An extended framework for pre-fermion loop dynamics

MICHAEL LAWRENCE
Maldwyn Centre for Theoretical Physics, Park Road, Ipswich, Suffolk, United Kingdom
lawrence@maldwynphysics.org
22 January 2024

The paper investigates pre-fermion loop dynamics within an extended framework that considers meon component angular momenta which are not constrained to be equal to Planck's constant $\boldsymbol{h}$. All three charged leptons are considered using exactly the same equation whose output is dependent on only one independent variable. All parameters are set using current CODATA values and use DASI units, where the adjusted-Planck mass $\boldsymbol{M_* = \sqrt{hc} = Q_* c}$, with $\boldsymbol{Q_*}$ the adjusted-Planck charge and the electron charge $\boldsymbol{q = \sqrt{\alpha/2\pi} Q_*}$. Although the method employed produces the observed or predicted anomalous magnetic moments of all three charged leptons with outer meon velocities identical to within $\boldsymbol{\pm 5x10^{-12} c}$, it is concluded that the anomalous magnetic moments are products of their external motion at the relevant 'magic' rotational frequency in Penning traps or cyclotrons rather than being intrinsic to their status as stationary rotating loops. The existence of anomalous magnetic moments is taken as confirmation that fermions contain separate internal charges rotating at different radii in such devices. The paper also uses the reconciled loop rotational mechanics in which $\boldsymbol{\sqrt{f}v = (r/\sqrt{f})(fw)}$ where $\boldsymbol{f}$ is the reconciled part of the relativistic factor usually expanded at low velocity and used as ½ .

Keywords: Momentum; Energy; Loop dynamics; Relativity; Intrinsic spin quantum number, Planck's constant; Electron; Magnetic moment; Pre-fermion;

PACS: 12.60.-i; 12.90.+b; 14.60.Cd; 45.20.dc; 45.50.-j; 75.10.Jm;

I. INTRODUCTION

This paper follows on from previous work on the structure of fermions based on a pre-fermion framework [1][2][3][4] which used the size of the angular momentum of the each of the meons and anti-meons in a loop set at Planck's constant.

Failure within those previous papers to produce the value of the anomalous magnetic moments for the stationary charged leptons, using the framework mentioned, has prompted investigation into the extended framework employed here, where the meon and anti-meon angular momenta are no longer constrained always to be of size equal to Planck's constant $\boldsymbol{h}$.

However, the same conclusions as before have been found to exist even in the extended framework, such that it is likely that only the external motion of loops in Penning traps and cyclotrons at their respective 'magic' frequencies [6] which produce those observed anomalous magnetic moments in moving charged lepton loops. But the results of the investigation have produced some interesting features, including that to be able to obtain the precise anomalous magnetic moments in all three stationary rotating charged leptons (two observed and one predicted) requires only that the velocities of the outer set of meons and anti-meons are the same to within $\pm 5x10^{-12} c$.

All parameters are set using current CODATA values at their best accuracy and use DASI units, where the adjusted-Planck mass $\boldsymbol{M_* = \sqrt{hc} = Q_* c}$, with $\boldsymbol{Q_*}$ the adjusted-Planck charge and the electron charge $\boldsymbol{q = \sqrt{\alpha/2\pi} Q_*}$.

The paper also uses the convention that the reconciled loop rotational mechanics are $\boldsymbol{\sqrt{f}v = (r/\sqrt{f})(fw)}$ where $\boldsymbol{f}$ is the reconciled part of the relativistic factor usually expanded at low velocity and used as ½. This factor is usually associated with ½ $\boldsymbol{h}$ spin of a loop, but is actually relativistic and the loop spin is $\boldsymbol{h}$ with the $\boldsymbol{f}$ being linked to the angular frequency $\boldsymbol{w}$ of a loop so is better described as $\boldsymbol{h(fw)}$.

The effect of the latter on the loop magnetic moments is zero because the velocity and radius $\boldsymbol{f}$ factors cancel in the angular momentum equation, but the actual loop angular frequency, radius and velocity are altered.

II. SIGNIFICANCE and OBJECTIVES

The significance is in investigating, in terms of the physical pre-fermion framework of loops, where the magnetic moments of all charged fermion loops arise from.

The standard QED explanation [5] for the anomalous magnetic moment of the charged leptons is their interaction with photons and other particles. However, the explanation takes no account of the background within which the leptons travel, which is composed of myriad partially merged pairs of meons and anti-meons. The background is a viscous environment through which the meons, and their loops, have to travel and to which they lose mass energy in the form of loop rotational rate. This means that they will also lose magnetic momenta set by that same rotational rate loss, which latter is replaced by photons stacking to speed up the loops to their locked-in rate, set at their initial inflation event.

Although this might seem to be the same as the QED explanation, the photons are just sources of extra rotational frequency, not force carriers. The accuracy of the QED figures belies that stationary rotating loops whose meons and anti-meons have internal angular momenta of size equal to Planck's constant $\boldsymbol{h}$ do not generate the observed anomalous magnetic moments of the charged leptons. This paper is a further analysis of possible loop dynamics with less constraint on meon angular momenta.

The objectives are to show that the anomalous magnetic moments of the charged leptons are more likely to be due to the external rotation of the loop, rather than its internal meon rotations, and to show that the internal charge momentum of the meons and anti-meons in an electron loop are exactly equal and opposite to the mass momentum of those meons and anti-meons, although the latter sum to zero over the loop and the former do not - because they are relative motion and sign dependent.

A further objective is to explain in detail how each of the energy types in the meons and anti-meons in a loop are equal and opposite, summing to zero overall, and yet produce the observable properties of mass, charge, magnetic moment and spin.

III. OUTLINE

The underlying foundation is that the total energy of a loop is always zero when all energies are taken into account, because for positive fundamental mass energy there is an equal and opposite negative fundamental mass energy. The same is the case for fundamental positive and negative charge energies. Furthermore, those fundamental mass and fundamental charge energies are opposite types.

The twist energies, due to meons or anti-meons rotating about an internal axis, are $\boldsymbol{sc^2/6}$ mass-type for the rotations and $\boldsymbol{qc^3/6}$ charge-type for the one-sixth size electron charge generated by rubbing against the background of partially merged pairs of meon/anti-meons. These latter are also opposite type energies so that $\boldsymbol{sc^2 = -qc^3}$.

The single internal angular momentum equation for a pair of meon and anti-meon rotating in a charged lepton loop will be used to generate values for both mass momentum in terms of $\boldsymbol{h}$ and charge momentum in terms of magnetic momentum $\boldsymbol{H = uc}$, as defined below.

Only the velocity of the outer meon/anti-meons will be adjusted to produce each charged lepton loop magnetic moment.

IV. MASS ENERGY

The meon rest mass is the adjusted-Planck mass $\boldsymbol{M_*}$ and its rest mass energy is $\boldsymbol{M_*c^2}$. The kinetic energy of the meon in motion at $\boldsymbol{v_e}$ in a circular electron loop, where the reconciled relativistic factor $\boldsymbol{f}$ is used, derives from the relativistic gamma function

$$\gamma_{v_e} = \mathbf{1}/\sqrt{(\mathbf{1} - \boldsymbol{v_e}^{\mathbf{2}}/\boldsymbol{c}^{\mathbf{2}})}$$

So that

$$\boldsymbol{E_{KE(v)}} = (\gamma_{v_e} - \mathbf{1})\boldsymbol{M_*c^2} = \boldsymbol{f_v M_* v_e^2}$$

$$= (\gamma_{v_e} - \mathbf{1})\boldsymbol{hw_e} = \boldsymbol{fhw_e}$$

$$\boldsymbol{fM_*v_e^2}/(\boldsymbol{M_*c^2}) = \boldsymbol{fhw_e}/(\boldsymbol{hw_*})$$

$$\boldsymbol{fv_e^2/c^2} = \boldsymbol{fw_e/w_*}$$

Without the $\boldsymbol{h}$ in this latter equation, it is clear that the factor $\boldsymbol{f}$ is not associated with $\boldsymbol{h}$ at all.

Assuming that the standard equation for a rotating body in a stable orbit $\boldsymbol{v = rw}$ is correct, and specifically here that $\boldsymbol{v_e = r_e w_e}$ and $\boldsymbol{h = M_* v_e r_e}$ apply, then the correct relationship between velocity and radius of rotation should be

$$(\sqrt{\boldsymbol{f}}\boldsymbol{v_e}) = (\boldsymbol{r_e}/\sqrt{\boldsymbol{f}})(\boldsymbol{fw_e})$$

which in turn shows that

$$\boldsymbol{h} = \boldsymbol{M_*}(\sqrt{\boldsymbol{f}}\boldsymbol{v_e})(\boldsymbol{r_e}/\sqrt{\boldsymbol{f}})$$

or alternatively the normal

$$\boldsymbol{h = M_* v_e r_e}$$

This latter equation, the usual angular momentum one used, hides the way the relativistic factor affects the split between the velocity and radius properties. This is usually not observable because the two properties always appear together in momenta equations and the split disappears.

However, when looking at the energy of orbitals, for example, the extra angular velocity introduces the relativistic factor, but in a way that only shows the total effect $\boldsymbol{f}$

$$\boldsymbol{fw_e h = M_* v_e r_e f w_e}$$

$$\boldsymbol{fhw_e = fM_* v_e^2}$$

which in normal circumstances where $\boldsymbol{f} \cong ½$ becomes the usual

$$½\boldsymbol{hw_e} = ½\boldsymbol{M_* v_e^2} = \boldsymbol{m_e c^2}$$

Where $\boldsymbol{m_e}$ here is the stationary electron mass.

The electron mass will be increased from its stationary value as its frequency increases through the $\boldsymbol{f}$ factor, although the means to achieve this without translational velocity is obscure.

The latter shows that

$$\boldsymbol{v_e/c} = \sqrt{\boldsymbol{m_e/M_*}}/\sqrt{\boldsymbol{f}}$$

And, where $\boldsymbol{r_*}$ is the adjusted-Planck radius,

$$\boldsymbol{r_e/r_*} = \sqrt{\boldsymbol{f}}\sqrt{\boldsymbol{M_*/m_e}}$$

V. MOMENTUM AND ENERGY EQUATIONS

It needs restating that the most basic dynamic equations are the same for both mass and charge systems, and that there is currently a difference between the momentum and energy interpretations which the appropriate use of the relativistic factor reconciles here.

The following uses the 'ideal' DASI values in any loop for charge $\boldsymbol{Q_*}$, mass $\boldsymbol{M_*}$, radius $\boldsymbol{r}$, velocity $\boldsymbol{v}$ and frequency $\boldsymbol{w}$ of the meons and anti-meons in a loop, without their adjustment for $\boldsymbol{s/6}$ and $\boldsymbol{q/6}$ sized mass and charge additions, except where mentioned. The energy values of $\boldsymbol{s}$ and $\boldsymbol{q}$ are both the same sizes with $\boldsymbol{sc^2} = \boldsymbol{qc^3} = \sqrt{\boldsymbol{\alpha/2\pi}}\,\boldsymbol{M_*c^2} = \sqrt{\boldsymbol{\alpha/2\pi}}\,\boldsymbol{Q_*c^3}$.

Usually the moment and momentum equations are

Mass (momentum)

$$\boldsymbol{h} = \boldsymbol{M_*vr}$$

Charge (moment)

$$\boldsymbol{\mu} = \boldsymbol{Q_*vr}$$

As has been shown above, these can be restated as

Mass

$$\boldsymbol{h} = \boldsymbol{M_*}(\sqrt{\boldsymbol{f}}\boldsymbol{v})(\boldsymbol{r}/\sqrt{\boldsymbol{f}})$$

Charge

$$\boldsymbol{\mu} = \boldsymbol{Q_*}(\sqrt{\boldsymbol{f}}\boldsymbol{v})(\boldsymbol{r}/\sqrt{\boldsymbol{f}})$$

The result is the same, but the value of the properties is better defined. This is similar to the stretching of SI units into DASI units when eliminating the gravitational constant G from all equations [7].

However, the charge moment has dimensionality as shown of $\boldsymbol{Y^{-2}}$ so needs to be adjusted to have the same dimensionality as mass momentum, which at $\boldsymbol{Y^0}$ is as should be expected for a universal constant

Since the DASI units are defined to be

$$\boldsymbol{M_*} = \sqrt{\boldsymbol{hc}} \qquad \boldsymbol{Q_*} = \sqrt{\boldsymbol{h/c}}$$

and $\boldsymbol{M_*} = \boldsymbol{Q_*c}$

to make the property charge momentum equation equal to $\boldsymbol{Y^0}$ dimensionality involves multiplying by $\boldsymbol{c}$ to become

$$\boldsymbol{\mu c} = (\boldsymbol{Q_*c})(\sqrt{\boldsymbol{f}}\boldsymbol{v})(\boldsymbol{r}/\sqrt{\boldsymbol{f}})$$

VI. ENERGY

The generalized mass kinetic energy of a meon in a loop is

$$E_{MKE} = (\Upsilon - 1)\boldsymbol{M_*c^2} = \boldsymbol{M_*}(\boldsymbol{fv^2}) = \boldsymbol{h}(\boldsymbol{fw}) = \boldsymbol{m_{loop}c^2}$$

This is the same size for both positive and negative meons, although they have positive and negative mass motional energies respectively. The loop has the observable frequency of the meon rotation as the gravitational effect, or its 'mass'.

Charge energy is treated in the same way, thus

$$E_{QKE} = (\Upsilon - 1)\boldsymbol{Q_*c^3} = \boldsymbol{Q_*c}(\boldsymbol{fv^2})$$

There being no equivalent to $\boldsymbol{h}$ in charge momentum a new charge angular momentum property $\boldsymbol{H}$ is defined

$$\boldsymbol{H} = \boldsymbol{\mu c} = (\boldsymbol{Q_*c})(\sqrt{\boldsymbol{f}}\boldsymbol{v})(\boldsymbol{r}/\sqrt{\boldsymbol{f}})$$

so that

$$E_{QKE} = \boldsymbol{H}(\boldsymbol{fw})$$

which is the same form as the mass energy equation, although not currently recognised as such. Usually in both the value of $\boldsymbol{f} \cong ½$.

There is no acknowledged energy equivalent of the mass of the loop for charge, but it is the same size as the mass energy and is actually the spin energy because $\boldsymbol{Q_*c}$ in $\boldsymbol{H}$ can be replaced with $\boldsymbol{M_*}$ and we then have

$$\boldsymbol{H} = \boldsymbol{M_*}(\sqrt{\boldsymbol{f}}\boldsymbol{v})(\boldsymbol{r}/\sqrt{\boldsymbol{f}}) = \boldsymbol{h}$$

The spin is currently taken to mean that the fermions have spin ½ $\boldsymbol{h}$, but they actually have spin 1 $\boldsymbol{h}$, which is adjusted by the $\boldsymbol{f}$ of the loop angular frequency $\boldsymbol{w}$ as described above.

The main point is that the charge energy of the intrinsic spin of an electron is exactly equal and opposite to the mass energy of the electron.

VII. MAGNETIC MOMENT AND MOMENTUM

This in turn leads to the wrongful interpretation of the magnetic moment of the electron (ignoring the anomalous component for now). Since the magnetic moment is a moment, then it takes the moment formula, adjusted by $\boldsymbol{c}$ for dimensionality. So for a negative meon, not the loop,

$$\boldsymbol{\mu c} = -(\boldsymbol{Q}_*\boldsymbol{c})(\sqrt{\boldsymbol{f}}\boldsymbol{v})(\boldsymbol{r}/\sqrt{\boldsymbol{f}})$$

$$= -(\boldsymbol{Q}_*\boldsymbol{c})[\boldsymbol{M}_*(\sqrt{\boldsymbol{f}}\boldsymbol{v})(\boldsymbol{r}/\sqrt{\boldsymbol{f}})]/\boldsymbol{M}_*$$

$$= -(\boldsymbol{Q}_*\boldsymbol{c})\boldsymbol{h}/\boldsymbol{M}_*$$

and now

$$\boldsymbol{\mu} = -(\boldsymbol{Q}_*\boldsymbol{c})\boldsymbol{h}/\boldsymbol{M}_*$$

which is the same form as the accepted magnetic moment of the electron, except without the ½, and using the electron mass and electron charge instead of the meon mass and adjusted-Planck charge respectively.

This equation is for the meons and anti-meons, of appropriate charge sign, in the electron loop, not for the electron loop orbiting a nucleus. It will be shown later that there is a ½ factor introduced in magnetic moments by that change from internal loop dynamics to external motion of a loop.

VIII. ACTUAL LOOP SYSTEMS

Using the actual meon and anti-meon loop masses and charges, with their sizes shown in Table H, of

Mass $\boldsymbol{M}_*(\pm 1 + \boldsymbol{s}/\boldsymbol{6})$

Charge $\boldsymbol{Q}_*(\pm 1 - \boldsymbol{q}/\boldsymbol{6})$

produces different velocities and radii for the meons versus the anti-meons in charged lepton loops in order for each to maintain the same mass angular momentum. The major change from the previous work, where the mass angular momentum was constrained to equal only $\boldsymbol{h}$, is that the individual mass angular momentum of meons and anti-meons is no longer constrained to be that size.

Using $\boldsymbol{f}$ throughout, because the velocity of each meon is very low but should be followed in the equations, there will be a small difference between inner $\boldsymbol{v_i}$ and outer $\boldsymbol{v_o}$.

The difference between $\boldsymbol{v_i}$ and $\boldsymbol{v_o}$ is set by the mass energy equations, using $\boldsymbol{j}$ instead of $\boldsymbol{s}/\boldsymbol{6}$ and $\boldsymbol{qc}/\boldsymbol{6}$ for brevity, and considers only the mass energy of a pair of positive and negative meons.

The inner meon must be the larger $\boldsymbol{M}_*(1+\boldsymbol{j})$ size and the outer meon the $\boldsymbol{Q}_*\boldsymbol{c}(-1-\boldsymbol{j})$ in order to produce a net negative magnetic moment for the negatively charged lepton loops discussed here.

The mass energy of the meon and anti-meon must be equal and opposite, so that they always sum to zero over a pair or a loop.

$$\mathrm{E}_{Mtotal} = +\boldsymbol{f}\,\boldsymbol{M}_*(1+\boldsymbol{j})\boldsymbol{v_i}^2 + \boldsymbol{f}\,\boldsymbol{M}_*(-1+\boldsymbol{j})\boldsymbol{v_o}^2 = \boldsymbol{0}$$

So individually the mass energy sizes will be

$$\mathrm{E}_{Mmeons} = +\boldsymbol{f}\,\boldsymbol{M}_*(1+\boldsymbol{j})\boldsymbol{v_i}^2 = -\boldsymbol{f}\,\boldsymbol{M}_*(-1+\boldsymbol{j})\,\boldsymbol{v_o}^2$$

From the equation, simplifying the results, can be found

$$\boldsymbol{f}\,\boldsymbol{v_i}^2\,(1+\boldsymbol{j}) = \boldsymbol{f}\,\boldsymbol{v_o}^2(1-\boldsymbol{j})$$

or

$$\boldsymbol{v_i}^2 = \boldsymbol{v_o}^2(1-\boldsymbol{j})/(1+\boldsymbol{j})$$

$$\boldsymbol{v_i}^2 = \boldsymbol{v_o}^2 0.988704338$$

Note that the $\boldsymbol{f}$ factor drops out of the equation and the difference between outer and inner velocities is fixed.

In the Table G, each fundamental and twist mass and charge momentum is shown separately to confirm that all positive energies have matching negative energies.

This constant value can be substituted into the similar charge energy equation, whose two component energies are not equated, like the mass version, but depend on their relative rotation and charge sign, thus

$$\mathrm{E}_{Qmeons} = +\boldsymbol{f}\,\boldsymbol{Q}_*\boldsymbol{c}(1-\boldsymbol{j})\boldsymbol{v_i}^2 + \boldsymbol{f}\,\boldsymbol{Q}_*\mathrm{c}(-1-\boldsymbol{j})\,\boldsymbol{v_o}^2$$

$$\mathrm{E}_{Qmeons} = +\boldsymbol{f}\,\boldsymbol{Q}_*\boldsymbol{c}(1-\boldsymbol{j})\boldsymbol{v_o}^2(1-\boldsymbol{j})/(1+\boldsymbol{j}) + \boldsymbol{f}\,\boldsymbol{Q}_*\boldsymbol{c}(-1-\boldsymbol{j})\,\boldsymbol{v_o}^2$$

$$= -\boldsymbol{f}\,\boldsymbol{Q}_*\boldsymbol{c}\boldsymbol{v_o}^2\,\frac{\boldsymbol{4j}}{\boldsymbol{1}+\boldsymbol{j}}$$

Since this is for one pair and there are three pairs in our matter loops, the total charge energy for a charged lepton loop with angular frequency w_x will be

$$\mathrm{E}_{Qxloop} = -2\boldsymbol{f}\,\boldsymbol{qc}\boldsymbol{v_o}^2\,/(\boldsymbol{1}+\boldsymbol{j})$$

$$\mathrm{E}_{Qxloop} = -2\boldsymbol{f}\,\boldsymbol{qc}\boldsymbol{v_o}\boldsymbol{r_o}\mathrm{w}_x\,/(\boldsymbol{1}+\boldsymbol{j})$$

And the magnetic moment will be

$$\boldsymbol{\mu_{xloop}} = -2\,\boldsymbol{f}\boldsymbol{q}\boldsymbol{v_o}\boldsymbol{r_o}/(\boldsymbol{1}+\boldsymbol{j})$$

This is effectively what sets the size of the charged lepton loop magnetic moments in the tables below, using only the value for $\boldsymbol{v_o}$ as the input - since $\boldsymbol{r_o}$ follows from $\boldsymbol{v_o} = \boldsymbol{r_o w_x}$.

Since it is no longer the constraining case that $\boldsymbol{h} = \boldsymbol{M_* v_o r_o} = \boldsymbol{H}$, this equation cannot be simplified to the usual form $\boldsymbol{\mu_x} = -½\boldsymbol{qh}/\boldsymbol{M_x}$ but is available to use to generate the anomalous magnetic moments of the charged lepton loops to understand what the effects are of pinning some relationships to the overall magnetic moments.

IX TABLES

The tables use CODATA [8] values for all the observed constants and derived properties used, plus the preicted value for the anomalous magnetic moment of the tau, all as shown in Table H. Each number is usually shown to 14 decimal places since the uncertainty of the anomalous magnetic moment of the electron requires this, even though the $\boldsymbol{v_o}$ velocities that produce the correct values at the respective lepton loop masses are not persuasive in their other outcomes.

The central values of each constant or property is used for all calculations. The accuracy of these does not permit any single $\boldsymbol{v_o}$ to produce all three anomalous magnetic moments at their respective lepton loop masses, although the respective $\boldsymbol{f}$-adjusted $\boldsymbol{v_o}$ velocities in Table G are the same to within $\pm 5x10^{-12}c$.

The tables show the different outcomes for different pinned $\boldsymbol{v_o}$ velocity values. There are six different possible v_o pinning values shown, each set to target an effect of those different velocities.

The velocities and distances used in the tables are natural units where $\boldsymbol{v_o} = \boldsymbol{v}/\boldsymbol{c}$, $\boldsymbol{r_o} = \boldsymbol{r}/\boldsymbol{r_*}$ and $\boldsymbol{V}$, $\boldsymbol{R}$ are used for printing clarity.

A Table A is the same calculation as was shown in reference [1] for the electron. The same magnetic moment is the result for each charged lepton loop to within 12 decimal places.

B Table B has the target of the same size mass energies for both meon and anti-meon. This simply means the same size angular momenta for each, which is always the case anyway. The correct magnetic moment is the result for each charged lepton loop to within 11 decimal places.

C Table C targets having the same gap in radii $\boldsymbol{r_o}$ and $\boldsymbol{r_i}$ from the central radius $\boldsymbol{r_x}$ value for each charged lepton loop. The same magnetic moment is the result for each charged lepton loop to within 10 decimal places.

D Table D targets the exact magnetic moments based on the calculation using $\boldsymbol{M_*}$ in the denominator of the equation for magnetic moment and is accurate to within 10 decimal places.

E Table E targets the exact magnetic moments, based on the calculation using each charged lepton mass $\boldsymbol{M_x}$ in the denominator of the equation for magnetic moment, and is accurate to within 14 decimal places. This table shows the strange result that each $\boldsymbol{f}$-adjusted velocity $\boldsymbol{v_o}$ is the same, to within $\pm 5x10^{-12}\boldsymbol{c}$ to exactly achieve each magnetic moment. However, the mass angular momenta values, although summing to zero over the loops, appear far too large individually to be consistent with $\boldsymbol{M_x c^2} = \boldsymbol{fhw_x}$.

F Table F targets a specifically different value for the mass momenta for the meon and anti-meon size at $(\boldsymbol{1} + \boldsymbol{j}/\boldsymbol{6})$. The same magnetic moment is the result for each charged lepton loop to within 12 decimal places.

G Table G shows the individual components of the mass momenta and charge momenta separated into fundamental $\boldsymbol{M}$, $\boldsymbol{Q}$ and twist $\boldsymbol{s}$, $\boldsymbol{q}$ types for each meon and anti-meon in the example given in Table A. Each energy type has an equal and opposite and yet there is an observable magnetic moment. This is because the mass energy twist component is internalized within the meons as the energy of their own axial rotation that net out whilst the charge energy twist component has relative directional and charge sign action that sum together in the same sense to produce a non-zero magnetic moment.

H Table H is the CODATA and derived properties used in the calculations shown in the tables and the predicted value for the anomalous magnetic moment of the tau as 0.001177.

X. CONCLUSION

This analysis has shown clearly that the spin quantum number of a fermion is $\boldsymbol{h}$ and not ½ $\boldsymbol{h}$. The $\boldsymbol{f}$ factor, usually used as ½ , is a relativistic effect that is linked to the velocity, radius and angular frequency of the meons as they rotate about a loop.

It is also clear that the energy of the intrinsic spin energy $\boldsymbol{h}$ ($\boldsymbol{f}$ $\boldsymbol{w}$) of a lepton is exactly equal and opposite to the mass energy $\boldsymbol{h}$ ($\boldsymbol{f}$ $\boldsymbol{w}$) of a lepton, which is itself the size of the kinetic energy of each of the meons and anti-meons $\boldsymbol{M_*}(\boldsymbol{fv^2})$ in the lepton loop where $\boldsymbol{f}$ at low velocity is equated to ½ .

The result of this extended pre-fermion loop dynamics framework is the same as in the previous, referenced, papers. There is no reasonable alternative available to generate the observed, and predicted, magnetic moments of the charged leptons if those rotating loops are not also in motion transversely. The conclusion must be that it is the external motion of the loops at the ‘magic’ frequency in Penning traps and cyclotrons that produce the observed full magnetic moments, including the anomalous parts.

The components of a charged lepton loop are its mass energy balanced by the same size opposite type spin energy, both being due to the rotational rate of the loop acting on the background, and the external charge energy balanced by the mass energy of axial rotation of the meons and anti-meons, both due to the twist action against the background. The fundamental mass and charge of the meons and anti-meons, and their associated energies and momenta, all sum to zero over the loop, but act to maintain the loop rotational rate, although depleted by the viscosity of the background over distance travelled.

XI. REFERENCES

1 Lawrence, M.: Why the intrinsic spin quantum number of a fermion is h and not ½ h and how to correctly reconcile velocities in momentum and energy equations (pre-print). Researchgate, (2020)

2 Lawrence, M.: A viscosity hypothesis – that the presence or absence of viscosity separates relativistic and quantum systems based on the simplest possible theory of everything, LAP Lambert Academic Publishing (2017) ISBN: 978-3-330-08736-1

3 Lawrence, M.: A hypothetical pre-fermion particle theory of everything based on 95 theses (pre-print), Researchgate, (2018)

4 Lawrence, M.: A physical explanation for why the electron spin g-factor exceeds 2 (pre-print), Researchgate, (2020)

5 https://en.wikipedia.org/wiki/Quantum_electrodynamics and https://en.wikipedia.org/wiki/Anomalous_magnetic_moment

6 E. Barlas-Yucel.: Current status of Muon g-2 experiment at Fermilab, Conference on flavour physics and CP

violation (FPCP) 2020.

7 Lawrence, M.: Eliminating the Gravitational Constant G from General Relativity and Cosmology, Journal of Physics and Chemistry Research, ISSN: 2582-3361, (November 2020), doi.org/10.36266/JPCR/122

8 CODATA from the Physical Measurement Laboratory of NIST, The NIST Reference on Constants, Units and Uncertainty, https://physics.nist.gov/cuu/Constants/Citations/Search.html

9 https://en.wikipedia.org/wiki/Anomalous_magnetic_moment

TABLES							
A	***Target h =1***	***This is same as the paper in reference [1] where each meon is constrained to have angular momentum equal the size of Planck's constant***					
	electron	muon	tau		electron	muon	tau
Set ***V*** *outer*	2.02757629665073E-09	2.91554108761315E-08	1.19562162544233E-07		ƒ ADJUSTED	ƒ ADJUSTED	ƒ ADJUSTED
V *outer*	2.02757629665073E-09	2.91554108761315E-08	1.19562162544233E-07		1.43371298373484E-09	2.06159887387926E-08	8.45432159083554E-08
V *inner*	2.01609236630323E-09	2.89902783934193E-08	1.18884977893218E-07		1.42559258371145E-09	2.04992224404727E-08	8.40643740495070E-08
V *difference*	1.14839303475002E-11	1.65132482712153E-10	6.77184651015381E-10		8.12036502339147E-12	1.16766298319934E-10	4.78841858848414E-10
R *outer*	4.96017021737306E+08	3.44948785075496E+07	8.41162734604918E+06		7.01473999308808E+08	4.87831250177889E+07	1.18958374744112E+07
R *inner*	4.93207645370944E+08	3.42995039695948E+07	8.36398497485421E+06		6.97500941149689E+08	4.85068236964708E+07	1.18284609869236E+07
R *difference*	2.80937636636174E+06	1.95374537954777E+05	4.76423711949707E+04		3.97305815911925E+06	2.76301321318023E+05	6.73764874875396E+04
h *outer (meon)*	-1.00000000000000	-1.00000000000000	-1.00000000000000		-1.00000000000000	-1.00000000000000	-1.00000000000000
h *inner (meon)*	1.00000000000000	1.00000000000000	1.00000000000000		1.00000000000000	1.00000000000000	1.00000000000000
h *total (pair)*	0.00000000000000	0.00000000000000	0.00000000000000		0.00000000000000	0.00000000000000	0.00000000000000
U *outer (meon)*	-1.01142471201970	-1.01142471201970	-1.01142471201970		-1.01142471201970	-1.01142471201970	-1.01142471201970
U *inner (meon)*	0.98870433766950	0.98870433766950	0.98870433766950		0.98870433766950	0.98870433766950	0.98870433766950
U *total for Mx (loop)*	-0.06816112305060	-0.06816112305060	-0.06816112305060		-0.06816112305060	-0.06816112305060	-0.06816112305060
U *total loop as (Mx)/q*	-2.00006452484459	-2.00006452484458	-2.00006452484456		-2.00006452484460	-2.00006452484458	-2.00006452484456
U *total for* ***M**** *(loop)*	-9.17183577845777E-06	-1.89644473572131E-03	-3.18925600827547E-02		-9.17183577845777E-06	-1.89644473572131E-03	-3.18925600827547E-02
U *total/ anomalous* ***U***	-4.58060597951314E-06	-9.47118103069520E-04	-1.59275333346425E-02		-4.58060597951316E-06	-9.47118103069520E-04	-1.59275333346425E-02
B	***Target is to have equal mass energies for meons and anti-meons***						
	electron	muon	tau		electron	muon	tau
Set ***V*** *outer*	2.02871887220000E-09	2.91719318020000E-08	1.19630574415000E-07		ƒ ADJUSTED	ƒ ADJUSTED	ƒ ADJUSTED
V *outer*	2.02871887220000E-09	2.91719318020000E-08	1.19630574415000E-07		1.43452087165374E-09	2.06276707975057E-08	8.45915904060884E-08
V *inner*	2.01722847045212E-09	2.90067057468969E-08	1.18953002287982E-07		1.42639593065926E-09	2.05108383335136E-08	8.41124745603308E-08
V *difference*	1.14904017478844E-11	1.65226055103121E-10	6.77572127018199E-10		8.12494099448663E-12	1.16832463992118E-10	4.79115845757561E-10
R *outer*	4.96296536210815E+08	3.45144250450032E+07	8.41644036674647E+06		7.01869292468125E+08	4.88107679961532E+07	1.19026441135572E+07
R *inner*	4.93485576710566E+08	3.43189397979841E+07	8.36877073522372E+06		6.97893995419591E+08	4.85343101085749E+07	1.18352290741444E+07
R *difference*	2.81095950024933E+06	1.95485247019097E+05	4.76696315227532E+04		3.97529704853404E+06	2.76457887578264E+05	6.74150394128058E+04
h *outer (meon)*	-1.00112735336475	-1.00113362193615	-1.00114470065595		-1.00112735336475	-1.00113362193615	-1.00114470065595
h *inner (meon)*	1.00112735336475	1.00113362193615	1.00114470065595		1.00112735336475	1.00113362193615	1.00114470065595
h *total (pair)*	0.00000000000000	0.00000000000000	0.00000000000000		0.00000000000000	0.00000000000000	0.00000000000000
U *outer (meon)*	-1.01256494507199	-1.01257128526000	-1.01258249055099		-1.01256494507199	-1.01257128526000	-1.01258249055099
U *inner (meon)*	0.98981895683132	0.98982515459504	0.98983610817337		0.98981895683132	0.98982515459504	0.98983610817337
U *total for Mx (loop)*	-0.06823796472202	-0.06823839199488	-0.06823914713287		-0.06823796472202	-0.06823839199488	-0.06823914713287
U *total loop as (Mx)/q*	-2.00231930431639	-2.00233184186366	-2.00235400001814		-2.00231930431638	-2.00233184186366	-2.00235400001815
U *total for* ***M**** *(loop)*	-9.18217567838350E-06	-1.89859458707442E-03	-3.19290675172021E-02		-9.18217567838345E-06	-1.89859458707442E-03	-3.19290675172022E-02
U *total/ anomalous* ***U***	-4.58576994107673E-06	-9.48191776927282E-04	-1.59457655924987E-02		-4.58576994107671E-06	-9.48191776927282E-04	-1.59457655924987E-02
C	***Target is to have exact gap in Ro above and Ri below Re***						
	electron	muon	tau		electron	muon	tau
Set ***V*** *outer*	2.02755176671570E-09	2.91550581494150E-08	1.19560716062500E-07		ƒ ADJUSTED	ƒ ADJUSTED	ƒ ADJUSTED
V *outer*	2.02755176671570E-09	2.91550581494150E-08	1.19560716062500E-07		1.43369560345144E-09	2.06157393233395E-08	8.45421930913131E-08
V *inner*	2.01606797530258E-09	2.89899276645014E-08	1.18883539604170E-07		1.42557533666949E-09	2.04989744376765E-08	8.40633570255684E-08
V *difference*	1.14837914131154E-11	1.65130484913574E-10	6.77176458329610E-10		8.12026678194578E-12	1.16764885663011E-10	4.78836065744753E-10
R *outer*	4.96011020845829E+08	3.44944611831194E+07	8.41152558086660E+06		7.01465512766695E+08	4.87825348319197E+07	1.18956935567098E+07
R *inner*	4.93201678467742E+08	3.42990890088363E+07	8.36388378605648E+06		6.97492502674255E+08	4.85062368533383E+07	1.18283178843535E+07
R *difference*	2.80934237808716E+06	1.95372174283080E+05	4.76417948101162E+04		3.97301009244025E+06	2.76297978581458E+05	6.73756723562628E+04
h *outer (meon)*	-0.99997580383369	-0.99997580383385	-0.99997580383371		-0.99997580383369	-0.99997580383385	-0.99997580383371
h *inner (meon)*	0.99997580383369	0.99997580383385	0.99997580383371		0.99997580383369	0.99997580383385	0.99997580383371
h *total (pair)*	0.00000000000000	0.00000000000000	0.00000000000000		0.00000000000000	0.00000000000000	0.00000000000000
U *outer (meon)*	-1.01140023941915	-1.01140023941932	-1.01140023941918		-1.01140023941915	-1.01140023941932	-1.01140023941918
U *inner (meon)*	0.98868041481491	0.98868041481507	0.98868041481494		0.98868041481491	0.98868041481507	0.98868041481494
U *total for Mx (loop)*	-0.06815947381273	-0.06815947381274	-0.06815947381273		-0.06815947381273	-0.06815947381274	-0.06815947381273
U *total loop as (Mx)/q*	-2.00001613095068	-2.00001613095102	-2.00001613095076		-2.00001613095067	-2.00001613095105	-2.00001613095075
U *total for* ***M**** *(loop)*	-9.17161385519367E-06	-1.89639884902938E-03	-3.18917884050681E-02		-9.17161385519363E-06	-1.89639884902941E-03	-3.18917884050678E-02
U *total/ anomalous* ***U***	-4.58049514640896E-06	-9.47095186442530E-04	-1.59271479493976E-02		-4.58049514640894E-06	-9.47095186442544E-04	-1.59271479493975E-02
D	***Target is anomalous magnetic moments using M* in denominator***						
	electron	muon	tau		electron	muon	tau
Set ***V*** *outer*	2.02871887220000E-09	2.91719318020000E-08	1.19630574415000E-07		ƒ ADJUSTED	ƒ ADJUSTED	ƒ ADJUSTED
V *outer*	2.02871887220000E-09	2.91719318020000E-08	1.19630574415000E-07		1.43452087165374E-09	2.06276707975057E-08	8.45915904060884E-08
V *inner*	2.01722847045212E-09	2.90067057468969E-08	1.18953002287982E-07		1.42639593065926E-09	2.05108383335136E-08	8.41124745603308E-08
V *difference*	1.14904017478844E-11	1.65226055103121E-10	6.77572127018199E-10		8.12494099448663E-12	1.16832463992118E-10	4.79115845757561E-10
R *outer*	4.96296536210815E+08	3.45144250450032E+07	8.41644036674647E+06		7.01869292468125E+08	4.88107679961532E+07	1.19026441135572E+07
R *inner*	4.93485576710566E+08	3.43189397979841E+07	8.36877073522372E+06		6.97893995419591E+08	4.85343101085749E+07	1.18352290741444E+07
R *difference*	2.81095950024933E+06	1.95485247019097E+05	4.76696315227532E+04		3.97529704853404E+06	2.76457887578264E+05	6.74150394128058E+04
h *outer (meon)*	-1.00112735336475	-1.00113362193615	-1.00114470065595		-1.00112735336475	-1.00113362193615	-1.00114470065595
h *inner (meon)*	1.00112735336475	1.00113362193615	1.00114470065595		1.00112735336475	1.00113362193615	1.00114470065595
h *total (pair)*	0.00000000000000	0.00000000000000	0.00000000000000		0.00000000000000	0.00000000000000	0.00000000000000
U *outer (meon)*	-1.01256494507199	-1.01257128526000	-1.01258249055099		-1.01256494507199	-1.01257128526000	-1.01258249055099
U *inner (meon)*	0.98981895683132	0.98982515459504	0.98983610817337		0.98981895683132	0.98982515459504	0.98983610817337
U *total for Mx (loop)*	-0.06823796472202	-0.06823839199488	-0.06823914713287		-0.06823796472202	-0.06823839199488	-0.06823914713287
U *total loop as (Mx)/q*	-2.00231930431639	-2.00233184186366	-2.00235400001814		-2.00231930431638	-2.00233184186366	-2.00235400001815
U *total for* ***M**** *(loop)*	-9.18217567838350E-06	-1.89859458707442E-03	-3.19290675172021E-02		-9.18217567838345E-06	-1.89859458707442E-03	-3.19290675172022E-02
U *total/ anomalous* ***U***	-4.58576994107673E-06	-9.48191776927282E-04	-1.59457655924987E-02		-4.58576994107671E-06	-9.48191776927282E-04	-1.59457655924987E-02
E	***Target is to get anomalous magnetic moments using lepton sizes with Me as denominator***						
	electron	muon	tau		electron	muon	tau
Set ***V*** *outer*	9.47361513638950E-07	9.47364479566285E-07	9.47369721413086E-07		ƒ ADJUSTED	ƒ ADJUSTED	ƒ ADJUSTED
V *outer*	9.47361513638950E-07	9.47364479566285E-07	9.47369721413086E-07		6.69885750529254E-07	6.69887847756585E-07	6.69891554302004E-07
V *inner*	9.41995780347185E-07	9.41998729475891E-07	9.42003941633548E-07		6.66091604132608E-07	6.66093689481514E-07	6.66097375033539E-07
V *difference*	5.36573329176482E-09	5.36575009039434E-09	5.36577977953780E-09		3.79414639664532E-09	3.79415827507020E-09	3.79417926846479E-09
R *outer*	2.31758201789969E+11	1.12086304541708E+09	6.66508608232068E+07		3.27755592162575E+11	1.58513972039164E+09	9.42585513200207E+07
R *inner*	2.30445553259201E+11	1.11451462185150E+09	6.62733589533344E+07		3.25899226807734E+11	1.57616169368552E+09	9.37246830558259E+07
R *difference*	1.31264853076767E+09	6.34842356557393E+06	3.77501869872421E+05		1.85636535484076E+09	8.97802670612359E+06	5.33868264194787E+05
h *outer (meon)*	-2.18311726542849E+05	-1.05583453294695E+03	-6.27843608291171E+01		-2.18311726542849E+05	-1.05583453294695E+03	-6.27843608291171E+01
h *inner (meon)*	2.18311726542849E+05	1.05583453294695E+03	6.27843608291170E+01		2.18311726542849E+05	1.05583453294695E+03	6.27843608291171E+01
h *total (pair)*	0.00000000000000	0.00000000000000	0.00000000000000		0.00000000000000	0.00000000000000	0.00000000000000
U *outer (meon)*	-2.20805875149124E+05	-1.06789713842632E+03	-6.35016540709306E+01		-2.20805875149124E+05	-1.06789713842632E+03	-6.35016540709306E+01
U *inner (meon)*	2.15845750997032E+05	1.04390818258589E+03	6.20751698895550E+01		2.15845750997032E+05	1.04390818258589E+03	6.20751698895550E+01
U *total for Mx (loop)*	-1.48803724562764E+04	-7.19668675212708E+01	-4.27945254412684E+00		-1.48803724562764E+04	-7.19668675212708E+01	-4.27945254412684E+00
U *total loop as (Mx)/q*	-4.36637539615921E+05	-2.11173719345302E+03	-1.25572772809359E+02		-4.36637539615921E+05	-2.11173719345302E+03	-1.25572772809359E+02
U *total for* ***M**** *(loop)*	-2.00231930436256	-2.00233184179999	-2.00235400000000		-2.00231930436256	-2.00233184179999	-2.00235400000000
U *total/ anomalous* ***U***	-1.00000000000000	-1.00000000000000	-1.00000000000000		-1.00000000000000	-1.00000000000000	-1.00000000000000

F	***Target here is to have meon angular momentum at h= 1+j/6***								
	electron	muon	tau		electron	muon	tau		
Set ***V*** *outer*	2.03332636902424E-09	2.92380936944768E-08	1.19901232935270E-07		*ƒ* ADJUSTED	*ƒ* ADJUSTED	*ƒ* ADJUSTED		
V *outer*	2.03332636902424E-09	2.92380936944768E-08	1.19901232935270E-07		1.43777886390246E-09	2.06744543203322E-08	8.47829748811572E-08		
V *inner*	2.02180987100925E-09	2.90724929069574E-08	1.19222127833340E-07		1.42963547006054E-09	2.05573568805074E-08	8.43027750584441E-08		
V *difference*	1.15164980149858E-11	1.65600787519414E-10	6.79105101930105E-10		8.14339384191784E-12	1.17097439824811E-10	4.80199822713158E-10		
R *outer*	4.97423693228876E+08	3.45927037032089E+07	8.43548216527284E+06		7.03463333209991E+08	4.89214707362320E+07	1.19295732832852E+07		
R *inner*	4.94606349656813E+08	3.43967750959769E+07	8.38770468346187E+06		6.99479007720514E+08	4.86443858426276E+07	1.18620057205321E+07		
R *difference*	2.81734357206333E+06	1.95928607231990E+05	4.77774818109655E+04		3.98432548947656E+06	2.77084893604353E+05	6.75675627531018E+04		
h *outer (meon)*	-1.00567991033988	-1.00567991033988	-1.00567991033988		-1.00567991033988	-1.00567991033988	-1.00567991033988		
h *inner (meon)*	1.00567991033988	1.00567991033988	1.00567991033988		1.00567991033988	1.00567991033988	1.00567991033988		
h *total (pair)*	0.00000000000000	0.00000000000000	0.00000000000000		0.00000000000000	0.00000000000000	0.00000000000000		
U *outer (meon)*	-1.01716951369951	-1.01716951369951	-1.01716951369951		-1.01716951369951	-1.01716951369951	-1.01716951369951		
U *inner (meon)*	0.99432008966012	0.99432008966011	0.99432008966011		0.99432008966012	0.99432008966011	0.99432008966011		
U *total for Mx (loop)*	-0.06854827211820	-0.06854827211820	-0.06854827211820		-0.06854827211820	-0.06854827211820	-0.06854827211819		
U *total loop as (Mx)/q*	-2.01142471201971	-2.01142471201969	-2.01142471201969		-2.01142471201970	-2.01142471201970	-2.01142471201968		
U *total for* ***M**** *(loop)*	-9.22393098333158E-06	-1.90721637178476E-03	-3.20737069645346E-02		-9.22393098333153E-06	-1.90721637178477E-03	-3.20737069645344E-02		
U *total/ anomalous* ***U***	-4.60662341077914E-06	-9.52497648976238E-04	-1.60180002959190E-02		-4.60662341077912E-06	-9.52497648976243E-04	-1.60180002959189E-02		
G	***Using the h=1 set in Table A, each momentum type is split out individually for the meons/anti-meons and then summed by type***								
Moment type	*inner*	*inner*			*outer*	*outer*	*vector sums*		***U*** *and* ***h*** *totals by type*
for meon/anti-meons	*fundamental M Q*	*twist s q*			*fundamental M Q*	*twist s q*			*(sum two lines each)*
- ***M V****o* ***R****o*					-1.00571235600985		-1.00571235600985		
*+****s****/6* ***V****o* ***R****o*						0.00571235600985	0.00571235600985		-1.00000000000000
*+****M V****i* ***R****i*	0.99435216883475						0.99435216883475		
*+****s****/6* ***V****i* ***R****i*		0.00564783116525					0.00564783116525		1.00000000000000
Sub total (directional)							0.00000000000000		
- ***Qc V****o* ***R****o*					-1.00571235600985		-1.00571235600985		
- ***qc****/6* ***V****o* ***R****o*						-0.00571235600985	-0.00571235600985		-1.01142471201970
*+****Qc V****i* ***R****i*	0.99435216883475						0.99435216883475		
- ***qc****/6* ***V****i* ***R****i*		-0.00564783116525					-0.00564783116525		0.98870433766950
Sub total (directional)							-0.02272037435020		
									-0.02272037435020
h *and* ***U*** *totals by type*	1.98870433766950	0.00000000000000			-2.01142471201970	0.00000000000000	-0.02272037435020		
U *overall total/* ***q***							-2.00006452484457		
H	***CODATA used in calculating the values in the tables and derived properties***								
	Values in SI (no ***G****)*	*DASI units*	*relative uncertainty*		*Derived properties*				
Planck's constant ***h***	6.62607015000000E-34	6.62607015000000E-34	(exact)				***f****- adjusted*		
Light speed ***c***	2.99792458000000E+08	2.99792458000000E+08	(exact)		*Adjusted-Planck mass* ***M****	4.45695620031085E-13			
Electron mass ***Me***	9.10938370150000E-31	2.04385757725523E-18	3.0E-10		*Adjusted-Planck radius* ***R****	4.95903256610439E-30	7.01313111123469E-30		
Muon mass ***Mu***	1.88353162700000E-28	4.22604921912545E-16	2.2E-08		*Adjusted-Planck frequency* ***W****	6.04538191681012E+37	3.02269095840506E+37		
Tau mass ***Mt***	3.16754000000000E-27	7.10695788255465E-15	6.8E-05		*Electron angular frequency* ***We***	4.08771515451046E-18	2.04385757725523E-18		
Electron magnetic moment ***Ue***	2.00231930436256	3.5E-13	1.7E-13		*Muon angular frequency* ***Wu***	8.45209843825091E-16	4.22604921912545E-16		
Muon magnetic moment ***Uu***	2.00233184180000	1.3E-09	6.3E-10		*Tau angular frequency* ***Wt***	1.42139157651093E-14	7.10695788255465E-15		
Tau magnetic moment ***Ut***	2.00235400000000		(estimate [9])						
Fine structure constant ***α***	7.29735256930000E-03	-1.1E-12	1.5E-10						
Value (1-j)/(1+j)	0.98870433766950								
Value √((1-j)/(1+j))	0.99433612911807								
Electron charge ***q***	3.40794620393051E-02								
Value ***s****/6* ***M*** *and* ***qc****/6* ***Q***	5.67991033988418E-03								
f *= 1/2 used*	0.50								
Ve *central velocity to set vs* ***Vo***	2.02180987100926E-09								
Vu *central velocity to set vs* ***Vo***	2.90724929069574E-08								
Vt *central velocity to set vs* ***Vo***	1.19222127833340E-07								