Reality of the Planck Mass

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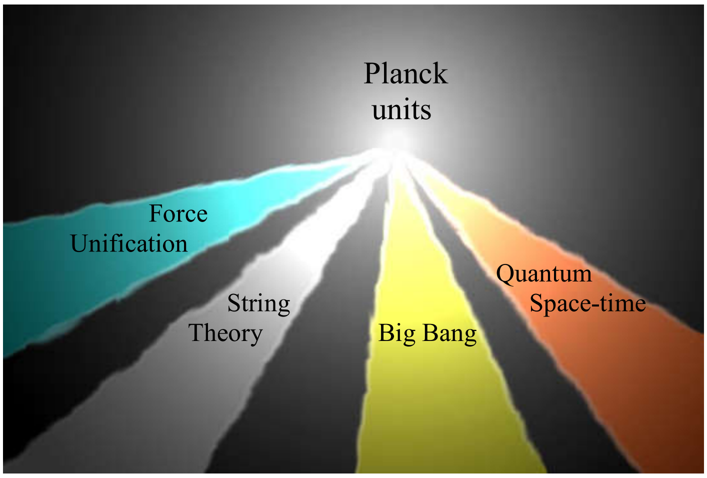
The Planck mass is not the elusive particle so often depicted and if it is considered as a black hole then its quantization via the Planck time will originate the electron mass and charge. The faster the rotation of the Planck mass the lower its measurable mass. At the speed of light we are left with a massless and chargeless particle identified with the neutrino and the interaction of the Planck charge with virtual particles in the vacuum seems to yield the charge for the d-quark. Furthermore, one of the solutions of the vacuum equation is a negative fine structure constant implying a speed slightly faster than light and an imaginary electron with its magnetic monopole.

Introduction

Uniton, geon, roton are some of the names attributed to the Planck mass with the intent to better explain some of the peculiarities of the relevant theory, be it the string theory, the quantum space-time, the big bang and so on. All these theories converge towards a supposedly grand unification where most, if not all, could be explained with the basic Planck units of length, time and mass. Now we know that the Planck length and time are beyond our capacity of detection due to their small value, but the Planck mass with a weight of tens of micrograms should be quite easy to find, yet, so far no trace of it has emerged. Its energy is so high that no present or future laboratory can conceivably produce even a single particle. So elusive is this particle that someone has even thought it might not exist at all and the Planck mass is only the result of playing with numbers. On occasions it has been endowed with fanciful properties or relegated to a very short life in the early stage of the big bang.



The recognized value for the Planck mass is $(\hbar c/G)^{1/2} = 2.18\text{x}10^{-8}$ Kg but you may find also the value $5.46\text{x}10^{-8}$ Kg depending on whether h or $\hbar$ appears in the equation. In cosmology it is occasionally mentioned the value $(\hbar c/8\pi G)^{1/2} = 4.34\text{x}10^{-9}$ Kg. In this paper we will give the Planck mass M the value $(2\hbar c/G)^{1/2} = 3.08\text{x}10^{-8}$ Kg. We really do not know the precise geometry of a Planck particle and the proposed number for the Planck mass could fit an acceptable model.

The Planck time t_p is accordingly calculated as $h/Mc^2 = 2.4x10^{-43}$ sec.
As we have seen, no matter how it is calculated, the Planck mass is extremely big even compared with the most massive particles. Its weight is in the range of a large molecule and it is just impossible not to see it. In fact it is all around us albeit under false pretences.

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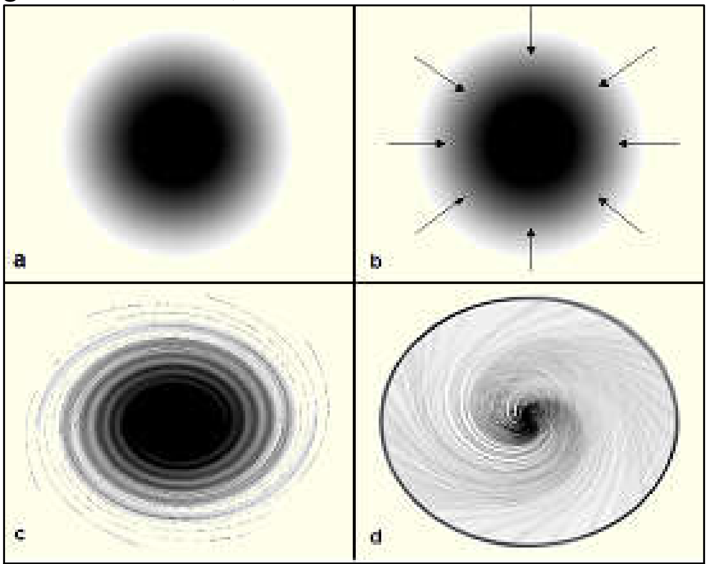
The Planck particle

The reason why we could not find the Planck mass M is because we were looking for a gravitational mass, but this is not how mass M behaves. In our hypothesis we have to see M as a black hole. We would then think that such a particle would either shrink into nothing or increase its size. To our senses neither of the two actually would take place; this would be forbidden by the ever increasing time dilation factor taking place near the black hole. What we would experience is the "tendency"; in other words, we would be left with a sign only: positive or negative depending on whether the particle would tend to shrink or enlarge, either diverging or converging arrows as in fig. b. The variation of mass would look like "frozen" in its initial state but we would experience a sign, positive or negative, and we assign the name charge to this peculiar particle. At this point we would no longer require the introduction of the dimension of charge as we could write everything with the dimensions of length, time and mass only. Yet, the dimension of charge is still retained for practical purposes provided that a comparison is made with the unitary charge as we will see further on.



The Planck mass is seen as a black hole (a), with a specific charge (b), spinning (c) and with an energy field extending up to a very large distance from the black hole (d). The boundary where this field coalesces is what we would experience as the radius of the particle.

All of the above means that we have to look for a charge having the same force as mass M. This originates what we would call the Planck charge Q:

$$Q = M(4\pi\varepsilon_p G)^{1/2} \quad (1)$$

In this equation ε_p is the Planck permittivity, already described in a previous paper [1], and can be calculated directly from the Planck time:

$$\varepsilon_p = (t_p/4\pi^2)^{1/4} \quad (2)$$

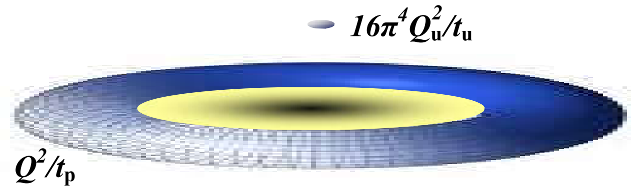
There is another factor to be taken into account in order to have a more comprehensive picture of our particle: its rotational speed u_0. We relate speed u_0 to the fine structure constant α_0 applicable to a Planck particle. We will call it the initial fine structure constant and will show a slight different, 0.02%, from the known constant:

$$\alpha_0 \;=\; 2(1 - u_0^2/c^2) \tag{3}$$

A link between the fine structure constant and the spinning speed has been proposed in the past [2] and has been identified in a previous paper [3] by getting α_0 directly from basic constants:

$$\alpha_0 \;=\; ((16\pi^4 Q_u^2/t_u)/(Q^2/t_p))^{1/2} \;=\; 2\pi(\pi/c)^{3/2}(2G/h)^{1/4}(c/\pi hG)^{1/16} \tag{4}$$

Eq. 4 is dimensionally balanced because is the result of ratio $((16\pi^4 Q_u^2/t_u)/(Q^2/t_p))^{1/2}$ where Q_u and t_u are unitary charge and time respectively and must be always accounted for, even if, numerically, it appears only as $16\pi^4$. The Coulomb was introduced in the measurement system with no relation with quantum gravity, yet, we are using it and a comparison with unitary charge squared Q_u^2 within unitary time t_u, originating $w_u = 16\pi^4 Q_u^2/t_u$, has to be made in order to place quantity Q2/t_p in the context of our experience.



Quantity $16\pi^4 Q_u^2/t_u$ is exactly α_0^2 smaller than quantity Q^2/t_p which refers to our ring model for the black hole electron. The unit of charge, Coulomb, would be seen as a derived unit in quantum gravitation because its basic dimension is a rather bizarre kg$^{1/2}$ m$^{3/2}$ s$^{-7/8}$

Now we know why the Planck mass could not be found: we were looking for a mass when in actual fact it was experienced as a charge that together with α_0 fully characterize a rotating Planck particle corresponding to the initial electron.

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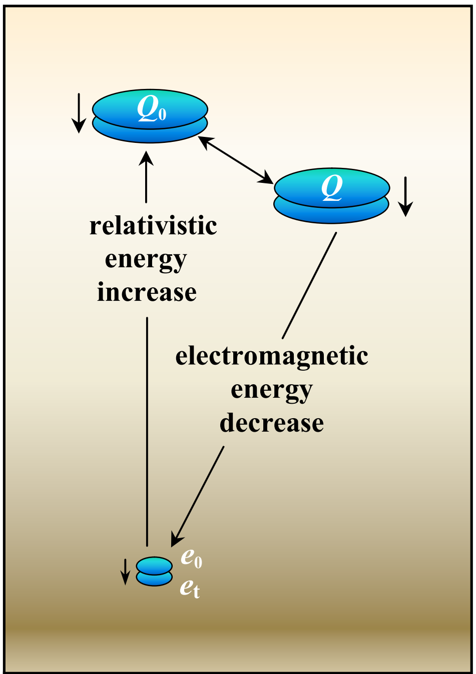
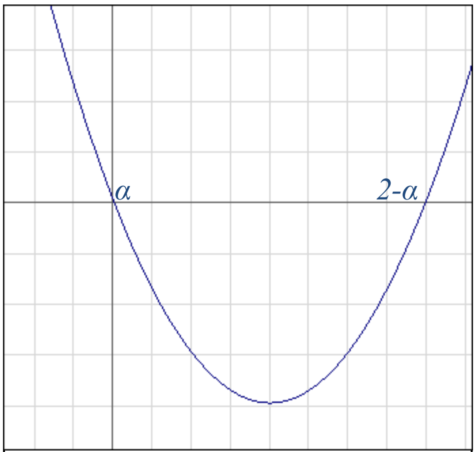
Electron charge and mass

The rotating charge Q will set up a magnetic field that will tend to slow down the rotation of the same charge. In other words the magnetic force will subtract from the electric force and is this final force, still electric in nature, that we will be able to measure and associate to the initial electron charge e_0. Furthermore, the particle will experience a relativistic effect because its rotational speed is close to the speed of light. The energy increase of e_0 will result in a new charge $Q_0 = e_0/(1-u_0^2/c^2)^{1/2}$ slightly larger than Q so that $Q_0 = Qc/u_0$. What happens is that charge Q increases its value to Q_0 as a result of two opposing factors: a decrease due to the magnetic field induced by rotation yielding the measurable charge and an increase due to the relativistic factor giving, for instance, the initial permittivity $\varepsilon_i = Q_0^2/4hc$ related to a rotating particle. This rotating particle is our initial electron as no precession of the spin angular momentum has been considered, as yet.

Such interaction would have the effect to marginally decrease the rotational speed just enough to give us the known electron charge.



Rotation of charge Q will set up a magnetic force which will subtract from the electric force leaving us a smaller charge e_0 which, in turn, is subjected to relativistic effects yielding charge Q_0 (eq. 5). Finally, if we consider the spin angular momentum we would have a decrease of all charge values until we have the known electron charge.



The equation linking α, h, G, c with the electron charge is plotted above. There are two solutions for the fine structure constant: α and $2\text{-}\alpha$. Both values would apply to the electron. Some experiments seem to confirm that there might be a second value for the fine structure constant close to 2.

When everything is taken into account we find the initial electron charge e_0 obtained directly from charge Q_0 and the initial fine structure constant α_0:

$$e_0 \;=\; Q_0/(2/\alpha_0)^{1/2} \;=\; Q/(2/\alpha_0\text{-}1)^{1/2} \qquad (5)$$

If all equations we have seen so far are put together we may formulate a new and interesting connection among basic constants:

$$\alpha_0^2 - 2\alpha_0 + (2\pi)^4 t_p/e_0^2 \;=\; 0 \qquad (6)$$

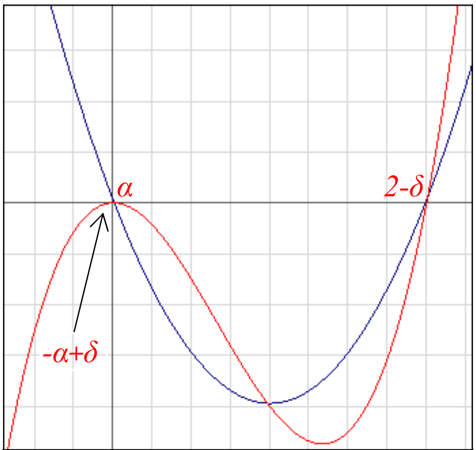
The introduction of an exact quantity for the electron charge e, in Codata 2018, [4] creates an additional problem if calculation precision is pushed high enough. Due to new relationships we find that the theoretic electron charge e_t must be larger by 1.5ppb.

The nice thing about eq. 6, which we will call the *electron equation*, is that it is still applicable if we substitute α instead of α_0 and the theoretic electron charge e_t instead of e_0. In this way we are able, for example, to calculate G from very accurate constants or we may get the fine structure constant directly from other fundamental constants; actually we get two values: one is the known value and the other, $2\text{-}\alpha$, might play a part in some exotic electron properties.

By substituting the theoretic electron charge with the equivalent classic expression showing it in terms of α, h, c and the theoretic permittivity ε_t, we are able to devise another equation that altogether removes the need to know the electron charge:

$$\alpha^3 - 2\alpha^2 + t_p w_u / 2\varepsilon_t h c \;=\; 0 \qquad (7)$$

We call this the *vacuum equation* as there is no direct reference to any physical object and will allow us to calculate the known fine structure directly from basic constants.
$(2\pi)^4$ which is part of both eq. 6 and 7 is quantity w_u already seen in the previous section.
The electron charge can be calculated in many ways, for example from the initial charge:



There are three solutions for the vacuum equation, red line. There is a negative solution hinting at the possibility of a speed faster than light. δ = 2.65x10^{-5}, see end section, is a quantity that simplifies calculations of the intercept points and relative fine structure values. The curve minimum divides the interval 0-2 in ⅔ and ⅓ and might reflect a certain vacuum asymmetry.

$$e_t = e_0((2-\alpha_0)\alpha_0/\alpha(2-\alpha))^{1/2} = (w_u t_p/\alpha(2-\alpha))^{1/2} \qquad (8)$$

If mass M is detected as charge Q where is then the gravitational mass?
Planck time t_p is the quantization factor that allows only a small portion of the force to be detected outside the black hole. In the time window given by t_p we would have a gravitational force but in our everyday experience we would be totally unaware of this quantization and the relevant time dimension will not appear in the force we measure. In practice we would have a gravitational force $GM^2 t_p$ but to our instruments it will simply look as a force GM_0^2:

$$GM_0^2 \;=\; GM^2 t_p \qquad (9)$$

This means that to $M_0 = Mt_p^{1/2}$ we must associate a sec$^{1/2}$ dimension wherever mass M_0 is involved.
If we apply the rotational factor as we did with the charge we get what we would call the initial electron mass m_b:

$$m_b \;=\; M_0(\alpha_0/2)^{1/2}(1-\alpha_0/2)^{3/8} \qquad (10)$$

Term $(1-\alpha_0/2)^{3/8}$ would represent the decrease of the 3 torus radii due to rotation at relativistic speed. The result is 0.25% close to the known electron mass. If we take into account the spin angular momentum precession, thus changing α_0 to α, and a correcting factor related to the radii variation of the ring and ring section, thus increasing each radius by the term $(\alpha/\alpha_0)^4$, we have our electron mass m_e:

$$m_e \;=\; M_0(\alpha/2)^{1/2}(\alpha/\alpha_0)^{12}((1-\alpha/2)(2-\alpha)/(2-\alpha_0))^{3/8} \qquad (11)$$

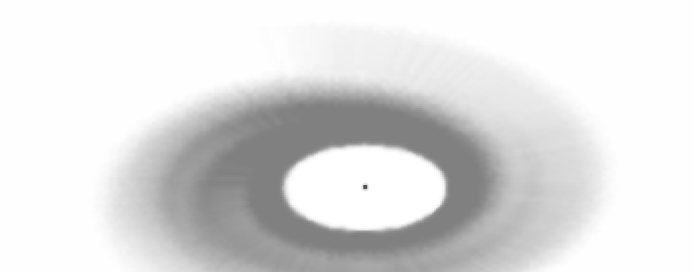
There is also an additional term $(u_e/u_0)^{3/4} = ((2-\alpha)/(2-\alpha_0))^{3/8}$ which would describe the speed variation from the initial speed u_0 to the final, and lower, speed u_e also applicable to the three radii. The conclusion is now obvious: Planck mass M is part of every electron, it is the electron itself and surely we have plenty of them around. But there is another particle, the neutrino, which seems to have the same origin with the difference that the rotational speed is very close to the speed of light c.

Neutrino and mass decrease

The detailed equation leading to the initial electron charge is based on the electromagnetic force acting on the Planck particle when it is spinning:

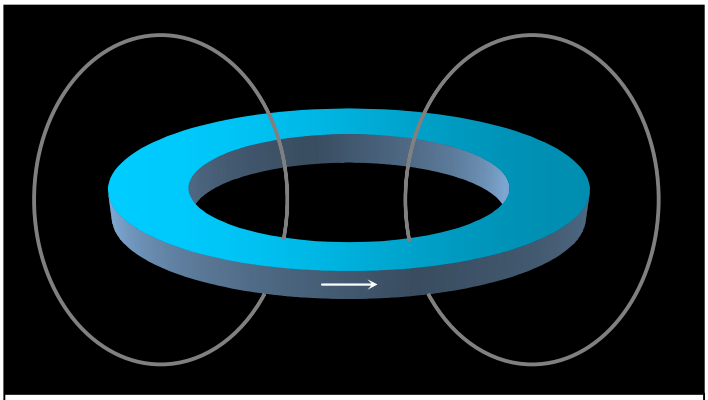
$$Q_0^2 - Q_0^2 u_0^2/c^2 = e_0^2 \tag{12}$$

The term on the left includes the electric force of charge Q_0 and the magnetic force generated by the same charge when rotating at speed u_0 and working against the electric force. From the above equation we see that if we speed up the particle to c the left side goes to zero and so does the fine structure constant. We are left with no charge and no mass. The faster we spin the particle, the lower will be its measurable charge and mass and if rotation takes place at exactly speed c, we have a particle that could be safely identified with the neutrino. A mass, however small, will be shown by the neutrino if the speed is not exactly c. We might even have a sort of speed oscillation leading to the observed mass oscillation. A rotation at speed faster than c cannot be ignored if it takes place in another dimension as reported in the addendum.



How would you envisage something with no mass, no charge, of unknown size, yet, it is spinning? A gray whirl is the best our imagination can figure out for the neutrino.

The interesting question is whether we can apply this same mass decrease to our physical world: first of all it would apply to charged objects and the mass decrease would be given by the factor $(1-u^2/c^2)^{1/2}$ where u is the rotational speed; this works out to be exactly the opposite of the mass increase when the relativistic factor is applied. The problem is that the object will fly apart due to the centrifugal force before we are able to detect any small change. A possible solution is to endow it with a strong magnetic field from a superconductive ring opposing the electric force as suggested by eq. 12. Under



The magnetic field of a fast rotating superconductive ring would bring about a tiny weight decrease of the ring itself. The technical problems connected with such a delicate measurement could prove quite difficult to overcome and experiments conducted in the past have given conflicting results.

these circumstances we might be able to measure what would amount to a weight decrease of the fast rotating ring without the need to rotate it at prohibitively high speed.
Early experiments conducted by Podkletnov in Finland in 1992 were based on the detection of an allegedly gravitational shield. But from the above it does not appear that there is such a “shielding” effect but just a weight decrease of the material under test.

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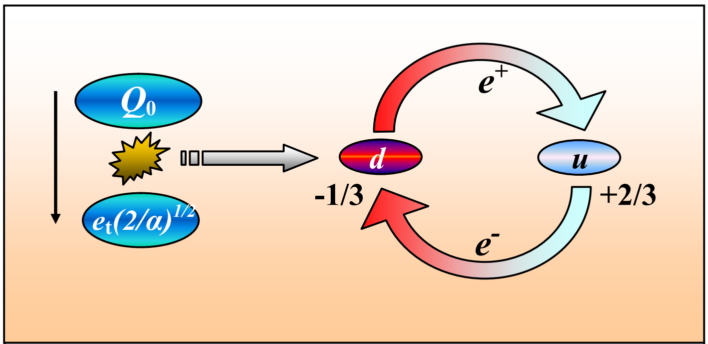
Quark charge

When calculating the electron charge we found that its measurable charge could be the result of the precession of the spin angular momentum: this would bring about a slowdown of the rotational speed, an increase of the fine structure and permittivity and a decrease of all charge values involved such as Q, Q_0 and e_0. Specifically, charge Q_0 changes to a lower value given by $e_t(2/\alpha)^{1/2}$. Where did the excess charge go?
We suggest the hypothesis that this charge difference is the one originating the d-quark charge d_q calculated as follows:



Because of the interaction with virtual particles, charge Q_0 would decrease its value and the difference is the d-quark charge. It was not possible to get the u-quark charge directly and it is inferred that the +⅔ charge is the result of further interaction with virtual particles.

$$d_q = (Q_0^2 - 2e_t^2/\alpha)^{1/2} \qquad (13)$$

We normally assign the d-quark charge ⅓ the electron charge. In our case, charge d_q is not exactly ⅓ but shows a difference of 669ppm. There might be secondary effects, such as a small variation of the rotational speed not taken into account or, more likely, eq. 13 is an approximation of a more complex equation. In addition, it was not possible to find the u-quark charge, normally given at ⅔ the electron charge, so it is inferred that the u-quark charge is somehow the result of interaction of the d-quark with virtual particles as shown in the above drawing. This quark charge asymmetry might be reflected by the vacuum equation where there is a ⅔ and ⅓ asymmetry in the plotted curve.
Quarks are associated with the strong force and the relevant fine structure constant is no longer α but should be close to 1. We have related the rotational speed to the fine structure constant and if we execute a new calculation following a similar procedure to the one used for the initial electron mass m_b, but with the fine structure constant equal to 1, we find that the resulting particle rotates at a lower speed $u_q = c/2^{1/2}$ and has a mass of 4.6 MeV or 9 times the electron mass. This value is within current estimate for the d-quark mass which is between 4.5 and 5.15 MeV.

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Conclusion

The Planck mass is actually an all-pervasive particle. It would be the one originating the mass and charge of the electron, the neutrino and, indirectly, the quark. It is so much bigger than any known particle that it was necessary to invoke the strong gravity to justify its existence, yet, it was there with us all the time: its behavior in our world is like a charge not a mass.

The table below shows the main numerical results for the most important equations.

Basic data		
$c = 299792458$ $\quad h = 6.62607015\text{x}10^{-34}$ $\quad G = 6.6729196876\text{x}10^{-11}$		
Planck parameters and initial electron		
Planck time t_p	$(\pi h G/c^5)^{1/2}$	$2.39502\text{x}10^{-43}$
Planck mass M	$h/t_p c^2$	$3.0782613\text{x}10^{-8}$
Planck permittivity ε_p	$(t_p/4\pi^2)^{1/4}$	$8.82546\text{x}10^{-12}$
Planck charge Q	$M(4\pi\varepsilon_p G)^{1/2}$	$2.6481162\text{x}10^{-18}$
Toroid unitary charge squared/unitary time w_u	$16\pi^4 Q_u^2/t_u$	1558.5454565
Initial fine structure α_0	$2\pi(\pi/c)^{3/2}(2G/h)^{1/4}(c/\pi hG)^{1/16}$	$7.295873082\text{x}10^{-3}$
initial charge e_0	$Q/(2/\alpha_0 - 1)^{1/2}$	$1.60233848\text{x}10^{-19}$
Electron and d-quark (Codata 2018 electron charge $e = 1.602176634\text{x}10^{-19}$)		
Theoretic charge e_t	$e_0((2-\alpha_0)\alpha_0/\alpha(2-\alpha))^{1/2}$	$1.6021766364\text{x}10^{-19}$
Theoretic permittivity ε_t Permittivity ε_0	$\varepsilon_p/(\alpha/\alpha_0)^2(1-\alpha/2)$ $\varepsilon_t(e/e_t)^2$	$8.8541878394\text{x}10^{-12}$ $8.8541878128\text{x}10^{-12}$
Vacuum equation fine struct. constants	Solve: $\alpha^3 - 2\alpha^2 + w_u t_p/2\varepsilon_t hc = 0$	$7.29735256929\text{x}10^{-3}$ 1.999973470767 $-7.2708233367\text{x}10^{-3}$
Electron equation fine struct. constants	Solve: $\alpha^2 - 2\alpha + w_u t_p/e_t^2 = 0$	$7.29735256929\text{x}10^{-3}$ 1.99270264743
Mass m_e	$M(t_p\alpha/2)^{1/2}(\alpha/\alpha_0)^{12}((1-\alpha/2)(2-\alpha)/(2-\alpha_0))^{3/8}$	$9.1093837015\text{x}10^{-31}$
Fine structure of intrinsic magnetic moment α_m	$\alpha/1.000089187709953$	$7.2967017932\text{x}10^{-3}$
Magnetic moment anomaly a_e	$(\alpha/\alpha_m)^{13}((2-\alpha)/(2-\alpha_m))^{5/4} - 1$	0.00115965218128
D-quark charge d_q	$(2e_0^2/\alpha_0 - 2e_t^2/\alpha)^{1/2}$	$5.337018\text{x}10^{-20}$

All numbers are within one standard deviation (Codata 2018), with the exception of G at a conspicuous 9 standard deviations and the d-quark charge, 0.067% smaller than expected.

Despite the basic and somewhat elementary model used, we have seen that no other constant is required except c, h and G in order to have our particle; this means that the Planck quantities are indeed all we need to build our world.

In some cases we have experienced an apparent change of dimension. We have seen that mass quantization is a fundamental process which introduces a time dimension in many equations, for example, time t_p is part of the electron gravitational force and also the ratio of the gravitational to the electric force in an electron, expected to be a dimensionless number, is in fact a quantized ratio where the additional time dimension is again time t_p.

Some equations in the above table may seem dimensionally unmatched at first, but we must not forget that quantity $(2\pi)^4$ is actually w_u, thus providing the required balancing factor and the possibility to link hitherto unrelated constants.

Fine structure	negative	standard	strong
Electron	no	α	$2 - \alpha$
Vacuum	$-\alpha + \delta$	α	$2 - \delta$
Magnetic	no	α_m	$2 - \alpha_m$
Spin speed	$u > c$	$u < c$	$u << c$

All fine structure constants are summarized in the table on the left.
Quantity $\delta = 2.653\text{x}10^{-5}$ was introduced in order to simplify calculations and it is obtained directly from α:

$$\delta = 1+\alpha/2-(1+\alpha-(3/4)\alpha^2)^{1/2} \tag{14}$$

The negative fine structure constant α_n can be written entirely in terms of α:

$$\alpha_n = -\alpha+\delta = 1-\alpha/2-(1+\alpha-(3/4)\alpha^2)^{1/2} = -7.27082\text{x}10^{-3} \tag{15}$$

$\alpha_m=\alpha/1.000089187709953$ is the value of the "magnetic" fine structure constant of the intrinsic magnetic moment [3]. α_m will give us the magnetic moment anomaly $a_e= (\alpha/\alpha_m)^{13}((2-\alpha)/(2-\alpha_m))^{5/4}-1$.
Another puzzling aspect is the possibility of a speed faster than light; eq. 7 gives also a negative fine structure α_n and from eq. 3 we get a speed 0.18% faster than c (see addendum). A speed faster than light seems to be merely a peculiarity of vacuum and would not apply to any real mass; yet, the presence of a negative fine structure and the intrinsic peculiarity of the vacuum equation seems to indicate a rather complex underlying structure populated by weird imaginary particles, where the property of the Dirac sea of virtual particles could be just an approximation.

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Related documents

1) D. Di Mario, (2003), *Planck permittivity and electron force,* http://digilander.iol.it/bubblegate/planckpermittivity.pdf
2) C. Spaniol, and J.F. Sutton, (1992), *Classical electron mass and fields*, Part II, Physics Essay, vol. 5(3), p. 429-430
3) D. Di Mario, (2003), *Magnetic anomaly in black hole electrons,* http://digilander.iol.it/bubblegate/magneticanomaly.pdf
4) Peter J Mohr, David B Newell, Barry N Taylor and Eite Tiesinga, 2018, *Data and analysis for the CODATA 2017 adjustment...* https://www.researchgate.net/publication/320995786_Data_and_analysis_for_the_CODATA_2017_Special_Fundamental_Constants_Adjustment

Other documents

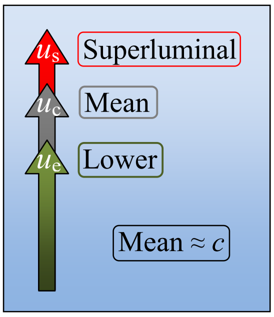
1) W.S. Oakley, (1995), *Gravity and quarks*, Speculations in Science and Technology, vol. 18, issue 1, p. 44-50. Chapman & Hall, London.
2) C. Sivaram, and K.P. Sinha, (1979), *Strong spin-two interaction and general relativity*, Physics Reports, vol. 51, p. 113-183
3) C. Sivaram, and K. P. Sinha, (1977), *Strong gravity, black holes, and hadrons*, Physics Review D, vol. 16 (6), p. 1975-1978
4) L. Motz, (1972), *Gauge Invariance and the quantization of mass*, Il Nuovo Cimento, vol. 12B (2), p. 239-255

Addendum

Superluminal and imaginary particles

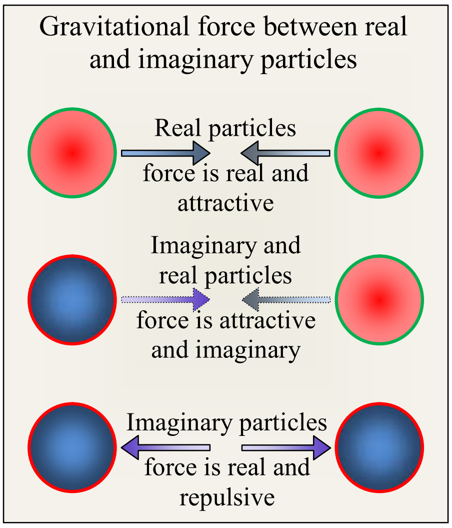
The negative fine structure constant α_n does not make sense in our real world and the only place where it might fit is a 4 dimension spacetime where we would have both a superluminal speed u_s and an electron with imaginary charge $\tilde{e}$ and imaginary mass m_s.

We get speed $u_s = c(1-\alpha_n/2)^{1/2}$ from eq. 3 where α_n is given by eq. 15. We will not experience speed u_s but only the mean speed between u_s and the lower speed $u_e = c(1-\alpha/2)^{1/2}$. As we are dealing with a 4 dimension spacetime, we have a mean speed $u_c = (u_s^4/2 + u_e^4/2)^{1/4} = 299792457.9934$ m sec^{-1}.



This is a perplexing result. It was expected the mean speed u_c to coincide perfectly with the speed of light c but there is a residual difference of 22 parts per trillion. It appears that this small difference is not due to calculation errors or small deviations of initial data and the divergence remains unexplained.

We get the imaginary charge $\tilde{e} = (w_u\, t_p / \alpha_n (2-\delta))^{1/2}$, eq. 8 and 14, resulting in an absolute value for $\tilde{e}$ which is the same as the electron charge e. For the imaginary electron mass m_s we substitute α with the negative fine structure α_n in eq. 11. The absolute value for m_s is lower than the real electron mass by 4%. This particle rotates at superluminal speed, yet, it does not mean that it travels at superluminal speed. We could get a speed $c_s = \tilde{e}^2 / 2\varepsilon_0 h\, \alpha_n (e_t/e)^2$ which is 0.36% higher than the speed of light and would be the actual photonic speed in this imaginary world and the relation with the rotational speed u_s is the same as in the real electron: $c_s/u_s = c/u_e$.



The imaginary particle will not be able to interact with matter in our universe except for fleeting moments when it hits a real particle and could be identified as the selectron and a constituent of dark matter.

In the table on the left we see the gravitational interaction between real and imaginary particles.

In the first case we are dealing with matter in our universe where gravitational forces are real and attractive. In the second case we still have an attractive force but it is imaginary and as such we will not experience it. In the last case we have interaction between two imaginary particles; they will experience a real force but it is repulsive.

The major difference with our world is that it is based on magnetism rather than electricity. There is a magnetic charge q_m, most likely a monopole, with the same energy as charge $\tilde{e}$ leading to $q_m = c\tilde{e} = 4.8\text{x}10^{-11} i$ A m. These imaginary particles will show an electric dipole generated by the magnetic monopole charge q_m and the universe they belong to is almost a specular and symmetric copy of our universe, based on new physics where the superluminal speed is a fundamental parameter. This imaginary universe is all around us and its particles will never coalesce to form galaxies, stars and planets and, in general, will not interact with us.