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Magnetic Anomaly in Black Hole Electrons

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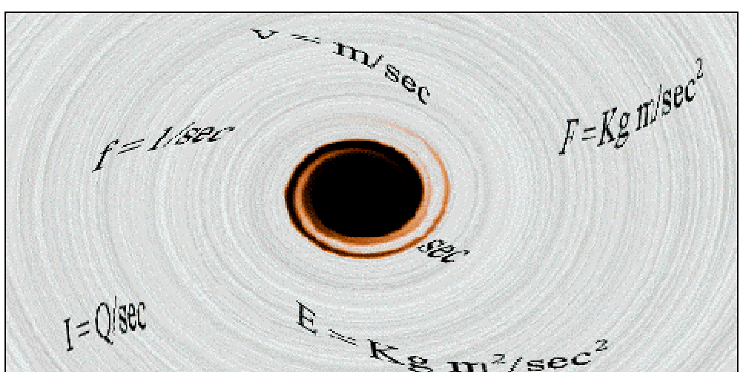
Abstract: A model for a "black hole electron" can be developed starting from three basic constants, namely: h, c, and G. The result is a comprehensive description of the electron with its own associated mass and charge. The precise determination of the rotational speed of such a particle yields accurate numbers, within a known uncertainty, of all quantities, including one of the most critical characteristics of the electron: its magnetic moment and its magnetic moment anomaly.
Keywords: magnetic anomaly, magnetic moment, black hole, electron, gravitational constant.

Introduction

When we approach a black hole strange things start to happen of which time dilation is one of them. What takes place if we go further on, beyond the event horizon, is anybody's guess: our present knowledge does not go that far and we are left only with a number of educated suppositions. One of them is that time does not exist within a black hole, rather it seems to disappear in it. Conversely why not think that a time dimension will appear for something coming out from a black hole? Of course, here we mean a force field rather than a material object. The result might be a change of dimensions for some of the quantities because we will use only the three basic dimensions of mass, length, and time without introducing the dimension of charge, yet the resulting numbers are the ones we are accustomed to see. This approach will allow us to link the Planck world with our real world as outlined in a previous paper [1].



In a black hole time loses its meaning and know quantities might show strange dimensions: time itself might become a dimensionless number in a black hole and vice versa. By working our way out from the black hole we discover that the particle is the electron.

This is evident when we calculate a quantity never considered before, the Planck permittivity ε_p, but first let us define the other Planck quantities i.e., Planck time $t_p = (\pi hG/c^5)^{1/2}$, Planck mass M $= h/t_p c^2$, and Planck length $l_p = (hG/\pi c^3)^{1/2}$. The resulting numbers differ by $2^{1/2}$ or $\pi 2^{1/2}$ from known numbers but it should be acceptable as a hypothesis. We are now able to define Planck permittivity:

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

The unusual dimension of Planck permittivity allows us to build a basic particle, the electron by using, as already mentioned, only the fundamental dimensions of mass, length, and time. The calculation of the Planck charge Q is now relatively easy and it is defined as the charge having the same energy as the Planck mass M:

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

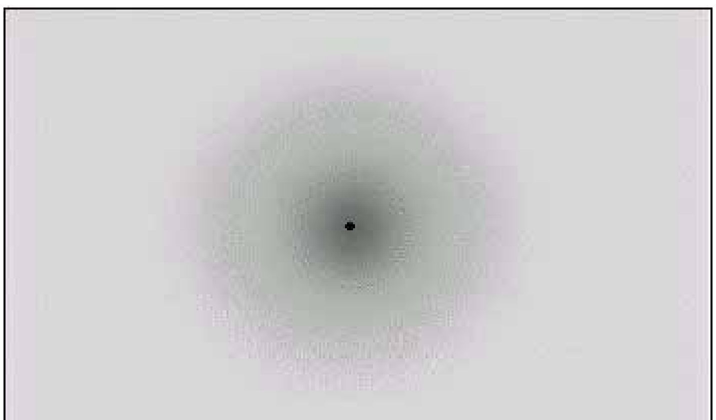
It is time now to check whether this particle with mass M, charge Q, and permittivity ε_p is indeed equivalent to a black hole.

Planck Black hole

The discriminant in the Kerr-Newman equation [2] will tell us whether our particle is a black hole or not. If we do all necessary calculations we find that such a particle satisfies the condition imposed by the discriminant for a static as well as a rotating black hole. Under the present circumstances, we cannot, as yet, identify this particle with the electron but let us see first how this black hole is measured in our real world.

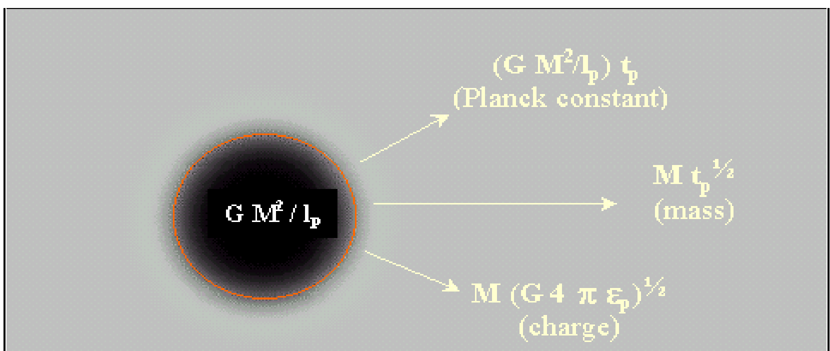
The energy of Planck's black hole is given by GM^2/l_p, but the constrain of time t_p outside the black hole will give us something different, the Planck constant in fact:

$$h = (G M^2 / l_p) t_p \quad .$$



The Planck black hole could be rendered by a tiny dot surrounded by a spherical energy field. In this basic model there is a charge but no rotation. Its characteristics make it a successful candidate for a Kerr-Newman black hole.

Although this may seem obvious because the Planck constant was used initially to calculate the other Planck quantities, it is the concept behind it that should be considered as we will never be able to measure the black hole energy because Planck time imposes a severe constraint on what we really measure and experience from our reference frame outside of the black hole. But there is more to it: if we rewrite the above equation in a different way we get $h = G(Mt_p^{½})^2/l_p$. This simple rearrangement of terms shows that there might be a quantity $M_0 = M\, t_p^{½}$ which would be the measurable gravitational mass of the Planck mass, in other words and despite all our efforts, we will only experience and measure mass M_0 and not mass M and thus in the same time, we would be totally unaware of the effect of time t_p. Now it should come as no surprise that if we use M_0 in the Kerr-Newman discriminant we will not get a black hole since we are still talking about the very same particle but its mass will be quite different when seen from our point of view. The idea of a black hole electron is not new, other researchers have thought about it in the past [3,4] while others were quick to point out that it does not satisfy the Kerr-Newman condition. We have seen that it is a black hole after all, although what we measure is something different from what we expect. Yet, the effect of mass M is still present and its effect on our real world is not gravitational but electric because we would experience it as an electric force, and as such we say it originates from charge Q but it is really the effect of mass M.



Just as we lose the time dimension in a black hole, we gain it when we go out of it. The Planck time is present in the energy of the black hole thus originating the Planck constant, in the same way we have a mass and a charge. They will be both identified with the mass and charge of the electron once rotation is taken in account.

The numbers for charge Q and mass M_0 are an order of magnitude larger compared to the known charge and mass of the electron, while permittivity ε_p is a fraction of a percent off, they will agree once rotation is again taken in account.

Spinning Black Hole

The most suitable physical model that best fits a rotating black hole is the ring model [5]. Although there is no direct evidence, there is more than one reason to believe that some sort of toroidal force field is present around the tiny black hole. Fortunately we do not have to know its radius or other data concerning its physical size since the equations in use will eliminate any reference to it and its real size, in this context, is still undetermined.

A rotating charge will set up a magnetic field opposing its own rotation until a stability point is reached. The rotational speed u_0, meant as the speed of a point on the surface of the ring, is a fundamental parameter and as a hypothesis, we establish a relativistic connection with the initial fine structure constant α_0 as follows:

$$\alpha_0 = 2 (1 - u_0^2 / c^2) \quad .$$

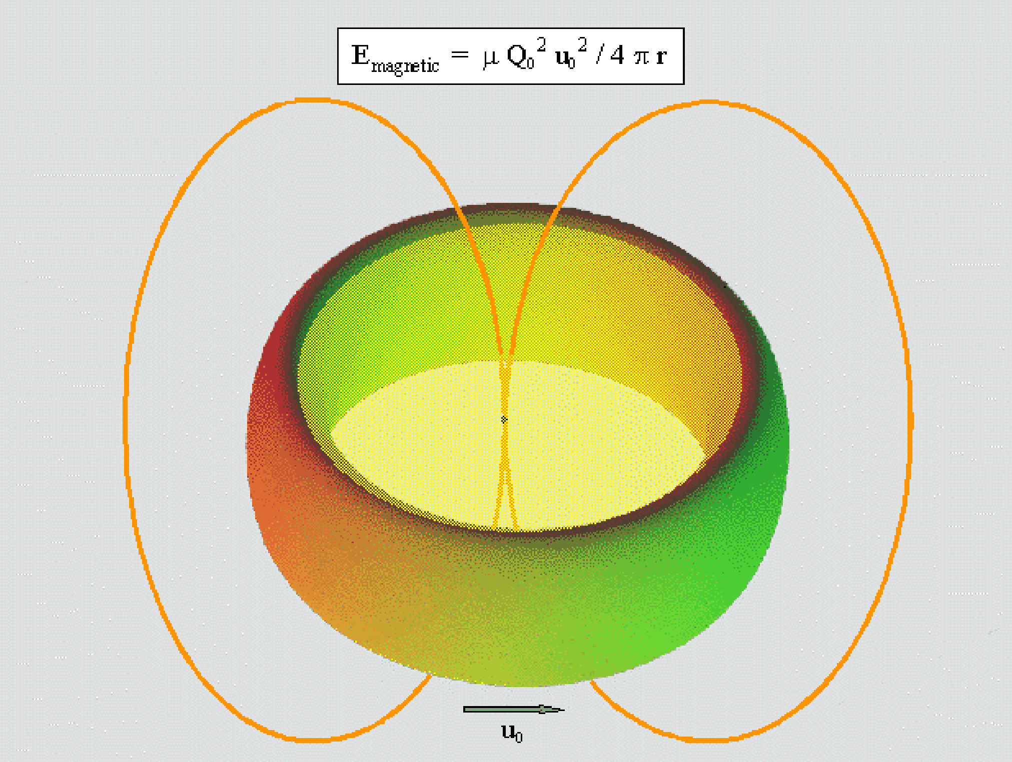
α_0 is defined, in turn as the ratio $(W_u/W_p)^{1/2}$, where W_u is the energy of the unitary charge in the unitary time applicable to a toroidal particle ($16\pi^4 Q_u^2/t_u$), and W_p is the energy (Q^2/t_p) of charge Q within time t_p. After elaboration of the relevant equations we have:

$$\alpha_0 = (4 \pi^5 / c^3)^{1/2} (2 G / h)^{1/4} (c / \pi h G)^{1/16} \quad .$$

The quantity $4\pi^4$ is $W_u/4$ thus dimensionally balancing the equation. With the knowledge of speed u_0 we are able to go deeper into the details of the ring model. Its rotation at relativistic speed will slightly increase the energy associated with charge Q. At this energy level corresponds a charge $Q_0 = Q\, c/u_0$ which will originate the initial electron charge $e_0 = Q_0 (\alpha_0 /2)^{½}$ also written as:

$$e_0 = Q / (2 / \alpha_0 - 1)^{1/2} \quad .$$

Q_0 will generate, in turn, a permittivity equal to $Q_0^2/4hc$ applicable to a rotating particle.



$E_{electric} = Q_0^2 / 4 \pi \varepsilon r$ | $E_{electric} - E_{magnetic} = E_{electron}$ | $Q_0^2 - Q_0^2 u_0^2/c^2 = e_0^2$

The energy of the electron is the electric energy of a given charge Q_0 less the magnetic energy given by the same charge. The difficulty related to the correct knowledge of the size and shape of the particle is removed if we wish to calculate only the charges involved and not the energy. In this case any reference to the size is eliminated and we need not worry about the radius of the particle.

After elaboration of existing equations we may write an interesting equation for the gravitational constant G given in terms of quantum constants only:

$$G = \alpha_0^2 (2 - \alpha_0)^2 (e_0 / 4 \pi^2)^4 c^5 / \pi h$$

The equation is dimensionally balanced because the quantity $4\pi^2$ is actually $W_u^{½}$. In addition, the quantity $\alpha_0(2-\alpha_0)e_0^2$ is itself a constant, in other words it will not change if we change the rotational speed with the result being that the equation is still valid if we write it in terms of known constants obtained by a small variation of speed u_0; the result is always the same and yields a very accurate constant of gravitation. Conversely, if we extract α_0, we find two values: α_0 and a second value equal to $2-\alpha_0$ which is 273 times bigger than α_0.
As far as the electron mass is concerned, if we take in account the relativistic rotation of M_0 we have the initial electron mass m_b in the same way as we had e_0 from Q_0:

$$m_b = M_0 (1 - u_0^2 / c^2)^{1/2} = M_0 (\alpha_0 / 2)^{1/2} .$$

The same equation can be transformed and written also in terms of the electron charge:

$$m_b = (8 h^3 / \pi e_0^4) (\alpha_0 / 2)^{1/2} / (2 / \alpha_0 - 1)^2 .$$

It was with some disappointment that after all the calculations were carried out, it was found that the electron parameters did not quite match with known ones. The systematic difference, see table below, was puzzling at first, but then it was realized that what we have been describing so far did fit with the notion of a bare electron and another adjustment is therefore necessary to get the right data.

ppm difference of bare electron parameters					
Mass	*Charge*	*Fine structure*	*Permittivity*	*Magnetic moment*	*Magnetic anomaly +1*
- 1164	+ 101	- 203	+ 405	+ 105	+ 105

The Electron Slowdown

A complete agreement with known values was achieved by changing the rotational speed u_0. There is indeed a lower speed u_e that yields all expected data. The hypothesis is that the interaction of the bare electron with the virtual particles present in the vacuum has the effect of lowering its rotational speed. After elaboration of the equation giving G we have a cubic equation yielding the known value for α and hence speed u_e in terms of c, h and G only. There is also a more intuitive solution where speed u_0 is decreased until $\varepsilon_0 = 1/4x10^{-7}\pi c^2$; this is an exact relationship and once such a condition is met, we will have also all other quantities although for the mass we need to define an additional term C which will be called a contributor.

So far we have not considered the radius or the area of the particle and still do not need it but we have to take into consideration its variation due to a change of the rotational speed. The variation of the radius of M_0 is directly related to the fourth power of the variation of the fine structure constant and eventually we have our contributor C_e relevant to the electron mass:

$$C_e = (1 - \alpha/2)^{3/8} \alpha^8 / \alpha_0^8 .$$

It is also necessary to devise another contributor C_a that will lead eventually to the anomalous mass m_a required for the calculation of the magnetic moment. In this case we are not interested in the radius variation but rather in the variation of the speed itself represented by the variation of the second fine structure constant:

$$C_a \;=\; (1 - \alpha / 2)^{1/4} \, (2 - \alpha_0)^8 / (2 - \alpha)^8 \quad .$$

The term $(1-\alpha/2)^x$ on both contributors is probably related to the field momentum of the electron [6] but its full significance within the contributors is not clear. We are now in a position to write down the complete equations for the electron mass m_e and for the electron anomalous mass m_a:

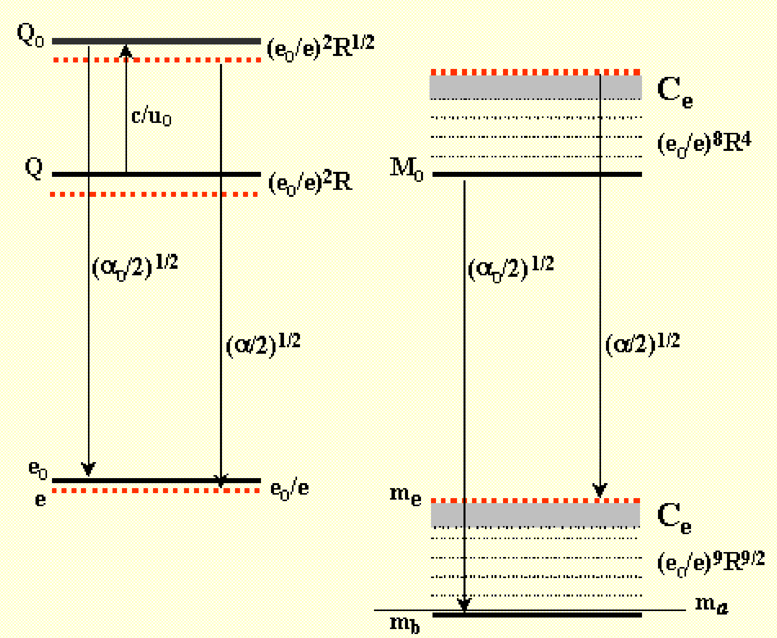
$$m_e \;=\; C_e \, (8\, h^3 / \pi\, e^4) \, (\alpha / 2)^{1/2} / (2 / \alpha - 1)^2$$

and

$$m_a \;=\; C_a \, (8\, h^3 / \pi\, e^4) \, (\alpha / 2)^{1/2} / (2 / \alpha - 1)^2 \, .$$

Magnetic Anomaly

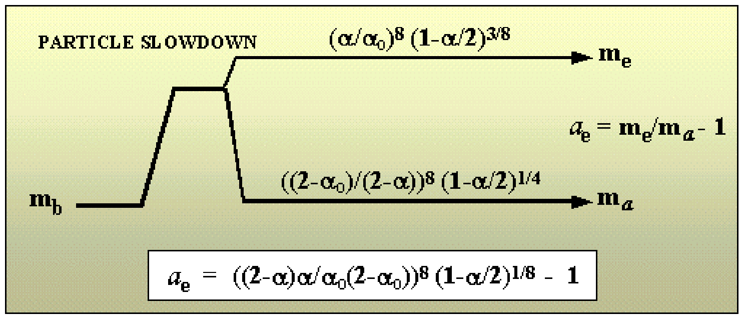
The magnetic moment is closely related to the electron magnetic anomaly, if you find one, you find the other. Quantum Electrodynamics (QED) offers an equation [7] with a number of terms leading eventually to the theoretical value of the magnetic anomaly. These terms involve complex calculations and it is remarkable that in the end there is a result that is almost a perfect match with the experimental value. Why not devise a single term that would bypass all those abstruse terms?



A very detailed picture is necessary to account for the magnetic moment. Every variation due to the change of velocity takes place in discrete steps where the steps are the ratio e_0/e and R. The magnetic moment is intimately connected with these steps and its accurate calculation is possible once e_0/e and R are taken in due account.

Contributor C_e (gray area) is also shown. The electron anomalous mass m_a is very close to the basic mass m_b .

In this theory the starting point is a black hole, leading to a bare electron with a very accurate mass and charge, we can know the initial and final value of the fine structure constant, the initial and final value of the electron charge, and so on. Any slight variation of the rotational speed brings about a variation of every parameter but they are always in a very well defined relationship. The diagram above shows how the mass variation is related to charge variation. The black line represents the initial value relevant to a bare particle while the red dotted line refers to the final value after the slowdown. A term R was introduced in order to simplify notation with R being the variation of the rotational speed compared to the initial speed u_0 and it is expressed as $R = (u_0/u_e)^2 = (2-\alpha_0)/(2-\alpha)$. As $\alpha/\alpha_0 = R(e_0/e)^2$ there is also a direct relationship with the electron charge variation.



The magnetic moment is calculated using, at first, the bare electron basic mass m_b. This gives a reasonable value, but the actual picture is slightly more complex with the mass of the bare particle branching to an upper value that originates the electron mass by means of contributor C_e already calculated and to an anomalous mass m_a as given by the other contributor C_a. This is clearly shown in the diagram above. Eventually we have the following two equations, one for the magnetic moment μ_e and another giving the electron magnetic moment anomaly a_e as ratio between m_e and m_a or, in an even simpler form, by considering the electron charge variation:

$$\mu_e = e\,h / 4\,\pi\; m_a$$

$$a_e = ((2 - \alpha)\,\alpha / \alpha_0\,(2 - \alpha_0))^8\,(1 - \alpha / 2)^{1/8} - 1 = (e_0 / e)^{16}\,(1 - \alpha / 2)^{1/8} - 1$$

The numbers for the magnetic moment and its anomaly are within know uncertainty but it must be said that a_e is very sensitive to the fine structure constant, both the initial and final one. This means that both of them must be given with the highest degree of accuracy. The initial value α_0 is obtained from h, c and G, with the latter being calculated with the equation given for this constant in order to have a very restricted range of values. The equation giving a_e is now a more manageable solution than the one suggested by QED.

Conclusion

A rotating Planck particle is able to explain the main electron features. All quantities can be calculated with extreme accuracy and although the right numbers do not mean that the theory behind it is correct (Sir Arthur Eddington knew something about this back in 1919), it is remarkable that there is no need to introduce any other constants but h, c, and G in order to have a reasonable description of the electron.

A summary table is shown below together with the main equations and the resulting numbers. The constant of gravitation was first calculated with known constants and then a refined value was used as part of the initial data, hence the difference between the value given by the equation and the one adopted. The Rydberg constant has been added and used as a check value because it is one of the most accurate constants known.

Initial data		
$c = 299792458$ $h = 6.6260683731 \times 10^{-34}$ $G = 6.6729177325 \times 10^{-11}$		
Basic quantities		
Constant of gravitation G	$\alpha^2 (2 - \alpha)^2 (e / 4 \pi^2)^4 c^5 / \pi h$	$6.6729181 \times 10^{-11}$
Initial fine structure const. α_0	$(4 \pi^5 / c^3)^{1/2} (2 G / h)^{1/4} (c / \pi h G)^{1/16}$	$7.2958732928 \times 10^{-3}$
Anomalous electron mass m_a	$(8h^3/\pi e^4)(\alpha/2)^{1/2}(1-\alpha/2)^{1/4}(2-\alpha_0)^8/(2-\alpha)^8(2/\alpha-1)^2$	$9.09882987 \times 10^{-31}$
Electron parameters		
Fine structure constant α	solve: $\alpha^3 - 2 \alpha^2 + (2 \pi)^5 (\pi G / c^3 h)^{1/2} 10^{-7} = 0$	$7.2973525329 \times 10^{-3}$
Mass m_e	$(8h^3/\pi e^4) (\alpha/2)^{1/2} (1-\alpha/2)^{3/8} \alpha^8 / \alpha_0^8 (2/\alpha-1)^2$	$9.10938135 \times 10^{-31}$
Charge e	$Q / (2 / \alpha - 1)^{1/2} (\alpha / \alpha_0)$	$1.602176416 \times 10^{-19}$
Magnetic moment μ_e	$e h / 4 \pi m_a$	$9.28476335 \times 10^{-24}$
Magnetic moment anomaly a_e	$((2 - \alpha) \alpha / \alpha_0 (2 - \alpha_0))^8 (1 - \alpha/2)^{1/8} - 1$	0.0011596521872
Other		
Initial rotational speed u_0	$c (1 - \alpha_0 / 2)^{1/2}$	299245146.458
Final rotational speed u_e	u_0 decreased until $\varepsilon_0 = 1 / 4 \times 10^{-7} \pi c^2$	299245035.389
Precise speed difference Δu	$u_0 - u_e$	111.0690483
Rydberg constant R_∞	$\alpha^2 m_e c / 2 h$	10973731.568570

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