Expression of Natural Constant $e$ in Physics

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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:

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

And:

$$\frac{4}{g_n g_p g_e g_\mu} \frac{m_p^2}{m_n^2} = 1.055614707158$$ (2)

Where:

- $e$ is the natural constant.
- $m_n$ is the mass of the neutron.
- $g_p$ is the spin $g$-factor of the proton.
- $m_p$ is the mass of the proton.
- $g_n$ is the spin $g$-factor of the neutron.
- $g_\mu$ is the spin $g$-factor of the muon.
- $g_e$ is the spin $g$-factor of the electron.
- $g_\tau$ 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:

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