

Anomalous Magnetic Moment Formula of the τ Lepton

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Abstract: We find a simple formula for calculating the anomalous magnetic moment of the τ lepton. Its results are basically consistent with the theoretical values of the Standard Model. The anomalous magnetic moment of the τ lepton we obtained is $a_\tau = 0.001177236$.

Introduction: Our formula is as follows:

$$a_\tau = \frac{\alpha}{2\pi} \left[1 - 2(g_p g_n + g_e) \frac{m_e}{m_\tau} \right]^{-1} \quad (1)$$

where:

- a_τ is the anomalous magnetic moment of the τ lepton;
- α is the fine structure constant;
- g_p is the g-factor of the spin magnetic moment of the proton.
- g_n is the g-factor of the spin magnetic moment of the neutron;
- g_e is the g-factor of the spin magnetic moment of the electron.
- m_e is the mass of the electron;
- m_τ is the mass of the τ lepton;
- π is the Pi.

The result calculated from equation (1) is: $a_\tau = 0.001177236$.

The theoretical value from the Standard Model is [1]:

$$a_\tau = 0.00117721(5) \quad (2)$$

Comparing these two values, we can find that they are basically consistent. Since there is no exact value for the mass and anomalous magnetic moment of the τ lepton, the formula in this paper cannot determine whether it needs to be corrected, and it may continue to be updated later.

Reference

[1] arXiv:hep-ph/0701260v1