The Mass of the Electron – Part III

(Draft)

This paper introduces a new formula for the mass of the electron. The formula is based on the mass of the proton, the Planck mass and other fundamental physical constants. By calibrating the value of the Newton's gravitational constant so that to be $G_{calibrated} = 6.67265565 \times 10^{-11}\, N\, m^2 / Kg^2$ *we obtain the observed value for the mass of the electron. This result seems to indicate that the formula is a true law of nature.*

by R. A. Frino

keywords: *Planck,s constant, Planck mass, fine-structure constant, electromagnetic coupling constant, atomic structure constant, elementary electric charge, permittivity of vacuum, Newton's gravitational constant, NIST.*

1. The Formula for the Mass of the Electron (The "Alpha-23" Formula)

The formula for the rest mass of the electron is:

$$m_e = \frac{m_p^2}{4\alpha^6 M_P}\left(\sqrt{1+\frac{4e^2\alpha^{23}M_P}{\pi\,\epsilon_0\,G\,m_p^3}}-1\right) \tag{1.1}$$

Note that the parenthesis is a dimensionless factor that we could call $f_{\alpha 23}$

$$f_{\alpha 23} \equiv \sqrt{1+\frac{4e^2\alpha^{23}M_P}{\pi\,\epsilon_0\,G\,m_p^3}}-1 \tag{1.2}$$

This formula yields the following value for the mass of the electron

$$m_e \approx 9.108\,978\,46 \times 10^{-31}\, Kg \quad (\text{for} \quad G = 6.67384 \times 10^{-11}\, N\, m^2 / Kg^2 \quad)$$

If we calibrate the value of G slightly as shown in the third row, first column of table 1 ($G_{calibrated}$) we get the observed value for the rest mass of the electron [1]. The third column of the table shows the relative error as a percentage:

$$\text{Relative Error (\%)} = \frac{G_{NIST\,2010} - G_{calibrated}}{G_{NIST\,2010}} \times 100 \approx 0.0177\,\%$$

I propose that the correct value of the Newton's gravitational constant, *G*, is closer to the calibrated value: $G_{calibrated} = 6.67265565 \times 10^{-11}\, N\, m^2 / Kg^2$, than to the NIST value. If this is correct then formula (1.1) must be an exact formula.

Value of G (N . m^2 / Kg^2)	Mass of the electron computed with formula (1.1) (Kg)	Relative error (%)
$G_{NIST\,2010} = 6.67384 \times 10^{-11}$	1 $9.108\ 978\ 46 \times 10^{-31}$	0
$G_{calibrated} = 6.67265565 \times 10^{-11}$	$9.109\ 382\ 911\ 379 \times 10^{-31}$	0.0177

Table 1: The mass of the electron computed with formula (1.1) using two different values for the Newton's gravitational constant.

Appendix 1 contains the nomenclature used in this paper.

2. Conclusions

The result of the previous section seems to indicate that the formula (1.1) is a true law of nature and that the value for the Newton's gravitational constant published by NIST in 2010 is inaccurate, at least when dealing with particle physics.

Appendix 1
Nomenclature

The following are the symbols used in this paper

m_e = electron rest mass
α = fine-structure constant, electromagnetic coupling constant, atomic structure constant.
M_p = Planck mass
m_p = proton rest mass
e = elementary electric charge
ϵ_0 = permittivity of vacuum
h = Planck's constant
c = speed of light in vacuum
G = Newton's gravitational constant

REFERENCES

[1] NIST, *Fundamental Physical Constants—Extensive Listing*, retrieved 2011 from: http://physics.nist.gov/constants, (2010).

