Quantum invariant in Newtonian gravitation?

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Abstract: The article begins by assuming that the energy, formulated in accordance with Newton's equation, is quantized. Quantized energy implies waves. In this case the wavelength is given by the distance between two bodies that gravitate mutually. In this context, consequences appear that are analyzed and formulated. The difference of 39 orders of magnitude between electromagnetic interaction and gravitational interaction is explained as an effect of phase dispersion. A threshold of approximately $4.4\ .10^{-21}\ Kg^2$ appears for the product of the masses. According to that, gravitation does not operate when the product is below that threshold.

Part 1 - Asking for pleasure

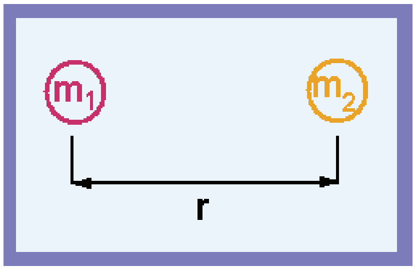
What happens if in Newtonian gravitation we assume that the energy is quantized?

The gravitational energy corresponds to a negative sign and we will suppose it to be constituted by a number n of quanta.

$$E_g = -\ n\ h\ \nu \tag{1}$$

E_g $\rightarrow$ gravitational energy of the two-body system
n $\rightarrow$ number of quanta
h $\rightarrow$ Planck's constant
ν $\rightarrow$ frequency

If the energy is quantized, then the gravitational bond between two bodies has wave nature. If they were traveling waves, they would carry off the energy and the system would collapse. We must think in standing waves.



Each particle of body 1 interacts in waves with all the particles of body 2 and vice versa. The standing wave established between a particle of body 1 and a particle of body 2 constitutes an elementary bond. All the elemental bonds constitute the gravitational link of the entire system.

Are the number n of gravitational energy quanta and the number of elemental bonds equal? The answer is no. Why? Because bonds are waves of the same type, made up of vector fields that give a global resultant. The number of quanta of gravitational energy is linked to that resultant. What does the number of elemental bonds depend on? It only depends on how many particles each body contains in its constitution. We cannot assume that both numbers are equal.

If all the mass of each body were concentrated at one point, the only possible wavelenght would be the distance between the point where m_1 is concentrated and the point where m_2 is concentrated. Actually, the wavelength of each elementary bond has a specific value, which differs from the values of the other elementary bonds. There is a variety of wavelengths and a variety of frequencies. Detailed analysis of everything exceeds my knowledge. Therefore the equations will refer to the length that it results from assuming the entire mass of each body concentrated at a point. With spherical bodies, having spherically symmetric density distribution, that artifice produces an acceptable error, on the order of the typical error of Newton's formula.

Let us express the frequency of the standing wave.

$$\nu = \frac{v_o}{\lambda} \tag{2}$$

ν $\rightarrow$ frequency
v_o $\rightarrow$ velocity of the wave type corresponding to the gravitational bond
λ $\rightarrow$ wavelength

In (1) we replace ν like (2) shows.

$$E_g = -\ n\ h\ \frac{v_o}{\lambda} \tag{3}$$

In the artifice of assuming all the mass concentrated at a point there is only one value of wavelength, equal to r.

$$\lambda = r \tag{4}$$

In (3) we replace λ as indicated by (4).

$$E_g = -\ n\ h\ \frac{v_o}{r} \tag{5}$$

Let us express E_g according to Newton's formula.

$$E_g = -G \ \frac{m_1 \ m_2}{r} \tag{6}$$

G $\rightarrow$ Newton's gravitational constant

Let's set (3) and (5) equal.

$$-\ n \ h \ \frac{v_o}{r} = -G \ \frac{m_1 \ m_2}{r}$$

We simplify.

$$n \ h \ v_o = G \ m_1 \ m_2$$

We clear n .

$$\boxed{n = \frac{G}{h \ v_o} \ m_1 \ m_2} \tag{7}$$

n $\rightarrow$ number of quanta of the gravitational energy of the system

In the Newtonian context n is invariant, since it does not depend on the distance or the kinematic behavior of bodies. They can orbit, be in free fall, or whatever. As long as both masses and G remain constant, n will also do so. For this reason, the phrase *quantum invariant* appears in the title of the document.

Part 2 - The prudence of Louis de Broglie

I have read Louis de Broglie's doctoral thesis decades ago, which contains the famous phase wavelength equation, i.e.

$$\lambda_f = \frac{h}{m \ v}$$

λ_f $\rightarrow$ phase wavelength
h $\rightarrow$ Planck's constant
m $\rightarrow$ particle mass
v $\rightarrow$ particle velocity with respect to the reference frame

At the time there were theoretical reasons to specify the type of wave that operates within the constitution of a particle. That is, explain what and how they are made the particles. Instead of daring, de Broglie preferred prudence. Not to specify the type of waves, presented the following hypothesis. *Suppose that each particle is linked to a periodic phenomenon such that (...)* . That hypothesis and Lorentz transformation produced the same equations that correspond to a group of electromagnetic waves. The simplest case appears within a rectangular waveguide. This is set out in detail in a 130-page article, available at the links indicated at the end of this document. Without resorting to quantum theory, only with the Maxwellian electrodynamics, the results teach us in Special Relativity and the discrete distribution of properties, assumed in Quantum Theory. The equation for λ_f presented by de Broglie also appears. Within the guide harmoniously coexist Electrodynamics, Special Relativity and postulates of Quantum Theory.

The analysis of the rectangular guide was solved since the 19th century, long before the thesis by Louis de Broglie. For lack of empirical evidence, de Broglie avoided specifying the nature of the waves that satisfy your equation. This lack remains to this day. The nature of the waves that satisfy the equation for λ_f has been left out of the institutional research objectives. The problem is that without knowing nature from those waves, we cannot know the value of the velocity v_o in equation (7). The available article in the links indicated at the end of this document contains an analysis of the topic, which implies the electromagnetic nature of the waves that satisfy the equation of Louis de Broglie and, consequently, implies v_o equal to the speed of light in the vacuum. For that reason we will consider the following.

$$v_o = C \tag{8}$$

$C \;\; \rightarrow$ speed of light in vacuum

In (7) we replace v_o as indicated by (8).

$$\boxed{n = \frac{G}{h\;C}\; m_1\; m_2} \tag{9}$$

The three universal constants that appear in (9) constitute a term whose inverse has dimensions of product two masses. How much should that product be worth to be $n = 1$? We clear $m_1\; m_2$.

$$m_1\; m_2 = n\;\frac{h\;C}{G} \tag{10}$$

Doing the calculation with the values of the constants we obtain the following.

$$m_1\; m_2 \simeq 4,421.10^{-14}\;Kg^2 \tag{11}$$

According to equation (9), gravitation operates only when the product of the masses equals or exceeds a threshold, which is determined by the constants h, C, G . When the product of the masses is less than $4,421.10^{-14}\;Kg^2$ no quantum can be formed. In that case the objects do not gravitate to each other.

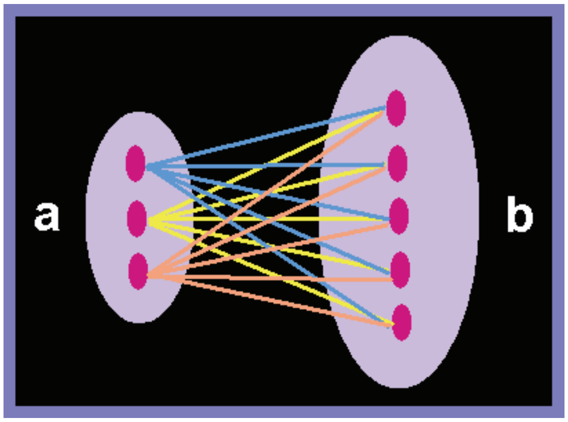
Currently, the question regarding a gravity operating threshold is being contemplated.

Part 3 - Genesis of Newton's formula

Today we use the phrase *Newton's gravitational theory* very cavalierly. It is a wrong expression for the reasons that Newton has pointed out, when he asked to be apologized by offering only the formula of force, without offering an explanation of the phenomena that cause gravity. He clarified that he put in a lot of effort without coming up with a description adequate and that, therefore, he preferred to leave the task for future generations. He was right because without Maxwellian electrodynamics it is impossible to describe the origin. Newton's honesty and lucidity are exemplary.

We know each particle of body 1 interacts in waves with all the particles of body 2 and vice versa. To facilitate reasoning suppose that a body **a** constituted by 3 partícles and another body **b** constituted by 5 .

How many elementary bonds are there in the system? There are 15, that is, 3 multiplied by 5. Although each body is made up of an enormous number of particles, the total number of elementary bonds are obtained by multiplying both numbers of particles. The example is represented in the following figure.



Is there a way to calculate, with reasonable approximation, the number of constituent partícles of a body ?

Nucleons (protons and neutrons) vibrate slightly with respect to the center of mass of the body. This allows durable standing waves to be easily established between a nucleon in body 1 and a nucleon in body 2. Consequently, it allows to maintain the set of standing waves established between both bodies. Electrons perform fast and chaotic translations, unfavorable for establishing stable standing waves between an electron of body 1 and a particle of body 2. This means that we make a negligible mistake if we assume that gravitation depends only on nucleons. So we are interested in the number of nucleons that is in each body.

In calculating mass, the error we make in neglecting electrons is small. That is why we will assume that the entire mass of each body corresponds only to the nucleons.

The mass of the proton and the mass of the neutron differ little from each other. We will make a tolerable mistake assuming them equal. For example, we can assume that the mass of the proton and the mass of the neutron are both equal to the average of the real masses. It is not a meticulous average, but it is preferable to assume that both are equal to the mass of the proton, or equal to the mass of the neutron.

$$m_i = \frac{m_p + m_n}{2} \tag{12}$$

m_i $\rightarrow$ value that we will attribute to the mass of each nucleon
m_p $\rightarrow$ proton mass
m_n $\rightarrow$ neutron mass

With these approximations we can calculate for each body the number of constituent particles.

$$n_1 = \frac{m_1}{m_i} \tag{13}$$

$$n_2 = \frac{m_2}{m_i} \tag{14}$$

The number of elementary bonds is the product of both.

$$n = n_1 \; n_2 \tag{15}$$

We apply (13) and (14) in (15).

$$n = \frac{m_1}{m_i} \; \frac{m_2}{m_i}$$

$$n = \frac{m_1 \; m_2}{m_i^2} \tag{16}$$

If there were only one elemental bond, the resultant force would simply be the force between a charge $+Q_o$ and a charge $-Q_o$. This can be seen in the article indicated at the end of this document. The electric field of this pair of charges is of the capacitive type. The capacitance is expressed as follows.

$$\mathscr{C} = \varepsilon_o \; \frac{\lambda}{2 \; \pi} \tag{17}$$

Let us express the energy of the electric field of the elementary bond.

$$W_E = - \; \frac{Q_o^2}{2 \; \mathscr{C}} \tag{18}$$

In (18) we express $\mathscr{C}$ as indicated by (17).

$$W_E = - \; \frac{Q_o^2}{2 \; \varepsilon_o \; \dfrac{\lambda}{2 \; \pi}}$$

We simplify and order.

$$W_E = - \; \frac{\pi \; Q_o^2}{\varepsilon_o \; \lambda}$$

According to (4) we can replace λ by r .

$$W_E = - \; \frac{\pi \; Q_o^2}{\varepsilon_o \; r} \tag{19}$$

The elemental force is the derivative of W_E with respect to the distance.

$$F_i = \frac{dW_E}{dr} \tag{20}$$

$F_i \; \rightarrow$ elemental force

We derive in (19).

$$\frac{dW_E}{dr} = \frac{\pi \; Q_o^2}{\varepsilon_o \; r^2} \tag{21}$$

We apply (20) in (21).

$$F_i = \frac{\pi \; Q_o^2}{\varepsilon_o \; r^2} \tag{22}$$

Can we assume that the gravitational force between two bodies is simply equal to F_i multiplied by n ? No, because the resultant of all elementary bonds is a vector sum. The result does not depend only on the number of elementary bonds. We must also take into account the complexity of the internal constitution of each body, where some phase relationships can strengthen and others can weaken the resultant. For that we need to include a complexity factor, that is, a dimensionless factor that depends on the internal workings of bodies.

$$F_g = \varphi \; n \; F_i \tag{23}$$

$\varphi \;\; \rightarrow$ complexity factor

In (23) we expres F_i as indicated by (22) .

$$F_g = \varphi \; n \; \frac{\pi \; Q_o^2}{\varepsilon_o \; r^2} \tag{24}$$

Let us express n as indicated by (16) .

$$F_g = \varphi \; \frac{m_1 \; m_2}{m_i^2} \; \frac{\pi \; Q_o^2}{\varepsilon_o \; r^2}$$

We order.

$$F_g = \varphi \; \frac{\pi \; Q_o^2}{\varepsilon_o \; m_i^2} \; \frac{m_1 \; m_2}{r^2} \tag{25}$$

Let's write Newton's formula.

$$F_g = G \; \frac{m_1 \; m_2}{r^2} \tag{26}$$

Equating (26) with (25) results in the following.

$$\boxed{G = \varphi \; \frac{\pi \; Q_o^2}{\varepsilon_o \; m_i^2}} \tag{27}$$

In (28) we note that G cannot be a universal constant, because φ is not. The term φ depends on the internal operation of matter, which can be affected by intense fields and other circumstances. In the solar system, Mercury is the closest planet to the sun. In the orbit of Mercury, the solar field is more intense than in the orbits of the other planets. And the orbit of Mercury differs somewhat from the calculation made with Newton's formula, which does not include the term φ . This means that G is not a universal constant. It is a function that is maintained approximately constant when the fields are weak.

The reference article demonstrates the following equality.

$$h = \frac{2\ \pi\ Q_o^2}{\varepsilon_o\ C}$$

We clear Q_o^2 .

$$Q_o^2 = \frac{h\ \varepsilon_o\ C}{2\ \pi} \tag{28}$$

In (27) we replace Q_o^2 as indicated by (28).

$$G = \varphi\ \frac{\pi\ \dfrac{h\ \varepsilon_o\ C}{2\ \pi}}{\varepsilon_o\ m_i^2}$$

We simplify and order.

$$\boxed{G = \varphi\ \frac{h\ C}{2\ m_i^2}} \tag{29}$$

Using the values of the constants we obtain the following.

$$\frac{h\ C}{2\ m_i^2} = 3,545(...)\ .\ 10^{28}\ \ \frac{N\ m^2}{Kg^2} \tag{30}$$

We note in (30) that the term located in (29) to the right of φ is 39 orders of magnitude greater than G . This means thtat complexity factor φ is in order of 10^{-39} .

In (29) we clear φ .

$$\varphi = \frac{2\ G\ m_i^2}{h\ C} \tag{31}$$

With the values of the constants, the following results.

$$\varphi = 1,8819.10^{-39} \tag{32}$$

The value we see in (32) corresponds to weak fields, like the fields of the solar system. In other situations φ can take different values. Surprisingly different in some cases.

Part 4 - Final Reflection

Is this document useful for anything? In my case it served to understand that it is a good idea to explore new possibilities and variants, regardless of how wrong or how successful may be, because they broaden the mental panorama.

In the Newtonian context n is invariant, since it does not depend on the distance or the kinematic behavior of bodies. They can orbit, be in free fall, or whatever. As long as both masses and G remain constant, n will also do so. For this reason, the phrase *quantum invariant* appears in the title of the document.

- Is institutional research indebted to General Relativity?
- If there is a debt, could it lie in the way of interpreting G?
- Can there really be a threshold in the product of the masses?

- If so, is General Relativity consistent with that threshold?
- Can φ take negative values, which would correspond to gravitational repulsion?
- What would happen if φ could take values of both signs many orders of magnitude greater than the value indicated in (32)?
- Would it be possible with current technology to control gravity by inducing changes in φ ?
- If possible, would microwave technology serve that purpose?

In the beginning I have expresed that the proposal of this document is to ask for pleasure. With this plan we have found details that we do not usually analyze. I hope that this details may raise exciting questions.

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Reference article available at the following links.

`http://www.monografias.com/usuario/perfiles/carlos_alejandro_chiappini/monografias`

`http://www.vixra.org/abs/1711.0313`