Expression of Natural Constant e in Physics

Shan-Hong Li

Email: duke3366@163.com

(October 14, 2022)

Abstract

The natural constant e is a mathematical constant, which is obtained by a mathematical formula. We find that there is also a simple expression for the natural constant e in physics, which is different from the formula in mathematics. It is composed of some physical constants, and its result is in good agreement with the value of the natural constant e.

Introduction

In this paper, the expression of the natural constant e is obtained from two simple equations, as follows:

$$\frac{g_p^2}{4e^2} = 1.055614707207 \tag{1}$$

And:

$$\frac{4}{g_n}\frac{g_\tau^2}{g_e g_\mu}\frac{m_n^7}{m_p^7} = 1.055614707158 \tag{2}$$

Where:

e is the natural constant.

g_p is the spin g-factor of the proton.

g_n is the spin g-factor of the neutron.

g_e is the spin g-factor of the electron.

m_n is the mass of the neutron.

m_p is the mass of the proton.

g_μ is the spin g-factor of the muon.

g_τ is the spin g-factor of the tauon.

Let Equation (1) be equal to Equation (2), then we can get an expression about the nature constant e, as follows:

$$e = \sqrt{\frac{g_p^2 g_n}{16}\frac{g_e g_\mu}{g_\tau^2}\frac{m_p^7}{m_n^7}} \tag{3}$$

The calculation result of the Equation (3) is: $e = 2.718281828522$.

The value of the natural constant e is: $e = 2.718281828459$.

Comparing the two, it can be found that the result of Equation (3) is in good agreement, with 9 valid digits after the decimal point.

In this paper, the spin g-factor of the tauon is a theoretical value [1], which is: $g_\tau = 2 \times 1.00117721$. It can affect the calculation results of Equation (3). Values for other physical quantities are from the 2018 CODATA recommendation.

Reference

[1] arXiv: hep-ph/0702026v1