Electric Field as Variation of Gravity

D. Di Mario

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Mass, in a quantum world, can be a fleeting event and the border between energy and mass is non-existent. However the Planck time, which we would see also as a dimensionless number, seems to place a limit on the measurable energy or mass. In addition, the rotation of this mass together with its electric and magnetic condition appears to influence what is actually measured and we have, with data from the quantum properties of the electron, an electric field generated by the variation of a gravitational field. Even the measurement of the constant of gravitation could be influenced by moving masses, the faster the motion the higher the measured value.

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Introduction

We often ponder with awe at the unusual magnitude of the Planck particle and associated time. Its mass, something like 10^{-8} Kg, is amazingly massive and its time in the region of 10^{-43} sec is quite short by any standard. Despite the unusual scale, what we measure is really the mass and charge of the electron [1]. It is proposed to look differently at how the Planck particle is detected in our world (Fig. 1). Here we have a source of energy, say, gravitational energy which exists only for a very short time, the Planck time in fact, acting as a super fast shutter. So fast is this shutter that only an infinitesimal portion of the energy is actually measured by our instruments, i.e. the energy impinging on a single frame. A comparison with a real movie film is now useful. If we were part of each frame and would be asked to measure the energy falling on

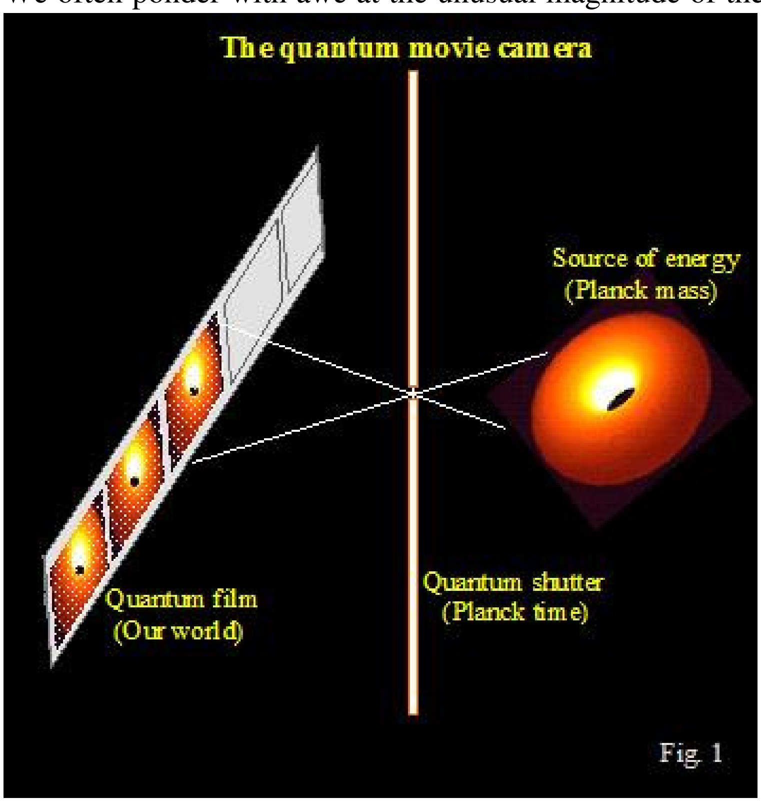
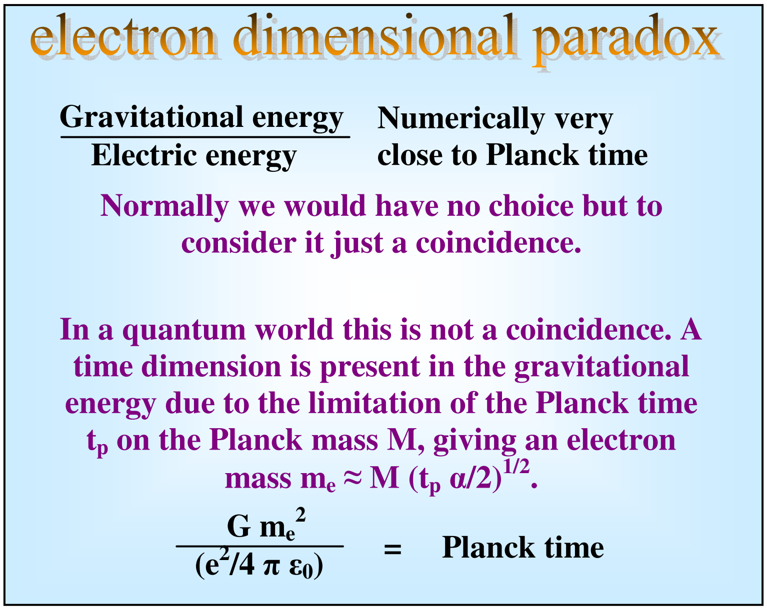


Fig. 1

it we should say that there are so many joules *per frame* but in our real world we are blissfully unaware of the frames following one after the other and we would only say that we measure so many joules, forgetting the time dimension attached to it. It follows that what was originally a time dimension, the Planck time, becomes, in our experience, a dimensionless number. The ratio between the energy on each single frame and the source energy is seen, in our world, as a dimensionless number numerically equal to the Planck time. We will call this dimensionless number the Planck ratio r_p. Strictly speaking it is advisable to use the Planck time instead of the Planck ratio if consistency of dimensions is to be preserved. On the other hand, all our current measurements ignore we actually live in a quantized world and the use of the Planck ratio would give us results more in line with current knowledge albeit fundamentally flawed.



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The electron is what we see

As we are unaware that we live in a quantum world, we would only experience the energy g_e falling on each single frame and this is the energy of the Planck particle e_p limited by Planck time t_p but it will appear to us simply as the ratio r_p:

$$r_p \;=\; g_e / e_p \;=\; (2 / \alpha)\, m_e^2 / M^2 \qquad (1)$$

Where:

- r_p is the Planck ratio numerically equal to Planck time $t_p = (\pi\, h\, G/c^5)^{1/2}$
- $e_p = (\alpha/2)\, G\, M^2$ is the gravitational energy of Planck mass $M = h/t_p c^2$ and α is the fine structure constant.
- $g_e = G\, m_e^2$ is the electron gravitational energy and m_e is the electron mass.

This is an approximation of a more complex equation and the result is an electron mass 0.1% close to its real value and would be the mass of the initial electron. The fine structure constant α takes care of the rotational speed of the particle which, in turn, is the result of electromagnetic interaction. Finer adjustments would be made by accounting for the interaction of virtual particles with its rotation giving a final value in line with experimental results. Full details about α and its relation with the rotational speed are

given in the next section. In practice, when we measure the electron mass we are actually measuring the Planck mass within the limitation of time t_p. If you still feel uncomfortable about the dimensions of eq. 1, you might be right. We will see later that the actual dimension of the electron mass squared does indeed include a time dimension making the equation dimensionally balanced if we consider the Planck time t_p instead of ratio r_p.
The electron and the Planck particle are the same particle [2] and, as a consequence, we would expect to find a similar relationship for the electron charge. So far we have used the dimensions of time, mass and length only. If we wish to see familiar numbers for the charge we have to introduce a unitary charge Q_u whose energy in the unitary time t_u is taken as a reference and the energy ratio between Q_u and e is, similar to the electron mass, equal to the Planck ratio r_p. Also in this case we should really write the Planck time instead of the Planck ratio because a time dimension is actually present in the definition we have given for the reference charge Q_u.
Even with the unitary charge Q_u we have to take care of a few additional factors: first of all we have to consider the shape of the particle. It is not a sphere, it is a ring, as this is the most accredited form for our black hole and possibly the electron [3,4] yielding a form factor equal to $4\pi^2$. The other parameter to consider is the rotational speed, hence the term $\alpha(2-\alpha)$, explained in the next section. Eventually we have:

$$t_p \;=\; e_e / e_u \;=\; \alpha\,(2 - \alpha)\, e^2 / 16\,\pi^4 \qquad (2)$$

Where:

- Energy $e_u = (4\pi^2 Q_u)^2 / t_u 4\pi\varepsilon_0\, \alpha(2-\alpha)$ applied to a spinning toroid with unitary charge in the unitary time, where ε_0 is the permittivity of vacuum.
- Energy $e_e = e^2/4\pi\,\varepsilon_0$ applicable to the electron charge.

This is an exact equation from where the electron charge can be calculated without any prior knowledge of the vacuum permittivity or electron radius. Conversely, G can be calculated directly from basic quantities.

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The fine structure constant α and the rotational speed

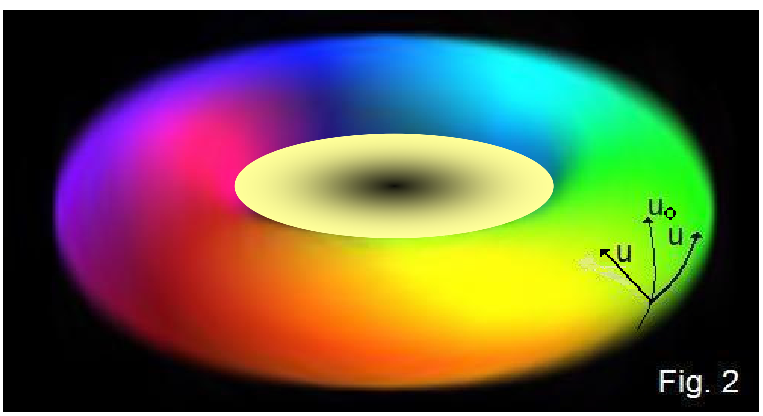


Fig. 2

Rotation of the ring model of the electron is normally taken for granted but there is no agreement on how fast the ring is rotating. The speed of light is often mentioned, useful to make calculations easy, but it does not take in account any relativistic effect. Another approach favored by Spaniol and

Sutton [5] is to relate the fine structure constant to the rotational speed. We will follow this approach even if the final equation will be somewhat different.

In addition to its rotation with speed u, we consider that a point on the ring is also rotating around the torus itself with the same speed u (fig. 2). The result of these two components is a point traveling around the ring at speed u_0 and describing a helix. We will define the Planck fine structure constant or initial fine structure constant α_0 as the factor accounting for speed u_0:

$$\alpha_0 \;=\; 2\,(1 - u_0^2 / c^2) \qquad (3)$$

This is really a relativistic factor and if we apply it to the toroidal unitary charge $4\pi^2 Q_u/t_u^{1/2}$ taken as a reference, we get a new charge Q that would be the one seen through the quantum movie camera once the limitation of the Planck time t_p is taken in account:

$$Q^2 \;=\; 16\,\pi^4\, t_p / \alpha_0^2 \qquad (4)$$

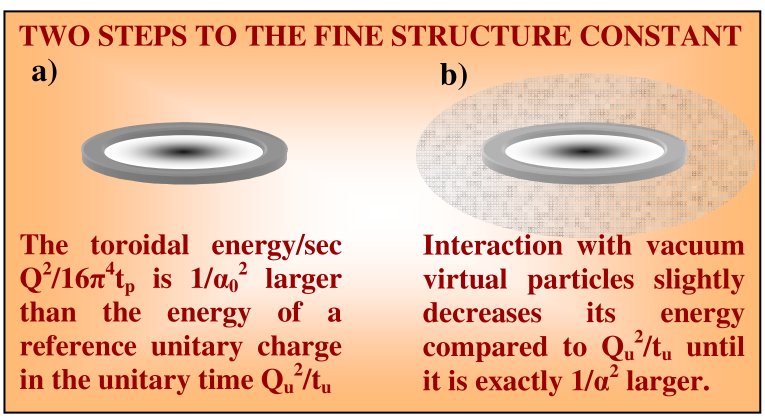
In order to find α_0 we define Q as the charge giving the same force as the Planck mass M:

$$Q \;=\; M\,(4\,\pi\,\varepsilon_p\,G)^{1/2} \qquad (5)$$

Where ε_p is the Planck permittivity [6] given by $(t_p/4\pi^2)^{1/4}$.

We are now in a position to find the initial fine structure α_0 and the relevant speed u_0. It is also possible to write α_0 in terms of fundamental constants only:

$$\alpha_0 \;=\; (4\,\pi^5/\,c^3)^{1/2}\,(2\,G\,/\,h)^{1/4}\,(c\,/\,\pi\,h\,G)^{1/16} \qquad (6)$$



The above equation is dimensionally balanced because it includes the term $4\pi^2$ representing our unitary charge/sec^{½}.

Charge Q is a rotating charge and as such it will generate a magnetic force opposing the electric force generating it. The residual force will be smaller and electric in nature and it will appear to us as it were generated by a charge e_0 which we identify as the initial electron charge:

$$Q^2\,c^2 / u_0^2 - Q^2 \;=\; e_0^2 \qquad (7)$$

From where $e_0 = Q/(2/\alpha_0\text{-}1)^{1/2}$. This is the link we were looking for, relating e_0, Q and α_0 to fundamental quantum constants. The equation can be elaborated in many ways; we could, for example, substitute Q in eq. 7 with the term given in eq. 4, thus getting:

$$16\,\pi^4\,t_p \;=\; \alpha_0\,(2-\alpha_0)\,e_0^2 \qquad (8)$$

Term $16\pi^4$ includes the energy/sec of the reference unitary charge. We note that the left term is a constant, this means that if we would change speed u_0 we would get a new set of values for the fine structure constant and the electron charge and there will be a given speed $u_e<u_0$ generating exactly the known fine structure constant and electron charge. Substituting the known values in eq. 8 we will have eq. 2 seen in the previous section. By rearranging its terms we would have what we would call the *electron equation*:

$$\alpha^2 - 2\,\alpha + 16\,\pi^4\,t_p\,e^2 \;=\; 0 \qquad (9)$$

As we know that $e^2 = 2\,\varepsilon_0\,h\,c\,\alpha$ and $\varepsilon_0 = 10^7/4\,\pi\,c^2$, we could rewrite eq. 2 or 8 without the need to know the electron charge yielding an equation which allows us to calculate the known fine structure constant in terms of fundamental constants only. The result is a cubic equation presented here in its canonic form:

$$\alpha^3 - 2\,\alpha^2 + 10^{-7}\,(2\,\pi)^5\,(\pi\,G\,/\,c^3\,h)^{1/2} \;=\; 0 \qquad (10)$$

One of the solutions is the known fine structure constant. All solutions, one of them negative, would be pertinent to the properties of vacuum and we would refer to eq. 10 as the *vacuum equation*.

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The quantum mass

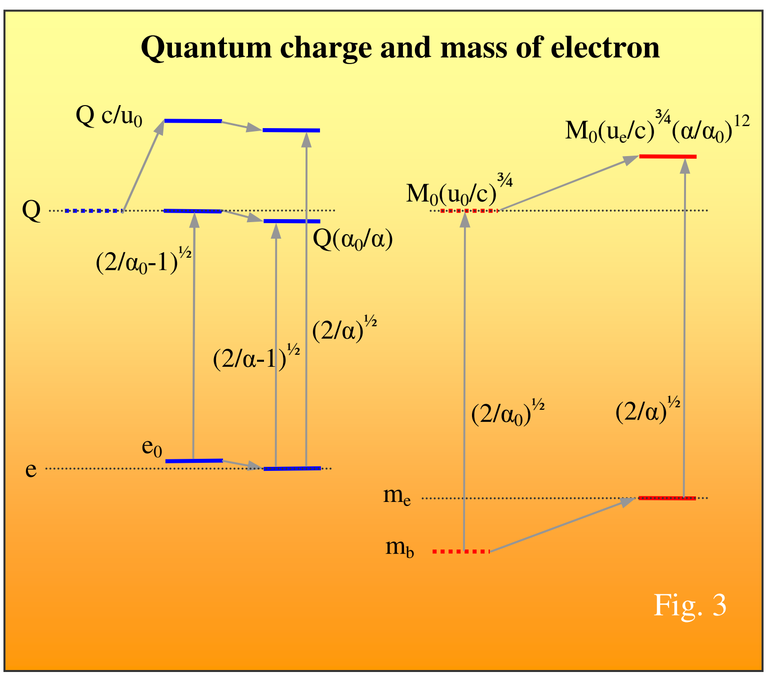


Fig. 3

The electron mass is obtained in a way similar to the electron charge (Fig. 3). First we find the detectable Planck mass: i.e. the mass that the Planck shutter will allow us to see. The energy falling on the quantum film is GM^2t_p but it will appear to us as originating from a mass $M_0 = Mt_p^{1/2}$. This mass is rotating with speed u_0 close to the speed of light, so there will be a certain electron mass m_b that will increase to M_0 once the relativistic factor is taken care of. The factor $(1\alpha/2)^{3/8} =$

$(u_e/c)^{3/4}$ seems to be closely related to the torus radii variation and shows a direct influence of the speed on the three radii but a proper proof is still missing:

$$m_b = M_0 (\alpha_0 / 2)^{1/2} (1 - \alpha_0 / 2)^{3/8} \qquad (11)$$

This is only a preliminary value for the electron mass and would apply to the initial electron but it is now possible to find a connection with the electron charge as they have a common origin in the Planck particle where M_0 and Q are related as follows:

$$M_0 = 8 h^3 / \pi Q^4 \qquad (12)$$

By expanding eq. 11 and placing the electron mass m_e instead of m_b and α instead of α_0 we have an electron mass only 0.16% lower than the expected value:

$$m_e \approx (8 h^3 / \pi e^4) (\alpha / 2)^{1/2} (1 - \alpha / 2)^{3/8} / (2 / \alpha - 1)^2 \qquad (13)$$

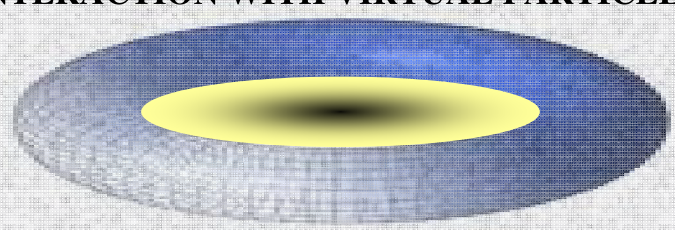
From the above equations we see that the mass is in inverse proportion to the fourth power of the charge. From eq. 4 we see a direct relation between Q and the fine structure constant. This means that the additional variation α_0/α in the charge becomes $(\alpha_0/\alpha)^4$ in eq. 12 when applied to the electron mass. Any variation of its ring radius and the radii of its section, an ellipse, is reflected as a corresponding variation of its mass. The three radii variation would originate a factor to be placed in the electron mass equation shown below in terms of M_0 or the electron charge:

$$m_e = M_0 (\alpha / 2)^{1/2} (1 - \alpha / 2)^{3/8} (\alpha / \alpha_0)^{12} \qquad (14)$$

$$m_e = (8 h^3 / \pi e^4) (\alpha / 2)^{1/2} (1 - \alpha / 2)^{3/8} (\alpha / \alpha_0)^8 / (2 / \alpha - 1)^2 \qquad (15)$$

In order to reach these results we introduced some new hypothesis on the nature of the electron but the most important fact is that the charge and mass we measure is the result of rotation. The rotating charge is creating an opposite magnetic force and what we measure is the residual electric force. If we would speed up rotation we would measure an even lower electron charge. The same applies to the electron mass: the corresponding energy of the electron charge

INTERACTION WITH VIRTUAL PARTICLES



Rotating mass before slowdown:
$M_0 (\alpha_0 / 2)^{1/2} (1 - \alpha_0 / 2)^{3/8}$

Rotating mass after slowdown:
$M_0 (\alpha / 2)^{1/2} (1 - \alpha / 2)^{3/8} (\alpha / \alpha_0)^{12}$

Interference with the vacuum virtual particles slows down its rotation resulting in a slight mass increase due to the $(\alpha/\alpha_0)^{12}$ factor acting on the overall size of the electron.

is detected as a mass and the faster we rotate it the lower its mass will be. We still have the relativistic mass increase but this is masked by the opposite magnetic force and the net result is a lower mass.

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Origin of the electric field

With the elaboration of existing equations, it is possible to relate directly the Planck mass with the electric force F_e applicable to the electron:

$$F_e \;=\; e^2 / 4\,\pi\,\varepsilon_0 \;=\; G\,M^2\,(\alpha / 2) \qquad (16)$$

Eq. 16 is telling us that the electron force is equal to the gravitational force of the Planck mass, provided we take in account its rotation represented by α.

The consequence is that the electric force is really a gravitational force but with a fundamental difference: it has a polarity, positive or negative.

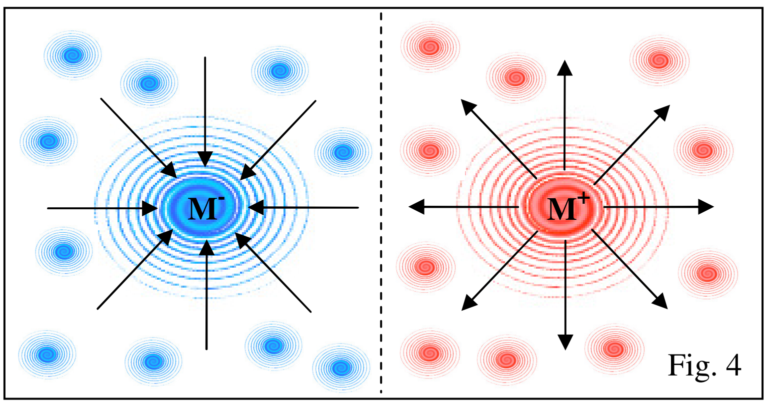


Fig. 4

We could possibly explain the existence of a polarity if we think that the Planck mass is a black hole trying to get bigger and bigger or smaller and smaller. This tendency will be experienced as a polarity: a variable gravitational field over an extremely long time. Time loses its meaning in the vicinity of the black hole and the variation of the gravitation field would take place over a long period of time, probably the age of the universe itself, and we would be left only with a polarity: negative or positive. The hypothetic "evaporation" of sub-atomic black holes implies that they have knowledge of time, which is not necessarily the case and in our everyday experience we would see the Planck mass as a steady and ageless particle. It would be this *polarized gravity* that we would experience as the electric field, as shown in the graphical representation of fig. 4 and detected as electrons and positrons.

If this is the case we would expect to be able to calculate the known electric field $E_e = e/4\pi\varepsilon_0$ generated by an electron directly from the Planck data.

Similar to the electron charge to mass quotient $K_e = e/m_e$, we have a similar quotient K_p for the Planck particle. Once rotation is taken in account it becomes:

$$K_p \;=\; Q / M\,(\alpha / \alpha_0)\,(1 - \alpha / 2)^{1/2} \qquad (17)$$

The resulting electric field generated by the Planck mass is the electron electric field E_e, derived from eq. 16, provided we introduce the charge to mass quotient applicable to the Planck particle:

$$E_e = e / 4 \pi \varepsilon_0 = G M (\alpha / 2)^{1/2} / K_p \qquad (18)$$

At this point it could be of interest to see that the ratio of the square of the quotients is the same as the ratio between the gravitational and electric force F_g/F_e in an electron:

$$(K_p / K_e)^2 = F_g / F_e \qquad (19)$$

The important question is of course whether we could actually detect a generic electric field E generated by a gravitational field variation δg given over a period of time δt:

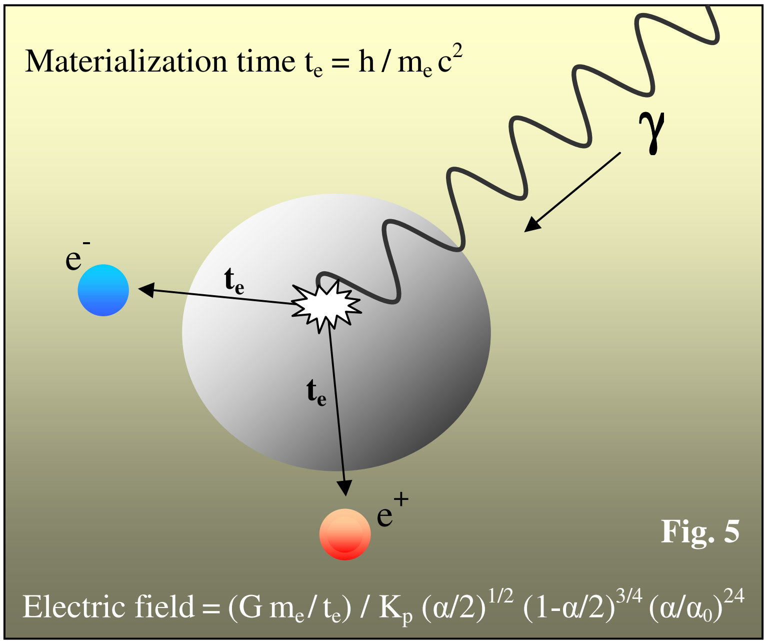


Fig. 5

$$E = \delta g / \delta t \qquad (20)$$

In this respect we will see how the electric field of an electron can be calculated with the above equation as an alternative to eq. 18.

A gamma ray materializes in an electron-positron pair in certain circumstances: for example when it is close enough to a massive atomic particle (Fig. 5). In this case the electron mass would go from zero to m_e within time $t_e = h/m_e c^2$. The resulting variable gravitational field would be given by $G m_e / t_e$. If we take in account the electron rotation, given by a series of terms involving α and α_0 and the Planck quotient K_p, we have our electric field E_e applicable to an electron without the prior knowledge of its charge:

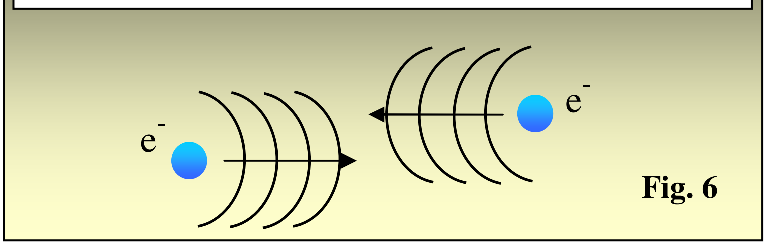
$$E_e = (G m_e / t_e) / K_p (\alpha / 2)^{1/2} (1 - \alpha / 2)^{3/4} (\alpha / \alpha_0)^{24} \qquad (21)$$

This equation is specifically applicable to an electron, a quantum rotating particle with all its collection of mathematical complications, but for the materialization of a generic mass m within time t, the rotational terms will not be present and eventually we would have a generic charge q generating an electric field given by:

$$q / 4 \pi \varepsilon_0 = G m / t K_p \qquad (22)$$

As it would be quite hard to materialize a large mass, the alternative way to get a variable gravitational field is to change the distance from the mass to the detector point. Rudimental experiments with rotating masses have given negative results. This could be attributed to the fact that the variable gravitational field cannot be screened and a difference of potential is not easily detectable. It could be that K_p is involved in sub-nuclear reactions only, such as pair production and quarks; on the other hand, if we would use the electron quotient K_e instead of K_p the resulting electric field would be so weak that its detection becomes impossible.

A field of investigation could be the interaction between like particles: according to this theory the electron-electron close range interaction gives a slightly different result from a positron-positron interaction because there is an additional electric field for an approaching particle and an opposite additional electric field when the particles are receding. The interaction of such effect with the intrinsic charge of the particle would cause a slight difference of behaviour between the particles. There would be a slight difference from the predicted outcome because the electric field due to the gravitational field variation is added, or subtracted, when the two masses come closer and closer to each other, fig. 6. The electric field would reverse when one of the particles has gone past the other.



Besides their intrinsic electric field, the two electrons would experience an additional electric field due to variation of the gravitational field caused by the fast approaching masses.

Fig. 6

This effect will only be evident when at least one mass is involved: in other words, we could have interaction of a particle with a photon as in fig. 5 or between two masses as in fig. 6. The effect should be most evident at a relatively close range and at the highest speed: the ideal case would be an approaching speed equal to c as in fig. 5.

In order to have a clear picture of the electric field created between two particles we have simulated the possible effect between two neutrons, fig. 7. In this case we would not worry about the intrinsic charge of the particles and the field experienced by the two neutrons would be the one shown in the drawing and it is the same as an induced voltage in a conductor when a magnet races past it. In our world it would show as a tiny anomaly in Newton's gravitational law generated by moving bodies approaching or receding from each other.

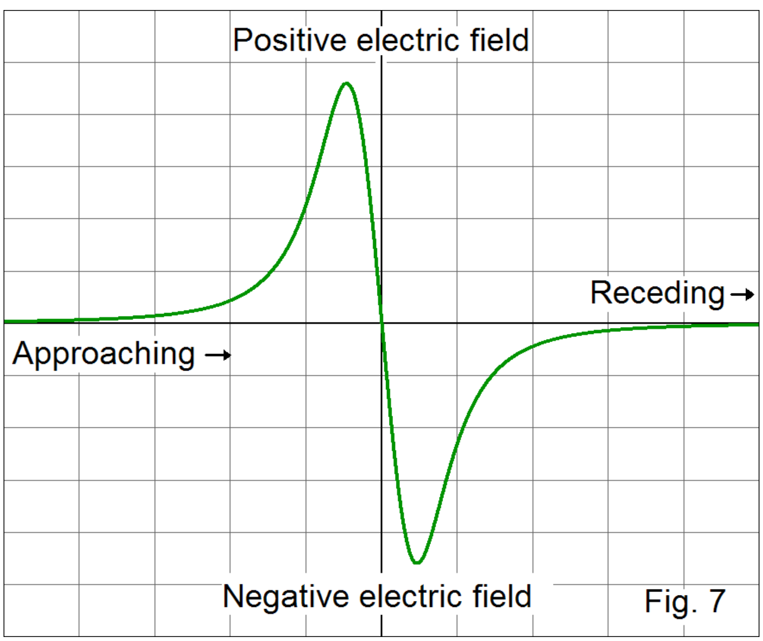


Fig. 7

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Deviation from Newton's law

The example reported in the previous section applies equally well to gravitational masses which could be regarded as neutral bodies. If we consider a similar case as in fig. 6 where two masses go past each other, a fly-by, and we apply the known square law of gravitational attraction we have that the force between the two bodies follows the curve shown in fig. 8. This curve is slightly modified if we would account for the additional force induced by the variation of the gravitational field. This additional force is really the square of fig. 7 and is reported, properly scaled, in fig. 9. The sum of the two forces, blue line, and the original curve given by Newton’s law are both shown in fig. 10.

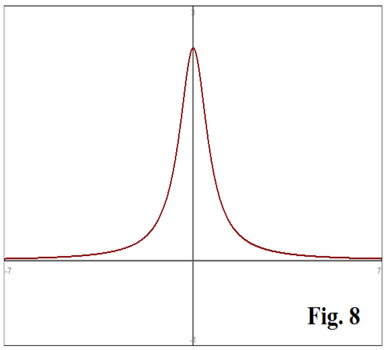

Fig. 8

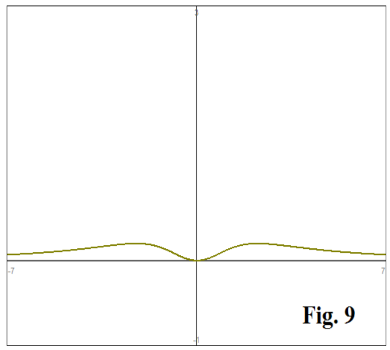

Fig. 9

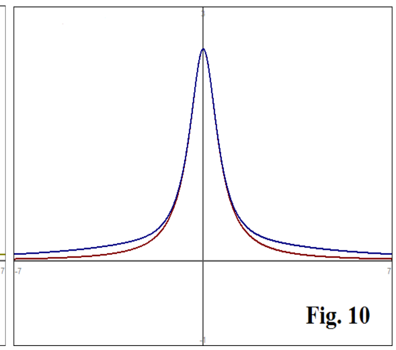

Fig. 10

In practice we have an extra tug which becomes prominent at an intermediate range: at close range or at very large range the additional force becomes very small and the classic square law of gravitation will be predominant. This is purely a qualitative analysis and no attempt has been made to actually calculate the effective strength of this extra force which depends on the mass and relative speed and distance of the bodies involved.
The mysterious tug experienced by the Pioneer probes might be the result of this anomaly and it is expected that the effect will decrease once the probes will get further away.
This effect could be felt even at galactic or intergalactic level: the additional pull would account for the observed extra gravitational force with no need to resort to dark matter.
One of the most important implication is in the measurement of the constant of gravitation G. We would not get the correct value if the moving masses generate a variable gravitational field. Since most of the experiments do actually employ moving masses in various configurations, we are bound to obtain incorrect and dissimilar results most of the time. The faster the relative speed of the masses the higher will be the measured gravitational constant. Measurements should be carried out by means of a feedback mechanism that keeps the mass, or masses, always in the same spot: the strength of this feedback will be proportional to the actual value of the constant of gravitation. A good approach to the measurement of G is through atom interferometry [8] but the presence of fast speeding atoms is bound to give, without a proper correction mechanism, an unusually high value for the constant of gravitation.

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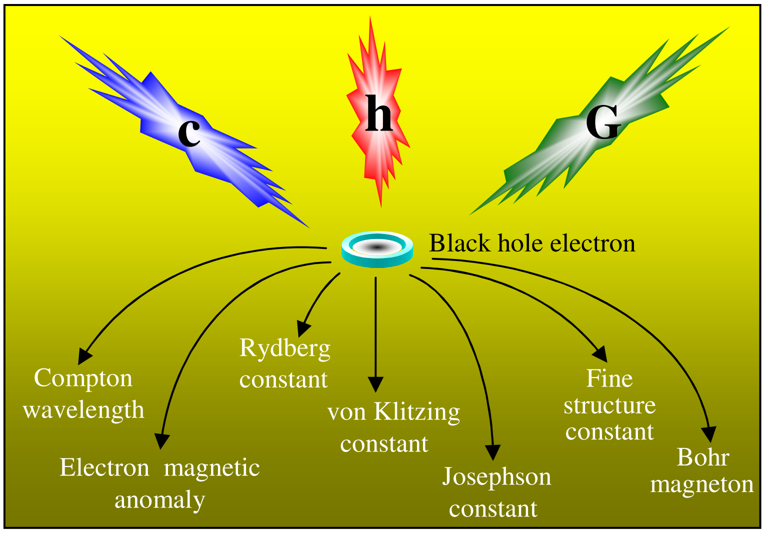
Conclusion

Anomalous gravitational effects and interaction of a gravitational field with a charge have been proposed in the past [7]. This paper seems to support the idea that a variable gravitational field generates an electric field and precise calculations are reported in the appendix. Three basic constants, h, c and G are sufficient to generate all basic quantum constants including the electron mass and charge. An electric field corresponding exactly to the one generated by the electron is generated when its mass changes from zero to its current mass within a given time, typical of a pair production process. The electric field calculated in this way does not require any knowledge of the electron charge or permittivity.



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Appendix

Initial data		
$c = 299792458$	$h = 6.62606837306 \times 10^{-34}$	$G = 6.67291773245 \times 10^{-11}$
Planck particle		
Planck time t_p	$(\pi h G / c^5)^{1/2}$	$2.3950193 \times 10^{-43}$
Planck mass M	$h / t_p c^2$	$3.07826132 \times 10^{-8}$
Planck permittivity ε_p	$(t_p / 4 \pi^2)^{1/4}$	$8.825459393 \times 10^{-12}$
Initial fine structure const. α_0	$(4\pi^5 / c^3)^{1/2} (2 G / h)^{1/4} (c / \pi h G)^{1/16}$	$7.2958732928 \times 10^{-3}$
Planck charge Q	$(4 \varepsilon_p h c)^{1/2}$	$2.6481157 \times 10^{-18}$
Detectable Planck mass M_0	$M t_p^{1/2}$	$1.50646829 \times 10^{-29}$
Planck charge to mass quotient K_p	$Q / M (\alpha / \alpha_0) (1 - \alpha / 2)^{1/2}$	$8.61662480 \times 10^{-11}$
Electron		
Fine structure constants *(vacuum equation)*	solve: $\alpha^3 - 2\alpha^2 + 10^{-7} (2\pi)^5 (\pi G/c^3 h)^{1/2} = 0$	$7.2973525329 \times 10^{-3}$ 1.999973470768 $-7.2708233006 \times 10^{-3}$
Charge e	$4 \pi^2 (t_p / \alpha (2 - \alpha))^{1/2}$	$1.602176416 \times 10^{-19}$
Electric force F_e	$G M^2 \alpha / 2$	$2.30707692 \times 10^{-28}$
Mass m_e	$M_0 (\alpha / 2)^{1/2} (1 - \alpha / 2)^{3/8} (\alpha / \alpha_0)^{12}$	$9.10938135 \times 10^{-31}$
Gravitat. Force F_g	$G M_0^2 (\alpha / 2) (1 - \alpha / 2)^{3/4} (\alpha / \alpha_0)^{24}$	$5.53724242 \times 10^{-71}$
Charge to mass quotient K_e	e / m_e	$1.758820225 \times 10^{11}$
Gravity to electric force ratio F_g / F_e	$(K_p / K_e)^2$	$2.40011175 \times 10^{-43}$
Electric field from a gravitational field variation		
Materialization time t_e	$h / m_e c^2$	$8.09329971 \times 10^{-21}$
Gravity field variation Δ_g	$G m_e / t_e$	$7.51067605 \times 10^{-21}$
Electric field $e/4\pi\varepsilon_0$	$\Delta_g / K_p (\alpha / 2)^{1/2} (1 - \alpha / 2)^{3/4} (\alpha / \alpha_0)^{24}$	$1.43996435 \times 10^{-9}$

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