Maldwyn Centre for Theoretical Physics

Update June 2019

Meon and Loop dynamics

Whilst the general mode of interaction between meons has been clear for a while, the efforts to uncover how the anomalous magnetic moment of loops are generated has overshadowed exactly how loop dynamics work to keep the loop together and what each energy in the loops precisely represents. This update will show more clearly how and why the loops are stable and how the meons interact within loops and from loop to loop.

There are a number of basic rules on how meons or loops interact which have become clear during this investigation. They are:

1 When considering the interactions of meons, it is necessary to look at a pair of positive and negative meons as a unit. It may be necessary to consider one meon then the other, but the outcome is always the sum of the two. It is also necessary to consider test particles with simultaneously both mass and charge of equal size when looking at intra-loop interactions.

2 The most appropriate base designation of the positive meon and negative meon is of a positive mass $+M$ together with a negative charge $-Q$ as the basic positive meon and a negative mass $-M$ with a positive charge $+Q$ as the basic negative meon. However, each size is always adjusted by the fraction $j = \pm|q|/6$ which represents the size of twist energy (spin of the meon relative to direction of travel) and of charge energy. A $+j$ means that the energy of twist is positive and will be balanced by $-j$ of charge energy, and thus $-q/6$ of charge, and vice versa.

3 The rotation of meons around a loop is governed by firstly, each meon having the same size (positive or negative) of outward acting force due to its kinetic energy, which due to $\pm j$ size adjustment results in two different radii of rotation. Secondly, it is the force due to the mutual potential energies of mass (chasing) and charge (attractive or repulsive) that drives the rotational rate of the meons.

4 There are <u>two</u> sets of mass and charge potential energies acting between any two meons. In loop-loop interactions, the mutual external rotation of two loops (or loop combinations such as stars, planets, atoms, nucleons etc) around each other hides that there are two potential energies present because they act along the same line between the two loops and so have the same size and direction of action.

5 Within loops the two forces due to mutual potential energy sets do not act along the same line. One set of mass and charge energies acts on the meon which it is chasing, whilst the other is due to the meon which is chasing it. The chase action is due to the different masses ($+M(+1 \pm j)$ and $-M(-1 \pm j)$) of such an interaction and acts to try to maintain the separation of the meons. The two can be described for simplicity as the 'chasing' energy or force and the 'chased' energy or force. At the most basic level, action and reaction are not as identical as currently understood so that the force on, or from, each of a pair of meons on each other is not necessarily along the same line, although it may be the same size.

6 The descriptions of energy and force can be used interchangeably since, as will be seen below, the directions of action of the two are always the same.

7 The direction of positive or negative motional energies or forces of meons is always outwards in a loop. The sum the net circumferential potential energies of a pair of meons in a loop is always perpendicular to the centre of rotation and for all meons in a loop is always zero in total overall.

8 For an electron, chosen using $+M(+1+j)/-Q(-1-j)$ as the positive meon (+Meon) and – $M(-1+j)/+Q(+1-j)$ as the negative meon (-Meon), there is no net potential energy interaction between +Meon and +Meon or between –Meon and –Meon. The only net potential energies present are between +Meon and –Meon (or vice versa). This is the case for all meons, regardless of loop identity. Considering the positron, its positive meon is $+M(+1-j)/-Q(-1+j)$ and negative meon – $M(-1-j)/+Q(+1+j)$ so the +Meon in an electron loop will have no net action with a +Meon in the positron loop, at any separation. The actual size of the potential energies may be different, but the attractive mass potential energy between same sign meons is always balanced by the repulsive charge potential energy. So in all loops, only the actions between different sign meons need be considered.

9 In going from a straight line chain of alternating positive and negative meons to a loop, where the chain has caught its own tail, the chasing and chased potential energies move from acting along the same line to acting differently. The meons in a chain will have a summation of potential energies relative to their opposite sign meons at separations of 1, 3, 5 etc inter-meon distances, dependent on the length of the chain. For a chain of six meons, those not at each end will change one of their potential energy sizes from a 3 inter-meon distance to approximately a 2 inter-meon distance (the newly formed loop diameter). The end meons change from a 5 inter-meon distances to a 1 inter-meon distance. These involve an increase in overall energy sizes in the formation of a loop.

10 When considered from the centre of rotation, using both a $+M/-Q$ and – $M/+Q$ test particle in turn there are only six sets of potential energies relative to that centre to consider. There are however six sets of potential energy between the meons around the circumference of the loop.

11 The summation of the different energies within the loop will be shown below to produce the 'mass' of the loop, the spin energy of the loop and charge of the loop. It is these properties that interact with other loops except when two loops approach each other to within mutual influence distance ID3, as defined below, and their energies, in terms of rotational rate, can be adjusted. The result is either stacks of loops with identical rotation rates, where two or more loops rotate in opposition alternately, or bosons, where loops rotate in the same direction – with photons the extreme example of bosons. In the latter case, the meons in one loop merge with the opposite sign meons in the other loop to chase each other, one way or the other perpendicular to the plane of the loops, up to local light speed.

12 Entanglement is when two loops get within their mutual influence distance ID2 and loop-loop potential energies equalise with those inside both loops. A tunnel is created between the two loops which excludes the environment, so that the two can travel from tunnel end to end at a speed not limited by viscosity and at very high frequency whilst the loop ends travel independently within the environment. The lack of viscosity within the tunnel stops the creation of the $\pm j$ charges and instead uses the released charge energy to keep the tunnel open. An external perturbing action of sufficient energy at either end of the tunnel causes the tunnel to collapse and each loop to become stuck at

whichever end of the tunnel it is at that instant, $\pm j$ charges being reinstated by the action of twist energy in spinning the meons against the background.

13 The positive or negative mass motional energy of the meons represents an outward pressure of the loop on the local environment. The net positive or negative motional energy gives the fraction of the loop frequency that the observable mass represents. Where there are six positive motional energies, the loop will show 100% mass relative to its frequency of rotation (actually slightly higher, as shown below) and where there are three positive and three negative the mass observed will be slightly over 0%. Other fermions will have other fractional masses relative to their loop frequencies and, because both positive and negative mass motional energies act outwards, all observable masses will appear positive, even the positron with its six negative mass motional energies which show slightly over 100% loop frequency.

14 Despite the net observable mass of the loop being proportional to the fraction of mass motional energies present, the opposite energy due to the charge motional energies of the rotating meons gives the net magnetic moment of the loop and is always slightly over 100% of the loop frequency. The observable, other than the magnetic moment, is the spin energy of the loop which is the product of the sum of the individual meon mass moments and half the loop frequency or slightly over $h(\frac{1}{2}w)$. The latter is due to the same relativistic expansion of the kinetic part of the meons' energy, being of the simple form $(\gamma - 1)Qc^3$ for charge motion and $(\gamma - 1)hw_o$ for mass motion, where w_o is the adjusted-Planck frequency, although each meon has actually either $h/(1 + j)$ or $h/(1 - j)$ angular momentum due to their different rotational radii in the loop.

15 The spin and other energies of one loop can be felt by another loop because of the action of the chase forces of the meons. Once within the influence distance ID3, the chase force of a meon in one loop acts to oppose the approaching of opposite sign meons in the other loop through repulsion and simultaneously attracting opposite sign meons which are receding from it. The result over one mutual rotation is a cycle of attraction and repulsion proportional to the relative rotational rates of the loops. At further distances, these effects get mitigated by the local environment until they are no longer felt. Outside the influence distance ID3, which depends on both the loop rotational rates and the relative orientation of the loops, the spin-spin interaction fails. The actual distances at which the interaction type change is unclear, but possible points are outlined below.

16 The change of interaction type in, for example, a photon separating into electron and positron, without entanglement, involves each meon in one loop changing from an extra single direct interaction with its opposite sign partner in the other loop to a sum over all three opposite sign meons in the other loop. Thus the size of potential energy restraining the separation of the two loops initially increases over some unspecified distance within ID1 before decreasing as the separation increases further. It is possible to treat a loop as a torus of either 3 +Meons or 3 –Meons. The result is generally that the loops are driven to stack.

17 All the following equations treat both mass and charge identically, all meon and loop properties always sum to zero over the whole loop and the sizes M and Q are the same, although their relationship is $M = Qc$.

Dynamic equations

The following equations use subscripts 'i' for inner or 'o' outer rotation distance meons, relative to meons that would rotate at the distance r appropriate for a meon of size M/Q which did not have any twist adjustment j. The latter have no subscript and are general equations. The subscript 'e' is used for sizes specific to the electron or positron.

The most basic general equations are those of rotational motion, kinetic and potential energies or forces:

$v = rw$ and $h = Mvr$

$PE_M = MM/r$ and $PE_Q = QQc^2/r$

$PF_M = MM/r^2$ and $PF_Q = QQc^2/r^2$

$E_{Mmot} = (\gamma_M - 1)Mc^2 \approx ½Mv^2$ and $E_{Qmot} = (\gamma_Q - 1)Qc^3 \approx ½Qcv^2$

$F_{Mmot} = (\gamma_M - 1)Mc^2/r \approx ½Mvw$ and $F_{Qmot} = (\gamma_Q - 1)Qc^3/r \approx ½Qcvw$

Although the '$\approx$' sign is used here, at the loop size of the electron the meon velocities are so low that '$=$ ' is actually a valid expansion. The specific sizes that the meons can take in any loop are:

+Meon	$+M(+1+j)/-Qc(-1-j)$	$+M(+1-j)/-Qc(-1+j)$
-Meon	$-M(-1+j)/+Qc(+1-j)$	$-M(-1-j)/+Qc(+1+j)$

The meons with M of '$+j$' produce charges of – $q/6$ and those M with '$-j$' produce charges of $+q/6$. So the left hand column above with three +Meons and three –Meons will produce an electron. The right hand column will produce a positron. Neutrinos can be produced with three +Meons from one column and three –Meons from the other column. The positions of the $\pm q/6$ in the neutrino loop can produce rotationally symmetric or asymmetric neutrinos. Quarks will have a mixture from each column and are always asymmetric.

The equations following will use the electron set of meons in general.

The starting point is that the external outward motional force sizes, positive or negative, are all the same regardless of rotational radius, and are equal to what the forces would have been if there were no twist energies. The rotational frequency w is the same for meons at the inner or outer rotational radius and the larger $+M(+1+j)$ +Meon rotates at the inner radius. Charge motional energies do not affect meon motion but are observable externally as the spin energy and magnetic moment of a loop.

$$F_{Mmot} = ½Mvw = +½M(+1+j)v_i w = -½M(-1+j)v_o w$$

so that

$$v = (+1+j)v_i = -(-1+j)v_o = (1-j)v_o$$

$$w = v/r = v_i/r_i = v_o/r_o$$

giving

$r_i = r/(1+j)$ and $r_o = r/(1-j)$

Circumferential Mass and Charge Forces

Meon angular momenta, using *H* for the charge component corresponding to the usual *h* of mass component, will be

$$h_i = M_i v_i r_i = +M(+1+j)vr/(+1+j)^2 \quad = h/(+1+j)$$

$$h_o = M_o v_o r_o = -M(-1+j)vr/(-1+j)^2 = -h/(+1-j)$$

$$H_i = Q_i c v_i r_i = -Qc(-1-j)vr/(-1-j)^2 \quad = -H/(+1+j)$$

$$H_o = Q_o c v_o r_o = +Qc(+1-j)vr/(+1-j)^2 \quad = H/(+1-j)$$

Over the electron loop of three pairs of +Meon and –Meon, this produces the total angular momenta of

$$h_e = -3h/(+1-j) + 3h/(+1+j) = 6hj/(+1-j^2) = |q|h/(+1-j^2)$$

where $|q|$ is the size of the electron charge momentum, not the charge itself, and

$$H_e = -3H/(+1-j) + 3H/(+1+j) = -6Hj/(+1-j^2) = -|q|H/(+1-j^2)$$

In this latter equation, $|q|$ is again a size, but as $|q|Q$ represents the total loop charge, the magnetic moment of the loop, using $H = Qcvr = Qc(Mvr)/M = Qch/M$, is

$$\mu_e c = H_e = -|q|H/(+1-j^2) = -|q|Qch/M(+1-j^2)$$

This magnetic moment is far smaller than the observed anomalous magnetic moment of the electron because the masses in motion are all M meon sized, rather than the electron mass m_e. However, it does have the necessary electron spin g-factor *g*=2 relative to the usual magnetic momentum equation $\mu = qh/2m_e$. As shown below, there is another component of loop magnetic moment due to the rotating electric fields between +Meons and –Meons on opposite sides of the loop.

Although the magnetic moment of the loop calculated so far here is based on M, it may be that, as shown below, the observable external mass m_e should be used instead of M in the formula. This would produce instead, using q now as the actual charge size and property, the formula for the magnetic moment of the electron loop as

$$\mu_e = -qh/m_e\,(+1-j^2) = -2\mu/(1-j^2)$$

where μ is the usually accepted theoretical value for the magnetic moment of the electron. The $(1-j^2)$ factor helps towards the anomalous part of the observed magnetic moment, but is not sufficient and is anyway not the only magnetic moment present.

The slightly higher than *h* value for the total angular momentum of the loop feeds into the observable mass of the electron being slightly higher than its frequency w_e would suggest. Additionally, the $(\gamma_M - 1)$ factor leads to the ½v^2 and ½w_e fractions. The correct interpretation of the simplified $m_e c^2 = ½Mv^2 = ½hw_e$ is $m_e c^2 = M(½v^2) = h(½w_e)$. The simplified meon momentum of *h* has energy due to half the frequency w_e. So the spin of a loop is not ½*h* , but *h*, again demonstrating where $g = 2$ for the electron loop comes from.

The more precise value of the mass of the electron is given by the formula averaging the outward motional energy components of the three +Meons and three -Meons

$$E_{Mmote} = 3(½M(+1+j)v_i^2 - ½M(-1+j)v_o^2)/6 = (½Mv^2)/(1-j^2)$$

$$=½hw/(1-j^2) = m_e c^2$$

However, for the neutrino the formula is slightly different because the j components on three +Meons or three –Meons are reversed, so that it becomes instead a summation of

$$E_{Mmotv} = 3(½M(+1+j)v_i^2 + ½M(-1+j)v_o^2) = 6j(½Mv^2)/(1-j^2)$$

$$=|q|(½hw_e)/(1-j^2) = m_v c^2$$

where, once again, the $|q|$ factor is just a size. Compared to the size of the electron at the same frequency w_e, the mass of the neutrino would be

$$m_v c^2 = |q|(½hw_e)/(1-j^2) = |q|m_e c^2$$

This implies that if the electron mass at rest is 0.511 MeV/c^2, then the electron neutrino should have a mass of 0.0174 MeV/c^2.

The net balance of $\pm j$ factors within a loop produces the fraction of that loop frequency that is observable as mass. The six $+j$ meons in the electron give slightly over 100% of the loop frequency w_e, whereas the three $+j$ and three $-j$ of the neutrino give slightly over 0%, with appropriate fractional values for the quarks.

Circumferential Potential Forces

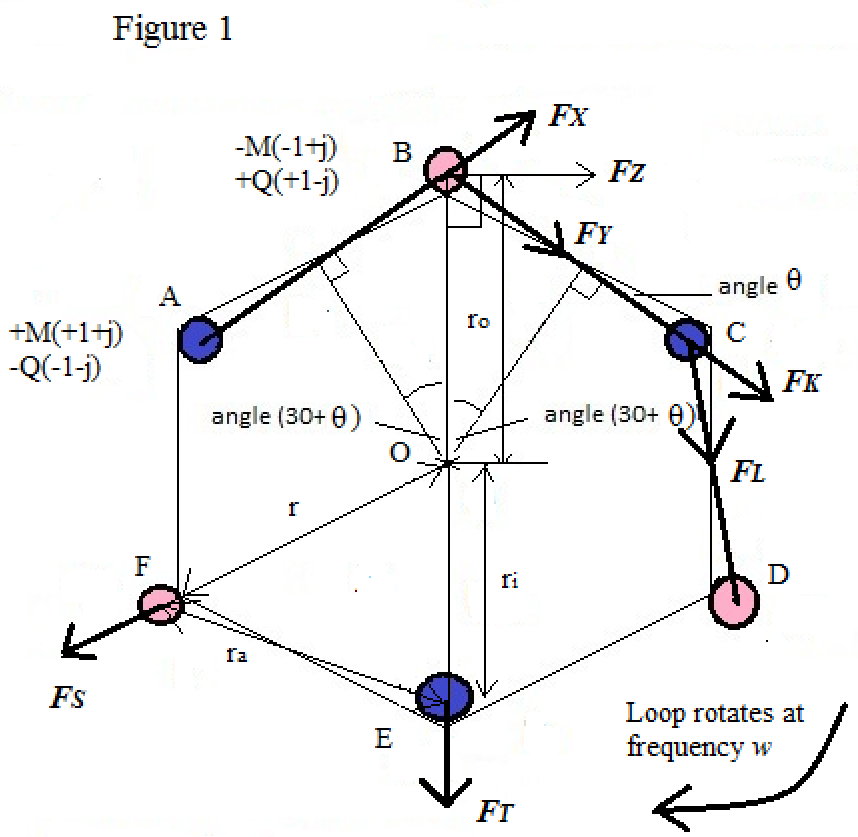
Turning now to the actions due to potential energy and forces, it is necessary to look at Figure 1.

Figure 1 shows six meons rotating clockwise at angular frequency *w*. The three +Meons shown are at a radius $r_i = r/(1+j)$ from the centre of rotation at O. The three -Meons shown are at $r_o = r/(1-j)$ from O. The mass chased force on B from A is shown as F_X, and the same on C from B as F_K. The mass chasing force from B on C is shown as F_Y and that from C on D as F_L. Because the direction of the forces on each meon from the others is different, the figure needs to include the six meons, although only two complete sets of circumferential forces are shown acting on meons B and C. The net force on B due to F_X and F_Y is F_Z, which acts perpendicularly to the radial line from O to B. Each set of circumferential forces on each meon acts perpendicularly to that meon's radial line from O.

In addition to the mass forces, there are charge forces. As explained at the start in the rules outlined, the forces of mass and charge always cancel between +Meon/+Meon and –Meon/-Meon because the mass attraction balances the charge repulsion. So only opposite sign meon interactions need be considered.

In each of the mass force F_X, F_Y, F_K and F_L there is also a charge force along the same lines of action. Although the chase force balances the charge attraction whilst the system is stable, when there is an external perturbation, the chase force acts to either repel or attract in order to try to maintain separation between the two interacting meons.

The two different radii of rotation of the +Meons and –Meons produce lines of action that are offset from a perfect hexagon that would be the case were the meons of simple mass M only, positive or negative. This offset force has an angle of θ outwards for a +Meon which is balanced by the inwards offset of a –Meon, so that over one pair there is no total offset and for each meon the total action of F_X and F_Y or F_K and F_L is perpendicular to the radial line from O, keeping the meons rotating at the same radius.



The two outward motional forces F_S and F_T are due to the motional kinetic energies of the meons as they rotate and represent both the pressure of the electron loop on the local environment and the tension that keeps the loop circular. As stated initially, these motional forces on the meons are all equal in size and $F_S = F_T$. The clockwise rotation of the meons in the electron loop in Figure 1 corresponds to spin ½ in accepted terminology. Flipping the loop over so that the meons rotate anti-clockwise would produce a spin – ½ electron loop.

For meon B, the two potential forces in action along the line of F_X between A and B at separation r_a, where $r_a = r\sqrt{1+3j^2}/(1-j^2)$, are

$$PF_{AB} = M(1+j)M(-1+j)(1-j^2)^2/(1+3j^2)r^2 - Qc(-1-j)Qc(1-j)(1-j^2)^2/(1+3j^2)r^2$$

$$= -(MM - QQc^2)(1-j^2)^3/(1+3j^2)r^2$$

Which is zero at any separation r since the size of M and Q is the same, provided the loop is stable so that the MM chase force does not need to attract or repel more. The net potential force for meon C along the line of F_K between B and C is the same size as along AB.

The force from B chasing C along the line of F_Y is

$$PF_{BC} = M(-1+j)M(1+j)(1-j^2)^2/(1+3j^2)r^2 - Qc(1-j)Qc(-1-j)(1-j^2)^2/(1+3j^2)r^2$$

$$= -(MM - QQc^2)(1-j^2)^3/(1+3j^2)r^2$$

which is the same as along AB, although along line of F_Y. And similarly the chasing force of C on D will have the same value.

The motional forces F_S and F_T have already been covered above and the resulting two different sets of outward motional energies provide the observable mass of the loop.

In Figure 1 the angle θ is $\theta = sin^{-1}[(\sqrt{3}(1+j)/2\sqrt{1+3j^2})] - 60^\circ$. This takes the value of 0.56365°. When $j = 0$ then $= 0$.

Diametric Potential Forces

There are also present the potential energies between opposing +Meons and –Meons across the loop diameters, for example between A and D and between D and A. This latter point is the consequence of the two potential energies, rather than a single one, between two meons. The effect here is that there is both a chasing and chased force acting on both A and D. The result is that the radius of the loop is held preferentially at a specific size when the loop itself is at rest unless there is additional kinetic energy added to the loop which will increase the loop rotational frequency. The size of the potential force acting across the loop diameter from A to D will be

$$PF_{AD} = M(1+j)M(-1+j)/(r_i + r_o)^2 - Qc(-1-j)Qc(+1-j)/(r_i + r_o)^2$$

$$= -(MM - QQc^2)(1-j^2)^3/4r^2$$

although there is an equal and opposite force PF_{DA} from D to A in action, and the same pair of opposing force for the other two diametrically opposing +Meon and –Meon pairs.

Compare this with the potential forces in action along a chain of six meons. Using Figure 1, but with the link between A and F eliminated and the chain straight at r_a separation between meons, the potential force on each meon will be

$$PF_A = -(MM - QQc^2)(1-j^2)/{r_a}^2 - (MM - QQc^2)(1-j^2)/9{r_a}^2 - (MM - QQc^2)(1-j^2)/25{r_a}^2$$

$$PF_B = -(MM - QQc^2)(1-j^2)/{r_a}^2 - (MM - QQc^2)(1-j^2)/9{r_a}^2 - (MM - QQc^2)(1-j^2)/{r_a}^2$$

$$PF_C = -(MM - QQc^2)(1-j^2)/{r_a}^2 - (MM - QQc^2)(1-j^2)/9{r_a}^2 - (MM - QQc^2)(1-j^2)/{r_a}^2$$

$$PF_D = -(MM - QQc^2)(1-j^2)/{r_a}^2 - (MM - QQc^2)(1-j^2)/9{r_a}^2 - (MM - QQc^2)(1-j^2)/{r_a}^2$$

$$PF_E = -(MM - QQc^2)(1-j^2)/{r_a}^2 - (MM - QQc^2)(1-j^2)/9{r_a}^2 - (MM - QQc^2)(1-j^2)/{r_a}^2$$

$$PF_F = -(MM - QQc^2)(1-j^2)/{r_a}^2 - (MM - QQc^2)(1-j^2)/9{r_a}^2 - (MM - QQc^2)(1-j^2)/25{r_a}^2$$

The two end meons have smaller potential forces acting on them than the middle meons. The change to a loop form equalises the forces on all the meons at a higher level. The motional forces of the straight chain are all along the line of motion and, since they alternate from positive to negative motional energies equally, sum to zero.

The magnetic field generated across the diameter of the loop by the rotating electric fields from +Meons to +Meons will produce a loop magnetic moment. The precise size of this moment is unclear because of the infinities generated in the calculation, but an approximate value is estimated below.

External Loop Interactions

When viewed from a distance from a loop, the actions of the +Meons will act on only –Meons and vice versa. So the loop can be considered for test purpose as two distinct part-loops, one of three +Meons and one of three –Meons simultaneously. Mathematically the centre of interaction of each of these part-loops will be at their centre of rotation. From this frame of reference, there are only three sets of potential and three motional forces in action for each part-loop.

The summation of the actions of a positive mass, negative charge test particle $+M/-Q$ placed at the centre of rotation O on the three –Meons of one part-loop will be the same as placing a negative mass, positive charge test particle – $M/+Q$ at O for the +Meons of the other part-loop. This complication is needed because it is necessary to consider both mass and charge interaction simultaneously and additionally of opposite sign mass and charge interactions to obtain the total result.

The potential force on a $-M/+Q$ test particle at O in Figure 1, between O and the +Meon at E will be both due to chasing and chased mass energies, but along the same line OB at separation r_i. This will be

$$PF_{OE} = -M(+1+j)(1+j)^2M/r^2 - Qc(-1-j)(1-j)^2Qc/r^2 = -(+1+j)^3(MM - QQc^2)/r^2$$

with the same for PF_{EO} along the line E to O but in the opposite direction. So again, not only does the mass chasing potential balance the charge potential, unless perturbed, but the chased potential in the reverse direction with its balancing charge potential will doubly net to zero along each line of action unless disturbed.

The potential force on an opposite test particle $+M/-Q$ at O in Figure 1, between O and the -Meon at B will be both due to chasing and chased mass energies, but along the same line at separation r_o. This will be

$$PF_{OB} = -M(-1+j)(1-j)^2M/r^2 - Qc(+1-j)(1-j)^2Qc/r^2 = (+1-j)^3(MM - QQc^2)/r^2$$

for each chase type of energy. Although this is not the same size as the forces PF_{OE} and PF_{EO} on and by the +Meon at O, the PF_{BO} and PF_{OB} forces balance, providing stability since they are zero unless perturbed.

This result implies that using a single mass $+m$ and charge $-q$ test particle ($|m| = |q|$) on an electron loop will produce slightly different observable energies to using a $-m$ and charge $+q$ test particle. However, a test particle with opposite signs would produce the same two energies on a positron, but reversed. The energy difference is $(6j + 6j^3)MM/r^2 = |q|(1 + j^2)MM/r^2$.

The six sets of potentials in action around the circumference between meons sum to zero individually and over the loop as a whole, despite the slightly larger distance r_a between each meon of $r_a = r\sqrt{1+3j^2}/(1-j^2)$, as shown between E and F in Figure 1.

Any loop at a sufficient distance from another loop will interact as if the loop properties were located at its centre of rotation O. So the properties observed will be only the mass of the loop, as produced by the net pressure of its meons' outward motional force, the total charge on the loop, which for the electron loop above will be $-6j = -q$, and the spin orientation and energy. The latter orientation interaction will depend on the loops being close enough together, likely to be within influence distance ID3, as defined below.

Influence Distances

There appear to be four different influence distances, the separations from a meon or loop at which the size or type of interaction with external loops changes. They are:

1 ID1 - The closest distance of interaction, that between one meon in one loop and another meon in another loop. It is likely that this one-to-one interaction occurs when the subject meon (SM) experiences the force from one object meon (OM) greater than the sum of the other forces from other similar OM meons in the OM loop. The example would be when the SM is in a loop and the OM is in an anti-loop and both loops are rotating in the same orientation. After equalisation of frequency of the loops, the result of the combination will be a photon – where each SM in the loop merges with its opposite sign OM in the other loop. Each SM will chase its OM, with each OM chased by its SM, up to local light speed. The breaking up of a photon into its two constituent loops will happen when the sum of the other similar OM meons' forces in the OM loop on each SM meon exceeds the force of the OM meon on its SM meon. However, if the separation of the loop and anti-loop occurs without crossing the individual lines of action from OM to SM in each loop, the result will be the formation of a tunnel between the two loops called entanglement. Perturbation to close the tunnel requires crossing the lines of OM to SM meon action and the excess force of other similar OM meons in the OM loop.

2 ID2 - From separation between loops greater than ID1 out to ID3, the interactions from the SM in the subject loop (SL) will be directly with each opposite sign meon in the object loop (OL). Where the loops are rotating in the same orientation but are not loop and anti-loop, there can be no merger between SM and OM meons in different loops. The result is the same as in loops rotating in opposite orientations, which are constrained to approach, after equalisation of rotational frequencies, no closer in separation than their rotational radii. The structures resulting will be stacks of loops, such as bosons, nucleons and nuclei.

3 ID3 - The distance at which the interaction type changes from direct meon to meon to overall SL loop to OL loop is probably a function of the wavelength of the smaller (greater frequency and energy) loop λ. This can be calculated from the basic relationships

$w_e = 2\pi f_e = 2\pi c/\lambda_e$ and $m_e c^2 = ½ M v_e^2 = ½ h w_e$

producing, where r_s is the adjusted Planck distance,

$$\lambda_e = 2\pi r_e^2/r_s$$

For the electron, where $r_e/r_s = 1.4137x10^6$, Λ_e is much larger than the loop radius.

This influence distance may also be the separation at which the relative orientations of two loops, their spin components, can no longer be distinguished. The underlying presumption is that the relative motion of meons within each SL loop can no longer be felt by each meon in the OL loop, so that relative approaching or receding of meons within a loop cannot be felt with consequent loss of orientation information.

4 ID4 – Although this is strictly not a distance in the same sense as the others, it is important to confirm that the mass and charge actions, either of meons themselves directly or as part of the overall loop properties, extend to infinity. The outward motional energies of the meons that represent the loop mass acts as a pressure on the local environment which could be considered as a depression in space-time and its effect is to attract other loops since there is no reverse pressure. The depression is only in one direction and, although very small at infinity, is a component in the attraction of other masses. The meon charges and total charge of the loops have two possible components, being positive or negative, so that in the charge-equivalent of space-time, there are depressions in both directions. This leads to the screening of charge action where opposite charges are present in a system. But even where two equal and opposite charges exist, their effect still extends to infinity even though their net effect may be zero at most points.

5 The weak force is the replacement of an electron loop in a neutron with a neutrino, passing frequency between the two to adjust stack frequency, resulting in a proton

Orbital Interactions

Where the <u>two</u> sets of potential energies or forces act from a central point of rotation, forming a stable orbit, it is then the loops of attractive mass m and charges $\pm q$ (shown only to ensure that charge action is included) at a sufficient distance between loops r that are interacting, the formula for balance will be

$$F_{bal} = (mm/r^2 \pm qqc^2/r^2) + (mm/r^2 \pm qqc^2/r^2) = mv^2/r$$

which produces the energy balance formula in a different manner than defined normally

$$E_{bal} = 2(mm/r \pm qqc^2/r) = mv^2$$

so $(mm/r \pm qqc^2/r) = ½mv^2$

And, since it has not been clear before that there are two potential forces in action for every interaction, the usual force balance formula is wrongly taken to be that one potential force balances the motional force, due to the energy of motion, thus

$F_{balaccepted} = (mm/r^2 \pm qqc^2/r^2) = mv^2/r$ --which is wrong!!

The correct force balance formula for an orbiting pair of masses is

$$F_{balnew} = 2(mm/r^2 \pm qqc^2/r^2) = mv^2/r$$

so $(mm/r^2 \pm qqc^2/r^2) = ½mv^2/r$

It is because historically physics had only simple physical systems with mutual rotational interaction that the fundamental rules have been hidden. Physicists have become stuck on their interpretations because loop-loop interactions, beyond separations where the chase force is significant, produce mathematically sound results, so they have not looked deeper. At the most basic level, action and reaction are not as identical as currently understood so that the force on, or from, each of a pair of particles is not necessarily along the same line.

Electric Field Calculation

The calculation of the electric field between two meons on opposite sides of an electron loop is complicated because the centre of rotation of the meons does not coincide with the zero of electric field. To find the distance along the line r_n from the centre of rotation at O, between the two meons, where the field is zero, the equation used is

$$E = Q(-1-j)c/\,(\tfrac{r_e}{1+j} + r_n)^2 + Q(1-j)c/\,(\tfrac{r_e}{1-j} - r_n)^2 = 0$$

Where r_e is the standard radius at which non-twisting meons would rotate. The distance r_n is given by the equation

$$r_n = r_e\left[(1+j^2) \pm \sqrt{1-j^2}\right]/j(1-j^2)$$

The negative root inside the loop and gives the value $r_{n-} = -8.520370664x10^{-3}r_e$. This represents a reduced distance from the $Q(-1-j)$ meon towards the centre of rotation.

The positive root may represent a point of stability outside the loop at $r_{n+} = 352.132r_e$.

At the centre of rotation of the loop the value of the electric field is

$$E_o = Q(-1-j)c/\,(\tfrac{r_e}{1+j})^2 + Q(1-j)c/\,(\tfrac{r_e}{1-j})^2 = 2Qj(1-j^2)c/r_e^2$$

However there are three opposing meon fields at the centre, so that the total field at the centre of rotation is

$$E_{o-total} = 6Qj(1-j^2)c/r_e^2 = |q|Q(1-j^2)c/r_e^2$$

For a symmetric neutrino, since the meons all have the same size masses and charges, although opposite in sign, the radii of rotation are the same and the centre of rotation and zero of electric field are coincident.

The values for the electric field between meons can be calculated in three parts by integration, using two reference frames based on the meons from of the centre of rotation, with the equation

$$E = Q(-1-j)c/\,(\tfrac{r_e}{1+j} \pm r)^2 + Q(1-j)c/\,(\tfrac{r_e}{1-j} \mp r)^2$$

This gives peaks when the denominator of one or other part of the equation goes to zero. The usual equations concern only the separation from a charge. The more interesting property to calculate is the magnetic field, which takes the form

$$B = qQc^2/v\; = qQc^2(-1-j)/\,v(\tfrac{r_e}{1+j} \pm r)^2 + qQ(1-j)c^2/\,v(\tfrac{r_e}{1-j} \mp r)^2$$

Where q is a test charge and v the velocity of the electric field at the point r, where $v = rw$.

The three parts of the line between the meons in the electron are

a) From the $Q(-1-j)$ meon at $r_e/(1+j)$ to the point of zero electric field at r_n from the centre of rotation the electric field has a negative value due to its negatively charged meon orbiting (for example) clockwise view from above, but the direction of the electric force is from the $Q(+1-j)$ to the $Q(-1-j)$ meon. From the RH rule, with the velocity clockwise, the magnetic field will point upwards.

b) From the zero point of electric field at r_n the electric field has gone from negative to positive, but the direction of the electric force and velocity remains the same as in a) and the magnetic field still points upwards. It does so until the centre of rotation, but to avoid infinities, this could be set at the Planck distance r_s from the centre.

c) From the Planck distance the other side of the centre of rotation, the velocity has changed relative to the electric force which remains as before. The result is that the magnetic field points downwards from the centre of rotation out to the $Q(1-j)$ meon at $r_e/(1-j)$.

Splitting the two electric fields into their parts, due to the $Q(+1-j)$ and $Q(-1-j)$ meons separately and integrating each, initially generally and excluding constants because they will disappear between the limits of integration in the three parts of the line, gives four equations with four integrals, disregarding temporarily the parameters qQc^2/w_e not functions of r:

A) 1 $B_{A1} = \int(-1-j)/(r\,(\frac{r_e}{1+j}+r)^2)dr$

2 $B_{A2} = \int(1-j)/(r\,(\frac{r_e}{1-j}-r)^2)dr$

Between 0 and positive r for the frame of reference based on the $Q(+1-j)$ meon. Then reversing the frame of reference to be measured from the $Q(-1-j)$ meon produces

B) 1 $B_{B1} = \int(-1-j)/(r\,(\frac{r_e}{1+j}-r)^2)dr$

2 $B_{B2} = \int(1-j)/(r\,(\frac{r_e}{1-j}+r)^2)dr$

for the same 0 and positive r, but at the other end of the line. The four resulting integrals, excluding other parameters, are

A1 $B_{A1} = -[(j+1)^3/r_e^2]\,[(r_e/(r_e+jr+r) - \,ln(r_e+jr+r) + ln(r)]$

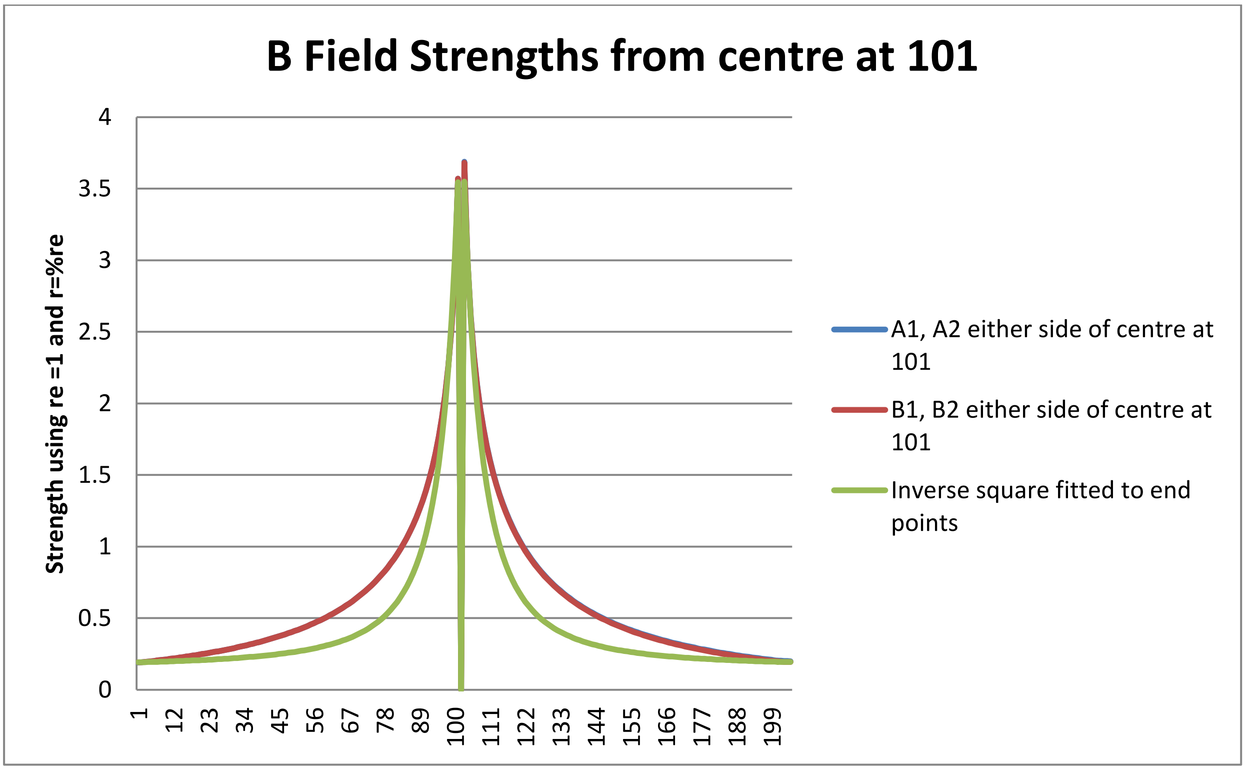
A2 $B_{A2} = -[(j-1)^3/r_e^2]\,[(r_e/(r_e+jr-r) - \,ln(r_e+jr-r) + ln((j-1)r)]$

B1 $B_{B1} = [(j+1)^3/r_e^2]\,[(r_e/(-r_e+jr+r) + \,ln(-r_e+jr+r) - ln((j+1)r)]$

B2 $B_{B2} = [(j-1)^3/r_e^2]\,[(r_e/(r_e-jr+r) - \,ln(r_e-jr+r) + ln((1-j)r)]$

The result is an overall curve along the line between the meons as shown in Figure 2. This line looks a lot like an inverse square relationship between magnetic field *B* and distance r, even though the simple form of the equation for the field at a point r , with the denominator $v(\frac{r_e}{1-j} - r)^2$, would seem to indicate an inverse cubed relationship.

Figure 2



The graph does not show the direction of the magnetic fields.

For the specific value of the *B* field along the parts of the line identified above, but now separated only into the two parts of the line either side of the centre of rotation, the results are:

a) From $r = r_e/(1+j)$ to $r = 0$

$$B_{A1(outer)} = -[(j+1)^3/r_e^2]\,[(\frac{1}{2} + \, ln(r_e/(1+j)]$$

$$B_{A2(outer)} = -[(j-1)^3/r_e^2]\,[((1+j)/(2j) - \, ln(2jr_e/(1+j)) + ln((j-1)r_e/(1+j))]$$

The sum of these two is 0.39203.

$$B_{A1(inner)} = -[(j+1)^3/r_e^2]\,[(1 - \, ln(r_e) + \ln(0)]$$

$$B_{A2(inner)} = -[(j-1)^3/r_e^2]\,[(1 - \, ln(r_e) + \ln(0)]$$

At $r = 0$ the answer is infinite and the specific value depends on how close to zero the calculation is to be taken. The value 1% r_e is used and the sum here is 7.25635.

The total field B between these two points is 6.86432 in the frame of reference of the -Meon, although this needs to be put in context with the other parameters excluded so far from the investigation of the *B* field. The graph and calculation used r_e=1 and r =% of r_e.

The other part of the line is

b) From $r = 0$ to $r = r_e/(1-j)$

$B_{B1(inner)} = [(j+1)^3/r_e^2]\,[(-1 + \,ln(-r_e) - ln(0)]$

$B_{B2(inner)} = [(j-1)^3/r_e^2]\,[(1 - \,ln(r_e) + ln(0)]$

The sum of these two, using 1% r_e as before, is 0.38627.

$B_{B1(outer)} = [(j+1)^3/r_e^2]\,[((1-j)/(2j) + \,ln(r_e(1-j)/2j) - ln(r_e(j+1)/(1-j))]$

$B_{B2(outer)} = [(j-1)^3/r_e^2]\,[\frac{1}{2} - \,ln(r_e/2) + ln(r_e)]$

The sum of these two then is 7.25059, giving the difference between the points again as 6.86432 in the frame of reference of the +Meon. From the RH rule, the direction of the *B* field is opposite on the other side of the centre of rotation, so that overall the net *B* field will be 6.86432 - 6.864232= 0.

There are three such fields acting across the electron loop and even though the total is zero, they exist along the lines between the meons producing an effect as if they were generated from the centre of rotation with an inverse square reduction from the centre.

Given a net zero effective magnetic field across the electron loop, it is too small to be observable in the context of its anomalous magnetic moment. However, there remains the asymmetry of the radii of the meons which should produce a non-zero sum that increases as the distance to the centre of rotation reduces. Using 1% r_e hides that value, but it should be observable at closer to the centre of rotation.

Circumferential Magnetic Fields

The last internal components of the electric and magnetic fields in a loop are between the meons circumferentially, due to the rotation of the meons being at different radii and so at slightly different velocities. This is not the same as the fields due to the rotation of the charges on the meons themselves. The electric field of meon A on B, and B on A, at separation r_a in Figure 1 is

$E_{AB} + \,E_{BA} = Q(-1-j)c/\,{r_a}^2 + Q(1-j)c/\,{r_a}^2 = -2jQc/r_a^2$

Since r_a is constant, the integral needed to produce the B field along the line between the two meons will be

$B_{effectivecirc} = -(2jqQc^2/(w_e r_a^2)\int(1/r)dr$

between $r = r_e/(1+j)$ and $r = r_e/(1-j)$ outwards from the centre at O. The result is

$$B_{effectivecirc} = -(2jqQc^2/(w_e r_a^2)[\ln(r_e/(1+j)) - \ln(r_e/(1-j))]$$

$$= -(2jqQc^2/(w_e r_a^2)[\ln((1-j)/(1+j))]$$

$$= 0.01136(2jqQc^2/(w_e r_a^2)$$

There are three similar *B* fields in the loop giving the total for these as

$$B_{effectivecirc3out} = 0.01136(|q|qQc^2/(w_e r_a^2)$$

In addition there three similar but opposite fields between the meons from $r = r_e/(1-j)$ and $r = r_e/(1+j)$ inwards with a total field of

$$B_{effectivecirc3in} = -0.01136(|q|qQc^2/(w_e r_a^2)$$

These two sets sum to zero over the loop in the same way as the fields across the loop.

General Field Equations

The equations above can be simplified for general use between charges which are the sum of loop charges – meaning equations between loops. Mostly this involves using the electron charge, or the appropriate fraction for the loops under consideration and the outward force of the meons in the loops which is otherwise called the loop mass and spin. L is the distance between the loops considered.

Force

$$F = 2(mm/L^2 \pm qqc^2/L^2) = mv^2/L$$

Potential Energy

$$E = 2(mm/L \pm qqc^2/L) = mv^2$$

Electric Field

$E = -qc^2/\,(L \pm r)^2 + +qc^2/(L \mp r)^2$ (Opposing charges, r is from centre of rotation to either)

Magnetic Field

$B = qqc^2/vr^2 \; = qqc^2/v(L \pm r)^2 + qqc^2/\,v(L \mp r)^2$ (Opposing charges at a point)

$B_{sum\ over\ 4} = \pm qqc^2\ [(L/(\pm L \pm r) \mp\ ln(\pm L \pm r) \pm ln(\pm r)]/wL^2$ (total between any r_1 and r_2)

The latter involves using the frame of reference from each loop along the lines shown for A1, A2, B1 and B2 above.

M Lawrence
Maldwyn Theoretical Physics
27 May 2019

Relativity versus Quantum Mechanics

There is a simple delineator that differentiates the realms of relativity and quantum mechanics. The differentiator is viscosity η, as previously noted elsewhere, and can be stated simply for display on, for example, T-shirts as

$$[\eta \neq 0]: G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

$$[\eta = 0]: i\hbar \frac{\partial}{\partial t} \psi(\boldsymbol{r}, t) = \hat{H} \psi(\boldsymbol{r}, t)$$

Viscosity η divides and rules