Numerological Formula for the Electron Spin g-factor

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The present article introduces a numerological expression for the electron spin g-factor. This formula is accurate to nine decimal places.

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1. Introduction

The electron spin g-factor g_e or simply the electron g-factor is part of the proportionality constant of the equation relating the magnetic moment $\overrightarrow{\mu_S}$ due to the spin of the electron with the spin angular momentum $\vec{S}$. This relationship is

$$\overrightarrow{\mu_S} = -g_e \frac{e}{2m_e} \vec{S}$$

The other constants are the electric charge e of the electron and the electron rest mass m_e
In 1928 Dirac developed his quantum theory of the electron [1] based on a relativistic version of the Schrödinger equation. Dirac's equation predicted an electron g-factor of 2. However, the measured value was about 2.002319304. Behind this small difference in absolute terms there was a giant difference in concepts. To solve the limitations of Dirac's formulation, Feynman developed the quantum electrodynamics theory (QED) in which he introduced the concept of virtual particles. This theory predicted a value for the electron g-factor which was in agreement with the experiment to 14 decimal places. This was an unprecedented success. Thus QED became humanity's most accurate formulation of reality. The next section introduces a formula that, on one hand, is not as accurate as the QED's result, but on the other hand, is much simpler.

2. The Formula

The formula for the electron g-factor I developed is

$$g_e = 2 \times \left[\sqrt[4096]{\frac{1}{\alpha} - \frac{2}{\alpha^{1/2}} + \frac{1}{\alpha^{1/10}}} \right] \qquad (1)$$

Where

g_e = electron spin g-factor
α = fine structure constant (electromagnetic coupling constant)

It is interesting to see that $2^{12} = 4096$.

This formula yields the following value

$$g_e = 2.\underline{002\,319\,304}\,229\,08 \qquad \text{(R1)}$$
$$\textit{accurate to } 9 \uparrow \textit{ decimal places}$$

The electron g-factor given by NIST is

$$g_{e\text{-}\exp} = 2.002\,319\,304\,361\,53 \qquad \text{(R2)}$$

Comparing the result (R1) with the experiment (R2) we see that formula (1) is accurate to 9 decimal places.

REFERENCES

[1] P. A. M. Dirac, *The Quantum Theory of the Electron*. Proc. Royal Society. Lond. A. 1928.