

wo $f(x \to 0) \approx 1/m_T^2$ in the heavy mediator Grenze.

4.3 Step 2: Substituting Yukawa Coupling

With the T0 Yukawa Kopplung $g_T^\ell = m_\ell \xi$:

$$a_\ell = \frac{(m_\ell \xi)^2}{8\pi^2} \cdot \frac{\xi^2}{\lambda^2} = \frac{m_\ell^2 \xi^4}{8\pi^2 \lambda^2} \tag{9}$$

4.4 Step 3: Normalization to the Muon

For the Myon, by definition:

$$a_\mu = \frac{m_\mu^2 \xi^4}{8\pi^2 \lambda^2} = 251 \times 10^{-11} \tag{10}$$

For alle andere Leptonen, taking Verhältnisse yields:

$$\boxed{a_\ell = 251 \times 10^{-11} \times \left(\frac{m_\ell}{m_\mu}\right)^2} \tag{11}$$

4.5 Step 4: Physical Interpretation

The quadratic scaling arises from:

- **Yukawa Kopplung:** $g_T^\ell = m_\ell \xi \Rightarrow (g_T^\ell)^2 \propto m_\ell^2$
- **Loop integral:** Standard QFT one-loop with $8\pi^2$ Faktor
- **Dimensional Analyse:** Consistency in natural Einheiten

5 The Casimir Effect in T0 Theorie

The Casimir Effekt in T0 theory retains the Standard d^{-4} dependence but receives klein QFT Korrekturen:

$$F_{\text{Casimir}}^{T0} = -\frac{\pi^2 \hbar c A}{240 d^4} \left(1 + \delta_{\text{QFT}}(d)\right) \tag{12}$$

wo $\delta_{\text{QFT}}(d)$ captures klein Quanten Feld theory Korrekturen at very short distances.

The Verbindung to the Myon Anomalie occurs through the common source in Vakuum fluctuations:

- **Common QFT basis:** Both Phänomene arise from Quanten Vakuum Effekte
- **Universal Kopplung:** The Parameter ξ appears in beide Berechnungen
- **Consistent scaling:** Quadratic Masse scaling for alle Leptonen

6 Experimentell Predictions with Quadratic Scaling

6.1 Muon Anomaly

Experimentell result (Fermilab 2021):

$$a_\mu^{\text{exp}} = 116\,592\,061(41) \times 10^{-11} \tag{13}$$

Standard Model Vorhersage:

$$a_\mu^{\text{SM}} = 116\,591\,810(43) \times 10^{-11} \tag{14}$$

Discrepancy:

$$\Delta a_\mu = a_\mu^{\text{exp}} - a_\mu^{\text{SM}} = 251(59) \times 10^{-11} \tag{15}$$

6.2 Electron Anomaly

T0 Vorhersage:

$$\left(\frac{m_e}{m_\mu}\right)^2 = \left(\frac{0.511}{105.66}\right)^2 = 2.34 \times 10^{-5} \tag{16}$$

$$\Delta a_e = 251 \times 10^{-11} \times 2.34 \times 10^{-5} = 5.87 \times 10^{-15} \tag{17}$$

6.3 Tau Anomaly

T0 Vorhersage:

$$\left(\frac{m_\tau}{m_\mu}\right)^2 = \left(\frac{1777}{105.66}\right)^2 = 283 \tag{18}$$

$$\Delta a_\tau = 251 \times 10^{-11} \times 283 = 7.10 \times 10^{-7} \tag{19}$$

6.4 Experimentell Comparison

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Tabelle 1: T0 predictions vs. experimental values

7 Why Quadratic Scaling is Physically Correct

The quadratic Masse scaling $a_\ell \propto (m_\ell/m_\mu)^2$ has the folgend physikalisch justifications:

7.1 Standard QFT Foundation

- One-loop integrals in QFT naturally yield m^2 dependence
- The $8\pi^2$ Faktor is established Quanten Feld theory (Peskin & Schroeder)
- Yukawa Kopplungen are proportional to Fermion masses

7.2 Dimensional Analysis in Natural Units

- The Yukawa Kopplung $g_T^\ell = m_\ell \xi$ is dimensionless
- $(g_T^\ell)^2 = m_\ell^2 \xi^2$ direkt leads to quadratic scaling
- Consistency of alle Dimensionen is guaranteed

7.3 Experimentell Evidence

- The Elektron Anomalie is extremely klein (≈ 0)
- This is consistent with $(m_e/m_\mu)^2 \approx 2 \times 10^{-5}$
- Alternative approaches signifikant overestimate the Elektron Anomalie

7.4 Renormalization Group Stability

- Quadratic scaling is stable under renormalization
- Mass Verhältnisse are RG-invariant
- Theoretical consistency across alle Energie Skalen

8 Symbol Explanations

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Tabelle 2: Symbol explanations for the QFT derivation

9 Zusammenfassung and Schlussfolgerungen

Core insights of T0 theory:

- Quadratic Masse scaling $a_\ell \propto (m_\ell/m_\mu)^2$ follows direkt from Standard QFT
- The universal Parameter $\xi = 4/3 \times 10^{-4}$ unifies alle leptonic Anomalien
- The Elektron Anomalie is correctly vorhergesagt as extremely klein
- The theory is experimentally validated and theoretically consistent

The T0 theory represents a significant extension of the Standard Model das, through the introduction of a universal Skalar Feld with geometrisch Kopplung, enables a unified Beschreibung of alle leptonic Anomalien. The quadratic Masse scaling is basierend auf established Quanten Feld theory and confirmed by experimentell data.

The outstanding agreement zwischen theory and Experiment, besonders the korrekt Vorhersage of the tiny Elektron Anomalie, underscores the validity of the T0 Ansatz. The theory somit offers an elegant Lösung to one of the meist important Anomalien in modern Teilchen physics.

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