The New Scientific Revolution - The Real Foundations of Physics (that they won't tell you about)

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Frustra fit per plura quod potest fieri per pauciora - It is futile to do with more things that which can be done with fewer

(William of Occam, Summa Totius Logicae i. 12)

Part I

Introduction

There is no such thing as the "New Scientific Revolution", and this is a book about it. With apologies to Steven Shapin for corrupting the opening to his excellent book 'The Scientific Revolution', but there are parallels in the new revolution that echo the older original one that is the subject of his book. There is a small but growing band that disagrees with the current scientific orthodoxy of the Standard Model and the biased system of peer review that maintains the present mainstream interpretation. The overturning of the old Aristotelian system by the small number of proponents of the mathematical interpretation was the original Scientific Revolution.

The current small band, of which I count myself just one, is trying to do the same to overturn the mathematical interpretation - not because the numbers are wrong - but because the current paradigm is built on foundations that do not go deep enough. If the simplest framework that is possible is able to explain everything we observe, its quirks, relativistic effects and quantum phenomena included, but is ignored because it contains aspects that are 'not allowed' in the current orthodoxy, then the foundations of that orthodoxy need to be challenged. That is what this book is about - a new scientific revolution that has started, but has not yet succeeded, in overthrowing the old scientific revolution.

Occam's Razor, quoted above, is the foundation of the framework which I will be explaining here, although it is not the only driver. Maybe the greatest driver is simply curiosity - given the many puzzle pieces that make up fundamental physics, what is the simplest single explanation that contains all the elements that we observe? However, I am not up to the task of explaining myself to the level required by Occam, so I apologise in advance for my excess wordiness where I feel that I have to explain a point to extremes. I have tried to avoid this by breaking some explanations into separable parts and concentrating on just one aspect of each initially, then providing more detail on the others later. A significant other driver of the framework is the requirement that there are as few adjustable parameters as possible. By limiting the number of adjustments possible, the veracity of the framework becomes easier to prove. Where the Standard Model has seventeen tuneable parameters, I use only 1, 2, π, the fine structure constant and the masses of the known building block particles. By 1, I mean Planck mass units, although adjusted slightly, as will be explained later. However, there are a still a number of relatively minor parameters that I have not pinned down, such as the various influence distances, which are described below and the major one - the anomalous magnetic moments of the charged leptons.

As many humorous providers of directions have stated to those lost on their way to somewhere -' I wouldn't start from here', but I need to make sure from the outset, as mentioned above, that my own foundations are understood to be the simplest that can ever be possible. There can be nothing simpler than the base framework that I will be using to explain all phenomena, which is that there is only one kind of particle (existing in particle and anti-particle form), only one method of motion of every particle and only one composite structure made from these particles. Each particle has only two sorts of base energy, which are equal and opposite and always sum to zero. Everything we observe can be built from these meagre and symmetric properties.

1 *Beginnings*

In 1994 I started thinking about the foundations of physics because my chosen career in finance, running my own business at that time, left me with a fair amount of free time. The business took place mostly in the mornings and my afternoons were relatively quiet. I had considered an academic career based on my physics degree in 1978 but other priorities overrode my desire and enthusiasm. So having spare time, especially on regular long journeys between London and Mid-Wales, I considered what I could do to add value away from the world of finance.

My thought process was quite simple and short. I had always enjoyed physics and done well in science and there were many unexplained paradoxes waiting to be looked into. However, I did not have access to any apparatus allowing me to explore the experimental side, so my contribution would have to be theoretical in nature.

Having made this decision, and knowing the area well, I determined to start from the bottom level and work upwards. My first question was: How can you start with nothing and yet produce something?

2 *The Physical Foundations*

It took many years to arrive at the result that this book explores. But the main guiding principles were quite simple, although they themselves only emerged gradually. The guiding principles are; 1) Everything we experience is made up of a single sort of base particle (existing as particle and anti-particle, with opposite properties) even though in most instances such particle pairs overlap and appear to distant observers not to be there; 2) For each property that a particle has, it has a different property that is of opposite sort (there are only two base sorts of property but their motions and interactions make it appear that there are more); 3) Base particles chase their opposite type and form a structure like a necklace (these necklaces include what we call our building blocks - the quarks and leptons); 4) All necklaces obey the equality of properties in guideline 2 above; 5) Energy is a vector property; and 6) For each form of energy there are two distances from a necklace at which the influence of the properties of the necklace change, one due to the physical size of the necklace and one due to the size of the relevant energy which the necklace has.

With these six guidelines, it possible to recreate all the structures and interactions known to the world of physics.

3 *The Interpretation Conflict*

The problem is that these guidelines contain within them implications that run counter to accepted physics. Two simple examples of this are vector energy and negative mass. In the case of energy, because orthodox physics does not define energy well, it sets constraints on what it understands energy to be. The different equations for force and energy interactions in a classical 2-body rotating system reinforce this thinking because the sizes of force and energy required for a stable orbit, adjusted for the extra distance factor in the force equation, are different.

What is not taken into account in the two different equations is that, as will be described later, in order for the bodies to be in a mutually stable orbit, both the force on and energy in each body must be in balance, or in my terms must total zero, otherwise they would move to a different separation. Current physics is missing a complete energy component in the classical energy equation. But it manages to find it in the quantum equivalent system, although it treats the result as defining the energy to exist in allowable quanta rather than accepting that each stable orbit has zero total energy, with the positive energies of motion balancing the negative potential energies.

If the quantum 2-body equations for force and energy produce the same results, adjusted for distance as before, then force and energy can be linked strongly with only that extra distance dimension being the difference. However, once more there is a long standing misinterpretation at work, involving centripetal and centrifugal forces. Currently physics interprets motion in a circle as generating a centripetal acceleration that stops an orbiting body spiralling into the other body. Instead, my interpretation is that the energy and force of an orbiting body act outward, away from the

central body - actually from the mutual centre of mass. This enables the balancing of the inward potential energy and force with the outward potential energy and force in a system that remains stable precisely because the inward and outward energy and force vectors cancel.

In the case of negative mass, the issue is one of understanding what is meant by 'mass'. Presently physics, again, has no good definition or understanding of what mass is and so immediately refuses to consider any ideas that contain the concept of negative mass. But what I use to mean negative mass applies only to the base particle type, not to the accepted building blocks, the quarks and leptons.

To get more specific, I contend that the base particle is of Planck mass size (slightly adjusted as detailed later) and appears in only two types. One type has positive base mass and positive base charge, both of equal size and strength, and which I call a positive meon. The other type has negative base mass and negative base charge, again both of equal size and strength, which I call a negative meon.

The structures formed by combining these two meon types come in only four varieties. One variety is where there is only one meon of each type present and the two overlap to some extent. The second variety is where there are equal numbers of each meon type with each meon chasing an opposite type in a necklace structure, but they do not usually overlap with each other inside the necklace. The third variety is a combination of the first two, where an even number of necklaces overlap so that the component meons are themselves overlapping with meons in the other necklace. The fourth variety is where the necklaces sit parallel to each other without overlapping, which I call stacking and the result is a stack.

Considering the second variety of structure first. This necklace, when it has six meons as its only constituents, I call a ring. All other even numbers of meons in a necklace I call loops or necklaces. The reason for this differentiation will be explained soon, but it does not matter yet.

The ring with three positive meons and three negative meons in alternating positions can be considered to be rotating because the meons are each mutually chasing the opposite type meon in front. Without wishing to use formulae unless absolutely necessary (there is an appendix at the back that contains the major formulae and some explanation) I can only state baldly here that the momentum of each meon in the ring is equal to Planck's constant h and its frequency of rotation is w, so that the energy that the ring appears to have, and what we would call its mass, ought to be equal to hw. However, there is confusion at work here. The actual motional energy present is only the difference between the relativistic kinetic and rest-mass energies of the meons, so is actually half this size when the ring frequency is low, as detailed in the appendix.

I contend that there is another energy of equal size present that works in a similar way to what we call mass in some circumstances and that this 'spin' energy is part of the previously mentioned dissonance between force and energy, as will be explained later. The energy $\frac{1}{2}hw$ is what physics calls the mass of a particle. What current physics thinks of as an amorphous ball of energy that has a mass, is actually a composite structure whose excess base mass relativistic energies in each meon, of angular momentum h, are what drive the ring around and which we interpret through its frequency of rotation w as its mass. The sum of each excess kinetic energy, taking the same sign as the base mass, and the underlying positive and negative meon base masses, is always zero in all rings. So what we term mass energy is just a counting method, referenced for masses to the rotational rate of the rings. I need to point out here that because of my choice of adjusted Planck mass size, as explained later, my w is smaller than that normally used by 2π, so the energy of a particle that would usually be described as $\frac{1}{2}hw/2\pi$ is the same size as my $\frac{1}{2}hw$. This point will need to be made again from time to time.

What this means overall is that because the orientation of counting doesn't matter far enough from a necklace, we will measure all ring frequencies or masses as positive. So accepting the negative base mass of one of the two fundamental building blocks does not lead to a negative mass in the quarks and leptons. However, guideline six allows that for each form of energy, the nature of interaction of two necklaces will change when each passes one of two distances, the physical one being the actual size of the ring and the other one, which I term for masses the 'influence distance' or 'id' of the other necklace, which is proportional to the size of the relevant energy that is interacting with the first

ring. Outside this id distance, one ring cannot feel the rotational aspect of the other necklace and so interacts only on size and not orientation information. What this means for necklaces is that although they may all be positive in counting when outside the id, the relative orientation when inside the id will lead to differential effects of attraction or repulsion of dependent on the relative orientation of the necklaces. Here orientation is mainly meant to mean either parallel (same plane of rotation for both necklaces and same direction of rotation) or antiparallel (same plane, opposite direction of rotation).

Where the relative orientation of two necklaces is between parallel and antiparallel, guideline six suggests that there will be some relative angle at which there is no effect, for an energy that is orientation dependent, between the two necklaces. This will be explored below in relation to spin energy orientations.

Returning to the other three meon structures, the first variety is where a single positive meon overlaps a single negative meon. If the overlap is complete, then the positive base mass of the positive meon and negative base mass of the negative meon sum to zero. Similarly the positive base charge of the positive meon and the negative base charge of the negative meon balance to zero. What the structure looks like is nothing, literally. Even if the overlap is not complete, farther away than the physical size of the two meons, nothing will be observable. Here is the answer to my original question - how can something emerge from nothing.

Whilst this structural variety is interesting, it is not something that will be observable by us using rings to make the observation. But it is the fount from which all meons in rings have been unmerged and is the background structure of the universe, interacting with rings as the entities transmitting each of the forces in ways that I will describe later. Why the meons first became unmerged and available to form rings is beyond this book.

Because the physical size of the meons, in line with their mass size, is on the Planck scale, what we have as the fundamental building blocks of all matter are black holes. The density of these black holes, the positive and negative meons, is the most dense possible, so they cannot be broken apart by anything. Even a massive stellar black hole, such as is thought to exist at the centre of most galaxies, is not strong enough to tear meons apart because all the components within each galactic black hole are themselves made of meons. Inside such a galactic black hole, the meons are like diamonds compared with the watery average density across the whole black hole.

In the discussion of mass above, I did not wish to confuse matters by being too specific too early. But it needs to be made clear that the property called 'base mass' of a meon is not necessarily the same as the 'mass' of a ring, even allowing that the former is its rest-mass energy and the latter is the excess of relativistic kinetic over rest-mass energy. What this means is that the actions of meon base mass need not be the same as those of what current physics calls mass. Because we do not observe negative base mass, due to the construction of rings, we cannot say that the actions are the same or different. What I contend is that the actions of positive and negative base mass are symmetric.

I suggest that, just as a positive mass attracts a positive mass, so a negative mass attracts a negative mass. Mass is a positive sort of energy because it attracts its own sort of energy, although it exists in both positive and negative base mass forms,. What drives all asymmetries is the action between opposite base mass types. I propose that a positive base mass and a negative base mass can remain at a specific separation from each other until they are perturbed, because this is their minimum energy state at that separation. The perturbation between the two opposite types of meon causes one meon to be attracted to the other, whilst the other is repelled by the first. The two try to maintain separation by mutually chasing along the axis between them. At all velocities, the pair has a total of zero energy because every positive energy is balanced by an exactly equal negative energy. Additionally, one further guidance to add, is that nature prefers smaller rather than larger amounts of any energy, so the absence of motion is preferred to the presence of motion even though both states for the two meons have zero total energy.

I have not mentioned the potential energy within rings, between the meons. I will go into more detail later, but the basic structure of a ring is stable in size at all sizes. The inward potential energies of meons acting on each other exactly balances their outward motional energies, leaving only the circumferential energy driving the meons around in the ring at the velocity and frequency appropriate for the energy balance that they possess. To change the size of a ring (its mass) requires frequency to be added or subtracted by another ring or collection of rings, which is only a

change in the mix of energies present within the ring, the total still summing to zero although the individual meons may have faster or slower velocities at higher or lower frequencies respectively.

Looking at charge is simpler. We observe both positive and negative electronic charges and the interaction between them. My contention is that the actions of the meon positive and negative base charges are exactly the same as is usually observed between electronic charges (although different in size). However, once again, provided the actions of the property called the 'base charge' of a meon are the same kind as electronic charge, what the actual property is does not matter. The base charge of the meons themselves, of adjusted Planck mass equivalent size, will be differentiated from electronic charge by continuing to be called base charge. Charge is a negative sort of energy because each attracts its opposite sort.

Just like the rest-masses of the meons in a ring, the total base charges or whatever the actual property is, always sum to zero over a ring. As will be explained, what we observe as electronic charge is actually a product of the spinning of the meons as they rotate around the ring (which to avoid confusion I will always refer to in future as 'twisting'). The relativistic excess of kinetic base charge energy over rest-charge energy is what is currently described as the 'spin' of a particle (a quark or lepton ring). The size of the excess base charge energy is identical to the excess base mass energy. The excess base mass energy as already mentioned is the mass of the ring, a positive sort of energy, whereas the excess base charge energy is the spin energy of the ring, a negative sort of energy. The two energies sum to zero over every ring.

The property opposite to charge is the energy that makes the meons twist. It is an energy of motion and so will be positive, in that it will attract same sorts and will chase opposites directly within a ring. However, I contend that it will not act directly beyond the ring‘s charge id and will then be ring-orientation dependent, attracting anti-parallel ring twist and chasing parallel ring twist. It will still be present, but will act only when rings get close enough. As explained later, I have identified this as the strong energy and is likely to be one of the causes of the anomalous magnetic moments of the charged leptons.

Charge and mass are not ring-orientation dependent energies, whereas strong and spin are orientation dependent and additionally depend on whether one ring can ‘see‘ the orientation of the other. Outside ids, relative spin orientation does not matter, although the spin and strong energies still exist within each ring. Inside ids, masses will attract whilst spins will be proportional to parallel or antiparallel relative orientations. Since spin is the product of the excess of relativistic charge energy over rest-charge energy, it is the sort of energy where opposites attract and alike repel. However, instead of opposite spin rings attracting, I infer that they repel. This inference is made because otherwise two uncharged rings adjacent and spinning parallel would have a net force of attraction between them, their mass attraction exactly equalling their spin attraction. This would imply that there would be no reason not to continue adding similar rings ad infinitum, which we do not observe. This difference in action can be justified by presuming that nature prefers smaller rather than larger energy balloons in rings with charge or mass, so a stack will preferentially have as small a spin total as possible. In the case of photons, since they have no overall charge or mass, the preference does not apply.

My interpretation is that the underlying reason for the Pauli exclusion principle is that two same spin rings chase each other when perturbed. So no two rings with the same mass attraction (energy) can form stable orbits when they have the same spins. The size of the spin interaction may be much smaller in an electron orbital than their charge interaction, but it will disrupt the otherwise constant force from the nucleons.

The change in interaction at ids, when one ring becomes able to feel the orientation influence of the other, acts as one form of delineation between quantum and classical regimes, although it is not the complete picture. Where rings are widely separated, the attraction between uncharged rings dominates and is defined as the classical regime, whereas when rings are at close distances, their relative orientations matter and we enter the quantum regime.

Because of the differential effects of relative ring orientations for spin effects inside ids, there will be a relative angle between two rings at which the spin effect is zero which is when the two are perpendicular.

This suggesst that when both rings are inside each others id, only mass and charge forces act on perpendicularly

oriented rings. However, inside the mutual ids, the interactions between individual meons within each ring will begin to overwhelm the overall ring-to-ring effects.

The explanation above has skated over another currently unacceptable feature of the framework proposed here. When one ring is within the other ring's id, it is not necessarily the case that the reverse is true. Ring A may feel the rotation of ring B, and react to it orientationally, but ring B may not feel the rotation of ring A, and so react unorientationally. The mutual actions of A on B are not the same as B on A when the rings are of different sizes. This mismatch serves to drive rings in stacks to be preferentially the same size and stacks in nuclei to contain the same size rings - otherwise it would not be possible to form composite structures which require balancing asymmetries within stacks of similar radii. So perversely, a conventionally unacceptable mismatch of action is what drives the standardisation of sizes in nucleons.

The equality of mass and spin energy sizes is not recognized in physics because of two factors. Firstly, the spin of a particle is usually represented by the angular momentum not the energy involved. So a quark or lepton is considered to have a spin of $\frac{1}{2}h$, which in terms of energy is $\frac{1}{2}hw$. The mass $\frac{1}{2}hw$, has the same size but is described as mc^2, which is the second factor, where m is the particle mass. As mentioned above, the two excess energies are each $\frac{1}{2}hw$ at low frequencies. What is not yet understood in physics is that the mass and spin energies of a ring are identical in size, but their actions differ in different circumstances. I need to point out again here that because of my choice of adjusted Planck mass size, my w is smaller than that normally used by 2π, so the energy of a particle that would usually be described as $\frac{1}{2}hw/2\pi$ is the same size as my $\frac{1}{2}hw$.

The differences show up when comparing two different systems. In the earlier 2-body quantum orbital system, the directions of action (because energy is a vector) for both mass and spin energies are both outwards away from the centre of rotation of the system. This is because both mass and spin energies are generated in the same way, as relativistic motional excess energies, so both the energies of motion of mass and spin are outwards, away from the centre of rotation. In this quantum system the effect is as if the orbiting bodies each have masses of hw. Please remember that the spin energy itself here is intrinsic to the ring, it is nothing to do with the orbiting of the bodies, nor with the interaction of spin energies between different rings. Even the 'stationary' body in a reduced mass system will have the same two energies acting in the same sense.

Here another aspect of the graduation from classic to quantum realms appears. In a system of two large bodies, the orientation of each individual ring within the bodies may be random overall or structured, but the separation of those bodies is outside the ids of the individual rings, so there is no orientation effect. Only when there are few component rings, inside some ring id separations and they are constrained in their relative orientations will the orientation effect show up.

So in the classical 2-large-body system, there is only the gravitational potential acting against the motional energies of mass and spin. Normally scientists only look for the mass part and conclude that the net energy of a stable classical orbit for large bodies is negative. It is as if the spin motional energy is not accounted for. This spin energy is the same size and has the same direction of action as the mass motional energy and serves to bring the total energy of the classical orbital system up to zero, rather than negative.

The same is the case in a charge bound system when considering the motions of particles, except here the relative spin orientations of two particles when they are individual rings will introduce further effects. This is not the same as the difference explained earlier between the force and energy equations in gravitational versus charge bound systems which concerns the kinetic versus potential balance of energies. The difference here is instead in the observed energy content of the particle, due to both its mass and spin energies.

These effects are the undeniable existence of the spin interactions, which need to be taken into account. The relative spin orientation of an electron orbiting a proton will produce repulsion in antiparallel and chasing balance in parallel orientations, but only in the view of the electron because the proton is inside the electron's id. The proton does not see the orientation of the electrons because they orbit, for the most part, outside the proton id. The observable energy change that is the spin-orbit energy difference between the two orientations is because of the interaction between the

two electrons as well as between the electrons and proton. When there is only one electron, it has an orbit, in a Bohr-type framework, that depends only on the nucleons. The addition of another electron inside its id provides charge, mass and spin energy components that require adjustment to its orbit. The electron-electron charge is repulsive and the mass action is attractive with the spin repulsive or chasing when spin oriented antiparallel or parallel respectively. The chasing action between electrons is disruptive, so does not occur in stable systems.

For the proton-electron interaction, the higher energy 'balloon' to be balanced to zero first is when the electrons are at the smallest separation, which is when the electron is most attracted, so the antiparallel spin electron, where spin repulsion balances mass attraction, is the preferred partner. This preference also acts to reduce the external overall spin of the atom formed, another reduction in energy or imbalances preferred by nature.

Of course, what we measure as the energy depends on what method we use to observe it, but the total energy of all stable orbits is always zero, either instantaneously or over a complete orbit.

So the charge-bound system shows the presence of the motional energies of mass and spin as $\frac{1}{2}hw$ each, at low energies, balanced mostly against the potential energy of charge, but also gravity and spin potential energies.

That the spin energy is real in other encounters is also shown by the deflection of photons passing the Sun. The electron and positron in a photon each contribute $\frac{1}{2}hw$ of mass and would have been expected to be deflected proportional to hw. But they also have $\frac{1}{2}hw$ each of spin energy and so the deflection should instead be proportional to $2hw$, which is what general relativity also predicts. But here there is no need to look into the warping of space by the presence of energies. As mentioned before, and as will be gone into in more detail later, all particles always have a total of zero energy so there is no real gravitational warping of space, although the actions of the mixes of energy that make up the zero total will produce effects that look like gravitational warping. The warping is due to the physical size of the rings, their charges and their energies, specifically not their masses, which will be explained more fully later.

Including the spin energy of all particles in the mix of energies when calculating effects like so-called gravitational deflection or stable orbits reveals the real reason for their motions and the zero energies of stable orbits. It is a continual surprise to me that nowhere does physics take a step back and ask what the spin energy really means. As explained here, it is the relativistic excess of base charge kinetic energy over base charge energy of each meon in the ring and is one of the energies that keep the ring in motion, the other being the chasing equivalent due to the meons masses. Traditional quantum physics says it is not valid to think of spin as representing any actual spinning of a particle, but that is in my view what is the actual motion of the meons around a ring.

The third variety of structure mentioned earlier is a combination of the first two. The simplest example is where two opposite rings (ring and anti-partner ring) rotating in the same sense completely merge together as do each of their component meons, each meon in one ring merging with its opposite partner in the other ring. The result is a double ring in which there are six merged meon pairs still rotating in the same sense and orientation at a rate equal to their average pre-merger frequency which, as will be shown below, is what we call a photon.

A short diversion is required here to explain twist, because the direction of twist relative to the direction of motion of a meon is important. As a meon moves on its course forming part of a ring, it is always directing its motion towards the opposite type meon ahead of it and I contend that the axis about which the meon twists is coincident with this direction.

This is another aspect that physics currently disagrees with, because the axis of a spinning mass is found to remain steady in space and does not depend on the position of any mass or charge close by. My interpretation is instead that each meon is effectively in the strong base mass (gravitational) and base charge (charge potential) fields of its adjacent meon and this drags the axis along with it.

The importance of the twist-to-motion relationship that I suggest is that the orientation of the spiral as the meon moves forward produces a different effect depending on whether it is a right hand screw (RHS) or a left hand screw (LHS), generating a fraction of the size of the electron charge. This is not an inbuilt handedness since the size of charge generated is identical in both spiral directions - only the charge sign is different. It does not matter which naming

system is used to define the charge generated, but one would be that a positive meon twisting RHS along its direction of travel generates one-sixth positive electronic charge, whilst twisting LHS generates one-sixth negative electron charge. Symmetrically, a negative meon twisting RHS generates one-sixth negative electron charge and twisting LHS generates one-sixth positive electron charge.

Time reversal considerations, dependent on twist versus rotational priority, raise issues of how to define a ring and its anti-partner or alternately its anti-ring, which are two different things, and will be looked into further later.

The generation of one-sixth electron charge by each meon is needed to produce the correct charge combinations observed in the quarks and leptons and also explains why necklaces of six meons are called rings. The rings are the particles that we observe. All other loops without six meons cannot merge together, or match frequency (or harmonics) and meon position, with rings composed of six meons. My feeling is that loops can have so little close interaction with rings that they make up a large fraction of dark matter, interacting only via the gravitational effect of their energies beause they will have formed mainly charge-neutral loop combinations that are unlikely to get inside any ring ids to feel spin effects.

So rings can produce overall charges of ± 0, $\pm\frac{1}{3}$, $\pm\frac{2}{3}$ and ± 1 electron charges. There will be isomers of down quarks and neutrinos, where the different positioning of twisting meons within a ring may have the same overall charge but will not be able to merge except with exactly similarly constituted anti-partners. Electrons can have no distinguishable isomers because there is only one method of producing the maximum charge size, although in reality there are three identical isomers, rotated by 120 degrees from each other.

The merging of an electron ring with its partner positron ring, both oriented similarly and spinning in the same sense, can only occur when each positive meon in one ring aligns with a negative meon in the other ring. A positive meon in the electron ring, which must be twisting LHS to generate one-sixth negative charge, needs to align and merge with a negative meon in the positron ring, which will be twisting LHS to generate a one-sixth positive charge. The result is a complete merger of the two meons, both twisting LHS. The next pair inline will both be twisting RHS to generate the same overall effect. This need to form photons with exactly balancing energies defines how the time reversal considerations must apply in a ring system.

The partner of the electron in a photon, for this is what is being formed, must involve only changing the position of all positive meons for negative meons, since each meon must still twist in the same sense and the ring must have the same spin orientation to physically form the photon. However, the photon, even though it has no energy in total, does not have a balanced mix of energies. It has two identical amounts of $\frac{1}{2}hw$ from mass and two similar orientations from spin. The anti-ring of the electron must have the opposite direction of spin, but retain the same twisting orientations through time and meon reversal. So where an electron is defined to be negative charge and spin $+\frac{1}{2}$, its anti-ring will have positive charge and spin $-\frac{1}{2}$.

I must be precise here and stress again that an 'anti-partner' ring is not the same as an anti-ring, which is the antimatter opposite of a ring. To generate a positron from an electron by time reversal requires that all motions are reversed and that the meons are switched from positive to negative and vice versa. The difference between a partner ring and an anti-ring is that the latter requires all motions to be reversed. So the anti-partner of the spin $+\frac{1}{2}$ electron is the spin $+\frac{1}{2}$ positron, whilst the anti-ring of that spin $+\frac{1}{2}$ electron is a spin $-\frac{1}{2}$ positron. This system should also be used to define all the anti-rings and anti-partners of the other rings. Which rings are defined as matter and which antimatter will be discussed later.

The structure that results is an odd one that comprises two merged rings that continue to rotate at their merged frequency, which is the average of their pre-merger frequencies, but with nothing in the way of properties showing when each meon is completely merged. This is a photon. It has no mass but does have frequency. That the two rings do not completely merge is seen in the electric and magnetic fields that are found as it moves. I ascribe this to the two rings merging precisely on one edge and forming a wedge cross-section to a mostly-merged opposite edge. The wedge rotates as the photon moves and this generates the electric and magnetic fields due to the differential amount of merging across the wedge.

Although the photon will continue to be described as just two rings merged, it could also be 4, 6, 8 or any other even number of ring plus anti-partner ring because each has no energy overall, only frequency. Provided the meons all merge into the same volumes to form zero mass black holes, we could not tell the difference since all would have the same frequency, except that the spin of the composite would be 1, 2, 3 etc.

Each of the merged pairs of meons in a photon is a zero mass black hole (zmbh). The two component meons are black holes, but their merger results in a volume which contains no mass in total. And yet there is still something there because it is in motion.

Another aspect of the structure of the photon is in the action of the coming together of the two rings, and the formation of the zero mass black holes by merger. This motion of opposite meons chasing is exactly what caused the formation of necklaces originally. The opposite type meons are chasing each other along the axis between them, although in this case the necklace is only two meons in length and unlike the chain formation, here the meons will merge. What this means is that the meons, once perturbed, will chase each other, and that chasing will be along the axis perpendicular to the plane of the rings. The two will chase each other at the maximum velocity that they can manage, which is whatever the local light speed is. This is why photons when travelling will do so at light speed. The meons in one ring are chasing the meons in the other partner ring to try to complete their merger and form complete zero mass black holes.

This was the solution that I had been in search of for years. The various parts provide the foundation structure for all normal matter particles as well as suggesting what may make up a large part of dark matter.

The fourth variety of structure is where rings are attracted to each other fairly strongly, but do not merge, becoming balanced at some separation. These are the previously mentioned stacks. Stacks can have any number of rings greater than one.

Stacks with two rings can have spins of 1 or 0, depending on the relative orientations of the two rings. Where the two rings have spin 1 and no mass, the result is the previously described photon. Where the two rings have zero overall spin, the stack may be a pion, either charged or uncharged or a zeron. A zeron is a ring and its anti-ring spinning in opposition with zero total spin and charge. The zeron is the base for quantum mechanical pair creation. These exist everywhere in all possible sizes, filling up all space, except where they cannot fit, such as between two parallel plates where the absence of larger radius zerons causes the Casimir effect. This means that at every point in space there is mass or energy due to the presence of zerons, which will only be observable due to their mass energy if that is what is being measured. Once more, the total energy at each point is always zero, the mass energy is only one part of the total mix of energies.

A zeron requires almost no energy to separate the two component rings since their gravitational attraction is balanced against equal spin repulsion and inside their mutual ids their charge attraction is balanced by the strong energy chasing from meon to meon. There is a net attraction outside and a net repulsion inside the qid distance, with the physical size of the rings providing a minimum separation for the rings.

The minimum separation exists from the sixth guideline. When mathematically calculating the effect of the energies of the meons in a ring, the denominator of the formula does not depend solely on the distance between ring centres, but also on the size of those rings. There is a distance apart for two rings at which the energy should become infinite because the denominator contains the centre-to-centre distance less the size of the largest ring (which will be the first inflection point to be reached as the rings approach each other). However, at that separation it is likely that the meon-to-meon energies will become more important and this will stop the potential energy becoming infinite. But what this means is that inside this distance, which I call the physical influence distance or 'pid', the action of every ring to ring energy reverses because the distance denominator becomes negative. Two rings that are attracted outside the pid will become repulsive inside, which sets a minimum distance at which they will settle as being the pid of one of the rings, probably the physically larger (smaller mass) one, but not less than the pid of the smaller ring.

So the zeron stack has the two rings loosely bound at some separation. The result is that a ring and anti-ring (usually electron and positron) seem to appear from nowhere. The pairs in pair creation already exist, and the energy available

in the location separates out the zeron that can use exactly the energy that is available. Once more, it is that part of the total zero energy that is being observed that appears as if it were energy.

The zerons are also the source of the vacuum, or zero point, energy at all points in space. Since the total energy of each ring is always zero, there is no infinite energy existing at any point, so no need for renormalisation. What is measured is the energy of one of the rings in the zeron that is released.

The zero point energy is observed to be $\frac{1}{2}hw$, being the size of the zeron broken apart by the energy used in the measurement. Orthodox physics actually uses the definition of the energy of a photon or the vacuum energy as proportional to $h/2\pi$ and the frequency of rotation w, whereas I use hw instead. The difference is only in the definition of the sizes of the Planck units used. I will go into a lot more detail on units later, but the basic difference is that where SI units use $h/2\pi$ is equal to the product of the Planck mass, light speed and Planck distance, I use an adjusted Planck scale which alters the value of w in my units, so I am saying the same thing, but in a different way.

Examples of longer stacks, with odd numbers of rings giving the stack a net spin of $\pm\frac{1}{2}$ are the proton and neutron. The possible constituents of these stacks will be examined in detail later, but the surprises to be uncovered include that the presence of the meons permits both electrons and neutrinos to exist within nucleon stacks, that neutrinos have observable mass induced in the presence of other charged rings in the stack and that isolated neutrinos have rings sizes that mirror the electron, muon and tau charged lepton sizes. The proton has a core of up quark, down quark, up quark and the rest of the stack is composed of zerons. The zerons will be made from symmetric leptons, whether charged or uncharged, but are unlikely to be made from asymmetric quarks due to the overall symmetry requirements of the stack. How many zerons are needed is not yet clear because there are a number of possible variants, all of which can provide the correct total mass, charge and spin of the nucleons.

Physics currently requires that much of the mass of a proton or neutron is in the form of 'binding energy'. The ring framework does not have any method of hiding energy. If a mass energy is present it will appear in the frequency of rotation of the component rings and the resultant deflection of space time by the stack of rings. So in my calculations all the stack ring masses total the overall particle mass. For the moment, all that is necessary is to understand that all known structures and magnetic moments can be made by rings or stacking rings (with the sole exception of the anomalous magnetic moment of the charged leptons) using the ring framework.

The basics are now in place and some misinterpretations resolved. The next questions I considered were on how these foundations could account for the weird aspects of quantum mechanics.

4 *The quantum world*

The specific questions that I set out to address were: How can two separated particles be linked so that measuring the properties of one would set the other's properties even though no signal even at light speed could pass between them fast enough, called non-locality? How do entanglement and superposition work? Why and how does delayed choice slit interference/non-interference work?

As before, the answers took years to find since, even with the basic foundation roughly in place, there were aspects that I did not fully consider could be true despite the six guidelines that I continued to use.

To start with the third question, the slit experiment, which I actually repeated to a very small degree myself at a local high school, convinced me that I could not refute the accepted experimental results. But it also confirmed in a different way to me that my foundation was correct. The sun, with its great mass, deflects the path of photons by only a small amount and yet a tiny slit causes massive deflections. My interpretation is that it is the meons in the rings that comprise the walls of the slit apparatus that provide the large interaction with the meons in the photon, or other particle passing through the slit, which deflects the path of the photon or other particle. The width of the slit versus the size of the photon or particle defines how large that deflection will be for any specific distance from the slit walls.

This interpretation may explain how deflection occurs, but not why two slits interfere when only one photon passes through them or alternatively how a photon can pass through just one slit, the other slit having been closed after that photon should have passed through both slits, but before observation, showing no interference.

When considering slits and photons, an explanation can be made. But it will also have to work for electrons and molecules, which is where I had the most difficulty in digesting the implications, as I will relate later.

To set the scene for the photon requires that we remember that the photon actually has no energy, only frequency. For every property that exists in the electron ring there is an equal and opposite one in the positron ring. Even in the transverse motion of the two merged rings, each motional energy along the line of travel has its exact opposite partner. So a photon is only a store of frequency rather than energy. If you measure frequency as energy in a photon, you are confusing properties, although it is convenient shorthand. However, when measuring frequency in a single ring it does represent mass or spin energy, and this will be explored more fully below.

The result is that we can think of a photon as having zero energy. And something that has zero energy requires no energy to transport. This is important when we consider how a photon moves.

When a photon is created at a source, we need to think of the photon not as a specific entity, which is how I described it earlier, with its own specific twelve meons that it always owns, but as a temporary construct that appears with a frequency and is made from meons or rings available locally. What moves outwards from the source is not the same twelve meons all the time, but an initially spherical shell or field, at some point on which there will be twelve meons with the correct frequency and rotational properties that exist at that specific point in space.

So as the shell moves outwards away from its source, a photon will exist somewhere on the shell at all times. But the points at which the photon appears on the shell will not form a straight path. Instead the points will be randomly distributed about the shell. The shell will continue to expand until at some time the shell is perturbed, when the photon appears at a random point, or the photon is observed. From this moment the shell no longer has zero energy and the photon can no longer "skip" between points. The photon is then locked into existence at that local point which it occupied when the shell was perturbed or it was observed, with its locally obtained meons. If the perturbation of the shell was at the point where the photon was located, we say it has been observed.

I use "skip" to mean movement of zero-energy-particle-properties about the shell without physical travel between each point and the next. The properties of the particle are impressed at a random point on the shell where the appropriate meons exist locally to replicate those properties.

What can we say about the path of the photon or what properties it should have? What describes which properties the observed photon should have, is how the shell itself has been affected along the line from source to observation, since the actual photon has not travelled this path. Even though the shell has no energy, nor does the photon, it is how the mix of energies within the zero total that was emitted has been affected by the passage of the shell across space. The photon must exist somewhere on the shell at all times, being like a defect that cannot be eliminated from the surface of the shell.

Translating this interpretation to the slits experiment, this means that until the photon has been observed, its path through the one or two slits has not been decided. In fact the photon has not necessarily gone through either of the slits at all, but the shell will have. So closing one slit after the photon should have gone through only means that the shell is then constrained to provide properties on observation that equate with the photon having gone through only one slit. So there will be no interference pattern in a single slit passage if a photon is observed where the shell and observing mechanism, such as a charge coupled device (CCD), coincide.

If both slits remain open, the shell provides energy/phase/deflection appropriate to the photon as if it had gone through both slits.

On a cosmological scale, the photon hitting a CCD in a telescope on Earth could have been on the diametrically opposite side of the source, light years behind the source, immediately prior to detection. There is no direct path from source to observer until observation, and even then a photon did not traverse that path, the properties of a photon

traversed the path. And the path is not a straight-line-like construct, even if it contains all the properties, such as red shift, diffraction, phase and deflection, that such a photon actually traversing that path would have had.

The concept of a zero energy shell or field is an important one. I suggest that the shell is a form of 'allowable space' about which the zero energy photon can skip. I will expand on this more later since it is also important in entanglement and superposition.

So we have a solution for slit experimental results, despite their oddness, for photons. How does this solve the issue for single rings or even molecules, where the same interference and quantum results appear despite the additional presence of mass and charge?

The answer is the one that has most troubled me, but as Sherlock Holmes said 'When you have eliminated all which is impossible, then whatever remains, however improbable, must be the truth'. The answer is that all rings and even molecules have zero energy in total. What we observe as energy depends on what property it is that we are measuring and how we measure it. How a body moves depends on what fraction of its total zero energy is in one or other form. The interactions between particles depend on how much of certain forms of energy each has, even though they will each have no energy in total, as the summation over all energy forms. Energy forms here specifically mean mass, spin, charge or strong energies as explained below.

This is absolutely in line with my guideline number 2, but is just difficult to digest until it has been thought fully through. I explained initially that mass is a positive form and spin a negative form of energy, so the equality of the two sizes ensures that they always total zero, even if their actions differ. On the other hand, charge is a negative form of energy, in that unlikes attract. In the same way that mass and spin are energy opposites, charge has an energy opposite. This opposite is what I called earlier the strong energy because it, along with mass, spin and charge, is what holds rings in balance together in stacks. I contend that there is the same size of strong energy in each ring as there is charge energy. The difference between these two energies I think is again the distance over which they act. Charge is a long distance energy, whereas strong appears to be short distance, although I think the equivalent of the mass and spin id depends on the size of charge that the ring has. I would term the charge/strong influence distance as the 'csid' to differentiate it from the spin id and the physical influence distance pid, although it appears only to affect the strong interaction.

Strong energy is manifested in the same way as charge, by the twisting of the meons as they travel round a ring, but represents the energy that creates the twisting.

So for every ring, for each energy there is always an equal and opposite partner. No matter what motions a ring undergoes, every motional or potential energy has an equal and opposite partner energy.

If we consider the passage of electrons or molecules through slits, we can now see that they also can exist as zero energy bodies on expanding shells. One limitation for quantum behaviour can now be interpreted to some extent as defining how complex a molecule can be and yet still skip randomly around the shell, finding sufficient meons in the local area to replicate the molecule at some point on the shell, and how physically thick a shell can be to find the necessary local meons or rings.

Considering now the second question I wanted to answer, on entanglement and superposition. Superposition is defined in quantum mechanics as the combination of all possible states of an unmeasured system. On measurement, the system will end up in one of the states. So a photon split into its constituent electron and positron, with the two separated some distance from each other, will have two possible measurements of the separated parts. Either one part contains the electron, and the other the positron, or vice versa - except that until one part is measured both separated parts will be in a superposition of the two possible outcomes. Once one part is measured as containing the electron, for example, the other, regardless of how far away it is or how fast a signal needs to travel, will immediately be found to contain the positron.

Entanglement describes how the electron and positron, in the case of a photon, are related. What happens to the properties of one is immediately reflected in the properties of the other until measurement or a perturbation destroys

that entanglement. When an electron and positron join together to form a photon, it is the merger of the meons in each ring across the two rings into zero mass black holes that underlies what is entangled and why they react instantly, regardless of subsequent separation whilst still entangled.

With the new shell interpretation, and zero total energy rings, entanglement and superposition can be understood differently. The shell in this instance, being the equivalent of the physical map of the volumes into which the photon has been separated, is now stationary and consists of just the two allowable states. The two are physically separated in our space. Skipping around the shell can be done instantaneously and randomly by the electron and positron. When the photon is separated into two, the shell is created and the electron and positron continuously and randomly skip between the two allowable spaces, always one ring in each space.

When a measurement is made of one space, whatever ring is currently in that space is given two sorts of energy, different to the mix in the other ring and there no longer exists an exact balance of all energy sorts across both rings. The ring measured becomes trapped in the space it occupied on measurement. The other ring is then trapped in the other space since the shell no longer exists to skip about on. The probabilities associated with superposition as a combination of states and skipping around a shell are the same and it would only be possible to differentiate the two interpretations if it were possible to measure both places within a timing accuracy of less than the skipping frequency. The act of measurement or perturbation might be described as 'giving energy to' one ring, except that all rings always have total energy equal to zero, so the act involves 'giving two sorts of energy' which changes the mix of energy sorts. This act breaks the entanglement of the two rings.

This skipping interpretation also shows how the fractional quantum Hall effect enables apparent fractional electronic charges in the passage of currents. The electrons, which exist within magnetic domains with specific numbers of flux lines per domain, will skip between allowable orbitals around the flux lines and look like each orbital has a fractional charge proportional to the time spent in orbit around each flux line. An electron existing in a domain with 5 flux lines will cause the carrier orbits to appear to have a $\frac{1}{5}$ charge each, whilst 5 elections existing in a domain with 11 flux lines will cause the carrier to appear to have $\frac{5}{11}$ charge each.

That this is quite a widespread effect can also be seen in the complex shapes of electron orbital probability distributions around atoms. Electrons are calculated to exist within the orbital clouds formed, but not elsewhere. Since the cloud shapes are often physically separated from each other, the only way an electron could move from one cloud to another is through skipping. So these probability clouds are exactly the same as the zero energy shells with separated allowable spaces and particles with total zero energy skipping about in them.

Since the probability clouds for any specific shell will always sum to 100%, there is no probability that the electron exists between the shells, so the skipping must be instantaneous. This explains why the effect of measurement in the case of the separated photon is instantaneous and so non-local. And so 'spooky action at a distance' is actually the norm for nature, since up to a certain level of complexity all motion of bodies involves expanding or stationary shells and skipping.

My explanation for how instantaneous action can occur is based on the existence of two different space times. The space-time we know of is based on rings. Because rings have formed, we have frequencies that we can use to measure the passage of time. Before rings, or more precisely necklaces, formed there were no repeating events to use to measure time. So the underlying meons, which existed in merged form as zero mass black holes, had no underlying time. Even within rings, they still do not experience time because in the frame of reference of a meon in a rotating ring the other meons are stationary (although twisting).

So we have the universe of rings, which we are made of and which enable us to experience time, called normal space-time and the universe of meons which do not experience time called meon space-time. This means that in meon space-time, without time there is no motion. So in meon space-time all meons created by unmerging from within individual zero mass black holes, which are the underlying components of the universe, are still in contact with all other meons. What I have described as either an expanding or stationary zero energy shell is actually a single point in meon space time. We may observe rings in motion, but that is because we are using rings to measure rings. The

underlying universe is a single point where time does not exist and everything we experience is happening at the same instant. This is why there will always be an appropriate collection of meons available to physically replicate the properties of a photon, on what, in our space/time, appears to be an expanding shell. All meons are available at all our times, because they all exist in one space and no time.

In considering these latter points, we have answered the first question I set myself on the oddities of quantum mechanics. So having now built a solid foundation consisting of particles of only one kind (in positive and negative types), size and motion which form only one composite structure, necklaces, and found a mechanism for the quirks of quantum mechanics, I turned my attention to how to reconcile these to relativity.

5 *Relativity and quantum mechanics combined*

To a certain extent we have already touched on this combination, although without being explicit about it. The effect of relativity on the motion on the meons in a ring, to external observers, provides the excess kinetic energy above each meon's rest-base mass which we observe as the ring mass, even though the sum of the excess kinetic energies for each ring is zero. And similarly the excess kinetic energy of base charge over rest-base charge energy shows as the spin energy. Looking at the motion of the ring itself brings in second order relativistic effects on the mass, electronic charge, strong and spin energies. So relativistic effects underlie all the observable properties of a ring. In a framework rotating with a ring, only the electronic charge and strong energies would exist since the base mass and charge energies would sum to zero and there would be no mass or spin energies.

Where the quantum properties emerge is in the relationship between the ring and its environment, whether shell spaces, flux lines, electron shells or whatever. Although we discussed orbital probability clouds earlier and instantaneous electron motion from cloud to cloud, we can also consider the electron from a Bohr stable orbit perspective. I have already mentioned that a stable orbit means an orbit where the total energy of each particle or body is zero. This means that as well as the total of each energy within a ring being zero, which we established above, each component part of the energies that affect the ring must also be zero. So in this instance, we mean that the external positive energies of motion must equal the negative potential energies of the bodies either instantaneously, or over a complete orbit, for an orbit to be stable.

The situation now will be that all stable orbits will have the same zero energy state, where the size of motional energy will balance the size of potential energy. Regardless of the overall motion of the atom around which the electron is orbiting, there will be no change in the zero energy state, although the size of the balancing energies themselves, the 'balloon', may alter depending on either elliptical orbits, spin-orbit orientations or different principal quantum numbers. So being zero energy states, they are time independent.

The same thought process supports the previously mentioned 'missing energy' argument for the classical gravitational orbit equation. For the energy of the orbit to be zero requires that there is an energy missing in the classical formulation. That missing energy is the intrinsic spin energy of the component rings, equal in size to their mass energy.

Even where there are energy differences due to different spin-orbit orientations, for example both spins up versus one each way, in the accepted convention, each of these is balanced by an equal and opposite energy that is not being measured, resulting in both orbitals having zero energy in total although that zero sum has different energy forms in different ratios.

The size of the energies requiring balance is given by relativity through the velocity of the electrons, but the balance to zero is what defines a stable orbit. A stable orbit where the particles are simple and relative alignment of rings is constrained, involves relative spin orientations and energies that we call quantum states.

With this explanation, we have shown how relativistic effects can coexist with quantum effects. The main point is that nature prefers states of zero energy, whether within rings or within systems comprising rings, and always balances the largest mismatches, the biggest balloons, first. Relativity affects the sizes of the energies and ballons, whilst quantum

mechanics ensures that the energies are balanced to zero at the simple and constrained alignment end of the particle scale.

6 *How relativity produces energies that we recognise (or don't)*

Without introducing tables and equations, it is difficult to show simply the hierarchy of relativistic effects on the meons in a ring. The appendix contains the hierarchy and equations, but I will try to explain here without them.

The starting point is the rest mass energy and rest charge energy of a meon in a ring. When it starts to move, the difference between its relativistic energy and rest mass energy is its kinetic energy, which is the same size (although positive and negative depending on which meon is moving) as we would describe the mass energy of the ring. Because this kinetic energy is both positive and negative, it sums to zero over the ring and all we see is the rotational frequency of the ring. The same motion produces charge kinetic energy in equal and opposite amounts, and this is what we call the spin energy of the ring, although again it is zero in total and we observe its effects via the ring angular momentum $\frac{1}{2}h$ and ignore the ring frequency w.

When the ring then moves, the external velocity provides another relativistic increase in each of these kinetic energies, which we would recognise as the 'normal' effect of relativity on a particle.

The twisting of the meons in a ring provides the only meon energies that do not individually sum to zero across the ring. The base charges and masses themselves sum to zero. The mass and charge kinetic energies sum to zero, although we see rotational frequency.

With six meons twisting appropriately for an electron, there will be six twist-generated charges that sum to the electron charge. And there will be six identical sized opposite strong energies that generated the twisting summing to one total strong energy. The total of the charge and strong energy overall is zero, but each can be observed from outside the ring separately.

Because the twist axis is always pointed along the direction of motion of the meons, there is no relativistic effect on the twist energy due to the meons' velocity around the ring. The direction of motion of the twisting is always perpendicular to the motion of the meons around the ring. So there is no first level relativistic effect on charge or strong energies, otherwise the size of charge generated would depend on the size of the ring that the meons were in and would no longer be a fixed constant of nature for stationary rings.

At the next level, the external velocity of the ring will affect the charge and strong energies, as shown in special relativity for the former. The motion of the twist charges and strong energies around the ring produces the intrinsic magnetic moment of the ring, whilst the external motion of the total charge and strong energy produces the orbital magnetic moment of the ring, if the ring is in orbit.

Some of the energies mentioned are recognised, and some are not. But I hope you can see that the framework is both symmetric in action, simple and consistent.

What has not been mentioned here are the potential energies of the meons, nor the equivalent of spin-orbit interactions between energies. These will have to wait for later explanation in the appendix.

7 *Newton 1 and 2 Reinterpreted*

As a result of my initial guidance point 5, that energy is a vector, it is now possible to reinterpret Newton and to see exactly what inertia is. Newton 1 says that a body continues in a straight line unless acted on by a force. My interpretation says that the reason a body is moving in a straight line is because it already has vector energy, the same as a force at a relevant distance, inside it. That energy is what was given to it in order to make it move from rest, and that energy is also the inertia of the body - equal to how much energy is necessary to stop the body or how much

work can be extracted. One interesting question which I will return to at a later point is where the force, equivalent to the energy of motion at a distance, should be measured from. The short answer is at one Planck distance from the body's centre of mass, but the reason involves a longer explanation.

Newton 2 says that force and mass are related through the acceleration caused to the mass by the force. Whilst this is correct for straight line motion, and provides the correct equation in non-straight line motion, it is not what keeps a body in orbit. As we have seen, in a stable orbit a body has zero total energy of motion and position. There is no need for any force due to acceleration in a circle because the inward potential energy/force in a stable orbit is balanced by the outward motional energy/force at all points of the orbit - except instantaneously for an elliptical orbit where the separation from the central body will vary over the orbit and the zero total energy refers to a complete orbit. Where the energies are not balanced, the bodies are not in a stable orbit and their separation will change. If the motional energy exceeds the potential energy, the body will escape from orbit, if the reverse, the body will decay from orbit.

So although the equations for acceleration around an orbit are correct, they do not describe a force in action and there is no acceleration involved in a change of direction in the motion of a body.

The underlying issue is the interpretation of energy as a vector or not. Newton and current scientists think not, but they have missed the spin energy within bodies and so have had to look for a way that energy and force can be treated differently. Their interpretation requires Newton 1 and 2, whereas my interpretation requires only the inverse definition of Newton 1.

8 *Paradoxes*

Many of the paradoxes that trouble modern physics are exposed by the new framework, which I will henceforth describe as the 'ring theory', as not being paradoxes at all. I remember sitting on train pulling into Ipswich railway station at the end of a long day when the thought first occurred to me that many paradoxes were actually a route to understanding how the ring framework worked. If I could show why something could appear to be inconsistent, and yet be consistent in the ring theory, then the paradox no longer existed.

The first few paradoxes we have already covered.

How can nothing give rise to something? The answer is zero mass black holes that unmerge into meons.

How can particles appear to be simultaneously in two places at once - in entanglement or superposition? The answer is that they can't, and only appear that way because the skipping frequency is too high for us to observe their skipping.

How do quantum mechanics and relativity fit together, when the latter requires a time component which the former does not? The answer is that classical and quantum mechanics have not recognized the zero energy of stable orbital states, although in different ways, that underlies the independence of classical and quantum energy states from time.

Why is the action of charge so strong compared with gravity? You may not appreciate that this has already been resolved. The answer is that the strength of action of both is identical. It is the relative size of the charges generated by the meons in a ring when compared with the ring masses that gives the appearance of different strengths. The gravitational constant also serves to confuse the situation. I will show later that the gravitational constant can be absorbed into the Planck mass and Planck distance to produce an 'adjusted' Planck scale in which the maximum charge and mass actions are identical. This absorption of the gravitational constant is not the equivalent of setting its value to be equal to unity, as many people have tried.

One glaring paradox, also considered the largest error in physics at the present time, is the size of the vacuum energy of space, also known as the zero point energy. This is the lowest possible energy that a quantum mechanical system can have or the background energy of space even when nothing is present. Cosmological calculates put an upper limit of $10^{-9}Jm^{-3}$ whereas quantum mechanics requires a much larger number of around $10^{113}Jm^{-3}$. The discrepancy is of the order 10^{122} times too large (or small). How can a system that provides the 12 decimal place accuracy of the

anomalous magnetic moment of the electron, be a factor of 10^{122} wrong? The answer is actually very simple when explained with ring theory.

What quantum mechanics is ignoring is the balancing energies for every point at which the energy should be measured. For every $E = \frac{1}{2}hw$ representing the presence of a wave (actually a ring) there is the negative energy of the rings spin, also $E = \frac{1}{2}hw$, to consider. At every point in space there is a concentric onion shell of zerons surrounding the point. Every size is present at each value of w, and is what produces pairs of electron and positron when enough 'energy' is available to break the zeron into its two constituent parts for a time inversely proportional to the size of energy available.

So the total energy of all the onion shell rings at all points in space is always zero. This means that the vacuum energy is always zero, so there is no need for quantum mechanics to 'renormalise' which in real terms just means' divide by infinity'. The result is that renormalisation, which leaves only the differences in positive energies, arrives at the right result although for the wrong reason.

The ring interpretation also answers why the zero point energy density of the vacuum does not change with changes in the volume of the universe. The vacuum energy density is always zero, so it will never change. The total energy of every point is always zero, although it requires taking account of all the energies present to actually observe this. For every energy we commonly observe, there is an exact opposite energy also present. What drives systems with energy imbalances on one side of the equation is a need to change to a lower level of that imbalance.

On a related note, the zero value of the vacuum energy density also implies exactly what we observe across the universe – a small cosmological constant. Current interpretation requires that the large size of vacuum energy density implied by quantum mechanics be almost exactly balanced by something else in order to arrive at the observed very small value of cosmological constant.

The most interesting paradox is that which exercised Bohr and Einstein so much. Put simply, is the universe spooky acting at a distance with no reality until measurement or is it clockwork composed of real particles? The answer surprisingly, or not if you have been following the explanation closely, is that both are correct! The difference is that each refers to different levels of meon structure.

The spooky action at a distance and lack of reality until observation are aspects of zero energy shells on which rings are randomly appearing during skipping and results in probabilistic observations. The clockwork interpretation applies to the individual meons, which are real particles. Unfortunately we have no access to their non-probabilistic motions because we can only observe using probabilistic rings. So Bohr was right at the level we can observe, whereas Einstein was correct in describing the underlying particulate form of nature.

Time, and its apparent non-reversible nature, is also no longer paradoxical in the ring framework. Before necklaces formed, there was no time - since all our measurement of time is based on using rings to observe. So time is a construct of the structures formed by meons and is not an extra dimension. That the physical size, the mass, of a ring is linked to a measurement of time is fundamental in the ring theory - they are just two different ways of describing the ring size. This is what underlies Heisenberg's uncertainty principle. For every ring, and necklace, the excess of relativistic kinetic energy over rest mass energy is equivalent to $\frac{1}{2}hw$ at low energy, so the product of energy and time (inverse frequency) is always $\frac{1}{2}h$. Measuring any two associated properties like energy and time for any ring will always result in the value $\frac{1}{2}h$ or its equivalent. For particles composed of multiple rings, the value will be a multiple of $\frac{1}{2}h$, so the minimum value is $\frac{1}{2}h$. For meons, the equivalent is h. Please note my usual warning on my use of units, so that the equivalent measure using the normal frequency definition of w will be $\frac{1}{2}hw/2\pi$

The 'twins' paradox is one that is not truly a paradox, but is worth understanding from a ring perspective. The two twins are separated, one travels elsewhere at high speed and the other doesn't. When they meet again, one is older than the other. The round trip by the fast twin involves no vector energy difference if the start and end points are coincident, but what has changed is the phase difference between the rings that comprise the bodies of the twins. The motion of the fast twin's rings has shifted the phase from being identical to being different. This is the equivalent of introducing a time difference. So initially identical rings with subsequently introduced phase differences are no longer

the same, even if they are later observed with the same frequency. This also underlies the asymmetries in a stack, which are the colour forces. Different phases of the same type of ring are different.

The paradox that suggests that normal physics does not apply inside stellar black holes can be seen in the ring framework to be false. Since normal physics is actually based on necklaces composed of the densest black holes possible, then normal physics applies inside stellar black holes. What gets destroyed on the way into large black holes is not the meons, but the rings. The differential effects of gravity and charge across a ring entering a black hole elongate the ring until it breaks. That breakage is the equivalent of the ring passing its mass, charge and spin to the black hole. But the broken necklace, reverting to its original chain form, will mix with other chains inside the black hole until it reforms inside as half of a photon that has sufficient energy to break out of the black hole. So a black hole is an agent for converting necklaces and rings into photons, and its inside is much like the initial chain stage of the Big Bang. Since the balance of rings leaving will be symmetric when compared with those entering, a black hole is also a symmetry engine, increasing overall ring symmetry on average.

One of the predictions of the standard model is that there is an energy at which all forces become equal. As you have seen, this can never be the case since the mass of a ring and the electronic charge are generated in different ways. However, there is an equivalent for rings, in that the spin interactions depend on the ring frequency (mass) and relative spin orientation. At very high ring frequencies, where the relativistic effect becomes much greater than $\frac{1}{2}hw$, the rings become indistinguishable except by charge and spin orientation. This contraction of differences at a high enough frequency/energy to allow rings to be differentiated mainly by charge leads to a new way of looking at matter versus antimatter, as will be considered later. If these are the energies at which stacks initially formed, then only the overall charge of the stacks would have mattered in the local environment, provided the individual rings were the correct isomers to fit within a particular stack and the stack were not all same spin. So regardless of whether the rings in a stack were electron/positron, quark or neutrino, they would have been of equal energy, differentiated only by charge. This is the basis on which I think stacks exist - containing electrons and neutrinos as well as quarks. I will show this to greater effect when explaining the magnetic moments of rings and stacks, providing a consistent magnetic moment framework for the moments of protons, neutrons and leptons in stacks (although not the anomalous magnetic moment of the latter).

Wave-particle duality is another paradox of sorts. How can a particle be both wave and particle? Well, as we have seen, a ring is exactly that. It has both a frequency of rotation and a mass. These two aspects are just different sides of the same coin. But note that there is no need for any Higgs boson to provide mass to rings. There is however, as will be seen later, a need for charge in a ring in order to show its mass externally or for charge to exist in another ring close by - in effect to enable space time to deflect appropriately for the size of the ring, since the sum of the excess kinetic energies which define the size of the mass sum to zero for each ring. In this way the neutrinos in a proton or neutron stack acquire mass equivalent to their frequency.

Matter and antimatter continue to exercise the standard model. How can they be created in equal amounts and yet then some mechanism manages to destroy all the antimatter and leave just a small amount of matter only. The answer in the ring framework is that all categories of ring, whether electrons, positrons, neutrinos, antineutrinos or quarks and antiquarks, were created in equal numbers when the unmerging of zero mass black holes turned into the Big Bang. Which ring is the matter and which is its antimatter partner depends on your definition. It is important to get the definition of ring and anti-ring precisely correct. As we saw earlier, the anti-partner of the spin $+\frac{1}{2}$ electron must be the spin $+\frac{1}{2}$ positron, in order that the meons from each ring can merge into zero mass black holes. But a ring and anti-ring would be the spin $+\frac{1}{2}$ electron and the spin $-\frac{1}{2}$ positron. So do we define antimatter to be by charge, mass or spin? Mass is always effectively positive regardless of spin direction and we know that mass is only the deflection of space time due to ring size. Orthodoxy usually goes with the negatively charged electron and positively charged proton and ignores spin, but, as was mentioned earlier, charge difference may be more fundamental at high energies.

What I propose is a different definition of matter and antimatter, which I think is more sensible, although, as with many of the concepts in the ring framework, you may initially disagree - but please bear with me. It doesn't matter whether the choice of matter is the rings with negative charge, or those with positive charge, because symmetrically

either could be the other. However, the point is to define rings of one sign of charge as matter and the other as antimatter.

I have chosen that rings of negative charge should be termed matter and positively charged rings as antimatter because we are surrounded by negatively charged electrons that act as our electric current carriers. With this choice, it becomes apparent that all our stable charge-bound states are a mix of matter and antimatter. Zerons, being ring and anti-ring, are a neutral mix. All stable uncharged atoms are neutral mixes of protons, neutrons and electrons. Neutrinos are both matter and antimatter, but are individually neutral anyway. The anti-ring for the neutrino is the opposite spin anti-neutrino, but this is identical to a neutrino rotated through sixty degrees about its central axis. So it is not possible to distinguish between neutrino and anti-neutrino. The zero mass black hole is also a neutral composite, as is the photon.

The result is that the preferred state for all meons and rings is to become neutral or uncharged. Atoms are driven to balance charge to neutral, rings form zerons and photons to become neutral. Furthermore, most structures also try to balance spin to zero as well, apart from the photon.

So what we currently think of as matter in our local environment is a balance of matter and antimatter, using my new description. But this does not answer the question why we have positively charged protons orbited by negatively charged electrons, rather than negatively charges anti-protons orbited by positively charged electrons.

My view is that this is a local environmental feature. There are likely to be regions where the reverse is true. We can imagine these simply by reversing the sign of charge that we ascribe to the proton and electron. Nothing changes. Everything continues to have the same numerical properties and interactions, only the local label has changed. However, if we met objects composed of negatively charged proton and positively charged electrons, we would not survive. That is not to say that the components of our bodies and the objects would annihilate each other, because no meons ever annihilate, but the component rings would find more stable composites to form, likely photons, and the resulting flash would look like annihilation.

We would be able to tell a positively charged proton local environment from a negatively charged proton environment only by contact. The photons that we generate, or are generated by photon emissions from either environment‘s atoms are the same spin ± 1 photons.

So the question of where is the missing matter is, in my view, the wrong question. We are surrounded by matter and antimatter in almost exactly equal amounts. It is just preferentially structured in our locale in one of the two only possible ways and the bulk is anyway neutral – a balance of matter and antimatter in the new definition.

Dark matter is another paradox, of a sort, because our normal matter is observed to be such a small fraction of the total required to keep galaxies gravitationally bound. With the ring framework, there is no paradox for two reasons. The first, smaller effect, is due to the requirement for creating ring stacks, that the component rings have symmetry in their asymmetries, which means that many ring isomers cannot remain in a stack. The way to understand this is to treat each ring as three sets of adjacent positive and negative meon pairs. As the rings rotate, if there is another ring stacked alongside, it must have a similar threefold symmetry. It doesn‘t matter what that symmetry is itself unless there are only two rings in the stack, when the asymmetry in one ring must balance the asymmetry in the other ring. For such a two ring stack, the result, to be stable, must be that the overall stack has no asymmetries.

Where there are three rings in a stack, the asymmetries of the three rings must produce a symmetric overall stack in order to be stable. Because there are only three sets of two meons in a ring, the maximum asymmetry is threefold, and further rings added to the stack need to provide their own symmetric total addition.

The asymmetries can be considered to be different colours, as in a colour force, which is usually what is described as binding a nucleon together. What I suggest is that instead, it is the requirement for the total particle (stack) to not be asymmetric that keeps the stack together because otherwise it will not be balanced enough to remain together and will separate into component rings. Think of it like a wheel that needs to be balanced in order to spin at high speed. A large enough imbalance will shake the wheel from its axis.

If we consider the single meon twisting negative $\frac{1}{6}$ electronic charge, with the remaining 5 meons twisting positive $\frac{1}{6}$ charge, as being at position 1 in a clockwise numbering system in a ring of 6 meons we could define this ring as a 'red' up quark. The asymmetry of the up quark ring is the axis across the ring that runs through the meon at position 1 and the centre point of the ring. The meon with the negative charge at position 3 on a similar ring could be defined as a 'blue' up quark, and a similar ring with that asymmetry at position 5 as a 'green' up quark. Because we are considering pairs of meons, these are the only three different orientations possible for the only negative charge in an up quark.

When two rings of the same size are rotating in opposite senses (eg clockwise as spin up and anticlockwise as spin down) the line of asymmetry is the same as if they were rotating in the same sense, and this requires that for a stack to be stable in the long term, the rings have to be rotating at the same frequency, so the same physical size - although as will be shown later this does not mean that they will have the same mass unless the rings are of the same sort. For some rings in a stack, the matched frequency requirement is not absolute. Harmonic frequency relationships between two different ring sizes in a stack can provide overall symmetry with the same colour relationships.

The same framework can be used to look at all the different possible meon combinations in rings to define what colours they might be. We can define 'anticolours' by looking at what is required to balance each colour. For balancing the red up quark, an antired upquark will have the negative charge meon at position 4, exactly opposite the red position 1 (although overall these two up quarks will repel).

Using this framework of asymmetries produces stacks of two rings where colour and anticolour are required. For stacks of three rings, one ring of each colour is required. Overall every stable stack is colourless, has total charge of ± 0, $\pm 1 q_e$ and $\pm K\ q_e$ with possible spin values of ± 0, $\pm \frac{1}{2}$, ± 1 and $\pm N \frac{1}{2}$. This exactly replicates what we see in nature.

However, not all rings have threefold charge symmetry even though they have threefold meon pair symmetry. Neutrinos, for example, can have twofold symmetry, where the meons on one side of the ring generate three positive charges and the meons on the other side generate three negative charges. And some neutrinos have no symmetry at all. These rings are able to form stacks, but only with the appropriate partner rings. Because of their less symmetric make up, they will be less likely to be found in stacks or interacting with existing stacks made of threefold symmetric rings.

It is these less symmetric rings that are the first source of dark matter. They do not have the appropriate symmetry to interact with our 'normal' threefold symmetric rings, apart from the photons, where the frequency of a photon, regardless of how many meons it contains, has the same relationship with its physical size and energy. So we cannot tell whether a photon has, for instance, 6 or 12 zero mass black holes rotating until it is broken into either a ring and anti-ring or necklace and anti-necklace. But when stacking with an electron, it is the electron acting as the meat in the sandwich between the two component rings of the photon or necklaces that keeps the stack together. The photon's internal attraction across its two components keeps the electron in place, but the position of the electron stops the meons in the photon from merging together and accelerating up to light speed. The photon has been captured by the electron, and it doesn't matter what the photon's symmetry number is.

The second and much larger source of dark matter is all the loops or necklaces, which do not contain six meons. Every necklace of 2, 4, 8 or more even number meons will not have the correct symmetry at the same physical size to interact with threefold symmetric ring stacks containing 6 meons. So most of the necklaces formed will not be able to interact with our threefold symmetric ring stacks.

Even photons composed of necklace and anti-necklace will not be able to stack next to an electron, which is how electrons get to move between different atomic orbitals. Photons move, as we have seen, due to internal meon chasing but they also stack with other rings. In order to give an electron more spin, for example to boost it to a higher principal quantum number orbital, requires that it add units of h angular momentum. The only way to do this is by stacking photons next to the electron, of correct energy and spin so that the composite stack will exist in a zero energy stable orbital. Electrons moving between stable orbits, the zero energy states, gain or lose those photons as part of the change in balloon energy sizes.

As an aside, electrons also have threefold symmetry, and can thus exist in nucleon stacks. It is the size of the meons,

not the electron rings, that allows this to happen. And the same meon structure enables neutrinos to exist within nucleon stacks. As will be shown later, zerons in the form of neutrino and antineutrino, or electron and positron, ring stacks act like two-ring 'end caps' to the proton stack core of up quark, down quark and up quark. To change a proton stack into a neutron stack requires only that an electron of the right size (energy) replaces an antineutrino in one of the end caps. The stack neutrinos' size becomes observable as mass when in a stack with other rings that have charge, probably as already described because the deflection of space time requires charge as an enabler. This feature is the only solution that makes sense mathematically in order to produce the mass, spin and magnetic moments of the nucleons.

Whilst I have nuclear stacks as being composed of the quark core plus zerons as pairs of leptons, either both charged or both uncharged, there is nothing to stop the effective formation of charged zerons within the stack. These could be the two rings at the point in a stack where a zeron formed from charged leptons sits next to a zeron formed from uncharged leptons. The central pair of these four rings is effectively a charged pion at stack size. And it is also possible to envisage that apart from the end-cap zerons, the remaining stack rings might sit beside the core stack, since the interactions between rings of the same size act almost as well adjacent as on top of the stack. This is also the basis on which other stacks, more protons and neutrons, will be held in place in a nucleus. A picture of short core quark stacks surrounded by a cloud of zerons and pions could emerge.

What this framework says overall about necklaces and less symmetric rings is that they will hardly interact with our matter other than gravitationally if they form charge-neutral necklace composites. And overwhelmingly there are many more necklaces than rings. But this doesn't mean that the necklaces cannot form their own composite structures - they will do so. The necklace composites will be of similar types to our own threefold symmetric constructs - stacks and single rings -but based on different total charges and different symmetry numbers.

An example might be the equivalent of a proton, but made using 8 meons in each necklace. It would have a total charge of $+\frac{4}{3}$ electron charge to match the maximally charged symmetric 8-meon equivalent to the electron. The 3-necklace stack core would have spin $\pm\frac{1}{2}$, exactly as our 6-meon rings do. It is possible that this stack would promote the formation of atoms because the orbiting 8-meon electron would have spin $\pm\frac{1}{2}$ in addition to its $-\frac{4}{3}$ charge. The only combination of three 8-meon necklaces that produces $+\frac{4}{3}$ electronic charge overall using two positively charged necklaces and one negative, to keep the stack in place, is $+\frac{2}{3}$, $+1$ and $-\frac{1}{3}$. As well as being an aymmetrically charged core, the probability of producing 8-meon rings is smaller than producing 6-meon rings, so numbers of such rings should be relatively small.

This reduced likelihood of atomic structure will appear in all necklaces based on even number asymmetry over 6, so 8, 10, 12 etc meon necklaces sizes. As mentioned, the higher the number of meons in a necklace, the less likely it is to form in the first place. Below 6-meon rings, it is not possible to produce a core with 4-meon necklaces using oppositely charged necklaces and 2-meon necklaces can only form short stack permutations using $\pm\frac{1}{3}$ electron charges. Atoms formed from necklaces will betray their presence in the emission or absorption spectra that they produce. If the atom is based on 8-meon necklaces, the energy levels will be a factor of $\frac{16}{9}$ greater than our normal spectra, and proportionately changed for each different sized necklace.

So only our threefold symmetric structures are likely to have formed in sufficient numbers, the vast bulk of necklaces forming neutral composites or photons, with the former mainly gravitationally interacting, which we call dark matter, and the latter normally indistinguishable from our threefold symmetry photons.

This is not the end for dark matter though. With enough rings in close proximity, a stellar black hole could form. Inside a stellar black hole, rings and necklaces get stretched and broken into strings or chains. This process will chop and mix necklaces into different lengths and meon numbers. When two necklaces or rings form into photons at sufficient energy and symmetry to break out of the black hole, the hole will effectively have turned dark matter into photons. The photons may or may not be threefold symmetric but will interact with our matter in the same way. Thus a stellar black hole is a dark matter sieve, making the universe more symmetric and possibly changing the fraction of threefold symmetric stacks versus other symmetries over time. With sufficient information, we could gauge

the age of a local environment from the fraction of threefold rings, or the speed of conversion given the size or number of stellar black holes in the environment.

Dark energy is another interesting speculation, rather than a paradox. But since I am looking at the speculative end of the paradoxes, in dark matter, it is appropriate to consider what dark energy might be. There are two aspects that I think may contribute to what looks like the effects of a dark energy. One is real and the other is a misinterpretation. First the potential real source of energy.

When necklaces initially form, they will have done so at or close to the Planck energy. What we observe now is rings with masses that are around 10^{-23} times smaller. So the necklaces started at very small sizes, meaning very high energies and are now much larger, meaning very small energies. In the expansion away from the centre, if we assume the start of unmerging of zero mass black holes, or the Big Bang, to be a centre, the energy (really frequency) that was in the necklaces could have transferred into either of three things. One could be the transverse motion of necklaces away from the centre across the zero mass black hole background, another could be the frequency of rotation or oscillation of the background zero mass black holes themselves and the last could be the expansion of space itself. The latter two may well be the same thing, if the action of oscillating faster means that the average distance between zero mass black holes increases.

However, I do not think there can be nothing between zmbhs, and instead more zmbhs partially unmerge as the oscillating ones move apart. So there is never truly nothing in space, the background generates more zmbhs as the pressure of the existing numbers allows more to partially unmerge where fields like gravity are strong. But the action of providing more rotation or oscillation uses some of the energy released by the physical expansion of the necklaces - although we need to remember that the total energy is always zero, it is just the fraction in one or other form that is being shared around. An alternative is that the core of nuclei, where zerons exist in the nuclear stacks, may exclude background zerons from that volume. This may set the size necessary for the stack rings, being effectively the pressure required to exclude zerons from the nucleus volume.

So there can be some form of motion of necklaces away from a centre, expansion of space and creation of new space funded by the loss of necklace energies. But this is not a repulsive force that increases with time, as dark energy is usually defined.

The second aspect of dark energy I think may arise from a misinterpretation. Not a misinterpretation of observation, but of underlying reason. When we observe motion towards or away from an observer, we see a blue or red shift in the light emitted by the moving body. This is due to the change in distance between the body and observer between emission and observation. This is a well understood phenomenon. What is not yet accepted is something scathingly termed ‘tired light‘, which is another possible explanation for some of the observed red shifts.

But there is an excellent theoretical underpinning for tired light within the ring framework. As will be shown later, it is possible to create all laws of nature by considering all existing properties, such as velocity, force, energy, time, distance, current, electric field, viscosity etc as powers of mass or inverse powers of charge. A law appears when the product of the properties being considered sums to zero, such as mass (m^{+1}), velocity (m^{+2}) and distance (m^{-3}) which is the basis for conservation of angular momentum $h = MVR$ for the meons inside the ring or $\hbar = mvr$ for the rings themselves in orbit. One such law of nature, not yet recognized as such, is that the product of viscosity and volume is a constant. This means that all meons have a viscosity associated with their motion across the background zmbhs, and that this slows their motion by a constant amount. For a lone ring, this will reduce its velocity over time, although not its size, if it has a preferred size. For a photon, the opposite is the case. The photon is internally chasing across its rings and stays at local light speed. What it can do to lose energy instead is to reduce rotational frequency. So the photon red shifts from its point of emission.

The usual argument against tired light is that the red shift will be proportional to its frequency at emission, so a star at great distance should have a wide spread of red shifts associated with its different photon emission energies. But this viscosity redshift is not proportional to the frequency of the emitted photon, it is proportional to the distance travelled by its constituent meons. For all except the highest energy photons, the distance travelled by the meons is

virtually identical to the distance travelled by the photon, the difference being the slight extra due to the screw path travelled by each meon rather than a straight line. Here I need to make clear that the framework I am using is of a travelling photon, as opposed to the zero energy shell framework with photon skipping. Rather like the use of Bohr orbits versus quantum orbitals, whatever provides the easiest way to understanding is the best simile to use.

So all the photons emitted by a star will lose virtually identical amounts of energy through the viscosity experienced by their meons constituents. And so all photons will experience virtually identical viscosity red shifts.

Over short distances, we will not be able to measure the viscosity redshift. Over great distances, the effect will be measureable. The question is how much of any observed red shift is due to viscosity red shift and how much to relative velocity red shift. This is why I think that some of the effects ascribed to dark energy may be spurious and have been misinterpreted. If all the redshift is currently ascribed to relative velocities, then the viscosity redshift contribution is being ignored. The effect of viscosity red shift will increase almost linearly with distance and so will appear to be like a force that is repulsive and larger at greater distances.

The change in interpretation that viscosity red shift enables, is that the universe is actually smaller than calculated currently and is expanding more slowly. Its age may be the same as the accepted value, or different, depending on the fraction of velocity versus viscosity contributing to the total redshift.

Having provided clarity on a number of paradoxes, there are many aspects which I have mentioned above as 'are to be explained later', and I need to address them. I will try to do so in a logical order, but every aspect is really connected to all the others, so there will be overlaps in the explanations, and some will be relegated to the appendix.

9 *Particles and forces*

You may have noticed that I have not described interactions in terms of particle exchanges. Usually, for example, the electromagnetic force is described in terms of the exchange of photons, or the colour force in terms of an exchange of gluons. This is not an omission. I do not agree that there is any need for the exchange of particles in the action of any forces. It is the strength and slope of the relevant interacting fields which sets the size of the interaction of one particle on another.

I agree that some of the exchange particles exist, such as the photon, or pions. But not that they are involved in transferring any interactions between rings. They exist because they are valid relatively stable configurations of rings. They do not appear in order to enable the exchange of forces, but because the appropriate rings exist in the local environment.

This interpretation enables the non-existence of gravitons to be more easily accepted, since their theoretical attributes cause some difficulties in the Standard Model.

10 *Addition or Product*

I have been remiss to some degree in my explanations of sizes, by skating over one of the underlying principles employed in the ring framework. Nothing is ever simply added, because otherwise there would be the possibility of generating infinities in extreme circumstances. The method used to avoid this is to use product formulae instead of addition, for example in calculating energies. I may describe energies as being added to simplify, or where there will be no significant distortion in results, but strictly it should always be the case that energies are combined on a product basis.

The effect of potential fields are treated in the same way by multiplying the energy or force under consideration by the factor of 1 less the field present. For an infinite number of fields, of strength 1 (the adjusted Planck scale) or lower, the total effect will always lie between 0 and 1. Using this technique ensures that the energy of any particle surrounded by any number of fields will always be 1 or less. The product method simplifies, for two energies, down to the accepted relativistic form of addition.

The specific point where I might have made this point earlier concerns the charge generated by meon twisting. Because there are six meons in a ring, the simple way of describing how much charge is generated is to say one-sixth the electron charge. However, due to the relativistic way of addition the actual charge generated by each meon will be slightly higher than one-sixth the electron charge. So one of the predictions of the ring framework is that when an isolated quark is finally observed, it will have a charge slightly higher than the simple fraction expected.

11 $\frac{1}{2}$ *and* 2π

Throughout physics there appears the factors $\frac{1}{2}$ and 2π. The latter is easy to explain. Any property of a meon in a ring has h as its angular momentum base unit, or equivalent adjusted Planck unit. Any property that involves the motion of the ring itself, has $\hbar = h/2\pi$ as its angular momentum base unit. So the intrinsic magnetic moment of the electron is based around h, whereas its orbital magnetic moment is based around $h/2\pi$. Because of the different treatment of the area over which each charge moves (as individual meons around the ring versus the overall orbiting of rings) and the action of the strong energy, the factor of 2 remains, providing what is describes as the g factor for the electron. This is not the end of the story, but the rest can wait until later when considering the anomalous magnetic moment of the electron.

The $\frac{1}{2}$ factor is slightly more complex. Although it emerges simply as the low velocity expansion of the effect of relativity on the meon and ring rest-energies, it has to be followed through very carefully because some factors of 2 are really exactly 2. But in the main, if there is a factor of 2 or $\frac{1}{2}$, it will be due to the effect of relativity and is thus only approximately 2.

When parameters can be measured at a high enough energy, this discrepancy between the actual value and $\frac{1}{2}$ will be observable. One example will be the spin of the electron when it is travelling at close to light speed. Since mass and spin energies are always the same size, when the mass of the electron has been boosted by its high velocity, the spin energy will also have been similarly boosted. However, it must be remembered in measuring that energy that the relationship between mass and rotational frequency which contains the $\frac{1}{2}$ factor at low energy will no longer hold at higher energies.

This complicates the treatment of the g factor, because the 2 factor discrepancy could be consolidated within the spin or left explicit. As shown in the appendix, my preference is to include the discrepancy with the spin value, which simplifies the gyromagnetic ratio simply to the electronic charge divided by the electron mass.

Apart from the three factors above, and the sizes of the leptons, proton and neutron, I do not use any other numbers put in by hand. This has limited my ability to produce the one number above all others that would show the veracity of the ring framework - the anomalous magnetic moment of the leptons. The standard interpretation is that the electron interacts with all possible particles in space and this increases its magnetic moment by a small fraction. The accuracy of the adjustment fits the experimental observation to twelve decimal places. My interpretation is that the anomaly is due to the internal structure of the electron and the action of meon twist charges and strong energies, but my explanation involves a number put in by hand, so is not strong.

However, the basic framework of twisting meons generating electronic charge and the twist energy generating further smaller charge does provide a consistent solution to the anomalous magnetic moments of the proton, neutron and other particles. It also shows that the electron and muon are just different sizes of electron ring.

12 *Units*

I have mentioned in passing my use of adjusted Planck units. The reasoning for the adjustments is easy enough to explain, and how the result can be used as a powerful tool in investigating relationships between physical parameters like mass, charge, time, velocity and the increasingly esoteric parameters like voltage, resistivity and viscosity. But

the depth of the explanation is limited here by the constraints of the fonts available to display the symbols or letters usually used as shorthand for the parameters. I could substitute alternate letters in the formulae, which are necessary to minimise the length of explanation and to ensure clarity, but that would confuse those used to the correct symbols and detract from the power of the explanation.

My compromise is to limit the number of parameters used here in the explanation and instead to provide more detail and parameters in the appendix. The need for adjusted Planck units arises from two main issues. The first is that there is a complete misunderstanding concerning the relative strength of the actions of mass and charge. The second is that the Systeme International (SI) set of units used in physics is misaligned in the values of the units it uses for parameters between the mass and the charge sides. Basically if the unit involves the action of charge somewhere in its make up, such as current or voltage, the unit is $3.162 \times 10^{+3}$ too large. To a certain extent, this latter factor (which is $\sqrt{10^{+7}}$) is already understood to be a problem because the same factor has caused issues when translating between SI charge units and the alternate cgs unit system, which was designed around the electronic parameters.

Only by starting at the most basic level can these two issues be reconciled and the correctly adjusted Planck units emerge from the result. What we get is actually two systems of units, one based on the maximal values theoretically possible and the other those same values limited by the value of the electronic charge. By 'maximal' I mean the most extreme value of a parameter, whether that is the largest or smallest possible in the appropriate sense. The maximal units are based on the theoretical maximum size of charge, and I will call these maximal units. The other set uses the electronic charge size and I will call these electronic units.

The starting point is the meon size. It's mass and charge are 1 in maximal units. The question is how are the maximal mass and charge units related in SI units. Many people have in the past tried to simplify the force equation that links mass and charge in $GM_pM_p/R_p^2 = Q^2c^2/R_p^2$ by eliminating the gravitational constant G. They usually merge G into the mass value or just set G=1. What they do not do is consider the other relationship formula $h = M_pcR_p$ as well.

Before explaining how to properly eliminate G, it is important to set the scene. The force equation I have quoted is relating maximal values, not electronic ones. So in the appendix I would differentiate between the use of maximal charge and electronic charge by using the appropriate symbol. Also the formula for the angular momentum is based on maximal values, rather than the values normally associated with the formula, which relate to the electron orbiting the nucleus. In the latter, the value of angular momentum is the reduced Planck constant $h/2\pi$ rather than h, and the mass is that of the electron rather than the meon.

Given the maximal framework, it is possible to eliminate G by multiplying the maximal mass by $\sqrt{G}$ and dividing the maximal distance by the same factor. So where the Planck mass M_p was used before, the adjusted Planck mass M_o is used now, with R_p replaced by R_o. In formulae, $GM_pM_p = M_oM_o = Q_o^2c^2$ and $h = M_pvR_p = M_ovR_o$.

Now by substituting the SI values for M_o and R_o, it becomes clear that the misalignment of the value of Q_o exists, so maximal Q needs to be translated into adjusted units, as does the electronic value of q_e by reducing the SI value by the factor $\sqrt{10^{+7}}$. With these new mass and charge values, it is possible to look anew at all the parameters, although their interrelationship needs to be better understood.

To understand the relationships between parameters better, there needs to be a deeper form of dimensionality employed. The normal understanding of dimensionality is that some parameters can be resolved into simpler constituent parameters, such as mass, length and time. My contention is that all parameters can be resolved into only two parameters, mass and charge, so that all parameters are ratios of mass and charge.

There is a less contentious way of saying the same thing, and which we have already met although without being explicit. We could make the same dimensionality statement by saying that all parameters are ratios of h Planck's constant and c the speed of light. The force equation above says in essence that the maximal values of mass and charge are related by $M_o = Q_oc$ or $M_o/Q_o = c$. The angular momentum equation says that at maximal values $h = M_ocR_o$.

By setting the dimensionality of parameters in terms of powers of mass, we can draw out the relationships. If $M_o = m^{+1}$ means 'mass has a mass power of 1', then because charge is the inverse of mass, $Q_o = m^{-1}$. The force equation now

says that $c = M_o/Q_o = m^{+1}/m^{-1} = m^{+2}$. We need the extension of the force equation $M_oM_o = hc$ to show that $h = m^0$, which, together with the angular momentum equation can then provide $R_o = m^{-3}$.

The results are powerful. Either in terms of M_o and Q_o or of h and c, all parameters can be shown to be ratios of the two. The appendix shows the progression of the ratios. It also means that the new adjusted SI units have values that are consistent with each other, across all parameters.

However, the more powerful tool is that any formula containing multiple parameters on one side of the equation sign, whose total mass power is zero, is a law of nature. The angular momentum equation already showed this, once more not explicitly. But since $h = m^0$, it is a constant of nature, so $h = M_ocR_o = mvr$ is a law of nature, although the value of h may be in multiples of h or of $h/2\pi$.

Whilst only certain values of the parameters will provide constancy in all circumstances, at maximal values, the laws will always be true.

I personally use the dimensional analysis all the time when checking my formulae. If I am looking at a formula whose outcome should be an energy, then if I do not have a total mass power of m^{+5} when including all the parameters, I will have made a mistake. Similarly for time as m^{-5}, showing that the product of energy and time is a constant m^0.

In h and c terms, we can now see that $M_o = \sqrt{hc}$ and $Q_o = \sqrt{h/c}$ and $R_o = \sqrt{h/c^3}$ and all the other parameters follow on from these.

To check back on our elimination of G, if we look at the SI units of G, we find that they correspond to mass units of m^0, so a constant. It was thus perfectly fine to adjust the mass and distance units by the $\sqrt{G}$ factor.

We do not though entirely lose G. It turns out that in order to make the SI misalignment perfectly fixed requires that we use the value of $\sqrt{G}$ instead of permeability factor. Permeability and permittivity are linked parameters which can be chosen individually to take any convenient value, provided the product has the value of c^2. The SI units of permeability turn out, like G, to be m^0, so using G instead ensures exact alignment of the new SI units such that whether used at maximal values in SI or adjusted Planck units, there is no need for any odd translation factors.

What the dimensionality tool also provides is an insight into a different interpretation of parameter relationships and of the electronic parameters. The product of viscosity and volume at maximal levels in either set of units is equal to h. Resistance has the same dimensionality as velocity. Inductance has the same dimensionality as distance. Magnetic inductance and acceleration are the same, as are mass density and current density. Viscosity has the same dimensionality as electric field. And most interestingly, magnetic flux has the same dimensionality as mass. So it is possible to construct a new framework for interpreting the electromagnetic parameters in terms of the mechanical parameters.

The difference between the maximal and electronic units can best be seen in the extra ratios that exist for the parameters in the two sets of units. Where the maximal parameters are all 1, the electronic have powers that are functions of the fine structure constant α, up to a power of α^{10} . So it is of little surprise that these relationship values have never been uncovered previously.

Without understanding what the maximal units of physics should be, that is without the distraction of G, the misaligned $\sqrt{10^{+7}}$ between mass and charge and the incorrect choice of permeability value, the experimental measurements made in current SI units have little chance of explaining the interrelationships between parameters at even the electronic units level.

But over and above all the usefulness of dimensionality as a tool, is its role in leading to the understanding that the strength of mass and charge action is the same. It confirms that the reason why the basic units of mass, the particle sizes, and of charge, the electronic charge q_e, have different values is because they are generated in different ways. They have no underlying relationship, one being the rate of twist of a meon and the other being its velocity or frequency of rotation around a ring. Not because the intrinsic effects of charge are stronger than gravity.

The identical strengths of action of mass and charge is of course one of the foundations on which the ring framework is built, but their apparent disparity is the cause of much speculation as to why the two are so different when the

electronic charge q_e and G are the two factors used when measuring the two effects. This leads to the incorrect conclusion that gravity dominates over long distances and charge over short ones. What is really the case is that both exist at all distances, and would be in equal measure were the size of rings the same proportionately to base mass as electronic charge is to base charge. The reason why gravity dominates over large distances is because the ring masses are so relatively small that nature's preference is to hide the larger charge effects first. The balancing of matter and antimatter into neutral forms also ensures that it is the smaller gravitational effect that remains unbalanced outside stable orbital systems.

The gravitational effects, in relatively near distances, are hidden by stable orbits which have zero total energy of motion and position. On the larger gravitational scale, the outward motion, either in terms of expansion, inflation or motion, away from what can be described as the source of the Big Bang is spherically symmetric. Taken together with the vector nature of energy, this means that the total energies of expansion, inflation and motion are zero, even allowing that every ring is already a total of zero energy over all energies.

13 *Ends*

So given the overall zero energy of the universe, its expansion, inflation and motion and of each ring individually, can we say what is the future of the universe and its parts? I am not sure that we have enough information to answer that question yet.

If the fine structure constant, which defines the size of the electronic charge, started at 1 and has declined over time to its current value, then we might expect the physical size of atoms to expand and eventually break apart. But the size of the rings is independent of the fine structure constant, so unless the preferred size of the ring families also started at $r = R_o$ and declined over time, rather than as a one-off result of inflation, I cannot see rings breaking apart spontaneously.

What might be possible is that photons could eventually break apart. Since each photon is composed of six twisting zero mass black holes, which is what the universe is made of, and the motion of the photons across the background zmbhs costs energy loss in viscosity friction, over enough time the photons will viscosity redshift to the extent that the distance between zmbhs within the photon will exceed the influence distance for mass or charge for that photon. At this point, it is possible that the six photon zmbhs might be considered as separated and the photon broken up. The difference between the photon zmbhs and the normal background zmbhs would be that the photon's zmbhs still have angular momentum, which the background ones may not, and the photon ones will all have the same rate of twist - if that does not decline over time.

The ownership of angular momentum is not necessarily an issue because when the ring size expands the distance effectively over which the angular momentum is measured approaches infinite and the relative velocity approaches zero. If there is no ring rotation available to fund the photon's motion against the background viscosity, then the zmbhs' velocity will be slowed. Eventually the photon zmbhs will become stationary, exactly the same on average as the background zmbhs, and whether the twisting similarly slows over time no longer matters.

The only way for such a reversion of photons to background zmbhs to occur is for all rings to become photons. Only stellar black holes can undertake this conversion in any major way, by breaking rings and reforming photons that escape. So the end of the universe can only be many years after all non-photon rings have been swallowed by black holes and re-emitted as photons. If any rings fail to be swallowed by black holes, then they will continue to exist. But this is all very speculative and better data on the change or lack of change over time of the fine structure constant or size of the electron, for example, will provide a firmer foundation for speculation.

14 *A common sense approach*

From speculation on the end of the universe, which can be adversely compared with asking how many angels can dance on the head of your particular pin, we can move back into more common sense areas - although the actions of water inside Newton's bucket might not be termed common sense to some.

Einstein's teacher Ernst Mach proposed that the reason why water stays in a bucket whirled round at arm's length is because the rest of the universe is attracting the water. Modern physics will say that it is due to centripetal force, the acceleration due to the whirling, which keeps the water inside the bucket. I say that it is due to the outward energy and force that acts on the water due to its circular motion - commonly called centrifugal force. Since there is no central potential energy attracting the water towards the centre of rotation, there is no stable orbit and the water will try to escape away from the centre, only restrained by the bottom of the bucket.

The same explanation also applies to why a water sprinkler with a centre axis and symmetrically offset outlets rotates when water is sent through. The water has outward energy but no attraction from the centre, so the offset directs a portion of the outward energy circumferentially to rotate the outlet. These two examples may seem too simple to explain, but they have both been the subject of much speculation over the years.

This is similar to the discussions that still go on in philosophical areas of physics trying to define mass and inertia. As I have explained earlier, these do become simple to understand if considered in the right framework.

I do not wish to keep plugging away at explaining every aspect of physics in the light of the ring framework, the detail would detract from the overall message that there is a better way of looking at nature which employs simple foundations to explain virtually all the observations that we see.

What the framework I have outlined proposes is that the underlying structure of matter contains significant amounts of common sense. It is symmetric in treating charge and mass energies the same, and shows how asymmetry of outcome is due to the ring structures formed. There are still sections 'around the edges' that could do with tidying up, but the core is sound.

If you think deeply enough about what we observe, you will find that beneath the difficult explanations currently used to explain quantum mechanics, there are reasonable explanations for everything, if looked at in the right framework. There are some difficult changes that need to be accepted in altering our current interpretations and definitions, but they are not insurmountable.

It has taken me almost two decades to arrive at this simplest of explanations for almost everything. I can understand why someone steeped in current physics would disagree with many of my points, when looked at individually. But the overall picture requires these points because they fit together so well.

It may take a further two decades to accept these ideas, but they will emerge eventually because they are right. No simpler system can explain virtually all that we observe.

For those readers with a need to look deeper into the explanations, and who can ignore my sorry style of explanation, I have attached the appendix. This is made up of sections explaining the points mentioned in passing above, but not explained in depth here, and excerpts from papers on specific topics using the full physics terminologies.

If after looking at these, you still have questions, I can be contacted via the physics (at) mlawrence.co.uk..

Part II

Appendix

This is the place where I have tried to cage-in the formulae. Unfortunately I had to use a small amount in the main part of the book. But here is where those readers with a mathematical bent can find my wordy explanations turned into something approaching mathematics.

Each section should be considered separately from the other because they were composed to show different aspects of the ring framework. Some papers were prepared in which the underlying ring framework does not affect the points being made, so a more conventional foundation is used. Some had to use a framework where the assumption is that particles and orbits have energies, in order to show the direct comparison with existing expectations.

Some sections use DAPU units or APU and SI and one compares units. The use of different units does not detract from the explanation or formulae, it only changes the numerical values that would result from using the formulae, roughly corresponding to saying that people have either two hands of five fingers each or they have ten individual fingers.

15 *Section 1*

Some simple formulae. These are some of the formulae I normally use, although they are not exact, as explained later, but are good working approximations.

16 *Basic Formulae*

Normal usage gives the following formulae for some relationships between two classical masses in mutual orbit in a reduced mass system with relative velocity v at separation r between the two masses m_a and m_b

$$Energy_a = Gm_am_b/r = \frac{1}{2}mv^2$$

$$Force_a = mv^2/r = Gm_am_b/r^2$$

The same equations for energy levels of quantum orbits for one of the two particles of opposite charge q are, when simplified,

$$Energy = q^2c^2/r = \frac{1}{2}mv^2 = \frac{1}{2}mvrw$$

$$Force = mv^2/r = q^2c^2/r^2$$

Both systems use the same formula for the angular momentum of each particle, with the charge bound system ignoring the gravitational interaction and using units in which $h/2\pi$ is replaced by h for clarity, as

.

$$\text{Angular-momentum } L = nh = mvr$$

and for defining quantum orbitals

$$Energy = mvrw = hw$$

with m, v and r appropriate for the system and nh for the quantum orbital.

Another useful equation is that of the magnetic moment of an orbiting electron around a proton, which is

$$\mu = qh/2m$$

These are basic and accurate enough for low energy or velocity systems, but fall down when energies or velocities are large. The section on more advanced formulae shows the better equations to use. It also shows that the reason why the classical and quantum energy formulae are different from the angular momentum formula is due to the complete omission of the intrinsic spin energy of the masses in motion (not their orbital spins). That section also shows how translating into DAPU units simplifies the formulae.

17 *Section 2*

These are the relativistic formulae, the true equivalent of the simple formulae, and some explanations on how they are achieved and where the inaccuracies appear.

18 *Advanced Formulae*

Following the same structure as the Basic Formulae section gives the following formulae in the ring framework for some relationships between two classical masses in mutual orbit in a reduced mass system with relative velocity v at separation r between two masses m_a and m_b ,using SI units initially, as

$$Energy = Gmm/r - 2(\gamma - 1)mc^2 = 0$$

$$Force = Gmm/r^2 - 2(\gamma - 1)mc^2/r = 0$$

The same equations for quantum orbits for one of the two particles of opposite charge q are, when simplified,

$$Energy = q^2c^2/r - 2(\gamma - 1)mc^2 = 0$$

$$Force = q^2c^2/r^2 - 2(\gamma - 1)mc^2/r = 0$$

Both systems use the same formula for the angular momentum of the systems, with the charge bound system ignoring the gravitational interaction and using units in which $h/2\pi$ is replaced by h for clarity, as

.

$$\text{Angular-momentum } L = nh = mvr$$

and

$$Energy = mvrw$$

with m, v and r appropriate for the system.

The difference here initially is only small, in that only the factor of $\frac{1}{2}$ has been changed in the energy formulae into $2(\gamma - 1)$, effectively twice the size. But this represents a significant alteration. This is because, as explained in detail in the appendix, of the complete omission by current physics and mathematics of the intrinsic spin energy of the masses in motion (not their orbital spins). By including each particle's intrinsic spin components, the classical and quantum formulae become identical to the angular momentum representation at low energies and velocities. Later on it is shown that to completely align the momentum, force and energy formulae requires that we follow the error in the expansion of $(\gamma - 1)$ closely, and that a better representation would include this error in an individualised value of h specific for each particle h_i.

18.0.1 *Units*

As shown above for two generic masses but now using instead the largest single-particle mass sizes M and Q and the distance L, the most basic two formulae for defining a Planck unit system are the force equation $F = GM^2/L^2 = Q^2c^2/L^2$ and the angular momentum equation $h = McL$. The normal usage of the latter is to define a Planck mass

M_p and Planck Length L_p such that $h/2\pi = M_p c L_p$ and $M_p = \sqrt{hc/2\pi G}$. Unfortunately this introduces the 2π factor in many equations, where it serves only to confuse.

The preferred definition as a starting point is to define the system without the 2π factor.

There are two stages to the change, the first is the adjusted Planck unit (APU) and the second the double-adjusted Planck unit (DAPU). Initially the APU mass M_o and APU length L_o are related by $h = M_o c L_o$ and M_o is defined to be $M_o = \sqrt{hc/G}$.

However, to achieve the right relationship between M and L in parameter space, as described later in the appendix, requires looking at the force equation at the same time. Rearranging to give $FL^2 = GM^2 = (Qc)^2$ provides the simple relationship that the APU mass M_o and APU charge Q_o are related such that $M_o\sqrt{G} = Q_o c$.

Since the latter equation does not include L_o it is not immediately apparent that compared with the Planck parameters M_p and L_p there is a need to adjust both by the factor $\sqrt{G}$ in addition to the $\sqrt{2\pi}$ factor, so that $h = M_o c L_o = 2\pi(M_p\sqrt{2\pi G})c(L_p/\sqrt{2\pi G})$ if the latter factor is distributed in the same way as $\sqrt{G}$. This stretches parameter space equally along the mass and length parameters, rather than just the mass parameter has been usually attempted in the past .

Now the second stage of the change can be made into DAPU units. The DAPU mass M_* is defined to be $M_* = M_o\sqrt{G} = Q_o c = Q_* c$ where Q_* is the DAPU charge. Comparing SI values of M_o and Q_o shows that Q_o in SI units for charge is $\sqrt{10^{+7}}$ too large and so this also needs adjustment.

Following the angular momentum equation, M_* and DAPU length L_* are related by $h = M_* c L_*$ with $L_* = L_o/\sqrt{G}$.

The result is the foundation of a DAPU parameter set and units based on $h = M_* c L_*$ and

$$F_* = M_*^2/L_*^2 = Q_*^2 c^2/L_*^2$$

Using this foundation, it is possible, as shown later in the appendix, to produce a complete set of force family equations relating many parameters together using the parameters as defined, as follows

$$F_* = (M_*/L_*)^2 = (\phi_*/L_*)^2 = (Q_* c/L_*)^2 = M_* a_*$$

$$= \phi_* B_* = Q_* c B_* = Q_* \xi_* = V_* c = i_*^2 = hc/L_*^2$$

It is also possible to use the same relationships at the electronic charge q_{e*} level, using the parameter values from the appendix thus:

$$F_{e*} = (M_{e*}/L_{e*})^2 = (\phi_{e*}/L_{e*})^2 = (Q_{e*} c/L_{e*})^2 = M_{e*} a_{e*}$$

$$= \phi_{e*} B_{e*} = Q_{e*} c B_{e*} = Q_{e*} \xi_{e*} = V_{e*} c = i_{e*}^2 = hc/L_{e*}^2$$

and so to confirm that $M_* Q_* = h$ and $M_*/Q_* = c$

The reason for the initial $\frac{1}{2}$ factor in the Basic Formulae section is derived from the exact action of relativity on the apparent mass energy of a meon, using APU units as

$$M_i c^2 = M_o(\gamma_i – 1)c^2 = h(\phi_i - 1)w_o \approx \tfrac{1}{2} M_o V_i^2 \approx \tfrac{1}{2} h w_i$$

since within all rings $M_o V_i r_i = h = M_o c R_o$

The apparent energy of the Plank mass is increased relativistically by motion, exactly the same as normally describes the energy increase of a normal particle. The factor $l_x = [(1 - v_x^2/c^2)^{-0.5} - 1] = [\gamma_x - 1] = [(1 - w_x/w_o)^{-0.5} - 1] = [(1 - r_o/r_x)^{-0.5} - 1]$ refers to this increased energy effect on the mass, where v_x is the velocity and w_x the angular frequency rotation in a system. The system is not defined here, but the relationships, using $M_o c^2 = hw_o$ are:

$$E_{relativistic} = l_x M_o c^2 \simeq \frac{1}{2} M_o v_x^2 = m_x c^2$$

and

$$E_{relativistic} = l_x M_o c^2 = l_x h w_o \simeq \frac{1}{2} h w_x$$

The energy available to a moving body, due to motion and gravity, but not intrinisc spin, is given by

$$E_{A-moving-mass} = m_A \gamma_A c^2 (1 - G m_B / r c^2)$$

In the same way, the formula for the total mass-related energy, substituting the charge components, arrives at the following formula for the total charge-related energy of a particle in motion with rest-charge cq around another particle of opposite sign rest-charge Ncq

$$E_{A-moving-charge} = cq\gamma_A c^2 (1 – Nqc/rc^2)$$

Both charge and mass can be treated identically.

In some of the above simplifications, the $\frac{1}{2}$ factor appears. It is important to follow the error away from exactly $\frac{1}{2}$ because this will increase as energies or velocities increase. So in the previous Basic Formulae section, the formula

$$\mu_e = eh/2m$$

contains the factor $\frac{1}{2}$ which derives from the relativistic expansion of $(\gamma - 1)$. The appendix show how to follow the error by being more precise in the expansion of l_x by defining the following relationships

$$l_x = (\gamma_x - 1) \backsimeq \frac{1}{2} v_x^2 = \frac{1"}{2} v_x^2 = \frac{1"}{2} w_x = \frac{1}{2} w_x"$$

which uses $\frac{1"}{2}$ or the $w"_x$ to denote the assignment of the error in the expansion either to the $\frac{1}{2}$ or to the variable w_x. Although the effect is small at masses and energies normally encountered, the effect will grow with increasing energy and it is useful to follow where that error will show itself.

18.0.2 *Addition or Product*

Adding energies or velocities relativistically is usually done using the following formula

$$T_r = (x + y)/(1 + xy)$$

However, this is actually only a specific example of a general form of treating actions within any number of dimensions or any number of interacting bodies, based on the interaction of, for example, energies or veocities acting as the product of fields thus

$$T_G(n) = (\prod^{i}(1 + i) - \prod^{i}(1 - i))/(\prod^{i}(1 + i) + \prod^{i}(1 - i))$$

19 *Section 3*

This is a toolkit for exploring the relationships between parameters and explains the relationships between Double-Adjusted Planck (DAPU), Adjusted Planck (APU) and SI units. It is written from a conventional viewpoint that expects orbits to have net energies. It also shows how G is eliminated.

20 A toolkit for improving the understanding of relationships between physical parameters based on adjusted SI units, a new Planck unit framework without G and the reinterpretation of the von Klitzing and Josephson constants and why and how energies and velocities should be combined by producting their fields not by addition

This section presents new ways of understanding the relationships between parameters. The novel insights and predictions include: A self-contained and consistent new Planck unit set of maximal sized parameters from which all observed values can be compared and easily combined in equations. A self-contained and consistent new Planck unit set of electron-charge based parameters, some of which are directly observable in experiments. The interpretation of the gravitational constant G as a dimensionless ratio and its relegation from gravitational to permeability use and the elimination of the need to test the equivalence of gravitational and inertial masses. That all parameters can be displayed in terms of only h and c for the Planck maximal parameter set and in terms of only h, c and α for the electron-charge based set (other than permeability and permittivity which have G content), and which was previously considered impossible. There exists a new hypothetical dimensional analysis that can be used to describe parameter dimensions and to uncover any law of nature or any universal constants. That all electron charge based Planck parameters can be described solely in terms of ratios of the R_k and K_j and so will benefit from the precision of measurement of these two parameters. That the experimentally observed value of R_k implies either that the velocity of a current within certain electromagnetic materials could be in excess of light speed, the patterns produced by subluminal physical objects have a maximum velocity of $2\pi c/\alpha$ or that such a velocity is required in order to pass through those material. That most electromagnetic parameters can be reinterpreted in terms of mechanical parameters. By adjusting currently misaligned SI units to be self-consistent and consistent with DAPU units, greater clarity will ensue. This is a toolkit for providing a better understanding of the fundamentals of physics. Also shown is that the normal method of relativistic addition of energies or velocities is a two-component simplification of a much more general method of combination by producting of fields.

20.1 *Background*

The discovery that the von Klitzing constant R_k [1] and the Josephson constant K_j [2] could be measured directly, although they are composed of Planck and near-Planck sized parameters h and q_e, has improved the precision of measurement of h and some SI electromagnetic units [3]. It is unfortunate that the misalignment of SI units between mechanical and electromagnetic parameters has not been addressed before. This paper looks at how the SI system should be adjusted to be self-consistent and consistent with the most fundamental set of Planck units that are hypothetically possible. It then reinterprets the meaning of, and relationships between, those fundamental parameters and predicts the possibility of a maximum faster than light speed for either physical objects, patterns created by subluminal physical objects or the minimum velocity required to cross certain materials.

20.1.1 *Methodology*

The paper starts by defining the most fundamental set of Planck units that are hypothetically possible, and then a second linked set based around the maximum values that are actually observed – the difference being that the former is built on a hypothetical Planck charge Q_*, defined later, and the latter on the electron charge q_e.

As part of the process in defining the new Planck units, it is shown that the gravitational constant G is only a dimensionless ratio, and can be subsumed within the new mass and distance units. What emerges from the q_e set are values in the new fundamental units for R_k and K_j. These two constants are members of the set of q_e units, as should be expected, although K_j appears inversely and twice the anticipated size.

The dimensional analysis used to subsume G is employed to show that R_k can be considered as equivalent to a velocity, and that many of the electromagnetic parameters can similarly be considered equivalent to mechanical parameters. This invites a reinterpretation of not just R_k and K_j, but of all electromagnetic parameters.

By using the new fundamental units as a framework, it is shown what adjustments are required to some of the electromagnetic SI units, so that the units are both self-consistent and consistent with the fundamental framework. This reintroduces $\sqrt{G}$ as a replacement for permeability, which is also shown to be dimensionless.

The measured value of R_k is shown to equate to a speed greater than light speed. Although it is not clear whether this increased maximum velocity applies to either physical objects, the media through which the physical objects travel or patterns created by subluminal physical objects, this can be experimentally tested.

The final output is to display all the Q_* parameter set as ratios of only h and c, and all the q_e parameter set as ratios of only h, c and $d = \sqrt{\alpha/2\pi}$. This highlights how the parameters are linked and shows that the laws of nature would be constructed in the same way regardless of the relative sizes of h, c and α.

The dimensional analysis enables new laws to be constructed and new constants of nature to be uncovered, although it is not clear that there are any of the latter needed since h and c are all that are required to generate all the Q_* fundamental parameter set.

Examples are given of simplifications of existing formulae using the new framework, one of which is new to physics.

20.1.2 *Significance*

The usefulness of the paper is partly in providing a toolkit for looking at the relationships between fundamental parameters and for displaying equations stripped of their usual SI based constants and ratios so that the underlying physics can be better understood.

Although to an extent this is already done [4], the new units introduced means that there need no longer be odd conversion factors needed when considering electromagnetic and mechanical units together. And further that many electromagnetic parameters can be replaced by mechanical parameters.

A prediction is made on the maximum faster than light velocity that can be obtained. The observed value of R_k implies that there is a limit above light speed, probably in terms of electromagnetic field pattern motion, and that limit can be tested in the laboratory.

The most fundamental set of units possible is produced and the set of SI units compared to it, with two adjustments proposed to ensure the self-consistency of SI units and of their consistency with the fundamental units framework. Also shown is how increased precision in the accuracy of other parameters can be constructed out of ratios of R_k and K_j. The gravitational constant G is eliminated from gravitational equations, confirming the equivalence of inertial and gravitational mass in a novel manner – there being only the former remaining. $\sqrt{G}$ is reintroduced to make the second adjustment to SI units and is thereafter a measure of the permeability or interaction within materials, rather than between masses.

So the paper covers some fundamental ground, changing interpretations of many electromagnetic parameters, eliminating G for gravity but reintroducing it for permeability, suggesting that there may be an observable maximum faster than light speed for electromagnetic patterns and indicating how SI units may be improved in consistency and precision.

20.1.3 *Objectives*

This paper sets out with a number of objectives in showing what insights this paper provides. These may initially seem disparate, but are actually fundamentally intertwined. The objectives listed were not necessarily objectives of the work undertaken, but were uncovered or used as part of its consideration.

The starting point is a discussion of units and the lack of consistency between current SI units and Planck units. It is shown below that the current set of SI units does not have a consistent relationship with the most fundamental set of Planck units, described as Double-adjusted Planck units (DAPU units), and is not internally self-consistent.

By showing the changes needed to SI units in order to gain consistency, it becomes possible to better understand the relationships between parameters such as mass, length, charge, magnetic flux, resistance and time and to achieve the following objectives:

1 The elimination of the gravitational constant G in gravitational formulae. G is shown simply to be a dimensionless ratio, but its elimination requires that it be subsumed within the mass and distance parameters, rather than just the mass parameter as has been tried previously [5]. This also shows that the question of the equivalence of gravitational and inertial mass is irrelevant. However, $\sqrt{G}$ is usefully reintroduced in place of permeability u_* as one of the adjustments needed within current SI units in order to provide consistency with DAPU units.

2 The definition of a set of self-consistent Planck units at the largest possible values using the hypothetical Planck size charge Q_* (the DAPU units) in terms of only Planck's constant h and light speed c. This has been considered impossible previously [6].

3 The use of DAPU units to define a self-consistent set of parameters using the observed value of electron charge q_e or e in SI units and q_{e*} in DAPU units, in terms of only h, c and a constant d which is based on the fine structure constant α.

4 To show that there exists a hypothetical dimensionality that can be used to describe parameters and to uncover any law of nature or any universal constants.

5 That the von Klitzing constant R_k and Josephson constants K_j are two of the electromagnetic DAPU parameters that emerge from the set of parameters based on the electron charge and that they can be reinterpreted in mechanical terms as equivalent to a velocity and inverse-mass respectively.

6 That all of the q_{e*} parameter set can be described solely in terms of ratios of R_k and K_j and so will benefit from the precision of measurement of these two parameters.

7 That the experimentally observed value of R_k implies either a velocity of physical objects, or patterns created by subluminal physical objects, within electromagnetic materials that is in excess of light speed or that such a speed is required to pass through maximal media..

8 That many electromagnetic parameters can be reinterpreted in terms of mechanical parameters.

9 That using DAPU parameters simplifies equations used in physics, can lead to better understanding and enables reinterpretations of existing expressions.

This paper is emphatically not an exercise in numerology. Although, by necessity, it manipulates numbers and relationships to produce self-consistent values for all the parameters considered in terms of the adjusted SI units, that is not the objective. What this paper provides is a toolkit for investigating the deeper relationships between parameters, which are currently hidden by their partially-aligned SI values and less than optimal Planck units.

20.1.4 *Units*

The paper by Mohr et al. [7] explains the current state in which SI units are being bought more into the quantum measurement realm. The excellent paper by M. J. Duff, L. B. Okun and G. Veneziano [8] includes a broad and varied introduction to the problems of fundamental units and also covers their relationship with SI units. The issue is not new. To paraphrase Dr Okun [6] - *The use of fundamental units h and c in SI has introduced greater accuracy in some of the units, but some electromagnetic units are based on pre-relativistic classical electrodynamics and so their measurement is not as accurate as other units. The use of permeability and permittivity spoils the perfection of the special relativistic spirit and, whilst this is useful for engineers, it results in the four physical parameters D, H and E, B having four different dimensions.* It is only by starting at the most basic and simple physical maximal sized set of Planck type units - and maintaining the integrity of the relationships within that set by not stretching the parameter space unequally - that it is possible to see that the electromagnetic and mechanical parameters are misaligned and that the current value of permeability results in a further misalignment. A new form of dimensional analysis underpins this and allows both mechanical and electromagnetic parameters to be treated on an identical basis. A simile for the current situation is that of a marionette suspended from a wooden framework by strings attached to various body parts and manipulated from above by a puppeteer. The strings may be attached to the right places, but some of their lengths are wrong and so the marionette can dance - but only after a fashion. Correcting the string lengths will allow a fuller appreciation of the puppeteer's skills.

20.1.5 *The Foundations*

The most basic two formulae for defining a Planck unit system are the force equation $F = GM^2/L^2 = Q^2c^2/L^2$ and the angular momentum equation $h = McL$. The normal usage of the latter is to define a Planck mass M_p and Planck Length L_p such that $\hbar = M_pcL_p$ and $M_p = \sqrt{\hbar c/G}$. Unfortunately this introduces the 2π factor in many equations, where it serves only to confuse.

The preferred definition to be used here as a starting point is to define the system without the 2π factor. There are two stages to the change, the first is the adjusted Planck unit (APU) and the second the double-adjusted Planck unit (DAPU). Initially the APU mass M_o and APU length L_o are related by $h = M_ocL_o$ and M_o is defined to be $M_o = \sqrt{hc/G}$.

However, to achieve the right relationship between M and L in parameter space, as described below, requires looking at the force equation at the same time. Rearranging to give $FL^2 = GM^2 = (Qc)^2$ provides the simple relationship that the APU mass M_o and APU charge Q_o are related such that $M_o\sqrt{G} = Q_oc$.

Since the latter equation does not include L_o it is not immediately apparent that compared with the Planck parameters M_p and L_p there is a need to adjust both by the factor $\sqrt{G}$ in addition to the $\sqrt{2\pi}$ factor, so that $h = M_ocL_o = 2\pi(M_p\sqrt{2\pi G})c(L_p/\sqrt{2\pi G})$ if the latter factor is distributed in the same way as $\sqrt{G}$. This stretches parameter space equally along the mass and length parameters, rather than just the mass parameter as is usually done [9].

Now the second stage of the change can be made into DAPU units. The DAPU mass M_* is defined to be $M_* = M_o\sqrt{G} = Q_oc = Q_*c$ where Q_* is the DAPU charge.

Following the angular momentum equation, M_* and DAPU length L_* are related by $h = M_*cL_*$ with $L_* = L_o/\sqrt{G}$.

The result is the foundation of a DAPU parameter set and units based on $h = M_*cL_*$ and

$$F_* = M_*^2/L_*^2 = Q_*^2c^2/L_*^2$$

as set out in the initial objective and without G. The dimensionality of G will be shown to be zero later. This is the most basic set of Planck parameters that can be devised because only the two universal constants h and c are used, and this is the minimum number of constants required to establish relationships between the parameters.

The subsuming of G within the mass and distance units also eliminates the difference between gravitational and inertial masses, since there is no longer any gravitational mass. This is not equivalent to making $G = 1$, as will be shown below, because the effect of subsuming G into M_* and L_* is to stretch current parameter space into the more symmetric DAPU parameters space, which does not occur when simply setting $G = 1$.

The base parameter space consists of M, L, c, h and Q. Since Q can be related to M and c only, the minimum parameter space is just M, L, c and h. Because h and c are the two basic universal constants, to maintain the topology and symmetry of the base parameter space requires that the other two parameters M and L are stretched proportionately together. Provided Q is treated in the same way as M, it will stay symmetric. Any non-symmetric stretching results in an asymmetric set of parameters and will require the use of factors such as d in the relationships between the stretched parameters.

20.1.6 *SI units and DAPU*

The above two relationships hold in the new DAPU system in DAPU units, but unfortunately in SI units there is the first misalignment that becomes apparent. To align the charge and mass side of the equation in SI units requires that the base unit size Planck charge is decreased by the factor $\sqrt{1x10^{-7}}$ relative to the mass side since $GM_o^2/L_o^2 = Q_o^2c^2(10^{-7})/L_o^2$ in SI units. To identify this difference, each equation in future may, where it might otherwise confuse, be identified either as being in DAPU or SI units, so that $Q_* = M_*/c(DAPU) = M_*\sqrt{10^7}/c(SI)$.

It is useful for display purposes, as will be used liberally later, to define a factor $d = \sqrt{\alpha/2\pi}$ that represents the ratio $d = q_{e*}/Q_*$, where q_{e*} is the DAPU size of the electronic charge.

The second SI misalignment appears when comparing electromagnetic and mechanical SI units that have material content requiring permeability or permittivity. The use of permeability u_* as $4\pi \times 10^{-7}$ causes the factor $4\pi \times 10^{-7}/\sqrt{G} = 6.501$ to appear in some parameters when compared with what their DAPU based value should be. This arises from some parameters whose SI units may mix electromagnetic and mechanical parameters within their definition, such as the Farad. So the second SI re-alignment is to define u_* to be equal to $\sqrt{G}$ rather than the usual $4\pi \times 10^{-7}$, which relegates G from gravitational to permeability use, so that it represents a measure of the strength of interactions within materials not between masses.

The result is that the proposed new adjusted-SI units (NSI) which should be used are either the same as the normal SI units or are different to normal SI units by a power of either the $\sqrt{1x10^{-7}}$ factor, the 6.501 factor or a combination of both. Wherever there is a factor q_{e*} used, the same power of $\sqrt{1x10^{-7}}$ is used. Where there is no q_{e*} or u_* factor, the NSI and SI values are the same. Where the current SI unit is adjusted by a power of the $\sqrt{1x10^{-7}}$ factor, the parameter has a cedilla above it. So the SI unit Watts, W becomes $\tilde{W}$ in NSI where $\tilde{W} = \sqrt{1x10^{-7}}W$. Because most of the parameter examples used here do not have any specific material dependence, as would be the case for the magnetic field H, there is no use of permeability u_* or permittivity ε_* within most of the parameter examples given. For the examples used here, there are no complications of additional 6.501 usage or identification of double adjusted SI units, other than in the permittivity ε_* and capacitance C_*, where the SI unit the Farad F is adjusted by that factor to be $F^{\#}$ in NSI with $F^{\#} = F/6.501$.

So the adjustment of SI units to make them self-consistent across both mechanical and electromagnetic parameters, and to ensure that they have the same overall shape in parameter space as the underlying DAPU units allows the direct comparison of all parameters in either DAPU or NSI units, with the only difference being the actual number value in each set of units. For the Q_* set of parameters, in DAPU the maximal values are always 1. For the q_{e*} set of parameters, the maximal values are always powers of d. For both these sets, the NSI values are shown in Tables 1 and 2.

20.1.7 *Dimensionality of G*

The subsuming of G with the APU mass M_o to produce the DAPU mass M_*, and the APU length L_o to produce the DAPU length L_*, would seem to ignore the units of G, effectively treating G as unity and without units. But this is not

the case. The units of G are $m^3kg^{-1}s^{-2}$. A consideration of the standard laws of nature and the fundamental constants through a form of dimensional analysis shows that if each parameter is assigned an appropriate dimensionality, every fundamental constant, other than c, will have a total dimensionality of zero. The dimensional analysis consists of solving for a basis vector in vector parameter space which produces zeroes of dimension for four important constants of nature, h, G, Permeability(u) and Boltsmann's constant k_B. Using G in the analysis may appear circular, but the analysis supports its use. It also shows that Boltzmann's constant, like G, is simply a factor that can be discarded in the correct units and that there may exist other parameters, as yet unrecognized, that correspond to missing dimensionalities.[12]

The dimensionalities of the main SI, NSI, APU or DAPU parameters in terms of a hypothetical dimension Y that emerge from the consideration are:

Mass $M_* = Y^{+1}$ Velocity $c = Y^{+2}$ Length $L_* = Y^{-3}$ Charge $Q_* = Y^{-1}$ Time $T_* = Y^{-5}$ Energy $E_* = Y^{+5}$

and of course

$h = Y^0$ and $G = Y^0$

The units of G are $\mathsf{m}^3kg^{-1}s^{-2} = Y^{-9}Y^{-1}Y^{+10} = Y^0$ dimensionality and h has units $kgm^2s^{-1} = Y^{+1}Y^{-6}Y^{+5} = Y^0$ dimensionality.

So the units of both h and G are actually irrelevant because they represent fundamental constants with zero dimensionality. Thus adjusting the APU mass to the DAPU mass, and APU length to DAPU length, involves only multiplying or dividing by $\sqrt{G}$ as a dimensionless number, and does not affect the dimensionality of the units of mass or length, other than changing the sizes of the base Planck mass and distance units. This stretches the current parameter space into the more symmetric DAPU parameter space, which is different to treating G as equal to 1, which does not affect the current parameter space topology at all.

The same dimensional analysis can be done for permeability $u_* = NA^{-2} = kg\mathsf{m}^{-1}s^{-2}(\sqrt{kg\mathsf{m}}s^{-1})^{-2} = Y^0$ which shows that the replacement of u_* by $\sqrt{G}$ does not affect the units used because they are both dimensionless.

This hypothetical dimensionality tool can be used to produce any law of nature by creating equations where the dimensionalities are equal on both sides. One example would be $F = Ma$, where force is Y^8 and is equal to the product of mass Y^1 and acceleration Y^7, so that both sides have Y^8 dimensionality. Another example would be the product of volume and viscosity which produces Y^0 on one side and would represent a new constant of nature on the other. To produce a constant of nature, aside from c, the minimum that is required is that it has Y^0 dimensionality.

However, producing laws of nature through the dimensional analysis does not provide the exact relationship between the non-maximal parameters, because these depend on the specific context in which the parameters are being considered. An example would be the kinetic energy of a particle in motion $E_{ke} = (\gamma_v - 1)mc^2 \simeq \frac{1}{2}mv_e^2$ compared with the rest mass energy of the same particle $E_{rm} = mc^2$. Dimensionally these exhibit the same relationships between mass, energy and velocity but they describe different specific aspects of that relationship.

20.1.8 *Values of the Q_* set of parameters*

Table 1 provides a list of the main Q_* parameter set and their NSI values at their maximal Planck sizes. The column headed 'NSI units' means that where the current electromagnetic SI units appear they have been adjusted by a power of the factor $\sqrt{1x10^7}$ mentioned earlier and their use is denoted by a cedilla above the unit or $F^{\#}$ describes the SI unit F adjusted by the 6.501 factor. Note that the factor d does not appear in Table 1 because these values are all based on the DAPU charge Q_*.

Table 1:Maximal parameter values in NSI units with electronic charge size Q_*

Parameter (X_*)	Q_*DAPU set's NSI Value	NSI Units	DAPU equivalent	As Constants
Gravitational Constant(G)	1	$m^3kg^{-1}s^{-2}$	*none*	*none*
Permeability(u_*)	$\sqrt{6.67428 \times 10^{-11}}$	NA^{-2}	*none*	$\sqrt{G}$
Boltzmann's Constant (k_B)	1	$J\check{K}^{-1}$	*none*	*none*
Angular Momentum(h)	$6.62606896 \times 10^{-34}$	Js	kgm^2s^{-1}	h
Mass(m_*)	$4.45695580 \times 10^{-13}$	kg	kg	$\sqrt{hc}$
Magnetic Flux(ϕ_*)	$4.45695580 \times 10^{-13}$	$\tilde{W}$	$\sqrt{kgm}ms^{-1}$	$\sqrt{hc}$
Charge-mass(q_*c)	$4.45695580 \times 10^{-13}$	$\tilde{C}ms^{-1}$	$\sqrt{kgm}ms^{-1}$	$\sqrt{hc}$
Velocity(v_*)	2.99792458×10^{8}	ms^{-1}	ms^{-1}	c
Resistance(R_*)	2.99792458×10^{8}	$\tilde{\Omega}$	ms^{-1}	c
Momentum(m_*v_*)	$1.33616173 \times 10^{-4}$	$kgms^{-1}$	$kgms^{-1}$	$c\sqrt{hc}$
Current(ι_*)	$8.98755179 \times 10^{16}$	$\tilde{A}$	$\sqrt{kgm}s^{-1}$	c^2
Action(m_*/r_*)	$8.98755179 \times 10^{16}$	kgm^{-1}	kgm^{-1}	c^2
Angular Frequency(w_*)	$6.04538246 \times 10^{37}$	Hz	s^{-1}	$c^2\sqrt{c/h}$
Frequency(f_*)	$6.04538246 \times 10^{37}$	Hz	s^{-1}	$c^2\sqrt{c/h}$
Energy(E_*)	4.00571211×10^{4}	J	kgm^2s^{-2}	$c^2\sqrt{hc}$
Temperature (K_*)	4.00571211×10^{4}	$\check{K}$	$\check{K}$	$c^2\sqrt{hc}$
Potential Difference($\vee_*$)	$2.69440024 \times 10^{25}$	$\tilde{V}$	$\sqrt{kgm}ms^{-2}$	c^3
Acceleration(a_*)	$1.81236007 \times 10^{46}$	ms^{-2}	ms^{-2}	$c^3\sqrt{c/h}$
Magnetic Inductance(B_*)	$1.81236007 \times 10^{46}$	$\tilde{A}m^{-1}$	ms^{-2}	$c^3\sqrt{c/h}$
Force(F_*)	$8.07760871 \times 10^{33}$	N	$kgms^{-2}$	c^4
Electric Field(ξ_*)	$5.43331879 \times 10^{54}$	$\tilde{V}m^{-1}$	$\sqrt{kgm}m^{-2}s^{-2}$	$c^4\sqrt{c/h}$
Viscosity (η_*)	$5.43331879 \times 10^{54}$	P_as	$kgm^{-1}s^{-1}$	$c^4\sqrt{c/h}$
Mass Density(ρ_*)	$3.65466491 \times 10^{75}$	kgm^{-3}	kgm^{-3}	c^5/h
Current Density(J_*)	$3.65466491 \times 10^{75}$	$\tilde{A}m^{-2}$	$\sqrt{kgm}m^{-2}s^{-1}$	c^5/h
Power(P_*)	$2.42160617 \times 10^{42}$	Js^{-1}	kgm^2s^{-3}	c^5
Pressure(p_*)	$3.28464901 \times 10^{92}$	Nm^{-2}	$kgm^{-1}s^{-2}$	c^7/h
Energy Density(ϵ_*)	$3.28464901 \times 10^{92}$	Jm^{-3}	$kgm^{-1}s^{-2}$	c^7/h
Charge(q_*)	$1.48668043 \times 10^{-21}$	$\tilde{C}$	$\sqrt{kgm}$	$\sqrt{h/c}$
Conductance(ς_*)	$3.33564095 \times 10^{-9}$	$\tilde{\Omega}^{-1}$	$m^{-1}s$	c^{-1}
Moment(m_*r_*)	$2.21021870 \times 10^{-42}$	kgm	kgm	h/c
Distance(L_*)	$4.95903212 \times 10^{-30}$	m	m	$c^{-1}\sqrt{h/c}$
Inductance($\mathcal{L}_*$)	$4.95903212 \times 10^{-30}$	$\tilde{H}$	$\sqrt{kgm}m^{-1}s^{-1}$	$c^{-1}\sqrt{h/c}$
Permittivity(ε_*)	$1.36193501 \times 10^{-12}$	$F\Psi m^{-1}$	$m^{-2}s^2$	$c^{-2}/\sqrt{G}$
Time(T_*)	$1.65415506 \times 10^{-38}$	s	s	$c^{-2}\sqrt{h/c}$
Area(A_*)	$2.45919996 \times 10^{-59}$	m^2	m^2	h/c^3
Volume(V_*)	$1.21952516 \times 10^{-88}$	m^3	m^3	$h\sqrt{h/c}/c^4$

20.1.9 *Values of the q_{e*} set of parameters*

In DAPU the value of each parameter in Table 1 is 1. To arrive at the maximal real values that can be found experimentally, the list needs to be adjusted to use q_e instead of Q_* since we do not observe Q_* charges usually. The maximal values in NSI units of some parameters under this limitation are listed in Table 2. Note that the power of factor d is inversely proportional to the dimensionality of every parameter

Table 2: Maximal parameter values in NSI units using electronic charge size q_{e*}

Parameter (X_{e*})	q_* DAPU set's NSI Value	NSI Units	DAPU equivalent	As Constants
Permeability(u_{e*})	$\sqrt{6.67428 \times 10^{-11}}$	NA^{-2}	*none*	$\sqrt{G}$
Angular Momentum(h)	$6.62606896 \times 10^{-34}$	Js	kgm^2s^{-1}	h
Boltzmann (k_B)	1	$J\tilde{K}^{-1}$	*none*	*none*
Mass(m_{e*})	$1.30781284 \times 10^{-11}$	kg	kg	$d^{-1}\sqrt{hc}$
Magnetic Flux(ϕ_{e*})	$1.30781284 \times 10^{-11}$	$\tilde{W}$	$\sqrt{kgm}ms^{-1}$	$d^{-1}\sqrt{hc}$
Charge-mass($q_{e*}c$)	$1.30781284 \times 10^{-11}$	$\tilde{C}ms^{-1}$	$\sqrt{kgm}ms^{-1}$	$d^{-1}\sqrt{hc}$
Velocity(v_{e*})	$2.58128076 \times 10^{11}$	ms^{-1}	ms^{-1}	$d^{-2}c$
Resistance(R_{e*})	$2.58128076 \times 10^{11}$	$\tilde{\Omega}$	ms^{-1}	$d^{-2}c$
Momentum($m_{e*}v_{e*}$)	$3.37583212 \times 10^{00}$	$kgms^{-1}$	$kgms^{-1}$	$d^{-3}c\sqrt{hc}$
Current(i_{e*})	$6.66301034 \times 10^{22}$	$\tilde{A}$	$\sqrt{kgm}s^{-1}$	$d^{-4}c^2$
Action(m_{e*}/r_{e*})	$6.66301034 \times 10^{22}$	kgm^{-1}	kgm^{-1}	$d^{-4}c^2$
Angular Frequency(w_{e*})	$1.31510410 \times 10^{45}$	Hz	s^{-1}	$d^{-5}c^2\sqrt{c/h}$
Frequency(f_{e*})	$1.31510410 \times 10^{45}$	Hz	s^{-1}	$d^{-5}c^2\sqrt{c/h}$
Energy(E_{e*})	$8.71397049 \times 10^{11}$	J	kgm^2s^{-2}	$d^{-5}c^2\sqrt{hc}$
Temperature (K_{e*})	$8.71397049 \times 10^{11}$	$\tilde{K}$	$\tilde{K}$	$d^{-5}c^2\sqrt{hc}$
Potential Difference($\vee_{e*}$)	$1.71991004 \times 10^{34}$	$\tilde{V}$	$\sqrt{kgm}ms^{-2}$	$d^{-6}c^3$
Acceleration(a_{e*})	$3.39465292 \times 10^{56}$	ms^{-2}	ms^{-2}	$d^{-7}c^3\sqrt{c/h}$
Magnetic Inductance(B_{e*})	$3.39465292 \times 10^{56}$	$\tilde{A}m^{-1}$	ms^{-2}	$d^{-7}c^3\sqrt{c/h}$
Force(F_{e*})	$4.43957068 \times 10^{45}$	N	$kgms^{-2}$	$d^{-8}c^4$
Electric Field(ξ_{e*})	$8.76255225 \times 10^{67}$	$\tilde{V}m^{-1}$	$\sqrt{kgm}m^{-2}s^{-2}$	$d^{-9}c^4\sqrt{c/h}$
Viscosity (η_{e*})	$8.76255225 \times 10^{67}$	P_as	$kgm^{-1}s^{-1}$	$d^{-9}c^4\sqrt{c/h}$
Mass Density(ρ_{e*})	$1.72949881 \times 10^{90}$	kgm^{-3}	kgm^{-3}	$d^{-10}c^5/h$
Current Density(J_{e*})	$1.72949881 \times 10^{90}$	$\tilde{A}m^{-2}$	$\sqrt{kgm}m^{-2}s^{-1}$	$d^{-10}c^5/h$
Power(P_{e*})	$1.14597784 \times 10^{57}$	Js^{-1}	kgm^2s^{-3}	$d^{-10}c^5$
Pressure(p_{e*})	$1.15236684 \times 10^{113}$	Nm^{-2}	$kgm^{-1}s^{-2}$	$d^{-14}c^7/h$
Energy Density(ϵ_{e*})	$1.15236684 \times 10^{113}$	Jm^{-3}	$kgm^{-1}s^{-2}$	$d^{-14}c^7/h$
Charge(q_{e*})	$5.06652691 \times 10^{-23}$	$\tilde{C}$	$\sqrt{kgm}$	$d\sqrt{h/c}$
Conductance(ς_{e*})	$3.87404585 \times 10^{-12}$	$\tilde{\Omega}^{-1}$	$m^{-1}s$	d^2c^{-1}
Moment($m_{e*}r_{e*}$)	$2.56696950 \times 10^{-45}$	kgm	kgm	d^2h/c
Distance(L_{e*})	$1.96279576 \times 10^{-34}$	m	m	$d^3c^{-1}\sqrt{h/c}$
Inductance($\mathcal{L}_{e*}$)	$1.96279576 \times 10^{-34}$	$\tilde{H}$	$\sqrt{kgm}m^{-1}s^{-1}$	$d^3c^{-1}\sqrt{h/c}$
Permittivity(ε_{e*})	$1.83707675 \times 10^{-18}$	$F^{\#}m^{-1}$	$m^{-2}s^2$	$d^4c^{-2}/\sqrt{G}$
Time(T_{e*})	$7.60396075 \times 10^{-46}$	s	s	$d^5c^{-2}\sqrt{h/c}$
Area(A_{e*})	$3.85256718 \times 10^{-68}$	m^2	m^2	d^6h/c^3
Volume(V_{e*})	$7.56180251 \times 10^{-102}$	m^3	m^3	$d^9h\sqrt{h/c}/c^4$
Capacitance(C_{e*})	$2.94580926 \times 10^{-57}$	$F^{\#}$	$m^{-1}s^2$	$d^7c^{-3}\sqrt{h/c}$

20.1.10 *Why this is not numerology*

What is important here is that the relationships between the parameters in both tables are easily displayed in terms of only h and c for the Q_* set and in terms of only h, c and d for the q_{e*} set (other than permeability and permittivity which have G content). So each parameter has a simple relationship to each other one. The actual NSI values of these parameters bear out these relationships numerically, but they are only a confirmation of what the fundamental constants already show.

Within the q_{e*} set are two parameters that deserve further consideration, R_k and K_j.

20.1.11 R_k *and* K_j *- members of the* q_{e*} *parameter set whose values can be measured directly*

The maximal value for Resistance R_{e*} is equal to the von Klitzing constant R_k, $R_{e*} = R_k$ (DAPU) and the value of the Magnetic Flux ϕ_{e*} is equal to twice the inverse of the Josephson constant K_j, $\phi_{eo} = (2/K_j)$ (DAPU). Table 3 shows that the NSI values of R_k and K_j are identical to R_{e*} and $2/\phi_{e*}$ when translated into DAPU units by multiplying by the factor $1x10^{-7}$ for R_j and $\sqrt{1x10^{-7}}$ for K_j. To ensure clarity, new parameters will be defined $R"_k = R_{e*} = R_k$ and $K"_j = 2/\phi_{e*} = K_j$ where $R"_k$ and $K"_j$ denote the DAPU interpretations of R_k and K_j which can be more easily compared with other constants in DAPU units. This will be explored further later.

20.1.12 *Parameters, physical constants and laws of nature*

Some of the q_{e*} set of parameters, such as velocity v_{e*}, appear to be larger than their Q_* set versions. As will be shown below, it is possible to interpret R_k as equivalent to a velocity and, if so, this suggests either that faster than light travel by physical objects, or patterns produced by subluminal physical objects, through media may be a possibility or that in order to pass through such maximal media an unachievable speed faster than light is required. Which is the case should should be investigated. This result, where the parameters $X_{e*} > X_*$, will be considered further below.

All the parameters above have been produced using standard relationships and formulae. It is interesting to observe that some parameters on the mechanical side have identical size and dimension partners on the electromagnetic side, for example mass M_* and magnetic flux ϕ_*. One interpretation could be that magnetic flux is the equivalent of the mass in an electromagnetic system, and that resistance R_{e*} is the equivalent of velocity v_{e*}. Dimensional analysis supports this and the appropriateness of this interpretation will be considered later.

To ensure that the above values can be understood properly, the following series of relationships at the Q_* level can be culled from the standard laws and the results computed and confirmed to be correct using their NSI values in Table 1 as:

$$F_* = (M_*/L_*)^2 = (\phi_*/L_*)^2 = (Q_*c/L_*)^2 = M_*a_*$$

$$= \phi_*B_* = Q_*cB_* = Q_*\xi_* = V_*c = i_*^2 = hc/L_*^2$$

It is also possible to use the same relationships at the q_{e*} level, using the parameter values from Table 2 thus:

$$F_{e*} = (M_{e*}/L_{e*})^2 = (\phi_{e*}/L_{e*})^2 = (Q_{e*}c/L_{e*})^2 = M_{e*}a_{e*}$$

$$= \phi_{e*}B_{e*} = Q_{e*}cB_{e*} = Q_{e*}\xi_{e*} = V_{e*}c = i_{e*}^2 = hc/L_{e*}^2$$

Since the values of some electromagnetic parameters are identical to the values of some mechanical parameters, it suggests that mechanical formulae could be used with electromagnetic parameters substituted instead, and vice versa. One example would be the simple $L_{e*} = v_{e*}T = \mathcal{L}_{e*}$ which suggests that in some way electromagnetic inductance is equivalent to a mechanical distance. Were this done in SI units, the mix of mechanical and electromagnetic parameters would not show that the parameters were interchangeable because of the misalignment of those two types of parameter in the SI units system.

The tables show that most electromagnetic parameters can be reinterpreted in terms of mechanical parameters. It requires a complete reinterpretation of what is understood by the terms magnetic inductance (acceleration), magnetic flux (mass), inductance (distance), current density (mass density), electric field (viscosity) and other electromagnetic parameters.

20.1.13 *Describing all parameters using only two from the set of parameters*

Now it is possible to reinterpret the only two fundamental constants left, aside from the factor d which defines the electron charge-based system that we experience because of the relative size of the charge on the electron q_{e*} versus the DAPU Planck charge Q_*, in term of the two base parameters which have only dimension $Y^{\pm 1}$ which are charge Q_* and mass M_*.

$M_*Q_* = h$

$M_*/Q_* = c$

So the two constants h and c represent the only two possible ratios of the DAPU mass and DAPU charge, each used once. That ought to infer something fundamental about any hypothetical underlying structure of matter, but such consideration is beyond this paper.

Also important is that the same reinterpretation can be done for h and c using R_k and K_j. However, for consistency, the DAPU constants $R"_k$ and $K"_j$ will be used, but the same relationships remain.

$R"_k(K"_j/2)^2 = h$

$R"_k = c/d^2$

The comparison with M_* and Q_* is not identical. $K"_j$ is an inverse magnetic flux and so equivalent to a mass of size $2/K"_j$. However, $R"_k$ is not a charge, but is a resistance or velocity. But by using the same relationship between equivalent mass and charge, with the factor of 2, the value of h can be recovered as:

Equivalent mass x electron charge $= (2/K"_j)q_{e*} = h$

And the same can be achieved with the ratio of equivalent mass to charge to recover the velocity c/d^2 or $R"_k$ as:

Equivalent mass / electron charge $= (2/K"_j)/q_{e*} = h/q_{e*}^2 = h/[d^2Q_*^2] = Q_*^2c/[d^2Q_*^2] = c/d^2 = R"_k$

This shows that if inverse magnetic flux can be considered as equivalent to a mass, then resistance can be considered as equivalent to a velocity.

20.1.14 *Parameters as ratios of $R"_k$ and $K"_j/2$*

It is possible to generate examples of the usual constants of nature or DAPU parameters, other than G which was subsumed into $M_*$and L_*, using just $R"_k$ and $K"_j/2$ (or with powers of d included for the Q_* set) as follows:

$M_* = d/(K"_j/2)$

$M_{e*} = 1/(K"_j/2) = \phi_{e*}$

$q_{e*} = 1/[R"_k(K"_j/2)]$

$Q_* = 1/[R"_k(K"_j/2)d]$

$L_* = 1/[R"_k^2(K"_j/2)d^3]$

$L_{e*} = 1/[R"_k^2(K"_j/2)]$

$T_* = 1/[R"_k^3(K"_j/2)d^5]$

$h = 1/[R"_k(K"_j/2)^2]$

$E_* = R"_k^2/[(K"_j/2)d^5]$

$c = R"_k d^2$

$\iota_{e*} = R"_k^2$

$\vee_{e*} = R"_k^3$

These relationships can be checked by using the following standard law formulae, in either Q_{e*} or q_{e*} form, and the DAPU values of the parameters in Table 1 or 2:

$\vee_{e*} = \iota_{e*} \times R"_k$

$B_{e*} = \phi_{e*}/A_{e*}$

$E_{e*} = m_{e*} \times v_{e*}^2$

$F_{e*} = p_{e*} \times A_{e*}$

$q_{e*} = \iota_{e*} \times T_{e*}$

$E_{e*} \times T_{e*} = h$

Many parameters have been left out of the list for brevity, including those based on materials which require the permeability factor u_* and would mean the inclusion of $\sqrt{G}$ in the formula of constants producing those parameters.

Of particular interest is the value of $\iota_{e*} = R"_k^2$ which suggests that the SI unit of Ampere could be defined using the DAPU value of $R"_k^2$ as its sole reference point.

20.1.15 *How to translate between SI and APU/DAPU units*

Table 3 shows the relative factors required to translate between DAPU/APU/SI units. The SI values should be multiplied by the the factors in the appropriate column to produce the DAPU or APU values of that parameter.

Table 3: Translating between units

Parameter NSI	Parameter	DAPU value	DAPU factor X_*	APU factor X_a	SI value of Planck unit	SI Name
$6.62606896 \times 10^{-34}$	h	h	2π	2π	$1.0545716 \times 10^{-34}$	$\hbar$
$4.45695580 \times 10^{-13}$	M_*	$\sqrt{hc}$	$\sqrt{2\pi G}$	$\sqrt{2\pi}$	2.1764374×10^{-8}	M_{Planck}
$1.48668043 \times 10^{-21}$	Q_*	$\sqrt{h/c}$	$\sqrt{1x10^{-7}}$	$\sqrt{1x10^{-7}}$	$4.7012963 \times 10^{-18}$	Q_{Planck}
$5.06652691 \times 10^{-23}$	q_{e*}	$\sqrt{\alpha/2\pi}\sqrt{h/c}$	$\sqrt{1x10^{-7}}$	$\sqrt{1x10^{-7}}$	$1.6021765 \times 10^{-19}$	e
$4.95903212 \times 10^{-30}$	L_*	$\sqrt{h/c^3}$	$\sqrt{2\pi/G}$	$\sqrt{2\pi}$	$1.6162525 \times 10^{-35}$	L_{Planck}
none	G	*none*	*none*	1	6.67428×10^{-11}	G
2.99792458×10^{8}	c	c	1	1	2.99792458×10^{8}	c
$2.58128076 \times 10^{11}$	R_{e*}	$2\pi c/\alpha$	$1x10^{+7}$	$1x10^{+7}$	$2.581280756 \times 10^{4}$	R_k
$1.52927081 \times 10^{11}$	$2/\phi_{e*}$	$2\sqrt{\alpha/(2\pi hc)}$	$\sqrt{1x10^{-7}}$	$\sqrt{1x10^{-7}}$	$4.835978909 \times 10^{14}$	K_j

20.1.16 *Metrology*

It may be possible to improve the accuracy of measurement of some of the constants by using the new relationships uncovered between $R"_k$ and $K"_j$. It is not only h that can be made more precisely from ratios of R_k and K_j. There are many more composites of $R"_k$ and $K"_j$ that produce other parameters which may not have been measured to as great an accuracy as R_k and K_j have been. Unfortunately G will not be one such open to improvement unless its square root equivalence to permeability u_*, as defined in the DAPU system of units, is confirmed as appropriate, when it will become the accuracy of measurement of permittivity ε_* that will set the metrology limits for precision of the value of G.

20.1.17 *Faster than light speed?*

The parameters in Table 2, based on q_{e*}, that have $X_{e*} > X_*$, have sizes greater than their Q_* DAPU set values in Table 1. This leads to parameters like $v_{e*} = c/d^2 = 2\pi c/\alpha$ which is greater than light speed. It is the d factor, the ratio q_{e*}/Q_*, that alters the parameter values in Table 2. Where the parameter has d^{+x} the parameter will be smaller than its Planck parent and where the parameter has d^{-x} it will be larger - the whole q_{e*} parameter space has been stretched out of symmetry when compared with the Q_* parameter space topology, even though the same laws and relationships still apply.

For all physical objects at the maximal values for each q_{e*} parameter possessed, the actual value of d is immaterial. Such objects obey the same laws regardless of the relative size of the electron charge q_{e*} to DAPU charge Q_*. It is only at the lower levels, below maximal values, that the ratio of d to, for example, the masses of the particles will produce varying sizes of physical effect, such as differing electron energy levels in atoms, dependent on the mass of the electron and its orbital velocity.

Whether the maximal values $X_{e*} > X_*$ can actually be attained is a question for experimental verification or rebuttal. That R_k and K_J have been measured to be the sizes that they are [10] makes it certain that some of them can, since $R_k = c/d^2 = 2\pi c/\alpha$. So although equivalent to a velocity, it is not clear if $R_k > c$ means that q_{e*} based physical objects can exceed c in velocity. So there may be limits on the interpretation of 'equivalent to' when two DAPU parameters have identical values and dimensionalities. What is physically possible may depend on whether the parameter under consideration is from the mechanical or electromagnetic part of parameter space and whether physical objects, or patterns caused by them, are at work.

Whilst it is easy enough to see that the inverse of K_j may be interpreted as a form of mass, it may be asked how can a resistance $R_k = c/d^2$ and a velocity c be the same parameter in a different disguise. The initial interpretation may be that the resistance equates to a measure of the velocity required in order successfully to pass through the material producing the resistance. So a zero resistance means that a current of any velocity will pass. At the other end of the

scale, this means that either the maximum resistance possible R_k cannot be overcome because nothing can exceed c (the resistance is 'infinite') or that within that material it is possible to travel across, but only if a velocity v/d^2 suitable for that material can be reached.

There have been experimental results [11] which show that patterns produced by subluminal physical objects can travel faster than light, and it may be that the factor c/d^2 represents the maximum velocity limit that these can attain. Experiments along the lines mentioned in the reference article could be undertaken to test the velocity limits of faster than light patterns so that it should be possible to determine which of the two cases, physical object or pattern motion, is actually correct and whether a velocity in excess of c within a material by physical objects is achievable.

The interpretation preferred here is that the factor v/d^2 represents a limitation on the minimum velocity required for electrons to pass across the media. As will be shown below, this velocity is inherent in the media and is distinct from the actual velocity of the current. The two velocities combine together to define the motional charge energy, which is explained later.

20.1.18 *Simplifying expressions (1)*

An example of the use of simplification enabled by the use of DAPU units would be to compare the standard expression for the principal energy levels of the one-electron atom with the same in DAPU units, where each observed parameter is displayed as a fraction of its maximal DAPU value. It is not suggested that this is the only way to arrive at the simplification, but it shows how thinking in DAPU units enabled simplicity to emerge.

The simplest example of a standard equation for the allowed energy levels, to use as an example, is the Bohr SI equation which provides that

$$E_{n_{mass}} = -1/n^2(k^2me^4/(2\hbar^2)) = -R/n^2$$

where R is the Rydberg constant and the other parameters are as usually described. The factor k has the value $8.988 \times 10^9 N\mathsf{m}^2C^{-2}$ in SI units and can be converted into DAPU units by dividing by $(\sqrt{1x10^{-7}})^2 = 1x10^{-7}$ to produce the value $8.988 \times 10^{16} = c^2$. The formula can be manipulated using $F = e^2c^2/r_e^2 = mv_e^2/r_e = \hbar v_e/r_e^2$ so that in DAPU terms this becomes a simpler to understand kinetic energy-like ratio

$$E_{n_{mass}}/E_* = -\frac{1}{2}mv_e^2/n^2$$

Whilst the DAPU equation is admittedly not so easy to measure, it does bring out that what is being measured is simply different variations in the kinetic energy of the electron. Had the Bohr example started with the potential energy separated out, then so would the DAPU presentation.

20.1.19 *Simplifying expressions (2)*

Another simplification providing greater clarity might be based on the expression for the magnetic moment of an orbiting electron, usually described in SI units as

$$\mu_e = eh/2m$$

but which can be recast using the same equations as previously to become

$$n\mu_e/\mu_{e*} = \frac{1}{2}ev_er_e$$

so that

$$E_{n_{charge}}/E_{e*} = \mu_e c\omega_e/n^2 = \frac{1}{2}[ec]v_e^2/n^2$$

which implies that in the same way that moving mass occurs in units of orbital angular momentum in $n\hbar = mv_e r_e$, so does charge although in units of orbital magnetic momentum as $n\mu_e = \frac{1}{2}ev_e r_e$, using the same form as the $\hbar$ angular momentum equation. And that the form of the equation for energy of motion of charge is comparable with that for the kinetic energy of the mass, but with ec replacing the mass m in the kinetic energy equation.

Taking these comparisons further, since the motional energy of charge is so similar in form to that for kinetic energy, being purely related to relative motion, it must be that both are due to the excess relativistic energy above rest mass or rest charge energy. So where $E_{ke} = (\gamma_v - 1)mc^2 \simeq \frac{1}{2}mv_e^2/n^2$ it should also be the case for charge that $E_{qe} = (\gamma_v - 1)[ec]c^2 \simeq \frac{1}{2}[ec]v_e^2/n^2$. Both charge and mass are being treated identically in terms of the relativistic increase in energy due to motion and are displayed in exactly the same form and the factor $\frac{1}{2}$ is only a low energy approximation.

The nature of latter approximation may be tested by measuring the divergence of electron energy levels from exactly $\frac{1}{2}$ in atoms where the velocity of the electrons is very high. The divergence should follow the relativistic factor minus one half, $\delta = (\gamma_v - 1)/v_e^2 - \frac{1}{2}$.

20.1.20 *Looking at a law of nature*

It is possible to now extend the consideration above and show how a velocity and a resistance can be the same thing, even at the SI level. If the equation for the motional energy of charge above is now simplified by ignoring the principal quantum number, but converting into q_e set units based on the maximum velocity c/d^2, the result is that

$$E_{qe} = (\gamma_v - 1)[ec/d^2]c^2/d^4$$

which can be equated with the energy stored in a capacitor $E_c = \frac{1}{2}e\vee_v$ where $\vee_v$ is the potential difference across the plates. The same argument about relativistic increase in energy can be made here as well, in that the electrons will be in motion, so that the more accurate description should be $E_c = (\gamma_v - 1)e\vee_v c^2/v_e^2$ and both can now be equated to give

$$E_c = (\gamma_v - 1)\vee_v c^2/v_e^2 = (\gamma_v - 1)c^3/d^6 = E_{qe}$$

or

$$\vee_v = [v_e/d^2][v_e c/d^4]$$

It is now necessary to take a step back to consider which velocities are being considered. In the kinetic energy formula there is only one velocity and the motional energy being considered is relative to this velocity. With the motional energy of charge, there are two components. One velocity v_I is how fast the electron is effectively moving on average as part of a current and the other velocity v_R is how fast the electron is able to move at in the material due to the limitations of the material. The two energies are the same, but the frameworks are different. The only way to solve this is to define that v_e^2 in the kinetic energy equation is equal to the product of the two velocities in the charge equation v_R and v_I, so that $v_e^2 = v_R v_I$. This does not say that the velocity of the electron is different to the velocity of the charge, only that the measurement of the velocity in the framework that is chosen decides which parameter is being measured. The result is that the formula for the voltage can now be written as

$$\vee = [v_R/d^2][v_I c/d^4]$$

and the two parts can be identified as the resistance $R_v = v_R/d^2$ and current $I_v = v_I c/d^4$ and the equation as Ohm's Law.

A worked example in both SI and DAPU units will serve to show that the equation is correct. If the circuit is of 240V with a current of 20A passing, the resistance must be 12 Ω. Simply expressed $240 = 20 \star 12(SI)$. The equivalent in DAPU units is a voltage of $1.39542 \times 10^{-32} \vee_{e*}$, a current of $3.0016 \times 10^{-22} i_{e*}$ and a resistance of $4.64886 \times 10^{-11} R_{e*}$. Now $1.39542 \times 10^{-32} = 3.0016 \times 10^{-22} \star 4.64886 \times 10^{-11}(DAPU)$ which again is correct.

Clearly it does not require DAPU units to arrive at these conclusions and the DAPU values here are more complex than the SI ones. But the underlying relationships between voltage, current and resistance are the velocities of the electrons, instantaneously or on average, together with the limitation of velocities inherent in the media, which are clearer in the DAPU format. It serves to show that it is the method of simplification that allows the core of relationships to be understood and easily manipulated. And by using DAPU units for calculation the relationships are direct and do not contain the current misalignments identified within SI units that bring with them the confusion produced by the $\sqrt{1x10^{-7}}$ and 6.501 factors, although the example given here does not mix mechanical and electromagnetic parameters, so is simple in any case.

20.2 *Addition of Velocities and Energies*

It is generally accepted that the relativistic addition of velocities follows the form

$$T_r = (x + y)/(1 + xy)$$

This short note sets out to show that this is only a specific example of a general form of treating actions within any number of dimensions or any number of interacting bodies, based on the interaction of, for example, energies or veocities acting as the product of fields thus

$$T_G(n) = (\prod(1 + i) - \prod(1 - i))/(\prod(1 + i) + \prod(1 - i))$$

as will be explained below. The frame of reference is for the energy of a body, or its velocity, in an absolute frame. The analysis will be extended to relative frames later. The equation above can be obtained by starting simply and extending the treatment of T_r to a third velocity, such that

$$T_r = (x + (y + z)/(1 + yz))/(1 + x(y + z)/(1 + yz))$$

$$T_r = ((x + y + z) + xyz)/(1 + (xy + xz + yz))$$

I will now introduce a new short method of describing these variables. The summation of the variables on their own I will describe as $\sum\prod(1)$ meaning the summing of the product of variables of interaction value one, that is they do not interact with any other variables. The summation of the cross products like xy, xz and yz I will describe as $\sum\prod(2)$, and here this would mean that $\sum\prod(2) = (xy + xz + yz)$. The next in the series will be the triple interaction product $\sum\prod(3) = xyz$. It is immaterial that in this example there is no actual summation because there is only one value of triple interaction, it standardises the use of this method. We now have the relativistic formula as

$$T_r = T_r(3) = (\sum\prod(1) + \sum\prod(3))/(1 + \sum\prod(2))$$

What is found is that as the number of variables rises the number of product parameters increases in line, with actual numbers of cross components following a Fibbonnacci-like sequence. So, starting at the left and end of the denominator and then up to the left hand end of the numerator, alternating to next along thereafter, and keeping the value 1 in the T(1) case, we get

T(1) has 2 parameters with components 1, 1

T(2) has 3 parameters with components 1, 2, 1

T(3) has 4 parameters with components 1, 3, 3, 1

T(4) has 5 parameters with components 1, 4, 6, 4, 1

T(5) has 6 parameters with components 1, 5, 10, 10, 5 1

T(6) has 7 parameters with components 1, 6, 15, 20, 15, 6, 1

and so on. Note that the sum of the numerator components is always equal to the sum of the denominator components, ensuring that the maximum value of any T(n) is 1.

Taking the T(3) formula as a simple example, which can be generalised we can rearrange this to form

$$(1 - T_r(3)) = (1 - x)(1 - y)(1 - z)/(1 + (xy + xz + yz))$$

$$(1 - T_r(3)) = \prod(1:3)(1 - i)/(1 + (xy + xz + yz))$$

where $\prod(1:3)(1-i)$ means the product of $(1-i)$ on each variable over three single variables i. However, we can do the same for the denominator, where we get the result

$$(1 + (xy + xz + yz)) = \prod(1:3)(1 + i) - (\sum\prod(1) + \sum\prod(3))$$

but it is also the case that

$$\prod(1:3)(1 + i) - \prod(1:3)(1 - i) = 2(\sum\prod(1) + \sum\prod(3))$$

so that we now have

$$(1 - T_r(3)) = 2\prod(1:3)(1 - i)/(\prod(1:3)(1 - i) + \prod(1:3)(1 + i))$$

or

$$(1 - T_r(3)) = 2/(1 + (\prod(1:3)(1 + i)/\prod(1:3)(1 - i)))$$

or

$$T_r(3) = (\prod(1:3)(1 + i) - \prod(1:3)(1 - i))/(\prod(1:3)(1 + i) + \prod(1:3)(1 - i))$$

which loses no strength when generalised to n variables i as

$$T_G(n) = (\prod(1+i) - \prod(1-i))/(\prod(1+i) + \prod(1-i))$$

What this formula says is that the total velocity (energy) is the difference between the products of the positive and negative velocity (energy) fields present divided by their sum. It also says that the value of $T_G(n)$ will always be less than or equal to 1. A simple check for $n = 2$ reveals

$$T_G(2) = [(1+x)(1+y) - (1-x)(1-y)/[(1+x)(1+y) + (1-x)(1-y)]$$

$$T(2) = (2x+2y)/(2+2xy) = (x+y)/(1+xy)$$

which is where we started. It is also clear that this can be extended to the square of total velocity or energy $T_G(n)^2$ and that the result is very different to that obtained by substituting x^2 for x. Reverting to simple variables using $T_G(3)$ where the variables x, y and z could be velocities or energies and by considering negative variables, we get

$$(1 - (-T_G(3))) = (1-(-x))(1-(-y))(1-(-z))/(1+(xy+xz+yz))$$

$$(1 + T_G(3)) = (1+x)(1+y)(1+z)/(1+(xy+xz+yz))$$

and from this, multiplying the $(1 - T_G(3))$ can be found

$$(1 - T_G(3)^2) = (1-x^2)(1-y^2)(1-z^2)/(1+(xy+xz+yz))^2$$

If this is simplified by making $z = 0$,

$$(1 - T_G(2)^2) = (1-x^2)(1-y^2)/(1+xy)^2$$

or

$$T_G(2)^2 = (x^2+y^2+2xy)/(1+xy)^2$$

and then compared with the 'usual' method of straight substitution of x^2 for x, y^2 for y and z^2 for z which would instead give

$$T^2 = (x^2+y^2)/(1+x^2y^2)$$

it can be seen that there is a significant difference in both the numerators and denominators, even though at an extreme where $x = 1$, both expressions result in $T^2 = 1$. The curve of each formula may start and end at the same points, but the curves are different between these.

The new formula works in all dimensions, that is with any number of velocities or energies acting. It is in the use for considering multiple overlapping fields that the utility of the $T_G(n)$ formula becomes apparent because rather than having to add fields, it is easier to multiply them and to understand what the interactions mean in terms of the cross components.

The meaning of the $T_G(n)$ formula is that the overall total energy (velocity) of a body in multiple energy fields (travelling at multiple relative velocities) is the difference between product of the sizes of those fields over and under the maximum field size (1 or velocity c) divided by the sum of those products. In a universe where energy can be considered to warp space, this is like considering any energy to be both positive and negative simultaneously, stretching space both 'upwards' and 'downwards' and comparing the difference between these stretches to the total energy involved in the stretching. Any variable that reaches 1 ensures that the total will also be 1 regardless of the size of any other variable. Thus space has a maximum stretch of 1 in any 'direction' and cannot be ripped.

There is also a distinct echo of the space-stretching in the formula for the relativistic factor γ, where

$$1/\gamma^2 = (1 - v^2) = (1 - v)(1 + v)$$

being the product of both 'upward' and 'downward' velocity fields simultaneously. Here the value of v would be the outcome $T_G(n)$ where there were multiple relative velocities to consider, so that

$$(1 - v)(1 + v) = (1 + T_G(n))(1 - T_G(n))$$

giving

$$T_G(n)^2 = 1 - \gamma_T(n)^{-2} = [(\prod(1 + i) - \prod(1 - i)]^2/[\prod(1 + i) + \prod(1 - i)]^2$$

and

$$\gamma_T(n) = (\prod(1 + i) + \prod(1 - i))/\sqrt{4\prod(1 - i^2)}$$

which continues to have the upward and downward products symmetrically included. Where $n = 2$ the total relativistic factor is

$$\gamma_T(2) = [(1 + i)(1 + j) + (1 - i)(1 - j)]/\sqrt{4(1 - i^2)(1 - j^2)} = 2(1 + ij)/\sqrt{4(1 - i^2)(1 - j^2)} = \gamma_i\gamma_j(1 + ij)$$

And the total velocity for $n = 2$ given by

$$T_G(2) = (\prod(1 + i) - \prod(1 - i))/(\prod(1 + i) + \prod(1 - i)) = (i + j)/(1 + ij)$$

as expected for the relativistic summation of two velocities. The relativistic factor for $n = 1$ produces

$$\gamma_T(1) = [(1 + i) + (1 - i)]/\sqrt{4(1 - i^2)} = 2/\sqrt{4(1 - i^2)} = 1/\sqrt{1 - i^2}$$

as expected, again.

The frame of reference used above could be for a single body being acted upon by multiple fields, or the total velocity of a body due to a number of velocities, but is always concerned with a single body and the fields acting on it or energies or velocities it has. When considering the body, and velocities, for example, it is necessary to look at both velocity directions, both positive and negative, in constructing the product formula.

In the case of different frames of reference, it is necessary to consider the two particles separately with each having only one velocity direction. Symmetry requires that each particle could have the opposite velocity, so that the relationship

between the two frames is symmetric. The energy of each particle E_a and E_b each of mass M_x with relative velocity v along one axis between them is given by dividing each by one of the fields $\sqrt{1-v/c}$ or $\sqrt{1+v/c}$

$E_a = M_x c^2/\sqrt{1-v/c}$ and $E_b = M_x c^2/\sqrt{1+v/c}$

The relationship between the two energies is given by

$E_a/E_b = \sqrt{1+v/c}/\sqrt{1-v/c}$

and since $E_a t_a = h = E_b t_b$ and $\gamma = 1/\sqrt{1-v^2/c^2}$ then

$t_a/t_b = (1-v/c)/\sqrt{1-v^2/c^2} = \gamma(1-v/c)$

and if $x_a = ct_a$ and $x_b = ct_b$ then

$t_a = \gamma(t_b - vt_b/c) = \gamma(t_b - vx_b/c^2)$

or, in normal Lorentz transformation terms, replacing t_a by t' and t_b by t with similar x substitutions, produces the accepted relationships

$t' = \gamma(t - vx/c^2)$ and $x' = \gamma(x - vt)$

This derivation does not beyond the energies of the two particles when they are the same size. A more general analysis would include the relatives sizes of the particles and their gravitational interaction. There is no call for considering product formulation here because there are only two particles in two frames of reference.

20.2.1 *Conclusions*

This paper presents new ways of understanding the relationships between parameters. The novel insights and predictions include:

1 A self-contained and consistent new Planck unit set of maximal Q_* based parameters from which all observed values can be compared and easily combined in equations.

2 A self-contained and consistent new Planck unit set of electron charge-size based parameters, some of which are directly observable in experiments.

3 The interpretation of the gravitational constant G as a dimensionless ratio and its relegation from gravitational to permeability use, so that it represents a measure of the strength of interactions within materials not between masses, and the elimination of the need to test the equivalence of gravitational and inertial masses.

4 That all parameters can be displayed in terms of only h and c for the Q_* parameter set and in terms of only h, c and d for the q_{e*} set (other than permeability and permittivity which have G content), which was previously considered impossible.

5 There exists a new hypothetical dimensionality analysis that can be used to describe parameter dimensions and to uncover any law of nature or any universal constants. All that is required to produce a law of nature is to create an equation where the dimensionalities are equal on both sides. To produce a constant of nature, aside from c, the minimum that is required is that it has Y^0 dimensionality.

6 That most Q_* and q_{e*} parameters can be described solely in terms of ratios of the R_k and K_j (and d for the Q_* set) and so will benefit from the precision of measurement of these two parameters.

7 That the experimentally observed value of R_k implies either that the velocity of a current within certain electromagnetic materials could be in excess of light speed, the patterns produced by subluminal physical objects could have a maximum velocity of c/d^2 or that such a minimum velocity is required in order to pass through those material. This is open to further experimental work to confirm which is the case.

8 That most electromagnetic parameters can be reinterpreted in terms of mechanical parameters. It requires a complete reinterpretation of what is understood by the terms magnetic inductance (acceleration), magnetic flux (mass), inductance (distance), current density (mass density), electric field (viscosity) and other electromagnetic parameters.

9 That the reinterpretation of R_k and $K_j/2$ with their current excellent precision of measurement, should enable increased accuracy in the estimation of the values of other parameters and fundamental constants identified as novel composite functions of $R"_k$ and $K"_j/2$.

10 A universal method of discovering laws of nature that apply regardless of any stretching of parameter space. A unit with $q_e/Q_* \neq \sqrt{\alpha/2\pi}$ would still have the same relationships between parameters although the numerical values of the results would be different.

11 Physics can be better understood when stripped to its bare essentials and without the use of a system of SI units that are currently misaligned across the electromagnetic and mechanical parameters. By adjusting SI units to be self-consistent and consistent with DAPU units, greater clarity will ensue.

12 The two adjustments necessary to align and make SI units self-consistent and also consistent with the simplicity of DAPU units have been proposed.

13. All energies and velocities should be combined by producting their fields rather than addition.

This is a toolkit for providing a better understanding of the fundamentals of physics.

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21 *Section 4*

This is a more detailed outline of the overall framework containing the hierarchy of energies. It is written from a conventional viewpoint that expects orbits to have net energies and uses the Adjusted Planck Mass system (APS), instead of DAPU or APU units, and SI units.

22 The underlying nature and mechanics of matter

22.1 *Mass and Charge Matrices*

I start by treating mass and charge identically and presenting simple tables of energies due to different types of relative velocity. Then I give those energies their usual names (where they are usually recognised as existing).

Below you will find two tables, or matrices. They are identical except that the mass one is concerned with the energies associated with the motions of mass and the charge one concerned with the energies associated with the motions of charge. Every mass energy has an identical-sized charge energy associated with it. Every energy has the same strength in action, it is only the size of an energy that may make a property, such as the mass of a particle and its gravitational action, appear weaker.

The starting point of the matrix is not the mass of a proton or an electron and the charge is not the electronic charge. The system used here is an adjusted Planck units scale (APS). The Planck scale relates the Planck constant h through the Planck mass M_p, Planck radius R_p and light speed c as $M_p c R_p = h/(2\pi)$. The APS scale instead uses the APS mass M_o and APS radius R_o through $M_o c R_o = h$ with the only difference that $R_o = 2\pi R_p$. The APS system is used throughout this section for all variables, except where clarity requires SI or other units to be used. However, the most important point to remember is that the mass of the particles to be introduced is M_o.

In the matrices below, the starting point for mass is the APS mass M_o and for charge is the APS charge Q_o. The relationship between the two is defined to be $GM_o^2/r = Q_o^2 c^2/r$ so that the energies associated with moving masses and charges are given here in units of $M_o c^2 = Q_o(c/\sqrt{G})c^2$.

In all the following explanations, except where extra clarity is required, the gravitational constant will be omitted from formulae and the electronic charge q will instead be written qc.

The second column first row of each matrix describes the rest mass energy or rest charge energy respectively and then the next rows show the motional energy above that rest energy due to velocities V_i, then V_x and then the two together. The third column does the same, but for a one fundamental size mass or charge that is also spinning at w_s, where the radius of the mass/charge is R_o and the edge velocity V_s through $V_s = R_o w_s$. V_i refer to velocities within a 'ring' (as explained later) and and V_x to velocities externally. These will be made clear later.

Mass Energy	**Matrix**	**MEM1**
Velocity/Unit size	$\pm M_o$	$\pm\frac{1}{5}M_o V_s^2 = t/6$
Rest Energy	$\pm M_o c^2$	$\pm ftc^2/6$
Ring internal Vi	$\pm M_o c^2(\gamma_i - 1)$	$\pm ftc^2/6$
Ring external Vx	$M_o c^2(\gamma_x - 1)$	$\pm ftc^2(\gamma_x - 1)/6$
Ring Vi and Vx	$M_o c^2(\gamma_i - 1)(\gamma_x - 1)$	$\pm ftc^2(\gamma_x - 1)/6$

Charge Energy	**Matrix**	**CEM1**
Velocity/Unit size	$\pm Q_o c$	$\pm\frac{1}{6}Q_o c V_s^2 = qc/6$
Rest Energy	$\pm Q_o c^3$	$\pm fqc^3/6$
Ring internal Vi	$\pm Q_o c^3(\gamma_i - 1)$	$\pm fqc^3/6$
Ring external Vx	$\pm Q_o c^3(\gamma_x - 1)$	$\pm fqc^3(\gamma_x - 1)/6$
Ring Vi and Vx	$\pm Q_o c^3(\gamma_i - 1)(\gamma_x - 1)$	$\pm fqc^3(\gamma_x - 1)/6$

The matrices are simple and show increasing complexity of velocities downwards. Without yet explaining what the terms ring or f'represent, we can give the energies their normally recognized names as follows:

Mass Energy	**Matrix**	**MEM2**
Velocity/Unit size	$\pm M_o$	$\pm\frac{1}{6}M_o V_s^2 = t/6$ **ring strong**
Rest Energy	$\pm M_o c^2$ **of each meon**	$\pm ftc^2/6$ **No name - M.b.1**
Ring internal Vi	$M_i c^2$ **ring rest mass**	$\pm ftc^2/6$ **No name - M.b.2**
Ring external Vx	$M_o c^2(\gamma_x - 1)$ **part of total energy**	$\pm ftc^2(\gamma_x - 1)/6$ **No name M.b.3**
Ring Vi and Vx	$M_i c^2(\gamma_x - 1)$ **ring kinetic energy**	$\pm ftc^2(\gamma_x - 1)/6$ **No name M.b.4**

Charge Energy	**Matrix**	**CEM2**
Velocity/Unit size	$\pm Q_o c$	$\pm\frac{1}{6}Q_o c V_s^2 = qc/6$ **ring charge**
Rest Energy	$\pm Q_o c^3$ **of each meon**	$\pm qc^3/6$ **ring charge energy**
Ring internal Vi	$S_i c^3$ **spin energy**	$\pm qc^3/6$ **ring charge energy**
Ring external Vx	$Q_o c^3(\gamma_x - 1)$ **part of total energy**	$\pm qc^3(\gamma_x - 1)/6$ **charge k.e.**
Ring Vi and Vx	$S_i c^3(\gamma_x - 1)$ **spin kinetic energy**	$\pm qc^3(\gamma_x - 1)/6$ **charge k.e.**

In matrix CEM2, the value of f has been taken to be -6, so that the energies represented in the third column are those for an electron. The potential energies have not been included but will be made clear later in the section on mechanics. Three extra cells have been added in addition to those in the first matrices as the following matrices MEM3 and CEM3, where some cross kinetic/potential energies have been identified.

Mass Energy	**Matrix**	**MEM3**
Velocity/Unit size	$\pm M_o$	
Spin orbit interaction energy	$(\gamma_i - 1)(P.E.)$	**spin orbit interaction**
Intrinsic μ energy	$(\gamma_i - 1)A_e$	**Anomalous mag moment** $A_e\mu_{im}m_i^2/M_o$

Charge Energy	**Matrix**	**CEM3**
Velocity/Unit size	$\pm Q_o c$	
Spin orbit interaction energy	$(\gamma_i - 1)(potentialenergy)$	**spin orbit interaction**

Of the 19 cells in the three matrices, 11 can be immediately identified as known energies, or are related to known physical attributes, of particles. Four cells, denoted 'of each meon' and 'part of total energy', will be explained later. This leaves 4 cells that do not have current names, although only two unknown values. This is because they have not yet been recognized as being present, except in specific circumstances. The variable 't' might be expected to be either the strong force or the colour force, but, as will be shown later, t is only one component within a framework of very short distances and particles, expected to be present in the nucleus or within a nucleon respectively. As will be shown more fully later, all particles have a 't' energy, here called 'twist' energy, but the nature of the energies of twist interaction change depending on the size and separation of the interacting particles. This is due to the ring nature of the particles. So those four cells in matrix MEM2 called M.b1, M.b2 M.b3 and M.b4 could be labelled as strong/colour energies in the same way as they are in matrix QEM2 for electronic charge, although this would only be for convenience. So M.b.1 and M.b.2 cell energies would be called ring strong/colour twist energy. M.b.3 and M.b.4 would be called ring strong/colour twist kinetic energy.

So potentially ALL 19 cells can be explained, related to physically recognised energies, or are the 4 energies not observable.

In each column, the energy of one particle is summed over all particles in the ring. So the six kinetic energies of the meons sums to zero, but their rotational frequency produces what we see as the total rest mass of the ring and space time is deflected due to the physical size of the ring (in the presence of charge or twist). The six charges sum to give the lepton and quarks charges. The designation 'of each meon' in some of the cells just represents the energy of each meon, whilst 'part of total energy' denotes that this quantity cannot be measured separately from the rest.

In the case of spin/ring-mass, the parallel spins always chase (with a dependence on relative angle between ring planes away from being parallel), the anti-parallel spins repel and the ring-mass interactions almost always attract, with both depending on how far apart and how large the rings are. It is only when they are in the Very Near interaction region, as defined later, that the ring-mass and anti-parallel twist and spin interactions are reversed. Additionally, when they are in the VN or closer, the direct meon to meon interactions lead to chasing effects between opposite sign meons in different rings.

The treatment of the energies represented by the two columns in the matrices is identical. The base charge energies of a meon due to its rotational velocity V_i around a ring or its external velocity V_x are each one-sixth of the energy for whole ring itself, although positive or negative with meon type, summing to zero overall. The energies of the meons are summed to produce the total charge energy. Each +meon has positive mass energy of motion which is exactly equal to the mass energy of motion of the –meon, so the total kinetic energy of the meons internally is zero, yet they still rotate at w_i. So the product of the angular momentum of each meon h and the excess relativity factor (γ_i–1), using the ring angular frequency w_i, is what we call the rest mass of the ring, as will be shown below. Internally, for all rings $M_oV_ir_i = h = M_ocR_o$ and externally, as detailed in the initial MEM1 matrix, the ring possesses an apparent mass of $M_ic^2 = M_o(\gamma_i–1)c^2 = h(\phi_i - 1)w_o \approx \frac{1}{2}M_oV_i^2 \approx \frac{1}{2}hw_i$.

Such a ring is the basis of the wave-particle duality framework of current physics. As will be shown, the rings are the quarks and leptons, which are both particles, composed of meons, and waves in that they are rotating systems. The size of the rings is based on the combination of $V_i = r_iw_i$ and $M_oV_ir_i = h = M_oV_i^2/w_i$ so that $V_i^2 = w_ih/M_o$.

The use of the APS system means that there is a difference in maximum angular frequency in the APS system versus that in Planck units, such that $w_o = w_p/2\pi$ so that

$$M_ic^2 = M_o(\gamma_i–1)c^2 = h(1/\sqrt{(1–((w_y/2\pi)/(w_p/2\pi)))} - 1)w_p/2\pi$$

$$\approx \tfrac{1}{2}hw_y/2\pi$$

where $w_i = w_y/2\pi$, which also follows through to the relative sizes of spin energies, as will become clear later. So wherever the angular frequency appears in relation to internal mass energy, the factor $w_y/2\pi$ that would normally appear is identical to the APS factor w_i. The size of energy is not different, just the value in those units. The uncertainty factor is also different in APS versus Planck units since

$$E_ot_o = (M_oc^2)(R_o/c) = h(APS)$$

and

$$E_pt_p = (M_pc^2)(R_p/c) = h/2\pi(PU)$$

It is also necessary to be clear that the intrinsic angular momentum of all rings is always h alone, as detailed below. Even when the momentum is given as $h/2\pi$ in PU, it is actually still only h, because the 2π factor should always be linked to the angular frequency, either $\frac{1}{2}w$ for a ring or w for the photon.

The sign of mass the ring has is always effectively positive because the kinetic energies of the meons always sums to zero, leaving us to consider either the ring frequency w_i or the deflection of space time due to the size of the ring,

as representing its mass effect. But it is useful to differentiate the underlying differences in the rings from a phase perspective, where the individual meons may have different spin orientations in different positions around the ring. So if we consider a chain of 6 meons in a straight line up this page, each meon chasing the one in front and being chased by the one behind. If the leading meon is deflected right, the result will be that the head of the chain will join onto the tail and form a ring, as a right hand rotating ring (defined as spin + $\frac{1}{2}$) in the plane of the page. If deflected left, the result will be a left hand rotating ring (defined as spin $-\frac{1}{2}$). Both rings have the same zero kinetic energy, so there is no difference between the energies of right hand or left hand motion, although the spin orientations are different. If we consider that the rotation of the ring in some way deflects space proportional to the energy of the ring, that is to the inverse of it's size, then both rings can be considered to have deflected space equally. Their rotational frequencies are the same, so their masses will be the same. And all rings in proximity to each other will 'fall into' the deflection of space made by the other rings – attracting each other, although as shown elsewhere, it requires the presence of charge or twist to enable space time to deflect.

It is still important to follow which meon is which in the underlying ring though, because there is a phase embedded in each rotational frequency. If we consider the right hand ring, when flipped over (as defined later) the result is the left hand ring, but of changed meon phase. So we can consider the right hand ring to have a locked-in phase called 'positive mass phase' and the left hand ring to have locked-in anti-phase called 'negative mass phase' (we could equally well have called these colour and anti-colour, but that would confuse). By symmetry the right hand anti-ring will have negative mass phase and the left hand anti-ring will have positive mass phase. So when considering rings, the notation +M means positive mass phase and –M means negative mass phase. But these are not positive and negative masses in the same way as $+M_o$ and $-M_o$, because both phases attract both themselves and each other. There are three possible phases for the symmetric rings, but they are all the same, which will become clear in the section on colour. So the energy of all 'stationary' rings (ignoring phases), which is the rest-mass of the rings, is given by

$$M_o(\gamma_i{-}1)c^2 = h(\phi_i - 1)w_o \approx \tfrac{1}{2}M_oV_i^2 \approx \tfrac{1}{2}hw_i = M_ic^2$$

for low V_i, where ϕ_i is the equivalent of γ_i but using w_i/w_o instead of V_i^2/c^2, where w_o is the APS angular frequency. This shows that the spin of a particle should not be measured in units of $\frac{1}{2}h$, but in units of h with the adjustment due to the $\frac{1}{2}$ in the apparent frequency of the ring. The confusion of $\frac{1}{2}$'s arises because the mass of the ring M_i, can contain the M_o and V_i factors within it, whereas the h factor cannot. To achieve the same treatment would involve producing a specific h_i for each particle, such that

$$M_o(\tfrac{1}{2}V_i^2/c^2)c^2 = h(\tfrac{1}{2}w_i/w_o)w_o = M_ic^2 = (\tfrac{1}{2}hw_i/w_o)w_o = h_iw_o$$

It will be explained later how some ring masses appear different at different separations or interaction regions.

The energy of a ring due to its spin (the definition 'spin' as used normally is actually the rotation of the meons around the ring) depends on the orientation of the plane of spin relative to an observer. A spin + $\frac{1}{2}$ ring (also denoted J + $\frac{1}{2}$) will have a positive mass phase $+M_i$, with spin energy $+S_ic$ (note that since spin energy is generated by the motion of charge it has the extra c factor included). A spin $-\frac{1}{2}$ ring (J $-\frac{1}{2}$ or $-S_ic$) will have negative mass phase $-M_i$, as will a spin + $\frac{1}{2}$ anti-ring. If M_i has been defined to be a positive energy, then S_ic, whether $+S_ic$ or $-S_ic$, is a negative energy. Where a negative charge $-qc$ exists, the matching twist energy is chosen to be negative as $-t$, and $+qc$ will have $+t$ of twist. Also note that although I will use the accepted name for the spin as '+ $\frac{1}{2}$ ' or '- $\frac{1}{2}$ ' to help clarity, these are $+S_ic$ and $-S_ic$ and are NOT $\frac{1}{2}h$ of angular momentum. In exactly the same way, the meon masses are M_o and not $\frac{1}{2}M_o$ the observable mass of a ring M_i, ignoring phase, is the same size as S_ic and only looks half the size relative to hw_i because it has not before been understood that the identical factor ($\frac{1}{2}$ at low V_i) already appears in the formula for the ring mass.

So far the units for the third columns in the matrices have not been explained. The parameter w_s represents the rate at which each meon spins as it travels. It is hypothesised that the twist energy causing that spinning, termed 'twisting'

to differentiate from the 'spin' of a ring, is responsible for producing the equal and opposite electronic charge energy. The screw orientation of the twist of a +meon with respect to motion generates either positive or negative charge, and vice versa for a –meon. I have chosen the RHS +meon to generate $+qc$ as the framework. The axis of spin of a meon is hypothesized to always be along its axis of travel around the ring.

As will be shown in more detail later, within a 6-meon ring it is possible for the six meons to have only eight possible different total charge values, corresponding to 0, ± 1/3 ±2/3 and ± 1 of electronic charge. These rings are the quarks and leptons. It will be shown later that all these rings are stable and maintain their size/energy until their frequency of rotation around the ring is altered by an external source. The net value of the charges defines the factor f in the third column, so 6 meons spinning $-qc/6$ charge represents an electron of charge $-qc$. Thus the third column treats the energies in a ring by summation of the charge or twist energies, identical to the treatment of the second column where the meon energies are the summed to give the ring energies.

So briefly, we have constructed rings, composed of 6 meons, which represent the quarks and leptons with their energies, spin and charges which are simultaneously composite particles and composite waves. Which property to be observed will identify which is the better description to use.

22.1.1 *Foundation Energies*

At the start of this section, I have used the names 'mass' and 'charge' for the APS mass M_o and APS charge Q_o. However, these foundation energies do not actually correspond to our normal definitions of mass and charge. Mass has been described as an energy, and charge as a different form of energy, without any deeper explanation. Within this new framework, what we call 'mass' is seen to be the excess kinetic energy of rotation of meons in a ring, above their rest mass energies, without regard to phase, and charge is the sum of the twisting energies of the meons in a ring. The difference between M_o and $M_o(\gamma_i–1)$, the ring mass, is that M_o can be negative, whereas the ring mass is always the same sign – chosen to be defined as positive, although it doesn't matter, – but is always attractive to other ring masses, regardless of relative mass phase because it deflects space time by its size and regardless of the fact that the kinetic energies of the meons sum to zero. So the APS definitions of mass and charge could have been as something completely different to mass and charge, provided they had the same effects. But, for simplicity, M_o and Q_o have been called mass and charge respectively, despite the additional existence of a negative M_o.

22.1.2 *Mechanics*

The basis of mechanics in this framework is simple. It is the same both inside and outside the rings, making due account for entanglement, for meon/meon interactions as much as for planets/stars, except that which energies take part in which interactions depend on the size and separation of the particles. This is because of the physical dimensions of the rings. Where the separation of two solid particles would depend on the factor r, the distance between centres, the action of meons travelling round one ring on meons travelling around the other ring depends on the distance factor $d = \sqrt{r^2 + r_i^2 + r_j^2 – F(r, r_i, r_j)}$ where r_i is the radius of one ring under observation, r_j the radius of the other ring and $F(r, r_i, r_j)$ is a complex function of the three variables depending on the angles between the two ring planes. This changes the sign of action when rings get very close to each other, in the Very Near, region as will be defined. The sizes also affects how far away other rings have to approach before they can feel the effects of the internal components within the rings, rather than the net effects of the rings. Each of these different interaction regions will be described in more detail later.

The non-entangled equation for the energy of a particle interacting with other particles will be explained fully later, but here is just stated. The total energy of a particle with energies K_a surrounded by n attractive energies and m repulsive energies due to particles of relative velocities V_n and V_m and energy units K_n and K_m is

$$E_{total} = \sum K_a c^2 \gamma_a (1 + \prod^{n} [1–K_n/d_n c^2] – \prod^{m} [1–K_m/d_m c^2])$$

The basic equation for the total energy of motion and position P of this particle involves deducting the unit rest energy under consideration and produces for stability

$$P = \sum K_a c^2[(\gamma_a - 1) + (\prod^{n}[1\text{–}K_n/d_n c^2] - \prod^{m}[1\text{–}K_m/d_m c^2])$$

$$+((\gamma_a - 1)(\prod^{n}[1\text{–}K_n/d_n c^2] - \prod^{m}[1\text{–}K_m/d_m c^2])] = 0$$

The summation is over all the different unit energies K, which could be M_o, Q_o, qc, t, $S_i c$, or M_i. The frame of reference is one in which the particle K_a is moving at V_a. The product factor is calculated for all particles with that type of interaction, either attractive or repulsive. The kinetic energies due to motion of M_i and $S_i c$ must be considered repulsive, that is outward from the other particle and the kinetic energies of qc and t appear not to take part in the dynamic balance but are expressed respectively as a magnetic moment and the strong or colour force, felt only in certain regions, as described later. The nature of energies as vectors will become clearer soon. The gravitational constant G and an SI factor $\sqrt{10^{+7}}$ associated with each charge have been omitted from the formulae and the examples following for brevity, as mentioned earlier, so this is an APS units system.

When $P = 0$, the result is a stable state, either a ring where the component meons travel together in a ring or where two particles rotate around a mutual centre – a stable orbit in a classical framework. The last part of the equation for P represents the cross interaction between the kinetic and potential energies and will be ignored until considering the fine structure of energy levels in atoms, although it is present in all interactions, even solely gravitational.

Not covered here are those additional relative orientation effects between nucleus and orbiting electron embedded within the factor $F(r, r_i, r_j)$. These are still under consideration as part of the push to replicate the Lamb shift additions, alongside the elliptical and other complex motions of electrons above the $l = 0$ shells.

22.1.3 *Examples*

1. Consider the M_o and Q_o energies between just the APS masses M_o and charges Q_o within all rings. In the symmetric frame of reference of the meons, their relative velocity is zero, so there are no kinetic energy components. Only the potential factors in KK/r are shown for brevity, although all higher factors also cancel in the same way, and r is used instead of the distance factor d for simplicity.

$$E_{meons M,Q} = [(-Q_o^2 c^2/r) + (-Q_o^2 c^2/r) + (-Q_o^2 c^2/2r) + (-M_o^2/(2\sqrt{3}r) + (-M_o^2/(2\sqrt{3}r)]$$

$$-[(-Q_o^2 c^2/(2\sqrt{3}r) + (-Q_o^2 c^2/(2\sqrt{3}r) + (-M_o^2/r) + (-M_o^2/r) + (-M_o^2/2r)]$$

$$= 2(Q_o^2 c^2 - M_o^2)/(2\sqrt{3}r) + 2(M_o^2 - Q_o^2 c^2)/r) + (M_o^2 - Q_o^2 c^2)/2r) = 0$$

provided $Q_o^2 c^2 = M_o^2$, which was already defined in this way earlier. So all rings are stable due to their underlying M_o and Q_o energies, provided the distance between meons does not change. But once it does change, the ring will again be stable at its new size.

2. Consider the qc and t energies between just the APS masses M_o and Q_o within all rings. If we consider just the twist and electronic charge energies within any ring, for each attractive $qc/6$ there will be a repulsive $t/6$. Again, in the symmetric frame of reference of the meons, their relative velocity is zero. The ring here is an electron ring. Again only the KK/r factors are shown for brevity.

$$E_{meons q,t} = [(-t^2/36r) + (-t^2/36r) + (-t^2/72r) + (-t^2/(18\sqrt{3}r) + (-t^2/(18\sqrt{3}r)]–$$

$$[(-q^2c^2/36r) + (-q^2c^2/36r) + (-q^2c^2/72r) + (-q^2c^2/(18\sqrt{3}r) + (-q^2c^2/(18\sqrt{3}r)]$$

$$= 2(q^2c^2 - t^2)/(18\sqrt{3}r) + 2(t^2 - q^2c^2)/36r) + (t^2 - q^2c^2)/72r) = 0$$

provided $q^2c^2 = t^2$. The same will be the case for any quark or lepton ring. So all rings are stable due to their underlying M_o, Q_o , qc and t energies, provided the distance between meons does not change. Again, once it does change, the ring will again be stable at its new size. This is the basis of conservation of energy because the change in size of one ring requires an opposite change in size of another ring. The actual mechanisms of changing sizes may be by direct impact, or by proximity transfer of frequency of rotation through attractive/chase beating of faster frequency meons on the slower ones in another ring. But whichever route the transfer takes, for every change by $+h$ and $-h$ in one ring, there will be a change of $-h$ and$+h$ on those respective sign meons in another ring. In this way, energy is conserved. All other apparent changes in energy are the result of relative observational frames of reference.

3. Consider a planet in orbit around a star, both bodies being uncharged. There is kinetic energy in this system that cannot be eliminated by a standard reduced mass system treatment, so their relative velocities cannot be considered to be zero. There is no symmetric frame of reference possible. Only in an asymmetric frame of reference, here one that is rotating, can a zero relative velocity be achieved. The energy of the planet, composed of its own kinetic plus the potential energy of the two, must be the same as that of the star, but opposite in action. But we have two types of energies present in each case, because as well as the normal gravitational energy, there is the potential due to the spin energies and the spin energy itself. Note that 'spin' here does not refer directly to the revolution of either body about its internal axis, but to the sum of the individual spins of all the component rings within each body, having regard to their spin orientations, of which the revolution of the body may be one observable component output. M_a is the mass of the planet travelling at V_a with spin energy of S_ac and M_b is the mass of the star travelling at V_b with spin energy S_bc, separated by distance r. Both mass and spin kinetic energies here are outward, effectively repulsive, with the masses attractive and spin potentials considered repulsive. This latter is the case here because as a chasing energy, the spin opposes the mass attraction, so will be repulsive. The energy of the system is given by

$$E_{system} = [(S_ac(\gamma_a - 1)c^2 + M_a(\gamma_a - 1)c^2) + (-M_aM_b/r + S_aS_bc^2/r)] = 0$$

for a stable orbit, ignoring spin orbit interactions. There is no energy above the mass and spin energies to move the bodies differently to how they are moving.

so for the planet

$$(M_a + S_ac)c^2(\gamma_a - 1) = (M_aM_b + S_aS_bc^2)/r$$

and for the star

$$(M_b + S_bc)c^2(\gamma_b - 1) = (M_aM_b + S_aS_bc^2)/r$$

so that

$$(M_a + S_ac)c^2(\gamma_a - 1) = (M_b + S_bc)c^2(\gamma_b - 1)$$

if $M_a = S_ac$ and $M_b = S_bc$

$$M_ac^2(\gamma_a - 1) = M_bc^2(\gamma_b - 1)$$

However, it is not necessarily the case that $M_a = S_ac$ and $M_b = S_bc$, except always where the two bodies are single rings. For planets/stars, the summation of spins over all the constituent rings will almost always be far less than the

sum of the masses of the bodies, unless there is some constraining factor such as a stable magnetic field throughout the body. This is because rings form stacks of alternating spins and effects like the magnetic or gravitational field of the bodies may affect the orientation of the stacks' or rings' spins. It is likely that the net spins of rings of a planet/star actually comprise a significant proportion of the net magnetic field of the body. So we cannot say without observation what the ratio $j = S_a c/M_a$ for a body is equal to, other than for single rings when $j = 1$ and for larger bodies generally that $j \ll 1$ or $j \approx 0$.

However, the above formula is correct in both extremes, so this can also be considered to be the formula for the energies in a gravitational/spin-only ($j \approx 0$) reduced mass system, with M_a, M_b, V_a and V_b representing reduced mass values. If $V_b = 0$, as required of the larger mass in a reduced mass system, then $\gamma_b = 1$ in order to produce the zero kinetic energy for M_b and so γ_a must also equal 1, which is not possible. So a reduced mass system based on a stationary central body is not equivalent to two mutually rotating bodies.

It is apparent that the usual energy formulae for such a system represent just part of the energy of the system since they miss out the spin energies. There are four formulae for the four external energies of a ring, each of the same form when simplified to ignore relative axes of spin interaction and cross kinetic/potential energy interactions. These energies equal zero in stable orbits, in the absence of any of the other energies:

Mass $E_m = M_a(\gamma_a - 1)c^2$–$M_a M_b/r$ when equal to zero, $M_a(\gamma_a - 1)c^2 = M_a M_b/r$

Spin $E_s = S_a c(\gamma_a - 1)c^2 + S_a S_b c^2/r$ which cannot equal zero to form a stable orbit since antiparallel spins are repulsive and parallel chasing

Charge (q+, q-) $E_q = q_a c(\gamma_a - 1)c^2$–$q_a q_b c^2/r$ when equal to zero, $q_a c(\gamma_a - 1)c^2 = q_a q_b c^2/r$

Charge (q+, q+)$E_q = q_a c(\gamma_a - 1)c^2 + q_a q_b c^2/r$ which cannot equal zero to form a stable orbit

Twist (t+, t+) $E_t = t_a(\gamma_a - 1)c^2$–$t_a t_b/r$ when equal to zero, $t_a(\gamma_a - 1)c^2 = t_a t_b/r$

Twist (t+, t-) $E_t = t_a(\gamma_a - 1)c^2 + t_a t_b/r$ which cannot equal zero to form a stable orbit

The mass formula is exactly the one normally used for such a gravitational system.

It is possible to suggest that the force equation should take the same form as the energy equation, adjusted in the denominator by an extra r, because the spin potential energy has never been considered before in gravitational interactions. Where $M_a = S_a c$, for a single ring being used to observe a body with a low j ratio, then $S_a S_b c^2 \approx 0$ and the formula above for the planet can be re-cast as

$$(M_a + S_a c)c^2(\gamma_a - 1) = (M_a M_b + S_a S_b c^2)/r$$

$$2M_a(\gamma_a - 1)c^2 \approx M_a M_b/r + [0]$$

$$M_a V_a^2 \approx M_a M_b/r + [0]$$

where the square bracket represents the spin gravitational energy of the two bodies, usually ignored because it is so small. This last formula would then be exactly the normal force equation, multiplied by r. Using this framework would reduce the force and energy equations to a single equation. Where the observing particle is a larger body with $j \ll 1$, the usual classical gravitational energy equation is recovered as

$$\tfrac{1}{2}M_a V_a^2 \approx M_a M_b/r + [0]$$

4. Consider an electron and proton in mutual orbit. The electron, spin $\pm \frac{1}{2}$, in stable orbit around a proton spin $+ \frac{1}{2}$, masses, spins denoted as for the planetary example, plus opposite charge qc on each. Here, because of the

interaction region the particles inhabit, the twist energy is not at work and the factor $qc(\gamma_a - 1)$, which is the product of orbital magnetic moment of the electron and its orbital frequency w_x, is externalised and does not appear in the attractive/repulsive balance. Present are attractive gravitational and charge potentials, the repulsive anti-parallel or chasing parallel (which can be treated as repulsive or attractive since the chasing interaction is trying to balance, but here the overall net attraction will make the parallel spins repulsive) spin potentials, and the kinetic energies for M_a and $S_a c$ as outward energies and, included here for the necessary accuracy, the spin-orbit term at the end for the motion of the electron charge

$$[(M_a(\gamma_a - 1)c^2 + (S_a c(\gamma_a - 1)c^2) + (-q_a q_b c^2/r – M_a M_b/r)]$$

$$-[(\pm S_a S_b c^2/r)] - ((\gamma_a - 1)q_a q_b c^2/r) = 0$$

$$[(M_a + S_a c)c^2(\gamma_a - 1)] + [-\gamma_a q_a q_b c^2 – M_a M_b \pm S_a S_b c^2]/r = 0$$

$$[(M_a + S_a c)c^2(\gamma_a - 1)] - [\gamma_a q_a q_b c^2 + M_a M_b \pm S_a S_b c^2]/r = 0$$

Here $M_a = S_a c$ because it is a single electron ring. For the proton, despite being a ring composite where it would be expected that $M_b \neq S_b c$, here, because the rings in the stack are all aligned along the same axis, each antiparallel spin in the stack repels the electron spin, and each parallel chases, leaving only one attractive or chasing (attracive or repulsive) spin interaction from the stack, dependent on whether the overall proton spin is parallel or antiparallel to the electron spin. So for the repulsive set $(+M_a M_b – S_a S_b c^2) = 0$ and we can say that it has energy

$$[2M_a c^2(\gamma_a - 1)] - [\gamma_a q_a q_b c^2]/r = 0$$

$$[2M_a c^2(\gamma_a - 1)] = [\gamma_a q_a q_b c^2]/r$$

Whereas the chasing set has energy $(+M_a M_b + S_a S_b c^2) \neq 0$, this introduces a very small difference. For the repulsive set

$$M_a V_a^2(1 + 3V_a^2/4 + 3V_a^4/8 + ..)\sqrt{(1 – V_a^2)} = [q_a q_b c^2]/r$$

$$M_a V_a^2(1 + 3V_a^2/4 + 3V_a^4/8 - \frac{1}{2}V_a^2 - 3V_a^4/8 – 3V_a^6/16) = [q_a q_b c^2]/r$$

$$M_a V_a^2(1 + V_a^2/4.....) = [q_a q_b c^2]/r$$

So each zero energy of motion and position, each quantum stable orbit, is represented by either side of the equation in current terms, or

$$E_{quantumballoon} = M_a V_a^2(1 + V_a^2/4.....) = [q_a q_b c^2]/r$$

This represents the simplified quantum energy levels in the one electron atom, but the actual measurements will show only the kinetic versus potential energy parts, without the spin kinetic component, as

$$E_n = \frac{1}{2}M_a V_a^2(1 + V_a^2/4 + ...)\text{-}[q_a q_b c^2]/r$$

$$= -\frac{1}{2}M_a V_a^2(1 + V_a^2/4 + ...)$$

whilst the Dirac equation, using the normal variables Z, u for reduced mass etc gives

$$E_{Dirac} = -\frac{1}{2}[uZ^2e^4(2\pi)^2/(2h^2n^2)](1 + [Z^2\alpha^2/n^2][n/n_\theta - \tfrac{3}{4}])$$

which, stripped of the complicated variables used and setting $n = n_\theta = 1$ for simplicity, is different only by the n and n_θ variables and the correction of the overall sign of energy for normal convention. Putting the former equation into a partially, but simplified, Dirac form, with the reduced mass M_u , relative velocity V_a and with the correct sign gives

$$E_{Dirac} = -\frac{1}{2}M_u V_a^2(1 + V_a^2[n/n_\theta - \tfrac{3}{4}])$$

The former simpler $2M_ac^2(\gamma_a - 1)$ equation is similar to that suggested for the gravitational force equation, adjusted by r, but here represents the energy of a stable charge-bound system. It also represents the quantum mechanical equation for the energy states of such a system, ignoring fine splitting caused by the J $\pm \frac{1}{2}$ spin of the electron, if the left hand equation is recast in frequency form using

$$M_a(\gamma_a - 1)c^2 = nh(\gamma_a - 1)w_o$$

as

$$2nh(\gamma_a - 1)w_o = [\gamma_a q_a q_b c^2]/r$$

$$nhw_a[SI] \approx (\gamma_a q_a q_b c^2]/r \approx nhw_{aP}/2\pi[PU]$$

Note that within the ring, the component meons have angular momentum h, whilst the ring has mass energy $\frac{1}{2}hw_i$ at rest. When in an orbital a ring has angular momentum $nh/2\pi$ in both Planck and APS units because the 2π factor is different only inside the ring. The latter formula is normally used for the simple principal energy levels of electrons in a shell. The more complex formula requires the relative angles between rings to be taken into account.

5. Consider the interaction between two protons. Starting from the position of one proton inside the nucleus and one starting outside. The initial region they inhabit will be the Medium, where the twist energy does not act. In order to get them inside the Near region, the repulsive charge energy has to be overcome. Once that has been achieved then the interaction follows exactly the same as for two electrons within their own Near region. The charge repulsion is equal and opposite to the twist attraction, directly from meon to meon, and the mass attraction is equal and opposite to the spin repulsion, provided the spin axes are anti-parallel. For parallel spins both the twist and spin energies have a chasing action, suggesting that the nucleons should be in motion within the nucleus, chasing each other at relatively fixed separations. So inside the nucleus, there is no net energy acting between protons with antiparallel spins and a chasing relationship for those with parallel spins.

The mass, charge, spin and twist energies used here are the sum of the constituent ring energies, which changes the actual distances that define the different regions. To pull the protons apart is easy until they approach the edge of the Near region, where the decaying twist energy-in-action will uncover the charge repulsion of the two again, releasing energy as this happens. So there appears to be nothing much holding a nucleus made of protons together. However, this will be shown in the next section to be not the case. The preference in spin of proton alongside proton, both with axis aligned, will be for opposite spins, so that the total energy of the two can be made as close to zero as possible. Also it is likely that the twist energy, in the same way that the motion of the charge energy generates magnetic moment,

generates some form of twist magnetic moment, both of which are likely to provide fields to keep the nucleons aligned either parallel or anti-parallel rather than offset.

6. Consider the interaction between a proton and neutron. For this, it is necessary to understand the structure of the neutron. It will be shown later in the section on magnetic moments that the electron and neutrino rings in the nucleus are likely to be over four times larger in mass than the quark rings. This mass difference introduces the possibility that the lepton rings in a nucleon stack may be in a different region to the quark rings in that same stack, when considering interaction energies for an external ring or particle. When the proton and neutron are separated in the Medium region, there can be no charge or twist interaction and the only energies must be of mass attraction balanced against antiparallel spin repulsion, or chasing when aligned parallel. So there is no energy of interaction in the Medium region for antiparallel nucleons. When the two stacks get closer together, there will be a separation distance at which the proton core quarks move within the Near region for the neutron quarks, but are still in the Medium region for the neutron leptons, because the latter have larger masses in the stack. At this separation, with spin axes aligned, the neutron and proton core quarks have a total charge of $+1$ qc that is repulsive, balanced against their attractive twist energies of the same size for anti-parallel spins or chase for parallel, and the same for mass and spin energies. But the proton core is still in the Medium region for the leptons, so is attracted by the electron charge but has no twist interaction energy. At this separation there is an overall attractive energy due to the attractive or chase twist energy of the two udu stack quarks. This relationship again supports the possible relative motion of the two in order to form stable nuclear orbits, balancing the mass attraction with twist attraction/chasing against the spin and motional energy repulsions. So the reason why the nucleus stays together is bizarrely that the neutrons appear to hold it together. At closer range, the proton will be in the Near region for both leptons and quarks in the neutron stack and the additional twist repulsion or chase (depending on spin orientation) due to the udu core interacting with the electron ring will balance out the energies to zero. At this closer distance, there is no interaction energy for anti-parallel spins and small chasing for parallel. So between a proton and neutron, the interactions are zero except within a narrow band where they are attractive.

The proton/neutron interaction energy for one of these nucleons in the attractive band, in motion at V_a relative to the other nucleon, in a stable mutual orbit with net spins antiparallel will be given by

$$E = [(M_a(\gamma_a - 1)c^2 + (S_a c(\gamma_a - 1)c^2) + (-M_a M_b/r) \pm t_a t_b/r]$$

$$-[(-S_a S_b c^2/r)] = 0$$

Where, because $M_a = S_a c$ and $M_b = S_b c$

$$2M_a(\gamma_a - 1)c^2 \pm t_a t_b/r = 0$$

$$2M_a(\gamma_a - 1)c^2 = \pm t_a t_b/r$$

7. Consider the interaction between two neutrons. When considering the interaction energies between two neutrons, the same considerations apply as before concerning the larger mass of the leptons within the nucleon stacks when compared with the quarks. At considerable distances and with axes aligned, the only energies acting are mass attraction balanced by spin repulsion. At very short distances, when all the stack rings are within the Near region of each other, there are four sets of interactions to consider between neutrons N_1 and N_2, N_1 electron to N_2 electron (charge repulsive, twist attractive), N_1 electron to N_2 udu core (charge attractive, twist attractive), N_1 udu core to N_2 electron (charge attractive, twist attractive) and N_1 udu core to N_2 udu core (charge repulsive, twist attractive). Thesame-same interactions each balance to zero, as do all the mass and spin energies, when axes are aligned and overall antiparallel spins between stacks. The same-different interactions are overall attractive.

There are between these extremes, two interesting separation regions to consider, but these are very complex.

Overall the two antiparallel spin neutrons, as their mutual separation decreases, move from an area of no interaction, to one of attraction, then repulsion and finally to no interaction again at the closest area. So between the two extremes will be a separation distance at which the two neutrons will be attracted back to that distance by twist energy if they move further apart, or repelled back by charge energy to that distance if they move closer together. The equation for the energy of motion of either of the neutrons with antiparallel spin, when in the attractive area, will be exactly the same as for the neutron and proton interaction, as

$$E = [(M_a(\gamma_a - 1)c^2 + (S_a c(\gamma a - 1)c^2) + (-M_a M_b/r) \pm t_a t_b/r]$$

$$-[(-S_a S_b c^2/r)] = 0$$

Where, because $M_a = S_a c$ and $M_b = S_b c$

$$2M_a(\gamma_a - 1)c^2 \pm t_a t_b/r = 0$$

$$2M_a(\gamma_a - 1)c^2 = \pm t_a t_b/r$$

There will be no stable orbit possible in the closer repulsive region, unless there is sufficient energy provided to reach the very closest region, where there is no interaction between nucleons.

So again the reason why the nucleus stays together is bizarrely that the neutrons hold it together. A neutron interacting with a neutron in the attractive region will have exactly the same energy as the neutron and proton interaction, with spin axis aligned anti-parallel, because all other energies cancel. Even though the proton and neutron are different masses, their mass attraction and spin repulsion with another nucleon will cancel. So all nucleon/nucleon interaction energies between antiparallel spin stacks will be the same, as will those between parallel spin stacks, although with a slightly different energy held in a chasing balance. As the disparity between ring sizes in a stack reduces - there may be no permanent difference in ring sizes in a stack - these interaction descriptions will simplify so that there would be no differential action of A on B versus B on A. This is my preferred interpretation, but the actual situation is not clear.

It may be asked why then all nuclei do not just keep growing in size. This may be because free neutrons are not common and are not found wandering around, ready to enter nuclei. Additionally, such neutrons as are formed outside the nucleus may be very short lived because the replacement of a stack neutrino by an electron/muon uses the latter at a slightly larger mass size than the stack neutrinos. This replacement is not consistent with the long term life of the neutron, which will eventually eject the electron in preference for a neutrino and reversion to a proton.

So overall, once the initial repulsive energy has been overcome, protons added to a nucleus are stable. Once neutrons have been added, close enough to other nucleons, they will also be stable until an impacting neutrino ring of the correct energy and phase finally replaces their odd-frequency electron ring, and the stack becomes a proton. To remain within the attractive region, assuming the formation of a stable orbit is preferred, nucleons may orbit each other. And nuclei should build by adding nucleons with spins that reduce the overall spin of the nucleus. What is termed the 'strong force' is a combination of all the energies, specifically when considering nucleon-nucleon interactions.

8. Consider the interactions between rings within a stack. In considering ring-ring interactions within a stack, the same energies will be in action as in the closest approach described above for the nucleons. So provided the rings are the same size, all aligned with spins anti-parallel down the stack and they all occupy the Very Near region, regardless of the identity of the rings, the energies between immediate neighbours will enable the formation of stable stacks. The phase of the energies between rings is now important, as will be seen in the section on colour, as is the meon-meon interactions between similar spin-sign rings. So what is described normally as the colour force is a combination of all the energies, but specifically when considering ring-ring interactions. When the stacks have spins aligned parallel, the

spin chasing, along with the meon to meon chasing when the appropriate rings are present, will ensure such stacks are not stable.

9. Consider the interactions between two electrons in the same atom. Starting from a great separation, and with axes aligned anti-parallel, the mass and spin energies balance to zero and only the charge repulsion is in action. Once the two have approached within their Near interaction region, the twist attraction will balance the charge repulsion and there will be no interaction between the two electrons. So antiparallel electrons compressed sufficiently together, if aligned axially, will have no interaction, other than impact. The same situation will occur in the Near region for parallel spin electron and positron, except it will be the twist chasing that tries to balance the charge attraction, eventually forming a photon. Anti-parallel electron and positron are attracted in this region and will form zerons. Outside the Near region, the latter two will be attracted by their charge with mass and spin balancing to zero. For parallel electron and positron both charge and mass are attractive, but spin chasing. So there is energy at work over large separations that tends to move opposite charges towards each other, to balance attraction and repulsion, which leads to the formation of chargeless 2-ring stacks. When the two electrons have parallel spins, they will form unstable chase relationships, which will disrupt them from remaining in stable orbits around a nucleus.

Considering the structure of electron orbitals, using the equations given earlier, but now adjusted by the effects of all the quantum numbers. It is apparent that the orbits that the electrons take are aligned along axes that change dependent on the mix of orbital and other momenta that the electrons possess. For example, the *s* ($l = 0$) shell is usually considered to be the mixture of J= $+\frac{1}{2}$ orbital and $m = -\frac{1}{2}$ magnetic momenta, with two electrons differing by intrinsic spin $\pm\frac{1}{2}$. But this framework suggests a different interpretation. The orbital momentum requires a velocity of $+V_x$, but the magnetic moment requires a velocity of $-V_x$, simultaneously. So the electron has both velocities, but their net effect is zero at all times. The shell can thus be described as a stationary state, but both momenta can be considered correct individually. Furthermore, the mixture of J= $-\frac{1}{2}$ orbital and $m = +\frac{1}{2}$ magnetic momenta give exactly the same result. So there are not two different orbitals here, only one, which will contain at most two electrons. In this shell, the zero net velocity will produce a symmetric spherical shell with the most likely positions towards the nucleus.

In the *p* ($l = 1$) shells, it is necessary to consider what the quantum numbers actually represent. The m= 0 sub-shell represents an orbital where the electron is not producing any magnetic moment in the xy plane. The motion of the electrons will be vertically up and down the z axis, elliptical viewed from the side proportional to it's $l = 1$ momentum, either above or below the nucleus. Where $m = \pm 1$, the electron orbits with an elliptical footprint in the xy plane that produces a magnetic moment, whilst simultaneously moving up and down in the z axis proportional to its l value of $l = 1$. The differentiation of $m = +1$ from $m = -1$ is that they are orthogonal in the xy plane.

The *d* and further out shells continue the process of filling in a spherically symmetric volume of space with orbitals. The underlying assumption is that all the electrons remain parallel or anti-parallel in intrinsic spin relative to the nucleus, even though their total other spins have different angles and will precess around their axis of spin. Each axis has two symmetric lobe systems, each of these lobe systems containing a maximum of one electron. When there is only one electron, it skips from place to place within all lobes along its axis. When there are two electrons, they swap skip between lobe systems, that is one electron is in one lobe system and the other electron in the other lobe system and they swap simultaneously between lobe systems, whilst skipping from place to place within the lobe system that they occupy at that time.

10. Consider the interactions between two electrons in different atoms. The difference between this system and the previous one is only that the two shared lobe systems are in two different atoms, rather than in the same atom. So electrons are swap skipping between lobes in different atoms and well as within lobe systems. The result is that both lobe systems are effectively better filled than they were on their own, but for a perfectly filled lobes system, on average filled completely half the time. The sharing of lobe systems across atoms must provide an energy advantage, producing a lower energy state and acting as an attractive energy between the atoms.

22.1.4 *Interaction Regions*

As mentioned earlier, the basis of mechanics in this framework is simple. It is the same both inside and outside the rings, with due allowance for the presence of entanglement, except that which energies take part in which interactions depend on the size and separation of the particles. This is because of the physical dimensions of the rings. Where the separation of two solid particles would depend on the factor r, the distance between centres, the action of meons travelling round one ring on meons in the other ring depends on the distance factor $d = \sqrt{r^2 + r_i^2 + r_j^2 - F(r, r_i, r_j)}$ where r_i is the radius of one ring under observation, r_j the radius of the other ring and $F(r, r_i, r_j)$ is a complex function of the three variables depending on the angles between two ring planes, as previously mentioned. This changes the sign of action when rings get very close to each other. The size of the qc, t, M_i and S_ic energies also affect how far away other rings have to approach before they can feel the effects of the internal components within the rings, rather than the net overall effects of the rings.

So for each particle, there are four non-entangled interaction regions at which the effects of the particles' energies are different. These are

1. Far – beyond the mass interference distance (mid) of either ring. This distance may be related to the inverse of the mass (wavelength) of the particles. Where two particles do not have overlapping mids, then the M_i effect is that all ring masses attract. The spin interaction is that antiparallel spins repel, dependent on relative orientation angle of the ring planes and parallel spins chase. A short description of this overlap would be 0/mid, meaning that the mid of the greater radius ring does not overlap with that of the smaller radius ring. Charge energy qc maintains its effects regardless of relative orientation or distance except in the Very Near region. The qc actions are the net sums of qc, although without any relative orientation effects. The t energy is not externalized, but affects the observable mass of the ring so that the value of mass is proportional to the fractional twist of the ring, so a neutrino appears to have no mass although it does have a rotational frequency.

2. Medium – where the mids of both particles overlap, but no overlap of any inner interference distance (qid), which is denoted by a 'q' because qc and t are the two larger energies present in the ring and thus represent the smaller interference distance. A short description of this region would be mid/mid. The qid distance is probably related to the charge of the particle. If two particles have overlapping mids, their S_ic interaction if antiparallel is repulsive again, dependent on the relative orientation and angle between them. Ring masses still attract and the qc energy remains on a summed no-orientation basis, and the t remains internalized, so that the value of ring mass is proportional to the fractional twist of the ring.

3. Near – where the mid of one particle overlaps with the qid (and always also the mid) of the other particle, written mid/qid. If two particles approach within mid/qid, then the t interaction is dependent on relative orientation and angle between them. The S_ic antiparallel repulsive interaction remains relative and the M_i and qc remain as for the Medium region, although now the value of ring mass is the same as its size, no longer proportional to its fractional twist.

4. Very Near – where both qids overlap, written qid/qid. All S_ic and t interactions are reversed as the denominator in the energy equation turns from positive to negative when the rings get close enough, and t may have some relative ring plane orientation component. If they have been previously driven away from each other, the two rings now become attracted and driven to symmetrically stack next to one another. If the rings were solid, the point at which $r = r_i$ or $r = r_j$ would be an impenetrable barrier to closer approach. However, they are composed of meons, so that any potential infinite energy stage is only a temporary point that occurs as the rings rotate, proportional to the rings' frequencies, allowing the rings to move 'round' the energy barrier rather than having to 'jump' over it. The M_i and qc ring-ring interactions are also reversed, although now the meon-meon interactions exceed the ring-ring net interactions. In this region it is likely that there will be entanglement between the particles, so the underlying $+M_o$ $-M_o$ chase action may cause closely stacked rings to move very quickly, if not up to light speed in the case of e- (J + $\frac{1}{2}$) and e+ (J + $\frac{1}{2}$) , forming a photon. The value of ring mass is the same as its size, not proportional to its fractional twist. So at this distance it is likely that the M_o, Q_o individual interaction energies between meons within rings dominate over the overall net qc, t, M_i and S_ic energies of the rings.

The four regions correspond roughly to different states of matter. Even though the actions in the Far and Medium are the same, they are differentiated by which energies are overlapping. Each ring to ring interaction has different overall effects in each interaction region. There is always at least one overall attractive outcome in each ring to ring interaction region. There is always at least one region where the overall effect is of stability, where attraction and repulsion are balanced.

My way of envisaging these overlaps is to consider that there is a constant C represented by the product of the ring mass acting over the ring area and the deflection factor D of space, produced by that mass energy. Thus

$$C \approx M_o(\gamma_i\text{–}1)c^2/(\pi r_i^2 D) \approx M_o w_i^2/(2\pi D)$$

so for small mass rings (large radii) the value of D is small, while for large mass rings (small radii) the value of D is large. C represents a constant energy density, and the total volume by which space deflects, due to this constant energy density, is hypothesized to be constant for each ring. This can be managed by judicious choice of how D varies with ring size, but really depends on the shape of the deflection curve, which is unknown. So, on a qualitative basis, a small mass ring with a small deflection will have a large distance to the edge of where the deflection of space ends, and a large mass ring will have a very small distance to that edge. It is the outer edge of the deflection of space, by that energy, which could be any of the usual energy types, that defines the relevant interaction distance. However, where that edge lies, or how large the deflection has to become in order to count as overlapping, is not certain.

The overall effect is that, other than in a small number of cases, all interactions in the far region are attractive since t is absent externally and the qc charges will tend to neutralize one another, and $M_i \geq S_i c$ for any bodies at all times.

The next section uses composites made of ring types, which have not yet been discussed. These composites will be detailed later, but put simply, photons are ring **r** and anti-ring **r** with the same spin whereas zerons are ring and anti-ring spinning opposite, in both cases using opposite mass phase rings.

Considering the interaction regions, we can say that the following stable or attractive regions exist for charged rings (here **r** is e- and **r** is e+, but other charged rings can be used providing due care is given to relative rotational symmetry of the outcome, and remembering that the $\pm\frac{1}{2}$ is the spin of the ring):

1 Near : **r** + $\frac{1}{2}$ **r** + $\frac{1}{2}$ – positronium, atomic shells, Cooper pairs.

2 Near : **r** + $\frac{1}{2}$ **r** − $\frac{1}{2}$ - positronium, atomic shells, Cooper pairs.

3 Far and Medium : **r** + $\frac{1}{2}$ **r** + $\frac{1}{2}$ - condensing gas clouds

4 Far and Medium : **r** + $\frac{1}{2}$ **r** - $\frac{1}{2}$ - condensing gas clouds

5 Far and Medium : **r** - $\frac{1}{2}$ **r** + $\frac{1}{2}$ - condensing gas clouds

6 Far and Medium : **r** - $\frac{1}{2}$ **r** - $\frac{1}{2}$ - condensing gas clouds

7 Near : **r** + $\frac{1}{2}$ **r** + $\frac{1}{2}$ - stacking photons in atomic shells

8 Near : **r** - $\frac{1}{2}$ **r** - $\frac{1}{2}$ - stacking photons in atomic shells

9 Near : **r** + $\frac{1}{2}$ **r** - $\frac{1}{2}$ - zerons

10 Near : **r** - $\frac{1}{2}$ **r** + $\frac{1}{2}$ - zerons

11 Very Near : **r** + $\frac{1}{2}$ **r** - $\frac{1}{2}$ - zerons, stack separations

12 Very Near : **r** - $\frac{1}{2}$ **r** + $\frac{1}{2}$ - zerons, stack separations

13 Very Near : **r** + $\frac{1}{2}$ **r** + $\frac{1}{2}$ - photons

14 Very Near : **r** - $\frac{1}{2}$ r**r** - $\frac{1}{2}$ - photons

15 Very Near : **r** + $\frac{1}{2}$ **r** + $\frac{1}{2}$ – positronium, atomic shells, Cooper pairs.

16 Very Near : **r** + ½ **r** − ½ - positronium, atomic shells, Cooper pairs.

For neutrinos, the following stable or attractive regions exist:

1 Near : **v** + ½ **V** + ½ - stacking in shells

2 Near : **v** + ½ **V** - ½ - stacking in shells

3 Very Near : **V** - ½ v + ½ - photons

4 Very Near : **V** - ½ v - ½ - zerons, stacking in shells

5 Near : **v** + ½ **V** + ½ - stacking in shells

6 Near : **v** + ½ **V** - ½ - stacking in shells

7 Very Near : **v** - ½ **V** + ½ - photons

8 Very Near : **v** - ½ **V** - ½ - zerons, stacking in shells

For mixed charged rings and neutrinos, the following stable and attractive regions exist:

1 Near : **e** + ½ **V** + ½ - stacks

2 Near : **e** + ½ **V** - ½ - stacks

3 Near : **e** - ½ **V** + ½ - stacks

4 Near : **e** - ½ **V** - ½ - stacks

5 Very Near : **e** - ½ **V** + ½ - close stacking

6 Very Near : **e** + ½ **V** + ½ - Pion

7 Very Near : **e** + ½ **V** - ½ - close stacking

8 Very Near : **e** - ½ **V** - ½ - close stacking

From this framework for mechanics, it can be seen that the reason for the Pauli exclusion principle is the underlying drive by nature to form systems with energies of motion and position as close to zero as possible. In the new energy equations described earlier, those equations describe states of zero energy where the motional energy of an electron, for example, is balanced in its orbit by a potential energy, ignoring spin orbit interactions. These states exist for all orbits that involve mass, charge, spin and twist. Where only gravity and spin are at work, in interaction regions outside the mid/mid, then the states are still zero energy states, but they may not be quantised. It is in the change in j ratio of $S_a c/M_a$ for the bodies under consideration that QM and classical regions exchange places. Where $j = 1$ will be a QM region and where $j \ll 1$ will be a classical region, but the change from one to the other will not necessarily depend on the size of the bodies. It can be hypothesized that a large body like a massive black hole, within which rings have been broken and will be reformed on exit, could have transferred the spin of each broken ring on entry to the revolutionary axial spin of the whole black hole. If this were the case, then for this star, $j = 1$ as much as for an electron. So the realms of QM versus classical are not necessarily bound by size constraints.

The short version of the interaction regions would be based on three distances r, r_i or r_j the separation distance and ring radii respectively, qid the charge influence distance and mid the mass influence distance, where $r_i <<$ qid $<<$ mid and K_θ means dependent on relative angle between the two spin axes and C means 'Chase', as follows:

Energy/Interaction region	Far o/mid	Medium qid/mid	Near qid/mid	Very Near qid/qid	Within ring Mo/Mo
$+M_o+M_o$				+	+
$+M_o-M_o$				**C**	**C**
$+Qo+Qo$				-	-
$+Qo-Qo$				+	+
$+q+q$	-	-	-	+	-
$+q-q$	+	+	+	-	+
$+t-t$					+
$+t-t$					**C**
mm	+	+	+	-	
$s_g \Leftarrow\Rightarrow$		-	-	+	
$s_g \Rightarrow\Rightarrow$		**C**	**C**	**C**	
$t_g \Leftarrow\Rightarrow$			+	-	
$t_g \Rightarrow\Rightarrow$			**C**	**C**	

There is a symmetry case that can be made for the size of spin energy to be dependent on ring charge, in the appropriate regions, in the same way that the mass energy depends on the fractional twist in those regions. However, this is difficult to observe since the fractional or zero charged rings necessary to test this hypothesis are not easy to isolate for measurement.

22.1.5 *Building Atoms*

Assume that the first electron in an orbital **s** $\pm\frac{1}{2}$ shell has its intrinsic spin aligned opposite that of the central proton, that is antiparallel. For a second electron to approach and successfully form a filled shell requires that the second electron has ALL the opposite properties of the first electron, other than charge and twist. If the first electron is e- - $\frac{1}{2}$, being a negative mass phase, then the second have a positive mass phase with spin + $\frac{1}{2}$ and it will have $-qc$ and $-t$. In the shell, the electrons will be inside their mutual mid/qid, thus in the Near region, so the t energy will be attractive, exactly matching the repulsion of the $-qc$ charges. The spins will be opposite, and repulsive, and the masses will be attractive and of opposite phase. So the effect between the two electrons in this shell is nothing. The sum of their respective energies is also nothing because of the opposite mass phases of each electron. They have opposite mass phases ($+m_i$, $-m_i$) and spins ($+S_ic$, $-S_ic$), and same charges ($-qc$, $-qc$) and twists ($+t$, $+t$). So the formation of a shell, or part of a shell, involves that shell summing its energies to zero for all motional and potential energies, although the actual masses are always viewed as positive. In the frame of reference of the electrons, their relative velocity will be zero, so all the motional energies are zero, although in the frame of reference of the proton there will be kinetic energies, which will take the same phase as their respective masses because $KE = M_i(\gamma_x - 1)c^2$ and $\gamma_x \geq 1$.

If the second electron were identical to the first electron, the mass attraction would not be balanced by a spin repulsion, which would instead have a chase interaction. Provided the two electrons remain at the same separation, they remain in balance, with no net effect between them, but any slight perturbation would start them chasing out of their orbits. Additionally, the shell would have ($+m_i$, $+m_i$) and ($+S_ic$, $+S_ic$), so that, although the overall summation of these energies would be zero, they would not be zero individually. This will be shown later, in a different context, to arise from allowable places, where for the electron, the shell cannot permit two identical particles to occupy the same place where each orbital containing that place overlaps.

So the Pauli exclusion principle is also a statement that each electron must be balanced by another exactly opposite energy and phase electron in order to build a partial shell of total energy of motion and position equal to zero, with no other pair having the same size of energies.

For the atomic orbitals, the energies that differentiate the $-M_i$ and $+M_i$ spinning electrons come from the last section of the original energy equation and are the cross interactions between the different spins and the potential energy of the bodies, here called the spin orbit interaction. The value of each is

$$E_{spin-orbit}(+\tfrac{1}{2}) = +(\gamma_a - 1)([(-q_aq_bc^2/r - M_aM_b/r)] - [(-S_aS_bc^2/r)])$$

$$\approx +(\gamma_a - 1)(-q_a q_b c^2/r)$$

$$E_{spin-orbit}(-\tfrac{1}{2}) = -(\gamma_a - 1)([(-q_a q_b c^2/r - M_a M_b/r)] - [(-S_a S_b c^2/r)])$$

$$\approx -(\gamma_a - 1)(-q_a q_b c^2/r)$$

The factor takes the sign of the spin, whilst the charge potential energy is negative in both cases, because the positive charge proton attracts both electrons. The J $-\frac{1}{2}$ electron thus has the lower energy and is the preferred partner of the two by a spin $+\frac{1}{2}$ proton. From the equation before, this produces an energy difference between the two spin orbit interaction energies of

$$E_{spin-orbit-difference} = 4M_a c^2(\gamma_a - 1)(\gamma_a - 1) \approx M_a c^2(V_a^4/c^4)$$

As a check, this can be calculated using the electron mass 0.511 MeV and the $n = 1$ orbital velocity of αc to give the magnitude of the spin orbit energy split as 1.45×10^{-3} eV.

Following on from building the **s** shells, come the **p** shells. The requirement again is that each added electron is either on its own or has an opposite partner added. The alignment of the electrons must be so that their axes are perpendicular to any other pair in the same shell. So, since there are three possible perpendicular axes, there are six electrons that can be accommodated whose axes do not fully align with the proton core. The amount by which the alignment differs from the two **s** shell electrons in the $n = 2$ shell gives momentum that each electron has along an axis parallel to the **s** shell electrons. This value is usually described as the L_z component. So although the six $n = 2$ **p** shell electrons are mutually perpendicular to each other, they each have partial energy components that are aligned with the **s** electrons, and remainders that are perpendicular to the **s** electrons.

Before going further, it is necessary to explain in more detail what a photon is composed of in this framework. The photon is a ring and its anti-ring, rotating the same way (with the same spin) each ring with an opposite mass phase. When stationary, the photon can be thought of as a ring stacked next to its anti-partner. When in motion, the two rings are almost completely merged, in that each meon in one ring of one phase almost completely merges with its opposite meon in the other ring of opposite phase, whilst continuing to rotate at the unmerged frequency. Their total energy of motion and rotation remains unaltered, with the amount of merging altering to maintain that same energy. What drives the photon to move is the chase energy, of the meon masses, between rings because they are entangled. Each +meon/-meon pair, one in one ring and its partner in the anti-ring, is attracted by their opposite charges $+Q_o/-Q_o$, but the opposite masses $+M_o/-M_o$ try to oppose/chase. Inside a ring, the chasing produces the rotation of the ring. Externally, from ring to ring, the chasing produces external motion of the rings. From a meon in one ring to an opposite meon in the other ring, the effective chain is straight and very short, being just two meons in length. The result is that the meons mutually chase and accelerate up to a terminal velocity. This terminal velocity is what we call light speed, c. The reason why there is a terminal velocity is hypothesized to be because there is a universal viscosity caused by the ZMBHs that compose the background universe. Where there are larger energy fields, such as mass concentrations, there will be greater concentrations of ZMBHs and the viscosity will be higher, which leads to local light speeds that are lower than the vacuum speed of light where there are no energy concentrations ('empty space'). The viscosity also contributes to the loss of energy of a photon as it travels, which is taken from the rate of rotation and is termed viscosity red shift. The amount of viscosity red shift is proportional to the distance that each meon travels, which is mainly a function, at lower energies, of the distance that the photon itself travels, rather than its frequency. For the building of atomic shells, it is enough to understand that photons can attach to electrons in shells, forming unmerged stacks alongside the electron and, in the same way that an electron, mass M_i , in a shell has angular momentum $\frac{1}{2}h/2\pi$ (APS and PU), a stacked photon in a shell will have $h/2\pi$ (APS and PU) angular momentum because it is composed of two rings in orbit with the electron. So where the internal mass and spin energy of a ring is either $\frac{1}{2}h$ (APS) or $\frac{1}{2}h/2\pi$ (PU), the orbital momentum is $h/2\pi$ in both units when in a shell. Once again, this explanation is based in terms of h and should be more formally made using h separated from the w, $\frac{1}{2}$ and 2π factors, plus the provision that the orbital is a $j = S_a c/M_a = 1$ state.

Note that the preferred first electron added to a proton spin $+\frac{1}{2}$ shell is the - $\frac{1}{2}$ spin electron. The creation of Hydrogen is from a spin $+\frac{1}{2}$ proton and a spin - $\frac{1}{2}$ electron. The addition of neutrons of spin $-\frac{1}{2}$ to a nucleus is an increase in the mass of the nucleus, as is the case when a proton spin $-\frac{1}{2}$ is added, but a balancing of mass phase and spin overall. The building of the nucleus is also done under the same drive by nature to reduce energy to as close to zero as possible.

The spin J+1 photon is now explained simply as the preferred version of the photon in our region of the universe, although as seen in optics, a J − 1 photon is also required to explain effects such as linear polarization. But using normal atoms to observe photons will preferentially show photons to be J + 1 because they can bind either side of the first electron, J $-\frac{1}{2}$, forming a stack of alternating spin rings.

Looking at how to boost electrons from shell to shell, or have them decay, it must be that the lowest shell $n = 1$ contains just the electron, without any photons stacked with it. As the electron is boosted to higher energies, photons are added with the right energy to move the electron between shells, and are available to be emitted when the electron decays back to its original shell. The boosting of an e- $-\frac{1}{2}$ electron by the addition of a photon J +1 will result in an electron/photon stack of e- $+\frac{1}{2}$ which may stay in the new shell if its original shell position becomes occupied by another electron, failing which it must decay back to where it was. The same will occur with an e- $+\frac{1}{2}$ boosted by a photon J+1, or a photon J-1, although the latter is likely to exist only fleetingly in the positive mass phase environment. The electron/photon stack will need to change speed and distance from the nuclear core in order to maintain a zero total energy of motion and potential energy, to be in a stable orbit. It is also possible that two photons of J+1 and J-1 can stack with the electron and boost it to a higher shell. Each photon would then have half the energy balloon separation of the two shells, but the $\pm\frac{1}{2}$ of the electron would not have changed, implying its principal quantum number n would not have changed.

We have not explicitly considered quarks and why fractional charges may not balance in the simple systems considered so far, other than quark and anti-quark. In the new 4 interaction regions system, it has been suggested that when the rings approach one another close enough, eg the Near region, the effect of the t energy becomes visible and this uncovers the size of the rings so that the spin and mass energies are then able to balance in order to form stable stacks. Beyond the Near region, the mass seen is the fractional mass; that is the mass of the ring multiplied by its fractional twist. So there are no stable states possible using only quarks beyond the Near region and the apparent mass of a ring depends on the t of that ring and which region it is in with respect to any other ring.

22.1.6 *Ring Combinations - Underlying Model and Colour*

The framework proposed here is a composite model of quarks and leptons, in which the fundamental observable charge is $\pm 1/6$ of the charge on the electron. In order to generate all possible observed electronic charge combinations for the leptons and quarks in normal matter, it is necessary to have six meons. In order to balance the total value of the fundamental charges of the meons, each of $\pm 1 Q_o$ within the rings of six, there must be three of each sign of meon present in every ring.

In order to show the combinations possible in a brief way, from now on in this section, the letter M will be used to denote the positive meon and E the negative meon, the anti-partner of the positive meon. An M twisting RHS will be denoted M+. An M twisting LHS will be denoted M-. The + and – now denote the sign of electric charge generated, of size 1/6 qc in every case. The change from ring to anti-ring, that is composite particle to anti-particle, involves only swapping the type of meon at every position, ie M to E and E to M. Such a change at each position, whilst keeping the twisting orientation the same, results in the generation of opposite charge at each position within a composite.

The only combinations possible, representing the rings in linear form starting at position 1, are:

(i) M+ E+ M+ E+ M+ E+ This is a ring of +1 electronic charge. We identify it as the positron e+. For an identical ring, but with swapped meons, each will generate charge –1/6 qc, giving a ring of total charge –1 qc and the ring is identified as the electron e-.

(ii) M+ E- M+ E- M+ E- This is a ring of 0 electronic charge. We identify this as a neutrino. The swapping of meons still sums to zero charge and is identified as the anti-neutrino. As well as the + - + - + - shown, there are other isomers such as + + + - - - or + - + - - +. The definition of the neutrino is taken to be the M at position 1 generates +1/6 qc, so RHS for each meon. Each neutrino and anti-neutrino is thus composed of meons all twisting RHS, differentiated only by 60^o of rotation when viewed as a rings. There are also other isomers generated when all the meons twist LHS, which are considered later.

(iii) M+ E- M+ E+ M+ E+ This is a ring of +2/3 electronic charge. We identify it as the up quark. Swapping meons provides the anti-up quark. The position of the sole negative charge in the up quark ring can be on either the M or E meons, but in each case represents an SU(3) symmetry if we decide that the position of the charge within the ring and the identity of the meon, twisting negative charge, represents different cases of the same ring. This is a colour type symmetry since each case, or state, is clearly degenerate. This suggests that 'colour' is actually a form of synchronization of the asymmetry of rings. The rings contain meons that are each chasing the next in front and the presence of an asymmetric charge can be thought of as providing a timing signal. The initial suggestion is that only the appropriate combination of asymmetries (colours) will enable a composite made of a number of rings to be stable (colourless). This will be shown to be only partially the case later.

(iv) M+ E- M- E- M+ E- This is a ring of –1/3 electronic charge. We identify it as the down quark. Swapping meons provides the anti-down quark. The SU(3) symmetry is here again in each of the different isomers. As well as the + - - - + - shown, there are also isomers such as - - - - + + or + - - + - -. Although one might suspect that only one isomer would be 'suitable' for correct synchronization with, and when sandwiched between, two up quarks of opposite spin to form a stack of rings that we would identify as a proton core, as will be shown later, all isomers can be found in multiple ring combinations that have overall symmetry of charges.

Also shown later is the result that all overall-symmetric ring combinations of 2, 3 or more rings ('stacks') have charges of only 0, $\pm$N qc (N integer ≥ 1) electric charges, which shows that this type of symmetry probably underlies why fractional charges are not normally seen free in nature.

Note that in each case above, if the orientation of the motion of the meons in the plane of the ring is assumed to be in one direction (eg rotating clockwise on the page defined as spin J + $\frac{1}{2}$), the time reversal of the motion of the meons around the ring will lead to the production of opposite charge and the rings having J – $\frac{1}{2}$ spin . So care is needed in the definition of a ring and its anti-partner. If the electron ring is defined as –1 qc and J + $\frac{1}{2}$, then the positron ring will be +1 qc J – $\frac{1}{2}$ in a time-reversed definition of the electron's anti-partner. In the cases described above, without time reversal but by switching meon identity only, the anti-partner to the electron –1 qc J + $\frac{1}{2}$ will be the positron +1 qc J + $\frac{1}{2}$. We will continue for the moment with the latter definition of ring and anti-ring relationship. It will later be shown that, from symmetry considerations, the definition of what is the ring and what is the anti-ring has to be more precise on two counts. However, it is interesting that this definition of both ring and anti-ring as spin + $\frac{1}{2}$ particles implies that there is a potential asymmetry in nature due to the formation of rings from chains, and that time plays no part in that initial asymmetry.

Also note that even the leptons have colour symmetry, but it is hidden in the $\pm$1 qc charged rings because each SU(3) position is identical to the other two. There are no possible isomers of the $\pm$1 qc electronic rings. There are isomers of the neutrino rings, such as + + + - - - and + + - - + +, the latter being SU(3) symmetric. So there is no underlying colour reason why certain isomers of the leptons should not be found inside nuclei, if colour is defined as synchronization ability plus SU(3) symmetry.

The above combinations represent the ONLY possible charge combinations of three M and three E meons. In the rings the order of the meons is always alternating from M to E to M etc and the fundamental masses of M and E are equal and opposite, so that their M_o and Q_o internal potential energy interaction overall is zero, as was shown earlier.

We would hypothesize that the rings do not break, once formed, except at extreme energies. This means that electric charge, baryon and lepton numbers are conserved when rings are not broken. So there is no process under normal circumstances for proton decay and yet at large energies, or in extreme enough charge or gravitational fields, rings may be broken.

The relation between quark and lepton charges is natural in this scheme. The vanishing sum of charges ν_e, e-, u, d and anti-partners across a whole generation can be explained in that there are equal numbers of +1/6 and –1/6 electron charges across the whole generation (24 of each).

The second and third generations of quarks and leptons are presumably constructed in an analogous way to the first generation, although, as will be shown later from considerations of magnetic moments for at least the charged leptons, the generations appear to be different mass resonances of the same rings. Each generation must contain the same sets of states, at higher mass energy, and smaller ring radius, values. What we suggest here is that it is the size of the ring (the radial distance to the center of the ring from each meon as well as the separation of each adjacent meon) that represents the motional energy of the ring, or its mass. So there are three sets of sizes that are preferred, for some reason, over all other sizes and these are the mass resonances. The alternative is that each ring attracts a stack of other rings with zero total charge and spin, and the mass of that stack adds to the mass of the initial ring to produce a second excitation level. It is unclear yet why there would be such stack quantisation, although the section on colour symmetries does show that there are very few different size mass stacks amongst the symmetric stacks composed of asymmetric rings.

From a brief perusal of which are the most common rings, there appears to be a preference, in the framework described, for the rings to travel with most of their meons twisting inwards towards the overall direction of travel of the ring. This gives rise to preferred spin orientations of different rings. Constraining a ring not to travel does not alter its preference in this direction of motion. So rings with equal numbers of meons twisting inwards and outwards have no preference, which are the electron and down quarks. A neutrino built with RHS meons, with all six meons twisting the same way, has a preference for RHS motion (ring rotating RHS along direction of travel), whilst its anti-neutrino prefers LHS. The reverse is the case for the neutrino built of LHS meons. The up quark has a RHS preference, with the anti-up quark having LHS. The overall outcome of this is that the preferred versions will be more prevalent and composites formed will tend to use these versions preferentially. Ring composites formed with preferences aligned along one axis will travel quickly, whilst those stacks formed with mixed preferences will move only slowly.

22.1.7 *Dynamics*

The dynamics of the meons inside a ring arise from the chasing $\pm M_o$ energies and potential energies present in the ring, which has a net effect of each meon chasing the one in front of it in the ring, although in the frame of reference of the ring there is no relative motion between the meons. The energies are thus as described in the initial section.

The shape of the ring, as a donut-like structure, or ring, with moving components constrained in a flat plane gives a reference plane to the interaction between observer and ring, either above or below the plane of the ring.

The mass of the electron and positron is fairly simple, in that a spin J + $\frac{1}{2}$ electron or positron both have a mass energy $M_i c^2 = M_o(\gamma_i – 1)c^2 = h(\phi_i - 1)w_o$ in all regions, one positive mass phase and the other negative, as described above.

The masses of the other rings, the neutrinos and quarks, relative to their rotational frequencies w is not so easily apparent. We hypothesize that the twist energy in some way mediates the size of the observed mass of a ring when in the Far and Medium region as a fraction of the ring frequency. So, for low energy environments where $h(\phi_i – 1)w_o \approx \frac{1}{2}hw_i$, the e-/e+ have observed $m_e = 1\frac{1}{2}hw_e$, the ν/V have $m_\nu = 0\frac{1}{2}hw_\nu$, the u+/u- have $m_u = (2/3)\frac{1}{2}hw_u$ and the d-/d+ have $m_d = (1/3)\frac{1}{2}hw_d$, and the same for all other generations. In each case w_i represents what the size of the ring would be if each ring had $\pm 1qc$, and that is the 'normal' or preferred ring size for that fermion and we represents the currently accepted angular frequency of the electron.

In this framework, when rings are in a stack of at least two rings, they inhabit the Near region and will show a mass equal to the size of the ring. In this case, the neutrino rings would have mass when in a stack, but not when isolated. This leads naturally to a very small observed mass for neutrinos when they are passing 'close by' (within the Near region of) other rings that have mass when isolated. This is an 'induced' mass for the neutrino, which increases to

100% when in a stack. The rotational rates of the rings would not necessarily change, but the existence of those rates would be partially disclosed. Within the Near region, each ring probably interacts between component meons, rather than as composite rings. This is expected to be what allows neutrinos to be stacked in nucleons. Interaction in the Near region was described earlier as a function of the relative orientation of the planes of the interacting rings, their respective sizes and their relative separation, together with the likelihood of entanglement between the rings.

So, in the this hypothesis, the relative sizes of the three ring generations can now be defined as three different frequencies of rotation of the same type of rings. Transition rates between generations will depend on the available energies that will increase or decrease the ring sizes to change one generation into another. As was suggested above, there may be more than just ring size at play, but the main feature is expected to be ring size.

There is a potential paradox on the direction of observation of the meons twisting. Since the rings are so small, the motion of the meons in a rings, both advancing and retiring on opposite sides simultaneously relative to any observer, does not allow any observer to experience a preferred direction of motion of a meon within a ring. All that can be observed normally is the frequency of rotation of the meons around the ring, the total electronic charge of the ring and the relative orientation of the plane of the ring to its direction of travel, with the spin J $\pm \frac{1}{2}$ apparent. An external observer can travel fast enough relative to the moving meons in a ring to change the apparent twisting direction of a meon, that is its apparent charge, for only a short period as it travels around the ring. But what the observer measures does not change the charge that the meon generates. In a ring, that meon, in its own frame of reference, is twisting with respect to the universe to generate the appropriate charge. The external motion of an observer does not change the sign of charge generated by the meon, although it may allow the observation of the meon to be twisting in the opposite direction and it will also change the apparent frequency w of the ring. But in the ring frame of reference, nothing has changed.

22.1.8 *Ring Sizes*

This framework gives predictions on the sizes of the rings, in a frame of reference in which the rings, but not the meons, are stationary with respect to an observer, such that the ring radius at low w_i is given by

$$r_i = \sqrt{2h^2/(M_o M_i c^2)}$$

So the isolated ring sizes for the charged leptons will be given simply as:

$$\begin{array}{lll} e- & m = 0.510999 \text{ MeV}/c^2 & r = 1.402127 \times 10^{-23} \text{ m} \\ \mu- & m = 105.658 \text{ MeV}/c^2 & r = 9.751 \times 10^{-25} \text{ m} \\ \tau- & m = 1,776.99 \text{ MeV}/c^2 & r = 2.38 \times 10^{-25} \text{ m} \end{array}$$

Provided the isolated neutrinos are the same size as the electron ring in each generation, which would be a reasonable assumption for their maximum interaction together, the sizes of the neutrino generations should be:

$$\begin{array}{lll} \nu_e & m = 0 \text{ MeV}/c^2 & r = 1.402127 \times 10^{-23} \text{ m} \\ \nu_\mu & m = 0 \text{ MeV}/c^2 & r = 9.751 \times 10^{-25} \text{ m} \\ \nu_\tau & m = 0 \text{ MeV}/c^2 & r = 2.38 \times 10^{-25} \text{ m} \end{array}$$

However, as will be shown in the section on protons and neutrons, the neutrinos appear to have a slightly smaller size when in the nucleon stacks than their related charged leptons.

The quark generations are understood to be the following sizes, using 2005 Particle Data Group masses given in the MS-bar scheme, plus the Top quark mass from the Tevatron Electroweak Working Group:

$u+$	$m = 1.5\text{-}4.0$ MeV$/c^2$	d-	$m = 4 - 8$ MeV$/c^2$
$c+$	$m = 1,150 - 1,350$ MeV$/c^2$	s-	$m = 80 - 130$ MeV$/c^2$
$t+$	$m = 170,900 \pm 1,800$ MeV$/c^2$	b-	$m = 4,100 - 4,400$ MeV$/c^2$

22.1.9 *Stacks and Colours*

We now look at the configuration of rings when they are not isolated. The most obvious configuration is to be stacked, like dishes ready to be washed. This also makes the calculation of magnetic moments easier because the orientations of the planes of the rings will be parallel and the sum of the magnetic moments of the component rings will be the total magnetic moment of the composite stack. To investigate how the rings may stack involves considering how asymmetric rings may be made to act symmetrically when in combination with other asymmetric rings in a stack. As will be shown below using the definitions set out, there are 144 possible different orientations of the asymmetric rings, giving rise to 1442 two-ring stacks and 1443 three-ring stacks. There is no need to consider longer stacks for symmetry because the only symmetries in the rings are 2, 3 or none. The latter 'no symmetry' rings will repeat with 3-fold symmetry of position, so if there have been no symmetric composites in 2 or 3 length stacks, there will be none at any longer lengths.

At the end are listed the 144 possible asymmetric ring orientations for the asymmetric rings. Not included in the work on combinations are the symmetric electron/positron and symmetric neutrino/anti-neutrino, because for these all positions are symmetric and they are able to add to any stack and retain the stack symmetry. These symmetric leptons are designated S3 for symmetry.

When considering how rings interact it is necessary to define a system for systematic comparison of the positions of the ring components, the meons. For this discussion, we define a ring as six meons in the plane of the paper, with position 1 being the top left meon (imagine a hexagonal metal nut placed flat on the paper, with flat faces parallel to the top of the page.) and position 2, 3 etc following in order along the direction of travel of the meons. So the definition of a spin J + $\frac{1}{2}$ ring is when the meons are traveling clockwise when viewed from above the paper. One half of rings will have a positive base mass meon M at position 1, and the other half will have a negative base mass meon E at position 1. This will not affect the charge combinations possible, but will affect which rings can merge to form photons rather than remaining as unmerged bosons, for example.

We also need to define colours and symmetries. We define the meon at which point, or through which line, the asymmetry of the ring lies as being in some way coloured. Since there are three pairs of meons in each ring, there will be three-fold symmetries possible, rather than the six that might be expected just by considering what the possible charges are. Instead of considering the symmetry of charges on the M of each pair, and then on the E of each pair, we will consider the symmetries of charges at positions on the ring by swapping each M with E, which makes the combinatory work simpler because the underlying identity of the meon does not affect the symmetry of the ring, although it does affect what the overall combination of rings can be (eg photon or boson as mentioned).

For a ring (not an anti-ring) the colours are either green (when the asymmetry is on position 1), or red (when on position 3) or blue (when on position 5). For an up quark, with its sole $-qc/6$ as the point of asymmetry at position 1, 3 or 5, this should be clear, so the ring can be defined as coloured g1, r3 or b5. But, as will be shown, the lines of asymmetry become more complex and can lie between meons. The asymmetric meon can be M or E at 1, 3 or 5 to give a coloured ring. This means that for a symmetric ring, with all charges the same at each point, there are two different but probably indistinguishable isomers, regardless of the colour positions, which may themselves also be indistinguishable. This means that there are expected to be two identical electrons in existence, but effectively rotated by 60^o relative to each other. Only if the two rings were created simultaneously, and one specific position tracked in each ring, could the 60^o difference in orientation be theoretically observed. Even trying to merge, for example, an

electron with its isomeric positron together would not work, because the twisting of the meons is in the wrong sense to allow meons at the same point to merge. Instead of correctly twisting meon pairs, with opposite charges, that will merge to form a photon, these are unable to merge. They may however be able to stack, with alternating isomers, because the meon to meon $+M_o/-M_o$-sized chasing attraction may overcome the charge to charge qc-sized repulsion, if the rings are entangled. But it will not be possible to say which isomer is which, only that they are different. So there are two types of electron, and two types of every different isomer of every fermion ring.

For the neutrino, the situation is more complex. As already seen above, the definition of the neutrino and anti-neutrino contains a 60^o difference, although the reason is different. The neutrino also has the second isomeric neutrino rotated by 60^o, but since there is no change of meon type, it is technically not an anti-neutrino that results, but a neutrino rotated through 60^o. So whether an uncharged ring is either a neutrino rotated by 60^o relative to its counterpart, or is the anti-neutrino to the counterpart, is not discernable to a new observer because they are precisely the same in layout and energy. In principle, for an observer watching from before the ring was formed, the difference would be observable, because the rotated ring would try to un-rotate, to recover its original phase, whereas the anti-neutrino would not.

In addition to defining colours, we need to define anti-colours. When the asymmetric meon, or symmetry line, of an anti-ring is at position 1, 3 or 5, these are defined as anti-green, ant-red and anti-blue. The anti-ring will be coloured g-1, r-3 or b-5. In this way, a ring and anti-ring rotating spin J + $\frac{1}{2}$ will have opposite charges and opposite sign meons at each point 1 to 6, which will allow the formation of a colourless photon from a coloured ring and its anti-coloured anti-ring.

But symmetry shows that there will also be opposite colours shown by the meons at the opposite point on the ring, through which the line of symmetry also passes. So rings will be anti-coloured when the asymmetry positions are at g-4, r-6 and b-2, and anti-rings will be coloured with the symmetry line, or meon positions, at g4, r6 and b2.

The result is that for all rings there are 24 different combinations of point/line of symmetry (Each ring or anti-ring, M or E at 3 coloured or 3 anti-coloured positions) for J + $\frac{1}{2}$ spin ring.

To consider the interaction of symmetry between J = + $\frac{1}{2}$ and J = - $\frac{1}{2}$ rotation rings we need to define how to achieve the change, the flipping over of the ring, remembering that each change of planar orientation of the asymmetry of a ring is defined as a different colour/anti-colour. The simplest definition is that the ring should be flipped over through its line of symmetry, with the point of symmetry (if on a meon) kept at the same position number. But we need to define how we think that the asymmetries of a J + $\frac{1}{2}$ ring interact with the asymmetries of a J − $\frac{1}{2}$ ring. Our hypothesis is that they act exactly as if they were rotating in the same way rather than opposite ways, provided that the two rings are the same size. This is because, when the rings are the same size, the lines of asymmetry will coincide twice as often as the rings' frequency, but will retain the same overall lines of asymmetry in the combination. After one rotation of each ring, the relative positions of the lines of asymmetry are unchanged, although they will have crossed after half a rotation. So whether the rings are rotating in the same way or opposite, in a stack of same-size rings, the lines of asymmetry of the combination will be retained. At the moment, we are not concerned with how long it takes to flip the ring – which will involve a change of relative phase – only with the definition of the end result of a flip.

Although there are now 48 possible orientations for each ring, only 24 need be considered when combining with other ring orientations. However, it is still necessary when considering the combinations, to define ring and anti-ring in a systematic way. This means that we have to redefine, solely for this consideration of symmetry, what is currently considered the particle and which the anti-particle in our four quark rings and four lepton rings (although as shown elsewhere, this redefinition of matter and antimatter by charge differentiation is actually preferable to the current system). We have chosen for this section that the ring is the positive charge variant and the anti-ring the negative charge variant. This simplifies the combinatorial work involved and allows summaries of what combinations are possible to be drawn on a consistent basis. So when discussing the combinatorial permutations of rings, we mean e+, u+, d+ and ν (latter is with $+qc/6$ on position 1, 3 and 5 for both M and E isomers), written where clear as e, u, d and ν. When discussing anti-rings we mean e-, u-, d- and V (latter is with $+qc/6$ on position 2, 4 and 6 for both M and E isomers), written where clear as e, u, d and V. However, this definition is not used in any other considerations

in this section, it is used here solely to simplify the outcomes of stack combinations when considered from a colour perspective.

Considering what the rings actually are, it is obvious that the electron (S3) and symmetric ν (Type $v1$, symmetry S3) are symmetric in all positions and will not change the symmetry of any other combinations of rings. So any combination of any-coloured e+, e-, $\nu 1$ and V1 will be possible with each other and with other ring stacks. Here the fact that they have S3 symmetry does not mean that they do not 'feel the colour force', in current parlance, but that they do not affect the symmetry of an existing stack and so cannot be used for balancing asymmetric stacks in order to make them symmetric. But they can join any stack that is already symmetric or replace a similarly symmetric ring that is already in a stack.

Looking at the asymmetric rings, there are a number of different symmetries present. The u+ are all A3 symmetric of the form - + + + + + (meaning the line of symmetry is on a meon, with three possible colour positions) and type U. The d+ of the form - + + - + + is defined as type D2 with symmetry A2, M2 (meaning that there are two lines of symmetry, one is 2-symmetric on a meon and one 3-symmetric between two meons). The d+ of the form + - + + + - is type D1 and the symmetry is A2 only. The d-, type D3 is M3 only, being of form - - + + + + .

There are three neutrino isomers, $v1$ we have met, is S3 and has the form + - + - + -. The isomer $v2$ is + + - - - + and is A2 symmetric only. The isomer $v3$ is + + - - + - and is non-symmetric, called N0.

In forming the possible symmetric combinations, using 2 or more asymmetric rings, all the asymmetric rings have been included. For 2 ring combinations, starting from 144 total different asymmetric ring orientations (24 each for U, D1, D2, D3, $v2$ and $v3$) there are 144 * 144 = 20,736 possible outcomes. At the end are some lists that show the identities of each orientation of the asymmetric rings.

In further simplifying the consideration of the outcomes, it is necessary to look at the relationships between the colours and the relationships between the rings, rather than the actual colours or rings. So instead of listing all possible outcomes of, for example, a stack of three rings u+ g1 (A3) d- r3 (A3) u+ b5 (A3), we have converted to c1+, c2+ and c3+ for the colours and X+ Y+ and Z+ for the rings, with anti-colours X-, Y- and Z-. This means that the three 2-ring combinations u+ g1 (A3) u- g-1 (A3), u+ r3 (A3) u- r-3 (A3) and u+ b5 (A3) u- b-5 (A3), can be simplified into the one group X+ X- c1+/c1- (A3 A3), where X+ represents a generic ring and X- its anti-ring. This has converted colour symmetries into group colour symmetries where it is the relationship between rings and colours that matters, rather than what the individual colours or rings themselves are.

The result is that there are only 16 different sets of 2 rings formed from asymmetric rings that are overall symmetric. There are examples listed at the end.

22.1.10 *2-Ring Combinations*

The lists at the end give some examples of 2-ring symmetric combinations. Considering these, it can be seen that there are many possible particles made from these 2-ring combinations. For example, photons made from u+ u- c1+/c1- (A3 A3), vV c1-/c1+ (S3 S3) or e+ e- c1+/c3+ (S3 S3). Depending on the definition of pions and gluons, which will be covered later, there are pions or gluons made from vV c1-/c1+ (N0 N0). But there are other combinations more exotic. A potential gluon could be vV c1+/c2- (S3 S3) that has colour and anti-colour and could be used to change the overall colour of a symmetric stack by balancing either the colour or anti-colour symmetries. Note that the outcomes are both colourless and coloured. So lack of colour is not a sufficient definition to say what can exist as a stable entity and what cannot, which was already evident in the colour or mass phases of the symmetric leptons, which exist separately but already have colour. The symmetry of the outcome defines what can exist as a combination, and that combination could be coloured in our use of that definition. A chameleon-like particle could be vV c1+/c2+ (S3 S3), which changes the colour of a stack by balancing one existing anti-colour in the stack. Another combination could be called a Zeron, being d+ d- c1-/c1- (A2, M2 ; A2, M2) which has no overall charge or spin and couldn't be used to change a colour. All of the 2 ring combinations can occur in both $J = 0$ and $J \pm 1$ spin varieties, so photons, pions and gluons may differ only by relative rotational direction of identical component rings within the stack.

Note that there are no charged 2 ring combinations possible using asymmetric rings, except u with d of the same sign charge. Other than this, a charged 2-ring of $\pm Nqc$ ($N \geq 1$) can only be achieved using the symmetric S3 leptons. The lists shows some examples of the many 'different' symmetric combinations of 2 symmetric leptons. In this framework, the symmetric rings are all the same energy, regardless of colour (phase), so there are not that many different symmetric combinations possible using S3 rings.

22.1.11 *3-Ring Combinations*

The lists provide the complete list of the 104 different symmetric combinations sets of 3 asymmetric rings out of the total possible number of symmetric combinations of 27,648. These do not include symmetric 2-rings made from asymmetric rings with an added symmetric third S3 lepton, which are also possible combinations that make a symmetric 3-ring stack.

Note again that the charges of these symmetric combinations are 0, $\pm Nqc$ ($3 \geq N \geq 1$) only. There are no fractionally charged symmetric 3-ring stacks. Again there are both colourless and coloured symmetric stacks. Similar to the 2-ring asymmetric combinations, which did not produce any charged outcomes without using same charge u+ with d+ or symmetric leptons, there are combinations such as ν u- d- c1+/c2-/c3- (N0 A3 A3), which has a charge of $-1qc$. On it's own, this stack cannot be a charged pion. It requires a symmetric $\nu 1$ neutrino to be added to the stack, and the spins to sum to zero in order to become a charged pion.

Another example is the colourless anti-proton core made from d+ u- u- c1+/c2+/c3+ (A3 A3 A3), which is what would be expected from current definitions of colour. It does appear here, but so do coloured proton core outcomes like u+ u+ d- c1-/c1+/c2+ (A3 A3 M3). From symmetry, every coloured ring can be swapped in the stack for its coloured anti-ring partner and the same colour grouping will be symmetric.

What this implies is that there are limitations on the outputs of interactions between stacks (particles) set by the symmetries and colours of the input stacks (particles). If two A3 rings and four N0 rings go in to an interaction, then that is what has to come out – even if other stacks become involved, the symmetry of their component rings must be accounted for. In the case of the coloured u+ u+ d- c1-/c1/c2+ (A3 A3 M3) core, it requires an anti-coloured (A3) symmetric neutrino ring to become colourless, after which a symmetric lepton could be added to produce a J + $\frac{1}{2}$ colourless proton stack. Unfortunately there is no (A3) symmetric neutrino, so a proton stack cannot be formed from the coloured u+ u+ d- core.

22.1.12 *Stack Masses*

In considering the number of different possible symmetric 2 and 3 ring combinations, it becomes apparent that, if the order of rings in a stack does not matter and all the rings in the stacks are the same frequency, there are very few different total mass sizes of symmetric stack. The lists show the only 14 different mass sizes for 3-ring combinations that are possible, under the assumption of order independence and constant stack size. This is an area that will be considered further at a later date, but does hint that together with the limitations on input/output symmetries, there are very few building blocks that can be used to make the 'normal' particle stacks, like protons, neutrons and bosons. The lists show examples of the only 6 different symmetric 2-ring mass sizes, under the same assumptions. However, the section on magnetic moments shows that some stacks can only be formed when the observed masses of the stack components have more than one size. So the strength of colour symmetries will be greatest only when considering that portion of a stack that is the same size – such as the u+ d- u+ proton/neutron core.

22.1.13 *Particle Types*

Having looked at the symmetries of 2 and 3 ring combinations, it is apparent that the differences between particle types can depend on as little as the relative direction of spin of two rings. So single rings are fermions. Two ring

combinations are bosons and can be spin $J \pm 1$ or $J = 0$ depending on relative spin components. The precise character of $J \pm 1$ combinations depends on the identities of the two rings. If they are ring and anti-ring, with opposite mass phases, then the combination will be a photon, where the meons have almost completely merged. If they are not ring and anti-ring, the combination will be a meson. $J = 0$ combinations that are not ring and anti-ring will have non-zero J spin energies because although their spin h values may cancel, the energy of those spins $\frac{1}{2}hw_i$ and $\frac{1}{2}hw_j$ will not, because the masses of the two rings are different.

3-ring combinations could be proton and neutron cores, J + 3/2 symmetric stacks or temporarily excited electrons with a photon stacked. Higher ring combinations are like engineering Lego, dependent on smaller symmetric stacks in combination.

22.1.14 *Bosons*

We now proceed to discuss the role played by the usual gauge bosons. Since the fundamental unit of electric charge is $qc/6$, the $W^{\pm}$ cannot act between single meon states. In fact the simplest boson with the quantum numbers of W^+ ($Q = +1qc$, $J = \pm 1$) corresponds to a state where two quark rings are stacked side by side, either rotating in the same sense (eg both spin J + $\frac{1}{2}$) or opposite, such as $W^+ = u^+ + d^+$. That is not to say that the sum of the masses of the two quarks will be the same as the mass of the W^+ because the stacking of rings can be longer than just the two needed for the correct charge and spin. The stack could be 2, 4, 6 or any even number of rings longer than the minimum required two, each extra pair adding mass but not charge or spin. An example of a pair of rings adding to the externally observable mass of the composite but not adding charge or spin, would be an electron and positron, with opposite spins. Here the mass (ring frequency) of the $e-$ and $e+$ may be changed, if the interaction during the formation of the stack has provided sufficient energy, and they may have larger or smaller masses than expected.

What this suggests is that the W (and Z) bosons are not carrier particles that mediate the weak nuclear force, but composites of quarks and leptons that have a specific preferred size of mass, charge and spin overall. Since the motion of the meons around the ring represents the mass size of the rings, there is potentially no need for a Higgs boson, and the mass of the gauge bosons not being zero is no longer a problem if they do not carry any forces. As we have already seen, the equivalent of a Higgs particle could be any ring that has mass when isolated, in that it induces observable mass into neutrinos when they are passing close by and the twist energy becomes externalized to some extent.

To show how the carrier of the electromagnetic force, the photon, fits into this interpretation it is necessary only to consider again what the photon would look like, based on the dynamics discussed above. The photon would be a stack of electron and positron, both spinning the same way. The stacks would have each meon in one ring chasing its anti-partner in the other ring externally, as well as simultaneously chasing its adjacent meon around in its own ring internally. The result would look like a single ring of six mostly-merged M and E meons. If we assume that the merger of M and E meons results in a zero-fundamental-mass black hole, then the photon has no mass, although it has energy in the w_i rotational motion of the meons, both rings being J + $\frac{1}{2}$. If, as hypothesized earlier, the force of chasing between meons were opposed by some background viscosity of the universe, then the result would be a maximum speed that the ring would accelerate to in transverse motion, the equivalent of terminal velocity of a falling object in air, which we call the speed of light, c. The existence of such a background viscosity would also enable the difference between actual motion and a change of frame of reference to be identified. Where a red-shift energy loss appears, the photons must be in motion against the background viscosity, whereas a frame of reference in motion at c would involve no viscosity red shift due to energy loss because the meons comprising the photons would not be in motion.

It is expected that the photons will not form six perfectly merged ZMBHs, but will instead maintain slightly unmerged volumes that represent the whole energy of the original unmerged meons. Also, that the formation of the photon involves an asymmetric merger across the plane of the rings, with a line of greater to lesser merging across the diameter of the ring. The result will be electric and magnetic fields generated across the rings, rotating as the rings rotate and moving along with the photon's external motion.

For photons, as combinations of ring and anti-ring, it is those with symmetric lepton components that are more likely to remain broken apart in any collision/interaction because the asymmetric rings would be unlikely to each quickly find an appropriate partner to stack with. As the colour symmetry section showed, and from a consideration of weak interactions, it is likely that quark and anti-quark are able to form photons. Most observations will be of leptonic photons, but many interactions require quark photons to be present. Photons do not have to be carrier bosons, but could be just manifestations of the combinations of rings present.

What is certain in this interpretation of fermions, bosons and rings is that rings themselves are not usually broken. If a $\mu-$ decays into e-, v and V, then this interpretation says that the v and V were already present in the stack that represented that particular $\mu-$ and will have taken away some of the w present in the original ring combination, or were present close by, in the form of a zeron, and were hit by the $\mu-$ and broken apart, taking the excess energy, of the incoming $\mu-$ ring, above that required by the ring, now in the guise of an e-. It could be that a $\pi-$, composed of a stack of e- and v, added a V ring, resulting in a $J \pm \frac{1}{2}$ $\mu-$. Alternatively the $\pi-$ could be d- and u- stacked, with an added V , to produce the $\mu-$, but in this case when broken apart there would be no e- exiting. So this interpretation does not allow W^+ to convert $\nu_e \Rightarrow e+$, $d- \Rightarrow u+$, $u- \Rightarrow d+$, or $e- \Rightarrow \nu_e$. What it does allow is these rings to be stack components of the composite W^+, which can be separated into the various rings in that stack. The result is the same, but the process is different.

Because the interpretation of rings interacting in stacks uses synchronicity of asymmetry in the rings as the equivalent of the colour force, there is no need for gluons to act between quarks. Provided the asymmetry of each of the quarks present in the stack is appropriately synchronized to maintain the stability of the stack, the stack will be stable. But not needing gluons does not mean that they do not exist. There are examples in the lists of gluons, in the accepted terminology of colour and anti-coloured particles, comprising v and V spinning opposite.

The phase of synchronization of a ring is physically similar to having different times for different synchronizations. Even though the frequency w_i of the ring may be the same, changing the phase of that frequency requires a fractional change in the transfer of h across rings, which is not possible because, for the meons to have the same hw_i all the time, the transfer must be in multiples of $+h$ and $-h$ on the respective sign of meons in the ring. So the phase of a ring, at a specific frequency and a specific orientation in space, is apparently fixed permanently when the ring is first formed and this is its preferred frame of reference in which it is 'at rest'. Any difference is opposed by the ring and shows as a very small energy difference. This energy difference is not necessarily lost when the ring frequency is changed by external means. As will be shown later, the flipping of a ring involves a change in its phase with respect to an observer, with possibly four flips required to return the ring to its original phase.

22.1.15 *Beginnings*

A possible route may be sketched out of the initial formation of rings, based on the merger of meons within a photon. If the initial state of the universe is just innumerable fundamental sized zero-mass black holes, then splitting these apart would see chains of meons chasing each other, attaching onto their own tails as loops, with Darwinian loop-breaking into the most stable length loops. Note that the formation of loops provides a frequency framework, and from a frequency can be obtained time. So the implication is that there could be no time before loops formed, and the basis of our time and observational framework is the loops, or rings.

Once loops have formed 4 or 6-meon rings, it is possible that abrupt physical interactions caused them to inflate from their formation size (around the APS energy at $r = R_o$, the APS length as initial ring radius) to their current preferred sizes, with one preferred size or resonance for each of the three space-dimensions, representing different inflation rates in each dimension, eg 10^{+23} for the electron. And the flatness problem is resolved because the amount by which they inflated is their new mass. The electron loop, at current size $10^{-23} M_o c^2$ holds within itself its original rate of inflation of 10^{+23}. And G is equal to 1 in Planck units, and is merged into the mass and distance units in DAPU and APU units, so what we measure its size to be in SI units is irrelevant. The energy released by the inflation of the loops funded the expansion of the universe with those loops embedded. The total energy available to the universe of loops has not changed, it was zero and remains at zero although the mix of different energies has changed.

22.1.16 *Protons and Neutrons*

In the ring framework, protons and neutrons are simply longer stacks than those encountered so far, containing an odd number of rings. The main assumption for a long stack is that most of the rings, or component composite short stacks, have the same ring radius. Only temporary replacement or additional rings could be of a significantly different size and that difference in size might be a measure of the stack lifetime. The greater the size difference, the shorter the lifetime.

In order to show why the proton and neutron stacks are composed in the way proposed here, it will first be necessary to list some of the underlying assumptions (all numbers used are 2006 CODATA recommended values), but first a warning.

The overarching assumption here is one that is not necessarily supportable any longer, but is included here, with the ramifications, in order to show how the magnetic moments may be comprised. That assumption was that the mass of a ring generates its own magnetic moment which needs to be separately identified. However, the latest ring framework interpretation says instead that there is no identifiable mass energy in a ring, since the sum of the kinetic energies of the six meons in a ring sum to zero over each ring. What we observe as mass in this interpretation is either the rotational rate of the meons in the ring or the deflection of space time due to the size of the ring, enabled by the presence of charge or twist energy. So in this latest version, there is zero total mass energy available to produce any magnetic moment, instead the anomalous magnetic moment is presumed to be derived from a magnetic moment provided by the twist energy. However, this fails to account for the different values of the anomalous moment in the electron and muon. So the question is still open, but the original interpretation is shown here because it could be argued that the physical size and rotation of the ring moving against the background space time instead provide the magnetic moment effect proportional to the size of ring mass, similar to the expectation that meon twist rubbing space time generates charge. The implied additional small magnetic moment also acts to provide another aligning energy, like a small north-south pole perprendicular to the ring. The size of this energy at $E_{tmm} = pS_ic^2(\gamma_i - 1) \approx p\mu_i cw_i \approx pm_ic^2qc/M_o \approx m_ic^2p\sqrt{\alpha/2\pi} \ll m_ic^2$ where p is the factor setting the effect of the magnetic moment generated by the twist energy, likely to be $p \sim \alpha/2\pi$, is much smaller than the other energies at work and so has been ignored in interactions. So the implications can still be made, even if the precise reason for the extra magnetic moment may not be correct:

1. The magnetic moment of a ring is composed of two parts – one due to charge and one due to mass. The formula will be detailed later, but the product of mass and magnetic moment of the two parts in all free rings are both separately equal to a new quasi-fundamental constant of nature $L = \frac{1}{2}hq/2\pi$, quoted in SI units and omitting the c here for clarity. The $\frac{1}{2}h$ and 2π factors appear for the same reasons as previously, being dissociated from the ring angular frequency w_i, here not overtly mentioned, but yet still present in the energy of the ring. The magnetic moment energy of the ring would be given in APS units as $E_i = qc^3(\gamma_i - 1) = \mathcal{L}"(\phi_i–1)w_o$ where $\mathcal{L}"$ is a true fundamental constant in APS units of $\mathcal{L}" = qch/M_o$ and the 2π factor would be omitted. The ring has L due to charge and L due to mass, with the former called 'charge momentum'. L appears to be the more fundamental driver for ring actions, and through it mass and magnetic moment are exchanged as rings change flavour or environment. By breaking down the actions of the rings in a stack into terms of L, the structure of the stack can be confirmed.

2. Electrons, in the form similar to large mass muons, are present in the nucleon stacks. The small size of the electron is normally taken to preclude its presence in the nucleus. But as an energetic muon, it has sufficient mass. The section on magnetic moment shows why the electron/muon ring in a neutron stack is expected in this interpretation to have a mass of 199.38 MeV. As will be shown later, the new formulation of magnetic moment implies that the electron, muon and tau are actually the same ring, but at different sizes. So discussion of the electron should now be taken to include muon and tau flavours.

3. Neutrinos are also present in nucleon stacks. There is a difference between the mass shown by a neutrino in a stack, the Near (qid/mid) region, and when isolated in the Far (o/mid) region, even when the neutrino ring radius is the same. When completely isolated, the ring will be symmetric with no external charge field. When such a ring passes

by another ring with a charge or mass, it will be slightly distorted. This distortion will be observed as a small mass and magnetic moment. So almost-isolated neutrinos appear to have very small masses because there are other rings generating mass and charge fields and, as mentioned earlier, all these other rings could be described as Higgs particles as far as the neutrinos are concerned. The size of those fields will affect the amount of neutrino mass observed. It is as if the deflection of space time requires some charge or twist energy to enable it to deflect. In the case where the neutrino is in a stack, the mass effect will be due to being in the Near region and the neutrino will show a mass of 100% of its ring radius or rotational frequency w_i. So a neutrino ring of around the size of the energetic muon would be allowable inside the nucleus. Since we require an odd number of rings in a nucleon stack, the closest match is seven rings in the proton - comprising four neutrinos/anti-neutrinos of size 198.09 MeV each with the udu core, each quark ring of mass 48.64 MeV. The same components will be in the neutron stack, but with a neutrino replaced by an electron ring of 199.38 MeV. Different length stacks may be possible, as discussed later, but the minimum is seven rings for both the proton and the neutron, simply because the negatively charged electron/muon ring has to have both the opposite charge-generated magnetic moment and yet the same sign spin as the up quarks, and the stack has alternating sign spins, plus symmetric end caps (v and V in the case of the proton).

4. In a similar way to the electron, muon and tau being resonances of the electron ring, so probably are the neutrinos. But they appear not to be limited to only three sizes. The neutrinos seem to act to add or subtract ring frequency in interactions between rings. Where this occurs within longer stacks, mass looks like it is conserved. Where this occurs in shorter stacks (2 rings), total mass will appear to change although the actual total energy of the interaction, as measured in terms of mass, magnetic moments and ring frequencies, will not change.

5. Quarks in a stack will show 100% of their ring radius or frequency because they are in the Near region. Quarks outside the stack are expected to show a fractional mass proportional to their charge because they would then be in the Medium or Far region.

6. The different energies within a ring have different actions. These were explained earlier, and it is only necessary to mention again that some energies act differently in different regions and dependent on relative angle between ring planes.

7. The mass energy of a ring is equal and opposite to the $J \pm \frac{1}{2}$ spin energy of that ring. Once again, it was explained earlier, that all energies in a ring have equal and opposite size partners, although the actions of those energies may be different. The asymmetry of action of mass and spin energies leads to quantised energy levels where the bodies have few different alignment orientations and lack of quantisation in bodies with many different alignment orientations – generally the formation of quantum based structures like atoms at short distances and of gravity based ones at large distances, differentiated by the ratio $j = S_a c/M_a$ for each body with $j = 1$ at the QM end and $j \ll 1$ at the gravitational end.

8. Because the main ring stack components are the same size in both the proton and the neutron, the energies of interaction between rings from stack to stack will be the same regardless of the identity of the stacks themselves. So whether an up quark in a proton stack is interacting with a down quark in a neutron stack or a down quark in another proton stack is immaterial, although the separation and relative orientation will matter.

22.1.17 *Masses and Magnetic Moments*

With these assumptions in this interpretation, it is now possible to consider the values of the masses and magnetic moments of the proton and neutron, and to extend these later into other particle stacks.

Consider the standard formula for the intrinsic magnetic moment μ_e of a spin $+\frac{1}{2}$ free electron (not its orbital magnetic moment) of mass m_e, using the charge as qc rather than q for consistency

$$\mu_e = \tfrac{1}{2} g_e (\tfrac{1}{2} hqc/(2\pi m_e)$$

where $g_e = 2.0023193043622(15)$ and is known as the most accurate agreement between theory and experiment in physics.

In the ring framework, the unit of magnetic moment is part of the energy of motion of the meon charges as they move around the ring outlined in the first section, which could be given for the electron by

$$E_{qmotion} = 6(qc/6)(\gamma_i – 1)c^2 \approx qc\tfrac{1}{2}V_i^2 \approx \mu_e w_i^2/w_o$$

in APS units. But, in the same way that the spin of a ring is h not $\frac{1}{2}h$, the same is the case for the unit magnetic moment. The unit of magnetic moment needs to be defined differently, so that the relativistic factor $(\gamma_i - 1)$ can be exactly factored out. Thus the new unit magnetic moment $\mathcal{L}$" was defined earlier to be

$$E_{qmotion} = \mathcal{L}"(\phi_i – 1)w_o \approx \mathcal{L}"\tfrac{1}{2}w_i \approx \mu_e w_i^2/w_o$$

So at low energies, and adjusted for the extra w_i, w_o and 2π PU factors, the product of c and $\mathcal{L}$" is approximately twice the size of a maximal magnetic moment $\mu_o = qh/2M_o$, but this relationship breaks down at higher ring energies. This treatment is equivalent to combining the $\frac{1}{2}$ factor that is usually associated with spin $\frac{1}{2}h$ in with the frequency of spin w_i instead, and gives the unit $\mathcal{L}$" a fundamental character that does not change due to motion. The value of unit $\mathcal{L}$" is the same for all rings, adjusted for ring charge, because $\mathcal{L}" = qch/M_o = qc^3/w_o$.

The difficulty is that what the unit values should be is different to the actual values measured. Normally it is the factor g_e that adjusts the equations in order to allow for the differences. In the ring framework, the hypothesis is that the magnetic moment of each ring is actually a composite that needs to be separated out into its component parts.

Rearranging the expression above for the magnetic moment, and using $g_e = 2 + 2A_e$, where $2A_e$ is the anomalous part of the g_e value, gives

$$\mu_e m_e = \tfrac{1}{2}\tfrac{1}{2}hqc(2 + 2A_e) = \tfrac{1}{2}\tfrac{1}{2}(2 + 2A_e)M_o\mathcal{L}" = \tfrac{1}{2}(2 + 2A_e)L$$

where L is the new charge momentum, named in order to highlight its special significance as a new fundamental constant of nature, albeit a composite, where

$$L = \tfrac{1}{2}\mathcal{L}"M_o/2\pi = \tfrac{1}{2}qh/2\pi = 8.448298x10^{-54}CJs$$

leaving the charge as q rather than qc and using SI units.

If the magnetic moment is now split into its two constituent parts, μ_{eq} that due to charge qc and μ_{em} that due to mass m_e, so that $\mu_e = \mu_{eq} + \mu_{em}$, the equation becomes

$$(\mu_{eq} + \mu_{em})m_e/(2 + 2A_e) = \tfrac{1}{2}L$$

$$(\mu_{eq} + \mu_{em})m_e/(1 + A_e) = 1L$$

$$\mu_{eq}m_e + \mu_{em}m_e = (1 + A_e)L$$

Now the assumption is that the 1 and A_e are specifically due to the charge and to the mass respectively, so the relationship can be recast as

$$\mu_{eq} m_e + \mu_{em} m_e / A_e = 2L$$

which implies that each part of the equation is equal to L separately and that $\mu_{eq} = \mu_{em}/A_e$, so that A_e is a measure of the relative strength of the magnetic moment due to mass versus that due to charge. This may be why the electron has $g_e = 2$ (plus anomaly). Note that with this interpretation, the unit relationship between the magnetic moment due to the rotating charges qc and the value L have returned, with

$$\mu_{eq} m_e = L$$

So the magnetic moment that is observed is composed of two parts, that due to the motion of charge and that due to the motion of mass or the rotation of the ring against space time. Since the main consideration is of the positively charged proton of spin J + $\frac{1}{2}$, the electron will be considered to be J + $\frac{1}{2}$ also. The overall magnetic moment of the neutron is negative, whilst the charged proton is positive, so the rotation of meons around the electron in J + $\frac{1}{2}$ spin orientation will be assumed to give rise to a negative magnetic moment, which is the same orientation as the negative charge circulating. The J − $\frac{1}{2}$ electron will have a positive magnetic moment due to the orientation of the ring-mass in circulation.

Although we imply here that A_e is due to mass, it may be that the underlying cause is a factor of induced mass or charge and the distorted shape of the ring when close to other rings, or the deflection of space time due to the size of the rings. The asymmetry would change the area of the rings and thus its magnetic moment. The greater masses/smaller distances in a stack could plausibly allow different values of A_e to those when free. The implication is that when completely isolated, the ring might have no A_e at all. The inducing of mass or A_e by rings on each other could involve the transfer of L between rings. Also possible is that A_e is due to the environment within which the ring exists, as considered by QED when obtaining the A_e and A_μ values so accurately. Those calculations are based on interactions with all possible other particles, which is another way of inducing charge or mass changes and anomalous magnetic moments. That the A_x value in nucleon stacks could be so different to A_e and A_μ, as will be detailed later, may show that the nuclear environment may be significantly different to that experienced by free electrons and muons.

The above formula needs to be adjusted for the fractional charges of the quarks, but the same fractional adjustment of the charge and mass in the appropriate regions, as already assumed, leads to the same outcome, that each quark has 1 L from charge and 1 L from mass, although the signs may be different. This is explained later. The question for the neutrinos is whether the same applies. Without any charge, it must be the case that they only generate magnetic moment when they have a mass, which is when they have induced mass when free in the Far region, or at a maximum when they are in a stack in the Near region. So neutrinos have only 1 L of charge momentum, due to their induced mass when free, or when in a stack.

The further implication of the above formula is that regardless of the size of an isolated ring, the product of its mass and magnetic moment due to charge is always the same. So an electron ring that has its size changed will have a different magnetic moment due to its charge, basically due to the change in area that the meons orbit around. This means that the mass and the intrinsic magnetic moment of a ring are simply two different ways of expressing the energy of rotation of the meons around a ring, as the opening matrices showed. So mass is not necessarily conserved in interactions, although the product of mass and magnetic moment, representing the momentum of the components of the ring, will be, and there must be a similar change in ring frequency in any other rings taking part in the interaction to cause that change in ring size. It may look like mass is conserved, but it is ring frequency that is conserved overall amongst rings.

The discussion so far has looked at free rings, those not in a stack, which have integer L. However, as will be shown below, because of the sizes used for calculating the magnetic moments of stacks, the stacks look not have integer L, but a different multiplier. However, when considered in the right units, integer L is conserved when in stacks as well.

Returning to the proton, it is assumed that it is composed of seven rings (although it is possible to be any odd integer of five or greater in this framework), of which three are the udu quark core. So the starting assumption is that the J $\pm \frac{1}{2}$ spins alternate down the stack, with the udu core rings having the same masses (ring radii). The only rings that are not charged are the neutrinos v and anti-neutrinos V, so it must be these that populate the remainder of the stack, unless the electron and positron occur in equal numbers at the appropriate stack size.

The simplistic argument for the relative ring sizes in the proton and neutron stacks is as follows. The J $+ \frac{1}{2}$ proton magnetic moment is $+1.410606 \times 10^{-26}\ JT^{-1}$ and the neutron $-0.966236 \times 10^{-26}\ JT^{-1}$. The masses are 938.262 MeV and 939.565 MeV respectively. The change from proton to neutron is hypothesized to be by replacement of a neutrino in the proton stack by an electron to form the neutron stack. Thus the change in magnetic moment must be due to the difference in charge momentum and mass from the electron to the neutrino, when in the stack. This difference is $-2.376842 \times 10^{-26}\ JT^{-1}$ and must represent the sum of the charge momentum and extra mass-generated charge of the electron. But the product of the charge momentum and mass is equal to L, which sets the mass of the electron at around 185 MeV, ignoring the mass-generated charge component. Regardless of whether the stack components have values of A_x appropriate for their masses, or the leptons are different to the quarks, being fixed around the value of A_μ, the two routes both arrive at roughly the same masses for the components, as laid out in the tables below. The neutrino is smaller than the electron ring by 1.293 MeV, and the remaining mass represents the three quark masses, all equal size because they occupy the Near region and showing 100% of their size, and the v and V. Note that in the proton stack the chargeless rings are called v when they are J $+ \frac{1}{2}$ and V when they are J $- \frac{1}{2}$, although it will be shown later that the identification of v and V is not so simple.

Proton - Lepton Stack	**NOT Spin**	**equal to Ring**	**quark A_z Ring A_z**	**Mass MeV**	**Total m JT^{-1}**
⇒	J $+\frac{1}{2}$	ν	−0.0011659	198.089	-2.7893×10^{-29}
⇐	J $-\frac{1}{2}$	V	−0.0011659	198.089	$+2.7893 \times 10^{-29}$
⇒	J $+\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
⇐	J $-\frac{1}{2}$	d	−1.52189	48.638	$+18.0761 \times 10^{-26}$
⇒	J $+\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
⇐	J $-\frac{1}{2}$	ν	−0.0011659	198.089	$+2.7893 \times 10^{-29}$
⇒	J $+\frac{1}{2}$	V	−0.0011659	198.089	-2.7893×10^{-29}
Totals ⇒	J $+\frac{1}{2}$			938.272	$+1.4106 \times 10^{-26}$

Proton - All A_z Stack	**are Spin**	**same Ring**	**Ring A_z**	**Mass MeV**	**Total m JT^{-1}**
⇒	J $+\frac{1}{2}$	ν	−1.52189	198.089	-3.6409×10^{-26}
⇐	J $-\frac{1}{2}$	V	−1.52189	198.089	$+3.6409 \times 10^{-26}$
⇒	J $+\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
⇐	J $-\frac{1}{2}$	d	−1.52189	48.638	$+18.0761 \times 10^{-26}$
⇒	J $+\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
⇐	J $-\frac{1}{2}$	ν	−1.52189	198.089	$+3.6409 \times 10^{-26}$
⇒	J $+\frac{1}{2}$	V	−1.52189	198.089	-3.6409×10^{-26}
Totals ⇒	J $+\frac{1}{2}$			938.272	$+1.4106 \times 10^{-26}$

The resulting summations leads to two stacks, each with a total J $+ \frac{1}{2}$, magnetic moment of $+1.410606 \times 10^{-26}\ JT^{-1}$ and gross mass of 938.272 MeV. Although both mass sets appear to be the same in the table, they are actually slightly different. Note that no allowance has been made for binding energy in stacks. The presumption is that a stable stack contains rings at internal separations that are stable, requiring no energy to bind them in place. The formation or break up of stacks may require/release additional energy externally. This energy is provided by/to external rings from/to their motion, external collision or change in ring frequencies.

The neutron, in contrast to the proton, has a larger mass and decays when free. So it can have a slightly dissimilar sized ring temporarily. It may be that the ring becomes semi-permanent when the neutron is constrained within the nucleus, but that should not change the size of the main components of the neutron stack. This means that the

neutron cannot be a dud J + $\frac{1}{2}$ quark stack, because it would then be exactly the same mass as the proton. This also becomes apparent when considering the magnetic moment of the down quark – in a stack of any length, the total magnetic moment of the J - $\frac{1}{2}$ down quark is always positive and always the same sign as the charge-generated magnetic moment of the J + $\frac{1}{2}$ up quark. So a J + $\frac{1}{2}$ dud core, with positive magnetic moment, will have a negative overall magnetic moment for the whole stack due to the mass generated component, but not the right size. A J – $\frac{1}{2}$ dud core, with negative magnetic moment, will have a positive overall magnetic moment due to the mass generated component. The solution is to replace a neutrino in the proton stack by an electron/muon, with its mass slightly larger than the neutrino rings.

Neutron -	Lepton Stack	NOT Spin	equal to Ring	Quark A_z Ring A_z	Mass MeV	Total m JT^{-1}
	⇒	J+$\frac{1}{2}$	e-	−0.0011659	199.383	-2.3796×10^{-26}
	⇐	J-$\frac{1}{2}$	V	−0.0011659	198.089	$+2.7893 \times 10^{-29}$
	⇒	J+$\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
	⇐	J-$\frac{1}{2}$	d	−1.52189	48.638	$+18.0761 \times 10^{-26}$
	⇒	J+$\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
	⇐	J-$\frac{1}{2}$	ν	−0.0011659	198.089	$+2.7893 \times 10^{-29}$
	⇒	J+$\frac{1}{2}$	V	−0.0011659	198.089	-2.7893×10^{-29}
Totals	⇒	J+$\frac{1}{2}$			939.565	$-0.966236 \times 10^{-26}$

Neutron -	All A_z Stack	are Spin	same Ring	Ring A_z	Mass MeV	Total m JT^{-1}
	⇒	J+$\frac{1}{2}$	e-	−1.52189	199.383	-6.0178×10^{-26}
	⇐	J-$\frac{1}{2}$	V	−1.52189	198.089	$+3.6409 \times 10^{-26}$
	⇒	J+$\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
	⇐	J-$\frac{1}{2}$	d	−1.52189	48.638	$+18.0761 \times 10^{-26}$
	⇒	J+$\frac{1}{2}$	u	−1.52189	48.638	-8.3327×10^{-26}
	⇐	J-$\frac{1}{2}$	ν	−1.52189	198.089	$+3.6409 \times 10^{-26}$
	⇒	J+$\frac{1}{2}$	V	−1.52189	198.089	-3.6409×10^{-26}
Totals	⇒	J+$\frac{1}{2}$			939.565	$-0.966236 \times 10^{-26}$

The resulting summation leads to two stacks, each with a total J + $\frac{1}{2}$, magnetic moment of –0.966236 × 10^{-26} JT^{-1} and gross mass of 939.565 MeV. This leads to the following properties of the rings in the proton and neutron stacks using both versions of stack:

Stack	Spin	Ring	Lepton Ring A_z	NOT Mass MeV	same as quark Charge m JT^{-1}	Mass-gen m JT^{-1}
⇒	J+$\frac{1}{2}$	e-	−0.0011659	199.38	-2.37686×10^{-26}	-2.7712×10^{-29}
⇐	J-$\frac{1}{2}$	u	−1.52189	48.638	$+6.4956 \times 10^{-26}$	-14.8283×10^{-26}
⇒	J+$\frac{1}{2}$	d	−1.52189	48.638	$+3.2478 \times 10^{-26}$	$+14.8283 \times 10^{-26}$
⇐	J-$\frac{1}{2}$	ν	−0.0011659	198.089	0	-2.7893×10^{-29}
⇒	J+$\frac{1}{2}$	V	−0.0011659	198.089	0	$+2.7893 \times 10^{-29}$

Stack	Spin	Ring	All same Ring A_z	Mass MeV	Charge m JT^{-1}	Mass-gen m JT^{-1}
⇒	J+$\frac{1}{2}$	e-	−1.52189	199.38	-2.4005×10^{-26}	-3.6173×10^{-26}
⇐	J-$\frac{1}{2}$	u	−1.52189	48.638	$+6.4956 \times 10^{-26}$	-14.8283×10^{-26}
⇒	J+$\frac{1}{2}$	d	−1.52189	48.638	$+3.2478 \times 10^{-26}$	$+14.8283 \times 10^{-26}$
⇐	J-$\frac{1}{2}$	ν	−1.52189	198.089	0	-3.6409×10^{-26}
⇒	J+$\frac{1}{2}$	V	−1.52189	198.089	0	$+3.6409 \times 10^{-26}$

To some extent, this framework may also explain some apparent asymmetry of action of what is termed the electro-weak force. The proton J + $\frac{1}{2}$ stack is capped at both ends by J + $\frac{1}{2}$ rings. This could be expected to influence the surrounding environment, favouring the replacement of the end rings over others in the stack. Those J + $\frac{1}{2}$ end rings could only be replaced by appropriate symmetry neutrinos or electrons. So the preferential observation of free J + $\frac{1}{2}$ electrons is because that is the only ring type that would bind in replacement for the existing J + $\frac{1}{2}$ neutrinos, forming the neutron. It is likely to be much more difficult to dislodge another stack ring. However, as will be shown later, there are also other factors providing asymmetry of ring interactions.

This stack framework also implies that the greater the flux of appropriate energy neutrinos impacting the nucleus, the greater the likelihood of converting a neutron to a proton. The greater the flux of appropriate energy electron/muons

impacting the nucleus, the greater the likelihood of converting a proton to a neutron. At another energy level, the incoming rings could instead break the nucleus apart. So overall, the rate of radioactive decay should be influenced by the flux of appropriate energy rings passing through the nucleus.

22.1.18 *Pions and Kaons*

In order to understand the stacks that form, the definitions of what actually are pions and kaons, for example, need to be widened. The framework proposed here does not suggest that a kaon is a specific set of rings in a stack, but that it is a stack whose external properties are constant whilst the components in the stack may vary. So, considering three related particles, the pion, kaon and eta, the framework would suggest that, although they have similar properties (apart from masses and the strange content of the kaon), the pion is composed of 2 or 4 rings, and the kaon and eta of 8 rings. So different but related particles are formed by extending the size of a stack.

To produce pion masses within 1/8 % of the actual observed values, it is necessary to propose that the stack neutrinos, for example, have a different size when in a pion stack to that in a proton/neutron stack, and that there are other neutrino size resonances, the smallest called a 'third-neutrino', ν_t because its resonance is at one-third the mass of a hypothesised neutrino ν_n. This is not outside the framework that is being used in this section because it is also proposed that quarks and anti-quarks form photons and it is the break up of these photons that provides the mass resonances that differentiate the flavours of the quarks. In the same way that it was shown that electron, muon and tau leptons appear to be all the same ring, but at different mass/magnetic moment resonances, the same is proposed for the quarks. So the basic particle stacks, composed of two rings, are expected to appear in sizes corresponding to their quark content following the interaction of quark-photons with other stacks. In order to produce a strange and anti-strange quark for interactions requires a photon that is composed of a down and anti-down quark that have been given enough energy, in terms of increased frequency, to become locked at the higher resonance of strange quarks. The decay of the strange particles in subsequent interactions could be via reformation of the strange photon or via the loss of frequency by the strange quarks, transforming rotational frequency into greater frequencies or velocities in other rings, reverting to their original base of down quark/anti-quark status.

In the following section, the use of neutrino should be taken to include anti-neutrino where necessary, for instance in the case of forming a gluon from a neutrino and anti-neutrino, where the use of '2 neutrinos' is shorthand. The size calculations are based only on masses and are not adjusted for the magnetic moments of the particles, where known, which would result in slight differences in actual mass sizes. This section is just meant to show the 'Lego' type nature of constructing stacks from a small number of component rings, then using those short stacks to compose longer stacks

In addition to the third-neutrino mentioned above, there are other proposed sizes of rings in pion, kaon and eta stacks. These are 101.233 MeV (v only), 67.489 MeV (u, d, e and v), 69.785 MeV (v, u and d), 33.744 MeV (the third-neutrino size, ν_t only) and 105.658 MeV (μ free mass). Note that 67.485 MeV and 33.744 MeV are 1/3 and 2/3 resonances of 101.228 MeV, close to the free muon mass.

In the case of the pions, the $\pi^{\pm}$ is expected to be composed of a muon at size 105.658 MeV plus a contra-rotating third-neutrino ν_t at size 33.744 MeV producing total mass 139.402 MeV, only 0.168 MeV smaller than observed. The π^o is expected to be ν_n at mass 101.233 MeV plus contra-rotating ν_t, producing a total mass of 134.977 MeV, as observed, or 4 ν_t , with two rotating in each sense, giving rise to two photons on break up, which is the main decay mode. The four third-neutrinos stack has the same mass of 134.977 MeV as the other two-neutrinos stack.

It is only possible to produce the correct values using quarks if the pions are treated as stacks where each ring is the same size. The implication would be that every ring would have a mass of 69.785 MeV in a charged pion stack and 67.489 MeV in a neutral pion stack. So there are multiple different ways to obtain what is called a pion using either 2 or 4 rings in a stack.

It is necessary to differentiate these short stacks into two groups, the pions and gluons. The pions, it is suggested, are composed of charged rings and the gluons of uncharged rings. So the neutral pion may be a stack of up quark

and anti-up quark, each at size 67.489 MeV, or electron and positron, or down quark and anti-down quark, all at that same size. The charged pion may be a stack of up and anti-down quarks or anti-up and down quarks each at 69.785 MeV or a muon plus third-neutrino.

The gluons are grouped in sizes using the possible neutrino resonances mentioned above. The four different gluons used to build the pion, kaon and eta are two third-neutrinos totalling 67.489 MeV, four third-neutrinos totalling 134.977 MeV, two 69.785 MeV neutrinos totalling 139.570 MeV and a mix of one neutrino at 67.489 MeV and one at 69.785 MeV totalling 137.27 MeV.

The eta and kaon stacks are presumed to be 8 rings long, composed of 4 short two-ring stacks. These stacks could be pions or gluons. The actual make up of the stack influences the outcome of the decay of that stack. But the make up of the stack changes as other rings interact with the stack as they travel. So a stack that starts as a 3 pion plus one gluon stack may interact with an external pion and become a stack of 2 pions plus 2 gluons. Because the sizes of the gluons and pions in each stack are generally the same (excepting only one temporary different component), the observable masses of the stacks are the same regardless of the identity of the 'components'. But whether the decay products can be identified is expected to depend on the break up of the components made from charged rings, not the uncharged rings.

So the eta is expected to be 4 2-ring components in length, each of mixed size 137.27 MeV, totalling 549.1 MeV, close to the observed value of 548.8 MeV. The components could be mixed gluons or mixed quark/anti-quark pairs. The maximum decay sees 3 pions and the minimum one pion, so in this framework the other components would be gluons.

The kaon is more complicated, but a consistent size of 155.9 ± 0.3 MeV for the strange quark is achieved when the neutral kaon is composed of 2 small components of 67.485 MeV, one large component of 139.570 MeV and the strange component (down plus anti-strange or vice versa) at 223.1 MeV. Assuming the down quark in the strange component is of size 67.485 MeV produces the strange mass at 155.6 MeV. Considering the charged kaon as two small components of 67.489 MeV, one medium component of 134.977 MeV and the strange component (up and anti-strange or vice versa) produces the mass of the latter at 223.7 MeV. Assuming the mass of the up quark is the same as the down quark in the neutral kaon (the same assumption as for the two quarks in the proton/neutron stack) produces the strange mass at 156.2 MeV. The average strange mass is 155.9 MeV, as mentioned.

Parity violation, using this framework, can be hypothesized to be simply down to the difficulty of observing the break up of the gluons from the stack, and the continual changing of the identities of the stack components. Here the difference between K_L^o and K_S^o may be only how many pions are in the K^o stack when observed. Only on decay is it likely that the charged components of the stack can be identified, but they could have been different immediately before decay. An example of each K^o stack would be:

K_L^o	Stack	Spin	Ring	MeV	K_S^o	Stack	Spin	Ring	MeV
	⇒	J+½	ν	33.744		⇒	J+½	ν	33.744
	⇐	J-½	V	33.744		⇐	J-½	V	33.744
	⇒	J+½	e-	33.744		⇒	J+½	ν	33.744
	⇐	J-½	e+	33.744		⇐	J-½	V	33.744
	⇒	J+½	e-	69.785		⇒	J+½	e-	69.785
	⇐	J-½	e+	69.785		⇐	J-½	e+	69.785
	⇒	J+½	s+	155.9		⇒	J+½	s+	155.9
	⇐	J-½	d-	67.489		⇐	J-½	d-	67.489
	Total	J = 0	$3\pi^o$	497.935		Total	J = 0	$2\pi^o$	497.935

The formation of other particles is expected to occur along similar lines, with different length stacks but using roughly similar stack and stack-resonance sized-rings.

22.1.19 *Asymmetry*

There are a number of sources of asymmetry. The first is in the charge momentum L of the rings. Using the relationship between the total L content and the contributions due to charge and mass respectively as $L_t = L_q + L_m$, rings can

now be seen to form three distinct sets of L, regardless of J $\pm \frac{1}{2}$ values. Rings with negative charge have $\pm$ 2 L. Rings with positive charge have 0 L. Rings with no charge have $\pm$ 1L. A proton, a positive charge stack, has total $+2L$, whilst the neutral neutron has ± 1 L. So forming a stack with overall positive charge turns the particle into a $+2L$ composite. Given the preponderance of e- and p+, it would appear that being a particle of $\pm$ 2L is favoured.

Neutron -

	Stack	Spin	Ring	L (charge)	L (mass)	L (total)
	⇒	J+$\frac{1}{2}$	e-	-1	-1	-2
	⇐	J-$\frac{1}{2}$	V	0	1	1
	⇒	J+$\frac{1}{2}$	u	1	-1	0
	⇐	J-$\frac{1}{2}$	d	1	1	2
	⇒	J+$\frac{1}{2}$	u	1	-1	0
	⇐	J-$\frac{1}{2}$	V	0	1	1
	⇒	J+$\frac{1}{2}$	ν	0	-1	-1
Totals	⇒	J+$\frac{1}{2}$		2	-1	1

Proton -

	Stack	Spin	Ring	L (charge)	L (mass)	L (total)
	⇒	J+$\frac{1}{2}$	ν	0	-1	-1
	⇐	J-$\frac{1}{2}$	V	0	1	1
	⇒	J+$\frac{1}{2}$	u	1	-1	0
	⇐	J-$\frac{1}{2}$	d	1	1	2
	⇒	J+$\frac{1}{2}$	u	1	-1	0
	⇐	J-$\frac{1}{2}$	V	0	1	1
	⇒	J+$\frac{1}{2}$	ν	0	-1	-1
Totals	⇒	J+$\frac{1}{2}$		3	-1	2

In the negatively charged rings, the sign of L_m is always the same as that of L_q, so the result is always the maximum value of $\pm$ 2L. In the positively charged rings, the signs of L_m and L_q are always opposed, so always sum to zero. The neutral rings take the value of L_m only, and are thus always $\pm$ 1L.

So there is a built-in asymmetry in the nature of rings, which, although it could be considered as charge-driven, is probably driven by the existence of the mass-generated magnetic moment. This may strongly influence which sort of environment dominates in nature. Protons and neutrons could be considered as ways of hiding the zero L rings within stacks that have caps of 1 or 2 L, and themselves have overall total values of 1 or 2 L. But the formation of these stacks leads to positive charge domination in the environment where J + $\frac{1}{2}$ spin characterises the end caps of the stacks. The negatively charged anti-up quarks do not need to be shielded because they have $\pm 2L$, so the drive to form negatively charged stacks is not present. Similarly, the presence of free positrons is not favoured because they have zero L. So these factors may be what drives the preferred existence of positively charged and neutral stacks alongside negatively charged free rings, in a positive mass J + $\frac{1}{2}$ environment.

A second source of asymmetry is in the neutrino. The definition of the neutrino has been as M on position 1 in a J + $\frac{1}{2}$ ring. The V has been defined as E on position 1 also in a J + $\frac{1}{2}$ ring. Both of these have all meons twisting RHS. But from symmetry, there can also be v and V with all meons twisting LHS. Considering only the S3 symmetric isomers of the neutrinos discussed previously in relation to colour symmetries (other neutrino isomers will have the same effect described below, but to a lesser extent) we can label the RHS as ν_a and the LHS as ν_b. It is obvious from previous discussion that only

γ (J + 1) = ν_a (J + $\frac{1}{2}$) + V_a (J + $\frac{1}{2}$)

γ (J + 1) = ν_b(J + $\frac{1}{2}$) + V_b (J + $\frac{1}{2}$)

γ (J + 1) = ν_a (J + $\frac{1}{2}$) + ν_a ($+60^o$) (J + $\frac{1}{2}$)

γ (J + 1) = ν_b(J + $\frac{1}{2}$) + ν_b ($+60^o$) (J + $\frac{1}{2}$)

When considering how ν_a and ν_b travel, there is a difference. Using the general assumption that rings not constrained by external fields travel with their planes of rotation perpendicular to their direction of travel and with the axis of rotation aligned along the direction on travel, the difference between ν_a and ν_b is in the relative orientation of meon twisting versus direction of travel.

In ν_a and V_a, with both J + $\frac{1}{2}$ providing a LHS for the ring as a whole along the direction of travel, each meon is twisting with 'front' face inner section in opposition to the direction of travel. In the ν_b and V_b, that inner section is twisting in the same sense as the direction of travel. This asymmetry of twisting-to-travel ('ttt') direction might have different effects in rings. If space were thought of like a screw thread along which a ring is travelling, an inner motion in the same direction of travel might be expected to help travel more than an opposing motion. The question is whether there is a difference between the inner and outer effects.

If there is a difference, then there will be a preferred ttt direction and a preferred type of ν_a in motion. The non-preferred type would probably be locked away in stacks. So there is a possible split in which types of neutrino are free and which in stacks, and a difference in their properties.

For the ν_b and V_b , with J + $\frac{1}{2}$ as LHS for the ring again (this overall screw orientation has not changed), the inner/outer ttt effects are reversed, with inner edges moving in the same direction as the direction of travel. So the preferred type of ν_b in motion will be reversed from that for the ν_a. For the J − $\frac{1}{2}$ ν_b and V_b, the ring travel is RHS and the inner and outer effects are reversed, with the outer edges moving in the same direction as the direction of travel, similar to the J + $\frac{1}{2}$ ν_a and V_a. The sets of possible variations are:

Neutrino	Spin	Meon twist	Ring screw	inner effect	outer effect	set
ν_a and V_a	J+$\frac{1}{2}$	RHS	LHS	oppose	same	A
ν_b and V_b	J+$\frac{1}{2}$	LHS	LHS	same	oppose	B
ν_a and V_a	J-$\frac{1}{2}$	RHS	RHS	same	oppose	C
ν_b and V_b	J-$\frac{1}{2}$	LHS	RHS	oppose	same	D

So the identities of the neutrino sets which prefer to be in motion would be either A and D or B and C, depending on which of the inner or outer effects dominates the other. If the preference for motion were assumed to be as for set A, then A and D would be the two neutrino sets seen preferentially in motion. If now these sets based on ν_a and V_b were redefined in terms of v_1 and v_2 as follows

Neutrino	Spin	Meon twist	Ring screw	inner effect	outer effect	set
ν_1	J+$\frac{1}{2}$	RHS	LHS	oppose	same	A
V_1	J-$\frac{1}{2}$	LHS	RHS	oppose	same	D
ν_2	J+$\frac{1}{2}$	LHS	LHS	same	oppose	B
V_2	J-$\frac{1}{2}$	RHS	RHS	same	oppose	C

then it would appear that a travelling neutrino would only be LHS and an anti-neutrino only RHS, although that would be to misidentify $v1$ as ν_a and V_a , and v_2 as ν_b and V_b. Similarly, the misidentification of v_2 in stacks would suggest that only neutrinos were J + $\frac{1}{2}$ and only anti-neutrinos J − $\frac{1}{2}$. But in each case, which is the neutrino and which the anti-neutrino depends on very small differences. But it would appear in both cases, that it is the neutrinos that have J + $\frac{1}{2}$ and LHS motion, with the anti-neutrinos having J − $\frac{1}{2}$ and RHS motion.

The stack rings, if set B were to generate –1L, would suggest that set C generates +1 L, as expected, but for both to have $-\mu_m$ implies that it may be the inner/outer difference combined with ring size that defines the sign of induced mass and thus magnetic moment in the stack.

What this suggests is that the identification of neutrino and anti-neutrino is open to further experimental observation to try to confirm that there are differences, as well as any preferential identity sets in motion or in stacks. But the framework suggested here is consistent with the magnetic moment framework above and the observed asymmetry in what are currently defined as neutrino/anti-neutrinos. In this framework, there is still symmetry in the rings – it is the identification of ν and V that breaks the symmetry.

Further consideration of how rings first formed can provide another view on aspects of asymmetry. As considered previously, if a straight chain of six meons, leading meon M at position 1, all twisting in the same RHS sense with respect to its direction of travel along the line of the chain, is considered, constrained on a plane, it is apparent that a rings could be formed by deflection either to the left or right of the leading meon. If the chain swings right and forms a ring, it will be a J + $\frac{1}{2}$ ring and identified as a positive mass phase neutrino. If the chain swings left and forms a ring, it will be a J – $\frac{1}{2}$ ring and identified as a negative mass phase neutrino. The difference is that the J + $\frac{1}{2}$ neutrino has its meons twisting inner edge into the plane, whilst the J – $\frac{1}{2}$ neutrino has its meons twisting outer edge into the plane. Any asymmetry in the preference of motion would be expected to affect which direction the resulting rings started to travel immediately after formation. If the preference is as has been assumed above, set A for motion (the two examples here are both ν_a neutrinos), then the J + $\frac{1}{2}$ neutrino would be expect to move upwards away from the plane, forming a LHS ring. The J – $\frac{1}{2}$ neutrino would be expected to move preferentially downwards from the plane, forming a LHS ring again. But whether the rings are neutrinos or anti-neutrinos depends on the identity of the first meon in the chain, if that is defined as position 1.

If the chain were instead composed of LHS twisting meons, then the outcome would be preferred RHS neutrino/anti-neutrinos in motion in this framework. But with the definition used here, it is not the direction of twist that changes particle to anti-particle – although it does have that effect – but the swapping of M for E.

The energies of the newly formed rings/rings must be the same until they start their motion away from the plane, which breaks the symmetry. Flipping a ring over involves changing the J + $\frac{1}{2}$ to J – $\frac{1}{2}$ as seen by an observer, although in the frame of reference of the ring, there has been no change. It might be expected that to flip twice would restore the original ring, but the process of flipping requires time. If the phase change during the flipping process described earlier involves a change of $h/2$ of rotation, then the twice-flipped ring will be out of phase by h of rotation. This phase difference is equivalent to an energy difference in rings without S3 leptonic symmetry and a second double flip will be required so that the ring will be $2h$ different to its original phase – which will return the meons to their original orientations, but rotated by 120^o and currently not observable. Such a double flip effectively moves the M onto the E positions and vice versa and the second double flip is like moving the ring to a colour symmetric position of equal energy, but with each M back on the M positions.

Finally, considering asymmetry in photons, given all the different combinations considered for rings and their J spins, even with preferences for motion of some rings over others, there does not seem to be any reason why photons should not appear in both J + 1 and J – 1 variants. Possibly the positively charged stacks with positive mass environment favours J + 1 photons, which are preferentially measured using most common first-in-shell J - $\frac{1}{2}$ electrons in overall J + $\frac{1}{2}$ atoms. It is interesting to ask what would be the result of stacking a J - $\frac{1}{2}$ electron with a J – $\frac{1}{2}$ positron. Logically it should be a J – 1 photon. So fundamentally there does not seem to be any asymmetry in the anticipated existence of both J +1 and J -1 photons.

With that digression into the land of past expectations, the next section returns to the mainstream current ring framework and interpretation.

22.1.20 *Relativity*

It has not been addressed yet why a 4-vector notation is not being used here, in what is supposed to be a relativistic treatment. Standard relativistic treatments simply add in gravitational potential fields. The Dirac equation extended for electromagnetic fields does the same and ignores gravity completely. The move to curved geodesics and curved space time, the Geometric Formulation (GMF), overcomes these simplifications, but loses understanding because it deals with four dimensions in general and complex terms and describes a path over time, without initial conditions, rather than energy levels at any specific time.

This discussion started the consideration of energies using the MEM and CEM matrices, multiplying the M_o and Q_o mass and charge sizes by the relativity factors (γ_i–1) for the meons in a ring and ($\gamma_x - 1$) for external motion of the ring. Similarly, ring-ring interaction energies were considered by simply using the latter relativistic factor, and the

same methodology for charge, so that $E_{KE} = (\gamma_x - 1)M_i c^2$. Now the formulation of special relativity in an inertial frame of reference (IFR) needs to be considered to see how the effect of a mass or charge field might enter.

If a standard special relativity system is considered, there is an IFR within which there is a flat stationary mirror off which a light beam is bounced. The stationary observer sees the beam reflected back directly. The moving observer sees an angle between the incident and reflected beams. The result is time dilation of the moving reference frame containing the moving observer.

To correctly include the effect of gravitation, it is necessary only to replace the flat mirror by a very large spherical mass M_s with a mirrored surface, the observers by very small mass clocks and to constrain the distance between the observers and the surface of the large mass to be so small that the gravitational field is constant over the distance that the light beam travels. This is the equivalent of speeding up all the clocks in this specific location by $(1 - GM_s/rc^2)$, where r is the distance of the moving observer from the centre of the spherical mass and is constant over the distance travelled during the measurement. This is identical to reducing the energy of any particle at that point by $(1 - GM_s/rc^2)$.

This treatment can be extended to cover any other $S_a c$, qc and t energy fields present, with the resulting energy equations as described initially. The simplest form, for the motional and potential energy of a two particle gravitational-only system, would be

$$E = M_a \gamma_a c^2 (1 – GM_b/r) – M_a c^2$$

Doubtless a matrix description of the four energies could be constructed, combining all these energies together, but that is beyond the scope of this work. It would, however, have to also include the $+M_o/-M_o$ chasing energy for rings in the Very Near region or when entanglement is present.

Strictly this system is not an IFR, but if the distances over which the event occurs are small enough that the gravitational field does not change (using a 'short light beam', called a limited general relativistic or LGR system), then that field acts only as a constant extra energy for the whole system comprising the mirror surface, light beam and the observers, and will not change the relationships between the observers and light beam, beyond providing a constant multiplication factor. In the case of a stable circular particle orbit or spherical shell orbital, where r is constant, this extends the applicability to the whole of that orbit or shell.

It could thus be argued that the 3-vector form (simplified into scalar notation) used here is appropriate, rather than the normal 4-vector form used in relativistic dynamics, because the clock adjustments used above act to eliminate the curvature of space-time due to mass, spin, charge or twist energies, to the extent of the system under consideration.

However, the short light beam argument means that LGR only applies to systems within which the fields can be considered to be unchanged, over the system, and at a specific time. Appropriate systems include all stable orbits, so planets and electrons are covered. But the development of non-stable orbit systems requires the fields to change over time, which is precisely what GR does so well, although for gravitational fields only. So GR in its 4 vector form cannot ever include spin, twist or charge-bound QM-like states, whereas LGR includes QM-like states for all energies, but not development over time. This would seem to imply that there should be some way of combining LGR and GR in a meta-formula that would describe both instantaneous energies and development of states over time.

The original equations used in the CEM and MEM matrices are derived using this LGR framework and combine to form the basis for the equations used to describe the motional and potential interaction energies between meons and planets in an identical fashion.

22.1.21 *LGR and QM Differences Considered*

The traditional differences between GR and QM, and some additional features, can be considered in the light of LGR and ZEMPs.

1. Clocks. LGR for a particle system has clock adjustments for mass, spin, twist and charge fields. QM, based on a set of ZEMPs within the overall energy of a particle system, has no clocks because there is no energy in that balanced system and all ZEMPs are the same, in terms of sum of energies, although different in terms of size of the balance, the balloon.

2. Quantisation. Arises in both mass and charge systems, as seen above, although the quantisation depends on the ratio $j = S_a c/M_a$ in the bodies under consideration, which makes such quantisation difficult to observe in gravitational systems.

3. Renormalisation. Not required in LGR. Both mass and charge are treated identically, and the initial assumptions on existence of balancing energies ensure that infinities do not appear. For every increase in a particle energy, whether rotational or due to a translational frame of reference apparent change, there is a corresponding increase in its balancing opposite partner energy, with mass partnering spin, charge partnering twist and M_o partnering Q_o.

4. Non-Locality. Whilst LGR is local for the overall system, the ability of a ZEMP to split into separate parts allows non-local effects within the ZEMP. Since the ZEMP is destroyed on measurement, no information can be transmitted.

5. Mass inflation. In the overall system the appearance of the rest-mass and rest-charge inflates in line with the relative velocity of the observer, but the real rest-mass and rest-charge do not change. Within the ZEMP, the mass and charge increases are balanced by spin and twist increases respectively.

6. Randomness. Within an orbital ZEMP, all places are the same zero energy, so the likelihood of being at a particular place is the same for all places, and the only information possible on the particle is probabilities. The orbitals are defined as being the allowable places for the state $ZEMP_n$ balance of energies and the probability of being in a non-allowable place is zero.

7. Information. The LGR interpretation, as one energy formula, which contains all existing parts, is simple and yet provides information on the energy of the system at any time. GR does not provide timely information, but a path over time.

8. The ZEMP states provide a simple foundation for QM without invoking waves, Hilbert states or operators. If the system is a state n, then the particle is in the orbital.

9. Measurement. The LGR energy is measurable, within h uncertainty, but this measurement destroys the stable orbit and ZEMPs.

10. High or Low Energy Cut Offs. Within the initial assumptions, there are no energies at which LGR ceases to function. It works equally for planets, electrons and meons.

11. Entanglement. Can now be interpreted as particles sharing a ZEMP, whether separated in space or not. Survives until measurement collapses the ZEMP. Meons entangled have mass chasing interaction.

12. History/Waves. The history of a particle's path is not locked in place until after it has been measured, and even then it is only the probabilities that can be summed. Where they interfere, the results are wave-like, although the waves do not exist. Where they do not interfere, the results are particle like.

13. Hidden Variables. There are no hidden variables in LGR, although a particle has a specific and real place (position and velocity) at all times, skipping randomly, within the ZEMP, and overall has specific energy states within the total system.

14. Shielding. It is generally considered that the action of gravity cannot be shielded, whilst the action of charge can be. LGR treats both types of field identically. Energy fields have many times as much charge action as mass action, because of the relative unit charge and mass sizes. Fields of negative and positive charges in close proximity have their charge fields overlapping to such an extent that the resulting net charge fields are near zero. However, the gross charge fields are still there. The gravitational fields, lacking a negative ring-mass component to overlap the positive ring-masses only show gross positive values. The underlying need to achieve zero energy in any system will ensure that the largest fields are balanced first.

15. Classical/QM system size. In the limit where $j = 1$, there can be single rings or possibly large black holes. Such a quantisation of large black holes would mean that any two such stars would have no effect on each other, since gravitational attraction would equal spin repulsion. Similarly, an apparatus with suitably pure internal spin alignment, if spun sufficiently fast enough might be able to provide some opposition to gravitational attraction.

22.1.22 *Conclusions*

Certain aspects of the standard model become clear in this interpretation, and there are obvious benefits:

(i) Since all normal matter rings are composed of 3 M and 3 E, there can only be single fermions with electronic charge ± 1, $\pm 2/3$,$\pm 1/3$ and ± 0 qc and $J = \pm 1/2$, although stacks may replicate these.

(ii) Rings are both particle and waves

(iii) Particles with $J > \pm 1/2$ are composites composed of stacked rings.

(iv) Colour is a manifestation of phase difference between rings at the same rotation rates, both internally as degenerate states and externally in providing a balance of asymmetries in a stack of rings.

(v) Mass is a function of rotational angular frequency and motional momentum of the ring components, which is the size and deflection of space time by a ring mediated either by the fractional twist of the ring when outside the Near region or by proximate neighbours, but showing 100% of the ring size when in a stack.

(vi) The fine structure constant, α, as the constant underlying electronic charge q, represents a standard rate of spinning of meons, here also described as a function of t.

(vii) Three generations represent different ring sizes of the same particles.

(viii) Carrier particles do not have to be carriers and may only be transient composites.

(ix) No Higgs particle is required to generate mass.

(x) The ring sizes may have been fixed by inflation.

(xi) The observation of only the photon J+1 suggests that it is the use of 'normal' rings (i.e. e- J - $\frac{1}{2}$ electrons) for observation that preferentially shows only half the actual entities present.

(xii) The requirement for synchronization infers that all short ring stacks within a longer stack, other than any temporary additions or replacements, should have the same rotational frequency or ring size.

(xiii) One possible solution to CP violation is that the K_L and K_S kaons are different in terms of their pion and gluon content, but are identical in terms of overall number of these components, and that the identities of those components change as the stacks travel.

(xiv) The combination of M and E in photon rings looks like the underlying state of space before M and E were initially separated to start chain formation.

(xv) No higher dimensions are necessary than the three observed, and time is a construct of the rings once formed.

(xvi) Neutrino oscillation is natural in this framework, with size resonances representing simply larger or smaller versions of the neutrino ring.

(xvii) Quantum mechanics is shown to lie in the zero energy of motion and position states in a relativistic framework at the $j = 1$ end of the $S_i c/M_i$ scale.

(xviii) The ring framework, where every M_o-related energy has an equal and opposite Q_o-related energy, ensures that no ring can exceed the adjusted Planck energy in total and so no infinities are possible anywhere.

(xix) There is one underlying relativistic factor at work in each level of energies and one equation that describes the energies of interactions at all levels, from meons to galaxies.

(xx) Free rings have mass energy $M_i c^2 \approx h\frac{1}{2}w_{iA}$ (APS units) $\approx h\frac{1}{2}w_{iP}/2\pi$ (Planck units) and free photons have energies $E_\gamma \approx hw_{iA}$ (APS units) $\approx hw_{iP}/2\pi$ (Planck units).

(xxi) The uncertainty factor is h in APS units and $h/2\pi$ in Planck units.

(xxii) There is no need formultiple universes.

Needless to say, we have major difficulties, even with a fairly simple dynamical explanation.

(i) Quark confinement here represents only rings that can be synchronized.

(ii) The mass spectrum of quarks and leptons remains unexplained, beyond suggesting that three different inflation rates set preferred sizes.

(iii) Why the isolated mass of the quarks and leptons beyond the Near region should be a factor of both ring frequency and twist is not clear.

(iv) The masses of the u, d and s quarks calculated here for the magnetic moment interpretations are not those expected using the Standard Model quark mass scheme.

(v) The anomalous magnetic moments of rings appear to depend on the ring mass and their local environments, yet each ring has a total of zero mass energy.

The scheme proposed here is extremely economical. It suggests that all of matter consists of only one fundamental entity, which is itself present as particle and anti-particle, with one mode of motion and forming only one composite structure and that this underlies the existence both of space and of all the particles that inhabit space. The related quantisation of quark and lepton charges is explained, the content of each generation appears naturally and the similarity between generations is obtained. The concepts of mass, electric charge, spin, time, colour, and flavour acquire meaning only at the level of the composite systems. The dynamics proposed lead to some simple relationships that may yet be open to investigation, including the size of the rings.

22.1.23 *Lists*

The following lists provide examples of some of the positioning of meons in rings, of their resulting symmetry and the symmetric stacks that they can form. Due to the limitations used in compiling the lists, instead of the names used in the main section they use v for ν , the neutrinos, and v- for V, the anti-neutrinos.

22.1.24 *List A1*

All 144 ring possible asymmetric ring orientations.

Charges are in order numbered from the colour point.

Ring No.	Ring	Meon on asym'try	Color	1	2	3	4	5	6	Sym'try	Spin	Ring Type
1	u+	+m	g1	-	+	+	+	+	+	A3	0.5	U
2	u+	+m	r3	-	+	+	+	+	+	A3	0.5	U
3	u+	+m	b5	-	+	+	+	+	+	A3	0.5	U
4	u+	-m	g1	-	+	+	+	+	+	A3	0.5	U
5	u+	-m	r3	-	+	+	+	+	+	A3	0.5	U
6	u+	-m	b5	-	+	+	+	+	+	A3	0.5	U
7	u-	+m	g-1	+	-	-	-	-	-	A3	0.5	U
8	u-	+m	r-3	+	-	-	-	-	-	A3	0.5	U
9	u-	+m	b-5	+	-	-	-	-	-	A3	0.5	U
10	u-	-m	g-1	+	-	-	-	-	-	A3	0.5	U
11	u-	-m	r-3	+	-	-	-	-	-	A3	0.5	U
12	u-	-m	b-5	+	-	-	-	-	-	A3	0.5	U
13	u+	+m	g-4	-	+	+	+	+	+	A3	0.5	U
14	u+	+m	r-6	-	+	+	+	+	+	A3	0.5	U
15	u+	+m	b-2	-	+	+	+	+	+	A3	0.5	U
16	u+	-m	g-4	-	+	+	+	+	+	A3	0.5	U
17	u+	-m	r-6	-	+	+	+	+	+	A3	0.5	U
18	u+	-m	b-2	-	+	+	+	+	+	A3	0.5	U
19	u-	+m	g4	+	-	-	-	-	-	A3	0.5	U
20	u-	+m	r6	+	-	-	-	-	-	A3	0.5	U
21	u-	+m	b2	+	-	-	-	-	-	A3	0.5	U
22	u-	-m	g4	+	-	-	-	-	-	A3	0.5	U

Ring No.	Ring	Meon on asym'try	Color	1	2	3	4	5	6	Sym'try	Spin	Ring Type
23	u-	-m	r6	+	-	-	-	-	-	A3	0.5	U
24	u-	-m	b2	+	-	-	-	-	-	A3	0.5	U
25	d-	+m	g-1	+	-	-	+	-	-	A2,M2	0.5	D2
26	d-	+m	r-3	+	-	-	+	-	-	A2,M2	0.5	D2
27	d-	+m	b-5	+	-	-	+	-	-	A2,M2	0.5	D2
28	d-	-m	g-1	+	-	-	+	-	-	A2,M2	0.5	D2
29	d-	-m	r-3	+	-	-	+	-	-	A2,M2	0.5	D2
30	d-	-m	b-5	+	-	-	+	-	-	A2,M2	0.5	D2
31	d+	+m	g1	-	+	+	-	+	+	A2,M2	0.5	D2
32	d+	+m	r3	-	+	+	-	+	+	A2,M2	0.5	D2
33	d+	+m	b5	-	+	+	-	+	+	A2,M2	0.5	D2
34	d+	-m	g1	-	+	+	-	+	+	A2,M2	0.5	D2
35	d+	-m	r3	-	+	+	-	+	+	A2,M2	0.5	D2
36	d+	-m	b5	-	+	+	-	+	+	A2,M2	0.5	D2
37	d-	+m	g4	+	-	-	+	-	-	A2,M2	0.5	D2
38	d-	+m	r6	+	-	-	+	-	-	A2,M2	0.5	D2
39	d-	+m	b2	+	-	-	+	-	-	A2,M2	0.5	D2
40	d-	-m	g4	+	-	-	+	-	-	A2,M2	0.5	D2
41	d-	-m	r6	+	-	-	+	-	-	A2,M2	0.5	D2
42	d-	-m	b2	+	-	-	+	-	-	A2,M2	0.5	D2
43	d+	+m	g-4	-	+	+	-	+	+	A2,M2	0.5	D2
44	d+	+m	r-6	-	+	+	-	+	+	A2,M2	0.5	D2

Ring No.	Ring	Meon on asym'try	Color	1	2	3	4	5	6	Sym'try	Spin	Ring Type
45	d+	+m	b-2	-	+	+	-	+	+	A2,M2	0.5	D2
46	d+	-m	g-4	-	+	+	-	+	+	A2,M2	0.5	D2
47	d+	-m	r-6	-	+	+	-	+	+	A2,M2	0.5	D2
48	d+	-m	b-2	-	+	+	-	+	+	A2,M2	0.5	D2
49	v	+m	g1	+	+	-	-	-	+	A2	0.5	v2
50	v	+m	r3	+	+	-	-	-	+	A2	0.5	v2
51	v	+m	b5	+	+	-	-	-	+	A2	0.5	v2
52	v	-m	g1	+	+	-	-	-	+	A2	0.5	v2
53	v	-m	r3	+	+	-	-	-	+	A2	0.5	v2
54	v	-m	b5	+	+	-	-	-	+	A2	0.5	v2
55	v-	+m	g-1	-	-	+	+	+	-	A2	0.5	v2
56	v-	+m	r-3	-	-	+	+	+	-	A2	0.5	v2
57	v-	+m	b-5	-	-	+	+	+	-	A2	0.5	v2
58	v-	-m	g-1	-	-	+	+	+	-	A2	0.5	v2
59	v-	-m	r-3	-	-	+	+	+	-	A2	0.5	v2
60	v-	-m	b-5	-	-	+	+	+	-	A2	0.5	v2
61	v	+m	g-4	+	+	-	-	-	+	A2	0.5	v2
62	v	+m	r-6	+	+	-	-	-	+	A2	0.5	v2
63	v	+m	b-2	+	+	-	-	-	+	A2	0.5	v2
64	v	-m	g-4	+	+	-	-	-	+	A2	0.5	v2
65	v	-m	r-6	+	+	-	-	-	+	A2	0.5	v2
66	v	-m	b-2	+	+	-	-	-	+	A2	0.5	v2

Ring No.	Ring	Meon on asym'try	Color	1	2	3	4	5	6	Sym'try	Spin	Ring Type
67	v-	+m	g4	-	-	+	+	+	-	A2	0.5	v2
68	v-	+m	r6	-	-	+	+	+	-	A2	0.5	v2
69	v-	+m	b2	-	-	+	+	+	-	A2	0.5	v2
70	v-	-m	g4	-	-	+	+	+	-	A2	0.5	v2
71	v-	-m	r6	-	-	+	+	+	-	A2	0.5	v2
72	v-	-m	b2	-	-	+	+	+	-	A2	0.5	v2
73	v	+m	g1	+	+	-	-	+	-	N0	0.5	v3
74	v	+m	r3	+	+	-	-	+	-	N0	0.5	v3
75	v	+m	b5	+	+	-	-	+	-	N0	0.5	v3
76	v	-m	g1	+	+	-	-	+	-	N0	0.5	v3
77	v	-m	r3	+	+	-	-	+	-	N0	0.5	v3
78	v	-m	b5	+	+	-	-	+	-	N0	0.5	v3
79	v-	+m	g-1	-	-	+	+	-	+	N0	0.5	v3
80	v-	+m	r-3	-	-	+	+	-	+	N0	0.5	v3
81	v-	+m	b-5	-	-	+	+	-	+	N0	0.5	v3
82	v-	-m	g-1	-	-	+	+	-	+	N0	0.5	v3
83	v-	-m	r-3	-	-	+	+	-	+	N0	0.5	v3
84	v-	-m	b-5	-	-	+	+	-	+	N0	0.5	v3
85	v	+m	g-4	+	+	-	-	+	-	N0	0.5	v3
86	v	+m	r-6	+	+	-	-	+	-	N0	0.5	v3
87	v	+m	b-2	+	+	-	-	+	-	N0	0.5	v3
88	v	-m	g-4	+	+	-	-	+	-	N0	0.5	v3

Ring No.	Ring	Meon on asym'try	Color	1	2	3	4	5	6	Sym'try	Spin	Ring Type
89	v	-m	r-6	+	+	-	-	+	-	N0	0.5	v3
90	v	-m	b-2	+	+	-	-	+	-	N0	0.5	v3
91	v-	+m	g4	-	-	+	+	-	+	N0	0.5	v3
92	v-	+m	r6	-	-	+	+	-	+	N0	0.5	v3
93	v-	+m	b2	-	-	+	+	-	+	N0	0.5	v3
94	v-	-m	g4	-	-	+	+	-	+	N0	0.5	v3
95	v-	-m	r6	-	-	+	+	-	+	N0	0.5	v3
96	v-	-m	b2	-	-	+	+	-	+	N0	0.5	v3
97	d-	+m	g-1	-	-	+	-	-	+	M3	0.5	D3
98	d-	+m	r-3	-	-	+	-	-	+	M3	0.5	D3
99	d-	+m	b-5	-	-	+	-	-	+	M3	0.5	D3
100	d-	-m	g-1	-	-	+	-	-	+	M3	0.5	D3
101	d-	-m	r-3	-	-	+	-	-	+	M3	0.5	D3
102	d-	-m	b-5	-	-	+	-	-	+	M3	0.5	D3
103	d+	+m	g1	+	+	-	+	+	-	M3	0.5	D3
104	d+	+m	r3	+	+	-	+	+	-	M3	0.5	D3
105	d+	+m	b5	+	+	-	+	+	-	M3	0.5	D3
106	d+	-m	g1	+	+	-	+	+	-	M3	0.5	D3
107	d+	-m	r3	+	+	-	+	+	-	M3	0.5	D3
108	d+	-m	b5	+	+	-	+	+	-	M3	0.5	D3
109	d-	+m	g4	-	-	+	-	-	+	M3	0.5	D3
110	d-	+m	r6	-	-	+	-	-	+	M3	0.5	D3

Ring No.	Ring	Meon on asym'try	Color	1	2	3	4	5	6	Sym'try	Spin	Ring Type
111	d-	+m	b2	-	-	+	-	-	+	M3	0.5	D3
112	d-	-m	g4	-	-	+	-	-	+	M3	0.5	D3
113	d-	-m	r6	-	-	+	-	-	+	M3	0.5	D3
114	d-	-m	b2	-	-	+	-	-	+	M3	0.5	D3
115	d+	+m	g-4	+	+	-	+	+	-	M3	0.5	D3
116	d+	+m	r-6	+	+	-	+	+	-	M3	0.5	D3
117	d+	+m	b-2	+	+	-	+	+	-	M3	0.5	D3
118	d+	-m	g-4	+	+	-	+	+	-	M3	0.5	D3
119	d+	-m	r-6	+	+	-	+	+	-	M3	0.5	D3
120	d+	-m	b-2	+	+	-	+	+	-	M3	0.5	D3
121	d-	+m	g-1	-	+	-	-	-	+	A3	0.5	D1
122	d-	+m	r-3	-	+	-	-	-	+	A3	0.5	D1
123	d-	+m	b-5	-	+	-	-	-	+	A3	0.5	D1
124	d-	-m	g-1	-	+	-	-	-	+	A3	0.5	D1
125	d-	-m	r-3	-	+	-	-	-	+	A3	0.5	D1
126	d-	-m	b-5	-	+	-	-	-	+	A3	0.5	D1
127	d+	+m	g1	+	-	+	+	+	-	A3	0.5	D1
128	d+	+m	r3	+	-	+	+	+	-	A3	0.5	D1
129	d+	+m	b5	+	-	+	+	+	-	A3	0.5	D1
130	d+	-m	g1	+	-	+	+	+	-	A3	0.5	D1
131	d+	-m	r3	+	-	+	+	+	-	A3	0.5	D1
132	d+	-m	b5	+	-	+	+	+	-	A3	0.5	D1

Ring No.	Ring	Meon on asym'try	Color	1	2	3	4	5	6	Sym'try	Spin	Ring Type
133	d-	+m	g4	-	+	-	-	-	+	A3	0.5	D1
134	d-	+m	r6	-	+	-	-	-	+	A3	0.5	D1
135	d-	+m	b2	-	+	-	-	-	+	A3	0.5	D1
136	d-	-m	g4	-	+	-	-	-	+	A3	0.5	D1
137	d-	-m	r6	-	+	-	-	-	+	A3	0.5	D1
138	d-	-m	b2	-	+	-	-	-	+	A3	0.5	D1
139	d+	+m	g-4	+	-	+	+	+	-	A3	0.5	D1
140	d+	+m	r-6	+	-	+	+	+	-	A3	0.5	D1
141	d+	+m	b-2	+	-	+	+	+	-	A3	0.5	D1
142	d+	-m	g-4	+	-	+	+	+	-	A3	0.5	D1
143	d+	-m	r-6	+	-	+	+	+	-	A3	0.5	D1
144	d+	-m	b-2	+	-	+	+	+	-	A3	0.5	D1

22.1.25 *List A2*

Examples of the 16 different symmetric combinations of 2 asymmetric rings out of 720 total possible.

Add any symmetric S3 lepton to make another symmetric 3 ring.

Ring A	Ring B	Colr A	Colr B	Grp Colr A	Grp Colr B	Ring Type A	Ring Type B	Total Chge	Sym'y A	Sym'y B
e+	e+	g1	g1	1	1	X	X	2	S3	S3
e+	e+	g1	r3	1	2	X	X	2	S3	S3
e+	e+	g1	b5	1	3	X	X	2	S3	S3
e+	e+	g1	g-4	1	-1	X	X	2	S3	S3
e+	e+	g1	r-6	1	-2	X	X	2	S3	S3
e+	e+	g1	b-2	1	-3	X	X	2	S3	S3
e-	e-	g4	g4	1	1	X-	X-	-2	S3	S3
e-	e-	g4	r6	1	2	X-	X-	-2	S3	S3
e-	e-	g4	b2	1	3	X-	X-	-2	S3	S3
e-	e-	g4	g-1	1	-1	X-	X-	-2	S3	S3
e-	e-	g4	r-3	1	-2	X-	X-	-2	S3	S3
e-	e-	g4	b-5	1	-3	X-	X-	-2	S3	S3
v	v	g1	g1	1	1	X	X	0	S3	S3
v	v	g1	r3	1	2	X	X	0	S3	S3
v	v	g1	b5	1	3	X	X	0	S3	S3

Ring A	Ring B	Colr A	Colr B	Grp Colr A	Grp Colr B	Ring Type A	Ring Type B	Total Chge	Sym'y A	Sym'y B
v	v	g1	g-4	1	-1	X	X	0	S3	S3
v	v	g1	r-6	1	-2	X	X	0	S3	S3
v	v	g1	b-2	1	-3	X	X	0	S3	S3
v-	v-	g4	g4	1	1	X-	X-	0	S3	S3
v-	v-	g4	r6	1	2	X-	X-	0	S3	S3
v-	v-	g4	b2	1	3	X-	X-	0	S3	S3
v-	v-	g4	g-1	1	-1	X-	X-	0	S3	S3
v-	v-	g4	r-3	1	-2	X-	X-	0	S3	S3
v-	v-	g4	b-5	1	-3	X-	X-	0	S3	S3
e+	v	g1	g1	1	1	X	X	1	S3	S3
e+	v	g1	r3	1	2	X	X	1	S3	S3
e+	v	g1	b5	1	3	X	X	1	S3	S3
e+	v	g1	g-4	1	-1	X	X	1	S3	S3
e+	v	g1	r-6	1	-2	X	X	1	S3	S3
e+	v	g1	b-2	1	-3	X	X	1	S3	S3
e+	v-	g1	g4	1	1	X	X-	1	S3	S3
e+	v-	g1	r6	1	2	X	X-	1	S3	S3
e+	v-	g1	b2	1	3	X	X-	1	S3	S3
e+	v-	g1	g-1	1	-1	X	X-	1	S3	S3
e+	v-	g1	r-3	1	-2	X	X-	1	S3	S3
e+	v-	g1	b-5	1	-3	X	X-	1	S3	S3

22.1.26 *List A3*

36 examples of the many different symmetric combinations of 2 symmetric rings.

Add any symmetric S3 lepton to make further symmetric 3 rings.

Ring A	Ring B	Colr A	Colr B	Grp Colr A	Grp Colr B	Ring Type A	Ring Type B	Total Chge	Sym'y A	Sym'y B
e+	e+	g1	g1	1	1	X	X	2	S3	S3
e+	e+	g1	r3	1	2	X	X	2	S3	S3
e+	e+	g1	b5	1	3	X	X	2	S3	S3
e+	e+	g1	g-4	1	-1	X	X	2	S3	S3
e+	e+	g1	r-6	1	-2	X	X	2	S3	S3
e+	e+	g1	b-2	1	-3	X	X	2	S3	S3
e-	e-	g4	g4	1	1	X-	X-	-2	S3	S3
e-	e-	g4	r6	1	2	X-	X-	-2	S3	S3
e-	e-	g4	b2	1	3	X-	X-	-2	S3	S3
e-	e-	g4	g-1	1	-1	X-	X-	-2	S3	S3
e-	e-	g4	r-3	1	-2	X-	X-	-2	S3	S3
e-	e-	g4	b-5	1	-3	X-	X-	-2	S3	S3
v	v	g1	g1	1	1	X	X	0	S3	S3
v	v	g1	r3	1	2	X	X	0	S3	S3
v	v	g1	b5	1	3	X	X	0	S3	S3

Ring A	Ring B	Colr A	Colr B	Grp Colr A	Grp Colr B	Ring Type A	Ring Type B	Total Chge	Sym'y A	Sym'y B
v	v	g1	g-4	1	-1	X	X	0	S3	S3
v	v	g1	r-6	1	-2	X	X	0	S3	S3
v	v	g1	b-2	1	-3	X	X	0	S3	S3
v-	v-	g4	g4	1	1	X-	X-	0	S3	S3
v-	v-	g4	r6	1	2	X-	X-	0	S3	S3
v-	v-	g4	b2	1	3	X-	X-	0	S3	S3
v-	v-	g4	g-1	1	-1	X-	X-	0	S3	S3
v-	v-	g4	r-3	1	-2	X-	X-	0	S3	S3
v-	v-	g4	b-5	1	-3	X-	X-	0	S3	S3
e+	v	g1	g1	1	1	X	X	1	S3	S3
e+	v	g1	r3	1	2	X	X	1	S3	S3
e+	v	g1	b5	1	3	X	X	1	S3	S3
e+	v	g1	g-4	1	-1	X	X	1	S3	S3
e+	v	g1	r-6	1	-2	X	X	1	S3	S3
e+	v	g1	b-2	1	-3	X	X	1	S3	S3
e+	v-	g1	g4	1	1	X	X-	1	S3	S3
e+	v-	g1	r6	1	2	X	X-	1	S3	S3
e+	v-	g1	b2	1	3	X	X-	1	S3	S3
e+	v-	g1	g-1	1	-1	X	X-	1	S3	S3
e+	v-	g1	r-3	1	-2	X	X-	1	S3	S3
e+	v-	g1	b-5	1	-3	X	X-	1	S3	S3

22.1.27 *List A4*

All 104 different symmetric 3 ring combinations, using asymmetric rings, out of a total of 27,648 possible.

Ring			Grp colr			Ring Type			Total	Sym'y	Sym'y	Sym'y
A	B	C	*A*	*B*	*C*	A	B	C	charge	A	B	C
v	v	v	1	2	3	X	X	X	0	A2	A2	A2
v	v	v	1	2	3	X	X	X	0	N0	N0	N0
d+	d+	d+	1	2	3	X	X	X	1	A2,M2	A2,M2	A2,M2
d+	d+	d+	-1	2	3	X	X	X	1	A2,M2	A2,M2	A2,M2
d+	d+	d+	1	-2	3	X	X	X	1	A2,M2	A2,M2	A2,M2
d+	d+	d+	1	2	-3	X	X	X	1	A2,M2	A2,M2	A2,M2
d+	d+	d+	1	2	3	X	X	X	1	A3	A3	A3
u+	u+	u+	1	2	3	X	X	X	2	A3	A3	A3
d+	d+	d+	1	2	3	X	X	X	1	M3	M3	M3
d+	d+	d+	-1	2	3	X	X	X	1	M3	M3	M3
d+	d+	d+	1	-2	3	X	X	X	1	M3	M3	M3
d+	d+	d+	1	2	-3	X	X	X	1	M3	M3	M3
d+	d+	d+	1	1	-1	X	X	X	1	A2,M2	A3	A3
d+	d+	d+	1	-1	-1	X	X	X	1	A3	A3	A2,M2
d+	d+	d+	1	-2	2	X	X	X	1	M3	A3	A3
d+	d+	d+	1	-1	2	X	X	X	1	A3	A3	M3
d+	d+	d+	1	2	2	X	X	X	1	A2,M2	A2,M2	M3
d+	d+	d+	-1	2	2	X	X	X	1	A2,M2	A2,M2	M3
d+	d+	d+	1	-2	2	X	X	X	1	A2,M2	A2,M2	M3

Ring			Grp colr			Ring Type			Total	Sym'y	Sym'y	Sym'y
A	B	C	*A*	*B*	*C*	A	B	C	charge	A	B	C
d+	d+	d+	-1	-2	2	X	X	X	1	A2,M2	A2,M2	M3
d+	d+	d+	1	2	1	X	X	X	1	A2,M2	A2,M2	M3
d+	d+	d+	-1	2	1	X	X	X	1	A2,M2	A2,M2	M3
d+	d+	d+	1	-2	1	X	X	X	1	A2,M2	A2,M2	M3
d+	d+	d+	-1	-2	1	X	X	X	1	A2,M2	A2,M2	M3
d+	d+	d+	1	2	1	X	X	X	1	A2,M2	M3	M3
d+	d+	d+	-1	2	1	X	X	X	1	A2,M2	M3	M3
d+	d+	d+	-1	-1	2	X	X	X	1	A2,M2	M3	M3
d+	d+	d+	1	2	2	X	X	X	1	M3	A2,M2	M3
d+	d+	d+	1	-2	2	X	X	X	1	M3	A2,M2	M3
d+	d+	d+	-1	2	2	X	X	X	1	M3	A2,M2	M3
d+	d+	d+	-1	1	2	X	X	X	1	M3	A2,M2	M3
d+	d+	d+	-1	-2	2	X	X	X	1	M3	A2,M2	M3
v	v	v-	-1	1	1	X	X	X-	0	A2	N0	N0
v	v	v-	1	2	3	X	X	X-	0	A2	A2	A2
d+	d+	u-	-1	1	1	X	X	Y-	0	A3	A2,M2	A3
d+	d+	u-	1	1	-1	X	X	Y-	0	A3	A2,M2	A3
u+	u+	d-	-1	1	1	X	X	Y-	1	A3	A3	A2,M2
u+	u+	d-	-1	1	2	X	X	Y-	1	A3	A3	M3

	Ring			Grp colr			Ring Type		Total	Sym'y	Sym'y	Sym'y
A	B	C	*A*	*B*	*C*	A	B	C	charge	A	B	C
d+	d+	u-	-1	2	1	X	X	Y-	0	A3	M3	A3
d+	d+	u-	1	2	-2	X	X	Y-	0	M3	A3	A3
d+	d+	u-	1	-2	2	X	X	Y-	0	M3	A3	A3
d+	d+	u-	1	2	3	X	X	Y-	0	A3	A3	A3
d+	d-	v	1	2	2	X	X-	Y	0	A2,M2	A3	N0
d+	d-	v	-1	2	2	X	X-	Y	0	A2,M2	A3	N0
d+	d-	v	1	2	1	X	X-	Y	0	A3	A2,M2	N0
d+	d-	v	1	-2	1	X	X-	Y	0	A3	A2,M2	N0
d+	d-	v	1	1	1	X	X-	Y	0	A3	A3	A2
u+	u-	v	1	1	1	X	X-	Y	0	A3	A3	A2
d+	d-	v	-1	-2	3	X	X-	Y	0	A3	A3	N0
u+	u-	v	-1	-2	3	X	X-	Y	0	A3	A3	N0
d+	d-	v	1	2	2	X	X-	Y	0	M3	A3	N0
d+	d-	v	-1	2	2	X	X-	Y	0	M3	A3	N0
d+	d-	v	1	1	1	X	X-	Y	0	A3	M3	N0
d+	d-	v	1	-1	1	X	X-	Y	0	A3	M3	N0
v	d+	d-	1	2	1	X	Y	Y-	0	N0	M3	A3
v	d+	d-	1	-2	1	X	Y	Y-	0	N0	M3	A3
v	d+	d-	1	1	1	X	Y	Y-	0	N0	A3	M3

	Ring			Grp colr			Ring Type		Total	Sym'y	Sym'y	Sym'y
A	B	C	*A*	*B*	*C*	A	B	C	charge	A	B	C
v	d+	d-	1	1	-1	X	Y	Y-	0	N0	A3	M3
v	d+	d-	1	-2	-3	X	Y	Y-	0	N0	A3	A3
v	u+	u-	1	-2	-3	X	Y	Y-	0	N0	A3	A3
v	d+	d-	1	2	1	X	Y	Y-	0	N0	A2,M2	A3
v	d+	d-	1	-2	1	X	Y	Y-	0	N0	A2,M2	A3
v	d+	d-	1	2	1	X	Y	Y-	0	N0	A2,M2	A3
v	d+	d-	1	-2	1	X	Y	Y-	0	N0	A2,M2	A3
v	d+	d-	1	1	1	X	Y	Y-	0	A2	A3	A3
v	u+	u-	1	1	1	X	Y	Y-	0	A2	A3	A3
v	u+	d+	1	-2	-3	X	Y	Z	1	N0	A3	A3
v	d+	u+	1	-2	-3	X	Y	Z	1	N0	A3	A3
u+	v	d+	-1	2	-3	X	Y	Z	1	A3	N0	A3
d+	v	u+	-1	2	-3	X	Y	Z	1	A3	N0	A3
u+	d+	v	-1	-2	3	X	Y	Z	1	A3	A3	N0
d+	u+	v	-1	-2	3	X	Y	Z	1	A3	A3	N0
d+	u+	v	1	2	2	X	Y	Z	1	M3	A3	N0
d+	u+	v	-1	2	2	X	Y	Z	1	M3	A3	N0
v	d+	u+	1	2	1	X	Y	Z	1	N0	M3	A3
v	d+	u+	1	-2	1	X	Y	Z	1	N0	M3	A3

	Ring			Grp colr			Ring Type		Total	Sym'y	Sym'y	Sym'y
A	B	C	*A*	*B*	*C*	A	B	C	charge	A	B	C
v	d+	u+	1	-2	1	X	Y	Z	1	N0	M3	A3
d+	v	u+	1	2	2	X	Y	Z	1	M3	N0	A3
d+	v	u+	-1	2	2	X	Y	Z	1	M3	N0	A3
v	u+	d+	1	1	2	X	Y	Z	1	N0	A3	A2,M2
v	u+	d+	1	1	-2	X	Y	Z	1	N0	A3	A2,M2
d+	u+	v	1	2	2	X	Y	Z	1	A2,M2	A3	N0
d+	u+	v	-1	2	2	X	Y	Z	1	A2,M2	A3	N0
v	d+	u+	1	1	1	X	Y	Z	1	A2	A3	A3
v	u+	d+	1	1	1	X	Y	Z	1	A2	A3	A3
u+	d+	v-	1	-1	1	X	Y	Z-	1	A3	M3	N0
u+	d+	v-	1	1	1	X	Y	Z-	1	A3	M3	N0
d+	u+	v-	-1	-2	3	X	Y	Z-	1	A3	A3	N0
u+	d+	v-	1	1	1	X	Y	Z-	1	A3	A3	A2
d+	u+	v-	-1	2	2	X	Y	Z-	1	A2,M2	A3	N0
d+	u+	v-	1	2	2	X	Y	Z-	1	A2,M2	A3	N0
u+	d-	d-	-1	2	1	X	Y-	Y-	0	A3	M3	A3
u+	d-	d-	1	2	-1	X	Y-	Y-	0	A3	M3	A3
d+	u-	u-	1	-2	2	X	Y-	Y-	-1	M3	A3	A3
u+	d-	d-	1	2	3	X	Y-	Y-	0	A3	A3	A3

	Ring			Grp colr			Ring Type		Total	Sym'y	Sym'y	Sym'y
A	B	C	*A*	*B*	*C*	A	B	C	charge	A	B	C
d+	u-	u-	1	2	3	X	Y-	Y-	-1	A3	A3	A3
u+	d-	d-	1	-1	1	X	Y-	Y-	0	A3	A3	A2,M2
u+	d-	d-	-1	1	1	X	Y-	Y-	0	A3	A3	A2,M2
d+	u-	u-	1	-1	1	X	Y-	Y-	-1	A2,M2	A3	A3
v	u-	d-	1	1	1	X	Y-	Z-	-1	A2	A3	A3
v	u-	d-	1	1	-2	X	Y-	Z-	-1	N0	A3	A2,M2
v	u-	d-	1	1	2	X	Y-	Z-	-1	N0	A3	A2,M2
v	d-	u-	1	-2	-3	X	Y-	Z-	-1	N0	A3	A3
v	u-	d-	1	1	-1	X	Y-	Z-	-1	N0	A3	M3
v	u-	d-	1	1	1	X	Y-	Z-	-1	N0	A3	M3

22.1.28 *List A5*

Examples of the only 14 different mass sets of 3 ring symmetric combinations using any rings if the rings are all the same size.

Rng			Col			Sym'y			Totl	Chg		
A	B	C	*A*	*B*	*C*	A	B	C	chge	A	B	C
e+	e+	e-	0	0	0	S3	S3	S3	1	1	1	-1
e-	e-	v	0	0	0	S3	S3	S3	-2	-1	-1	0
u-	u+	e-	1	-1	0	A3	A3	S3	-1	-2/3	2/3	-1
d-	u-	e-	1	-1	0	A3	A3	S3	-2	-1/3	-2/3	-1
d+	d-	e-	1	-1	0	M3	M3	S3	-1	1/3	-1/3	-1
e-	v	v	0	0	0	S3	S3	S3	-1	-1	0	0
u+	u+	u+	1	2	3	A3	A3	A3	2	2/3	2/3	2/3
d+	u-	u-	1	2	3	A3	A3	A3	-1	1/3	-2/3	-2/3
v	u+	u-	1	-2	-3	N0	A3	A3	0	0	2/3	-2/3
d+	d+	u-	1	2	3	A3	A3	A3	0	1/3	1/3	-2/3
v	u+	d+	1	1	2	N0	A3	A2,M2	1	0	2/3	1/3
d+	d+	d+	1	2	3	A2,M2	A2,M2	A2,M2	1	1/3	1/3	1/3
v	d+	d-	1	2	1	N0	M3	A3	0	0	1/3	-1/3
v	v	v	0	0	0	S3	S3	S3	0	0	0	0

22.1.29 *List A6*

Examples of the only 6 symmetric 2-ring mass sizes, if each ring type is a different size.

ring A	ring B	Group Col A	Group Col B	Ring Type A	Ring Type B	Total Charge	Sym'y A	Sym'y B
v	v-	-1	1	X	X-	0	A2	A2
d+	d-	-1	-1	X	X-	0	A2,M2	A2,M2
u+	u-	-1	1	X	X-	0	A3	A3
d-	u-	1	-1	X-	Y-	-1	A3	A3
e+	e-	1	-1	X	X-	0	S3	S3
e-	v-	1	-1	X	Y-	-1	S3	S3

For an added symmetric lepton to make a symmetric 3 ring, there are 10 different 3-ring masses

23 *Section 5*

This is a look at the quantisation of gravitational orbits. It is written from a conventional viewpoint that expects orbits to have net energies.

24 The quantization of gravitational orbits

Gravitational orbits are shown to be quantized into units of $h/2\pi$ with identical relationships between the equivalent of the principal quantum number n and the velocity v and separation r as those found in quantum mechanics. Where $v_e = \alpha c/n$ and $r_e = a_o n^2$ in quantum mechanics, the gravitational equivalents are $v_g = v_\alpha c/n_g$ and $r_g = k n_g^2$ with the normal quantum mechanical angular momentum relationship $nh/2\pi = m_e v_e r_e$ replaced in the gravitational system by $n_g h/2\pi = m_x v_g r_g$.

24.1 *Background*

Physics is generally divided into two realms, the classical and the quantum. The difference is usually defined by whether the orbital systems have energies that differ by discrete quanta or vary continuously. Quantum orbitals can be described as having energy levels that are proportional to a principal quantum number. Classical orbits are supposed to have no such proportionality. This paper will show that the distinction is false and that all orbits are quantum in nature, regardless of how difficult this may be to observe in practice.

24.1.1 *Quantization of Orbits*

In order to show the quantization of orbits for both gravitational and quantum systems, it is necessary to start from a consideration of what it means to be in orbit. Currently the expectation is that each orbit is associated with an energy [1]. This paper shows that the actual requirement is that each orbit contains no energy of motion and potential in total. A particle cannot leave the stable orbit it currently exists within because it has no energy to do so. There are two different routes to this zero energy orbit, one from the gravitational standpoint, and one from the quantum mechanical standpoint and although they end up the same, the reasons why they do so are different.

24.1.2 *Gravitational Orbits*

What has been missing from all consideration of gravitational orbits before, paradoxically, considering how many energies have been considered, is the spin energy of the particles or bodies [2]. Where particles are being considered that are small and spin energies can be identified, then the spin energy is already included [3]. Where the bodies under consideration are large, no account at all has been made of spin energy because it has been considered not to have any effect. But the size of the spin energy of an electron is exactly the same size as its mass energy.

This can be shown simply because the spin of an electron is $\frac{1}{2}h$ and its frequency, the wave equivalent of its mass energy is w, so that it has energy $E_{spin} = \frac{1}{2}hw$, although it tends not to be stated so simply [4]. This same energy is called the electron's mass energy $E_{mass} = m_e c^2$. This equality can be derived from a consideration of the effect of relativity on a Planck mass body in motion. For simplicity an adjusted Planck unit is used that is based on the properties of Planck mass size M_o and Planck charge size Q_o respectively, where $M_o = \sqrt{hc/G} = Q_o c/\sqrt{G \times 10^7}$ rather than the more usual use of $h/2\pi$ in producing a smaller Planck-related mass M_p. Also affected is the Planck length, where $r_o = h/(M_o c)$ rather than the more usual $r_p = h/(2\pi M_p c)$. M_o , Q_o and r_o are part of what is termed here the Adjusted Planck Unit (APU) system. This starting system is used in order to eliminate the 2π factor that would otherwise clutter the consideration.

The apparent energy of the Plank mass is increased relativistically by relative motion, exactly the same as normally describes the energy increase of a normal particle. The factor $l_x = [(1-v_x^2/c^2)^{-0.5}-1] = [\gamma_x-1] = [(1-w_x/w_o)^{-0.5}-1] = [(1-r_o/r_x)^{-0.5}-1]$ refers to this increased energy effect on the mass, where v_x is the velocity and w_x the angular frequency rotation in a system. The system is not defined here, but the relationships, using $M_o c^2 = hw_o$ are:

$$E_{relativistic} = l_x M_o c^2 \simeq \frac{1}{2} M_o v_x^2 = m_x c^2$$

and

$$E_{relativistic} = l_x M_o c^2 = l_x h w_o \simeq \frac{1}{2} h w_x$$

Where the particle is an electron, the properties would reflect this as m_e and w_e respectively.

So the size of spin energy in a system is the same as the mass energy. The reason why in larger masses there are no obvious spin-gravitational effects is because the spins of all the particles that compose the body are not aligned. Where there are few enough particles, or a very strong alignment, then the spin-gravitational energy will matter, and that is what defines a quantum mechanical orbit. It is not the quantum nature of the orbits that differentiates a 'quantum' orbit from a gravitational one, it is instead the relative strength of the overall net spin energy when compared with the mass energy.

This can be shown by considering the potential and motional energies present in a gravitational orbit. The assumption is that 'gravitational' means that the spin energies of all the component particles that make up the gravitational bodies do not align along one axis and that antiparallel aligned spins repel, parallel aligned spins chase and perpendicular spins have no interaction. The energy balance, showing the spin-motional energy in the same terms as the mass-motional energy, will be

$$E_{grav-attraction} - E_{spin-repulsion} = E_{motional-mass} + E_{motional-spin}$$

$$GM_a M_b/r_y - 0 = l_y M_a c^2 + l_y M_a c^2 \simeq \frac{1}{2} M_a v_y^2 + \frac{1}{2} M_a v_y^2$$

$$GM_a M_b/r_y \simeq \frac{1}{2} M_a v_y^2 + \frac{1}{2} M_a v_y^2$$

which is the usual gravitational formula but with the addition of the extra energy of motion due to the spin energies of all the particles making up the body. The two sides are equal and the body is in a stable orbit, with the same formula as the force formula if both sides are divided by r_y thus

$$GM_a M_b/r_y^2 = M_a v_y^2/r_y$$

What is measured as the negative net energy of the orbit is the missing part, due to the spin energy also in orbit, but not being considered or measured. It does not matter in the gravitational system what the alignment of the spin energies within the orbiting body are, the motional energy that matters is due to their being in motion. Obviously the framework here is that of a reduced mass system.

24.1.3 *Charge Orbits*

Now the consideration can be made of what energies are present in orbits that are held together by charge. The same energy balance is considered as before, but this time all possible energies are present, including spin-gravitational

energy, because the bodies in orbit are made up of few components and are likely to have aligned spin axes. The spin-gravitational energy is represented as if it were the masses of the particles, here electron and proton, because it is the same size, although can be considered opposite in action to the mass-gravitational energy when spin axes are aligned:

$$E_{gravitational-attraction} - E_{spin-repulsion} + E_{charge-attraction}$$

$$= E_{motional-mass} + E_{motional-spin}$$

$$Gm_em_p/r_e - Gm_em_p/r_e + q_aq_bc^2/(10^{+7}r_e)$$

$$= l_em_ec^2 + l_em_ec^2 = \frac{1}{2}m_ev_e^2 + \frac{1}{2}m_ev_e^2$$

$$q_aq_bc^2/(10^{+7}r_e) = m_ev_e^2$$

This is the usual formula for a quantum orbit using the force or angular momentum equations, ignoring quantum numbers, and includes the factor 10^{+7} that is required to align SI units of mass and charge together. The energy equation, as for the classical, doesn't include spin and reverts to $E = \frac{1}{2}m_ev_e^2$ for the orbitals because it works, not because it obviously describes a state of zero energy of motion and potential. But spin-motional energy cannot be ignored, because it is the same size as the mass-motional energy. The motional energy of charge has no effect on the mass energy balance and appears as the orbital magnetic moment $Eq = (\gamma_e - 1)qc^3 \simeq \frac{1}{2}qcv_e^2 = \frac{1}{2}qcv_er_ew_e = \mu_ecw_e$ where $\mu_e = (\gamma_e - 1)qc^2/w_e \simeq \frac{1}{2}qv_er_e = \frac{1}{2}qh/m_e$.

24.1.4 *Comparing quantum orbits*

The two formulae for charge and gravitational orbits are now in a similar form and their parameters can be compared to see how they are related. Using the principal quantum number n for the charge side in $nh/2\pi = m_ev_er_e$ and initially assuming n_g for the mass side in the initially assumed relationship $M_av_yr_y = n_gh/2\pi$ as a starting point for the gravitational side since it works for charge, the comparison can be followed line by line, starting from the energy equations

$$q_eq_pc^2/(10^{+7}r_e) = m_ev_e^2 \text{ and } GM_aM_b/r_y = M_av_y^2$$

$$q_eq_pc^2/10^{+7} = m_ev_e^2r_e = v_enh/2\pi \text{ and } GM_aM_b = M_av_y^2r_y = v_yn_gh/2\pi$$

The two formulae need to be reduced further using the relationships $q_e = q_p = \sqrt{\alpha/2\pi}Qo$, $M_a/M_o = M"_a$ and $M_o = \sqrt{hc/G} = Q_oc/\sqrt{G10^{+7}}$ to become

$$\alpha hc/2\pi n = v_eh/2\pi \text{ and } GM_aM_b = v_yn_gh/2\pi$$

so that the two velocities can be identified as

$$v_e = \alpha c/n \text{ and } v_y = 2\pi GM_aM_b/hn_g = 2\pi M"_aM"_bc/n_g$$

In order to find the value of the base parameters for the gravitational system, using, for example, v_α instead of α and k instead of a_o for the Earth/Sun system, the same parameters are identified in the quantum system by setting $n = n_g = 1$ thus

$$1/2\pi = m_e\alpha ca_o \text{ and } M_av_\alpha k = 1/2\pi$$

which gives the values of $v_\alpha = 7.5156 \times 10^{78} ms^{-1}$ and $k = 2.3489 \times 10^{-138} m$ only consistent with using one value of n_g when using the observed average values for the velocity and distance of the Earth around the Sun [5]. These may seem improbable numbers since they are above light speed and less than the Planck distance respectively, but these parameters represent what the case would be for two bodies, Earth and Sun here, at $n_g = 1$ although this could never be the case. In this instance the value of the principal quantum number, based on the accepted values for Sun and Earth is $n_g = 2.5236 \times 10^{74}$.

The relationship for such bodies as the Earth and Sun can be described, in quantum terms as

$M_a(v_\alpha/n_g)(kn_g^2) = n_g h/2\pi$

which is exactly the same as the quantum relationship although with different base parameters for velocity and distance. The initial assumption has been shown to be consistent. This relationship is dependent on the masses of the two bodies in the system, rather than being a universal ratio as is the case for charges and charge bound systems. However, the quantum nature of gravitational systems is clear.

The principal quantum number n_g also sets a limit on the number of particles in the larger, lower velocity, body because in a reduced mass system each single component particle in that body - the electrons, components of protons and neutrons etc - will have only $h/2\pi$ angular momentum - the minimum that the components in the system can have and still have angular momentum with respect to an external body. Just using the volume of the Sun at its average density as being filled with protons and electrons in equal numbers gives a figure around 2×10^{57} as the number of particles in the Sun, so there is sufficient scope for this number to be too low and yet the limitation still be true when compared with an $n_g = 2.5236 \times 10^{74}$.

24.1.5 *Conclusions*

Although the value of the principal quantum number in a gravitational system is nice to know, it is not a fixed value in the same way as in a charge bound system that requires photons of specific energies to shift electrons from level to level. Because the Sun is continually emitting energy, and the Earth picks up matter as it travels in its orbit, the system is not stable in the same way. The masses of both bodies are continually changing and the value of n_g will be continually changing. However, the orbit that the two bodies would share, if the masses were stable, is a quantum orbital that changes by quanta of $h/2\pi$ from one level to another. At the current estimate of n_g the values of angular momentum available to the system may appear to be continuous, but they are not.

24.1.6 *References*

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25 *Section 6*

This looks at reduced mass systems and their energies. It is written from a conventional viewpoint that expects orbits to have net energies but adding the internal spin energy of the masses.

26 Reduced Mass Mechanics

It is apparent that the use of reduced mass systems is wrongly done. The assumption underlying a reduced mass system is that a change of frame of reference in an orbital system to a stationary central particle with only one moving particle can simplify the solution. This ignores the basic conservation of energy and angular momentum in the situation.

Starting from the most basic state, for a gravitational only system, we can say that:

The energy of each particle when stationary would be

$$E_{A-stationary} = m_A c^2(1 - Gm_B/rc^2)$$

and

$$E_{B-stationary} = m_B c^2(1 - Gm_B/rc^2)$$

These are not equal, so need to move relatively in order to form a stable system.

The energy of each when moving will be:

$$E_{A-moving} = m_A \gamma_A c^2(1 - Gm_B/rc^2)$$

and

$$E_{B-moving} = m_B \gamma_B c^2(1 - Gm_A/rc^2)$$

The energy difference between these two states for each will be:

$$E_{A-difference} = m_A c^2(\gamma_A - 1)(1 - Gm_B/rc^2)$$

and

$$E_{B-difference} = m_B c^2(\gamma_B - 1)(1 - Gm_A/rc^2)$$

So the energy available to the orbiting particles will be reduced by their own mass energies and by the difference in potential energies (the latter not being available initially):

$$E_{A-available} = m_A c^2(\gamma_A - 1)(1 - Gm_B/rc^2) - m_A c^2$$

$$-(Gm_A m_B/r - \gamma_A Gm_A m_B/r) = m_A c^2(\gamma_A - 1) - Gm_A m_B/r$$

and

$$E_{B-available} = m_B c^2(\gamma_B - 1)(1 - Gm_A/rc^2) - m_B c^2$$

$$-(Gm_A m_B/r - \gamma_B Gm_A m_B/r) = m_B c^2(\gamma_B - 1) - Gm_A m_B/r$$

These two amounts must be equal in the following system:

Ao————————x—O B

Two bodies, A smaller and B larger separated by distance r, are rotating around a point x between them. The energies of A and B are given by the available energies

$$E_{A-available} = m_A c^2(\gamma_A - 1) - Gm_A m_B/r$$

and

$$E_{B-available} = m_B c^2(\gamma_B - 1) - Gm_A m_B/r$$

And these energies are equal so that the kinetic energy of each will be

$$E_{kinetic-energy} = m_A c^2(\gamma_A - 1) = m_B c^2(\gamma_B - 1)$$

But we need to include the internal spin energies of the masses, which are equal in size to the masses, and consider the spin potential energies between the two masses. If we assume that the spins of all the particles making up the mass are not aligned, then the effect of their potentials will be much smaller than that of the gravitational potential, so we can ignore that contribution. In a small system where orientations are constrained, this will not necessarily be the case.

So now the amount of kinetic energy is doubled, because the contributions of spin kinetic are added to the mass kinetic energy to give

$$\begin{aligned} E_{spin-and-mass-kinetic-energy} &= 2m_A c^2(\gamma_A - 1) \\ &= 2m_B c^2(\gamma_B - 1) \end{aligned}$$

And for each particle to be in a stable orbit

$$E_{new-A-available} = 2m_A c^2(\gamma_A - 1) - Gm_A m_B/r = 0$$

and

$$E_{new-B-available} = 2m_B c^2(\gamma_B - 1) - Gm_A m_B/r = 0$$

so that

$$2m_A c^2(\gamma_A - 1) = 2m_B c^2(\gamma_B - 1) = Gm_A m_B/r$$

The distance from point x is incorporated in the γ factor for each mass, since

$$\gamma = (1 - v^2)^{-0.5}$$

and $v = rw$ so x can be any point along the line between the two masses, except at the end points where $v = 0$ for either mass. So a reduced mass system effectively assumes an infinite mass for the centre of system particle, which can never be the case.

The reduced mass system here is based on ANY point x between the two masses, and at each point the energies of the two masses are equal to each other, although they vary in size and the frequency of rotation w is the same. Therefore such a system can only be valid if the energies of the two masses in motion are equal and opposite, with their sum remaining at zero. So it is necessary to treat the system as having positive and negative directions and positive and negative vector energies. We need to choose a direction for the positive energy of motion which in this system will

be outwards away from x. The potential energy will be defined as negative, so that the totalmotional and positional energy of the system will be zero at all times, even though the two masses are in orbital motion. Consequently, the resulting reduced mass system can take any value for x and the energies of the two particles, and all are equally valid.

It must also be the case that $m_A m_B = m_X m_Y$, where m_X and m_Y are the reduced masses in the frame of reference of point x. From these equations, there are many other relationships that can be deduced between γ_A, γ_B, m_X, m_Y, m_A, m_B and r. Examples are

$$m_A \gamma_A = m_X \gamma_X$$

$$m_B \gamma_B = m_Y \gamma_Y$$

$$\gamma_A = G m_B / 2r + 1$$

$$\gamma_B = G m_A / 2r + 1$$

$$\gamma_A / \gamma_B = (m_B + 2r/G)/(m_A + 2r/G)$$

The basic outcome is that it is still not possible to pin down one mass to produce a reduced mass system, because that requires the centre of system mass to be infinite.

Adding charge into the system increases the complexity because the point x will be influenced additionally by the relative sizes of the charges and masses. The change can be made simply enough by replacing the gravitational potential energy by the combined charge and mass potential energy. Simplification is complicated because there are no mass or spin factors in the charge potential energy.

This indicates that the use of a reduced mass system is not as simple as is usually portrayed and more work needs to be done to look into its utilisation.

27 *Section 7*

This section looks at four different phenomena that are explained as being due to the same underlying action of skipping. It also considers many of the different aspects that the ring framework has relative to other interpretations of quantum mechanics and shows how measurement is not what affects the particle, but is what affects the shell on which the particle exists. It uses a conventional framework where particles and orbits have energy.

28 Fractional Quantum Hall Effect, Entanglement, 'Electrinos' and Electron Orbitals – Different skins but the same Quantum Mechanics animal underneath?

FQHE, entanglement, 'electrinos' and electron orbitals do not at first sight seem to be related phenomena, but a reinterpretation of the underlying principles of Quantum Mechanics shows how they may be the same actions at work, viewed from different perspectives. The reinterpretation involves accepting that entangled particles and particles in quantum states exist simultaneously within no-time space as well as 'normal' space/time; and that these particles can 'skip' randomly and non-locally between positions in normal space/time which are coincident with the no-time space. Measurement causes the collapse of the no-time space and leaves the particles stuck only within normal space/time and subject to Lorentz invariance.

28.1 *Quantum Mechanics*

There are many different interpretations of, or approaches to, Quantum Mechanics (QM). The mainstream one is the Copenhagen variant that posits indeterminism, Bohr's correspondence priciple, Born's statistical interpretation of the wave function and Bohr's complementarity interpretation (1). The de Broglie-Bohm theory (BB) is a hidden variables interpretation of quantum mechanics, with a pilot-wave and hidden variables (2). More interpretations will be examined as the paper progresses, but all interpretations contain the inherent concept of non-locality and try to treat the measurement problem in different ways.

This paper sets out to show that each of the different approaches or interpretations, other than the Many Worlds interpretation (3), can be broadly reconciled to each other by subtly redefining certain aspects of each, although such redefinitions do have secondary effects on the lower order predictions of those interpretations, such as making the redefined BB theory non-deterministic even before considering interaction with the measuring apparatus. The result is a a single novel interpretation of QM that can provide a basis for understanding what QM actual is, and how the phenomena of FQHE, entanglement, electron shells and electrinos can be different manifestations of the same underlying physical reality in action.

28.1.1 *Hypothesis*

We start with the underlying outline of what will be called the 'Skipping' hypothesis.

A The presumption is that all the particles we call fundamental are actually real and exist.

B The particles also possess real objective properties of spin, charge, mass and energy, the latter, for example, in the form of positional or motional energy relative to some other real particle (but what the value of each such energy separately is not definable except after measurement), regardless of whether a measurement has been made or not.

C These particles can exist in two space/times simultaneously – one of which is our own 'normal' space/time and the other is the space of the particle itself, the volume or volumes that it is allowed by its relative energy to occupy, where

there is no time and no distance – called 'no-time space'. Where more than one particle shares the same no-time space, they are entangled.

D Each particle, when possessing specific levels of a property with relation to another particle, for example an electron being in a specific orbital around an atom, occupies all of the orbital as no-time space, the space effectively composed of a number of allowable particle positions, each of which is part of the no-time space available to the particle to occupy, the whole orbital volume called 'allowable space'.

E A perturbation of sufficient size which changes, for example, the energy of the orbital so that the particle can no longer remain within the orbital makes the allowable space collapse down to the physical extent of the particle - from the whole orbital down to its own physical extent which is the only volume that it can now occupy at that energy (when done deliberately a 'measurement') and at a position and velocity product corresponding to the particle's energy.

F The QM motion of a particle, for example an electron within its orbital, is not proper motion in normal space time.

G The electron skips from point to point within the orbital, taking no time to change position, because in allowable space there is no time or distance.

H The energy that the electron possesses is precisely the amount that allows it to remain in that orbital, and that orbital shape represents the volume of normal space in which an electron of that energy can be found.

I The orbital affects where the electron can be but the electron does not affect the extent of the orbital.

J The skipping from point to point is completely random.

K The properties of the electron at any specific point within allowable space represent the fraction of normal time spent at that point relative to the total time spent in the orbital. The sum of those properties across the whole orbital represents the total properties of the particle.

L Some of these properties, such as charge and mass, can be observed in total without needing to know exactly where in the orbital the electron is situated. Other properties, such as position within the orbital, require measurement.

M When a measurement is made, the position of the particle is instantaneously fixed within the orbital at whichever point it occupies at that moment, with velocity appropriate for the particle's energy (although these cannot be observed separately).

N It is the measurement of the orbital that happens, not the particle.

O The orbital and particle are separate entities, even in the case of a photon, where its wavefunction is the equivalent of the electron orbital. So the position of the electron is undetermined within the orbital until a measurement is made, at which time it stops skipping from point to point.

P The motion of wavefunctions and orbitals, particles not in orbitals, or composite particles which contain orbitals but are themselves not in orbitals or whose wavefunction is moving, are subject to Lorentz invariance (4) and move subject to general relativity.

Using just these foundations, it is possible to construct a 'how it happens' theory on the observations of quantum mechanics. The dividing line between QM and relativity can be defined by looking at the relative energies of each system, but this is not covered here.

28.1.2 *Comparisons*

Each QM aspect can now be subject to interpretation using the skipping hypothesis and compared with the main interpretations of QM. The following is written as if the skipping interpretation is definitely the case, rather than in the conditional tense, for which apologies are made in advance.

Non-locality

It can be seen that skipping is non-local because the motion from point to point within the allowable space happens without proper motion, which is the foundation hypothesis, parts F and G. As will be shown later, under "Proof" below, this aspect should allow confirmation of the skipping interpretation to be made experimentally. All the QM interpretations are non-local (5).

Quantum orbitals

The electrons must have well defined energies in orbitals in order for there to be specific volumes for them to skip between. The addition/removal of energy to/from electrons allows the electrons to skip from one orbital to another – without proper motion between orbitals, and only specific energy photons enable skipping to other allowable orbitals. All the QM interpretations contain quantum orbitals (6).

Random Transitions

The nature of random skipping, hypothesis part J, does not allow prediction of when a transition between orbitals will happen, nor how. All QM interpretations contain randomness (7).

Transition Gaps

The only photons that enable transitions between orbitals are those with the correct energy to allow the electron to begin and end in an orbital. All QM interpretations contain transition gaps (8).

Projection/Collapse

De Broglie-Bohm, Many Worlds and Modal interpretations of QM deny the projection postulate, that upon measurement of a physical system, its state will collapse (9). Skipping differentiates between the collapse of the allowable space that a particle can occupy and the state of that particle. There is not one state that a system as a whole possesses which can collapse. A system is made of two parts – the allowable space (for example, an orbital or a wavefunction depending on the system) and the real particle. The real particle occupies all parts of the allowable space, but skipping from position to position. When the allowable space is perturbed, the particle 'drops out' where it happens to be at that instant in normal space because the allowable space is no longer allowable to the particle. It will then occupy a specific point within the volume of the old allowable space, in normal space, but the old allowable space is no longer there for it to skip about. If there are other allowable spaces for it to skip between, with the energy that it then possesses, it will do so. Because the particle itself has not changed energy, the energy it will be measured to have will be an allowed eigenstate of the whole system, just as they were in the allowable spaces – and as Dirac (10) postulated. So these no-projection interpretations are correct if the state to which they refer is the real particle, but there is definitely a collapse of part of the system.

Collapse Theories

The addition of non-linear and stochastic terms to the normal dynamical formulation of QM to take account of the two stages of before and after measurement results in theories of collapse, of which the best known is due to Ghirardi, Rimini and Weber (GRW) (11). Skipping probably requires a similar treatment, although the reason is different. The collapse of the allowable space is a separate process to the random skipping motion of the particle, although the maximum extent of the position of the particle is defined by that allowable space. However, the motion of the particle, skipping around the allowable space, does not lend itself to other than probabilistic interpretation of position. The defining line between an event causing collapse and not-causing collapse is inherent in all QM interpretations involving some form of collapse (12). Skipping also faces that problem. As mentioned below, the question of how much is enough is not covered here.

Dynamics

The von Neumann-Dirac interpretation requires that a system evolves continuously with linear deterministic dynamics and on measurement instantaneously either has or has not got the property being measured (13). The latter aspect depends on when and where the measurement is being made within the orbital relative to where the particle is at the moment skipping stops as a result of that measurement. If the orbital is collapsed and the particle is at a point away

from the measurement point or in a state that has a zero value for that measurement property, then the measurement will be close to zero (and may not be sufficiently large to be measureable by the measurement apparatus) or zero for that property. Where the measurement is coincident with or close enough to the particle's position on orbital collapse, then the measurement will have a value. The particle always has its properties, it is only a case of whether they are observed and the value of that observation when a measurement is made. However, the evolution of the system is not continuous, because the particle randomly skips within the allowable space, when considering the position of the particle. What is continuous is the evolution, motion or movement of the whole allowable space. A complete waveform in motion with a photon is continuous and linear in its motion. So provided the definition of the system that needs to be continuous is not identically the same as the instantaneous-value system, the von Neumann-Dirac interpretation is correct.

Mixed States

The Everett proposal, that there is no collapse and no instantaneous-measurement, leads to the Many Worlds interpretation (14). Skipping can say nothing about the existence of many worlds, but does requires instantaneous-value measurements.

Pilot Waves

The de Broglie-Bohm interpretation (BB) is a pilot wave model (15). It is closest to skipping of all the QM interpretations. However, the BB interpretation is a hidden variables interpretation, which skipping is not. Skipping has no guiding equation specifying the position of a particle 'within' an orbital or its wavefunction.

Skipping says that the particle occupies all points within its orbital or wavefunction over a sufficient time period, randomly skipping between points. There is no precise point that the particle can be identified as having until the skipping stops on measurement. For a photon emitted from a source, the position of the photon is at some random point on the shell representing its distance travelled since emission in all directions. There is no identifiable path that the photon takes from source to observation point. It is a random walk around an expanding shell. The nature of the allowable space that this represents, as no-time space, means that the instant before measurement, the photon could have been occupying a point a diameter away in the opposite direction away from the source. The photon moves in its allowable no-time space that is represented by a shell of normal space/time until the shell is observed, when the photon becomes constrained in normal space/time at its last occupied point on the shell. It is the expansion/motion of the shell that is influenced by other masses. If the BB interpretation used the allowable space shell, with its random particle positions, rather than a pilot wave, then it would be correct.

Determinism

Skipping is non-deterministic, because of the randomness of the skipping of particles. Unless skipping is non-random (which we would never be able to measure because nothing is measureable until after skipping stops), there can be no determinism with our fundamental particles within a QM system. Only when at the level of particles moving outside orbitals or wavefunctions, will there be a measure of determinism. All QM interpretations are non-determistic, except BB before mixing with the measuring apparatus (16).

Measurement Apparatus Mixing

The BB interpretation suggests that by invoking randomness in the measuring apparatus, the BB interpretation can be deterministic, but the result non-deterministic (17). Such an argument can never define the limits of the measurement, except to include the whole universe as part of the system being measured. The limits on measurement depend on the size of the energy differential between an allowable space, the particle occupying that space and the energy used in the measurement, is not covered here.

Probability

The randomness inherent in skipping gives rise to probability distributions of property values over the allowable space, as do all QM interpretations (18).

Decoherence

Decoherence concerns how a system changes from being a QM system to being a classical one through spontaneous interaction between the system and the environment (19). This is related to how much of an interaction is enough to be a measurement, either deliberately or accidentally, which disturbs the QM system. This is again a question of relative energies and is not covered here.

Spin

In a Stern-Gerlach experiment (20) the allowable space, here a discrete wave packet, of a spinor-valued particle directed towards the magnet splits into separate volumes as it goes through the apparatus and the particle continues skipping between the separated volumes until a measurement is made.

Value Definiteness (VD)

The Korchen-Specker (KS) theorem provides powerful arguments against a hidden variables (HV) interpretation of QM (21). Skipping is not a hidden variables theory, but it is important to show that it is possible to have value definiteness, since this is one of the HV premises, and a variation on VD underlies skipping. The usual definition for VD is that all observables defined for a QM system have definite values at all times (22). The difference in skipping is that it is only the basic properties of the particles that have definite values. The basic properties are spin, charge, mass and positional and motional energy relative to another particle. The positional and motional energies are such that the particle can occupy certain allowable spaces, but what the value of each energy is separately is not definable except after measurement, when the skipping stops and specific values of position and motion are then set. So if the definition in VD is altered to account only for those basic particle properties, then VD does not need to imply any hidden variables.

Noncontextuality (NC)

This is closely linked to VD, and says that if a QM system possesses a property, then it does so independently of any measurement context (23). Once more, defining the QM system only to be the basic particle properties, NC can be correct. The particle in its allowable space has an independent reality from its being measured, but because it is skipping, the actual value or split of these over that space is not defined and cannot be known and only probabilities can be recovered. At each point, which the particle occupies in normal space/time for a fractional time period as it randomly skips within no-time space, it has a definite charge, spin, mass and positional/motional energy. The energy is the same everywhere, as are the charge, mass and spin (for instance in an orbital) and the sum of the products of these and fractional times over all positions within the allowable spaces is the total value of these properties for the particle. So the KS theorem is correct except when considering the QM system as real particles skipping within allowed no-time space. And the KS theorem does not forbid HV theories with that redefinition of QM systems.

Lorentz Invariance

All QM interpretations, being non-local, are incompatible with special relativity and Lorentz invariance (24). What skipping implies is that the two space/times that a particle inhabits within a QM system should be considered differently. When skipping stops, the allowable no-time spaces collapse to the physical size of the particle. This effect is instantaneous and non-local. The no-time spaces and their collapse are QM systems. After collapse the 'naked' particle inhabits normal space/time and is subject to normal constraints on motion from place to place. So it is possible to imagine a hierarchy of systems and subsystems where the motions of particles within each system depend on their relationships with each of the two space/times. A molecule accelerated to close to light speed is unlikely itself be in a quantum relationship with another larger system, but the electrons in orbitals within the molecule's constituent atoms will be skipping amongst no-time spaces in quantum relationship with those atoms. To understand where the line between QM and special/general relativity lies, it is necessary to understand what energy is. This is not covered here.

Correspondence Rule

The principle that values in domains of large quantum numbers should approximate classical results has guided all QM interpretations (25). As will be shown below, FQHE may be another area, in addition to electrinos, where quantum

values extend into a physical size large enough to be accessed in a classical fashion and skipping provides a novel interpretation of the fractional nature of the phenomenon.

Complementarity

The interpretation of objects as both waves or particles, depending on how they are measured is a foundation of all QM interpretations (26). What skipping implies is that, in the QM domain, the two aspects are separate but linked. The wavefunction of a particle or the orbital it occupies is the allowed space that it can occupy. The particle occupies all the outer shell of the wavefunction or volume of the orbital, randomly skipping within the allowable space. When the orbital or wavefunction is perturbed sufficiently, the particle stops skipping and the particle is either observed (measurement close enough) or not. When no measurement is made, the particle continues skipping and the wavefunction travels along all allowable paths, causing interference and other wave-like phenomena, or the orbital remains occupied by the particle with undefined properties. The orbital or wavefunction define where the particle can exist, and develop smoothly until measurement. The particle does not affect the orbital, but cannot be measured whilst the orbital exists.

Superposition

A superposition is usually considered to be a mixture of all the possible states of a particle in a system (27). A particle such as a skipping electron can be considered mathematically to be in a superposition of all the different positions within an orbital that are allowable, as an average over time. But there is no mixture of positions and no superposition – only the particle randomly skipping, whose average position and properties look like a superposition. At each position it has definite values for a fractional time, but over a sufficient period these sum to the total value of the properties of the electron. The time-averaged position of where the effect of a property such as the charge of a particle on another particle is located will be at the center of a symmetric orbital, over sufficient time.

EPR Paradox

The separation of two entangled particles, usually photon split into electron and positron, too far apart to allow signaling, seems to allow simultaneous contradictory measurements (28). The paradox is solved by using skipping. The photon continues to be a no-time space, even when split into two separate parts at large separation. The electron is randomly skipping between the two spaces, with the positron doing the reverse simultaneously. So no two measurements made on both spaces can ever be made 'simultaneously' to find one space in a superposition of electron and positron and the other space with a definite particle present. The 'superposition' is just the average of the random skipping of the two particles, which are always one in one space and the other in the other space. There is no superposition of both simultaneously in both places and so no paradox. But until a measurement is made, any macroscopic measuring apparatus cannot register the difference between a superposition (partly both in both, but not the case anyway) and a random average skipping (always one in each, swapping continually but randomly). The break here comes when the randomness decays to meet the minimum timescale over which the apparatus can register a result of one or other being present, either wholly for a time or large enough trigger on a biased average. Only on measurement or randomness reduction (which may be a factor leading to the equivalent of an automatic measurement) will a result be obtained. As for Schrodinger's poor cat (29), it is either dead or it is alive, but not both, for there is no superposition.

Bell's Inequalities

Bell's theorem that no physical theory of local hidden variables can ever reproduce all of the predictions of QM, and other similar inequality formulations (30), are correct in that they require QM to be non-local. In the same way that superposition is a valid average interpretation of the skipping of entangled particles over a given time period, the act of skipping in no-time space might appear to be introducing hidden variables, except that these well defined variables at random positions within the allowable space do not give rise to measureable properties except after the skipping stops. Thus no information can be obtained on any variables during skipping except the basic properties of charge and mass. So although skipping may at first appear to be a hidden variables interpretation, it is not, and so skipping is in agreement with Bell's theorem.

It is also important to note that skipping does not imply that, for example between an entangled pair, information is passed non-locally between the pair on each other's states. The actual particles skip around the available spaces, here two separated spaces, so that they are never exchanging information, only places randomly and non-locally.

The motion of entangled particles may be non-local in normal space/time, but they are local in their own no-time space. For them, there is no time taken to pass between the spaces because the spaces themselves are all in contact whilst the allowable spaces exist. These spaces only exist between the entangled particles. Other entangled pairs have their own allowable spaces. As will be shown below for FQHE, where allowable spaces exist, particles can be added or subtracted from the entangled group of particles that occupy those allowable spaces. Addition/subtraction causes the collapse of the initial no-time space, to be replaced by a new no-time space with the new group of CAs within the garden (see below).

28.1.3 *Broken Principles*

The principles which have been broken within a QM system to get to the explanation of QM using skipping are:

1 The principle of time and space within a QM system– although physical objects exist in space and time, they also exist in no-time space under certain conditions. When in the latter they are not localizable or countable and evolution of the system does not take place in normal space and time. Outside a QM system, the principle still stands.

2 The principle of determination within a QM system – It is not the case that every later state of a system is uniquely determined by any earlier state. Outside a QM system, the principle still stands.

3 The principle of continuity within a QM system – It is not the case that all processes exhibiting a difference between initial and final state have to go through every intervening state. Outside a QM system, the principle still stands.

28.1.4 *How Much is Enough for a Measurement?*

It may be that the necessary event for a measurement is an interaction with an 'other' particle, for example, that particle relative to which an orbital exists. So an atom with one electron in an orbital would change the energy of the orbital – which represents the allowable spaces for the electron – if it were perturbed sufficiently. The size of 'sufficient' has still not been pinned down, but what might cause the electron to drop out has been better defined, since the electron energy remains unchanged as the orbital energy changes. At the atomic level, energy perturbations are not far different to classical interaction levels and it may be that the 'sufficient' interaction necessary to collapse a quantum system is a classic interaction. This would mean that no quantum system-to-quantum system interactions would result in collapse. Collapse would only happen on a classic interaction level. Here a 'classical' interaction level means changing energy levels by an amount which does not result in another allowable quantum energy level of the orbital.

However, it has not yet been clarified exactly what energy is and so the question of how much is enough is not open to consideration until that has been defined. This is linked to why some allowable spaces are stationary orbitals and some are moving wavefunctions. What energy is, is not considered here, but what can be said is that a particle in a stable orbit has zero total energy of position and motion. This zero energy state allows no-time skipping, requires no energy for motion, enables allowable shells to exist and external energies which perturb of the shells to collapse the allowable spaces.

28.1.5 *The Four Phenomena to be explained by Skipping*

Electron Orbitals

The position of any electron within an orbital around an atom cannot be specified precisely and the electron does not travel in a defined orbit (31). The only certain aspect is that the electron is somewhere within the allowable orbital volume (32).

FQHE

Fractional charges are involved in the transfer of current (33). Those fractions occur in specific series (34). The current theory is one of Composite Fermions, being composites of electrons (or holes) and either flux lines or vortices at hierarchies of Landau levels (35). For example, two related members of a series are 4/11 and 7/13 (36).

Entanglement

Entanglement is best observed when a photon is split and the component electron and positron removed from each other to a separation which allows subsequent measurement of, for example, relative identity and spin angles to be made fast enough to confirm a non-local relationship (37).

Current interpretations of this effect lean heavily on 'mixed' states, where the particle being measured is a superposition of both the electron and positron and is not defined until measured (38).

Electrinos

These are defined as fractions of an electron that has been split within bubbles, and behave as fractional electrons (39).

28.1.6 *Interpretation of the Phenomena using the Skipping Hypothesis*

Each of the above four phenomena can be seen as a different view of the same underlying skipping in action as follows:

Electrinos

The initial bubble, containing one electron, is split into smaller bubbles. Each smaller bubble represents a probability that the electron occupies it and is part of the allowable space, split into separate parts. The mass and charge properties observable of the electron will be proportional to the size of the bubble. If there are two equal bubbles, each bubble will contain the electron for half the time, having on average half the electron charge and mass. Where there are many small bubbles, one possible method of showing whether this interpretation is true is to destroy one of the smaller bubbles. Then that one part of the allowable space will have been destroyed and the electron will only be able to exist within the bubble that it happened to occupy at that instant. This will cause that bubble to inflate back to the size of the initial bubble, because the size of a bubble is related to how long the electron spends inside the bubble (rather than what fractional part of the electron is there all the time). The electron will have become trapped in that specific smaller bubble, causing it to inflate. This is different to the current interpretation of electrinos which involves fractional electrons.

FQHE

The novel interpretation suggested by skipping is that each electron skips amongst the allowable orbits around the flux lines contained within a specified area (a "garden", see 'A Constant Garden' below). If the garden contains, for example, two electrons and seven flux lines, each electrons spends one-seventh of its time around each flux line and each composite particle, a Composite Anyon (CA), within that garden is made of one flux line and an average of two-sevenths of an electron. The garden contains seven CAs, each an entanglement of one flux line and two-sevenths electrons on average. Adding or subtracting electrons or flux lines changes the identity of the composite particles by collapse and reformation of no-time space within the garden. This interpretation can be shown to be likely because each composite particle will have a fractional value of all the electron properties except magnetic moment. The magnetic moment of all these fractional CAs will always be the same as that of the electron, because the charge and mass fractions will always cancel equally in the magnetic moment formula and actual action.

Electron Orbitals

This phenomena has been used earlier as part of the explanation of skipping, so will only be covered briefly here. Each electron in an atomic orbital is assumed to skip about all the allowable parts of the orbital, effectively those volumes with the same energy. Each electron orbital around an atom represents the probability of finding the electron there.

Higher orbitals have complex probability distributions. The volumes of the lobes of complex orbitals, as a fraction of the total volumes of each orbital, represent how much time an electron will spend in that lobe rather than the other lobes, on average. This lobe fraction will also be the fraction of the electron properties that will be observed within that lobe, on average. This can be confirmed by an experiment to detach a lobe from an atom so that there is no contiguous probability distribution between that lobe and the rest of the orbital. The observed properties of the electrons in the lobe should be precisely proportional to the lobe volume fraction.

Entanglement

The electron and positron split out from a photon and separated are randomly swapping places, each contained within a half of their allowable space (similar to but not the same as the bubble splitting of electrinos). At any instant the electron is in one volume of the allowable space and the positron in the other, but on average they each spend half their time in each. So the superposition interpretation is appropriate, even if for the wrong reason. Only once a measurement is made, that is that the energy of the allowable volume of one particle is changed sufficiently, does one particle become stuck in one volume. The entangled state is broken. The other particle is then forced to remain where it is at that instant. Effectively the volume surrounding the photon is split apart into two volumes of no-time space that remain that way until the energy of either is changed and the electron and positron are stranded in normal space-time. Being no-time space, the skipping will be instantaneous regardless of normal space-time distance between separated volumes. This interpretation is consistent with currently accepted superposition, but explains why superposition exists.

28.1.7 *Quantum Mechanics*

The non-locality of QM is explained by skipping, although skipping does not explain why a particle skips. The action of skipping hints at a deeper level underlying skipping, providing the why as well as the how.

Effectively an electron skipping in an orbital is self-entangled, in that it is switching positions with itself, rather than another particle, which is the case in a split photon. In order to be self-entangled, there must be some underlying structure to the particle. However, it is not as simple as envisaged in the description of electrinos (40). If electrons could be split into smaller, self similar, pieces then since FQHE has larger strength magnetic fields than those electric fields used in the electrino experiments then the resultant fractions ought to be due to fractionation of the electrons. But the fractional series found experimentally shows that the electron would have to be able to split into thirds, fifths, sevenths, elevenths, thirteenths, seventeenths etc (41). This series of prime denominators implies that the electron must fractionate into an infinite number of smaller self-similar pieces. This would surely have shown up in earlier experiments and such an interpretation represents just another level of 'smaller' electrons. The underlying nature of the current fundamental particles, the leptons and quarks, is not covered here.

28.1.8 *Proof – How to show that the Skipping interpretation is true*

Each of the above four phenomena has its own indicator of how the truth may be discerned. However, the overarching feature of each is precision. If the fractions in bubbles, FQHE and lobes of electron orbitals are absolutely precise fractions such as $\frac{1}{2}$, $\frac{1}{3}$ etc, or the properties of particles are absolutely precisely proportional to the volumes of those bubbles or orbitals, then there can be no motion of particles between separated allowable spaces. Such motion would introduce some time spent outside those allowable volumes, smearing out the properties across larger volumes and leading to near-but-not-exact fractional properties for the electrons in those volumes.

Without motion outside allowable volumes, there must be skipping.

28.1.9 *Explanation in formulae - A Constant Garden*

Consider the standard Hall Effect formula for the action of a magnetic field on a current carrying sample

$$M\phi_o = BA$$

with $\phi_o = hc/e$, B the external field, A the area of the sample and M usually the degeneracy of the Landau level, but here termed the number of flux lines present in the sample.

The magnetic field B can be shown to be inversely proportional to the fractions v (usually the filling factor, but here the fractional state), with

$$C = \phi_o/(Bv)$$

Ca sample-dependent constant representing the effective area (not the actual area) of a part of the total area of the sample, called a 'garden'. This formula applies equally to the whole sample and to each individual garden and says that the fractional state v is inversely proportional to the field B, linked through a constant which identifies an area specific to the sample.

The Composite Fermions (CFs) of FQHE are instead interpreted in the skipping hypothesis to be entangled states of electrons and flux lines, whose values of charge, mass and spin are proportional to v, and are thus better described as Composite Anyons (CAs).

The amount of time an electron spends in any one orbital path around a flux line relative to the complete set of paths available to that electron (the latter the 'garden' mentioned above and generally the allowable space for each electron) represents the fraction of each electron's charge and mass that will be observed for each CA within that garden. The orbital path is not the CA, the CA is the time averaged observable of the combination of how many electrons and orbital paths are present in the garden.

So a garden with 2 electrons and 5 orbital paths would be otherwise described as 5 CAs each with $\frac{2}{5}$ charge, mass and spin, that is an anyon with fractional statistics. The whole area A of a sample will be made up of many identical gardens. A garden represents the quantum entanglement of the electrons and the flux lines, which the electrons orbit around. The requirement of non-fractional spin overall for a garden is probably what keeps the garden together.

Any change in fraction is accommodated by a change across the whole garden to all CAs, although local impurities may allow localised areas with slightly different CA states and the speed of change from one fraction to the next may be shown by the steepness of B against R_{Hxx} around each fraction.

Changing the state of the CAs involves either increasing/reducing the magnetic field, which increases/reduces the number of flux lines and thus the number of orbital paths available for the existing number of electrons to hop around, or increasing/reducing the number of electrons hopping around the orbital paths, each, each change of CA identity involving no-time space collapse and reformation.

A CA state with more electrons than orbital paths, which would usually be subject to the Pauli exclusion principle, is allowed because the electrons are skipping about, actually spread over all the orbital paths in the garden, and the CAs themselves are fractional anyons rather than fermions. The state of any CA within the garden is the average of the electron population number over the orbital path number for that garden. Over any reasonable timescale, these will trend towards the same state, although initially on a change of state there will be differences across the garden.

In addition to the fractional features of charge and mass that are observable will be those of magnetic moment and spin. For any garden, the total properties will be the sum of the number of electrons present, regardless of how many orbital paths are available. The magnetic moment of all CAs is

$$\mu = q_{CA}h/(2m_{CA}) = ve/(2vm_e) = eh/(2m_e) = \mu_e$$

the magnetic moment of the electron, where m_e is the mass of the electron, m_{CA} the mass of the CA ($m_{CA} = vm_e$), e the electronic charge, q_{CA} the CA charge ($q_{CA} = ve$) and h Planck's constant.

28.1.10 *Evidence*

The evidence is already in many existing papers. It is possible to estimate the garden size C by using, for example, one paper (42) to provide approximate numbers, arriving at a garden area in that sample of approximately $4 \times 10^{-16} m^2$ leading to an effective area of $6.2 \times 10^{-8} m^2$ since the constant ϕ_o/C obtained in that paper is $9.2 W m^{-2}$. Other papers arrive at different constants ϕ_o/C as follows $4.14 W m^{-2}$ (43), $5.8 W m^{-2}$ (44), $5.3 W m^{-2}$ (45), and $4.13 W m^{-2}$ (46). The value of C for different samples can be simply calculated from the relevant graphs of B against R_{Hxx} as the points of minimum B multiplied by the fraction at that point. So for example, in the Pan et al. paper (46), the estimate of the $\frac{2}{5}$ fraction read off the graph is $B = 10.3T$, giving $\phi_o/C = 4.12 W m^{-2}$, or the $\frac{2}{7}$ fraction at $B = 14.5T$ gives $\phi_o/C = 4.14 W m^{-2}$. These ϕ_o/C values are reasonably consistent across each graph for all fractions.

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29 *Section 8*

Is an introduction to Limited General Relativity which explains the limits set on General Relativity by the ring framework. It introduces the unconventional viewpoint that orbits to have zero net total energy. It uses APU and SI units.

30 Introduction to Limited General Relativity and its internal quantum mechanical states in stable orbital particle systems

This is an introduction to the extension of special relativity to produce Limited General Relativity (LGR) based on three initial assumptions. Starting from an equation for the relativistic mass energy of one moving Standard Model particle, the extension of Special Relativity (SR) leads to a single equation for the total mass-related energy of the particle in the vicinity of another particle which includes all the presently accepted separate mass-related energies and predicts one new energy which results in the better alignment of prediction and observation of the excess perihelion shift of Mercury. A novel form of motional energy is proposed which enables states of zero energy of motion and position (ZEMPs) to exist, which form the basis of quantum mechanical energy levels. Based on the structure of that mass-related energy equation, a single equation is developed for total charge-related energy. Each currently accepted separate aspect of charge-related energy is identified as arising from within this single equation. The two equations for the total charge and total mass-related energies are combined into one equation representing the total energy states of a moving particle in a charge and mass field, providing precision beyond the relativistic Dirac equation for the combined fields and predicting anomalous magnetic moments for all orbiting particles. The applicability of the combined equation is examined and extended, within specified limits, to more than two particles and why General Relativity (GR) for composite bodies breaks down at extremes is discussed. Quantisation is shown to arise in both charge and gravitational systems. Quantum mechanics is shown to be based on motion within ZEMPs inside LGR systems. Based on the strictly limited assumptions identified in this paper, no infinities can occur in any system. A novel third way of introducing the concept of relativity is advanced and two new constants of nature are identified.

30.1 *Outline*

The conventional wisdom is that General Relativity (GR) and Quantum Mechanics (QM) are presently incompatible [1]. This paper sets out to show that a specifically constrained form of GR (called Limited General Relativity, or LGR) contains within it the states (of Zero Energy of Motion and Position, or ZEMPs) that define the main elements of QM, and that the extension of these states beyond the stable orbits initially considered can explain more features of QM.

The starting assumption is that GR is too general and does not include charge fields. GR does not identify states in which QM may exist. There are two alternative routes to a less general form of relativity, one is to take GR in its most general form and constrain it and the other is to extend Special Relativity (SR). This paper takes the latter route because charge fields are included and specific energies at specific times naturally occur within SR, whereas GR needs to have a time slice through its 4-vector paths to produce energies of stable gravitational orbits. So the form of LGR, whilst built from SR, can be described as a constrained form of GR, with added charge fields.

QM can be compared with pimple imperfections on the otherwise smooth face of GR. These imperfections are the constraints that define LGR. LGR does not set out to usurp GR, but to show in which circumstances GR needs to be modified to show the pimples. Within these limited circumstances there are two predictions of LGR that differ from SR and GR, one at the atomic and one at the planetary end of the energy scale. The differences are small, but may, in the latter case, be identifiable.

This paper does not set out to cover the whole of the interrelationship between GR and QM, but only to point at a change in interpretation that leads to a new understanding of the interrelation between them. There are changes in current interpretations of other aspects of physics that result from the new LGR interpretation that are not covered here. None of the mathematics is speculative, only the interpretation is novel.

30.1.1 *Route*

This sets out the route that is taken by this paper from current interpretations to its conclusion:

1 Assumptions – the constraints define LGR applicability. Additionally, a description of the use of units and simplifications (for vector notation, reduced mass and ellipses) in this paper.

2 Extension of special relativity by clock adjustments for gravitational fields, applicable over small systems, to produce a formula for the mass-related energy of a two-particle system.

3 Break out of the sub-energies within the energy formula, describing what they represent.

4 Introducing a motional energy which allows the sub-energies to be interpreted differently and is the basis of the ZEMP states that describe QM.

5 Using the mass-related energy formula to undertake the same analysis on a charge-related system.

6 Combining the mass and charge formulae into one formula describing the total energy states of the system and comparing the appropriate part of this favourably to the relativistic Dirac formula.

7 Showing how quantisation arises in the formula and what this means for the energies and angular momenta of the system.

8 A description of how the initial steps introducing LGR could have been taken in a different way and why the 3-vector form used here (although for simplicity kept in scalar notation), rather than the 4-vector form, is appropriate.

9 A three line recipe for going from rest-mass and rest-charge to relativistic energy levels and quantum states

10 Conclusions

30.1.2 *Assumptions*

There are only three assumptions. These serve to limit the maximum energy of a Standard Model particle due to its relative velocity, or to limit the maximum size of a charge or mass field, with respect to an observer. Initially these are taken to apply only to one particle in motion with respect to a second particle that is generating charge and gravitational fields. These limits do not apply to the energies or charges of composite bodies like planets when considered as a whole, but will to their individual Standard Model (SM) components.

1 The maximum observable mass energy of any SM particle in empty space due to its velocity relative to an observer is the Planck energy

$$E_o = mc^2/\sqrt{1 - v^2/c^2} = M_p c^2$$

Where m is the rest mass of the particle, v its velocity relative to an observer, c the speed of light and M_p is the Planck mass. This limit sets a maximum velocity $v_{LGR(m)}$with respect to any observer that any SM particle with mass can travel at as $v_{LGR(m)} = c\sqrt{1-m^2/M_p^2}$. The rest mass of the particle is the mass that it has in a frame of reference in which it is stationary. Were there any SM particles with rest mass equal to the Planck mass, they would not be able to be observed to move with respect to any observer.

2 The maximum gravitational moment due to any Standard Model particle is less than unity $1 > GM_k/rc^2$ where G is the gravitational constant, M_kc^2 represents the total mass energy of the particle generating the gravitational field and r the separation of the test particle from the gravitational field-generating particle.

3 The maximum charge moment due to any SM particle is less than unity$1 > cN_kq/r_kc^2$ for any charged particle k at a separation r_k of the test particle from the charge field-generating particle. The fields of attractively charged particles have the same effect as attractive gravitational fields, whereas repulsively charged particles have the opposite effect, as described later, so that the overall field effect of two charged distributions on a test particle can be described by

$$D = \prod^i(1–cN_iq/r_ic^2)/[\prod^j(1–cN_jq/r_jc^2)]$$

where $\prod$ is the product symbol and $\prod^i(1 - cN_iq/r_ic^2)$ is the total attractive charge field of the i particles generating the charge field that is of opposite sign to that of the moving particle under consideration and $\prod^j(1 - cN_jq/r_jc^2)$ the total repulsive charge field of the j particles generating the charge field that is of similar sign to that of the moving particle. Specifically

$$\prod^i(1 - cN_iq/r_ic^2) = (1 - cN_1q/r_1c^2)(1 - cN_2q/r_2c^2)....(1 - cN_iq/r_ic^2)$$

In empty space the value of D on a test particle will be one, on average, representing no effect. Each product is defined to include all particles from $i = 1$ and $j = 1$ to the maximum number of particles present i and j respectively. In the system described below, for simplicity, only one moving particle of charge cq and one stationary particle of opposite charge Ncq are considered. The representation of the charge field in this way, as cq rather than q, with c in both numerator and denominator of the equation, may seem strange, but it highlights the similarities across the treatment of charge and mass.

This paper uses Planck units throughout, so $c = 1$ PU of velocity, $h/2\pi = 1$ PU of angular momentum and q is the electrostatic charge e/Q_p equal to $\sqrt{\alpha/2\pi}$ PU of charge, where Q_p is the Planck charge of 4.7013 x10-18 C with α the fine structure constant. To convert to SI units, each time cq appears in a formula, the cq appearance must be divided by $\sqrt{G \times 10^{+7}}$ and other variables should be multiplied by the SI value of the appropriate PU variable, so that the mass of the electron m_e is 1.6695×10^{-23} PU of mass and 9.1096×10^{-31} kg in SI units, having been multiplied by the Planck mass 5.4565×10^{-8} kg. Throughout the paper, the charge is identified as cq, rather than plain q, because it can then be directly dimensionally compared in all equations to m.

The use of radius r is a simplification, since for orbitals the motions could be ellipses. But elliptical motion does not change the principal energy levels considered here. As explained later, 3-vector notation is used, rather than 4-vector notation, but additionally this is simplified to scalar notation because directionality is not an issue for energy levels and the only forces considered are radially inwards towards, or outwards from, a stationary central particle.

The use of m within the equations is also a simplification, since the reduced mass $U = mM_k/(m+M_k)$ is more correct in considering energy levels. However the equations would then become very messy, and the values of v and r do not in any case change in the frame of reference of a stationary central particle, which is what is used in this paper – stationary with respect to the universe.

Also used for simplification, $1/\sqrt{1–v^2/c^2} = \gamma$ and each energy formula has dimensions of mc^2 or cqc^2. Later on, the velocity subscripts v_a and v_n , or kinetic energy subscripts E_{KE_a} and E_{KE_n} , will be used to specify, for example, v_a as the original velocity within the system and v_n as the new velocity. Combinations of energies are designated $E_{(xx)}$ and parts of those combinations as E_{XX}.

Although references are generally up to date, some have been deliberately taken from historic undergraduate teaching publications in order to show that the hints on the need for a new interpretation of energy levels have been around for many years, and that the main thrust of LGR only requires a change of viewpoint to be made.

30.1.3 *Foundation - Mass Energy*

The rest mass energy of a particle of mass m at rest E_{RM} is given by

$$E_{RM} = mc^2$$

$$E_{RM}^2 = (mc^2)^2$$

$$E_{RM}^2 = (\gamma mc^2)^2(1–v^2/c^2)$$

The accepted formulation for special relativity [2] without a potential field, being normally written as the relativistic mass energy E_{RR}

$$E_{RR}^2 = (\gamma m)^2c^4 = m^2c^4 + p^2c^2 = E_{RM}^2 + p^2c^2$$

where

$$p^2c^2 = [(\gamma mc^2)v/c]^2$$

So far this simply rearranges a formula. The problem arises, when trying to include all energies, that potential fields need to be included, moving from an inertial frame of reference (IFR) to a non-inertial frame.

It is normal when the concept of relativistic mass is just defined as a relation [3] (CRM) to derive the total mass-related energy by simply adding in the potential energy [4]

$$E_{PE} = V = GM_k m\gamma/r$$

However, this is not a fully relativistic treatment.

30.1.4 *Extending Special Relativity*

When considering a standard special relativistic derivation of energy [5], no account is taken of the presence of a gravitational field. Even standard relativistic treatments [6] simply add in potential fields. The Dirac equation extended for electromagnetic fields does the same and ignores gravity completely [7]. The move to curved geodesics and curved space time, the Geometric Formulation (GMF), overcomes these simplifications, but loses understanding because it deals with four dimensions in general and complex terms and describes a path over time, without initial conditions, rather than energy levels at any specific time [8].

This paper will start from the CRM viewpoint, in simply defining the relativistic mass and then expanding this to include gravity, followed by extension to charge, but with the GMF ontology of space-time $E_{KE} = (\gamma - 1)mc^2$ [9]. However, later the paper will show how a different starting point could have been used.

As shown above, the standard CRM formulation for the relativistic rest mass energy E_{RR} [10] is

$$E_{RR} = \gamma mc^2$$

Care must be taken that this is not interpreted as meaning that the rest mass increases with velocity. The appearance of the size of the energy of the rest-mass increases when observed from a frame of reference relative to which the rest mass is in motion.

As an aside, this can possibly be understood more easily if a hypothetical structure were given to the particle that involved the mass of the particle being due to the rotation of the particle about its own axis. A measurement of the

rate of rotation will vary dependent on the velocity of the particle with respect to the observer. If that dependency were as described by the CRM formulation, then the particle's mass would appear to vary because the measured rotational rate varied.

Now the formulation of special relativity in an IFR needs to be considered to see how the effect of a gravity field might enter.

If a standard special relativity system is considered [11], there is an IFR within which there is a stationary mirror off which a light beam is bounced. The stationary observer sees the beam reflected back directly. The moving observer sees an angle between the incident and reflected beams. The result is time dilation of the moving reference frame containing the moving observer.

To correctly include the effect of gravitation, it is necessary only to replace the mirror by a large spherical mass with a mirrored surface, the observers by very small mass clocks and to constrain the distance between the observers and the surface of the large mass to be so small that the gravitational field is constant over the distance that the light beam travels. This is the equivalent of speeding up the clock in this specific location by $(1 - GM_k/rc^2)$ [12]. This is identical to reducing the energy of any particle at that point by $(1 - GM_k/rc^2)$.

Although strictly this system is not an IFR, if the distances over which the event occurs are small enough that the gravitational field does not change (using a 'short light beam'), then that field acts only as a constant extra energy for the whole system comprising the mirror surface, light beam and the observers and will not change the relationships between the observers and light beam, beyond providing a constant multiplication factor. In the case of a stable circular or spherical orbit, where r is constant, this extends the applicability to the whole of that orbital path.

So the relativistic rest mass energy E_{RR} defined above, now becomes the total mass-related energy of the particle $E_{(mt)}$, where

$$E_{(mt)} = \gamma mc^2(1–GM_k/rc^2)$$

$$= mc^2[\gamma–\gamma GM_k/rc^2)]$$

$$= mc^2[(1 + (\gamma - 1))–GM_k(1 + (\gamma - 1))/rc^2]$$

so that, defining the following

$E_{RM} = mc^2$ as the rest mass energy

$E_{KE} = mc^2(\gamma - 1) \approx \frac{1}{2}mv^2$ as the kinetic energy

$E_{PE} = GM_km/r$ as the mass potential energy

$E_{SPE} = [GM_km/r](\gamma - 1)$ as the mass-orbit interaction

The total mass-related energy of the particle is now

$$E_{(mt)} = E_{RM} + E_{KE} - E_{PE} - E_{SPE}$$

The first three are well known, but the latter has never been proposed. It is similar to the spin orbit interaction in a charge field, as will be seen later. The size of E_{SPE} is such that it would have produced acceleration towards the Sun, at the distances at which Pioneer spacecraft have been moving for the last few years, of $1.5 \times 10^{-13}\mathrm{m}s^{-2}$. This compares with the anomalous acceleration observed for the Pioneers of $8.7 \times 10^{-8}\mathrm{m}s^{-2}$ [13]. The effect is too small to measure currently and cannot be used to explain the anomaly.

The maximum effect of E_{SPE} on the orbit of Mercury would be observable in an extra excess precession of perihelion, above that provided by GR, that would be approximately 0".11 (seconds of arc/century). This is a large fraction of

the 0".14 representing the current level of accuracy of measurement, and it represents 75% of the difference between the GR prediction (42".98 ± 0".04) and the current central observation (43".13 ± 0".14) of the excess advance [14]. Adding this maximum extra factor would make the GR plus LGR central prediction of excess advance 43".09 ± 0".15, providing a closer agreement between prediction and observation.

Even though the total mass-related energy is now expressed in a form that is fairly familiar, other than the very small E_{SPE} that is generally lost in the approximations made to break out the E_{KE}, there is a better way of expressing this energy.

30.1.5 *Motional Energy*

The starting point is to ask what relationship is required for a constant energy, where the derivative of $E_{(mt)}$ with respect to r, for a circular orbit, will equal zero. Although a circular orbit is used, the result can be generalised to elliptical orbits.

$$\delta E_{(mt)}/\delta r = mc^2 GM_k\gamma/(r^2c^2) – (\delta v/\delta r)vmc^2(1 – GM_k/rc^2)\gamma^3$$

which, if $v = -rw$ so that $\delta v = -w\delta r$ and $\delta E_{(mt)}/\delta r = 0$, gives

$$mv^2/r = GM_k m/r^2$$

which is the standard classical formulation for the forces acting in a stable orbit [15]. Normally this is not used in the derivation of the energy of the orbital, because, as seen in $E_{(mt)}$, the relationship of E_{PE} and E_{KE} is not like that. However, if we introduce a new definition of a motional energy E_{ME} as

$E_{ME} = mv^2$ the motional energy

and equate this to the $GM_k m/r^2$ part of the force equation, having multiplied the latter by r, then the total mass-related energy can now be defined as

$$E_{(mt)} = E_{RM} + (E_{ME} - E_{PE}) + (E_{KE} - E_{ME}) - E_{SPE}$$

The energy of the balance of motional and potential energy for mass-related energy E_{SOE} is given by

$$E_{SOE} = E_{ME} - E_{PE} = 0$$

which defines the ZEMP state for mass-related energy in a stable orbit.

Having added E_{ME} to the equation in order to balance E_{PE}, it has also to be deducted, specifically by linking the reduction to E_{KE}, which has a similar structure in the m and v variables in its formula.

In a stable gravitational orbit, now using the force balance and consistent energy equations, $E_{SOE} = 0$, what remains is

$$E_{(mt)so} = E_{RM} + (E_{KE} - E_{ME}) - E_{SPE}$$

For a particle system without charge, this is as far as can be progressed. The effect of charge needs to be included to get further, but the energy due to motion $E_{(mot)}$, ignoring $E_{SPE} \ll E_{KE}$ for the moment, is given by

$$E_{(mot)} = (E_{KE} – E_{ME}) = mc^2(\gamma – (1 + v^2))$$

$$\approx -\tfrac{1}{2}mv^2$$

for low v , and which is a negative value as expected, whilst the motional energy of the particle E_{ME} is positive.

30.1.6 *Charge Energy*

Taking the formula for the total mass-related energy and substituting the charge components, arrives at the following formula for the total charge-related energy of a particle in motion with rest-charge cq around another particle of opposite sign rest-charge Ncq

$$E_{(qt)} = \gamma cqc^2(1–Nqc/rc^2)$$

Again, as for the rest mass, this does not say that the rest-charge changes size due to its velocity or to a charge field that it is in, only that an observer will measure the value of the energy due to charge to be different. The use of cq and qc as the units of charge energy is to take due care in the dimensionality of the energy that is to be measured. As mentioned at the start of the paper, care needs to be taken when converting these Planck unit values into SI units.

A similar 'short light beam' argument can be made for the effect of a charge field on a small mirror and observers system, exactly as already used for the extension of special relativity in respect of mass energy to the localised general form, so that the effect of the relative velocity of the charges is identical to that for the relative velocity of masses in this treatment.

Defining the same set of energies as for mass-related break out

$E_{RQ} = cqc^2$ as rest-charge energy

$E_{KQ} = cqc^2(\gamma - 1) \approx \frac{1}{2}cqv^2$ as charge kinetic energy

$E_{MQ} = cqv^2$ as charge motional energy

$E_{PQ} = Nq^2c^2/r$ as charge potential energy

$E_{SPQ} = [Nq^2c^2/r](\gamma - 1)$ as spin-orbit interaction, and

$E_{SOQ} = E_{MQ}–E_{PQ} = 0$ as a ZEMP for charge-related energy

where E_{MQ} is defined because the r derivative of $E_{(qt)}$, when $\delta E_{(qt)}/\delta r = 0$ and $\delta v/\delta r = -v/r = -w$ gives

$$cqv^2/r = q^2c^2/r^2$$

so that the total charge-related energy now becomes

$$E_{(qt)} = E_{RQ} + (E_{MQ} - E_{PQ}) + (E_{KQ} - E_{MQ}) - E_{SPQ}$$

Note that each charge energy is identical to its comparator in the mass energy section above, only different in size by m and GM_k versus cq and Ncq respectively. It is useful to identify the ratio of the size differences for the moving particle as K, where $K = cq/m$.

The ratio K will be specific to each type of particle, and will not change. It is a constant of nature for that particle, taking the value for an electron, for example, of $K_e = 1.1302 \times 10^{-42}$ C $ms^{-1}kg^{-1}$ in SI units (using $\sqrt{G \times 10^{+7}}$) or $2.0413 \times 10^{+21}$ in Planck units. As we will see later, K_e is also fundamental in its own right, although it will continue to be described simply as K in this paper. The constant K should be distinguished from the ratio e/m, the charge to mass ratio.

The identification of most of the charge energies is straightforward, E_{RQ} the rest-charge energy, E_{PQ} the potential energy and E_{SPQ} is the spin orbit interaction and has the same form as usually expressed [16] (with due allowance for the normal expression of those latter in terms of e, Z, μ, n and h). E_{KQ} will be explained below.

30.1.7 *Combining Charge and Mass Energies*

Combining charge and mass energies requires that the signs of the energies are identified. Because the attractive action of opposite charges is the same as that of gravity, the charge-related energy has been added to the mass-related energy

in the system under consideration here. Had the charge action been repulsive, the energy would have been deducted.

Now the two types of particle energy can be combined into one equation to give the total energy of the moving particle $E_{(tt)}$

$$E_{(tt)} = \gamma[mc^2(1 - GM_k/rc^2) + cqc^2(1–qc/rc^2)]$$

$$= E_{RM} + (E_{ME} - E_{PE}) + (E_{KE} - E_{ME}) - E_{SPE}$$

$$+E_{RQ} + (E_{MQ} - E_{PQ}) + (E_{KQ} - E_{MQ}) - E_{SPQ}$$

Setting the same constraints as before, that $\delta E_{(tt)}/\delta r = 0$ for a stable orbit and $v = -rw$, then the following relationship emerges, that

$$v(h + H)/(2\pi) = (GM_k m + q^2c^2)$$

where H is a constant of momentum similar to h for mass, but instead is in respect of charge,

$$H/(2\pi) = cqvr = 2\mu c$$

and

$$h/(2\pi) = mvr$$

and μ is the magnetic moment of the particle moving in an orbit, usually an electron.

$H/(2\pi)$ takes the value 2.1527×10^{-13} C $m^{-1}s^{-1}$ in SI units and 0.03408 in Planck units of charge momentum (if q were Q_p, then $H/(2\pi) = 1$). It is also the case that

$H = Kh$

H is a fundamental constant of nature in the same way as Planck's constant, if not more so because q is a basic unit of charge for all charged particles. So K can be interpreted as the ratio between the charge and mass constants of momentum, regardless of the identity of the particle under consideration, and, as already mentioned, is itself another fundamental constant. When different particles are used, it is the size of the product of the variable v and r that alters to maintain the balance in the momentum equations.

30.1.8 *Quantisation*

The equation

$$v(h + H)/(2\pi) = (GM_k m + q^2c^2)$$

or

$$(v/n)(nh + nH)/(2\pi) = (GM_k m + q^2c^2)$$

shows that the velocity should be quantised for both gravitational and charge systems, although the size of the quantisation unit is different for mass and charge energies. A particle with $2(h + H)$ of momentum should have a velocity $v/2$ in the constant $(GM_k m + q^2c^2)$ system considered here. This also flows from the two force equations for which

$$v^2r = GM_k$$

and

$$v^2r = qc$$

The equation describes a potentially stable system at velocity v, if both the mass m and charge cq are involved in the dynamics of the particle.

However, for reasons that are not clear, but could be described as H 'spinning-up' the particle (possibly it may be that charge cannot 'own' momentum in the same way that mass can) all the energy of that charge momentum $H/2\pi$ acts on just the mass of the particle, in addition to its original energy due to its $h/2\pi$ mass angular momentum. This is because experimentally [17] it is found that

$$mv^2/r = q^2c^2/r^2$$

(strictly, $m\delta^2 r/\delta t^2 = F$)

to the current limits of accuracy in a charge-bound system, which cannot distinguish between the values of K and $(K+1)$ which would show the inclusion of the gravitational action.

The spinning-up moves the particle into a new state where the velocity changes from its initial velocity v_a to a new velocity v_n. The change is shown in a number of new relationships:

$$(h+H)v_a/(2\pi) = hv_n/(2\pi) = (GM_km + q^2c^2)$$

$$mv_n^2/[(1+K)(2\pi)] = mv_a^2(1+K)/(2\pi) = (GM_km/r_a + q^2c^2/r_a)$$

$$hw_n/[(1+K)(2\pi)] = (GM_km/r_a + q^2c^2/r_a)$$

$$E_{ME_n}/[(1+K)(2\pi)] = E_{PE_a} + E_{PQ_a}$$

However, for both systems the moving particle has the same mass angular momentum, given by

$$h/(2\pi) = mv_ar_a = mv_a(1+K)r_a/(1+K) = mv_nr_n$$

with $w_n = (1+K)^2 w_a$ and $r_n = r_a/(1+K)$

So the new state is one where the velocity is higher and the orbital radius smaller and how the energies are internally balanced or externally expressed is different.

Now the ZEMP for the combination stable orbit energy E_{SOT} is given by

$$E_{SOT_n} = E_{ME_n} - (E_{PE_n} + E_{PQ_n}) = 0$$

for all stable orbit states n.

30.1.9 *Energy systems of different velocities*

Because of the different velocity relationships in the v_n and v_a systems, although the mass angular momentum of the system is unchanged, the energy of the system overall could change. To see how the energies of the two systems compare, a comparison can be made with between v_n and an initial state v_c where $v_c = 0$ and $r_c = \infty$.

The energy difference $E_{(DK)}$ between systems v_n and v_c can be described as

$$E_{(DK)} = (mc^2 + cqc^2)(\gamma_n - \gamma_c) - (GM_km + q^2c^2)(\gamma_n/r_n - \gamma_c/r_c)$$

$$= (mc^2 + cqc^2)(\gamma_n - 1) - \gamma_n(GM_k m/r_n + q^2c^2/r_n)$$

$E_{(DK)}$ can also be described as the energy that is required to increase the velocity of the system from $v_c = 0$ to v_n, or the work done on the system.

The work energy can be split into its mass and charge components, including E_{ME} and E_{MQ} components, as

$$E_{(DK_q)} = cqc^2(\gamma_n - 1 - v_n^2) - \gamma_n q^2 c^2/r_n + cqv_n^2$$

$$= E_{KQ_n} - \gamma_n E_{PQ_n}$$

and

$$E_{(DK_m)} = mc^2(\gamma_n - 1 - v_n^2) - \gamma_n GM_k m/r_n + mv_n^2$$

$$= E_{KE_n} - \gamma_n E_{Pe_n}$$

Note that all the energies of the system, other than the rest mass and rest charge energies, are included in the work energy, and the total energy can be recast as

$$E_{(tt)_n} = E_{RM} + E_{RQ} + E_{(DK)_n}$$

This is true regardless of the way that E_{MQ} is used within that energy, either against E_{PQ} or not. So the consequence of the spinning up is that E_{MQ}, not being used in balancing against E_{PQ}, must be externalised if the total energy is not to change. The externalised energy is observable as the magnetic moment of the system. So now the total energy can be described as

$$E_{(tt)_n} = E_{RM} + E_{RQ} + (E_{(DK)_n} - E_{MQ_n}) + E_{MQ_n}$$

To distinguish this state, with the different internal energy balances and variable relationships to those at v_a and the lack of external magnetic moment, v_n will continue to be used to describe these states. The overall effect is that either the change in variable relationships causes the magnetic moment, or the magnetic moment causes the change in relationship amongst the variables. This difference in variable relationships may be a factor that helps to identify whether charge fields are present in apparently gravitational-only systems.

30.1.10 *States of zero energy of motion and position (ZEMPs)*

Although ZEMPs have been mentioned in relation to the balancing of motional and potential energies, it has not been emphasised what this actually means. The state that the system is in is one where the motional and potential energies sum to zero at each principal number n. These are the ZEMPs mentioned in the introduction. Every ZEMP has no motional and positional energy in total.

Such internal states of zero energy will now be included in formulae as $<ZEMP_n>$, even though they add no energy, so that the total energy can now be described as

$$E_{(tt)_n} = E_{RM} + E_{RQ} + (E_{(DK)_n} - E_{MQ_n}) + E_{MQ_n} + < ZEMP_n >$$

The current interpretation of the energies of orbitals as being negative overall is represented by the work less motional charge energy term in brackets and is comparable to the Dirac equation. It is the changes between each state that represent the atomic spectra.

In this interpretation, QM features arise because the $ZEMP_n$ states are states of zero energy.

30.1.11 *Including the Magnetic Field*

The method of considering charge energy as outlined above should be contrasted with the standard method of introducing the magnetic field B in the presence of an electric field ξ. Standard methods of introduction [18] consider the forces on an isolated charge due to a current in a wire in a stationary frame or reference and compare this to the same system when viewed from a moving frame of reference. The difference between the two requires a magnetic field B to be introduced when viewing the system from the moving frame of reference because of the change in apparent energy viewed from that observer's moving frame of reference. The standard text uses differences in force and charge per unit length rather than energy.

The formula for this extra force, using the terms as contained in the reference and in terms of energy E_{mA} rather than force F_{mA} [19], is given by

$$E_{mA} = \gamma E_{\xi} - vE_B$$

where the signs of E_{ξ} and E_B depend on their relative orientations and the electric field, or electric intensity, ξ is defined as the ratio of the force F on a charge at rest to the magnitude of the charge q

$$\xi = F/q$$

and the magnetic field, or magnetic induction, B is defined as the ratio of the force on a moving charge to the product of the charge and velocity [20]

$$B = F/vq$$

E_{mA}can be recast as

$$E_{mA} = E_{\xi}(\gamma–1) = (\gamma–1)q^2c^2/r = E_{SPQ}$$

so that the spin orbit interaction can be seen in a different light. The standard texts only identify E_{PQ} and E_{SPQ}, rather than all the energies present in a charge and mass particle system. So $E_{(qt)}$ and $E_{(tt)}$ already contain within themselves the effects of v on ξ fields generating an apparent B field, although it is normally described in very different terms. The net effect is small because the energies E_{ξ} and E_B in this orientation are opposite, but the size of each is of the order E_{PQ}.

It is interesting to consider if there is a similar type of mass-related field (non-gravitational in the same way that B is magnetic where ξ is electric) at work in E_{SPE}. Using ρ to represent this field, it would have the relationship

$$\rho v = GM_k/r^2c^2$$

and

$$E_{SPE} = \gamma E_{PE} - vE_{\rho}$$

in parallel with the B and ξ treatment. The product of this ρ field and velocity v would have the value of E_{PE}, but the effect of the net energy would be much smaller and would act in the same sense as the gravitational field.

30.1.12 *Identifying all the Energies*

In the new system the mass motional energy now balances both potential energies

$$E_{ME_n} = E_{PE_n} + E_{PQ_n}$$

giving a ZEMP as defined earlier. The total energy of the new system n, reverting to the earlier break out of the

energies rather than the work energy, is now given by

$$E_{(tt)_n} = E_{RM} + E_{RQ} + (E_{KE_n} - E_{ME_n}) + (E_{KQ_n} - E_{MQ_n})$$

$$+E_{MQ_n} - E_{SPE_n} - E_{SPQ_n} + < ZEMP_n >$$

The parts can be identified as the rest mass E_{RM}, rest charge E_{RQ} and charge kinetic energy E_{KQ}

$$E_{KQ_n} = cqc^2(\gamma_n - 1)$$

and the charge motional energy E_{MQ_n}, which is observable externally via the magnetic moment of the orbit and particle $2E_\mu$, as

$$E_{MQ_n} = cqv_n^2 = 2\mu cw_n = Hw_n = 2E_\mu$$

whilst the three other components, including the B field, can be combined into one as

$$E_{OR_n} = (E_{KE_n} - E_{ME_n}) - E_{SPE_n} - E_{SPQ_n}$$

$$= mc^2[-v_n^2 + (\gamma_n – 1)(1 + v_n^2 K/(1 + K) + v_n^2/(1 + K))]$$

$$= mc^2[-v_n^2 + (\gamma_n – 1)(1 + v_n^2)]$$

or, by expanding $(\gamma_n – 1)$ to the first three places

$$E_{OR_n} \approx -\tfrac{1}{2}mv_n^2[1 + v_n^2((K/(1 + K)) – \tfrac{3}{4} + 1/(1 + K))]$$

where the last component $1/(1 + K)$ was left to highlight the split between E_{SPQ} and E_{SPE} energies. The simple version is

$$E_{OR_n} \approx -\tfrac{1}{2}mv_n^2[1 + v_n^2(1 – \tfrac{3}{4})]$$

which is identical to the Dirac equation for the energy states of the moving particle in an electron proton system, when quantum number $n = 1$, m is the rest-mass of the electron and there are no other quantum numbers considered here. However, the full version of EOR does not contain any approximations, as the Dirac equation does [21], and also includes the mass orbit interaction and gravitation, which the Dirac equation does not, and is therefore more accurate, even though the advantage is slight. It is also to be noted that no spin of the moving particle has been assumed. And that the spin energy is exactly equal and opposite to the mass energy states, so that all ZEMPs are zeros of all energies.

30.1.13 *Momenta and Magnetic Moment*

As stated, the mass motional energy E_{ME_n} is observable externally via the angular momentum of the orbit and particle, although it does not contribute to the external energy, as

$$E_{ME_n} = mv_n^2 = hw_n$$

and the charge motional energy E_{MQ_n} is observable externally via the magnetic moment of the orbit and particle, although it does not contribute to the external energy levels as normally measured, as

$$E_{MQ_n} = cqv_n^2 = Hw_n$$

The remaining energy not yet associated with an external observable is

$$E_{q\rho} = (E_{KQ_n} – E_{MQ_n}) = (\gamma – 1 – v^2)cqc^2$$

the energy associated with the magnetic moment, in the same way that E_{OR} represents the energy associated with the angular momentum (apart from the inclusion of E_{SPQ} as part of E_{OR}, where really it should be with $E_{q\rho}$, which is addressed below).

This energy $E_{q\rho}$ should be compared with the expected energy of the magnetic moment E_μ such that

$$E_{q\rho}/E_\mu = (\gamma – 1 – v^2)cq/(-\tfrac{1}{2}cqv^2)$$

$$\approx (1 + \tfrac{3}{4}v^2)$$

which represents an anomalous energy of magnetic moment for any orbiting particle of charge cq.

This difference, $\frac{3}{4}v^2$, is not as high as the actual anomalous magnetic moment of, for example, the electron [22]. The actual anomalous value is accepted to result from interaction with the local environment surrounding the electron [23] and its internal structure.

It is worth noting that the value of the actual anomalous magnetic moment of the electron can be obtained here by adjusting the velocity or radius of orbit of the charge-energy, both relative to the mass-energy, or alternatively the size of the rest-charge. Unfortunately none of these is feasible in a fixed rest-charge particle that stays together as it travels.

30.1.14 *Energy Comparison*

So the total energy of the particle in a stable orbit is given at all n states precisely by

$$E_{(tt)} = E_{RM} + E_{RQ} + E_{OR} + E_{q\rho} + < ZEMP >$$

or

$$E_{(tt)_n} = mc^2 + cqc^2 + mc^2[-v_n^2 + (\gamma_n – 1)(1 + v_n^2)]$$
$$+(\gamma_n – 1 – v_n^2)cqc^2 + < ZEMP_n >$$

or

$$E_{(tt)_n} = \text{rest mass energy + rest charge energy + Dirac energy states}$$

$$\text{+ magnetic moment energy + QM states of zero energy}$$

with B field, ξ field and energy of magnetic moments included. This is a pleasing result, the derivation of which has given some clarity to the relationships between different energies within the total energy. This equation, less the rest mass and rest charge energies, ZEMP and energy of magnetic moment, can be compared directly with the Dirac equation for a orbiting particle in an electromagnetic field, where the lack of approximation in $E_{(tt)_n}$, gives a slight edge to the latter.

It is interesting to note that both E_{SPQ}, which is a charge-related energy, and E_{SPE}, which is a mass-related energy, are combined with the energy of motion from the mass-related $(E_{KE} – E_{ME})$ to form E_{OR}. This is not clear in any other derivation of the energy of such a particle system. Were the two energies E_{SPE} and E_{SPQ} kept with their

correct energy types, the ratio of total mass-related to total charge-related energies would, reverting to non-subscripted parameters, be

$$E_{(qt)}/E_{(mt)} = -K + ((1+v^2)(Nqc–GM_k)/rc^2)/(1-\gamma-[(1+v^2)GM_k/rc^2])$$

Which equals $-K$ when $Nqc = GM_k$. Note that the mass energy $E_{(mt)}$ is negative and $E_{(qt)}$ is positive, although the latter is generally denoted negative because the direction of orbital current motion, as defined, is opposite to that of electron motion.

The quantisation of the orbits is now

$$(nh/(2\pi))(v/n) = (GM_km + q^2c^2)$$

which, when $q^2c^2 \gg GM_km$ gives the usual

$$nhw/(2\pi) = m(v/n)(rn^2)w = q^2c^2/r$$

Although this simplification is normally used, it is both the gravitational and charge fields that set the quantisation levels, with $(1+K)$ the base for the ratio between different energy sizes in a stable orbit, but with $K \gg 1$ this not apparent. The correct version is

$$nhw/(2\pi) = m(v/n)(rn^2)w = (GM_km/r + q^2c^2/r)$$

and, in terms of ZEMP, can be described as

$$< ZEMP_n >= m(v/n)(rn^2)w - (GM_km/r + q^2c^2/r) = 0$$

This is the basis of quantum mechanics and will be explored more fully later.

30.1.15 *Angular Momentum*

The mass motional energy of the particle as it moves around its orbit, E_{ME}, is associated with $h/(2\pi)$ of angular momentum. The charge motional energy of the particle as it moves around its orbit, E_{MQ}, is associated with $H/(2\pi)$ of charge angular momentum, even though the latter is expressed in the magnetic moment of the system rather than the motion of the particles in the system. Each momentum is the property of the system of two particles with a mutual orbit, rather than just the moving particle on its own. If the moving particle doesn't spin then the total angular momentum $h/(2\pi)$ must be in the orbit, however the charge in the system is not concentrated in only one part. If the moving particle does spin, then the $h/(2\pi)$ and $H/(2\pi)$ must be shared. It is to be expected that in such a situation the angular momentum would be shared equally between the orbit and the particle.

The orbit has its half share of the E_{ME} and E_{MQ} as $E_{(b)}$

$$E_{(b)} = \tfrac{1}{2}hw/(2\pi) + \tfrac{1}{2}Hw/(2\pi) = E_{MEO} + E_{MQO}$$

although this energy is usually measured in terms of angular momentum $L_{(b)}$ as

$$L_{(b)} = \tfrac{1}{2}h/(2\pi) + \tfrac{1}{2}H/(2\pi)$$

because E_{ME} is balanced by $E_{PE} + E_{PQ}$ when $E_{SO} = ZEMP = 0$.

Only the charge momentum H is externalised as the magnetic moment. The momentum h shows that there is energy within the system due to mass angular momentum. The $\frac{1}{2}h/(2\pi)$ is called the 'spin half' of the orbit. This is the value

in the frame of reference of the central particle. The $\frac{1}{2}H/(2\pi)$ is the momentum associated with the magnetic moment μ of the orbit, where

$$H = 2\mu c$$

and is externalised because it does not provide balance to any potential energy. The particle has its share of the E_{ME} and E_{MQ} as $E_{(p)}$

$$E_{(p)} = \tfrac{1}{2}hw/(2\pi) + \tfrac{1}{2}Hw/(2\pi) = E_{MEP} + E_{MQP}$$

and

$$L_{(p)} = \tfrac{1}{2}h/(2\pi) + \tfrac{1}{2}H/(2\pi)$$

where the intrinsic spin of the particle is called $\frac{1}{2}h/(2\pi)$, helical spin or 'spin half' and $\frac{1}{2}H/(2\pi)$ is the charge angular momentum also associated with the intrinsic spin of the particle. However, although the values of E_{MEP} and E_{MQP} are in the frame of reference of the central particle, the motion of the particle is subject to Thomas Precession [24] which reduces the precessional rate of the orbiting particle by half, so that to maintain the energies E_{MEP} and E_{MQP}, an extra factor of 2 is required for the momentum. This is the spin g factor. The factor g is 1 for the orbit and 2 for the orbiting particle, so now

$E_{MEO} = \frac{1}{2}hw/(2\pi) = \frac{1}{2}hw/(2\pi)$

$E_{MEP} = \frac{1}{2}hw/(2\pi) = 2\frac{1}{2}h(w/2)/(2\pi)$

$E_{MQO} = \frac{1}{2}Hw/(2\pi) = \frac{1}{2}Hw/(2\pi)$

$E_{MQP} = \frac{1}{2}Hw/(2\pi) = 2\frac{1}{2}H(w/2)/(2\pi)$

At the $n = 1$ level considered here, the relative directions of the orbital and particle spins, being either up or down for each and identifiable as quantum number m, do not lead to different energies, It is only when further quantum numbers (l or j) are included that the relative orientations lead to split energy levels.

30.1.16 *Quantum Mechanics and ZEMPs*

Using the equation

$$< ZEMP_n >= E_{ME_n} - (E_{PE_n} + E_{PQ_n}) = 0$$

$$= m(v_n/n)(r_n n^2)w_n - (GM_k m/r_n + q^2c^2/r_n) = 0$$

the energy of each state n sums to zero for motion and potential energy. Changes between each state n_1 and n_2 alter v_n and r_n for the orbiting particle, the size of balanced motional and potential energies, plus the other energies in the system. The absorption or emission of a photon, corresponding to a change in work, changes the ZEMP balance and the internal energy levels, but not the external, which are always zero.

In every ZEMP the clock rate is the same, even though the clock effects of the external fields are present in the motional and potential energies, each contributing to one side of the balance of energies. Only when a photon is absorbed or emitted from outside the system will the external environment impact, in that the energy of the photon will appear higher or lower depending on the underlying motion of the particle/system relative to the observer. But when considering the ZEMP energy states in the frame of reference of the system itself, the external motion will not affect them.

The equation for $ZEMP_n$ is an expression of QM energy levels, although classically the gravitational potential energy is usually ignored, and represents the quantisation of energy states. The energy of motion of the particle is positive, as required.

The quantisation really can be seen to arise from these $ZEMP_n$, which set all stable orbits at the same total energy, so that to have different variable values, meaning different v and r, for the energy levels requires that $ZEMP_n$ be composed of multipliers which balance out across the whole equation, leaving the sum as zero, as well as retaining the appropriate angular momentum and $v = -rw$ for the particle. The lowest multiplier possible is n acting on the components in the way given in $ZEMP_n$.

The 'spookiness' of QM can be construed as arising because the specific internal ZEMP state of the particle in the orbital, due to motion and position, has no energy. A particle having zero sum of energy due to motion and position can be anywhere within an orbital, provided only that those energies sum to zero. And provided there are no emissions or absorptions, the particle does not need any energy to move from one part of the orbital to any other part of that orbital. It may be this aspect that enables apparent superposition, where a particle appears to exist at all points of the orbital simultaneously, and that gives rise to spookiness.

30.1.17 *Third Way*

Having started the route to reach a new form of GR including non-gravitational fields from a base of extending special relativity, by just defining the concept of relativistic mass as a relationship between mass, velocity and c (the CRM route), and having ignored the geometric formulation (GMF), it is now worth asking whether the result could have been arrived at more simply.

Another way of describing $E_{(tt)_n}$ is as

$$E_{(tt)_n} = mc^2\sqrt{[(1–GM_k/r_nc^2)^2]}/\sqrt{[(1-v_n/c)(1+v_n/c)]}$$

$$+cqc^2\sqrt{[(1–Nqc/r_nc^2)^2]}/\sqrt{[(1-v_n/c)(1+v_n/c)]}+ < ZEMP_n >$$

This represents the square root of the products of the extremes of the fields that the particle is in, if the velocity of the particle with respect to the observer can be considered to represent a field. All these fields act to correct clocks for the effect of the fields that they are in. The mass or charge field adjustment speeds up the moving particle's local clock that is slowed by gravity or charge respectively. The velocity field adjustment slows down the clock of the local field of the particle, although only from the point of view of the moving observer. The gravitational and charge fields are real fields, in that they involve the presence of masses or charges and the actual change of clock speed, whereas the velocity field is a construct of an observer at any point, although it is real to that observer. This difference in the treatment of real and apparent fields is appropriate since the size of the gravitational (or charge) field is a fixed quantity at the point that the particle occupies, which is not the same for the relative aspect of the velocity field. Using the 'short light beam' argument, the gravitational (or charge) field will have the same maximum and minimum values since, by definition, it is constant over the system of mirror and observers. By contrast, the velocity field will have maximum and minimum values, corresponding to opposite directions of the observer's velocity, that are always different, except when the observer is in the same frame of reference as the particle. So the velocity field clock effect will always return a square root containing both maximum and minimum velocity field values. The clock effect of a charge field has not been proposed in this way before, but the mathematics here shows it to be the case, in the same way as for the gravitational field.

This interpretation of clock adjustment using the square root of the product of the maximum and minimum of the fields within which the particle sits (SRP) leads directly to the generalised version of $E_{(tt)o}$ where the moving particle's apparent rest-mass and rest-charge energies are adjusted identically for velocity fields and differently for gravitational and charge fields, giving

$$E_{(tt)o} = mc^2([\prod^{k}\gamma_k(1-GM_k/r_kc^2)][\prod^{i}\gamma_i(1-GM_i/r_ic^2)][\prod^{j}\gamma_j(1-GM_j/r_jc^2)])$$

$$+cqc^2([\prod^{i}\gamma_i(1-cN_iq/r_ic^2)]/[\prod^{j}\gamma_j(1-cN_jq/r_jc^2)])+ < ZEMP_n >$$

where $\prod^{k}\gamma_k(1-GM_k/r_kc^2)$ is the total gravitational field acting on the particle due to the distribution of uncharged masses M_k generating a gravitational field at distances r_k from the mass under consideration and moving at relative velocity v_k.

$\prod^{i}\gamma_i(1-cN_iq/r_ic^2)$ is the total field of the attractive charge distribution of the i particles and $\prod^{j}\gamma_j(1-cN_jq/r_jc^2)$ the total field of the repulsive charge distribution of the j particles and M_i and M_j are those particles' respective masses. Each product is defined to include all particles from $i=1$, $j=1$ and $k=1$ to the maximum number of particles present i, j and k respectively. The charges do not have to be coincident with any central particle.

Comparing this with the current treatment of fields, using a system with no overall charge ($i=j=0$), all particles under consideration stationary ($\gamma_k=1$) and each $GM_k/r_kc^2 \ll 1$, the energy of a mass m will be

$$E_{(tt)_n} = mc^2[\prod^{k}\gamma_k(1-GM_k/r_kc^2)]$$

$$\approx mc^2[1-\sum^{k}(GM_k/r_kc^2)]$$

which, excluding the rest mass energy, gives

$$E_{(grav)} \approx -\sum^{k} GM_km/r_k$$

Which is the accepted treatment of the gravitational action of M_k masses at separation r_k from a particle m. Thus the treatment proposed here gives the accepted treatment at low gravitational fields and velocities, but applies at all gravitational and charge fields and velocities, with the limits of the initial assumptions, and possesses additional attributes.

In the LGR formulation the potential energy can never reach an infinite value, regardless of how many masses k are present. The limitation is one of the base assumptions of LGR, which effectively states that a particle of Planck mass cannot approach closer than the Planck distance R_p from any other particle, measured between centres. Two spherical 'Planck particles', each with Planck mass and Planck radius cannot physically get closer than twice the Planck radius between centres, so that the unitless gravitational field between them will be $(1-GM_p/(2R_pc^2))=0.5$. Such Planck particles are expected to be the most dense particles possible, so that the gravitational field within a group of k of these particles can never be smaller than 0.5 between two such particles, but it will never be higher than 1. Each extra particle added to the existing masses k will bring a multiplication factor between 0.5 and 1 to the existing energy of the particle under observation, which will never enable the total energy of the particle to exceed 1 or to turn negative. So no infinities can occur in LGR gravitational fields.

Also, due to the clock adjustments for real and apparent fields, it could be argued that the 3-vector form used here is appropriate, rather than the normal 4-vector form used in relativistic dynamics, because the clock adjustments act to eliminate the curvature of space-time due to time, to the extent of the system under consideration.

However, the short light beam argument means that LGR only applies to systems within which the fields can be considered to be unchanged, over the system, and at a specific time. Appropriate systems include all stable orbits, so planets and electrons are covered. But the development of non-stable orbit systems requires the fields to change over time, which is precisely what GR does so well, although for gravitational fields only, but in which there are no stable orbits and so no ZEMPs. So GR in its 4 vector form cannot ever include charge-bound QM states, whereas LGR includes QM states, but not development over time. This would seem to imply that there should be some way of combining LGR and GR in a meta-formula that would describe both instantaneous energies and development of states over time. But, as described below, there are further limitations that would need to be placed on GR to achieve such a combination.

Because the effect of overall charge distributions in empty space is 1, on average, the multiplication effect of γ on cqc^2 can take any value and yet not push the value of $E_{(qt)}$ above Q_pc^2 or unity in Planck units, in empty space. So, provided the charge distributions are not too imbalanced, there will be no velocity limitation due to charge.

In a system of electron and proton, there will be a velocity limitation due to charge fields $v_{LGR(q)}$ given by

$$cQ_pc^2 = \gamma_{LGR(q)}cqc^2(1–qc/rc^2)$$

which gives an approximate limit of

$$v_{LGR(q)} = c(1–q^2/Q_p^2 = c\sqrt{1-\alpha/2\pi}$$

This limitation of the relative velocity of a particle by limiting the observable energies of charge and mass to their respective Planck energies, or

$$E_{max} = M_pc^2 + cQ_pc^2$$

is a form of limitation on general relativity, and is another reason why the interpretation given here is called LGR.

LGR implies that in order to avoid infinities in observable energy, each particle type must be treated individually, without generalisation across composite bodies. So in a body composed of multiple particle types, an electron will have a different maximum velocity to that of a muon or proton. As the maximum velocity of one particle type is reached, the body will break into separate parts, discriminated by rest-mass size, so no observer will ever measure energies greater than E_{max}. GR would have to be constrained by these particle-specific limitations in any meta-formula.

The size of particles used here has implicitly been at the quantum end of the scale, but the same equations can be applied to planets and stars at all relative velocities and fields covered by the initial assumptions, but constrained generally only to stable orbits.

This interpretation would seem to sit between the CRM and GMF interpretations, since it is based on the existence of real fields for gravity and charge, plus an observational field for velocity.

30.1.18 *Recap*

This is just a cooking recipe to show how to move from the rest-mass and rest-charge of a particle in a stable orbit to the relativistic energy levels and the quantum states of that orbital in three lines, within the limits outlined originally.

1. Take the rest mass and rest charge of the particle under consideration:

$$E = mc^2 + cqc^2$$

2. Include the fields present using SRP (taking the central particle example in the main text):

$$E_{(tt)_n} = \gamma_n[mc^2(1 - GM_k/r_nc^2) + cqc^2(1–qc/r_nc^2)]$$

3. Break out the energies into convenient packages:

$$E_{(tt)_n} = mc^2 + cqc^2 + mc^2[-v_n^2 + (\gamma_n–1)(1 + v_n^2)] + ((\gamma_n–1–v_n^2))cqc^2$$

$$+ < m(v_n/n)(r_nn^2)w_n - (GM_km/r_n + q^2c^2/r_n) >$$

which are described as

$$E_{(tt)_n} = \text{rest mass energy} + \text{rest charge energy} + [\text{relativistic Dirac energy states}]$$

+ {magnetic moment energy} + <ZEMP>QM states of zero energy

This interpretation shows that the current and historic ways of breaking out the energies within orbital systems, which generally requires many pages to explain in text books, are not as simple or accurate as the LGR method. In addition, the LGR assumptions ensure that the energy equation gives non-infinite results for all situations.

30.1.19 *Conclusions*

LGR is a useful constrained version of GR, in that energies at a particular time for a local system can be calculated, charge fields and QM states are included and the formula is simple. The 'invention' of motional energy, which is really only a reinterpretation, to establish ZEMPs provides states where QM features can exist away from clocks and the need for energy for motion within a ZEMP. A ZEMP is effectively a fixed background for QM within the overall LGR system, so externally the system, when observed by a moving observer, will be a Lorentz environment, but internally QM rules.

The energies of charge and mass can be treated and combined in precisely the same way into one equation, which, having been extended from special relativity using the SRP interpretation of clock adjustments, contains all the standard measures of energy within it, and applies to particles of all sizes at all velocities and fields within the initial assumptions.

There are two new constants of nature that appear from looking at charge energies in the same way as mass energies and comparing relative sizes, and the prediction and observation of the excess perihelion shift of Mercury are more closely aligned.

Hopefully this introduction will serve to intrigue other researchers into investigating the further and wider implications of the LGR interpretation.

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31 *Section 9*

The overarching assumption here is one that is not necessarily supportable any longer, but is included here, with the ramifications, in order to show how the magnetic moments may be comprised. That assumption is that the mass of a ring generates its own magnetic moment which needs to be separately identified. However, the latest ring framework interpretation says instead that there is no identifiable mass energy in a ring, since the sum of the kinetic energies of the six meons in a ring sum to zero over each ring. What we observe as mass in this interpretation is either the rotational rate of the meons in the ring or the deflection of space time due to the size of the ring, enabled by the presence of charge or twist energy. So in this latest version, there is zero total mass energy available to produce any magnetic moment, instead the anomalous magnetic moment is presumed to be derived from a magnetic moment provided by the twist energy. However, this fails to account for the different values of the anomalous moment in the electron and muon. So the question is still open, but the original interpretation is shown here because it could be argued that the physical size and rotation of the ring moving against the background space time instead provide the magnetic moment effect proportional to the size of ring mass, similar to the expectation that meon twist rubbing space time generates charge. So the question is still open, but the original interpretation is shown here for the interesting implications that can be made, even if the precise reason for the extra magnetic moment may not be correct.

32 Predictions of the anomalous magnetic moment of the Tau lepton and of anomalous charges in isolated quarks

The prevailing Standard Model explanation for the anomalous magnetic moments of the leptons revolves around their interaction with other particles. This paper sets out to show that 1) the reason is instead that leptons and quarks have underlying structure which causes the anomalous effects, 2) that each charged lepton is only a different sized variant of the same underlying structure and 3) that isolated quarks have charges slightly larger than the $\frac{2}{3} \mid q_e \mid$ or $\frac{1}{3} \mid q_e \mid$ expected. To enable determination of whether the new interpretation of the causes of the anomalous magnetic moments is correct or not, the single formula used for the moments of the electron and muon is extended to the tau lepton and the resulting predicted figure of $a_t = 0.0012655505324(2)$ is open to comparison with the latest theoretical estimate and is within the experimental range of values observed. A second source of confirmation of this alternate interpretation is the excess charge ratio of an isolated Up quark at 1.0002151814115(2) times larger than $\frac{2}{3} \mid q_e \mid$ and of an isolated Down quark at 1.0003443436114(6) times larger than $\frac{1}{3} \mid q_e \mid$.

32.1 *Underlying Structure of Leptons and Quarks*

The prevailing Standard Model explanation for the anomalous magnetic moments of the leptons revolves around their interactions with other particles, usually split into three components, due to QED, electroweak and hadronic contributions [1]. This paper sets out to show that the reason is instead that leptons and quarks have underlying structure which causes the anomalous effects and that the interactions are the results not the reasons. To enable determination of whether the new interpretation of the anomalous magnetic moment is correct or not, the single formula used for the moments of the electron and muon is extended to the tau lepton and the resulting predicted figure of $a_t = 0.0012655505324(2)$ is open to comparison with the latest theoretical estimate of $a_\tau = 0.00117721(5)$[2] and is within the experimentally observed range of values -0.052 to +0.013 [3]. Many numerical values in the paper are quoted to 13 decimal places because the pinnacle of the Standard Model interpretation is built on the foundations of the 12 decimal place accuracy of the anomalous magnetic moment of the electron and the methodology presented here was actually undertaken to 14 decimal places where possible, and using CODATA-2006 [4].

The different interpretation of the anomalous magnetic moments outlined here is based on an identical composite structure for the leptons and quarks. The hypothesis used is that all leptons and quarks are composed of only one type of particle and its anti-partner, to be called 'meons', and that there are three positive and three negative meons

in each quark or lepton. The structure is that of a circular necklace or loop of these meons, with each meon chasing the meon in front and being chased by the meon behind. The same structure is also possible using any other even number of meons, but only those with six meons make up our leptons and quarks because of the limitations necessary to replicate only the experimentally observed charge outcomes for any single or composite particle.

The motion of each meon in a loop is identical and is the only motion that any meon can have. As each chases the meon in front, it spins about an axis pointed at the meon that it is chasing. This spinning motion of the meons is called twisting, to differentiate it from the overall rotation of the six meons as they chase each other in a loop. So each meon has a screw orientation relative to its forward motion as it twists along its path around the loop composed of six meons. The rotational motion of the loop, either a quark or lepton, is caused by an energy that is usually described either in terms of the angular momentum $\frac{1}{2}h$ of the loop or of its angular frequency w_x. Note that the $\frac{1}{2}h$ rotational angular momentum is usually called the 'spin' of the particle, but this term is used sparingly here to avoid confusion.

The hypothesis proposes that the properties that each meon possesses are always in equal and opposite pairs, other than each meon's volume which is always the Planck volume, defined by a sphere of physical size equal to the Planck length L_o as its radius. A positive meon is presumed to have positive fundamental charge and positive fundamental mass. As will be shown later, fundamental mass is not the same as what is normally interpreted as mass, but it has properties that mean that calling it a form of mass makes it easier to understand. Similarly fundamental charge is not charge as it is usually understood, but is easier to describe as such for the moment. Both these properties are Planck unit size $+M_o$ and $+Q_o$ respectively, where $M_o = \sqrt{hc/G} = Q_o c/\sqrt{G \times 10^7}$ rather than the more usual use of $h/2\pi$ in producing a smaller Planck-related mass M_p. Also affected is the Planck length, where $L_o = h/(M_o c)$ rather than the more usual $L_p = h/(2\pi M_p c)$. M_o , Q_o and L_o are part of what is termed here the Adjusted Planck Unit (APU) system.

The negative meon in this hypothesized system will have negative fundamental charge and negative fundamental mass, $-Q_o$ and $-M_o$ respectively. Because fundamental mass is not normal mass, there is no problem caused by a particle having a negative fundamental mass.

The twisting motion as each meon moves is hypothesized to generate two opposite energies. These energies are approximately $q_e c^3/6$ of electronic charge energy and $s_e c^2/6$ of kinetic energy due to twisting, where s_e is the equivalent of a 'twisting' mass. It can also be considered that the kinetic energy of the twisting meons generates the charge energy, but the main point is that both are equal in size and of opposite type. The energies are only approximately equal to 1/6 of the normal value of electronic charge energy $q_e c^3$ because the values of the charges generated by each meon need to be added relativistically, with the result being equal exactly to the electronic charge. So the actual charge generated by each meon is not $q_e/6$ but the slightly larger size $q_x/6$, and it is that same size regardless of the physical size of the loop or the loop's component meon spin directions.

The sign of charge generated by each meon depends on the orientation of twist versus direction of motion and the identity of the meon. For consistency, this paper uses the hypothesis that a positive meon twisting clockwise generates positive electronic charge, as does a negative meon twisting anti-clockwise. Reversing either the meon twist orientation or the meon type changes the sign of generated charge.

So the difference in identity between a loop of six meons depends only on the twisting orientation of the meons in the loop. If they all twist clockwise, the loop will be a neutrino or anti-neutrino with total charge of zero. If all the positive meons twist one way and the negative meons twist the other, the result will be a charged lepton with +1 or -1 electronic charge. Where the twisting is not symmetric in this way, the result will be fractionally charged quarks with expected charge values of $\pm\frac{2}{3} \mid q_e \mid$ or $\pm\frac{1}{3} \mid q_e \mid$, although as shown later the actual values should be slightly larger for each. Only the charged leptons are of concern here for the anomalous magnetic moments, but some quark properties will be considered as they form the basis of the second prediction of this paper, that of excess charge when isolated.

32.1.1 *Energies*

It is hypothesized that the meons in motion have energies increased relativistically, exactly the same as normally describes the energy increase of a normal particle. In Table 1, $l_x = [(1-v_x^2/c^2)^{-0.5}-1] = [\gamma_x - 1] = [(1-w_x/w_o)^{-0.5}-1]$ refers to this increased energy effect on each individual meon, where v_x is the velocity of the meons as they rotate around in the loop and w_x the angular frequency of meon rotation around the loop. Where a lepton-specific value is used, such as $l_e = m_e/Mo \simeq \frac{1}{2}w_e/w_o \simeq \frac{1}{2}v_e^2/c^2$, this refers to the effect on a complete loop, where here the mass m_e, angular frequency w_e, velocity around the loop v_e and, used later below, the unit magnetic moment μ_e all refer to the electron loop. The energies of the meons and the energies of their twisting, plus their total value across the loop, are given in Table 1 for one positive meon and one negative meon, although there are three of each in a lepton or quark loop.

Table 1: Energies of the positive and negative meons, with their relativistically added totals and usual names and formulae

Property/Meon Energy type	Positive Meon	Negative Meon	Total $\prod$ *added*	Formla	Usual name
Fundamental mass	$+M_oc^2$	$-M_oc^2$	0		None
Fundamental chge	$+Q_oc^3$	$-Q_oc^3$	0		None
Twisting mass (e^-)	$+s_zc^2/6$	$+s_zc^2/6$	$+s_ec^2$		Strong En'gy
Twisting chge (e^-)	$-q_zc^3/6$	$-q_zc^3/6$	$-q_ec^3$	$-q_ec^3$	Electron Chge En'gy
M_o motional in loop	$+l_zM_oc^2$	$-l_zM_oc^2$	$\mid l_zM_oc^2 \mid$	m_zc^2	Mass of loop
Q_o motional in loop	$+l_zQ_oc^3$	$-l_zQ_oc^3$	$\mid l_zQ_oc^3 \mid$	$\frac{1"}{2}hw_z$	loop ang mom x w_z
Motional of charge	$-l_zq_zc^3/6$	$-l_zq_zc^3/6$	$-l_yq_ec^3$	$\mu"_y cw_y$	loop mag mom x cw_y
Motional of twisting	$+l_zs_zc^2/6$	$+l_zs_zc^2/6$	$+l_ys_ec^2$		None
Charge Echo (e^-)	$-K_z/6$	$-K_z/6$	$-K_y$		None
Twist Echo (e^-)	$-\epsilon\zeta^2K_z/6$	$-\epsilon\zeta^2K_z/6$	$-\epsilon\zeta^2K_y$		None

The energies listed in Table 1 are the main ones that are viewed in a stationary loop, where there is no overall velocity of the loop as a whole relative to any external framework. The use of $\frac{1"}{2}$ h and μ" instead of $\frac{1}{2}$ and μ are explained later. The parameters K, ζ and ϵ are explained below in relation to magnetic moment generation.

32.1.2 *Units*

Every time q_e or Q_o is used in an energy formula, it should be multiplied by c in order that it has the same dimensionality as mass and there is also a conversion factor between charge energy and mass energy of $1/\sqrt{G \times 10^{-+7}}$, which can be used to convert the the energy of a charge in APU units, as used here, into SI units to compare with accepted values. Table 2 provides some example formulae and values in APU and SI units for comparison.

Table 2: Some comparisons between APU and SI formulae and values for parameters

APU	Value (APU)	Formula (SI)	Value (SI)	Name
$(\gamma_e - 1)M_o$	$1.669755 \times 10^{-23}M_o$	m_e	$9.109382 \times 10^{-31}\ kg$	e−mass
q_e	$\sqrt{\alpha/2\pi}Q_o$	$q_e/\sqrt{G \times 10^{-+7}}$	$1.602176 \times 10^{-19}C$	e−charge
q_ec	$\sqrt{\alpha/2\pi}Q_oc$	$q_ec/\sqrt{G \times 10^{-+7}}$	$4.803204 \times 10^{-11}Cms^{-1}$	e−chge-mass
$E_e = q_ec^3$	$\sqrt{\alpha/2\pi}E_o$	$q_ec^3/\sqrt{G \times 10^{-+7}}$	$1.670976 \times 10^{8}J$	e−chge enrgy
M_o	1	M_o	$5.455520 \times 10^{-8}kg$	adj Planck mass
Q_o	1	$Q_o/\sqrt{G \times 10^{-+7}}$	$4.701296 \times 10^{-18}C$	adj Planck chge
M_oc^2	1	M_oc^2	490317644 J	Planck mass engy
Q_oc^3	1	$Q_oc^3/\sqrt{G \times 10^{-+7}}$	490317644 J	Planck chge engy
c	1	c	$299792458\ ms^{-1}$	light speed
h	1	h	$6.626068 \times 10^{-34}Js$	Planck's constant
L_o	1	L_o	$4.051344 \times 10^{-35}\ m$	Adj Planck lngth
$A_eE_e/cw"_e$	$\frac{1"}{2}A_e\sqrt{\alpha/2\pi}Q_oh/m_e$	$\frac{1}{2}A_eq_eh/m_e$	$9.284764 \times 10^{-28}JT^{-1}$	e- mag moment
$S"_e$	$\frac{1"}{2}h$	S	$\frac{1}{2}\hbar$	e- spin
Γ_e	$A_e\sqrt{\alpha/2\pi}Q_o/m_e$	$\Gamma_e = A_eq_e/m_e$	$1.760860x10^{11}$	gyromag ratio

32.1.3 *Relativistic Addition*

The change from l_x to l_e or l_y and q_x to q_e is a result of the use of relativistic addition of properties across the six meons in the loop. The value of the property for each meon will be slightly higher in the relativistic sum over all six meons than would be the case for simple addition. So $q_x = 1.0003766404166(1) \mid q_e \mid$, a value of $0.0340922976680(1) \mid Q_o \mid$. For the effect on mass and loop angular momentum energies the relativistic factor is simply $l_x = l_e$, where $l_e = m_e/M_o$, because these energies sum to zero, although the size of the energies is still present. When used with the properties that do not sum to zero over the loop, that is the charge, strong and motional energies of charge and twisting, the use of l_y, m_y, μ_y, w_y and K_y denotes that the relativistic additions would produce significantly different values for these properties if the loop sizes were smaller than the current actual sizes of those loops (that is, of higher frequency, higher energy and greater mass). However the mass size of the electron loop, for example, at $1.6697552037414(1) \times 10^{-23}\ M_o$ means that this extra contribution above 1, equivalent to $(1 + Bm_e/6M_o)$, makes the difference between the relativistic addition of any property B that includes the factor l_x and the simple addition of that property virtually indistinguishable at normal energies.

As mentioned, for the two lines 'Mass of the loop' and 'Loop angular momentum x w_x' there is no addition required since each meon has the same size of energy as the overall loop, although the energy sign will be either positive or negative. Here there is no need for any g_y consideration. Even though the sum of these energies over the loop is always zero, the size of the energies is a representation of the internal motion of the loop, which is directly related to what we call the mass energy or the spin of the loop (a lepton or quark).

The meaning of the column '$\prod$ *added*' is that each property must be added relativistically. The easiest way to do this for multiple sources of eg six charges or six magnetic moments, denoted B here, where $B < 1$ so must always be expressed in DAPU units, is to use the product formula

$$B_{total-relativistic} = [\prod_{n}^{6}(1 + B_n) - \prod_{n}^{6}(1 - B_n)]/[\prod_{n}^{6}(1 + B_n) + \prod_{n}^{6}(1 - B_n)]$$

32.1.4 *Loop Charges*

Considering charges, for the electron, where $B = -q_x/6$, this gives the total charge formula

$$q_{electron} = [(1 - q_x/6)^6 - (1 + q_x/6)^6]/[(1 - q_x/6)^6 + (1 + q_x/6)^6]$$

$$= -0.0340794619652(1)Q_o = -1 \mid q_e \mid$$

and provides the value of $q_x = 1.0003766404166(1) \mid q_e \mid$ mentioned above. For the neutrino the formula will be

$$q_{neutrino} = [(1 + q_x/6)^3(1 - q_x/6)^3 - (1 - q_x/6)^3(1 + q_x/6)^3]$$

$$/[(1 + q_x/6)^3(1 - q_x/6)^3 + (1 - q_x/6)^3(1 + q_x/6)^3] = 0$$

For an Up quark, using the same value of $q_x/6$ as the leptons, but with $B = +q_x/6$ for 5 meons and $B = -q_x/6$ for 1 meon, the formula will be

$$q_{Up-quark} = [(1 + q_x/6)^5(1 - q_x/6)^1 - (1 - q_x/6)^5(1 + q_x/6)^1]$$

$$/[(1 + q_x/6)^5(1 - q_x/6)^1 + (1 - q_x/6)^5(1 + q_x/6)^1]$$

$$= +0.0227245301546(1) \mid Q_o \mid$$

$$= 1.0002151814115(1) \mid 2q_e/3 \mid$$

whilst the negatively charged Down quark, with $B = +q_x/6$ for 2 meons and $B = -q_x/6$ for 4 meons, will have a charge of

$$q_{Down-quark} = [(1+q_x/6)^2(1-q_x/6)^4 - (1-q_x/6)^2(1+q_x/6)^4]$$
$$/[(1+q_x/6)^2(1-q_x/6)^4 + (1-q_x/6)^2(1+q_x/6)^4]$$
$$= -0.0113637323367(1) \mid Q_o \mid$$
$$= 1.0034434361145(1) \mid q_e/3 \mid$$

One of the main predictions of this paper is that the charges of isolated quarks will be larger than the Standard Model predictions of exactly $\mid \frac{2}{3}q_e \mid$ and $\mid \frac{1}{3}q_e \mid$. This will be proof of the component structure of the quarks and leptons. The values of the extra amounts above $\frac{2}{3}$ and $\frac{1}{3}$ are $1.0002151814115(1) \mid \frac{2}{3}q_e \mid$ for the Up quark and $1.0034434361145(1) \mid \frac{1}{3}q_e \mid$for the Down quark.

However, when two Up quarks and a Down quark are stacked together, as in a proton core, and their charges added relativistically, their total charge will be exactly the same size as the charge on the electron although opposite in sign. The same exact equality of size is also the case for an anti-Up quark and Down quark, or vice versa, stacked in a charged Pion, where the charge size will be exactly the same as that of the electron.

32.1.5 *Loop Magnetic Moments*

Although the equations have used the meon charges, the same formula can be used for the magnetic moments, kinetic or any other energies of the meons where the parameters being summed are expressed in DAPU units. The last two lines in Table 1 relate to Echo energies. These are hypothesized effects of energies changing from one form into another, reducing by the same factor at each echo. Each of these two energies, the motional energy of charge and motional energy of twisting, is hypothesized to generate a magnetic moment, dependent on the charge and an 'echo factor' ζ . In the case of the twist kinetic energy there is hypothesized to be also a 'mass generated factor' ϵ, where the motional energy of twisting, which is also related to the mass of the loop through the velocity of the meons, is hypothesized to also produce a magnetic moment from echoing energies.

These effects can be split into two separate summations for each meon.

Firstly the magnetic moment energy of each meon, if there were no anomalous energies, can be represented through the following relationships, using $h = M_o v_x r_x$ and $v_x = r_x w_x$ as the internal formulae relating the size of the loop to the velocity of the meons around the loop, $l_x M_o c^2 = m_x c^2$ and q_x from the charge consideration above, as

$$E_{q/6-in-motion} = -l_x q_x c^3/6 = \frac{-m_x}{M_o} q_x c^3/6 \backsimeq -\frac{1}{2} q_x c v_x^2/6$$

$$\backsimeq -\frac{1}{2}(q_x h/M_o) c w_x/6 \backsimeq \mu_x c w_x/6$$

However, it is useful to be more precise in the expansion of l_x by defining the following relationships

$$l_x = (\gamma_x - 1) \backsimeq \frac{1}{2} v_x^2 = \frac{1"}{2} v_x^2 = \frac{1"}{2} w_x = \frac{1}{2} w_x"$$

which uses $\frac{1"}{2}$ or the $w"_x$ to denote the assignment of the error in the expansion either to the $\frac{1}{2}$ or to the variable w_x. Although the effect is small at masses and energies normally encountered, the effect will grow with increasing energy and it is useful to follow where that error will show itself.

For the six meons in the loop, the sum of their energies in motion, including the anomalous contributions can be described as the relativistic sum ($\sum \prod$) of the individual meon contributions as

$$E_{\sum\prod q/6-and-more-in-motion} = \sum\prod^{6}(\pm l_x q_x c^3/6)$$

$$= \mu_{eoT} c w_e = A_e \mu"_{eo} c w_e$$

where for the charged leptons the factor $A_e = \frac{1}{2} g_e$, g_e being the electron g-factor. $\mu_{eoT} = A_e \mu"_{eo}$ is the total magnetic moment of the loop and $\mu"_{eo} = \frac{1"}{2} q_e h/M_o = (m_e/M_o)\mu"_e$ with $\mu"_e = \frac{1"}{2} q_e h/m_e$. The relationship between the spin energy of a loop and its magnetic moment energy, ignoring anomalies for the moment, can be considered as follows. The spin energy E_{spin} is the 'M_o motional energy' described in Table 1 with a total value, not having to be relativistically added, for an electron of

$$E_{spin} = l_e M_o c^2 = l_e h w_o$$

$$= \frac{1"}{2} h w_e = \frac{1}{2} h w"_e$$

or

$$E_{spin} = (\frac{1"}{2} q_e h/M_o)(M_o w_e/q_e)$$

$$= \mu"_{eo}(M_o c w_e/c q_e)$$

By defining the spin angular momentum S_e as the spin energy divided by the angular frequency of rotation, there are two possible definitions of S_e, either including or excluding the expansion error:

$$S_e = E_{spin}/w"_e = \frac{1}{2} h$$

or

$$S"_e = E_{spin}/w_e = \frac{1"}{2} h$$

The magnetic moment energy $E_{magnetic-moment}$ is also described in Table 1, as the 'Motional energy of charge' and has the relativistically summed value, again for the moment ignoring anomalous components, of

$$E_{magnetic-moment} = l_e q_e c^3 = \mu"_{eo} c w_e$$

$$= \mu"_e c w_e m_e/M_o$$

The direct comparison of the two provides that the ratio Y of magnetic moment energy to spin energy is

$$Y = E_{magnetic-moment}/E_{spin} = l_e q_e c^3/l_e h w_o$$

$$= q_e c/M_o = \sqrt{\alpha/2\pi} Q_o c/M_o = \sqrt{\alpha/2\pi}$$

and the relationship between the spin $S"_e$ and the error-containing magnetic moments $\mu"_e$ or $\mu"_{eo}$ can be described as

$$\mu"_{eo} = E_{magnetic-moment}/c w_e = E_{spin} q_e c/(M_o c w_e)$$

$$= S"_e q_e/M_o$$

or

$$\mu"_e = E_{magnetic-moment} M_o/m_e c w_e$$

$$= E_{spin} q_e c/(m_e c w_e) = S"_e q_e/m_e$$

Including the anomalies now produces

$$\mu_e^{"} = A_e S_e^{"} q_e / m_e = g_e S_e^{"} q_e / 2m_e$$

which last is the usual definition of the magnetic moment. This consideration shows that the extra 2 factor in both the numerator, as part of the g-factor, and in the denominator, are not required. Also made clear is that the $\frac{1}{2}$ factor is not exactly $\frac{1}{2}$ but is only approximately so for the size of loops at normal energies. The same error in the value of $\frac{1}{2}$ also arises in the spin of the loop, since the definition of $S_e^{"}$ was used to arrive at the usual magnetic moment, so the value is only approximately $\frac{1}{2}h$ and is exactly $S_e^{"} = \frac{1"}{2}h$.

The ratio of magnetic moment to spin, the gyromagnetic ratio Γ, can take two values. either

$$\Gamma_{eo} = \mu_{eo}^{"} / S_e^{"} = q_e / M_o = \sqrt{\alpha / 2\pi} Q_o / M_o$$

or

$$\Gamma_e = \mu_e^{"} / S_e^{"} = q_e / m_e$$

When using the electron magnetic moment with m_e on the denominator rather than M_o, the result is not the intrinsic magnetic moment of a loop. Where the meons are in motion around the loop and the loop itself is stationary overall, the meon mass M_o must be used in the magnetic moment formula in order to show the ratio correctly.

32.1.6 *Echo Hypothesis*

The echo hypothesis is that firstly each of the magnetic moment energies for a meon can be described within the energy formula for each meon, as part of a series of contributions declining by the factor ζ from the initial energy thus

$$E_{total-q/6-in-motion} = \mu_x c w_x (1 + \zeta + \zeta^2 + \zeta^3 + ...)/6$$

$$= \mu_x c w_x / [6(1 - \zeta)] = K_x / 6$$

Secondly, the twisting motional energies are hypothesized to generate a further magnetic moment in each meon, with similarly reducing contributions, as

$$E_{loop-twist-generated} = \epsilon \zeta^2 K_x / 6$$

Here the twist energy $s_x c^2/6$, which is the same size as the charge energy $q_x c^3/6$, has been represented in terms of charge energy so that it is easier to compare and combine the charge and twisting energies. The twist energy needs to be echoed first into a charge-like form, and then echoed again into a magnetic moment, so the factor ζ^2 is required. The factor ϵ describes how effectively the echo occurs and is related to the loop size, so is effectively proportional to the loop mass. So now the total energy for each meon, due only to the motional energies of charge and the echos of charge and twisting energies, can be described as

$$E_{total-q/6-and-twist-generated} = K_x/6 + \epsilon \zeta^2 K_x / 6$$

$$= \mu_x c w_x (1 + \epsilon \zeta^2) / [6(1 - \zeta^2)]$$

This combining of energies is possible without relativistic addition because the energies being considered are hypothesized to be the same type of energy, generated by the meon in different ways. Using this expression for each meon in a relative addition formula across the loop of six meons produces a total magnetic moment energy for a loop. The

anomalous part of the magnetic moments of the leptons, with total intrinsic magnetic moments A_e, A_μ or A_τ, is the extra factor a_{lepton} in $A_{lepton} = (1 + a_{lepton})$ which arises from the energy factor $(1 + \epsilon\zeta^2)/[6(1 - \zeta^2)]$ of each meon. Using the accepted values of the anomalous magnetic moments of the electron and muon produces values of $\zeta = 0.0011591518365(1) = 0.9980559045794(1)\alpha/2\pi$ and $\epsilon = 0.0226636429850(1)$, the latter specifically for the electron sized loop. The factor ϵ can be split into two parts as $\epsilon = Zm_x$ and $Z = 1.1088661490963(1) \times 10^{16} M_o^{-1}$, where Z is a constant for all rings with units of inverse mass, although without any specific reason for its size. Because of the hypothesized structure of the loops, the only difference between the electron and muon is the physical size of the loop, which is reflected externally in either the mass m_x or rotational frequency w_x. Logically implied is that, as a similarly charged type of loop, the tau will have a similar structure, but with a smaller sized loop, rotating at a higher frequency and observed as a larger mass. The anomalous moment of the tau lepton obtained using the same formula gives $a_t = 0.0012655505324(1)$.

Potential energy due to either charge or gravity has not been mentioned so far. The structure of the loop and its dynamics are such that the meons are balanced in motional and potential energy inside the loop, at every size, for every loop, whilst they chase around the loop. Apart from the chasing energy, which gives the meons their velocity, the action of every other energy is balanced by an equal and opposite energy. To change a loop size involves reducing or increasing the frequency of meon rotation around the loop - which is equivalent to adding or subtracting what we would measure as energy. The loop, having had its energy changed, will be stable at the new size until another external interaction again alters its size. So no consideration of internal potential fields due to charge or gravity is necessary.

32.1.7 *Conclusions*

The suggested value for the anomalous magnetic moment of the tau should be compared with the latest Standard Model theoretical estimate of $a_\tau = 0.00117721(5)$[2], and with the experimental range of -0.052 to 0.013[3]. The paper of J. Bernabéu et al. [5] suggests an improved method of increasing the accuracy of measurement of the anomalous magnetic moment of the Tau. Because there is a significant difference between the value derived from the model presented here and the Standard Model theoretical value, it should provide a powerful initial indicator of which model is more likely to be the correct interpretation. However, a future confirmation of the accuracy of the model presented here does not mean that the Standard Model is incorrect, only that the interactions that it interprets as being at the root of the anomalies are not the causes. Those anomalies are interpreted here instead as being caused by the different loop masses/sizes and echo energies, rather than the multitude of possible interactions. The interactions do not cause the anomalies, it is the loop sizes and the echo energies that cause the anomalies, which in turn cause the interactions. This interpretation suggests that it is the interactions that are effects whereas the loop sizes and echo energies are the causes of the anomalous magnetic moments of the charged leptons.

Observations of the charge of isolated quarks at sufficient accuracy will enable any charge deviation from the fractions $|\frac{2}{3}q_e|$ or $|\frac{1}{3}q_e|$ to be identified. Identification of such a deviation will be confirmation of the existence of underlying structure in quarks and leptons.

References:

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33 Late Additions -

33.0.8 What is real and what imaginary?

There are aspects of current physics that utilize concepts which are accepted as imaginary, in order better to understand systems. It may be that the mathematics needs specific items to which can be given values in otherwise intractable problems, or that what physically appears is given a name but there is no conceivable physical basis for there to actually exist such named objects. The following is a short description of some of these imaginary entities, which in my framework are actually real entities.

The first imaginary object is a zero mass black hole. These are the basis for the whole framework of my ideas, but exist in accepted physics only as imaginary objects that are required by mathematics in extreme gravitational field calculations.

The second imaginary object is actually an imaginary pair. Called 'pair creation' the idea is that a particle and it's anti-particle are created from nothing when sufficient energy, over a short enough time, is present within a volume. In the nucleus or around black holes, any particle/anti-particle pair can be created from nothing. My framework requires that such a pair already exists - as a zeron - and the zeron which is broken apart by the presence of sufficient energy is the one which matches that energy at that point because all volumes have zerons of all sizes centred on all points.

The third imaginary objects are called virtual photons and are accepted as being the source of action of forces and interactions. If a photon can be observed directly, it is real. If only its action can be observed, it is said to be virtual. The stumbling block here is the accepted wisdom that photons must travel at light speed. In my framework they can stack with other rings by unmerging their two ring/anti-ring components. So there is no barrier to real photons, for example, moving between electrons in orbitals and the consequent acceptance that virtual photons are real.

The fourth imaginary object is more complex to explain, but is the flux line which is currently taken as the imaginary representation of the magnetic field of a magnet. It seems that zero mass black holes are perfect candidates for the role of building blocks of a flux line. Since a zmbh is a merged (wholly or partially) positive and negative meon, beyond the immediate radius of the two particles, there is no physical observable due to mass directly, nor to spin because both mass and spin are properties of the composites called rings.

However, when the pair is partially unmerged, there will be an electric field acting between the two centres, as well as a gravitational chasing field. The strength of these two fields will depend on the centre to centre distance and the amount of volume unmerged by the pair. When the pair separate by more than the DAPU distance R_*, then the two have completely unmerged and are chasing each other in the process of forming a chain and possibly a loop or ring.

When the pair separate just slightly, they will still chase, but not transversely. Instead they will chase by spinning about the axis perpendicular to the plane on which they are maximally separated. This spinning of an electric field is identical in framework to the motion of an electron around an atom and will generate a magnetic field along the axis of spinning. However, unlike the electron/atom there is no external motion.

The partially unmerged zmbh produces an electric field and a magnetic field within itself without the need for transverse motion. So such a zmbh is the unit of a magnetic flux line itself.

A permanent magnet will, at its physical border, have an electric field generated by its component atoms, electrons etc. If there were no zmbhs, there would be no external field. The border of the magnet induces the adjacent zmbhs

to slightly unmerge and spin, proportional to the strength of electric field. It is the zmbhs that line up along the maximum effect of a specific area, which we describe as a flux line. The process is then repeated by the adjacent zmbh to the next zmbh until all such maxima have been populated by spinning zmbhs and the flux lines can be observed by their actions.

As the magnet is moved, so the identity of the zmbhs that are spinning to form the flux lines will change. But without zmbhs, there would be no flux lines extending beyond the body of the magnet. This is not because the flux lines would still be there but not observable, but because any volume without zmbhs is not part of our universe. We can only experience where there are zmbhs to act as the background across which particles like rings move, forming, breaking and reforming from the ocean of accessible zmbhs that is the universe.

The spin rate at which a pair can be separated and completely unmerged at $2R_*$ is the same for all pairs and probably is related to the fine structure constant, since all separated meons spin (twist) at the same rate, and that rate generates one-sixth the electronic charge. So in a strong enough electric field, a pair can be forced to spin at a rate fast enough to separate them. This may represent the initial conditions necessary to begin a general unmerging of zmbhs prior to a big bang.

The number of flux lines per unit area of a magnet will increase up to some maximum number , probably related to the number of atoms in the area. The maximum may well be one flux line per atom or per nucleon/electron. The flux lines provide sites around which electrons can orbit when in the right material. The rate of zmbh spinning will be directly proportional to the possible orbital energy levels of those electrons.

These few examples serve to show, I hope, that concepts that are required within physics can be generated from real particles and their combinations using the pre-quark/ring framework which I have described here.

33.0.9 Paradoxes – another two resolved

Absolute and relative velocities Galilean advocates argue that there must be an absolute frame of reference against which everything can be measured to be moving. Relativists argue that there can be no absolute frame, only relative. Once more, with the ring framework, these two views can be reconciled.

What is needed is to consider firstly what are the requirements of an absolute reference frame. I would suggest that it would have to be the most symmetric available anywhere and that the maximum number of particles within the reference frame should have the minimum energy.

If the universe were considered to be expanding away from the big bang, then the original point of the big bang would be a good point to define as the absolute centre of the universe, with everything else having velocities relative to this point – and these velocities would be counted as absolute.

However, my requirement for an absolute reference frame is deeper than any big bang expansion point. It is a frame in which the total energy is zero. I do not consider what the energies are that are in balance, only that they do balance. Since the total energy of the universe zmbh background is zero at every point, and the zero point energy of all zerons is zero at each point, and the total energy of all rings is zero at all times, then every point and every particle is a valid absolute reference frame, provided the particle is not close to a large energy balloon – by which I mean that the balances of energies to zero close to the point or particle must be small, which is to say that it is not in an external field. Effectively the point or particle needs to be in 'empty space' to observe the correct ring rotational rate in its stationary frame of reference.

Within that reference frame, where the particle is not in translational motion, the rotational rate that it is observed is its absolute rate of rotation. So what we call the mass of a particle, which is the rotational rate of a ring, is its rest mass in a frame of reference in which the ring is stationary. This may seem a banal result, but what it says is that the velocity of the meons around the ring, when a ring is considered in its own stationary frame of reference, is an absolute velocity.

Any translational motion with respect to the stationary frame will increase the apparent ring rotational rate (the particle's mass) from the point of an external observer. So regardless of where a particle is, provided it is not in an external field, or what velocity it has relative to any external observer, in the particle's own stationary frame of reference, its meons have absolute velocities. And all such points in the universe are equally valid absolute frames of reference.

But we do not generally measure rotational rates of rings in isolation. There are gravitational and charge fields present which affect the rotational rates of the rings, even though every point has zero total energy. Those fields that affect the meon motions will have an effect, even though the other fields that are present and balancing will not affect the meons. So we have to specify that the ring whose rotational rate we wish to measure should be in otherwise empty space. Now every point in space, and particle in motion, both not close to any external gravitational or charge fields, will be a valid absolute frame of reference.

But even here, we do not have access to the rotational rates exactly because there are always fields present. But theoretically we can do so. In which case we have the rotational rate of rings, or vibrational rates of zmbhs, as suitable absolute reference frames. From these absolute frames we can observe other particles and measure their relative velocities.

Since all absolute reference frames are equivalent but separate, the only useful information we can gather of one reference frame about another is the relative velocity of the particles. So we have an infinite number of absolute and relative reference frames. This means that both absolute and relative velocities exist together, but each only gives one side of the properties of a particle. The absolute frame will give the absolute rotational rate, so the rest mass, but no relative velocity. The relative frame will only give the relative velocity, not the rest mass. They co-exist.

Background zmbhs Leading on from this is the sort of paradox concerning whether there is an aether or not. Once more the zmbh background provides an interesting key to use, although some explanation is needed first.

So far in this book, I have described the zmbhs which fill the universe as a 'background' across which rings move, without being very specific about how the rings and background interact. This is because the interaction, logic requires, is much more pervasive than just the replication of photons on an allowed shell using meons from the local background, or other rings.

I have also not yet explained what 'space' is or by what mechanism space deflects, because of the presence of rings and in order to affect the motion of rings.

The solution to both the interaction of the background zmbhs and the definition of space is the same – it is the background which is space itself and is the interaction mechanism. There are only four methods by which zmbhs transmit gravity, spin, electric and magnetic fields. These will be described in detail after considering why there only needs to be four methods.

The meon foundation energies are mass-like and charge-like. They have properties that are like mass and charge, but do not have to be what we currently call mass and charge.

Actually what we call mass is a misinterpretation which needs to be understood in detail. The meons in motion have excess mass-kinetic energies which sum to zero over each ring and a similar amount of charge-kinetic energy which we call the spin angular momentum but is really an energy. These excess kinetic energies sum to zero not only just in terms of themselves in the ring, but also because the mass-like and charge-like energies are of opposite type.

So the only parameters which could deflect space due to the mass and spin energies of a ring are the physical size or angular frequency of rotation of the ring.

So what we call the mass of a particle involves having no energy in the particle in total. The electronic charge is due to the twist of the meons as they rotate around the ring rubbing against the background zmbhs, and is of equal and opposite size and type to the strong energy that causes the twisting motion. The size of total charge energy in a loop depends on the orientation of the meon twists and can be ± 0, $1/3$, $2/3$ or 1. The strong energy has exactly the same

size but is of opposite type, so the total over each ring due to charge and strong energies is zero, although it is not zero, except in the case of neutrinos, individually for each energy.

The motion of the charges as they rotate around the ring, or as the ring rotates around a nucleus, generates electric and magnetic fields. For every energy type, there is an equal and opposite one in action. But each energy only acts on its own type, so that the rings move, despite having zero energy in total.

The size and position of rings provides mass and spin interactions, whilst the size and position of charge and strong energies provides those interactions. Mass interacts with mass, spin with spin, charge with charge and strong with strong.

The explanation below looks at these four interactions through the mediums of gravity, spin, electric and magnetic fields. The weak 'force' is not a force, but a displacement of one ring in a stack by a different ring.

The building block of the background, and space itself, is the zero mass black hole as already described simply as a merged meon and anti-meon. When fully merged, there is literally nothing there. When partially merged, beyond some distance, an observer will still see nothing there. Within that distance though, there will exist fields due to mass-like and charge-like energies because there will be partial shells of the two meons, separated by a distance of between zero and twice the double-adjusted Planck distance. The greater the unmerging, the larger the mass-like and charge-like energies showing, with the strength of field increasing with increasing separation because the volume unmerged grows faster than the separation distance.

Note that there is no electric charge size shown by the meons when they are not in a ring. It is assumed that the twist energy that generates the one-sixth electronic charge is due to the zmbh being completely unmerged and the act of unmerging spins the meons by the same amount for each unmerging, after which their motion against the background zmbhs generates a one-sixth electronic charge.

In the following explanation it must be remembered that because all points and particles in the universe have zero total energy, all points are valid frames of reference for observing absolute rotational rates - but for observing external motion only relative velocities are possible. Also the strength of a field at any point along the lines described below is set by its distance from the relevant energies, but without the zmbhs or line there is no energy at that point because the universe does not exist where there are no zmbhs.

The four 'space' actions of the zmbhs can be split as follows:

A Magnetic Flux Line - The zmbhs, as a pair, are partially unmerged and spin about their symmetric axis of rotation, without any external motion of the pair. The field between the meons is both electric and gravitational, but since there is no relative motion, gravitational chasing does not occur. The sum of the mass-like part is zero, as is the charge-like part, and all that remains is the rotating electric field. This rotating electric field generates a magnetic field along the line of the rotational axis which does not extend far beyond the pair. This is one building block of a flux line. A continuous line of these pairs will form a complete flux line, started by the magnetic field produced by a ring or any magnet and finishing on the opposite side. The rate of rotation defines the strength of the field at that particular point.

B Electric Field Line – attractive charges - The zmbh pair is partially unmerged and is not rotating or moving externally. Since it is not rotating and the meons have no relative velocity, there is no magnetic field nor any gravitational chasing. The electric field lines up between two opposite charges, with alternating zmbh pairs, each separated or partially merged with the next in line, forming an electric field line.

C Electric Field Line – repulsive charges - The zmbh pair is partially unmerged and is not rotating or moving externally. It does vibrate along the line between charges, centred on the stationary meon with charge opposite to the external charges. The same-charge meon vibrates through the opposite-charge meon and its slight excess energy relative to the opposite-charge meon, due to its motion, is enough to maintain the pair in position. It is also possible that the moving meon orbits around the non-moving meon, which would maintain meon to meon separation and avoid gravitational chasing between them. The vibrational or orbital frequency would depend on the strength of the field at that point and the orientation of rotation would have to alternate along the chain to keep the average total magnetic field zero.

D Gravity – Since the presence of a ring, unlike for charge and strong energies, shows no external energy due to mass or spin energies, it is the meons in the ring themselves which interact with the zmbhs. Since an isolated meon is the densest particle possible, it will represent a maximum action of gravity (or charge). A positive meon in a ring will be moving at the ring rotational velocity and the negative meon in an external zmbh pair will chase it, with its own partner doing the same to it. This will extend out in a chain-like structure with alternating meon and anti-meon. The meon-to-anti-meon separation/merger will represent the strength of gravity at that point – a form of deflection acting on any other ring that approaches. A chain based on a negative ring meon will have the reverse orientation, although at great enough distances the difference may not be observable. This action is called dragging – where the meons in the ring drag chains of zmbhs around as the ring rotates. This whirlpool-like effect extends out to the influence distance, where the swirling no longer enables one ring to identify the orientation of another ring, only its frequency of rotation which represents its mass.

E Spin – The zmbh interaction is identical to that for gravity, except that it is the charge of the ring meons which attracts the zmbh pair. The size of effect is the same and the chains formed are the same. However, at separations greater than the interaction distance, because the orientation information is no longer available, the interacting rings cannot react to each other's spin energies. Where the gravitational chains provide a continuous gradient of gravity along the chain towards the ring meons (attraction), the same chains provide no overall charge gradient along a chain. So the interaction of rings due to spin is because physically their whirlpools combine.

The action of two whirlpools with similar rotational orientations is to combine, whereas the action of two oppositely rotating whirlpools is to repel, both when inside the influence distance. The relative angle of the whirlpool planes of rotation will also affect the strength of interaction with a minimum when the planes are at right angles. Although the overall charge along each chain is zero, there will be an alternate electric field extending outward along the chain from each ring meon which will be non-zero and larger closer to the ring meon.

The total of the field across the whole ring due to the meon charge-like energies will be zero, but will non-zero for the one-sixth electric charges, due to twisting, except for the neutrino. This slight excess electric field which rotates with the meons in the ring, and with the ring in atomic orbit, may be the source of the anomalous magnetic moment in the charged leptons.

F Strong - The actions in the strong case are identical of those of the zmbhs in the electric and magnetic fields, but their effects are limited in the same way as spin is limited, by an influence distance, although it is likely to be a different distance to the spin case.

The above field interactions imply that the zmbhs may shield the meon charges to some extent. It may therefore be that the electronic charge represents only the asymptotically approached charge size that is experienced beyond some distance from the meons. This suggests that the meon twist rate may be higher than needed to produce one-sixth the electronic charge. It is possible that the twist energy is the same size as the mass-like double-adjusted Planck energy. Then there would be no numbers in ring theory beyond 1 (and the quark and leptons masses due to their ring sizes). However this would not indicate how the asymptotic charge value that we measure is arrived at by nature. But there clearly needs to be meon twisting in order to produce the relative charge values of the quarks and leptons.

Aether So is the background, in its new guise as space to be warped and to interact with rings, an aether? It depends what is meant by an aether. None of the interactions described above involves long range motion of the zmbhs, which is what is generally described as an aether flow. That is not to say that the zmbhs might not move in clumps, but there needs to be something that drags the clumps along.

Because the meons themselves provide the strongest fields possible, and meons are in all rings, any large or cosmological feature will, on average, have much weaker chains being dragged along – although there may be many more chains – with a correspondingly shorter likely influence distance. But since the velocity of zmbh pairs inside photons is limited to light speed as a terminal velocity of gravitational chasing against zmbh background viscosity, and zmbhs define the universe so should exist everywhere, then it does not seem likely that it would be possible to measure any 'isolated' light speed. It requires a density of zmbhs to set the local light speed and without zmbhs there is no universe present.

So the paradox here is that there is no limit to the speed of a photon, except if it is in our universe. However, if it is not in our universe, speeding without a zmbh background, we would not be able to observe it.

So the zmbh background is just like a form of aether, except that it is not likely to be something that flows against an empty background since it is the background. If there are no zmbhs in a volume, then that volume is not part of the universe and is not accessible to us. However, it is unlikely that the zmbh background as a whole could be spinning, but it is possible that the rings and loops formed in the Big Bang due to unmerging, may have some spin component. Currently we would view the latter as the universe spinning, but the rings and loops are not the whole universe. It does though provide the possibility that we may be able to measure whether the rings and loops have some spin compoenent compared with the zmbh background.

One effect that may betray the presence of this aether-like background is through the viscosity that acts against the standard volumes of the meons. As previously described, like a sky-diver reaching terminal velocity as they fall, the meons that are chasing from one ring to the anti-meons in the other ring reach a terminal velocity that we call light speed. The local value of that speed will depend on the density of zmbhs and other particles or fields present in the local environment and possibly on the local velocity of the zmbhs. So round a large black hole, the actual velocity of a photon may be very slow, but that would still be light speed at that point.

The effect of the viscosity is a viscosity red-shift which needs to be taken into account when observing the red-shift of cosmological objects. Closer to home, the effect of the viscosity is too small to be observed in, for example, the decay of quantum or gravitational orbits.

Where a red-shift energy loss appears, the photons must be in motion against the background viscosity, whereas an aether in motion at c would involve no viscosity red shift due to energy loss because the meons comprising the photons would not be in motion in that frame of reference.

So the viscosity red-shift energy loss is both a measure of the density of zmbhs and other particle fields as well as the velocity of any aether at that point of observation.

The observation of different viscosity redshifts along different axes is complicated by the local replacement of meons in photons as they move. The photon moves as an allowable shell whose exact structure will be adjusted away from spherical by particles and fields as the shell expands away from its point of emission. The background itself affects the shell, by generating field concentrations, which are reflected in the photon properties, which in turn affect the shell. But at each point that the photon appears on the shell, it is likely that it uses local meons or zmbhs to replicate its structure. Whether those meons or zmbhs are from existing rings, aether flows or field lines will potentially affect the viscosity red-shift observed at that point.

So the ring framework provides a type of aether which has non-aether-like properties, especially in the viscosity causing a terminal velocity of local light speed.

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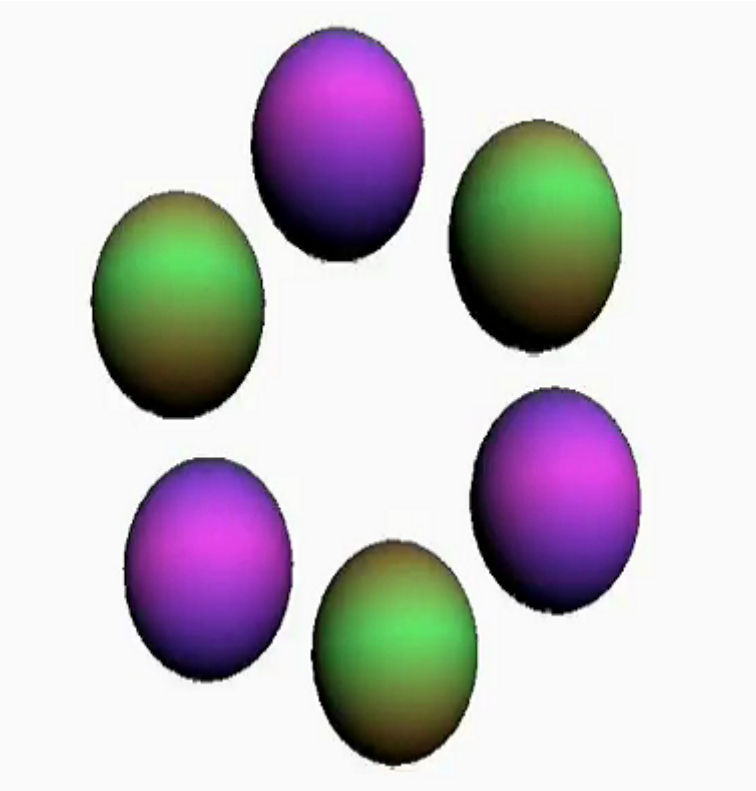
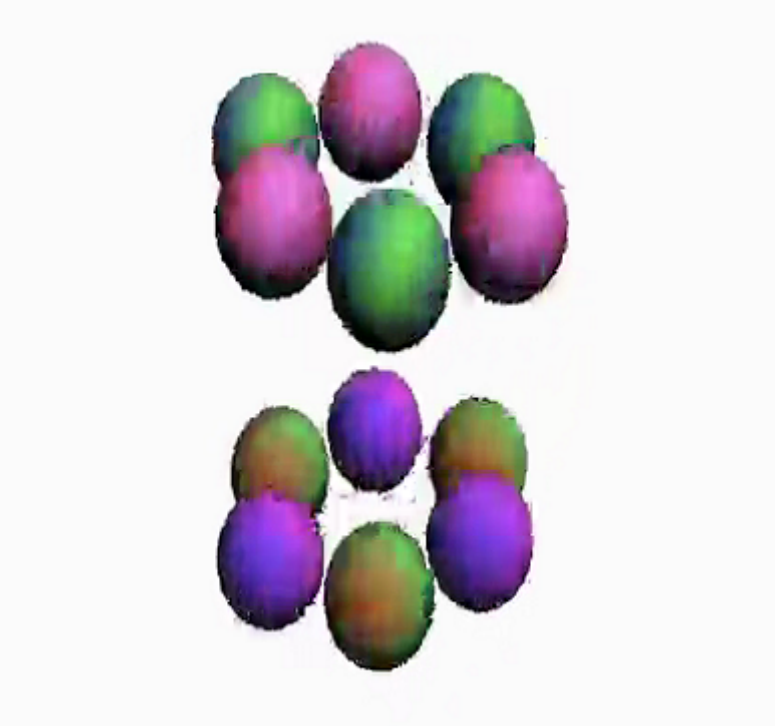
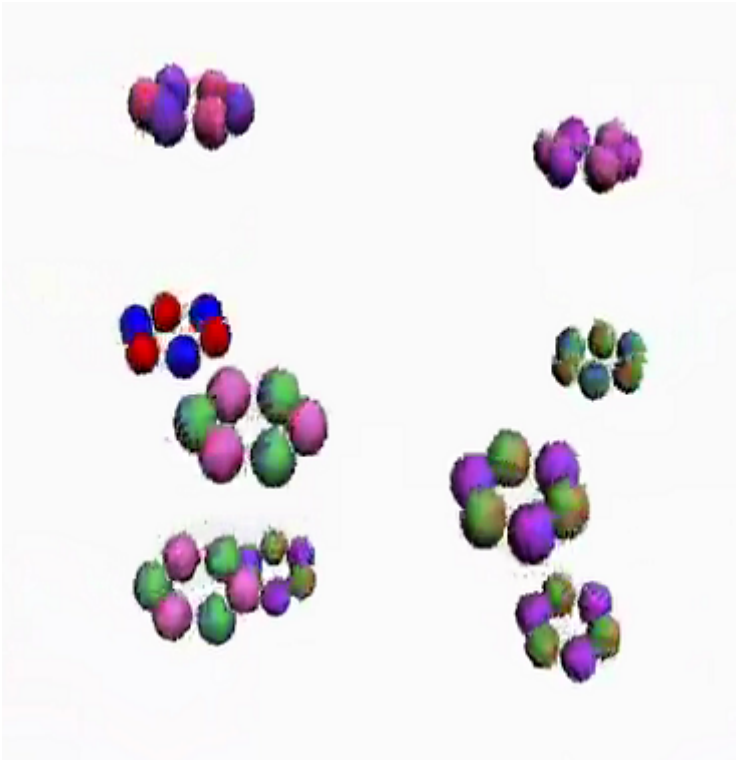
A single ring (not to scale.....)



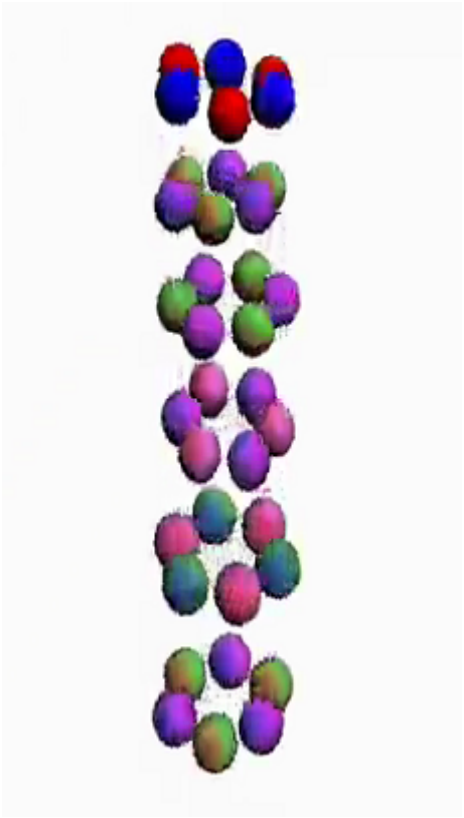
Ring and anti-ring



Many rings



A stack of rings



ELIMINATING PLANCK'S CONSTANT *h* AND FINISHING THE IMPROVEMENT OF SI UNITS, USING TWO NEW PLANCK UNIT FRAMEWORKS WITH ALL PARAMETERS AS RATIOS OF ONLY *c* AND $\sqrt{\alpha/2\pi}$

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This paper follows on from an earlier paper which eliminated three important constants of nature, the Gravitational constant G, Permeability u and Boltsmann's constant k_B by showing that they were only dimensionless ratios. Shown here is how to complete the elimination of the last dimensionless constant *h*, leaving all parameters as ratios only of the speed of light *c* and the fine structure constant α, the latter only when considering parameters that can be observed. There can be no deeper analysis than is presented here. It is also shown that the von Klitzing constant R_k is the inverse square of half the Josephson constant K_j, when displayed in the newly adjusted SI units and proposed Triple adjusted-Planck units .

Keywords: Gravitational constant; Planck constant; Planck units; SI units; Dimensionality; Parameters.

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1. Background and Methodology

The earlier paper [1] which eliminated three important constants of nature, the Gravitational constant G , Permeability u and Boltsmann's constant k_B by showing that they were only dimensionless ratios did not show how to eliminate Planck's constant *h* because it was considered that the effect would be to confuse readers.

The earlier paper sought to show simply that it is possible to relate all parameters to each other through powers of two (in the case of the maximal set of parameters) and three (in the case of the experimentally observable set) constants. This was considered to be a big enough mouthful to swallow in one paper.

The methodology followed here is the same as the earlier paper and merges $\sqrt{h}$ into the mass and length parameters as the foundation for the maximal parameter set, now termed X_b instead of the earlier X_* set, without changing the size of *c*. The base formulae which were the foundations of the DAPU parameter set had units based on

$$h = M_* c L_* \tag{1}$$

and

$$F_* = M_*^2/L_*^2 = Q_*^2 c^2/L_*^2 \tag{2}$$

This time the third adjustment is made by setting

$$M_b = M_*/\sqrt{h} \tag{3}$$

$$L_b = L_*/\sqrt{h} \tag{4}$$

$$Q_b = Q_*/\sqrt{h} \tag{5}$$

to form the Triple adjusted Planck unit (TAPU) set of parameters based around

$$M_b c L_b = 1 \tag{6}$$

and

$$F_b = M_b^2/L_b^2 = Q_b^2 c^2/L_b^2 \tag{2}$$

Further substitution and analysis leads to a number of adjustments to each of the parameters in the parameter sets in Table 1 and Table 2, which are taken from the earlier paper. The results are displayed in Table 3 which combines the two parameter sets and shows both the Brand New SI (BNSI) values of the TAPU parameters and their values in terms of ratios of *c*, or of *c* and $d = \sqrt{\alpha/2\pi}$. The changes can be split into six groupings.

The parameters Mass $(m\_)$, Magnetic Flux $(\phi\_)$, Charge-mass (q_c) , Momentum $(m\_v\_)$, Energy $(E\_)$, Temperature $(K\_)$, Charge $(q\_)$, Distance $(L\_)$, Inductance$(\mathcal{L}_)$, Capacitance$(C_)$ and Time$(T_)$ change in the form $X_b = X_*/\sqrt{h}$.

The parameters Angular Frequency$(w_)$, Frequency $(f\_)$, Acceleration $(a\_)$, Magnetic Inductance $(B\_)$, Magnetic Field $(H\_)$, Electric Field $(\xi\_)$ and Viscosity $(\eta\_)$ change in the form $X_b = X_*\sqrt{h}$.

The parameters Velocity$(v_)$, Resistance$(R_)$, Current $(\iota\_)$, Action $(m\_/L\_)$, Potential Difference$(\vee_)$, Force$(F_)$, Power$(P_)$, Conductance $(\varsigma\_)$ and Permittivity $(\varepsilon\_)$ remain in the form $X_b = X_*$.

The parameters Moment $(m\_L\_)$, and Area $(A\_)$ change in the form $X_b = X_*/h$.

The parameters Mass Density $(\rho\_)$, Current Density $(J\_)$, Pressure $(p\_)$ and Energy Density $(\epsilon\_)$ change in the form $X_b = X_* h$. The parameter Volume$(V_)$ changes in the form $X_b = X_*/h\_^{3/2}$.

2. Dimensionality of h

The subsuming of *h* within the parameters as a ratio is appropriate because it has, as a dimensionless constant, by

definition no dimensions. This can be shown either 1) by the DAPU equation (1) above, where $h = M_* c L_* = Y^1 Y^2 Y^{-3} = Y^0$ using Y as the dimension or 2) by SI unit analysis where $h = Js = kgm^2 s^{-2}\, s = Y^1 Y^{-6} Y^5 = Y^0$

Subsuming h also requires that the NSI values be adjusted by the appropriate factor for each parameter. So the value of, for example, a metre (NSI) becomes larger in BNSI by the factor $1/\sqrt{h}$.

Table 3 shows the two TAPU sets in BNSI values and ratios of *c*, or *c* and α, and shows the BNSI TAPU units for each parameter.

3. Relationship with experimental data

The earlier paper showed the relationship between R_{e*} (DAPU) and the von Klitzing constant R_k , and between ϕ_{e*} (DAPU) and the Josephson constant K_j . Based on

$$R"_k (K"_j/2)^2 = h^{-1} \quad (6)$$

The relationship in DAPU becomes

$$R_{e*}\,(\phi_{e*})^{-2} = h^{-1} \quad (7)$$

The same relationship in TAPU becomes

$$R_{e*}\,(\phi_{e*})^{-2} = 1 \quad (8)$$

This shows that, from one point of view, the more accurately known parameter could be used to define the other. However, the whole TAPU set of parameters is based on only *c*, or *c* and , so that all parameters will have the accuracy to which the utilised parameters, *c* or α , are known.

That h = 1 (TAPU) does not mean that it is a trivial substitution, since the actual DAPU value has been used to adjust each parameter appropriately.

Note that in Table 3, all the X_{e*} parameters have *d*, so $\sqrt{\alpha}$, and $\sqrt{c}$ powers equal in size and opposite in sign. This suggests powerfully that α is produced by a motional effect. It is possible to combine these two parameters into a single one of size $\sqrt{2\pi c/\alpha}$ where all X_{e*} parameters are simply powers of this size.

Table 1. Values of the Q_* set of parameters

Parameter (X_*)	Q_*DAPU set's NSI Value	NSI Units	DAPU equivalent	As Constants
Gravitational Constant(G)	1	$\mathrm{m}^3 kg^{-1} s^{-2}$	$none$	$none$
Permeability(u_*)	$\sqrt{6.67428 \times 10^{-11}}$	NA^{-2}	$none$	$\sqrt{G}$
Boltzmann's Constant (k_B)	1	$J\tilde{K}^{-1}$	$none$	$none$
Angular Momentum(h)	$6.62606896 \times 10^{-34}$	Js	$kg\mathrm{m}^2 s^{-1}$	h
Mass(m_*)	$4.45695580 \times 10^{-13}$	kg	kg	$\sqrt{hc}$
Magnetic Flux(ϕ_*)	$4.45695580 \times 10^{-13}$	$\tilde{W}$	$\sqrt{kg\mathrm{m}}\mathrm{m}s^{-1}$	$\sqrt{hc}$
Charge-mass$(q_* c)$	$4.45695580 \times 10^{-13}$	$\tilde{C}\mathrm{m}s^{-1}$	$\sqrt{kg\mathrm{m}}\mathrm{m}s^{-1}$	$\sqrt{hc}$
Velocity(v_*)	2.99792458×10^{8}	$\mathrm{m}s^{-1}$	$\mathrm{m}s^{-1}$	c
Resistance(R_*)	2.99792458×10^{8}	$\tilde{\Omega}$	$\mathrm{m}s^{-1}$	c
Momentum$(m_* v_*)$	$1.33616173 \times 10^{-4}$	$kg\mathrm{m}s^{-1}$	$kg\mathrm{m}s^{-1}$	$c\sqrt{hc}$
Current(ι_*)	$8.98755179 \times 10^{16}$	$\tilde{A}$	$\sqrt{kg\mathrm{m}}s^{-1}$	c^2
Action(m_*/L_*)	$8.98755179 \times 10^{16}$	$kg\mathrm{m}^{-1}$	$kg\mathrm{m}^{-1}$	c^2
Angular Frequency(w_*)	$6.04538246 \times 10^{37}$	Hz	s^{-1}	$c^2\sqrt{c/h}$
Frequency(f_*)	$6.04538246 \times 10^{37}$	Hz	s^{-1}	$c^2\sqrt{c/h}$
Energy(E_*)	4.00571211×10^{4}	J	$kg\mathrm{m}^2 s^{-2}$	$c^2\sqrt{hc}$
Temperature (K_*)	4.00571211×10^{4}	$\tilde{K}$	$\tilde{K}$	$c^2\sqrt{hc}$
Potential Difference$(\vee_*)$	$2.69440024 \times 10^{25}$	$\tilde{V}$	$\sqrt{kg\mathrm{m}}\mathrm{m}s^{-2}$	c^3
Acceleration(a_*)	$1.81236007 \times 10^{46}$	$\mathrm{m}s^{-2}$	$\mathrm{m}s^{-2}$	$c^3\sqrt{c/h}$
Magnetic Inductance(B_*)	$1.81236007 \times 10^{46}$	$\tilde{A}\mathrm{m}^{-1}$	$\mathrm{m}s^{-2}$	$c^3\sqrt{c/h}$
Magnetic Field (H_*)	$2.21841235 \times 10^{51}$	$\tilde{A}\mathrm{m}^{-1}$	$\mathrm{m}s^{-2}$	$c^3\sqrt{c/hG}$
Force(F_*)	$8.07760871 \times 10^{33}$	N	$kg\mathrm{m}s^{-2}$	c^4
Electric Field(ξ_*)	$5.43331879 \times 10^{54}$	$\tilde{V}\mathrm{m}^{-1}$	$\sqrt{kg\mathrm{m}}\mathrm{m}^{-2}s^{-2}$	$c^4\sqrt{c/h}$
Viscosity (η_*)	$5.43331879 \times 10^{54}$	$P_a s$	$kg\mathrm{m}^{-1}s^{-1}$	$c^4\sqrt{c/h}$
Mass Density(ρ_*)	$3.65466491 \times 10^{75}$	$kg\mathrm{m}^{-3}$	$kg\mathrm{m}^{-3}$	c^5/h
Current Density(J_*)	$3.65466491 \times 10^{75}$	$\tilde{A}\mathrm{m}^{-2}$	$\sqrt{kg\mathrm{m}}\mathrm{m}^{-2}s^{-1}$	c^5/h
Power(P_*)	$2.42160617 \times 10^{42}$	Js^{-1}	$kg\mathrm{m}^2 s^{-3}$	c^5
Pressure(p_*)	$3.28464901 \times 10^{92}$	$N\mathrm{m}^{-2}$	$kg\mathrm{m}^{-1}s^{-2}$	c^7/h
Energy Density(ϵ_*)	$3.28464901 \times 10^{92}$	$J\mathrm{m}^{-3}$	$kg\mathrm{m}^{-1}s^{-2}$	c^7/h
Charge(q_*)	$1.48668043 \times 10^{-21}$	$\tilde{C}$	$\sqrt{kg\mathrm{m}}$	$\sqrt{h/c}$
Conductance(ς_*)	$3.33564095 \times 10^{-9}$	$\tilde{\Omega}^{-1}$	$\mathrm{m}^{-1}s$	c^{-1}
Moment$(m_* L_*)$	$2.21021870 \times 10^{-42}$	$kg\mathrm{m}$	$kg\mathrm{m}$	h/c
Distance(L_*)	$4.95903212 \times 10^{-30}$	m	m	$c^{-1}\sqrt{h/c}$
Inductance$(\mathcal{L}_*)$	$4.95903212 \times 10^{-30}$	$\tilde{H}$	$\sqrt{kg\mathrm{m}}\mathrm{m}^{-1}s^{-1}$	$c^{-1}\sqrt{h/c}$
Permittivity(ε_*)	$1.36193501 \times 10^{-12}$	$F^{\#}\mathrm{m}^{-1}$	$\mathrm{m}^{-2}s^2$	$c^{-2}/\sqrt{G}$
Time(T_*)	$1.65415506 \times 10^{-38}$	s	s	$c^{-2}\sqrt{h/c}$
Area(A_*)	$2.45919996 \times 10^{-59}$	m^2	m^2	h/c^3
Volume(V_*)	$1.21952516 \times 10^{-88}$	m^3	m^3	$h\sqrt{h/c}/c^4$
Capacitance(C_*)	$5.51766736 \times 10^{-47}$	$F^{\#}$	$\mathrm{m}^{-1}s^2$	$c^{-3}\sqrt{h/c}$

Table 2. Values of the q_{e*} set of parameters

Parameter (X_{e*})	q_e DAPU set's NSI Value	NSI Units	DAPU equivalent	As Constants
Permeability(u_{e*})	$\sqrt{6.67428 \times 10^{-11}}$	NA^{-2}	$none$	$\sqrt{G}$
Angular Momentum(h)	$6.62606896 \times 10^{-34}$	Js	$kg\mathrm{m}^2s^{-1}$	h
Boltzmann (k_B)	1	$J\tilde{K}^{-1}$	$none$	$none$
Mass(m_{e*})	$1.30781284 \times 10^{-11}$	kg	kg	$d^{-1}\sqrt{hc}$
Magnetic Flux(ϕ_{e*})	$1.30781284 \times 10^{-11}$	$\tilde{W}$	$\sqrt{kg\mathrm{m}}ms^{-1}$	$d^{-1}\sqrt{hc}$
Charge-mass$(q_{e*}c)$	$1.30781284 \times 10^{-11}$	$\tilde{C}ms^{-1}$	$\sqrt{kg\mathrm{m}}ms^{-1}$	$d^{-1}\sqrt{hc}$
Velocity(v_{e*})	$2.58128076 \times 10^{11}$	ms^{-1}	ms^{-1}	$d^{-2}c$
Resistance(R_{e*})	$2.58128076 \times 10^{11}$	$\tilde{\Omega}$	ms^{-1}	$d^{-2}c$
Momentum$(m_{e*}v_{e*})$	$3.37583212 \times 10^{00}$	$kgms^{-1}$	$kgms^{-1}$	$d^{-3}c\sqrt{hc}$
Current(ι_{e*})	$6.66301034 \times 10^{22}$	$\tilde{A}$	$\sqrt{kgm}s^{-1}$	$d^{-4}c^2$
Action(m_{e*}/L_{e*})	$6.66301034 \times 10^{22}$	$kg\mathrm{m}^{-1}$	$kg\mathrm{m}^{-1}$	$d^{-4}c^2$
Angular Frequency(w_{e*})	$1.31510410 \times 10^{45}$	Hz	s^{-1}	$d^{-5}c^2\sqrt{c/h}$
Frequency(f_{e*})	$1.31510410 \times 10^{45}$	Hz	s^{-1}	$d^{-5}c^2\sqrt{c/h}$
Energy(E_{e*})	$8.71397049 \times 10^{11}$	J	$kg\mathrm{m}^2s^{-2}$	$d^{-5}c^2\sqrt{hc}$
Temperature (K_{e*})	$8.71397049 \times 10^{11}$	$\tilde{K}$	$\tilde{K}$	$d^{-5}c^2\sqrt{hc}$
Potential Difference(V_{e*})	$1.71991004 \times 10^{34}$	$\tilde{V}$	$\sqrt{kg\mathrm{m}}ms^{-2}$	$d^{-6}c^3$
Acceleration(a_{e*})	$3.39465292 \times 10^{56}$	ms^{-2}	ms^{-2}	$d^{-7}c^3\sqrt{c/h}$
Magnetic Inductance(B_{e*})	$3.39465292 \times 10^{56}$	$\tilde{A}\mathrm{m}^{-1}$	ms^{-2}	$d^{-7}c^3\sqrt{c/h}$
Magnetic Field (H_{e*})	$4.15521180 \times 10^{61}$	$\tilde{A}\mathrm{m}^{-1}$	ms^{-2}	$d^{-7}c^3\sqrt{c/hG}$
Force(F_{e*})	$4.43957068 \times 10^{45}$	N	$kgms^{-2}$	$d^{-8}c^4$
Electric Field(ξ_{e*})	$8.76255225 \times 10^{67}$	$\tilde{V}\mathrm{m}^{-1}$	$\sqrt{kg\mathrm{m}}\mathrm{m}^{-2}s^{-2}$	$d^{-9}c^4\sqrt{c/h}$
Viscosity (η_{e*})	$8.76255225 \times 10^{67}$	P_as	$kg\mathrm{m}^{-1}s^{-1}$	$d^{-9}c^4\sqrt{c/h}$
Mass Density(ρ_{e*})	$1.72949881 \times 10^{90}$	$kg\mathrm{m}^{-3}$	$kg\mathrm{m}^{-3}$	$d^{-10}c^5/h$
Current Density(J_{e*})	$1.72949881 \times 10^{90}$	$\tilde{A}\mathrm{m}^{-2}$	$\sqrt{kg\mathrm{m}}\mathrm{m}^{-2}s^{-1}$	$d^{-10}c^5/h$
Power(P_{e*})	$1.14597784 \times 10^{57}$	Js^{-1}	$kg\mathrm{m}^2s^{-3}$	$d^{-10}c^5$
Pressure(p_{e*})	$1.15236684 \times 10^{113}$	$N\mathrm{m}^{-2}$	$kg\mathrm{m}^{-1}s^{-2}$	$d^{-14}c^7/h$
Energy Density(ϵ_{e*})	$1.15236684 \times 10^{113}$	$J\mathrm{m}^{-3}$	$kg\mathrm{m}^{-1}s^{-2}$	$d^{-14}c^7/h$
Charge(q_{e*})	$5.06652691 \times 10^{-23}$	$\tilde{C}$	$\sqrt{kg\mathrm{m}}$	$d\sqrt{h/c}$
Conductance(ς_{e*})	$3.87404585 \times 10^{-12}$	$\tilde{\Omega}^{-1}$	$\mathrm{m}^{-1}s$	d^2c^{-1}
Moment$(m_{e*}L_{e*})$	$2.56696950 \times 10^{-45}$	$kg\mathrm{m}$	$kg\mathrm{m}$	d^2h/c
Distance(L_{e*})	$1.96279576 \times 10^{-34}$	m	m	$d^3c^{-1}\sqrt{h/c}$
Inductance$(\mathcal{L}_{e*})$	$1.96279576 \times 10^{-34}$	$\tilde{H}$	$\sqrt{kg\mathrm{m}}\mathrm{m}^{-1}s^{-1}$	$d^3c^{-1}\sqrt{h/c}$
Permittivity(ε_{e*})	$1.83707675 \times 10^{-18}$	$F^{\#}\mathrm{m}^{-1}$	$\mathrm{m}^{-2}s^2$	$d^4c^{-2}/\sqrt{G}$
Time(T_{e*})	$7.60396075 \times 10^{-46}$	s	s	$d^5c^{-2}\sqrt{h/c}$
Area(A_{e*})	$3.85256718 \times 10^{-68}$	m^2	m^2	d^6h/c^3
Volume(V_{e*})	$7.56180251 \times 10^{-102}$	m^3	m^3	$d^9h\sqrt{h/c}/c^4$
Capacitance(C_{e*})	$2.94580926 \times 10^{-57}$	$F^{\#}$	$\mathrm{m}^{-1}s^2$	$d^7c^{-3}\sqrt{h/c}$

4. Conclusions

This paper shows the simplest relationships which can exist between all the parameters analysed here. It presents new ways of understanding the relationships between parameters. This is the complete toolkit for providing a better understanding of the fundamentals of physics. Amongst the novel insights and predictions include:

i. A self-contained and consistent new Planck unit set of maximal X_* based parameters from which all observed values can be compared and easily combined in equations using only ratios of c, and $u = |\sqrt{G}|$ where appropriate.

ii. A self-contained and consistent new Planck unit set of X_{e*} electron charge-size based parameters, some of which are directly observable in experiments using only ratios of c and α, and $u = |\sqrt{G}|$ where appropriate.

iii. The X_* set will benefit from the precision of measurement of c, and the X_{e*} will continue to suffer the inaccuracy in α.

iv. Most electromagnetic parameters can be reinterpreted in terms of mechanical parameters. It requires a complete reinterpretation of what is understood by the terms magnetic inductance (acceleration), magnetic flux (mass), inductance (distance), current density (mass density) and other electromagnetic parameters.

v. Eliminating h allows the frequency and angular frequency BNSI values to coincide exactly with that of energy.

Table 3. Values of parameters in BNSI and ratios of *c* and *d*

Parameter ($X\_$)	X_* TAPU set's BNSI Value	X_{e*} TAPU set's BNSI Value	X_* as Constants	X_{e*} as Constants	BNSI Units (*h*-adjusted)
Permeability(u)	$\sqrt{6.67428 \times 10^{-11}}$	$\sqrt{6.67428 \times 10^{-11}}$	$\sqrt{G}$	$\sqrt{G}$	$none$
Angular Momentum(h)	1	1	$none$	$none$	$none$
Boltzmann (k_B)	1	1	$none$	$none$	$none$
Mass(m)	$1.73145158 \times 10^{04}$	$5.08063063 \times 10^{05}$	$\sqrt{c}$	$d^{-1}\sqrt{c}$	kg
Magnetic Flux(ϕ)	$1.73145158 \times 10^{04}$	$5.08063063 \times 10^{05}$	$\sqrt{c}$	$d^{-1}\sqrt{c}$	$\tilde{W}$
Charge-mass(q_c)	$1.73145158 \times 10^{04}$	$5.08063063 \times 10^{05}$	$\sqrt{c}$	$d^{-1}\sqrt{c}$	$\tilde{C}\mathrm{m}s^{-1}$
Velocity(v)	$2.99792458 \times 10^{08}$	$2.58128076 \times 10^{11}$	c	$d^{-2}c$	$\mathrm{m}s^{-1}$
Resistance(R)	$2.99792458 \times 10^{08}$	$2.58128076 \times 10^{11}$	c	$d^{-2}c$	$\tilde{\Omega}$
Momentum($m\_v\_$)	$5.19076126 \times 10^{12}$	$1.31145341 \times 10^{17}$	$c\sqrt{c}$	$d^{-3}c\sqrt{c}$	$kg\mathrm{m}s^{-1}$
Current(ι)	$8.98755179 \times 10^{16}$	$6.66301034 \times 10^{22}$	c^2	$d^{-4}c^2$	$\tilde{A}$
Action($m\ /L$)	$8.98755179 \times 10^{16}$	$6.66301034 \times 10^{22}$	c^2	$d^{-4}c^2$	$kg\mathrm{m}^{-1}$
Angular Frequency($w\_$)	$1.55615108 \times 10^{21}$	$3.38522944 \times 10^{28}$	$c^2\sqrt{c}$	$d^{-5}c^2\sqrt{c}$	Hz
Frequency(f)	$1.55615108 \times 10^{21}$	$3.38522944 \times 10^{28}$	$c^2\sqrt{c}$	$d^{-5}c^2\sqrt{c}$	Hz
Energy(E)	$1.55615108 \times 10^{21}$	$3.38522944 \times 10^{28}$	$c^2\sqrt{c}$	$d^{-5}c^2\sqrt{c}$	J
Temperature ($K\_$)	$1.55615108 \times 10^{21}$	$3.38522944 \times 10^{28}$	$c^2\sqrt{c}$	$d^{-5}c^2\sqrt{c}$	$\tilde{K}$
Potential Difference($\vee\_$)	$2.69440024 \times 10^{25}$	$1.71991004 \times 10^{34}$	c^3	$d^{-6}c^3$	$\tilde{V}$
Acceleration(a)	$4.66522356 \times 10^{29}$	$8.73822761 \times 10^{39}$	$c^3\sqrt{c}$	$d^{-7}c^3\sqrt{c}$	$\mathrm{m}s^{-2}$
Magnetic Inductance($B\_$)	$4.66522356 \times 10^{29}$	$8.73822761 \times 10^{39}$	$c^3\sqrt{c}$	$d^{-7}c^3\sqrt{c}$	$\tilde{A}\mathrm{m}^{-1}$
Magnetic Field ($H\_$)	$5.71044889 \times 10^{34}$	$1.06959938 \times 10^{45}$	$c^3\sqrt{c/G}$	$d^{-7}c^3\sqrt{c/G}$	$\tilde{A}\mathrm{m}^{-1}$
Force(F)	$8.07760871 \times 10^{33}$	$4.43957068 \times 10^{45}$	c^4	$d^{-8}c^4$	N
Electric Field($\xi\_$)	$1.39859884 \times 10^{38}$	$2.25558188 \times 10^{51}$	$c^4\sqrt{c}$	$d^{-9}c^4\sqrt{c}$	$\tilde{V}\mathrm{m}^{-1}$
Viscosity ($\eta\_$)	$1.39859884 \times 10^{38}$	$2.25558188 \times 10^{51}$	$c^4\sqrt{c}$	$d^{-9}c^4\sqrt{c}$	$P_a s$
Mass Density(ρ)	$2.42160617 \times 10^{42}$	$1.14597784 \times 10^{57}$	c^5	$d^{-10}c^5$	$kg\mathrm{m}^{-3}$
Current Density($J\_$)	$2.42160617 \times 10^{42}$	$1.14597784 \times 10^{57}$	c^5	$d^{-10}c^5$	$\tilde{A}\mathrm{m}^{-2}$
Power($P\_$)	$2.42160617 \times 10^{42}$	$1.14597784 \times 10^{57}$	c^5	$d^{-10}c^5$	Js^{-1}
Pressure(p)	$2.17643109 \times 10^{59}$	$7.63566217 \times 10^{79}$	c^7	$d^{-14}c^7$	$N\mathrm{m}^{-2}$
Energy Density($\epsilon\_$)	$2.17643109 \times 10^{59}$	$7.63566217 \times 10^{79}$	c^7	$d^{-14}c^7$	$J\mathrm{m}^{-3}$
Charge($q\_$)	$5.77550080 \times 10^{-05}$	$1.96825960 \times 10^{-06}$	$1/\sqrt{c}$	$d/\sqrt{c}$	$\tilde{C}$
Conductance(ς)	$3.33564095 \times 10^{-09}$	$3.87404585 \times 10^{-12}$	c^{-1}	d^2c^{-1}	$\tilde{\Omega}^{-1}$
Moment($m\_L\_$)	$3.33564095 \times 10^{-09}$	$3.87404585 \times 10^{-12}$	c^{-1}	d^2c^{-1}	$kg\mathrm{m}$
Distance($L\_$)	$1.92649970 \times 10^{-13}$	$7.62512793 \times 10^{-18}$	$c^{-1}/\sqrt{c}$	$d^3c^{-1}/\sqrt{c}$	m
Inductance($\mathcal{L}$)	$1.92649970 \times 10^{-13}$	$7.62512793 \times 10^{-18}$	$c^{-1}/\sqrt{c}$	$d^3c^{-1}/\sqrt{c}$	$\tilde{H}$
Permittivity(ε)	$1.36193501 \times 10^{-12}$	$1.83707675 \times 10^{-18}$	$c^{-2}/\sqrt{G}$	$d^4c^{-2}/\sqrt{G}$	$F^{\#}\mathrm{m}^{-1}$
Time($T\_$)	$6.42611129 \times 10^{-22}$	$2.95400952 \times 10^{-29}$	$c^{-2}/\sqrt{c}$	$d^5c^{-2}/\sqrt{c}$	s
Area(A)	$3.71140109 \times 10^{-26}$	$5.81425760 \times 10^{-35}$	c^{-3}	d^6c^{-3}	m^2
Volume(V)	$7.15001309 \times 10^{-39}$	$4.43344580 \times 10^{-52}$	$c^{-4}/\sqrt{c}$	$d^9c^{-4}/\sqrt{c}$	m^3
Capacitance($C\_$)	$2.14352000 \times 10^{-30}$	$1.14439683 \times 10^{-40}$	$c^{-3}/\sqrt{c}$	$d^7c^{-3}/\sqrt{c}$	$F^{\#}$

vi. That the reinterpretation of R_k and $K_j/2$ with their current excellent precision of measurement, should enable increased accuracy in the estimation of the values of other parameters and fundamental constants identified as novel composite functions of $R"_k$ and $K"_j/2$, as defined in the earlier paper, or through their ratios of *c* and α.

vii. A universal method of discovering laws of nature that applies regardless of any stretching of parameter space space. A unit with $q_e/Q_* \neq \sqrt{\alpha/2\pi}$ would still have the same relationships between X_{e*} parameters although the numerical values of the results would be different. The maximal X_* set would remain unchanged in their interrelationships as ratios of *c*.

viii. Physics can be better understood when stripped to its bare essentials and without the use of a system of SI units that are currently misaligned across the electromagnetic and mechanical parameters. DAPU and NSI units follow the current parameter sizes more closely than the TAPU units, even though the latter are notionally simpler. Thus by adjusting SI units to be self-consistent and consistent with DAPU units, greater clarity will ensue.

ix. The three adjustments necessary to align and make SI units self-consistent and also consistent with the simplicity of TAPU units have been proposed, producing the system of BNSI units. However, it is not proposed that BNSI units be used instead of NSI units.

Appendix A. References

1. Lawrence, M. (2013) "Eliminating the Gravitational constant G and improving SI units, using two new Planck unit frameworks with all parameters as ratios of only h, c and $\sqrt{(\alpha/2\pi)}$" in R.L. Amoroso, L.H. Kauffman & P. Rowlands (eds.) The Physics of Reality: Space, Time, Matter, Cosmos, Singapore: World Scientific Publishers.