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The Physics of Creation

Given two electric charges we find that their total electric energy relates their masses by a quadratic equation. By examining alternative solutions of such equations it is found possible to account for particle creation in terms of lower mass forms. The creation of the electron is not explained in this way, but the processes described appear relevant to the generation of elementary particles, particularly the muon, the proton and the pion. Also, we find an evaluation of the mass of the gravition, which then allows us to derive the value of the constant of gravitation G.

The Quadratic Mass Equation

The existence of the electron is intimately associated with the structure of the vacuum, as we shall see in Appendix I. Given the electron and the equally-fundamental q charge already introduced, we can readily explain the development of elementary particles and, in particular, the production of muons, protons and pions. A full analysis is deferred to Appendix III. However, we will, in this chapter, explain the basic principles of particle creation and evaluate the mass of the graviton. It will be found that the muon mass emerges incidentally as we study the graviton creation process. Thus, it suffices for the purpose of this chapter to accept the existence of electrons and protons, but in addition to recognize that the ease with which a proton can be created sets a threshold on admissible normal energy quanta. We will see that the proton can act as a catalyst in the production of other particles and that the proton threshold determines the most massive particle likely to develop in a very energetic environment, the graviton.

There is a classical relationship between the mass, charge and size of a spherical electric particle. Although modern physics pays little attention to past views on the physical form of the electron, it would be unwise and hardly enterprising to reject the classical relationship in our quest to develop an understanding of particle creation. Accordingly, we echo a statement made in 1904 by Whetman at page 285 of his book *The Recent Development of Physical Science*:

> The mass of the electron being electrical in its nature, we may calculate the size of the individual electrons or corpuscles from the expression $2e^2/3a$ for the electrical mass.

Here a is the radius of the charge and e is its charge in electromagnetic units. Therefore, in electrostatic units we may regard the expression as a measure of mass energy. We will use the electromagnetic unit in the next equation so as to relate mass and energy without reference to the parameter c.

We know that opposite charges attract and it is natural to ask what happens if two charges $+e$ and $-e$ form the system shown in Fig. 6. There is a negative interaction energy as well

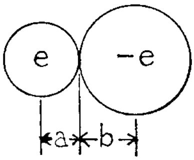

Fig. 6

as the self-energy of the two charges. The total mass M is thus:

$$M = \frac{2e^2}{3a} + \frac{2e^2}{3b} - \frac{e^2}{a+b} \tag{38}$$

but, taking individual masses as m_1 and m_2, this is best written as:

$$M = m_1 + m_2 - \frac{3m_1 m_2}{2(m_1 + m_2)} \tag{39}$$

Our laws of physics say that energy is conserved. This does not preclude energy exchange. For this simple particle system M is constant but m_1 and m_2 may vary. Therefore we can easily see how particles of any mass value up to M can be created, since collision by the above system and some other particle can occur at any moment to drive the two charges apart. Clearly, there is some kind of quasi-stability of the separated parts since energy has to be conserved by them individually after such separation. The problem we face is not how particles of different masses are created but why particles conforming to certain families, such as the pion family, are created. Electrons, protons, muons, etc., are all members of their own separate species.

The answer to this comes from a study of stability, a subject reserved for Appendix III. Meanwhile the reader is asked to accept that the lifetime of a particular energy state is greater when in the vicinity of particles in the same state. It follows that the particles we will see most are those which have masses determined by transformations likely to recur.

The Muon and the Graviton

If two charges such as those in Fig. 6 were driven well apart by drawing energy from an external source they might come together again to add their masses as a new total mass for the system. There are then numerous ways in which they can share their energies. One probable state is that for which most of the energy is contained in one of the charges, inasmuch as the other is possibly unstable. Thus we may have m_1 nearly equal to M and m_2 quite negligible. However, (39) has two solutions since it is quadratic. Thus, whilst m_1 remains stable at the value M, m_2 may suddenly change from its near zero value to one for which:

$$m_2 - \frac{3m_1m_2}{2(m_1+m_2)} = 0 \qquad (40)$$

m_2 could become $\frac{1}{2}M$ without any energy being added to the system from external sources.

This argument suggests that a pair of particles of masses m_1 and m_2 could combine to form a particle pair of masses (m_1+m_2) and $\frac{1}{2}(m_1+m_2)$. Then these could form higher mass pairs by a process of iteration. This sequence could repeat until there were insufficient energy quanta of enough strength to promote separation. Given the proton quantum energy threshold we see that three times the quantum 1836 would be the highest mass quantum to expect. This is 5508 but it depends upon there being a normal pair of particles which satisfy the condition that $(1{\cdot}5)^n(m_1+m_2)$ is 5508, where n is an integer.

If one mass is that of the proton and the other is that of the anti-proton, we could expect the 5508 result and n would merely be unity. However, anti-protons are rare and so this possibility is unlikely. If one mass is that of the proton and the other is that of the electron the maximum end product is 4133. n is 2. Note that the proton energy threshold would prevent build up to higher particle forms.

Before deciding that the graviton has this mass quantum 4133, let us examine equation (39). If m_1 is the mass of a proton it may be that the system with m_2 as an electron could be very prevalent. Indeed, it may be so prevalent that we could wonder whether the total mass M is all that stable. Accordingly, let us ask whether, with m_1 fixed, M could adjust itself to a minimum value by releasing energy in exchanges with surrounding particles. We find that there is minimum M when:

$$(m_1+m_2)^2 = \frac{3}{2}(m_1)^2 \tag{41}$$

which means that m_2 becomes $0{\cdot}225\ m_1$. In other words, if m_1 is 1836 we find that m_2 can adjust to 413. Now with this as the likely proton-based starting unit we can develop a much heavier particle which is still less than 5508, and we will now analyse this process by reference to Fig. 7.

It is now known from experiment, as reported by Feynman* (1974) that the proton comprises three discrete charges. Accordingly, in Fig. 7 we depict the proton as an aggregation of what we will call the H particle of charge $+e$, the electron e of charge $-e$ and the positron p of charge $+e$. The individual masses are 1836, 1 and 1, combining, when we allow for interaction energy, to give a total proton mass slightly in excess of 1836.

The first stage of graviton generation happens when the

* *Science*, 183, 15 February 1974, p. 601.

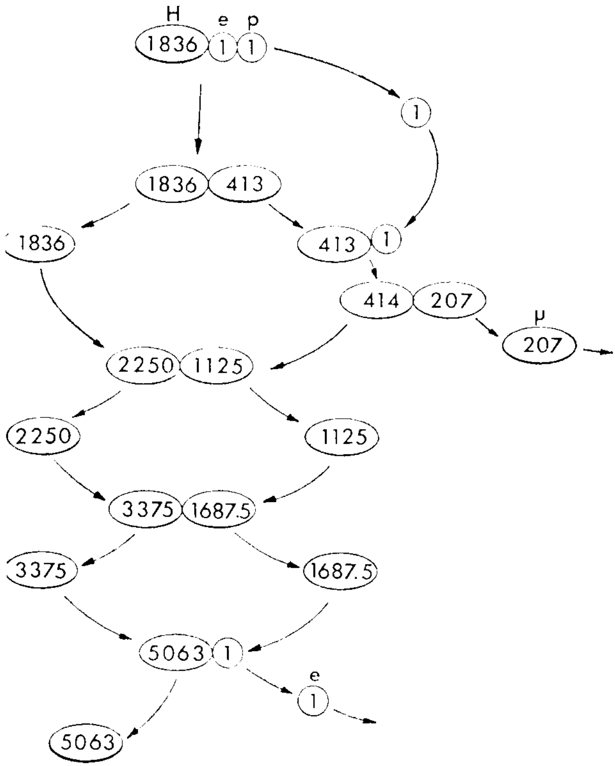

Fig. 7

proton finds itself releasing energy. This is possible even though the proton is normally quite stable. Note that the H particle is most stable. However, in an environment which is subject to very active energy exchange the electron constituent of the proton can absorb energy quanta which give it the mass of 413 as interaction energy is released in excess of this. This is the energy minimization process already described, but we must expect the positron to be ejected in the action. Actually, however, the 413 particle will have few members of its own species in the near vicinity and it will be short lived. This instability of a constituent of the minimal energy combination makes the system a receptor for a restoring energy quantum. Thus the proton form can revive and be rejoined by a positron, making the proton a very stable system.

The graviton creation process is initiated during the stage when the minimal energy state applies. The 1836 and 413 particles are deemed to be driven well apart by an external energy fluctuation. The 413 particle captures a positron and by its own collision action generates a paired system of total mass 414. By the process already described this converts to a system of 414 and 207, by the creation of a particle having half the total mass, this creation being at the expense of interaction energy. Next, we may envisage separation to eject a positive particle of mass 207, whereas the negative 414 particle moves to combine with the 1836 particle. Then we have a simple pair of charged particles which merge to form a system combining almost all the mass in one particle of 2250 mass units. The other particle of negligible mass is able to deploy the interaction energy available to form itself into a half-mass unit 1125. This division and combination to form half mass particles proceeds until, two stages later, we have a total mass of 5062·5. This is the nearest this process can take us to the maximum of 5508. The particle pair will try to concentrate most of the energy in one particle. The other will convert itself to the half mass state and probably revert to low mass, as energy fluctuations disturb its equilibrium. However, a quasi-stable existence can develop if the low mass particle has the form of an electron. In this case the interaction energy is negative and equal to one and a half electron units. Thus the main particle will have a mass of 5063. An external influence can easily separate this system to eject an electron and the particle we seek, the graviton of mass 5063 times that of the electron.

An interesting by-product of this process is the particle of mass 207. This is exactly the mass of the muon and it is an encouraging step in our quest to be assured that we have discovered the right form of the graviton. It may be asked why we can ignore the partial separations and the multitude of other possible combinations in a system which comprises numerous activated particles. There is mutual stability between particles of the same mass. Hence, it is the values of mass likely to recur most often which determine the values of the stable particles. When two charges are separated there are numerous states of different interaction energy but the difference gets very small once the separation is large relative to the particle radii. The truly stable particle is going to be the one which forms consistently by reacting to strong energy fluctuations which drive the particles well apart in the creation process. Also, once the gravitons take up their place in the G frame of the vacuum medium they are less likely to meet charges of opposite polarity. The latter, in the main, are bound to matter moving with the E frame. Even when the gravitons collide with the migrant q charges, their relative sizes and high speeds are such that the gravitons probably move right through the bodies of the q charges and no combination occurs. Conservation of energy and momentum will assure the integrity of both particles. The processes described in Fig. 7 are deemed to occur in and relative to the E frame and the graviton particles are deemed to be less stable in the E frame and so find their preferred location in the G frame.

The Evaluation of G

We are now ready to calculate the force of gravitation. The graviton can be assigned a radius g and since its mass is 5063 m_e we know g. The graviton energy is:

$$E = 5063\ m_e c^2 = 2e^2/3g \tag{42}$$

If an energy dE is stored on the graviton system so that the G frame increases in mass then the volume of the gravitons is reduced a little. There is then a small change in the continuum charge displaced by the graviton system. Let V be the volume of the graviton. Then:

$$dV = (4\pi g^2)\ dg \tag{43}$$

Also

$$dE = -(2e^2/3g^2)\ dg \tag{44}$$

From (43) and (44):

$$-dV = (6\pi g^4/e^2)\ dE \tag{45}$$

The link with gravitation is revealed when we realize that the charge element σdV created by the disturbance energy dE, that is by a mass element dE/c^2, has an exact connection with the constant of gravitation G. Indeed, we have only to write:

$$\sigma dV = \sqrt{G}\, dE/c^2 \tag{46}$$

It is a mere matter of algebra to show that we have now evaluated G in terms of σ, c, e and m_e. Avoiding use of σ, we can go further and formulate G in terms of h, c, m_e, e and the ratio r/d of the space structure. Thus, combining the calculated value of r/d of 0·3029 with equations (35), (36), (42), (45) and (46):

$$\sqrt{G} = \left(\frac{4}{3}\right)^3 \left(\frac{r}{d}\right)^3 \frac{4\pi}{(5063)^4}\, \alpha^3 \left(\frac{e}{m_e}\right) \tag{47}$$

The value of q has been replaced by e. α is the fine structure constant $2\pi e^2/hc$, known from experiment to be $7{\cdot}298\ 10^{-3}$. The value of the charge/mass ratio of the electron e/m_e is $5{\cdot}273\ 10^{17}$ esu/gm. Accordingly, we may deduce from (47) a value of G of $6{\cdot}67\ 10^{-8}$ cgs units, a result exactly in agreement with the measured value.

Before going on to explain the physical basis of this relationship, that is the justification for equation (46), it should be noted that the theoretical principles outlined in this work extend well beyond the problems of particle creation and gravitation. It is, for example, possible to deduce Planck's constant. This will be further discussed in Appendix I. Meanwhile, suffice it to say that we can in fact deduce the relationship:

$$\alpha^{-1} = \frac{hc}{2\pi e^2} = 144\pi\, r/d \tag{48}$$

Using this in (47) we can make the evaluation of G independent of any reliance upon the calculation of r/d. We obtain the relationship:

$$\sqrt{G} = \frac{4\pi}{(108\pi)^3 (5063)^4}\ (e/m_e) \tag{49}$$

It is claimed that this remarkable result, the derivation of the constant of gravitation G, in a manner which is linked to the physics of elementary particles and to the quantum phenomena of a Dirac-style aether, is a complete vindication of the classical