

### A Dimensionless Accidental Relation Between the Fundamental Constants

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#### ABSTRACT

An accidental dimensionless relation of relatively good accuracy (~113ppm), between  $\alpha_G$  (the gravitational coupling constant),  $\alpha$  (the electromagnetic fine structure constant) and  $\beta$  (the proton to electron mass ratio); has been found. Although this relation is based on no theoretical basis, it might impose a kind of clue toward a possible understanding of some fundamental physics problems, especially the unification of electromagnetism and gravity.

#### INTRODUCTION

Accidental relations are known to scientists a long time ago, but they are not used to build theories in physics in any way, though they establish some amazement in such as, the approximate equality between a dimensionless combination of fundamental constants and a specific number such as ( $\alpha \sim 1/137$ ) where  $\alpha$  is the fine structure constant, or the approximate equality between two different dimensionless combinations of fundamental constants such as  $[(\pi/2)\ln(\alpha_G)^{-1} \sim \alpha]$  where  $\alpha_G$  is the gravitational coupling constant which might impose a kind of probable connection between electromagnetism and gravity, and so on.

An accidental relation is chosen to be dimensionless for the reason that the numerical magnitude of the two sides of it will be independent of the system of units used to establish the relation.

According to our knowledge, that apart from the good equality between the magnitude of  $\alpha$  and  $1/137$  to an accuracy of about 236 ppm, there is no other accidental relation that is comparable in accuracy to the relation proposed in this paper.

In this paper, we establish a new accidental relation (i.e discovered by sheer accident with no physical theoretical basis) between  $\alpha_G$ ,  $\alpha$  and  $\beta$  (the proton to electron mass ratio), which in fact contains all the known most fundamental constants,  $c$  (velocity of light in vacuum),  $h$  (Planck's constant),  $G$  the gravitational constant),  $e$  (the electron or proton charge),  $m_e$  (the electron rest mass), and  $m_p$  (the proton rest mass). This relation might have some clue about how to attack some fundamental physics problems such the connection between electromagnetism and gravity. if it is taken on its face value only because it might not have any physical basis being accidental in nature, but we feel it is useful to let this relation known to the scientific community.

#### The dimensionless relation

We present here a simple dimensionless accidental relation between

$\alpha_G (= \frac{Gm_p^2}{\hbar c} \approx 5.9 \times 10^{-39})$ ,  $\alpha (= \frac{e^2}{\hbar c} \approx \frac{1}{137})$  and  $\beta (= \frac{m_p}{m_e} \approx 1836)$  it is:

$$\alpha_G = (1.0001132) \left( \frac{10^{-36}}{1 + 4\pi\alpha\beta} \right) \dots\dots\dots(1)$$

*A Dimensionless Accidental Relation*

The values of fundamental constants defining  $\alpha_G$ ,  $\alpha$  and  $\beta$  i.e.  $e$ ,  $c$ ,  $G$ ,  $h$ ,  $m_e$  and  $m_p$ , are taken from reference [1], and they are accurate to eight order of magnitude except for  $G$  where the relative uncertainty is high (128 ppm), which is the largest source of uncertainty in the numerical factor (1.000132) in eqn. (1).

The above relation is completely accidental discovered by chance with no physical basis at all, but it is comparable in accuracy to the relation ( $\alpha \sim 1/137$ ) which according to the values of the fundamental constants taken from reference [1] is given by:

$$\alpha = 1.0002627 \left( \frac{1}{137} \right) \dots \dots \dots (2)$$

The relatively good accuracy of eqn.1 is more imposing than eqn.2 because it connects all the most fundamental constants in one equation, and it is more appropriate for this purpose to write eq. (1) in the  $\log_{10}$  form that is,

$$(\log_{10}) \left[ \frac{\hbar c}{G m_p^2 \left( 1 + 4\pi \frac{e^2 m_p}{\hbar c m_e} \right)} \right] = 35.999951 \cong 36 \dots \dots \dots (3)$$

It is really astonishing that the left side of eqn.3 which contains all the most fundamental constants of nature is equal with a very good degree of accuracy of about (14) ppm to the exact integer (36)!

**DISCUSSION**

As the accidental relation whether eqn.1 or eqn.3 are purely accidental no definite physical conclusions can drawn from them, but taking them on their face values, we can speculate some ideas from their appearance Eqn.1 seems to establish some connection between gravity (through  $\alpha_G$ ) and electromagnetism (through  $\alpha$  and  $\beta$ ), which might suggest a possible unification between these fields into a unified field, and a possible unification scheme might fix the relation between  $\alpha_G$ ,  $\alpha$  and  $\beta$  i.e. eqn.1.

Our speculations about eqn.3 are more weird, It is thought that in the initial stages of the universe it was in a state of high activity, where even the fundamental constants were not defined, but at a definite stage the state of the universe then self optimized to a physical state such that the fundamental constants were well defined and were connected by eqn.(3).

**CONCLUSION**

As the accidental relation is discovered by sheer accident, it may not bear any physical value or implication, but by virtue of its relatively good accuracy, the authors think it might be useful to let this accidental relation known to the scientific community.

**REFERENCES**

[1] E.R. Cohen and B.N. Taylor, Reviews of Modern physics, 59, 4, 1139(1987).