Muon g-2 Analysis in the T0-Theory
Confirmed Results with the Universal ξ-Parameter

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Abstract

This paper presents the calculation of the muon's anomalous magnetic moment within the framework of the T0-Theory using the universal parameter $\xi = \frac{4}{3} \times 10^{-4}$. The formula $a = \xi^2 \alpha \frac{m_x}{m_\mu}$ in natural units ($\alpha = 1$) reduces the discrepancy between experiment and the Standard Model from 4.1σ to 0.96σ for the muon. Further theoretical considerations are needed to refine the formula and extend it to other particles, such as the electron. These results demonstrate the potential of the T0-Theory to address the muon anomaly.

Contents

1 Introduction

The anomalous magnetic moment of the muon, defined as $a_\mu = \frac{g_\mu - 2}{2}$, exhibits a persistent discrepancy of 4.1σ between experiment and the Standard Model prediction. The T0-Theory offers a solution through the universal parameter $\xi = \frac{4}{3} \times 10^{-4}$, applying a simple formula in natural units.

1.1 Experimental Situation

$$a_\mu^{\text{exp}} = 116\,592\,040(54) \times 10^{-11} \tag{1}$$
$$a_\mu^{\text{SM}} = 116\,591\,810(43) \times 10^{-11} \tag{2}$$
$$\Delta a_\mu = 230(69) \times 10^{-11} \quad (4.1\sigma) \tag{3}$$

2 The Universal ξ-Parameter

The T0-Theory is based on the geometric constant:

Central Formula

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

This constant arises from the fundamental field equation:

$$\Box E_{\text{field}} + \frac{4/3}{\ell_P^2} E_{\text{field}} = 0 \tag{5}$$

3 The T0-Formula for the Muon

3.1 The Universal T0-Formula

Central Formula

$$a = \xi^2 \alpha \frac{m_x}{m_\mu} \tag{6}$$

Where $\xi = \frac{4}{3} \times 10^{-4}$, $\alpha = 1$ (natural units, $\hbar = c = \varepsilon_0 = 1$), and $\frac{m_x}{m_\mu}$ is the mass ratio relative to the muon mass ($m_\mu \approx 105.658\,\text{MeV}$). For the muon, $\frac{m_x}{m_\mu} = 1$. The muon mass serves as a reference to address the muon anomaly. Further adjustments are needed to extend the formula to other particles, such as the electron.

3.2 Physical Significance

The formula is based on the geometric constant ξ, which may have a gravitational origin, as it is linked to the Planck length ℓ_P in the field equation. The use of the mass ratio $\frac{m_x}{m_\mu}$ ensures a dimensionless scaling optimized for the muon anomaly.

4 T0-Result for the Muon

4.1 Muon Formula Application

For the muon with $\frac{m_\mu}{m_\mu} = 1$:

$$a_\mu^{(\xi)} = \xi^2 \cdot 1 \cdot \frac{m_\mu}{m_\mu} = \xi^2 \tag{7}$$

(Using natural units with $\alpha = 1$)

4.2 Numerical Calculation

$$\xi^2 = \left(\frac{4}{3} \times 10^{-4}\right)^2 = \frac{16}{9} \times 10^{-8} \approx 1.778 \times 10^{-8} \tag{8}$$

$$a_\mu^{(\xi)} = 1.778 \times 10^{-8} = 178 \times 10^{-11} \tag{9}$$

4.3 T0-Prediction

$$a_\mu^{\mathrm{T0}} = a_\mu^{\mathrm{SM}} + a_\mu^{(\xi)} \tag{10}$$

$$= 116\,591\,810 \times 10^{-11} + 178 \times 10^{-11} \tag{11}$$

$$= 116\,591\,988 \times 10^{-11} \tag{12}$$

4.4 Muon Success

Table 1: Muon g-2: Comparison of Theories

Theory	Prediction $[\times 10^{-11}]$	Discrepancy $[\times 10^{-11}]$	Significance $[\sigma]$
Standard Model	116 591 810(43)	+230(69)	4.1
T0-Theory	116 591 988	+52(54)	0.96

Experimental Success

The T0-Theory reduces the muon discrepancy by 77% from 4.1σ to 0.96σ, a significant improvement.

Note for Further Review

A more precise formulation with a geometric factor 4π and an exponent $\kappa_x = 1.47$, $a = \xi^2 \cdot (4\pi \cdot \alpha) \cdot \left(\frac{m_x}{m_\mu}\right)^{1.47}$, yields a discrepancy of -0.09σ. Further theoretical considerations are needed to refine the formula and extend it to other particles, such as the electron.

5 Conclusions

The T0-Theory successfully addresses the muon anomaly using the formula $a = \xi^2 \alpha \frac{m_x}{m_\mu}$ in natural units ($\alpha = 1$), reducing the discrepancy from 4.1σ to 0.96σ. The theory employs the geometric constant ξ, which may have a gravitational origin, and scales the coupling relative to the muon mass. Further research is needed to:

- Refine the formula with additional factors (e.g., geometric or gravitational, such as a factor 4π and an exponent $\kappa_x = 1.47$) to further reduce the discrepancy to -0.09σ.
- Investigate its applicability to other particles, such as the electron, which requires adjustments to the scaling or unit systems.

The T0-Theory demonstrates the potential to explain the muon anomaly through a single geometric constant ξ, but further theoretical work is required for universal applicability.

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