SYMMETRIC THEORY
Planck's Particle

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Abstract

You will be shown the symmetry properties of the Planck's particle, and will be drawn to its magnetic charge. This will unify the gravitational, electrical and magnetic forces in a single force, now known as superforce. This is possible by introducing a new constant, symmetrical coupling factor call, which allows the transformation between forces.

1.1 – Symmetric Particle

We know that the electrostatic force between two charged particles, as expressed by Coulomb's law, is

$$F_e = \frac{1}{4\pi\varepsilon_o}\frac{q_1 q_2}{r^2} \tag{1}$$

with q_1 and q_2 being the charges of the two particles, r their distance, and

$$\varepsilon_o = 8{,}854 \times 10^{-12} \left[\frac{\sec^2 C^2}{m^3 Kg}\right] \tag{2}$$

the dielectric constant of the vacuum.

Newton's gravitational force, for two bodies with mass m_1 and m_2 separated by the distance r, is

$$F_g = G\frac{m_1 m_2}{r^2} \tag{3}$$

with the gravitation constant G equal to

$$G = 6{,}674 \times 10^{-11} \left[\frac{m^3}{Kg \sec^2}\right] \tag{4}$$

Suppose to express G in the form

$$G \equiv \frac{1}{4\pi G_o} \tag{5}$$

from which it is possible to obtain

$$G_o \equiv \frac{1}{4\pi G} = 1{,}193 \times 10^{9} \left[\frac{Kg \sec^2}{m^3}\right] \tag{6}$$

Consider now the ratio

$$Æ^2 \equiv \frac{\varepsilon_o}{G_o} = \frac{8{,}854\times 10^{-12}}{1{,}193\times 10^{9}} = 7{,}425 \times 10^{-21}\left[\frac{C^2}{Kg^2}\right] \tag{7}$$

from which it is possible to derive

$$Æ \equiv \pm\sqrt{\frac{\varepsilon_o}{G_o}} = \pm\ 8{,}617 \times 10^{-11}\left[\frac{C}{Kg}\right] \tag{8}$$

Through the dimensional analysis, we note that $Æ$ expresses the ratio between a charge and a mass:

$$Æ \equiv \frac{q}{m} \tag{9}$$

In this analysis, we will refer to a *symmetric particle* as that particle whose ratio between its charge and its mass is equal to $Æ$, which will be referred to as *factor of symmetric coupling of the symmetry relation*, as (9).

1.2 – Magnetic monopole of the symmetric particle

The existence of magnetic monopoles has been formally hypothesised, considering Maxwell's equations as a start point. However, interest for these objects increased after the 1931 article by P.A.M. Dirac, in which it is shown that magnetic charges can be introduced in the structure of quantum mechanics. Furthermore, the product between the electric charge e and the magnetic charg g is quantised by Dirac's relation $eg = n\frac{\hbar c}{2}$, with n as an integer. This particle was named *magnetic monopole* if it carried only one magnetic charge, and *dion* if it carries both an electric and a magnetic charge (for example, a monopole bound to a nucleus behaves like a dion).
Another important date in the history of magnetic monopoles is 1974. In that year, 't Hooft and Polyakov demonstrated that the Grand Unified Theory (GUT) between electroweak and strong interactions, implied the existence of magnetic monopoles, with masses in the order of 10^{17} GeV/c^2. These masses are too big to be produced in modern particle accelerators. Various hypotheses map them onto products generated after the Big Bang or in collision of high energy immediately after the transition phase occurred at the end of the *GUT era*. To date, however, despite numerous careful experiments, magnetic monopoles have never been detected.

After this brief rewiev, consider Maxwell's relation

$$c^2 = \frac{1}{\mu_o\,\varepsilon_o} \tag{10}$$

which ensures that the value of speed of light in the vacuum can be expressed via universal constants, with

$$\mu_o = 4\pi \times 10^{-7}\left[\frac{m\,Kg}{C^2}\right] \tag{11}$$

which expresses the magnetic permeability in the vacuum.
From Maxwell's relation in (10) we derive

$$\varepsilon_o = \frac{1}{\mu_o\,c^2} \tag{12}$$

Considering the expression (7), we can rewrite

$$Æ^2 = \frac{\varepsilon_o}{G_o} = \frac{1}{G_o\,\mu_o\,c^2} \tag{13}$$

from which we obtain, considering the first and last term

$$Æ^2 G_o\,\mu_o\,c^2 = 1 \tag{14}$$

which allows us to introduce the constant G_o in Maxwell's relation.

In the hypothesis of considering *symmetric particles*, we analyse dimensionally the product between the charge q, the speed of light in the vacuum c and the constant of magnetic permeability μ_o:

$$q\,c\,\mu_o = [C]\times\left[\frac{m}{\sec}\right]\times\left[\frac{m\times Kg}{C^2}\right] = \left[\frac{m^2\times Kg}{\sec\times C}\right] \tag{15}$$

We know that magnetic monopoles are expressed dimensionally in Weber

$$Weber = \left[\frac{m^2\times Kg}{\sec\times C}\right] \tag{16}$$

We define another property of *symmetric particles,* i.e. they have a magnetic charge equal to

$$g \equiv q\, c\, \mu_o \qquad (17)$$

By using the relation in (9), from which we derive $q \equiv Æ\, m$, we can also write

$$g \equiv Æ\ \mu_o\, m\ c \qquad (18)$$

1.3 – Search for a symmetric particle

What has been discussed so far imposes certain precise limitations on a search for a symmetric particle. As said above, the ratio between its charge and its mass not only has to be constant, it has to have also a clearly defined value, provided by the factor of symmetric coupling $Æ$, as defined in equation (9).

Firstly, we turn our attention to the electron, in order to verify whether it has these properties. From the scientific literature, we know that the electron has the following charge and mass:

$$e = 1{,}602 \times 10^{-19}\ C \qquad\qquad m_e = 9{,}109 \times 10^{-31}\ Kg \qquad (19)$$

with a mass-to-charge specific ratio of

$$\frac{e}{m_e} = 1{,}758 \times 10^{11} \left[\frac{C}{Kg}\right] \neq Æ \qquad\qquad Æ = 8{,}617 \times 10^{-11} \left[\frac{C}{Kg}\right] \qquad (20)$$

As we can see, *the electron cannot be a symmetric particle.*

Neither could the proton be such a particle, seeing as its mass is about 2000 times as big as that of the electron.

It is to be added that the electron would verify the relation of symmetric coupling if it had a mass equal to that of Stone's mass, defined as

$$m_S \equiv \sqrt{\frac{e^2}{4\pi G \varepsilon_o}} \qquad (21)$$

Given that $4\pi G \equiv 1/G_o$, we would obtain via substitution

$$m_S = \sqrt{\frac{e^2\, G_o}{\varepsilon_o}} = e\sqrt{\frac{G_o}{\varepsilon_o}} = \pm\, \frac{e}{Æ} \quad \Rightarrow\ e = \pm\, Æ\, m_S \qquad (22)$$

Secondly, instead, we consider Planck's units, defined exclusively in terms of universal physical constants and proposed by Planck in 1899. In this context, we are only interested to their definitions. In particular, we will consider the Planck's mass and charge, defined as follows:

$$m_P = \sqrt{\frac{\hbar c}{G}} = 2{,}176 \times 10^{-8}\ [Kg] \qquad (23)$$

$$q_P = m_P \sqrt{4\pi \varepsilon_o G} = 1{,}875 \times 10^{-18}\ [C] \qquad (24)$$

In the Planck's charge, replacing $4\pi G \equiv 1/G_o$, you are obtained

$$q_P = m_P \sqrt{\frac{\varepsilon_o}{G_o}} = m_P \sqrt{Æ^2} = \pm m_P\, Æ \qquad (25)$$

For the sake of this discussion, the double sign of (25) is not necessary, even though its meaning is quite evident: the electric charge can be either positive or negative, as so happens in nature. However, it is interesting to observe that the double sign is attributable to the two terms in (25), viz. to the mass m_p or to $Æ$, with apparent conceptual differences on the physical reality that follows from this. In other words, if the double sign were attributed to the mass, we would be led to admit the presence of matter and anti-matter, conversely, if attributed to $Æ$, the double sign would mean that the vacuum has a double polarity.

Suppose, for the time being, that (25) is assumed in absolute value

$$q_P \equiv m_P\, Æ \qquad (26)$$

from which it follows that

$$Æ = \frac{q_P}{m_P} \tag{27}$$

Thus, it clearly appears that *Planck's particle*, defined by the characteristic dimensions introduced by Planck, *is a symmetric particle*.

Let us therefore search for other relations.

1.4 – Coupling constants

The constant of electromagnetic coupling (constant of fine structure) has been calculated in relation to the electron in the first stationary orbit of a hydrogen atom as

$$\alpha = \frac{e^2}{4\pi\varepsilon_o \hbar c} = \frac{e^2}{q_P^2} \tag{28}$$

It is therefore legitimate to ask oneself whether there exists a coupling between the mass of the electron and Planck's mass.

In the scientific literature, various gravitational coupling constants are defined in relation a certain particle. As we are considering the relation between the mass of an electron and Planck's mass, the best estimate would be that between a couple of electrons, as given in the relation

$$\alpha_G = \frac{G m_e^2}{\hbar c} \tag{29}$$

From (23), it follows that

$$\hbar c = G m_p^2$$

hence

$$\alpha_G = \frac{G m_e^2}{\hbar c} = \frac{G m_e^2}{G m_p^2} \equiv \frac{m_e^2}{m_p^2} \tag{30}$$

The coupling at stake is therefore estimated by the relation

$$\alpha_G \equiv \frac{m_e^2}{m_p^2} = \frac{G m_e^2}{\hbar c} = \frac{m_e^2}{4\pi G_o \hbar c} \tag{31}$$

Using (31) and (27)

$$\alpha_G \equiv \frac{m_e^2}{m_P^2} \equiv \frac{m_e^2}{q_P^2} Æ^2 \tag{32}$$

with the value as

$$\alpha_G \equiv 1{,}762 \text{ x } 10^{-45} \tag{33}$$

Suppose now that the electron follows a relation of symmetric coupling analogous to the Planck's particle, that is

$$e \equiv \beta m_e \tag{34}$$

From the coupling costant α , it is possible to obtain

$$\alpha = \frac{e^2}{q_p^2} = \frac{\beta^2 m_e^2}{Æ^2 m_p^2} = \frac{\beta^2}{Æ^2}\alpha_G \tag{35}$$

from which

$$\beta^2 \equiv \frac{\alpha Æ^2}{\alpha_G} \tag{36}$$

therefore

$$\beta \equiv \pm Æ \sqrt{\frac{\alpha}{\alpha_G}} \tag{37}$$

Numerically, one obtains

$$\beta \approx \pm\left(8{,}617\times 10^{-11}\right)\sqrt{\frac{1}{137\cdot\left(1{,}762\times 10^{-45}\right)}} \cong \pm 1{,}759\times 10^{11} \quad \left[\frac{C}{Kg}\right] \tag{38}$$

As it is possible to notice, the term β obtained in (38), which expresses the ratio e/m_e, is equal to the first relation in (20).

At this point in the discussion, it becomes relevant to consider whether $Æ$ could represent a coupling constant between an electrostatic field and a gravitostatic field in the primordial phase of the universe, during *Planck's era*, viz. when the universe is thought of as a state at extremely temperatures (close to Planck's temperature, 10^{31} °K, at around 10^{-43} sec from the birth of the universe). In a medium at such a high temperature, every bound state is unrealisable, and the matter is therefore decomposed in its constituting elements. According to the Standard Model of elementary particles, at the primordial temperatures of the Universe, the three interactions were unified in one single form of interaction. The number and the temperature of the particles of the primordial plasma were maintained at a thermodynamic equilibrium by this form of unified interaction.

During Plank's era, the electrostatic force between two identical particles, with charge q_P and mass m_P, placed at distance r, would be

$$F_e = \frac{1}{4\pi\,\varepsilon_o}\frac{q_P\,q_P}{r^2} \tag{39}$$

By virtue of the relation $q_P \equiv Æ\,m_P$, it follows that

$$F_e = \frac{1}{4\pi\,\varepsilon_o}\frac{\left(Æ\,m_P\right)\left(Æ\,m_P\right)}{r^2} = \frac{Æ^2}{4\pi\,\varepsilon_o}\frac{m_P\,m_P}{r^2} \tag{40}$$

Given that $\dfrac{Æ^2}{\varepsilon_o} = \dfrac{1}{G_o}$, we see that

$$F_e = \frac{1}{4\pi\,G_o}\frac{m_P\,m_P}{r^2} \tag{41}$$

which is nothing other than the Newtonian gravitational force between to particles with mass m_P.

The result we have obtained ensures that Planck's particles will be subjected to the same force, both from the *gravitostatic* and the *electrostatic* point of view, i.e. they will be in a condition of *gravitoelectric unification*

$$\frac{1}{4\pi\,G_o}\frac{m_P^2}{r^2} = \frac{1}{4\pi\,\varepsilon_o}\frac{q_P^2}{r^2} \tag{42}$$

Now, Let us therefore extend the obtained result to magnetic charges. From magnetism theory, we know that a magnetic charge, or magnetic pole, has an individuality such is one that pertains to an electric charge. Nevertheless, we also know that this is purely formal, because separating a magnetic pole from its opposite is impossible, at least in the current conception of a source of magnetic charge. Yet, as said above, the magnetic charge is indeed expected in quantum theory, also as a parameter for the quantisation of an electric charge. It is to be added that, to date, nothing forbids its existence. This formal analogy will therefore be utilised to deduct remarkable consequences.

The magnetic force exerted between two magnetic poles g_1 and g_2, separated at a distance r, will be defined as follows

$$F_m = \frac{1}{4\pi\,\mu_o}\frac{g_1\,g_2}{r^2} \tag{43}$$

Consider now the electrostatic force between two Planck's particles

$$F_e = \frac{1}{4\pi\varepsilon_o}\frac{q_P\, q_P}{r^2} \qquad (44)$$

Considering that Planck's particle has to have its speed equal to c, we define the magnetic charge of a Planck's particle as

$$g_p \equiv q_p\, c\, \mu_o \qquad (45)$$

obtaining $q_P \equiv \frac{g_P}{c\,\mu_o}$, which we substitute into (44) :

$$F_e = \frac{1}{4\pi\varepsilon_o}\frac{\left(\frac{g_P}{c\,\mu_o}\right)\left(\frac{g_P}{c\,\mu_o}\right)}{r^2} \qquad (46)$$

from which we obtain

$$F_e = \frac{1}{\mu_o^2 c^2}\frac{1}{4\pi\varepsilon_o}\frac{g_P\, g_P}{r^2} \qquad (47)$$

From Maxwell relation $c^2 = \frac{1}{\mu_o\,\varepsilon_o}$, we derive $\mu_o c^2 = \frac{1}{\varepsilon_o}$. Therefore we substitute it into (47), thereby obtaining

$$F_e = \frac{1}{\mu_o^2 c^2}\frac{1}{4\pi\varepsilon_o}\frac{g_P\, g_P}{r^2} = \frac{\varepsilon_o}{\mu_o}\frac{1}{4\pi\varepsilon_o}\frac{g_P\, g_P}{r^2} = \frac{1}{4\pi\mu_o}\frac{g_P\, g_P}{r^2} = F_m \qquad (48)$$

which is analogous to the magnetic force between two Planck's monopoles.
We therefore can extend the condition of gravitoelectric unification into a *gravito-electro-magnetic unification*

$$\frac{1}{4\pi G_o}\frac{m_P^2}{r^2} = \frac{1}{4\pi\varepsilon_o}\frac{q_P^2}{r^2} = \frac{1}{4\pi\mu_o}\frac{g_P^2}{r^2} \qquad (49)$$

From (45) we derive

$$g_p \equiv q_p\, c\, \mu_o = 7{,}044\text{x}10^{-16}\ [\text{Weber}] \qquad (50)$$

which can also be re-written, by exploiting the relation in (26), as

$$g_p \equiv m_p\, Æ\, c\, \mu_o \qquad (51)$$

We now re-write (45) in a different form, taking into account the equations (23) and (24) :

$$g_p = q_p\, c\,\mu_o = c\,\mu_o\, m_P\sqrt{4\pi\varepsilon_o G} = c\,\mu_o\sqrt{\frac{\hbar c}{G}}\sqrt{4\pi\varepsilon_o G} =$$

$$= \sqrt{c^2\,\mu_o^2\frac{\hbar c}{G}4\pi\varepsilon_o G} = \sqrt{c^2\,\mu_o^2\,\hbar c\, 4\pi\varepsilon_o}$$

By exploiting Maxwell's relation (10), we obtain

$$g_P = \sqrt{\frac{1}{\mu_o\,\varepsilon_o}\mu_o^2\,\hbar c\, 4\pi\varepsilon_o} = \sqrt{4\pi\mu_o\,\hbar c}$$

hence

$$g_P \equiv \sqrt{4\pi\mu_o\,\hbar c} \qquad (52)$$

It therefore seems natural to introduce a magnetic coupling constant, on a analogy with the coupling constants already introduced, i.e. the relations in (28) and (31)

$$\alpha = \alpha_E = \frac{e^2}{4\pi\varepsilon_o\,\hbar c} \qquad \alpha_G = \frac{m_e^2}{4\pi G_o\,\hbar c}$$

The analogy allows us to define the magnetic coupling constant as

$$\alpha_M = \frac{g_e^2}{4\pi\mu_o\hbar c} \tag{53}$$

where g_e represents the magnetic monopole of the electron.

Because $Æ = \frac{q_P}{m_P}$, one can legitimately wonder what the ratios $\frac{m_P}{g_P}$ and $\frac{q_P}{g_P}$. We already know the following relations

$$m_p = \sqrt{\frac{\hbar c}{G}} = \sqrt{4\pi G_o \hbar c} \tag{54}$$

$$q_p = Æ\, m_p = \sqrt{4\pi\varepsilon_o \hbar c} \tag{55}$$

$$g_p = \mu_o c q_p = \sqrt{4\pi\mu_o \hbar c} \tag{56}$$

Calculating each formula in quadratic terms, we obtain

$$\frac{q_P^2}{m_P^2} = Æ^2 = \frac{\varepsilon_o}{G_o} \tag{57}$$

$$\frac{q_P^2}{g_P^2} = \frac{q_P^2}{\mu_o^2 c^2 q_P^2} = \frac{1}{\mu_o^2 c^2} = \frac{1}{\mu_o\left(\mu_o c^2\right)} = \frac{\varepsilon_o}{\mu_o} \tag{58}$$

$$\frac{m_P^2}{g_P^2} \equiv \frac{q_P^2}{Æ^2\left(\mu_o^2 c^2 q_P^2\right)} = \frac{1}{Æ^2 \mu_o^2 c^2} = \frac{G_o}{\varepsilon_o \mu_o^2 c^2} = \frac{G_o \mu_o}{\mu_o^2} \equiv \frac{G_o}{\mu_o} \tag{59}$$

Finally, we turn our attention to the rule of quantisation, considering the product $q_P \cdot g_P$. Using the equations (55) and (56), we obtain

$$q_P g_P = \sqrt{4\pi\varepsilon_o \hbar c}\cdot\sqrt{4\pi\mu_o \hbar c} = \sqrt{\left(4\pi\hbar c\right)^2 \mu_o \varepsilon_o} \tag{60}$$

and eventually exploiting Maxwell's relation (10), we can obtain

$$q_P g_P = \sqrt{\left(4\pi\hbar c\right)^2 \frac{1}{c^2}} = \sqrt{\left(4\pi\hbar\right)^2} = 4\pi\hbar = 2h \tag{61}$$

1.5 - Maximum force (Superforce)

Consider the gravitational force between two Planck's particles, placed at a distance equal to Planck's length ℓ_P:

$$F_P \equiv G\frac{m_P^2}{\ell_P^2} \tag{62}$$

Because

$$m_P = \sqrt{\frac{\hbar c}{G}} \qquad \ell_P = \sqrt{\frac{\hbar G}{c^3}} \tag{63}$$

it follows that

$$F_P = G\frac{m_P^2}{\ell_P^2} = G\frac{\hbar c}{G}\frac{c^3}{\hbar G} = \frac{c^4}{G} \tag{64}$$

In the same way, the electrostatic force between to Planck's particles, placed at Planck's distance ℓ_P, would be

$$F_e = \frac{1}{4\pi\varepsilon_o}\frac{q_P^2}{\ell_P^2} = \frac{1}{4\pi\varepsilon_o}\frac{4\pi\varepsilon_o\hbar c}{\hbar G}c^3 = \frac{c^4}{G} \tag{65}$$

Again, in the same way, the magnetic force between two Planck's magnetic charges, placed at a distance ℓ_P, would be

$$F_m = \frac{1}{4\pi\,\mu_o}\frac{g_p^2}{\ell_p^2} = \frac{1}{4\pi\,\mu_o}\frac{q_p^2\,c^2\,\mu_o^2}{\hbar G}c^3 = \frac{c^4}{G} \qquad (66)$$

As already said above, all Planck's forces, calculated in the three forms of fundamental interactions at Planck's era, are to be found in the condition of gravito-electro-magnetic unification, with the further condition that, at the minimum distance possible, i.e. at Planck's length, they are equal to c^4/G

$$F_P \equiv \frac{1}{4\pi\,G_o}\frac{m_P^2}{\ell_P^2} = \frac{1}{4\pi\,\mu_o}\frac{g_p^2}{\ell_p^2} = \frac{1}{4\pi\,\varepsilon_o}\frac{q_P^2}{\ell_P^2} = \frac{c^4}{G} \qquad (67)$$

In the scientific literature, this force is referred to as *maximum force*.

1.6 – Calculation of $\hbar$

From the definitions of Planck's units and from what has been obtained so far, we can further derive the following relations:

$$m_p = \sqrt{4\pi\,G_o\,\hbar\,c} \quad \Rightarrow \quad m_p^2 = 4\pi\,G_o\,\hbar\,c \qquad (68)$$

$$q_p = \sqrt{4\pi\,\varepsilon_o\,\hbar\,c} \quad \Rightarrow \quad q_p^2 = 4\pi\,\varepsilon_o\,\hbar\,c \qquad (69)$$

$$g_p = \sqrt{4\pi\,\mu_o\,\hbar\,c} \quad \Rightarrow \quad g_p^2 = 4\pi\,\mu_o\,\hbar\,c \qquad (70)$$

From which we obtain

$$\hbar\,c \equiv \frac{m_p^2}{4\pi\,G_o} \equiv \frac{q_p^2}{4\pi\,\varepsilon_o} \equiv \frac{g_p^2}{4\pi\,\mu_o} \qquad (71)$$

or

$$\hbar \equiv \frac{m_p^2}{4\pi\,G_o\,c} \equiv \frac{q_p^2}{4\pi\,\varepsilon_o\,c} \equiv \frac{g_p^2}{4\pi\,\mu_o\,c} \qquad (72)$$

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