Current physics concepts compared individually with those of a pre-fermion model

Michael Lawrence
Maldwyn Centre for Theoretical Physics, Park Road, Ipswich, Suffolk, United Kingdom
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The pre-fermion model is a comprehensive explanation for most of the observations made of the universe, from the smallest to the largest scales. Previous papers have covered each different aspect by concentrating on how the model reinterprets that aspect. There has been nothing before which compared current physics concepts to pre-fermion interpretations across all aspects individually within one paper. This paper fills that gap, although in doing so it has to cover some of the content of previous papers.

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I Introduction

These comparisons seek to start a reassessment of the current interpretations of all physics, although disagreeing with none of the experimentally observed numbers. Currently there are some sections of the physics jigsaw which fit together well, and some that do not. These comparisons are a pointer to how to reassemble the pieces so that they all fit together and the whole picture becomes clear. Symmetry and simplicity underlie what follows. The pre-fermion model uses only one fundamental particle/anti-particle, two fundamental energies and one composite form to explain almost everything. No hypothesis could use fewer foundations to build with.

II Significance and objectives

The significance is in providing an (almost) all-encompassing reinterpretation of the observations made in physics. The particle-based explanation explains why and where relativity exists and why and where quantum mechanics rules – and why the two are incompatible.

The objective is to provide a template for the reinterpretation of the main aspects of physics, so that it is possible to understand how we get the observations that we do. Along the way the paper shows that there are a large number of aspects that are similar, but not exactly the same, but which are best explained using the pre-fermion model.

III Methodology

Each physics concept is described in as simple a way as possible first, without direct references, in italics, as it is currently interpreted. After this description, the comparison is made by explaining how the pre-fermion model treats the same concept, not italicised. These comparisons may partially appear in different sections where there is some overlap with more than one aspect that needs to be explained. There is no specific order to the comparisons, although they have been grouped together by area where possible.

The paper uses Double-adjusted Planck units throughout, as explained in that section, but calls sizes based on those units simply as ‘Planck’ units.

IV Comparisons

Standard Model

The standard model predicts three of the four fundamental forces that exist and its foundational fermion, meson and boson particles, although not consistently those particle masses. It is based on the exchange of bosons as being responsible for transmitting forces but says nothing about gravity. It also does not explain apparent baryon asymmetry, the existence or identity of dark matter or the observations that imply an accelerating expansion of the universe.

The pre-fermion model [1, 2] proposes that fermions are not fundamental particles and that there exists a myriad of a single type of particle and anti-particle, called meons and anti-meons individually, and pairs when considered together, that are more fundamental and which, in numbers of chasing pairs, form loops. Loops of three pairs are our fermions and loops of other pair number are dark matter.

The model also proposes that those same pairs, when partially merged, form the background to all relativistic motion – rather like space-time but with each partially merged pair having its own individual time and space. All forces of the meons and anti-meons, whether in loops or pairs, are transmitted by the background.

Gravity is the effect of the rotation of loops, whose meons and anti-meons each have chains of partially merged pairs attached, which sweep through the background attracting the background towards the loops, and vice versa. Each loop is its own Higgs-like particle, creating its own gravity within the background, which itself is somewhat like a Higgs field.

The unmerging of each partially merged pair always results in both positive and negative one-sixth the electron size charge being generated, so that the loops and loop composites of mixed pairs have equal chances of being overall positively or negatively charged, resulting in there being no baryon asymmetry.

The interpretation of the acceleration of the expansion of the universe is due to the difference in the fraction of red shift observations, due to the viscosity of the background through which loops move, within our own big bang envelope versus those red shifts from outside. Outside red shifts are due mainly to the effect of loss of energy due to viscosity over distance on photons, whereas inside our big bang envelope red shifts also include the relative flow of our big bang constituents.

The result is that our big bang envelope is smaller than currently interpreted and our own big bang envelope may be contracting or expanding more slowly. The model also proposes many big bangs before our own, during our expansion and continuing over time. The result is no isotropy or homogeneity of matter throughout the universe.

The Universe

There is no accepted definition of the foundations of the universe in the Standard Model, but it is thought that the large scale equivalent of quantum pair creation may be the source of matter and anti-matter, with most of the latter somehow destroyed swiftly thereafter. Particles that result are considered to be amorphous point-like blobs with properties of mass, charge, magnetic moment and spin.

The universe is defined to encompass everything, whether observable or not and is the result of a single big bang. It is usually taken to mean space and time and all within. It is based mainly on mass energy considerations with the presumption that the overall charge is zero and that a quantum-like event started it off with an initial instant of inflation of space followed by the subsequent expansion of space. The main observables are stars and galaxies where, at great distances, their red shifts imply mainly their relative velocities. Observations suggest the existence of dark matter and possibly dark energy in addition to normal matter. The laws of physics are assumed to be specific to the universe, although the idea of multiverses suggests that different laws may apply in different universes and singularities are presumed to exist within black holes.

The pre-fermion model hypothesises that there is nothing separately physical in the universe except a myriad of the single type of fundamental particle/anti-particle, existing as pairs of meon and anti-meon, in six different forms. Fully merged (1) as zero mass black holes (ZMBHs), they are the material from which the universe is initially composed. As partially merged pairs (2) that form the main background through which all objects move, other than when in the quantum environment - which latter excludes the background. The background produces a viscosity against which all objects move and lose energy.

On unmerger of a pair (3), each spins about an internal axis (‘twists’ to differentiate from loop spin) and generates either positive or negative one-sixth the size of the electron charge, always totalling zero for an unmerging pair.

Partially merged pairs and unmerged pairs form chains (5) by catching onto other similar pairs, and chains catch onto their own tails to form loops (6). Loops of three pairs are our fermions and loops of other pair number are dark matter. Once pairs are no longer ZMBHs, they are always in motion.

The meon and anti-meon have Planck size fundamental mass and charge, positive and negative respectively, within a spherical Planck radius. Negative fundamental mass is completely symmetric with positive fundamental mass in that both attract the same type, but chase, or are chased by, the opposite type in a Bondi-like [3] action.

There is only one universe because there is only one size of the fundamental meon and anti-meon, and one composite loop form. ZMBHs unmerging enable loops, boson stacks, nucleon stacks and atoms. Nothing thus produces something, although the total mass and charge energies are always zero for all systems.

There are only two sizes in the universe, other than the loop sizes (‘masses’) which were locked-in by loop inflation, which are the Planck size of the meons and anti-meons and the fine structure constant, a function of the energy needed to unmerge partially merged pairs.

The laws of physics are the same everywhere and could not be any different because of the dimensionalities of properties, the consistent size of the meons and anti-meons everywhere in the universe and the maximal density of the meons and anti-meons ensuring that no composite formed from them can form singularities.

Particles

The Standard Model predicts the energies and other properties of the fermions, bosons and hadrons well, but they are treated as amorphous point-like blobs. The model requires a Higgs boson to produce the mass of the particles, otherwise they would be massless. All particles are observed to have positive gravitational mass.

Standard Model foundational particles’ physical sizes are usually immeasurable and they are presumed not to be composites. The reasons why they have the same integer, or fractional, values of electron-size charge and spin are not explained, nor why any two similar particles have identical properties. In many systems they exhibit quantum mechanical relationships.

The pre-fermion model hypothesises that the only directly observable ‘particles’ are loops or loop composites. The actions of the partially merged pairs of the background are observable in the energy lost in motion within the background as heat. The properties of the loops are the sum of the properties of the component meons and anti-meons in the loops and of their internal interaction and external interaction with the background.

Symmetric loops, the leptons (except asymmetric neutrinos), can be observed without the need for balancing by other loops, but can stack with other balanced loop stacks. Asymmetric loops, the quarks (and asymmetric neutrinos), require other asymmetric loops to produce a balanced stack. Stacks of loops are mesons, bosons and baryons.

The Higgs scalar boson [4] is just a stack of loops like other zero spin bosons. Each loop is its own version of a Higgs particle in that its rotation produces the effect of gravity proportional to its rotational rate - its mass – and size of overall loop 'missing charge' factor, explained below.

The summation over a three-pair loop of the one-sixth electron-size charges on each meon or anti-meon produces the total loop charge of, positive or negative, zero, 1/3, 2/3 or 1 electron charge size.

There are chains of partially merged pairs attached to each meon and anti-meon in a loop which sweep through the background and produce, by the dragging effect, the attraction that is called gravity. The mass energy of the loop rotation is ½ hw and is the same size, but opposite type, to the loop spin energy.

Changes to loop sizes can move loops between charge families. An electron taking sufficient frequency from a photon or neutrino can change into a muon. It is the change in loop radius that changes the loop mass and magnetic moment.

Loops built from twisting meons and anti-meons pairs always have the same size of charge in zero or ±1/3 electron charge size steps.

Forces

Force is the effect of energy on a particle at a distance, and is a vector property. Balancing energies produce stable systems.

1 The Higgs scalar boson is used to explain why the Standard Model massless particles have the effect of mass and gravity. The effect is considered to be dragging particles through the Higgs field.

2 The strong and colour forces are thought to be due to the exchange of pions and gluons respectively and act to keep quarks inside nucleons and enable switching between quark types.

3 The weak force is thought to be due to the exchange of W and Z bosons between protons and neutrons to change one to the other, despite the W and Z being larger than protons and neutrons.

4 The electromagnetic force is thought to be due to the exchange of photons, over many frequency ranges, between charged particles.

In the pre-fermion model photons and bosons are not force carriers. The background partially merged pairs provide the means for transmitting forces due to mass (gravity), spin and charge by changes of local density, spinning, moving, vibrating or aligning in chains. Magnetic field lines are real. Partially merged pair chains transmit forces via density changes and strings of vibrating, rotating or moving partially merged pairs chains between sources. The background is rather like a form of dilute aether with loops acting on the background and the background acting on the loops – to some extent the background is like a form of Higgs field.

The background itself is a form of dark matter, taking energy from moving meons and anti-meons to increase the partially merged pair frequencies of rotation, vibration or velocity and varying in density dependent on local loop concentrations. However, the background is not exactly dark because of its interactions via charge and spin fields and viscosity in addition to gravitation, which are absorbed as heat. Zerons, spin zero photons, are the source of zero point energy and pair creation.

The actions of bosons and photons are instead the following

1 Gravity was already explained above as the interaction of rotating chains attached to meons and anti-meons in loops with the background. The nearest object to a graviton is a partially merged pair, although only as part of a chain, without any emission or absorption.

2 Strong force is the direct action of meon to anti-meon and meon, or vice versa, by relative potential energy between adjacent loops. The 'colour' force is the balancing of asymmetric three-pair loops in a stack to produce rotational symmetry along the stack and integer charge in total.

3 Weak force is the replacement of the electron and anti-neutrino loops in a neutron stack by appropriate energy neutrino and anti-neutrino loops. The Planck size of the loop components, of meons and anti-meons, means that they can exist within nucleons.

4 Electromagnetic force is the transfer of loop rotation from photons to loops which have lost energy to the background in order to return those loops to their original frequency as set during inflation.

5 Two loops can swap pairs or individual meons or anti-meons during an interaction to change into two different loops. Their total energies will remain unchanged, but their observable masses may not, due to the change in 'missing charge' factor for differently charged loops.

Energy

In current physics, energy is a property that produces a force on an object or can be transferred between energy types within a system. A particle is defined to have energy, when at rest in a frame of reference, due to it mass and relative position or when moving. The existence of an external field may alter the energy of the particle.

1 Mass energy is always positive and attractive of other masses.

2 Mass kinetic energy is scalar and no spin kinetic energy is included in classical orbital systems.

3 Active and passive potential energies are the same and do not vary in action dependent on change of separation.

1 The pre-fermion model hypothesises that there is extreme energy-symmetry within the only universe. For every mass-related energy, there is an equal and opposite charge-related energy. Each meon has positive fundamental mass energy balanced by opposite type positive fundamental charge energy, through $M = Qc$, with the reverse for the anti-meon.

The twist energy, which is required to unmerge every partially merged pair is always the same size and is equal but opposite in type to the one-sixth charge energy that results from rubbing against the background for each meon and anti-meon. The total charge and mass energies of the universe are always zero, regardless of how many loops are created, and so are every composite formed from pairs.

2 The mass kinetic energy of an orbital system acts outwards from the centre of rotation, so that energy is a vector. In standard equations for orbital energies, the charge-kinetic energy of the spins of the loops in both bodies has been ignored. Including the latter energy makes the energy and force equations identical, other than one separation term.

The ‘mass’ of a loop is proportional to its rotational frequency and ‘missing charge’ factor, and each meon and anti-meon in the loop has the same size fundamental mass kinetic energy as the overall observable loop mass.

3 The mass and charge potential energies of those meons/anti-meons and their composite forms exist in two forms. How particle A affects particle B and how B affects A, and this can be different to current definitions in certain interactions. The size of the potential energies may be the same for each of the particles, but they only act in the way currently accepted between charges and same-sign masses. The extreme energy-symmetry hypothesis implies that negative masses attract negative masses and that they chase or are chased by positive masses, and vice versa, with these latter actions being the underlying reason why photons travel at a terminal velocity, in the relativistic background environment, that is termed light speed. With the extreme symmetry proposed, it is not possible to say whether a body inhabits an overall positive or negative energy-based environment because the outcomes are the same.

Relative Potential energy

Currently potential energies are considered to be due to either active mass that produces a gravitational field or passive mass which responds to an external gravitational field. They are assumed to be equal in size and act always in the same attractive way.

The pre-fermion model agrees on the same size of these mass types, because the gravitational constant G can be eliminated, but that how each fundamental mass type reacts when considering interactions between meon to anti-meon, or vice versa, depends on their relative motion, separating or closing, and which is the chaser or chased particle.

What underlies the laws of thermodynamics is relative potential energy. The latter, between meons and anti-meons, within loops and from loop to loop, depends on their change in relative separation. From stationary starts, one will be the chaser and one the chased loop, leading to a Bondi –type motion and the formation of chains and loops.

For meon and anti-meon in adjacent loops already in motion, the direction of action of relative potential energy will change at the points of maximum and minimum separation, leading to equalisation of rotational rates for loops in stacks.

It is how the same energy types interact between different loops and meons that drive actions, even though the total energy across all types is zero. The total of mass motional and mass potential energies of a stable system is zero. That is why the system is stable.

The effects of spin are not currently included in energy calculations correctly. Although large objects like the Earth and Sun may not have all loop spins aligned (so no overall spin-spin potential energy) the loops still all have total spin energy equal to total mass energy. Even if the net spin energy is zero, the kinetic energy of all the spins still exists and acts like mass kinetic energy.

The quantum orbital energy and momentum levels are correct for mass kinetic energy when spin states are included. At this level the relative spin momenta and mass energies are included, although spin kinetic energy has not been included as such so far, rather the spin angular momenta instead.

The odd shape of some electron orbitals, where parts of the volume of its probability distribution are separated, shows that the electron is ‘skipping’ via entangled tunnels between volumes. Since the sum of the probabilities of being in all the orbital volumes must be 100%, then the skipping between volumes must take no time and be via entanglement tunnels. The electron is self-entangled in orbitals and moves by skipping at high frequency, looking like a superposition. Photon emission double-shells can also have separated but entangled volumes between the expanding shells.

The reason gravity and charge appear so different in size, even after eliminating G, is because the gravitational effect of a loop is proportional to its rotational radius w, which in adjusted-Planck terms is very small in the loops we normally experience, whilst the charge effect is proportional to the adjusted Planck charge Q by the fine structure constant α, which is relatively very large.

Elimination of h and G from all equations shows that size is not what differentiates gravitational from quantum systems. The energy equations in both systems are the same when the kinetic energy of spin is accounted for.

Quantum Mechanics

Quantum mechanics differs from classical mechanics in that properties such as energy levels are quantised rather than continuous, with the generalisation that the former applies to small systems whereas the latter applies to large systems. Features of quantum mechanics include wave-particle duality, entanglement, superposition, non-locality and uncertainty. An underlying feature is that all actions can be reversed in time. Some features are:

1 Photons can be emitted, but it is not possible to observe how they get from source to observer – they can take any path.

2 Photons are both a wave and a particle – which depends on the type of observation.

3 Entanglement is just point-like particle blobs coalescing

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4 Superposition is the overlap of waves.

5 Quantum mechanics exists inside black holes and a full explanation requires quantum gravity.

6 Quantum mechanics supports the possibility of the existence of multiverses.

7 Pair-creation exists potentially everywhere within the universe, producing zero point energy levels

The pre-fermion model hypothesises that there are seven different aspects to quantum mechanics observations.

1 The first is that photons are emitted not as double-loops alone, but within a double-shell of outwardly-aligned partially merged pairs whose outer shell expands at local light speed and whose inner shell is at a reduced rate due to the energy lost to viscosity. Within that double-shell, the photon skips about the gap between the shells non-locally.

When a sufficient disturbance occurs, on either the outer shell or the photon itself, the shell evaporates. If it is the shell that is disturbed, the photon becomes trapped where it is located at that instant. If the photon is disturbed, either by stacking or being observed, the shell evaporates. The former is a probabilistic wave effect, whilst the latter is a particle effect.

2 The second aspect is that a loop is both a wave and a composite particle. Bohr and Einstein were both correct. They referred to different levels of structure, meons/anti-meons versus loops, without being aware that there were different levels.

3 Entanglement is where two loops have stacked together with planes parallel. Subsequent separation opens up a gap between them that is bridged by a tunnel composed of chains. Partially merged pairs from the background that have detached from the loops' chains themselves become loops which elongate the tunnel as the separation continues.

4 Superposition is the observation at a tunnel end of the two original loops which alternately swap ends, travelling randomly and non-locally from tunnel end to tunnel end. What is observed is the properties of each loop at each tunnel end for the time that each spends at that tunnel end. The result is the sum over time of those digital visits by the loops, but is not the overlap of the waveforms of the 'particles'.

When the tunnel is disturbed, it evaporates and whichever loop is left at which end depends on where they were at that instant. Because their motion is non-local, it is not possible to predict which will be at which end on observation.

It is the tunnel ends that traverse the background in experiments, not the loops. A loop at a tunnel end, constrained on its path by a filter, will immediately thereafter be replaced by the other loop, and then continue to switch ends randomly thereafter. It is the tunnel ends that expand to lose energy as they travel through the background with the loops adjusting size when the tunnel evaporates.

It is because the background is excluded from within the tunnel that the loops can travel non-locally along it, above light speed. Since it is the background that transmits all energies and forces, there can be none acting from loop to loop within the tunnel.

This means that within a tunnel, no mass or charge fields can act on anything outside a loop. The loop is massless and spinless and its charge cannot be transmitted within tunnels, but its internal partially merged pairs acting between the meons and anti-meons, that comprise the loop, remain in place.

Quantum mechanics, being supposedly dependent on pair creation as a door to other universes or dimensions is actually already a process within our universe based on dislodging a zeron into its constituent loop and anti-loop, but only within the relativistic background environment.

5 Without loops inside a massive black hole, there can be no quantum mechanics at work, no tunnels and no zerons to produce pair-creation. Loops can only form at the black hole surface.

6 In our only universe, with many continued big bangs observable within it – all based on the same size meons and anti-meons and their one-sixth electron charge sizes generated on pair-unmerger and identical universal laws relating properties – there cannot be any other universes. Anything created must use the same building blocks and combinations of pairs into loops – but the loop sizes will depend on the inflation amount of the big bangs which formed those loops within the universe and will set their chemistries.

7 Within a no-background tunnel, there are no partially merged pairs and no zerons. So there can be no pair-creation within tunnels and the quantum environment is split between the non-local motions within tunnels and the pair-creation possible within the relativistic background, based on the unmerger of double-loop zerons. The true vacuum - inside a tunnel - has literally nothing there, has no energy and no means of pair-creation.

Relativity

Relativity is the theory that the observation of all energies is relative. Special relativity applies to spacetime without gravity, whereas general relativity includes gravity. The special theory unites the concepts of space and time into one of flexible spacetime and the general theory rests on the laws of physics being the same for all observers.

Results include a maximum velocity of light speed, length and time measurement distortions, the equivalence of mass and energy and that light is deflected by mass. It proposes that inertial and gravitational masses are the same, that the universe is expanding and the existence of frame-dragging.

However, it produces singularities at the heart of massive black holes and does not distinguish between relative motions of objects that are stationary versus those in motion through the background.

The pre-fermion model agrees with all relativity other than two aspects. The first is that with meons and anti-meons being the densest particles possible, there can be no singularities.

The second is that there is a preferred frame of reference for observing the relative motion of objects. The latter is due to the existence of partially merged pair background. Unlike a generalised spacetime background, with distortions caused by matter on space time, and vice versa, the background causes objects to lose energy by the action of viscosity on the meons and anti-meons and there is a difference in whether that energy is lost by a loop that is stationary or in motion within the background.

The Twins paradox shows the difference between the two aspects most clearly, when one twin is stationary within the background and the other moves. The loops that comprise the moving twin build up a difference in phase with the loops in his stationary twin. This is because in addition to the rotational energy loss due to the background viscosity suffered by both, the translational motion of the moving twin also loses energy. When they are both back together, both will have loops rotating at the same frequency, but the phase difference between loops is a time difference.

Note that this is not the same for twins moving in opposite directions and then coming back together – here they will both have experienced the same phase difference- provided that they experienced the same velocity or acceleration and distances travelled in equal density background volumes.

The result is that there is a preferred frame of reference for relative observations, except when those observations are made within an environment from which the background is excluded – but this would then not be a relativistic environment because there would be no maximum speed and no energy loss.

Quantum mechanics versus relativity

There are many attempts to combine quantum mechanics and relativity. The major ones are:

1 Loop quantum gravity proposes that spacetime is a mesh of many Planck scale toroidal matter toroids which interlock and that this system should allow gravity to be treated in the same way as the other three forces.

2 String theory proposes that particles are open lengths of one-dimensional string which vibrates in many different ways so as to appear to be specific particles. Loops of string, and closely related M-theory, have shown interesting mathematical links to other areas of physics, but, being very general, have not yet produced specific enough predictions.

The issue is mainly that relativity is based on flexible spacetime and needs time and a maximum velocity whereas quantum mechanics is based on flat spacetime and does not need time.

In the pre-fermion model, because a loop can either exist within the background, or outside the background, the two environments are mutually exclusive. Either the loop loses energy within the background or alternatively the tunnel, or shells, lose energy to the background whilst the loops are unaffected whilst they are in the tunnel, or shells. Relativity and quantum mechanics are irreconcilable and completely different mechanics rule in each environment.

Red Shift

Red shift is the decrease in frequency of a travelling wave, usually considered to be light, due to relative motion of the *source and observer. Gravity can also affect red shifts.*

1 Photons are not affected by energy loss proportional to distance travelled – there is no tired light.

2 Particles exchange photons in the electromagnetic force, but have consistent masses

Viscosity energy lost by meons and anti-meons in loops takes two forms which result in red shifts in photons.

1 Photon double-loops, that is a loop and an anti-loop rotating parallel in the same sense merged together, lose angular frequency (rotational rate) as they translate at light speed through the local background – called viscosity red-shift. Viscosity red shift requires the rethinking of how much, or whether, dark energy exists and the size and age of our big bang.

The shear viscosity of the background is inversely proportional to the volume of the meons and anti-meons, not the loop size. This means that a photon loop, with its six meons and six anti-meons merged into six new partially merged pairs, composed of previously unmerged pairs, suffers the same viscosity energy loss over distance regardless of the loop radius. The result is that the energy loss of photons is frequency-independent, except at near Planck energy.

It is frequency-independent tired light that is responsible for the viscosity red shift of photons that is proportional to distance travelled by the meons and anti-meons, not by the photons. This viscosity red shift has not yet been accounted for in observations of cosmic red shifts, and leads to the expectation that objects are much closer than currently calculated.

2 In the other form of viscosity energy loss, non-photon loops would lose energy, that is rotational rate, except that they interact with photons in order to take frequency from the photons by stacking (absorption) and release (emission) so that they continue to maintain their frequency, which was locked-in by inflation in our big-bang.

The non-photon loops also lose energy as they translate through the background partially merged pairs, which, whilst refreshed by photons during travel and when again stationary within the background, will have a locked-in phase difference compared to when they were previously stationary.

The background takes the energy from these loops into forms of additional rotation, vibration or motion of the background partially merged pairs, basically heat, so ‘mass’ would be lost in the absence of photons that would otherwise refuel those loops.

The speed of light c is the maximum local velocity at which a meon or anti-meon, or a pair, can travel against the background, balancing viscosity forces against the mass chaser/chasing force between meons and anti-meons that have formed new partially merged pairs in the two photon component loops. Motion subject to this limitation is relativistic. Light speed c in metres per second depends on the local density of the background, which itself depends on the local masses present. Where there is a dense enough mass, light speed could be zero.

If a loop is not passing through the background, it is not limited to c and will not lose energy due to viscosity so exists in a quantum mechanical environment, producing non-locality with speeds above c.

The viscosity of the background underlies relativity, the arrow of time, electric charge generation and the second law of thermodynamics.

Spacetime

Space time is the united mix of separate space and time, which moved classical mechanics into special relativistic mechanics where length and time are relative. General relativity explains how spacetime and masses are observed to interact together for different observers.

In the pre-fermion model, there is no overall spacetime. Each loop, and each meon/anti-meon partially merged pair is its own spacetime. A volume of many loops and pairs will have an average spacetime inversely proportional to the mass energy within. The overlapping of the partially merged pairs, and their chains, within the background produces both a continuous medium and a source of indivisibles for transferring all forces in the same way.

Spacetime does not exist for the universe as a whole. There may be average times across volumes of space, but time exists only within loops for bodies composed of loops. Time for particles composed of loops did not exist before loops formed. Time exists mainly in loops and when a loop breaks as it falls into a black hole it loses all time and reverts to being a chain.

General relativity requires time because it depends on the frequencies of loop rotations. Quantum mechanics does not require time because its non-local effects are outside the background partially merged pair environment and are reversible in time.

Before loops formed, there was no time in our sense since there were no loops, or composites formed of loops, existing to observe. Partially merged pairs’ rotational, vibrational or motional activities form the main background, alongside myriad zerons, but only affect the specific partially merged pairs themselves.

There are three levels of time – outside the partially merged pair background, which has no time, partially merged pair motion/rotation/vibration and loop time.

Other failed big bangs may have had their own times, but will have lost them when their loops broke as a black hole formed and broke the loops into chains, unless the failure results in the intermediate state of a collapsing galaxy.

There is no time inside a black hole since it is a chain star, so no loops in general, except at the surface where high frequencies symmetric photons can form stably and escape. So black holes eat time, but are not home to singularities, because there are none. Quantum mechanics cannot exist within black holes, only at their surfaces.

Equivalence principle

The principle is that the inertial and gravitational mass of an object is the same and that it is not possible to distinguish between acceleration and gravity at a point. The test is that different mass objects, whether charged or uncharged, should fall at the same rate in a gravitational field because the latter is equivalent to accelerating in an inertial frame and the source of any charge is not point-like.

The principle for loops is correct because the gravitational constant *G* can be eliminated from all equations, so that there is no different inertial or gravitational mass and additionally because loops always have a positive mass effect.

However, when considering non-point-like loops, there will be a difference in the local environmental volume for the two cases. Gravity will be cone shaped, pointing towards the source of gravity, whilst acceleration will be cuboid along the direction of travel. Also the total of mass motional and mass potential energy for an accelerating loop will always be greater than zero whereas the same total of gravitational energies will always be less than zero for a non-stable-orbiting loop.

The same equality of inertial and gravitational mass applies to the meons and anti-meons, except that it is the size that is the same in each case, not the direction of action of each of the mass energies when considering the relative potential energies between bodies as they change separation.

Dark Matter and ratios

Dark matter is a hypothetical solution to the observations of the unexpected velocities of stars in galaxies and higher than expected gravitational lensing of light around objects. The main ideas are that the missing effect is due to a type of matter that does not emit light or form atoms, but acts only through gravity. There are many proposed particles that might qualify. The current best estimate of the ratio of normal matter to the total of normal matter and dark matter is around 16%.

Loops are split into the two categories of normal matter and dark matter by the number of meon-pairs within a loop.

Loops with three meon-pairs are our normal matter and all other pair numbers are dark matter. It is assumed initially that no loops can be formed from a single pair.

The ratios of various number-loops can be estimated based on their pair-numbers and their probabilities of forming.

This will give the following summation of the number of loops $N_{loop-weighted}$ across all n sets of pair-numbers, initially including 1-pair loops in the calculation, to be

$$\begin{aligned} nN_{loop-weighted} &= \frac{n}{1^2} + \frac{n}{2^2} + \frac{n}{3^2} + \cdots + \frac{n}{n^2} \\ &= n(1 + \tfrac{1}{2^2} + \tfrac{1}{3^2} + \cdots + \tfrac{1}{n^2}) \\ &= n\frac{\pi^2}{6} \end{aligned}$$

where each set is based on the whole number of available pairs being used for each, which produces a total that is n times too large, although when calculating a ratio this effect will cancel.

For the ratio of normal matter to total matter $R_{m/all-m}$ this, excluding 1-pairloops, gives

$$R_{m/all-m} = (\tfrac{1}{3^2})/[\tfrac{\pi^2}{6} - 1] = 0.1723 \quad \text{or } 17.23\%$$

This ratio is the starting point of a big bang unmerging event and would be expected to change over time as massive black holes swallow both symmetric and asymmetric loops and emit only symmetric loops, with a greater probability of the latter being two-pair dark photons.

Atomic dark matter

Most hypothesized dark matter particles do not form atoms and are only gravitationally bound. It is proposed in order to solve issues around galaxy formation, motion and evolution. Dark matter can be cold, warm or hot, depending on its velocity.

Previous papers [5] explained that only odd-number pair-loops can form atoms because their balanced stacks have to contain one loop of each asymmetry that will be matched overall by an orbiting symmetric loop of equal and opposite charge to the stack total charge.

This means that as shown in a different previous paper [6] a 5-pair loop has 12 fermion-equivalent loops of which 4 are symmetric lepton-equivalent and 8 asymmetric quark-equivalents, ignoring asymmetric neutrino equivalents. The quark-equivalent charge sizes are 1/3, 2/3, 3/3, and 4/3 with lepton equivalent charges of 0 and 5/3, all as fractions of positive or negative the electron charge size q.

How the positive and negative one-sixth electron-sized charges of the meon and anti-meon pairs are placed around the loop define the symmetry or asymmetry of the loop and there will be the equivalent of 5 different asymmetries – or 'colours' in the QCD sense – for asymmetric 5-pair loops.

To be overall colourless requires one of each colour charged asymmetric loop to be present in a stack. That is what balancing the stack means.

Since each loop has spin angular momentum of $\pm$½ h, the total spin for an odd-pair-number stack, whose loops have alternating spin orientations, will always be $\pm$½ h. Thus to balance the stack requires a similar size opposite-charge loop that is symmetric and has a spin of $\pm$½ h. In this 5-pair loop example, that is the lepton-equivalent that has charge $\pm 5q/3$ and $\pm$½ h spin.

This means that all odd-pair-number loops of odd number k will be able to form atoms where the central stacks (nucleon-equivalents) are colourless overall and will contain k loops of total charge $\pm kq/3$ orbited by an electron-equivalent symmetric loop of charge $\mp kq/3$. Stacks may have different total charges to their symmetric charged loops, but will not be able balance them orbitally unless their total charge is $\pm 5q/3$ and have all coloured asymmetries present.

What is observed in the equivalent of photon emission/absorption will depend on the mass of the electron-equivalent loop. The photon emitted or absorbed will be a double loop of positive and negative k-pair symmetric fermion-equivalents rotating in the same sense.

If an initial general big bang inflation of loops is related to pair-number then the sizes of such k-pair loops would be different to our 3-pair versions. If an initial general big bang inflation was related to loop charge then the observable sizes of such k-pair loops would also be different to our versions. However, if the initial inflation was not related to either of those properties, the k-pair loops could have the same sizes as our versions because the mass and spin energies of a loop are independent of the number of pairs in that loop, although for equal total inflation for each charge family of quark loops, the 'missing charge' factor is required for their observable masses.

So the red shift emitted by different k-pair loop photons could be similar to that emitted by our 3-pair loops, or different. This model of dark matter has hot, warm and cold loops and composites. Fast loops and composites have spin ± 1, slow loops and composites spin 0 and warm loops are baryon equivalents with spin $\pm$ ½ .

Big Bangs

Our current big bang model is considered to be the initiation event for the universe, probably from a singularity, through the stages of inflation and subsequent expansion of space to what is currently observed. The model explains issues of flatness, the cosmic microwave background radiation and Hubble red shift relationships to galaxies. Issues it fails to explain include baryon asymmetry, acceleration of expansion and how space expands.

A big bang in the pre-fermion model does not create a new universe, but occurs within the only universe.

Our big bang is one of many throughout the history of the universe. Failed big bangs are studded throughout the universe as isolated black holes and collapsing galaxies. The success or failure of a big bang depends on the amount of inflation of loops that occurs along the three dimensional spatial axes. The mix of two axes defines the size of each type of loop inflated in that plane, so there are three families of loops.

There are only two sizes in the universe, other than the loop sizes ('particle masses') which were locked-in by loop inflation, which are the DAPU Planck size of the meons and anti-meons and the fine structure constant, a function of the energy needed to unmerge the background partially merged pairs and produce one-sixth electron size charges for the meons and anti-meons. There are only three spatial dimensions so there are only three generations of fermions and no evidence exists of any more.

If the amount of loop inflation of a big bang is sufficiently large, the resulting loops will be large in radius, so small in mass. The energy released by this amount of inflation will drive a large expansion away from the centre of loop inflation, acting on small mass loops. In this scenario, gravity will be unable initially to overcome the subsequent expansion.

If the amount of loop inflation is not sufficiently large, the resulting loops will be small in radius, so large in mass. The energy released by this amount of inflation will not be enough to drive a large expansion away from the centre of inflation and it will be acting on large mass loops.

In this scenario, gravity will overcome the subsequent expansion and the loops will collapse over different timescales to become black holes or slowly collapsing galaxies. Many black holes and galaxies are these failed inflation events. Isolated black holes with no surrounding matter would prove that they were such failed inflation events.

Inflation is of the loop sizes, not the size of the meons or anti-meons, so our big bang is moving through the pre-existing background in which failed big bangs should be observable as having 'wrong' red shifts for their positions relative to objects co-moving within our big bang expansion. Where there are two seemingly physically conjoined galaxies that have different red shifts, one will be part of our expansion and the other part of the pre-existing universe or a failed big bang which occurred during our own expansion but is not part of our flow.

The difference in red-shifts for these objects at the same distance from us will enable the calculation of the relative motional rates and the age of our big bang. Since we are unlikely to be at the centre of expansion, there will be significant uncertainties in the calculation, but our relative position within our big bang may be estimated eventually.

The unit size of meons and anti-meons means that space cannot be expanding in the accepted sense of all distances increasing. The observance of expansion in this sense is due partially to travel through the viscosity of the background producing a red shift in photons which has not yet been taken into account.

There will be a change in average red shift gradient versus distance starting from the extreme point of our big bang's current expansion. The average red shifts being a mix closer in due to both viscosity over distance and the motion of our expansion itself and further out solely with viscosity over distance, ignoring small relative local transverse velocities.

The existence of the viscosity red-shift will necessitate reconsideration of our current standard candle calibration.

Big bangs beyond the current envelope of our own will be observable as extreme red shift objects. There will probably be failed big bangs just outside or within our big bang envelope whose discordant red shifts compared with adjacent galaxies which are part of our big bang flow will enable their identification.

This set of red shifts will enable the calculation of the actual average viscosity red shift effect on photons over distance and will help in estimating the real Hubble rate for our big bang.

If the fraction of red shift observations due to viscosity is high, it is possible that the net red shift of our own big bang components will show it to be collapsing, or expanding more slowly than previously calculated.

Failed big bangs beyond our own big bang envelope will look like galaxies that have grown too quickly for their lifespan from the start of our big bang. Such large early galaxies will have no relationship in time with the start of our big bang.

The twist/charge $qc^3/6$ energy sizes will be the same in any big bang because they depend on the size of the meons/anti-meons and the fixed energy needed to unmerge them. The maximum speed of light *c* will also be the same in any big bang because the partially merged pairs are always the same size.

Other failed big bangs may have had their own times, but will have lost them, if they collapsed significantly, when their loops broke as a black hole formed.

Fields

A field is a volume in space which possesses energy, or other properties, within it and which may change over time. A field can be generated by a particle or act on a particle. The main fields studied are those of the four fundamental forces. Fields can have internal symmetries or symmetries that vary within spacetime.

The strength of fundamental mass and fundamental charge fields is equal through $M = Qc$. All charge and gravitational energy fields have equal strengths of interaction when considered in fractional adjusted-Planck terms in DAPU form. This is because the gravitational constant *G* is related not just to the mass of bodies, but also to their separation. By increasing the current Planck mass by the factor $\sqrt{G}$, and reducing the current Planck radius by the same factor, *G* can be eliminated completely from all equations. The same can be done for Planck's constant *h*, but the resulting numbers become unwieldy.

Unified field theory

Another name for a theory of everything which combines which particles form and how they interact - usually the four fundamental forces and the observed particles- based on their respective fields.

The pre-fermion model is particle-based and hypothesises that mass and charge fields (both fundamental and emergent) exist and are transferred by the partially merged pair chains which constitute the main background material of the universe.

Dimensional analysis and dimensionality

Dimensionality is the analysis of physical properties and their interrelationships, used to find the lowest number of properties which can be used to define other properties - usually expressed in terms of mass, length, time and charge. Dimensional homogeneity is the concept that equations must have the same dimensions on each side of an equation in order to be valid dimensionally.

The Planck and gravitational constants *h* and *G* can be shown to be dimensionless ratios using a dimensional analysis of all the properties deeper than mass *M*, length *L* and time *T*. This involves considering a dimension *Y* for each property, where mass has dimensionality Y^1, velocity Y^2, distance Y^{-3}, energy Y^5, charge Y^{-1}, Electric Field Y^9 etc. Laws of nature can be used to uncover these dimensionalities and new laws can be found by reversing the process.

Elimination of *h* and *G* shows that size is not what differentiates gravitational from quantum systems. The energy equations in both systems are the same when the kinetic energy of spin is accounted for. Since the fundamental constants *h* and *G* have zero values for dimensionality they can be eliminated from all equations by appropriate adjustment property units because they are only dimensionless ratios. To correctly understand the relationships between properties h and G needs to be eliminated.

Dimensionless constants

These arise either in translating between different units for the same property or from the use in SI of historic choices for the values of certain properties or property relationships.

In the pre-fermion model, dimensionless constants have dimensionality of zero, so are independent of any and all properties. The main dimensionless constants are Planck's constant h, Gravitational constant G, Boltzmann's constant K_B and permeability μ. These constants can be eliminated from all equations by adjusting properties, mainly M, Q, L and T.

Scientific laws

Scientific laws express the repeated observations of relationships between properties under specific circumstances and can be used to predict new relationships.

A scientific law is the equating of sets of properties, using their dimensionalities, either side of an equal sign such that their total of both sides is the same. This sets the overall relationship between those properties, but different aspects of each property define the actual numerical values which are dependent on the units used.

Conservation laws

Conservation laws are based on symmetries of either space or time, or both, on a system.

All energy is conserved overall, and within isolated systems, although the type of energy may change in those systems.

Laws of physics and nature

These are thought to be foundational constituents of the universe and are products of repeated observation. It is thought that the possibility exists that different laws apply in different parts of the universe or in other universes as part of the multiverse idea.

In the pre-fermion model, the laws of physics are set by the relationships between properties based on the dimensionalities and apply everywhere over all time. Dimensionality is the underlying relationship between properties. Every property has a dimensionality of Y^x where $-9 \leq x \leq 17$ for those properties already known and two not yet discovered. Dimensionally Planck's constant h is $Y^0$and G is also Y^0. Any equation where the sum of the dimensionalities on each side are equal is a law of nature (h=mvr, Y^0 = $Y^1Y^2Y^{-3}$).

Laws of nature can be uncovered by equating properties across an equation (ηV = h, the product of shear viscosity and volume is a constant). This latter is why the background viscosity effect is the same for all frequencies of photons. The spiral path of meons and anti-meons in a loop is the distance over which they are subject to viscosity and, apart from at very high frequencies, this can be considered as the path of the loop itself.

Any property which has a dimensionality of zero is a universal constant, not affected by any property. It is possible to eliminate other properties of dimensionality zero like G or h.

Given the dimensionality relationships, the laws of physics could not be any different to what they currently are. Physics is the same everywhere and breaks down nowhere. There are no singularities. The laws of physics can be no different anywhere because the maximal values of all properties are powers of $\sqrt{c}$, or of $\sqrt{c}$ and the fine structure constant α. Loop sizes define the size of interactions but not the relationships between properties. However, the results of those laws (energy levels etc) depend on the sizes of the loops, which could be different in a different big bang to ours.

The sizes of the twist, and one-sixth charge, energies $\pm sc^2/6$ and $\pm qc^3/6$ respectively, will be the same in any big bang because they depend on the size of the meon/anti-meons and the energy needed to unmerge them. The maximum speed of light c will also be the same in any big bang because the ZMBHs are always the same size.

Charge and spin

Charge is a type of property mostly associated with electromagnetism and quantum chromodynamics, although it can be generalised to other areas. Specifically here it is used only to represent the property that the electron possesses which is equal in size and opposite in sign to that of the proton, and which produces an attractive force between them.

Spin is the internal angular momentum of fermions and of many composites. The spin value is quantized in size and appears either as up or down relative to some orientation. Its value is usually given as $\pm$½ h.

In the pre-fermion model, when a partially merged pair is unmerged, or split into a meon/anti-meon pair, it always requires the same amount of energy, again of two equal and opposite types. That amount of energy is the equivalent of $qc^3/6 = \sqrt{\alpha/2\pi}\, Q\, c^3/6$ where q is the size of the electron charge. This is where the fine structure constant α appears from and why the charge on protons and electrons is the same size.

The mass energy goes into twisting the meons ('twist' meaning to spin about an axis along the meons' direction of motion, used to differentiate this mode of rotation from a loop's rotation about an axis perpendicular to the plane of the loop, which is what we call spin) and the other is electrostatic charge generated by spiral motion of the meons' fundamental charge against the background partially merged pairs axially along its direction of motion.

The sign of electrostatic charge generated by the twisting depends on the identity of the meon or anti-meon and the direction of spiral twist in motion. In all cases both signs of charge *+q/6* and *–q/6* are generated by each unmerging meon pair. Twist energies occur in units equivalent to the *q/6* electron charge $qc^3/6$ because it takes the same amount of energy to unmerge each partially merged pair into a meon and anti-meon pair.

Unmerged meon/anti-meon motions

The Standard Model says nothing about any building blocks beneath fermions.

The pre-fermion model hypothesises that, once unmerged, the meons and anti-meons chase each other to try to recombine due to the chase/chased relative potential energy effect. This is because, although the fundamental charges act in the same way as electronic charge (same repel, unlike attract), the fundamental masses act differently (same attract, but unlike masses either chase or try to maintain separation from each other, the latter being attracted to retreating meons/anti-meons and repelled by approaching ones) – the combined charge and mass effect is that opposite sign meons chase, or are chased by, each other as a pair when in motion, having started from rest on unmerger.

Their relative direction of chasing depends on the initial cause of their change in separation because either could be the chaser or the chased. There can be no retro-causality, it is a digital effect within a loop. Across adjacent loops, the effects change between closest and furthest approach points.

Because there are both positive and negative fundamental masses $M+$ and $M-$, each adjusted by positive or negative twist energy $\pm sc^2/6$, within loops, the normal electromagnetic equations apply exactly as for charges, except for the additional viscosity factor due to the background. So there are mass flux lines between meons and anti-meons in the loops in the same way as magnetic flux lines between charges.

An unmerged chasing pair of meons will find other similar pairs when a big bang occurs and will form chains, each meon chasing an anti-meon, or vice versa, in front. When a chain catches onto its tail, a loop is formed. This is the only stable form of combinations of unmerged meons.

When a loop has three pairs, it has possible electrostatic q charge values of ±1, $\pm2/3$, $\pm$ 1/3 and 0 and is our matter with three-fold symmetry. These loops are our fermions.

Fermions and bosons

Fermions are quarks and leptons which have half-integer spin and obey the Pauli exclusion principle which mean they cannot occupy the same state in an atom. Bosons have integer spin and have no such restrictions and are thought to be the particles which transmit forces.

In the pre-fermion model, fermions are single loops. Symmetric fermions are the leptons – electron, positron and some neutrinos and anti-neutrinos. Asymmetric fermions are the quarks and some neutrinos and anti-neutrinos.

Asymmetric fermions stack to make baryons whose cores are three asymmetric quarks with charges totalling 0 or ±1 and spin $\pm$½ *h* and whose end caps are symmetric leptons.

Fermions exist in three generations whose sizes were set during inflation along three planes set by the three spatial axes.

Bosons are stacks of two loops whose charges total 0 or ±1 and spin 0 or ±1 depending on the relative rotational orientation of the two loops. Bosons do not transmit forces. Zerons are stacks of symmetric loop and anti-loop of all sizes, with zero charge and zero spin, centred at every point in space. They produce zero point energy and are responsible for pair creation when impacted. The Higgs particle is a scalar boson of a specific size.

Particles, Loops and Majorana fermions

A Majorana fermion is one which is its own anti-particle. The neutrino may or may not be its own anti-particle.

The symmetric loops are the electron, and positron, and some variants of neutrino and anti-neutrino. Some symmetric neutrino and anti-neutrino loops differ by only 60 degrees of rotation. There can be no Majorana fermions because there is always a difference between a symmetric neutrino and anti-neutrino at meon/anti-meon level - even if the difference is not observable

The quark loops are asymmetric. Normal matter is loops of three pairs. Dark matter is mainly loops with other than three pairs.

Loops can stack one above another, provided the stack itself is symmetric overall, which means that the number of pairs in a loop define which other loops can successfully contribute to the overall symmetry of the stack.

For a stack to be symmetric overall requires that the total charge in the stack is either a multiple of 1q or 0q and the asymmetries of the asymmetric loops balance along the stack axis.

Nucleons are balanced stacks of loops, each loop rotating opposite to its adjacent loop. Since the only particles in a stack are the underlying meons which comprise the loops, electrons, positrons and symmetric neutrinos/anti-neutrinos can exist within nucleon or other overall symmetric stacks.

The requirement of symmetry, to match the local environment where q charges are 1 or zero, is why quarks do not easily appear on their own.

Examples of short stacks of loops are pions, which form when nucleon stacks are impacted. They could be quark or lepton loops rotating in either sense, provided the total charge of the stack is $\pm 1q$ or $0q$.

Dark Matter

Dark matter is not known to interact with ordinary matter except gravitationally. The most likely solution is considered to be weakly interacting massive particles, axions or primordial black holes.

In the pre-fermion model, loops of other than three-pair numbers of pairs are one form of dark matter, unable to stack in our threefold symmetric stacks, because their symmetries are different and unable to produce balance overall along the stack axis. Dark matter loops can stack with loops of their own pair symmetry to form stacks. However, only odd pair number loops can produce chemistry.

The threefold symmetry of three pair loops is what drives chemistry. In an odd-pair number loop, there will always be an odd number of loops required in a nucleon stack in order to balance the asymmetries of the component loops. This means that the nucleon stack will always have a net $\pm$½ h spin, which will require an orbiting loop with $\mp$½ h spin to balance it to form an atom.

If loops are composed of an even number of loops, then net nucleon-equivalent spins will be zero or units of 1 h, and no further balance is required, so no atoms will form and no chemistry will happen.

The latter requirement for balance is the fundamental drive in the universe. The largest imbalance will be sorted first, then smaller ones. All systems tend towards zero total of each energy type.

Loop stacks

The Standard Model says nothing below fermions – treating fermions as amorphous point-like particles.

Stable baryon stacks include protons and neutrons. To change a neutron into a proton requires that the electron and anti-neutrino loops in the neutron stack be impacted and replaced by a neutrino and anti-neutrino loop of appropriate energies. This change from neutron to proton is usually described as the weak force, but it is only the result of incident impact. A stack has to have all the component loops of the same size in order for balancing symmetry to be achieved.

What we term the mass of a particle, considering just a single loop, is its rotational rate w because all the fundamental mass/charge and twist/charge energies in the loop due to the meons and anti-meons' motions sum to zero, leaving only the rotation and overall charge.

The mass energy can be considered as being due to the rotation around the loop of the meons' fundamental masses. The spin energy can be considered as being due to the rotation around the loop of the meons' fundamental charges. The mass and spin energies of every loop are the same size, although of opposite type.

The charges on the loops are the sum of the *q/6*'s of the meons in the loop. The sum of the twist energies in the loop is the sum of the $sc^2/6$'s of the meons in the loop. A symmetric zero charge, zero twist loop will have no observable mass. A $2q/3$ charge, $2sc^2/3$ twist loop will have the product of its 'missing charge' factor and the rotational frequency w of the loop observable. A non-symmetric zero charge, zero twist loop may have some mass observable.

Although the loop is described as having a mass, it is the effect of the rotation of the loop on the background partially merged pairs that produces the effect of mass. This may be described as the deflection of space by mass, but it is actually the greater or lesser alignment and density of partially merged pairs in the local background relative to the rotating meons and anti-meons in the loops and attached chains of partially merged pairs attracted to the meons in the loop due to the meons and anti-meons' masses and charges and chasing strings of partially merged pairs.

The appearance of the mass of loops and black holes is due to the local density of the background, caused by the frequency of loops indirectly. There are both magnetic and mass field lines through the centre of the loops, with the same shapes and equal strengths.

As loops decrease in size (increase in energy, w) the charge (magnetic) and mass fields passing within the plane of the loop increase in density and increase the local background density. Each partially merged pair in a chain attached to a meon or anti-meon in a loop is trying to attract/repel/chase other partially merged pairs/loop meons that are not in the loop, so the effect is like a whirlpool around the loop with charge and mass fields extending beyond loop itself, effectively dragging the background, and vice versa.

Strings of partially merged pairs attached/chasing in the plane of the loop provide stability for spin momentum and limit how far and what relative orientations for spin interactions act between loops.

The meons within loops always exist, even though they may switch places with meons in other loops converting two loops into two different loops, maintaining total frequency as mass and spin plus charge, but not necessarily total mass and magnetic moment.

Loop quantum gravity

Loop quantum gravity proposes that spacetime is a mesh of Planck scale toroidal matter that interlock to comprise spacetime and that this system should allow gravity to be treated in the same way as the other three forces.

The definition of mass as solid toroids restricts how the size of those toroids can change and their interlocking restricts how they can move, although as a background mesh they provide a source of gravity. The pre-fermion model enables a more flexible mass definition in how and why the loops sizes can change as a result of adding, or subtracting, frequency or swapping meon/anti-meon pairs in loop-loop interactions.

String (loops)

String theory proposes that particles are open lengths of one-dimensional string which vibrate in many different ways in many dimensions so as to appear to be specific particles. Loops of string, and closely related M-theory, have shown interesting mathematical links to other areas of physics, but, being very general, have not yet produced specific enough predictions.

The string (loop) vibrating in many dimensions provides excessive degrees of freedom in what can be constructed. This means that anything can be replicated, at high energy, but nothing specific, at low energy, predicted. Pre-fermion loops provide the better model as they use inflation to explain physically why initially near-Planck energy loops become low energy loops.

Nucleons

Nucleons are protons and neutrons, when within the nucleus of an atom, and are composed of different quarks. The strong force between nucleons keeps the nucleus together. The colour force keeps the quarks together. Protons are composed of two up quarks and one down quark, totalling a charge equal in size but opposite in sign to that of the electron. Neutrons are composed of two down quarks and one up quark and have zero overall charge. The quarks each have to have one of three different colours in order to be stable. An isolated neutron decays into a proton plus electron and anti-neutrino.

The pre-fermion model treats neutrons and protons as stacks of loops whose cores are asymmetric quark loops with symmetric leptons as end caps to the stack.

The proton, where positively charged loops are defined as matter loops, is a matter stack overall, whilst the neutron stack is an anti-matter stack overall. Stable nuclei form with a balance of matter and anti-matter stacks.

The force keeping the stacks together, and between adjacent stacks in the nucleus, is relative potential energy due to the chase/chasing action between meons and anti-meons.

There is no separate strong force. Colour force is instead the need for the stack core of asymmetric quark loops to achieve overall balance along the stack.

Matter and anti-matter

Matter is used somewhat loosely as something that has volume, mostly being particles like atoms. Matter is also more precisely used to describe the normal set of particles of the Standard Model, as opposed to their anti-partners which are termed anti-matter, all of which have positive mass. Since all such particles are thought to be point-like amorphous objects, the definition of matter is somewhat loose. Mass and matter can be used indiscriminately in a cosmological context, where the difference is not material.

Anti-matter is defined to be the anti-partner particles of normal matter, having opposite charge as the main characteristic. The normal matter particles are the proton, neutron, electron and neutrino. Anti-matter is closely related to negative matter in that the mixing of matter and anti-matter results in annihilation into radiation, but where anti-matter has the same positive sign of mass as normal matter, negative matter is considered to have negative mass. Negative mass is presumed to repel other negative mass and is associated with negative energy. The universe is apparently composed of normal matter, but the reason why the expected balancing anti-matter appears to have disappeared is unsolved.

There is no baryon asymmetry because the loop nature of meon/anti-meon composites creates more aspects that need to be mirrored from a matter loop to an anti-matter anti-loop. It is the loop system that sets which stacks composed of multiple loops are overall matter or anti-matter.

The loop structure produces extra degrees of freedom that enable the anti-loop of a spin +½ electron to be a spin +½ positron. The only possible property, in a meon/anti-meon loop system, that can be used to differentiate between matter and anti-matter, for a charged loop, is the overall sign of charge of the loop. If the choice is made to define the electron as the matter loop, then loops and stacks with net positive charge will be anti-matter loops. And vice versa, if the choice is to make protons the matter stacks. Matter and anti-matter do not annihilate each other. No meons/anti-meons or loops are ever annihilated, although positive and negative meons might be able to remerge into partially merged pairs under certain conditions.

Since charge is the only differentiator for matter and anti-matter loops, then all systems tend towards neutral outcomes. Matter and anti-matter are created equally. All stable orbital systems have equal quantities of charge because the only differentiator is the sign of charge.

In both matter and anti-matter loops the meons and anti-meons have attached partially merged pair chains dragging through the partially merged pair background which gives rise to attractive positive mass effects only.

Mass

Mass is the property of a body which causes, and is subject to, gravity and acceleration. It is presumed to be only positive in all matter and anti-matter particles. However, the Standard Model proposes that those particles have no observable mass until they move within the field generated by a Higgs boson. The three forms of mass are inertial, active gravitational generated by the object and passive gravitational exerted on an object. These forms are thought to be the same, but are still the subject of experiment. Relativity states that mass and energy are the same and that mass deflects spacetime and vice versa.

In the pre-fermion model, mass is the effect caused by the rotation of the meons and anti-meons in a loop, each of which has chains of partially merged pairs attached that drag through the background. The rotational frequency of the loop produces what we call the size of the mass and that rotational energy is equal in size and opposite in type to the spin energy of the loop. Each loop, with its chains dragging through the background is like its own Higgs particle where the Higgs field is like the background of partially merged pairs and zerons.

The mass that we observe a loop to have is also proportional to the 'missing charge' factor of that loop. The square of the loop radius will not be, apart from the charged leptons which have no 'missing charge', directly inversely proportional to the loop mass. The quark observable masses are changed by the factor $(1-\frac{missing\ loop\ charge}{maximum\ loop\ charge})^{0.5}$ so that needs to be included in the calculation of the loop radius.

The result for the electron is that, with no missing charge, the factor is 1, whereas a symmetric neutrinos, which is missing all its charge has the factor zero. The situation for the asymmetric neutrinos is unclear, but may allow a partial mass to be shown.

For the three-pair quarks, the factors are 0.8165 for the $1/3$ charge family and 0.5774 for the $2/3$ charge family.

Dark matter loops will have further factors depending on the pair-numbers, but the high and low charges will have the same factors as the electron and symmetric neutrino.

This gives a pointer to what the observable masses and charges of dark matter may be, despite the difficulties in actually being able to observe them. The gravitational masses and spins will be identical in size to our three-pair fermions since those energies depend only on the rotational rates of the loops and their inflation rates are likely to be the same as our fermions families overall, even if not individually the same.

How to define matter and anti-matter

Matter is taken as being the most common particles, the proton, neutron, electron and neutrino. Their anti-particles are taken to be anti-matter, meaning that our environment is a matter one because all the major particles in our atoms are defined to be matter. Because each particle is considered to be point-like with properties of mass, charge, spin and magnetic moment, the degrees of freedom available to define the difference between matter and anti-matter are severely limited. However, the result is that the difference between matter and anti-matter is the sign of their charge – but based on the mix of charges that matter has been defined to be.

The definition of matter and anti-matter in the pre-fermion loop system has more flexibility and does not presume that the most common particles are the matter ones. The result, explained below, is that positively charged loops are matter, negatively charged loops are anti-matter and uncharged loops may be either, or vice versa depending on choice of sign. Baryons are positively charge matter protons and uncharged anti-matter neutrons with negatively charged electrons being anti-matter.

The starting point in defining the difference between matter and anti-matter is to consider a chain of pairs, of meons and anti-meons, of any number travelling across a theoretically-existing flat surface. The chain then encounters an obstacle which deflects it either right or left so that it catches its own tail to form a loop. One loop version will become a clockwise rotating loop and the other an anticlockwise rotating loop, each relative to the flat surface. If the clockwise rotating loop, knocked to the right in this thought experiment, is defined to be spin +½ then the anticlockwise will be spin -½ .

It is also apparent that the spin energies, caused by the rotation of the fundamental charges of the meons and anti-meons in each loop, are the same and so are their mass energies, caused by the rotation of the fundamental masses of the meons and anti-meons in each loop. They are both the product of Planck's constant (angular momentum) ½ *h* and the loops' rotational frequencies.

The charges of the loops will also be the same since the meons and anti-meons have not changed twist orientation, which latter is the spiral combination of axial spinning of the meons/anti-meons along their direction of travel that defines the sign of one-sixth electron-sized charge each generates. This stage has produced two loops of the same size mass, same sign charge but different spin signs.

The next stage is to define a matter or an anti-matter loop by considering all possible mirror properties that can be performed on those loops by switching each in turn, for time, spatial and identity properties. Firstly the initial direction of travel of the chain and the twist orientation of each meon/anti-meon needs to be reversed. Then the underlying identity of each meon has to become an anti-meon and vice versa.

So now, for example, a meon twisting right hand screw along one spatial direction (forwards), generating negative one-sixth electron size charge, will become an anti-meon also twisting right hand screw along the opposite spatial direction (backwards), generating positive one-sixth electron size charge.

A spatial difference is also that the chain previously deflected right will now be deflected left to form a spin -½ loop instead of the earlier spin +½ loop since the chain travel direction is reversed and the obstacle is in the way of its new path. The last spatial change is that this loop itself must be flipped over to become a spin + ½ loop.

These switches in time, identity and spatial orientation constitute the degrees of freedom for defining matter or anti-matter in a pre-fermion loop-based system and are greater in number than currently considered in the amorphous view of particles.

The result is that the only property that provides an unambiguous definition that can be used to define loop matter and anti-matter is the sign of charge of the loop. This means that if the positively charged positron loop is defined to be matter, then the negatively charged electron makes it an anti-matter loop, as would be all other negatively charged loops.

The neutrino loop could be defined as either matter or anti-matter since it has no overall charge. Even if a specific position, and meon/anti-meon identity, for the start of an analysis of a symmetric neutrino loop is defined, so that it would be possible to call one matter and the other anti-matter (rotating either loop by 60 degrees would convert one to the other), this would not be observable. However, this difference is enough to negate the neutrino as a Majorara fermion, even if the difference is not observable.

The anti-loop of a positively charged spin +½ loop is a negatively charged spin +½ loop. Therefore a photon, being loop and anti-loop rotating parallel in the same sense (and stacked/merged together), is a perfectly balanced composite of matter and anti-matter. This means that matter and anti-matter do not annihilate on contact, but form composite loop stack systems.

With this loop-based definition of which is matter or anti-matter, it means that in the nucleus, the three core quarks in a loop-stack that defines a proton have two positively charged matter loops and one loop of negatively charged anti-matter. This presumes that the choice has already been made to define the positively charged positron to be a positive (normal) matter particle, although the opposite could be chosen.

In the neutron, the opposite is the case for its core stack-loops, with two anti-matter loops and one matter loop, and this means that, although the neutron is charge-neutral, it is an anti-matter particle overall. Therefore nuclei build up generally by balancing matter core loop-stacks (protons) with anti-matter core loop-stacks (neutrons) and are more likely to be stable when the number of matter and anti-matter nucleon components is equal.

Therefore all stable nuclei contain equal numbers of matter and anti-matter nucleons, and all atomic photon emission energies will be identical whether the atoms are composed of neutrons and positively charged protons or anti-neutrons and negatively charged anti-protons with balancing electrons or positrons emitted/absorbed respectively.

Any simplistic definition of amorphous point-like matter and anti-matter by sign of charge alone, rather than by net loop charges, would not treat neutral particles appropriately.

Since in the big bang there was a balance of fundamental charges of the meons and anti-meons, as well as of one-sixth electron-sized charges in the twisting meon and anti-meon pairs, there can be no charge or matter/anti-matter imbalance in the universe, even though there may not be an exact balance in the number of matter and anti-matter loops subsequently formed.

Taken overall, the symmetry of the definition of matter and anti-matter is such that even if it were reversed, there would be no difference that could be measured. Only when two environments, composed mainly of different overall charge sign in the proton stack, came into contact could it be observed that they were different. But each could equally well claim to be the matter version.

An electric battery is a matter/anti-matter device.

Zero point energy

Zero point energy is the lowest possible energy that can exist in a quantum mechanical spacetime system because of the uncertainty principle and is the same as the energy of the vacuum of space. The difference between the theoretical value and the expected value is the largest discrepancy in physics.

A form of stacked matter/anti-matter loops is a zeron - like a photon but with zero spin. This is a spin +½ electron stacked with a spin -½ positron, or vice versa, with total spin zero - opposite rotating loop and anti-loop. The zeron has the lowest stack energy of any loop stack, although not the lowest mass energy, and zerons exist centred at all points in space at all concentric radius sizes. Zero point energy is due to multiple concentric shells of zerons centred at every point in space and may be considered part of a form of Higgs field along with the partially merged pair background.

The existence of zerons means that 'pair creation' is not a quantum mechanical effect. The no-background environment inside tunnels is the lowest possible energy state, but pair creation cannot occur. The no-background environment is a real vacuum with nothing in it other than the two loops which caused the entanglement tunnel to form. It is not possible to measure the energy level because inside the tunnel can only be the loops that formed the tunnel.

Uncertainty principle

The uncertainty principle states that no object can have precise values for both of two linked properties, such as position and velocity, simultaneously, described for change in energy and time as the Heisenberg uncertainty $\delta E\ \delta T = h$.

In DAPU units, used by the pre-fermion model, h can be eliminated by substitution into the SI units of mass and distance, so the equivalent relationship becomes $\delta E\ \delta T = 1$. This suggests that, in the correct units, it is possible to know two linked property values precisely.

Pair creation

Pair creation is caused by the non-zero value of zero point energy and the uncertainty principle, resulting in the possibility of a particle and anti-particle spontaneously appearing at a point in space.

Pair creation is the temporary separation into loop and anti-loop of a zeron that has been impacted by another loop, or loops, of appropriate energy (frequency). The loop pair always exists, but is hidden, as zero point energy, until impacted. Pair creation is effectively the temporary un-stacking of a zeron.

Zerons are also one reason for the Casimir effect [7]. Any zerons of greater diameter than the distance between two parallel plates cannot exist between the plates and have to be moved aside, creating a pressure at the plates.

Frame dragging

Frame-dragging is a relativistic effect on spacetime caused by motion.

In the pre-fermion model, frame-dragging is a physical effect of the partially merged pair chains attached to meons and anti-meons in a loop sweeping through the background of partially merged pairs and zerons. The overall effect of the sweeping is gravity, the loops lose frequency and the dragging produces a phase change in the loop's rotation.

Black Holes

Black holes are considered to be massive objects whose gravity is so large that nothing can escape and they can be observed only by their effect on other nearby objects. General relativity predicts such objects and currently the boundary of escape is called the event horizon. The only properties that a stable black hole has are mass, charge and spin. The result is that it is expected that no information on what has entered a black hole will ever emerge - despite conservation laws on fermion, and total baryon, numbers – called the information loss paradox. Later work has suggested that quantum pair creation at the event horizon allows holes to evaporate and possibly information to escape.
At the centre of a massive black hole is thought to be a singularity – a place of infinite density where laws of physics break down – protected from view by the event horizon. The solution to the apparent breakdown of general relativity at a singularity is expected to be solved by some form of quantum gravity explanation.

The pre-fermion model proposes that there are two types of black hole.

1 Meons and anti-meons are the densest black holes of Planck size mass and charge, and of Planck radius size, which cannot be broken into smaller units and so there are no singularities and physics does not break down anywhere - even inside the second form of black hole, the massive type.

2 Massive black holes are the second type of black hole, where ZMBHs, partially merged pairs, chains of partially merged pairs and unmerged pairs, and, at the surface of the black hole, loops exist. They are not black and photons form at their surface to escape.

All massive black holes are identical in their composition, although not their total mass, charge and spin. As a loop enters a black hole, a loop whose plane is not parallel to the local hole surface will experience differential gravitational and charge fields from the hole that stretch and eventually break the loop into a chain.

The ex-loop's attached/surrounding background chains of partially merged pairs and the chain itself enter the black hole and its 'mass' increases because the local background density is now larger and the mass energy of the rotational rate of the loop, due to the fundamental masses of the meons and anti-meons, is absorbed by the hole. The same is the case for the fundamental charge energies that produce the 'spin' energy of the loop, so that this energy is absorbed by the hole in a changed spin overall. The one-sixth charges on each meon and anti-meon in the chain remain with those meons and anti-meons inside the hole, as do their fundamental masses, one-sixth electron size charges and twist energies.

The result is that, by the time the ex-loop gets to the massive black hole horizon, all its rotational energy has been absorbed by the hole, but the chain retains its individual meon and anti-meon properties. The latter are available, after breaking into/reforming into other chains within the hole, to become loop and anti-loop then merge as a symmetric double-loop photon at the surface of the hole to escape perpendicular to the black hole surface, if the rotational rate is high enough - although such a photon will lose most of its energy in escaping.

A massive black hole is mainly a mass of chains forming, breaking and reforming. A black hole is really a chain star. All black holes are the same, whether pre-existing failed big bangs, or formed in our successful big bang, because they break symmetric and asymmetric loops into chains, then shorter fragments, and spit out very symmetric photons whose frequency of exit depends on the mass of the black hole. Regardless of the loop sizes or pair number formed in the failed big bang, the result of being broken into chain fragments means all black holes are identical in their components.

Massive black holes transform loops preferentially into dark matter photons since 2-pair loops are more likely to form than 3-pair loops. The need to leave perpendicularly means that the physical size of the black hole cannot be observed. For an observer, the photons being viewed are those that escaped along their line of sight and no photons from other parts of the black hole surface can be observed simultaneously.

Black holes act as symmetry sieves, taking in all symmetry loops and converting them to symmetric photons, both matter and dark matter versions.

Where a failed big bang has occurred, the loops formed during inflation have too large masses and not enough energy of expansion to resist gravity. In some instances, the loops formed will break into chains as the contraction occurs to form a black hole. In other instances, where the amount of inflation is larger, galaxies will form.

It may be possible for single symmetric loops to escape from the poles of axial rotation of a rotating black hole because the extra rotation at these two points may aid the formation of loops and their subsequent motion away.

Laws of thermodynamics

The laws of thermodynamics describe changes in systems, or whilst in equilibrium, between properties of energy, temperature and entropy. The main outcomes are a definition of temperature, conservation of energy, that slower particles cannot speed up faster ones, change increases entropy, no perpetual motion machines are possible and that at absolute zero there may be a non-zero entropy.

The first law of thermodynamics is true in the most fundamental way. Energy is conserved because it is always zero in total across all energy types in a system. What needs to be considered is how much of which types of energy is present in any system, and it is that which defines how encounters are affected. The usual type of energy to which conservation of energy is applied is mass-related energy.

However, in loop-loop interactions where those loops break briefly into chains and then swap some meon or anti-meon partners across the chains before forming new loops, the result may look like the total mass of the two loops changes. What occurs is that the total loops' frequencies are conserved, but the observable mass will differ depending on the new loops' individual charges and magnetic moments.

It is the total across all energies that is conserved in such a transformation, not just the total loop masses.

For two random particles, the mass-type energies of one will only influence the mass-type energies of the other. And the charge-type energies of one will only influence the charge-type energies of the other. In their interactions, when all energies are considered, they will both start with zero total energy and end with zero total energy. However, the amount of each energy type they each have will alter.

The second law of thermodynamics requires that spontaneous processes are irreversible. This is best shown in the viscosity of the background of partially merged pairs, where every motion by every meon/anti-meon pair-based structure requires a rotational, or motional, energy loss, even the tunnel ends within which there is no background. The action cannot be reversed and energy regained. Reversal of an action just results in more energy loss. So all motion loses energy, providing an arrow of time, which is a breaking of the symmetry of actions. There are no energy-free reversible actions within partially merged pair space, so quantum mechanics does not exist within the background, other than where it includes zeron loop-anti-loop stacks.

Laws of black holes

Laws of black holes have been proposed to apply to massive black holes and seek to match the laws of thermodynamics. Two outcomes are that the gravity at the surface of a black hole is proportional to its temperature and its surface area is proportional to its entropy.

None of the four black hole laws apply to the meons and anti-meons on an individual level, despite them being the densest black holes possible.

All of the black hole laws apply to massive black holes.

Between these two extremes, the various composite systems formed by pairs of meon and anti-meon vary in whether, or not, each of the laws apply. Those structures are ZMBHs, partially merged pairs, partially merged pair chains, unmerged pair chains and loops. Composite structures for which the laws are not applicable are the partially merged pair background, loops with attached partially merged pair chains, inside entanglement tunnels, photons and atoms.

Inflation

Inflation is considered to be the exponential expansion of *space immediately following the initiation of the (only) big bang. It was proposed to solve issues including the flatness, symmetry and isotropic problems – that all directions appear equal and relatively low in energy in the cosmic microwave background observation – and the large-scale structure of the universe that saw galaxies produced from early quantum fluctuations.*

The pre-fermion model proposes that inflation is in loop size, not space, because the meons and anti-meons which constitute the background material of the universe cannot change size – their fundamental mass, charge and radius are all 1 in DAPU. At the initiation of a big bang, myriad partially merged pairs are unmerged and form chains, then loops, at near Planck energy.

At some point during unmerger, the loops physically impact together, slowing rotational velocities, so that, in order to retain the mass angular momentum of the meons and anti-meons within the loop at a size of Planck's constant h, the loop size inflates.

With three spatial dimensions, the inflating loops would rapidly diverge in orientation into the three planes formed by those axes. The result is that there are three generations of loops, each formed by the different inflation rates within each of the planes and each loop's overall family charge.

The loops can change generation by transferring frequency between them – either directly between same charge loops – or by stacking/unstacking of photons or neutrinos/anti-neutrinos. In such a transfer, the mass and spin energies alter together and the magnetic moments will change.

For the electron, the amount of inflation is the difference between its current radius and its radius near the Planck energy, which for an electron is a volume change of approximately $(4.95\ x\ 10^{8})^{3} = 1.21\ x\ 10^{26}$, although the section below on differential loop inflation shows the amount to be an average of $1.44x10^{23}$ across all loop families.

The energy released by the change in loop sizes was available to move the loops away from the centre of their big bang as expansion.

Gravity

Gravity is the force of attraction between bodies due to their mass sizes, in classical interpretations. In relativity it is the reaction of spacetime in distorting due to the presence of mass and of the movement of mass due to the distorting of spacetime. It is based on mass only existing in positive form, classically always attractive of other mass, and in relativity that the distortion of spacetime is always in one direction - usually displayed in drawings to be downwards.

The generalisation of the effect is the potential energy that exists between two bodies due to mass or charge energies. The active and passive potential energies are observed to be constant in their direction of action and have the same size.

In the pre-fermion model, what is called gravity is the effect of the rotation of a loop on the background, and vice versa. Mass is the observable effect caused by the rotation of the meons and anti-meons in a loop, each of which has chains of partially merged pairs attached that drag through the background. The rotational frequency of the loop produces what we call the size of the mass and that rotational energy is equal in size and opposite in type to the spin energy of the loop. Each loop, with its chains dragging through the background is like its own Higgs particle where the Higgs field is like the background of partially merged pairs and zerons.

The effect of the fundamental mass of the meons and anti-meons is like gravity to some extent in that it attracts the same mass types, but between opposite mass types has the chase/chased action. The chase/chased effect acts directly between meons, between meons in loops and between meons in adjacent loops.

The chase/chased effect is a different form of potential energy, a 'relative' potential energy, because its direction of action depends on the relative position, or change of separation, of objects. The active and passive mass energies are the same size, but their direction of motion depends on the relative positions, of meons and anti-meons starting from rest, or on the change in separation between loops.

There is a difference between the continuity of action of gravity between loops and partially merged pairs. In loops, unless within a tunnel where there are no partially merged pairs available to transmit the rotation of the loops, the partially merged pair chains attached to the meons and anti-meons are continually sweeping through the background.

For partially merged pairs, their internal motions of vibration, rotation and translation will produce intermittent mass and charge fields as the pair change their merged fraction. The result is intermittent gravitational and electromagnetic fields produced by the pair.

Rather than the action of partially merged pair chains attached to loops sweeping through the background, this gravity effect is directly to other partially merged pairs, acting to form short or long chains as the fields decrease or increase, but is not only attractive. This type of gravity effect is due to the relativistic potential energies of the pair acting on other pairs and can have no net effect, net attraction or net chase/chased action.

The tunnel ends, formed as the start of entanglement of loops, effectively transfer the sweeping partially merged pair chains of those loops onto themselves as those chains are stripped off the loops when the loops enter into the newly forming tunnel. This means that the gravitational, and charge, effects of the loops remains continuously at the tunnel ends even whilst the loops themselves have no gravitational or charge effect within the tunnel. The motion of the tunnel ends, and their gravitational and charge properties, are affected as if they were the loops.

The gravity and charge properties of a loop in motion at c are transmitted by partially merged pair chains which extend at c. So rather than having gravitational and charge field lines that bend backwards as loops move forwards, they are continually symmetric front to back, where there are no local asymmetric mass or charge distributions.

Although this seems un-relativistic, it is because the loop must have started somewhere at zero transverse velocity, with chains attached and reaching out towards infinity. As the velocity increases, so the chain lengths remain and are extended at the loop velocity. Since the partially merged pairs can move at c, and the chains can extend at c, the chain distribution will remain symmetric at c.

Magnetic moment

Magnetic moments are caused by charges in motion and in amorphous point-like particles by their spin component. Current theory and observation of the spin g-factor linking the spin of the electron with its expected value produce a value slightly over 2. The accuracy of the extra factor, produced by the interaction with all other particles on the electron, is taken as a major achievement of quantum electrodynamics.

The pre-fermion model suggests that the magnetic moment of the electron has $g=2$ because there are two components to its magnetic field. One component is due to the rotation of the $-q/6$ charges and the other to the rotation of the fundamental $-Q$ and $+Q$ charges, of anti-meons and meons respectively, rotating at slightly different radii.

The latter is due to the slightly different mass energies of the meons needing to rotate at slightly different radii in order for all have the same angular momentum of h within the loop. The meons have $+Mc^2 \pm sc^2/6$ and the anti-meons have $-Mc^2 \pm sc^2/6$ total mass energies. The meons have $+Q\mp q/6$ and the anti-meons have $-Q\mp q/6$ total charges.

The result is that, in the electron for example, the anti-meons with negative fundamental charge $-Q$ and one-sixth charges $-q/6$ rotate at slightly larger radii than the $+Q$ charge meons, which also have negative one-sixth charges $-q/6$, giving an extra g factor.

The existence of positive and negative fundamental masses means that all the electromagnetic formulae applied to charge positions and motions can be applied to the masses, although there are the additional chase/chasing relative potential energies in action and the effects of background viscosity to include.

A loop will have balanced mass currents, but may have net charge current and internal electric fields producing magnetic fields due to loop rotation. All meons and anti-meons have only two possible radii of rotation in asymmetric loops. In symmetric neutrinos, the rotational radii of the meons and anti-meons are the same and can be any size, which enables symmetric neutrinos to adjust size and frequency easily.

The motions and positions of the meons should allow some small anomalous magnetic moment to be calculated for loops. However, the pre-fermion calculated figure is far smaller than the currently accepted figure for the anomalous magnetic moment of the electron. So either the present methodology of external interactions is likely to be the overwhelming reason for that anomalous moment, or it is instead because in Penning traps, or cyclotrons, the rotation of the electrons, or muons, respectively are at the ‘magic’ frequency.

The difference in strength of action at distance between gravity and spin, despite both being equal in size and due to the rotation of the loop, is due to the underlying difference in action of charge and gravity. For a loop with sweeping chains attached, the chains transmit both the mass-gravitational and charge-spin effects.

The gravitational fields are attractive within the background due to the sweeping of the chains, but the chains themselves are driven by their partially merged pair - pair interactions, which are due to their relativistic potential energies which include the chase/chased action. This extends to infinity in theory, but is set by the charge and rotational rate of the loop and the local background density.

The spin energy is due to the rotation of the fundamental charges in the loop and does not have any chase/chased action, only attractive or repulsive. So it some distance from the loop, the effect of the rotating charges that the chains are transmitting will become balanced by the background charge distribution. This distance will depend on the loop charge, rotational rate and the local background density.

At that distance, the existence of the spin of the loop will no longer be observable to another loop.

Inertia

Inertia is the property that requires a force on a body to change its motion. Newton defined it to be what the body possesses and that requires a force to change, although the former is no longer accepted.

Inertia is the property that requires a force on a body to change its motion. Newton defined it to be [8] what the body possesses and that requires a force to change, although the former is no longer accepted.

The pre-fermion model hypothesis is that Newton was right the first time, on both points, and that a body moving within a frame of reference possesses a force internally which requires another force to change it.

Retained momentum is what produces inertia. Since energy is a vector in the same direction as an applied force, a body subject to such a force has energy along the same direction and retains that energy, ignoring viscosity loss to the background partially merged pairs, as momentum until it encounters another body or force in opposition. Inertia is the vector total mass energy that a particle has in an external frame of reference.

Differentiating acceleration and gravity

Gravity is the force of attraction between bodies due to their mass sizes, in classical interpretations. In relativity it is the reaction of spacetime in distorting due to the presence of mass and of the movement of mass due to the distorting of spacetime. It is based on point-like mass only existing in positive form, classically always attractive of other mass, and in relativity that the distortion of spacetime is always in one direction - usually displayed in drawings to be downwards.

Acceleration is the increase in velocity of a body caused by a force. The comparison, where gravity and acceleration are seen as unable to be differentiated, is at a point.

The pre-fermion model proposes that it is possible to differentiate between the effects of gravity and acceleration, although not at a point. Given a volume to observe, the gravity field will be a shortened conical shape, acting inwards towards the smaller end of the cone and the source of the gravitational field, gradually converging.

Acceleration will be a cube shape with all lines of acceleration parallel. At the level of total mass motional and potential energy, the difference between acceleration and gravity fields, acting on a body not in a stable orbit, is that the body accelerating will have a positive total mass energy whilst the body in a gravitational field will have a negative total.

Considering the velocity of a body in the plane of a sphere, it is immaterial which direction the velocity takes. There is energy, and thus a force, outward and perpendicular to the plane of the sphere. This centrifugal force exists whilst centripetal acceleration does not.

The outward energy of rotation is real and can be seen in three examples:

A) A bicycle wheel has unbalanced upward energy opposite its point of contact on the ground which helps keep the bicycle upright.

B) In a gyroscope, the rotating circular armature can be considered as a circle rotating on the plane of a sphere centred at the point of axial contact. The upward force acts perpendicular to the plane of the sphere with a resultant acting along the axis of rotation, keeping the gyroscope upright until the rotational rate reduces and it can no longer defeat gravity.

C) Newton’s bucket keeps water in for both vertical and horizontal rotation provided the outward motional energy of the water due to rotation exceeds the effects of gravity.

Spacetime

Spacetime combines the three dimensions of space and one of time into four dimensions that can be used for general relativistic calculations when gravity is present. In that environment it is considered to be both distorted by a particle’s mass and to act on that particle.

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It is the background that underlies the effects of spacetime, although at individual partially merged pair level – as both a continuum of myriad overlapping partially merged pairs and set of pairs of individual meons/anti-meons. The gravitational action is due to the partially merged pair chains which are attached to the meons and ant-meons in the loops as they sweep through the local background with the loop’s rotation. The loops influence the background density as the background density affects the loops.

Space-time does not exist for the universe as a whole. There may be average times across volumes of space, but time exists only within loops for bodies composed of loops. Time for particles composed of loops did not exist before loops formed. Time exists mainly in loops and when a loop breaks as it falls into a black hole it loses all time and reverts to a chain.

General relativity requires time because it depends on the frequencies of loop rotations. Quantum mechanics does not require time because its non-local effects are outside the background partially merged pair space and are reversible in time.

Before loops formed, there was no time in our sense since there were no loops, or composites formed of loops, existing to observe. Partially merged pairs’ rotational, vibrational or motional activities form the main background, alongside myriad zerons, but only affect the specific partially merged pairs themselves.

There are three levels of time – outside the partially merged pair background, which has no time, partially merged pair motion/rotation/vibration and loop time.

Other failed big bangs may have had their own times, but will have lost them when their loops broke as a black hole formed and broke the loops into chains.

There is no time inside a black hole since it is a chain star, so no loops in general, except at the surface where high frequencies symmetric photons, can form stably and escape. So black holes eat time, but are not home to singularities, because there are none.

Black hole information loss

The question of whether information passing into a black hole can be recovered intact or not is due to conflicting predictions of general relativity and quantum mechanics.

In the pre-fermion model, it is the chains that enter a black hole and they retain the fundamental masses and charges, and twist and one-sixth charge energies, of the meons and anti-meons in the chains. This meon and anti-meon information is retained by each individual meon and anti-meon regardless of which chain or loop that each may reform within the hole, or as they escape from the hole.

The information that enters the black hole comes out as photons are formed and escape from the black hole surface. As the photons form and escape, they take rotational energy from the hole, reducing its mass and spin energies.

For a rotating black hole, it will be easier to form photons on the axis of rotation of the black hole, reducing the size of its net spin, so there should be two symmetric beams of photons either side of the hole, along its axis of rotation.

In order to lose charge, it may be that the only way to manage this is to eject symmetric loops with the same sign charge as the net charge of the hole. Again, this would be easiest at the rotational axis poles.

The rotational rates of loops entering black holes, their mass and spin energies, are transferred to the hole before entering as the loops are broken into chains.

It is the individual meons and anti-meons that retain their information before, during and after entry into a black hole. The loop that entered loses its mass, charge and spin energy to the hole as it breaks up on entry. But exiting newly formed loops, at the surface of the black hole, take back some of those energies until there are no meons and anti-meons remaining inside.

Overall, there is no information loss caused by black holes.

Dark energy

Dark energy has been proposed as a solution to the supposed observation of the accelerating expansion of the universe, through its existence as a negative pressure, of constant energy density, throughout empty space within the universe, and is thought to interact only via gravity. Evidence is in the increased relative red shift observations beyond a certain distance, the need to explain the flatness of the universe and large scale effects across groups of galaxies.

In the pre-fermion model there is no dark energy. The change in the rate of expansion of the universe is instead interpreted as occurring at the boundary where our big bang envelope ends and the rest of the universe begins.

Each big bang is proposed to be an event within the only universe, so that there have been many before our big bang, during it and will continue afterwards. The extent to which our big bang matter, in the general sense, has expanded defines our big bang envelope. Failed big bangs will be studded within our big bang envelope and outside as quickly or slowly collapsing galaxies or black holes. Each failed big bang initiation event has no relationship to our own big bang initiation event, although failed big bangs within our own envelope will have influenced matter within our expansionary flow.

The result is that the universe is neither isotropic not homogeneous, being filled with random big bangs.

The red shifts observed of all objects, ignoring local gravitational and motions, will be of three types:

1 Inside our big bang envelope the red shifts will be a mix of the viscosity red shift, proportional to distance travelled, and to the relative motion of that object.

2 Outside our big bang envelope the red shifts will be due only to the viscosity red shift of those objects, proportional to distance travelled.

3 Failed big bangs within our own envelope will have red shifts, due only to viscosity red shift, which are discordant to seemingly conjoined objects that are co-moving with our big bang expansionary flow.

The different rate of red shift change beyond our big bang envelope looks like an change in the expansionary rate of our big bang, but is an artefact of the change in red shift component factors inside and outside that boundary.

The result interpreted is that the net red shift within our envelope may be actually a blue shift with our big bang now collapsing, or that it is expanding at a slower rate than heretofore calculated.

Inflation and steady state cosmology

The early steady state models of the universe, which involved random matter creation within an infinite life universe, were superseded by the inflationary models involving a single start to the universe. The proposed overall consistent state of the universe, with constant-density homogenous conditions, and later anomalous red shifts within the Hubble expansion, were supportive of the steady state model, but the amount of deuterium, cosmic microwave background observations and flatness of the universe were better explained by inflationary models.

The pre-fermion picture of random big bangs that fail or succeed is a mixture of an inflationary and a form of steady state models mixed with a dash or non-multiverses caused by failed big bangs throughout the whole universe.

The big bang and steady state theories can coexist, with failed inflation events appearing randomly as isolated black holes or galaxies.

Very large black holes or galaxies which appear to have formed too early after our big bang are probably pre-existing failed big bangs just inside or outside the envelope of our own big bang that have attracted our subsequent big bang matter around them.

It may be that some volumes of the background are subject to a general flow, with a likelihood increasing with increased local mass dragging that local background.

Outside our big bang envelope will be very high red shift failed big bang galaxies whose development is far greater than would be expected had they occurred as a result of our own big bang. The timing of these failed big bang galaxies have no relationship to the timing of our own big bang.

The model is a type of mix of big bang (but not itself creating a universe), steady state (the continual eruption of big bang events within our single universe) and multiverse (but observable directly as failed big bangs within the only universe).

The result of many big bangs, our own and the failed ones, means that there is no overall homogeneity in the distribution of matter. It could be that one failed big bang sets off a nearby second and maybe a third and so on, so that we observe a large scale structure formed in one event that is actually a series of connected events over time.

Multiverses

Multiverse is a term for many different and separate universes whose laws may not be the same, and whether some of those universes are observable by us, or not, is still a subject for discussion. The many-worlds interpretation of quantum mechanics is related concept.

If failed big bangs within the only universe happened before our own big bang occurred, during its expansion and continuing thereafter are counted as multiverses, then they exist. But every big bang always uses the same meons and anti-meons to build the same loop structures.

It is only the amount of inflation by each big bang that gives rise to the loop sizes that may be different to our own. Depending on the pair-number of the loops formed, there may be chemistry possible in those big bangs, with three-fold most likely to produce it because three is the lowest odd number needed to produce atoms.

All failed big bangs will be visible, provided they are close enough to us for their light to have reached us because they are all inside the only universe.

All physical laws will be the same in each big bang because it is the dimensionality of the properties which sets the relationships between those properties that we call laws.

Photon double-shell emission

There are still different views on the general area of 'hidden variables' theories such as of de Broglie-Bohm with their wavefunction or of 'pilot waves'. Quantum mechanics is limited to special relativistic flat spacetime and non-locality.

The photon is conceived of as an amorphous point-like blob travelling at light speed, with no mass, only energy, and with horizontal or circular rotating electromagnetic fields.

The pre-fermion model is closely related to the hidden variables ideas and does not try to reconcile quantum mechanics and general relativity because each exists within its own environment and no loop can be in both simultaneously.

The model also looks at 'particles' from a different viewpoint, that there are partially merged pairs that constitute most of the background and through which the only directly observable objects, loops, move in the relativistic environment. Where there is no background, there is no relativity and then quantum mechanics rules.

The result is that the emission of a photon is proposed be in two parts, the double-loop photon and a double-shell entanglement tunnel within which the photon moves randomly and non-locally.

A photon in the pre-fermion model is a mixture of a loop and anti-loop with *w* rotation, as six newly formed partially merged pairs, internally and externally chasing, and also has quantum mechanical properties to add to its relativistic terminal velocity of local *c*, although strictly the latter is the property of an outer shell of a layer of partially merged pairs.

At emission a photon is both the double-loop and a spherical double-shell of entanglement composed of partially merged pairs, whose outer shell expands away at *c*, with the photon skipping randomly within the double-shell.

When an observation is made of a photon, the photon must be at that point of observation in order to be observed, otherwise the shell continues to expand. Immediately prior to a successful observation at the observer's location, the photon could have been equidistant away from the point of emission, on the other side of the shell, far beyond its emission point, away from the observer.

At each skipping point, if then stacked or observed, the photon experiences local viscosity and the sum of energy loss over its total path produces the photon's viscosity red-shift. Two entangled photons travelling through an apparatus will be continually swapping position so filters will not stop the passage of supposedly filtered photons.

If instead the outer shell is disturbed, the whole collapses with the photon trapped where it was at that instant. This latter is a wave-like probability of observation, with the former stacking/observing of the photon directly being particle-like observation.

Distant collisions drive local random effects in that 'observations', or sufficient size disturbances, of entangled loops or photons at a far distant location can result in the un-entanglement of a loop or photon in another distant place.

The shape of many simultaneous expanding photon emission double-shells from an object reflects the gravitational effects of local matter distribution. Each single photon emission shell has its photon randomly skipping around the shell, and affected by viscosity at each observable point, but the effect over many photons and shells is that the effective combined shell is populated and affected by gravity as it expands past objects.

Twins paradox

The Twins paradox is based usually on the idea that one twin remains in place whilst the other accelerates away, stops, and then accelerates back. One outcome could be that both twins see the other as moving and so each should have found, under general relativity that the other has aged. Another outcome could be that since acceleration is not an inertial frame, then the outcome will be that one has aged more than the other. The latter is the preferred outcome.

The twins paradox is explained by a differential change in loop phase between the two twins. The home-based twin has the baseline loop phase, the tourist twin's loops change phase during translational motion – due to the extra energy loss due to that motion against the partially merged pair background. When the two compare phases back together at home, there is a locked-in phase difference between the two, which is a time difference in their experiences. The twins' paradox is not really a paradox.

Singularity

A singularity is a place of infinite density, at the centre of a massive black hole, where laws of physics are expected to break down.

In the pre-fermion model, since the meons and anti-meons are the densest particles that exist, nothing can break either apart. Therefore there can be no singularities and physics does not break down anywhere.

Dark matter properties

Currently the properties of dark matter are not considered much beyond the general outline at either point-like particle or composite primordial massive black hole level.

Loops are split into the two categories of normal matter and dark matter by the number of meon-pairs within a loop.

Loops with three meon-pairs are our normal matter and all other pair numbers are dark matter. It is assumed initially that no loops can be formed from a single pair.

The ratios of various number-loops can be estimated based on their pair-numbers and their probabilities of forming.

This will give the following summation of the number of loops $N_{loop-weighted}$ across all n sets of pair-numbers, initially including 1-pair loops in the calculation, to be

$$\begin{aligned} nN_{loop-weighted} &= \frac{n}{1^2} + \frac{n}{2^2} + \frac{n}{3^2} + \cdots + \frac{n}{n^2} \\ &= n(1 + \tfrac{1}{2^2} + \tfrac{1}{3^2} + \cdots + \tfrac{1}{n^2}) \\ &= n\frac{\pi^2}{6} \end{aligned}$$

where each set is based on the whole number of available pairs being used for each, which produces a total that is *n* times too large, although when calculating a ratio this effect will cancel.

For the ratio of normal matter to total matter $R_{m/all-m}$ this, excluding 1-pairloops, gives

$R_{m/all-m} = (\frac{1}{3^2})/[\frac{\pi^2}{6} - 1]$ = 0.1723 or 17.23%

This ratio is the starting point of a big bang unmerging event and would be expected to change over time as massive black holes swallow both symmetric and asymmetric loops and emit only symmetric loops, with a greater probability of the latter being two-pair dark photons.

In th epre-fermion model, dark matter symmetric loops, of non-three pair size, have the same spin and mass energies as the same frequency of symmetric matter loop. This is because it is the physical size of the loops (*w* frequency at radius *r*, *v*=*rw*) that defines what the mass and spin energies of the loops are. The number of pairs only defines the range of charges that the loop could have.

The volume of dark matter exceeds that of normal matter because loops with less than three pairs are easier to make, black holes convert asymmetric loops into mainly symmetric dark matter photons and the background partially merged pairs soak up viscosity energy which is higher around denser distributions of normal matter loops.

A symmetric 4-pair loop equivalent to the 3-pair electron size will have charge 4/3*q*, spin $\pm$½ and electron mass at 100% of the loop frequency *w*. A similar symmetric neutrino-equivalent will have 0% of loop *w*. The mass of normal and dark matter symmetric loops will be the same size as ½ *hw*. Their spin energies will all be ½ *hw* as well, but the magnetic moments will depend on the number of pairs in a loop.

Non-symmetric dark matter will have different fractional masses observable, when compared to the same frequency of matter loops. A 3-pair matter quark of charge +2/3*q* will have observable mass 2/3 loop frequency *w*. The equivalent 4-pair dark matter quark (asymmetric) loop will have charge +6/8*q* and observable mass ¾ loop frequency *w*. The actual loop sizes will be the same, as will their spins at ½*hw*.

Three-fold symmetry in normal matter arises because there are three meon pairs in normal matter loops.

Atomic dark matter

Atomic dark matter is considered unlikely because it has not been observed to interact with charge or light, only with gravity. This means that dark matter atoms are considered unlikely to exist.

Only odd-number pair-loops can form atoms because their balanced stacks have to contain one loop of each asymmetry that will be matched overall by an orbiting symmetric loop of equal and opposite charge to the stack total charge. Only odd pair number loops can have chemistry.

This means that, as shown in a previous paper referenced above, a 5-pair loop has 12 fermion-equivalent loops of which 4 are symmetric lepton-equivalent and 8 asymmetric quark-equivalents (ignoring asymmetric neutrino isomers). The quark-equivalent charge sizes are 1/3, 2/3, 3/3, and 4/3 with lepton equivalent charges of 0 and 5/3, all as fractions of positive or negative the electron charge size.

How the positive and negative one-sixth electron-sized charges of the meon and anti-meon pairs are placed around the loop define the symmetry or asymmetry of the loop and there will be the equivalent of 5 different asymmetries – or ‘colours’ in the QCD sense – for asymmetric 5-pair loops.

To be overall colourless requires one of each colour loop to be present in a stack. That is what balancing the stack means.

Since each loop has spin angular momentum of $\pm$½ *h*, the total spin for an odd-pair-number stack, whose loops have alternating spin orientations, will always be $\pm$½ *h*. Thus to balance the stack requires a similar size-opposite-charge loop that is symmetric and has a spin of $\pm$½ *h*. In this 5-pair loop example, that is the lepton-equivalent that has charge $\pm 5/3$and $\pm$½ *h* spin.

This means that all odd-pair-number loops of odd number *k* will be able to form atoms where the central stacks (nucleon-equivalents) are colourless overall and will contain *k* loops of total charge $\pm k/3$ orbited by an electron-equivalent symmetric loop of charge $\mp k/3$. Stacks may have different total charges to their symmetric charged loops, but will not be able balance them orbitally.

What is observed in the equivalent of photon emission/absorption will depend on the mass of the electron-equivalent loop. The photon emitted or absorbed will be a double loop of positive and negative *k*-pair symmetric fermion-equivalents rotating in the same sense.

If initial general big bang inflation of loops is related to pair-number then the sizes of such *k*-pair loops would be different to our 3-pair versions. If initial general big bang inflation was related to loop charge then the sizes of such *k*-pair loops would also be different to our versions. However, if the initial inflation was not related to either of those properties, the *k*-pair loops could have the same sizes as our versions because the mass and spin of a loop is independent of the number of pairs in that loop, but the observable masses would have their specific ‘missing charge’ factor to account for.

So the red shift emitted by different *k*-pair loop photons could be similar to that emitted by our 3-pair loops, or different.

The requirement for balance is the fundamental drive in the universe. The largest imbalance will be sorted first, then smaller ones. All systems tend towards zero total of each energy type.

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A symmetric 4-pair loop equivalent to the 3-pair electron size will have charge 4/3*q*, spin $\pm$½ and electron mass at 100% of the loop frequency *w*. A similar symmetric neutrino-equivalent will have 0% of loop *w*. The mass of normal and dark matter symmetric loops will be the same size as ½ *hw*. Their spin energies will all be ½ *hw* as well, but the magnetic moments will depend on the number of pairs in a loop.

Chemistry – for normal and dark matter loops

Chemistry is the study of the properties and interactions of composites including fermions and baryons, meaning mostly atoms, ions and molecules. The main properties that influence the outcome of chemical reactions are the sizes of charge and mass of the particles.

Chemistry arises from odd loop symmetries leading to odd numbers of loops in stacks. Where the ‘core’ stack has $\pm$½ spin in total it needs an orbiting loop of $\mp$ ½ spin to balance it. The lowest symmetry that this works for with stacks is three, as in our matter.

A single loop considered as a stack is already part of our chemistry for example in positronium, but has very limited chemical diversity. Chemistry arises because of the need to balance loop stack spin by the orbiting of the largest charge symmetric loop of the same pair number. Chemistry for five-symmetry is possible, but the probability of chains forming 5-pair loops is considerably less than forming 3-

pair loops.

With three-fold symmetry and odd loop stack numbers we get the proton and neutron which probably have seven loops in their stacks. This would be a core of three quarks protected from the $\pm 1q$ or $0q$ local environment by end caps of total four neutrinos/anti-neutrinos for the proton and three neutrinos/anti-neutrinos and an electron for the neutron.

It is likely that all the loops in a stack are the same radius, to provide maximum force holding each opposite-rotating loop in place. However, each loop mass observed will depend on the twist fraction that is the fractional loop charge.

The electron and neutrino/anti-neutrino can both survive in a nucleon stack because they are each composed of adjusted-Planck size meons and anti-meons. The electron needs additional energy (frequency) in order to match the stack loop size when forming a neutron stack and could take it from an incident neutrino/anti-neutrino or photon.

Electrons also stack and unstack photons when they change orbital levels, adding to move higher and releasing to move lower. Photons can also stack with other symmetric loops.

Neutrinos are not only left-handed. The anti-neutrino of the most symmetric isomer of a neutrino is different only by 60 degrees of planar rotation. So it is hard to tell which is which. The neutrino is not a Majorana fermion.

Asymmetric neutrinos and anti-neutrinos will have net magnetic moments that vary at their rotational rates due to their two-fold asymmetric one-sixth charges' distribution around the loops, but no overall charge.

Energy hierarchies

Because current physics does not consider that the total energy of the universe and all systems within it, have a zero total over all types of energy, there is no consideration of whether any such hierarchies exist.

There is a hierarchy of zero total mass energy states which matter prefers to inhabit. At each stage from unmerging a partially merged pair into a meon and anti-meon pair, forming chains, then loops, loops stacking to form nucleons, nucleons combining to form atoms, atoms to molecules and so on, there are preferred states which always have zero totals of all the differing forms of energy present.

Stable states exist as multiple levels of zero energy balance. All systems prefer states of zero total energy.

Energy, in the sense of frequency w, has circles of life. It starts in the background partially merged pairs and their rotational, vibrational and motional movements. If a large enough energy balloon arrives at a partially merged pair sufficient to unmerge meons from anti-meons, then there can be a cascade to unmerge many partially merged pairs.

The energy of unmerging produces $\pm qc/6$ on each meon and anti-meon, totalling zero, through twisting against the background of other partially merged pairs and through the chase/chasing relative potential energy-driven motions of meon pairs.

The pairs form chains, then loops, at extreme frequencies, which look like energy but is still total zero energy. At some point collisions occur between meons/anti-meons in different loops and the meons/anti-meons slow significantly. This expands the loop radius dramatically to maintain angular momentum h size for each meon and anti-meon in the loop, and the loop itself.

This is inflation, the enlargement of the loops, not space.

The 'energy' released by the reduction in loop frequency is put into translational motion of the loops outward from the centre of unmerging or expansion. Since energy is a vector, the symmetric outward mass energy of all the loops still totals zero overall.

Both inflation and expansion take place against and through the background of partially merged pairs that have not inflated.

The loops form photons, stacks, atoms, compounds, planets etc which all lose frequency as they move against the background partially merged pair viscosity, which increases the frequency of the local background partially merged pairs as a form of heat.

The photons absorbed or emitted (stacked or unstacked) by electrons and other loops serve to keep the loops at their post-inflation locked-in sizes.

Photons will eventually lose all their frequency and become free unmerged meons and anti-meons again.

Energy moves from the background partially merged pairs to meons, then chains, then loops, then stacks - at each stage returning some through viscosity to the background as forms of heat until all is returned to the background.

Wave-particle duality

Wave-particle duality is the quantum mechanical concept that objects can be observed as either a wave or a particle. It is usually shown in experiments with light passing through slits. With two slits, there is an interference pattern observed, showing probabilities of observing photons, until a detector is inserted to try to discern which slit the photons have traversed. With a single slit, or a detector in place, only photons as particles are observed, without probabilities.

The pre-fermion model agrees on the wave-particle concept, but extends that beyond simply loops being both wave-like and particle-like to include a pilot-wave-like structure to the emission of photons. The latter are proposed to comprise the photon double-loop and additionally an expanding entangled double-shell, like a tunnel, within which photons travel randomly and non-locally.

The model does not treat the universe and its expansion as wave-like since its components are meons and anti-meons, loops, individually and in composites, and partially merged pairs, that are all particulate, although individually also wave-like.

The particulate nature of the universe and its myriad overlapping partially merged pair background means that overall it is both a continuous medium and a source of indivisibles, at different levels.

Atomism

Atomism is the concept that the entire universe is composed of indivisible objects, historically based on atoms, existing within a void. The current building blocks instead are the fermions, but these are described as point-like amorphous objects with properties of mass, charge and spin and quantum mechanics treats them as waves within spacetime.

The pre-fermion model is based on indivisible meons and anti-meons whose overlap reduces the overall fields of the pair, due to the fundamental mass and charge of each, and produces overall a medium of partially merged pairs that is continuous - but built on those indivisibles – that is the relativistic background through which loops move.

Flatness

In cosmology, flatness is a description of space that has no curvature due to the presence of its own mass energy. Flat space is the dividing line between whether the universe will continue to expand or collapse back on itself.

In the pre-fermion model, the overall universe started with no total energy and remains with no total energy, although energy moves between different types. Therefore the universe is always flat on the basis of all energy types across the whole universe and also across the total of any big bang envelope.

However, since energy is a vector, the inflation of loops and subsequent expansion away from the unmerger of our big bang hides that the outward motional mass energy, in a symmetric expansion, sums to zero. It also hides that the total outward expansion mass energy of zero was released by the inflation of the loops and will also be the same size of zero. Only at individual loop or constrained volumes within any big bang will the total mass energy look like non-zero and have the appearance of a non-flat volume of space.

Quantum gravity

Quantum gravity is the expected solution to combining relativity and quantum mechanics so that gravity can be treated in the same way as the other three fundamental forces, despite the difficult issue of the non-renormalizability of a gravitational field. In general relativity, gravity is treated as the curvature of spacetime whereas quantum mechanics uses the flat spacetime of special relativity.

The solution to singularities, unphysical relativistic effects inside black holes, by quantum mechanical effects would be one achievement. The need for dark matter and dark energy may also be avoided and the huge difference between the observed and predicted size of the vacuum energy of space

The pre-fermion model differentiates between environment with and without the presence of the background of partially merged pairs, and zerons. Where there is the background, there is viscosity which limits the velocity of meons and anti-meons, and their composite loops, to a maximum terminal velocity of local light speed.

Quantum gravity cannot exist because a loop is either within the background or it is not. It may be argued that a loop itself is a quantum of mass and charge energy, which always sums to zero, but to have gravitational mass requires that the rotation of the loop is within the background.

The model also solves the issue of the identity of dark matter particles since they are built from exactly the same meon and anti-meon foundations, in exactly the same structure, as our normal matter. The different is only that our fermions are built from loops containing three meon/anti-meon pairs, whereas dark matter loops have different pair numbers.

The model uses unbreakable meon/anti-meons as the building blocks for loops, so that, even when loops are broken apart in massive black holes, there are no singularities and physics does not break down.

The proposed presence of zerons, symmetric loop and anti-loop rotating parallel in opposite sense, at every point and size throughout the background, enables pair creation to be interpreted as the temporary breaking apart of such zerons, and their identification as zero point energy at any chosen point within the background.

Occam’s razor

The simplest solution is usually the best one.

The basis of the pre-fermion model of a single type of particle and anti-particle with only two fundamental energies, due to mass and charge, and only one observable composite form cannot be simplified. Since its reinterpretation of almost all observations of the universe, it is probably the best candidate for the theory of everything.

Non-locality

Non-locality in quantum mechanics is action at a distance *which takes less time than light would take to travel the same distance.*

In the pre-fermion model, non-locality exists within entanglement tunnels and shells. The orbitals of electrons in atoms are examples of multiple tunnels between allowable orbitals, in that travel by the electron between each orbital must be non-local in order for the probability of being in the shells at all times must be 100%.

That same non-local motion also explains why observations of entangled photons in filter experiments find that passing one polarisation of one photon, sent through a filter and deflected onto one path, does not stop the other undeflected photon appearing in the deflected path, after the filter. The photons keep swapping paths randomly and non-locally across both paths both before and after the filter.

Force carriers

Force carriers are the bosons which transmit forces between particles. An example is the photon which is expected to transmit the electromagnetic force between two charged particles. Either every particle is expected to produce a field which the other particle experiences or every field has its own carrier particle, real or virtual, which is exchanged between the particles.

The only force carriers are the partially merged pairs and chains of partially merged pairs that form the background material of the universe. The meons and anti-meons in the chains spin, rotate, vibrate and translate along the chains between unmerged meons and anti-meons.

The same chains transfer the fundamental mass and charge, and emergent twist and one-sixth charge, energies/forces of the meons and anti-meons between unmerged meons and anti-meons within loops and from loop to loop.

The effect of the rotation of the loop and its attached chains is also transferred to the background by the attached chains sweeping through the background as the observable mass and spin energy of the loop, the former we call gravity.

The fate of the universe

There are various possible fates considered for the universe, depend on the matter and dark energy densities as the major features, but based only on the big bang creating the universe. Current observations suggest that the universe is either flat or very close to flat, but it could be closed or open and we are around the turning point. The end could be a big freeze, or heat death, big bounce or big crunch depending on those densities.

The pre-fermion model is a mix of steady state, with multiple failed big bangs before, during and after and both within and beyond our own big bang envelope, in the only universe. The question then is only what is the fate of our own big bang within our own volume of the universe. The same questions arise as for the whole universe, but on a smaller scale.

Frequency-independent tired light suggests that it may be that our own big bang is now collapsing, or is expanding more slowly than we currently calculate.

Unless a new big bang occurs in our neighbourhood, it is likely that our big bang will either collapse to form a massive black hole, whose emitted photons will eventually disperse our light across the universe in a form of heat death, or our component galaxies will do the same individually.

The universe will continue to have multiple big bangs randomly throughout its volume. There is no beginning or end to the universe. ZMBHs and partially merged pairs have always existed and all loop and unmerged pair energies will eventually return to the background partially merged pairs as local heat death, awaiting new big bangs.

Double-Adjusted Planck units (DAPU)

Normal natural units are the Planck units but they mix values of properties so much that their interrelationships are difficult to untangle.

The pre-fermion model is built on DAPU units where the normal Planck units are adjusted by eliminating the Gravitational constant G and adjusting the electron charge by $\sqrt{1x10^{-7}}$ so that the Planck charge $Q = M/c$ and $q = e\sqrt{1x10^{-7}} = \sqrt{\alpha/2\pi}\,Q$ where e is the normal value for the charge on the electron, M the Planck mass and the relationship for angular momentum is $h = Mcr$, where r is the Planck distance.

The Boltzmann constant K_B is also eliminated as is the permeability constant μ by adjusting the permittivity ε. The Planck constant h can be eliminated to produce Triple-adjusted Planck units, but the values become more difficult to grasp, although absolutely correct.

SI units are currently misaligned. They do not match mechanical and electrostatic properties correctly. Elimination of G is a start, but the factor $\sqrt{(1x10^{-7})}$ is also needed to adjust the electron charge q, plus the recognition that the maximum possible charge is $Q = M/c$ not q. Improved SI units will allow a much better understanding of physics.

The Background

The base material of the universe is either relativistic spacetime or a quantum mechanical vacuum. The latter is from where pair-creation can produce particle and anti-particle whose lifetime is inversely proportional to the energy of the particle and anti-particle created through the Heisenberg relationship $Et = h$.

In the pre-fermion model, the initial starting point for the whole universe is myriad ZMBHs. These are unstable and form partially merged pairs which constitute the main material of the universe as both continuous in overlap and indivisible in being made from meons and anti-meons.

What we describe as mass is due to the rotation of the loops which the unmerged pairs form, and the sweeping of chains of partially merged pairs through the background of other partially merged pairs to transfer all forces.

Additionally there are zerons – double loops, of loop and anti-loop, stacked and rotating in opposite sense – which are the physical basis for pair creation. No particles need to be created, they are always there, at all points and at all sizes, within the universe and can be unstacked briefly on impact to produce the zero point energy level.

Each loop, with its chains dragging through the background is like its own Higgs particle where the Higgs field is like the background of partially merged pairs and zerons.

All the partially merged pairs continually create altering mass and charge fields at their rate of vibration, rotation or due to their motion.

The background can also include local masses that act to increase the local background density. This increase in density slows the value of local light speed, although it remains at c because that is the fastest that the partially merged pairs, that constitute the photon, can travel at in that density of background plus local masses due to the viscosity of that local background.

It is not clear whether the effect of the local background extends far beyond the sweeping of the partially merged pairs attached to loops. On unmerger of a ZMBH the partially merged pair chain will form at local light speed away from the point of unmerger out towards infinity. Such a chain will also ‘dissolve’ as a partially merged pair chain re-merges to become a ZMBH. So there will be a continual formation and dissolving of partially merged pair chains across the universe.

The lack of clarity is whether the background can be dragged by large local masses like stars to become a flow, or by galaxies to become a larger flow through which stars must travel. This possibility might suggest a fraction of galactic star velocities are due to being within that flow, so reducing the need for some dark matter.

This latter would affect the choice of frame of reference for relativistic interactions because the object in a non-moving background will experience a different energy change to that of an object moving within the background. The different is a phase change that appears as a time difference for those objects.

The partially merged pair background is both a continuum and the source of indivisibles, providing a flexible mechanism for transmitting forces and one sort of lightly dark matter. The action of opposing change of separation, which is driven by the mass chase/chasing relative potential energy, is as fast as partially merged pairs can transmit forces within the background, so at c due to their own viscosity effect.. The meons and anti-meons themselves have always ‘known’ about all other meons and anti-meons during and after a big bang.

The background is not the lowest energy level in the universe. That is the no-background environment within tunnels. However, the no-background environment is not the environment in which pair creation can occur.

Differential Loop Inflation

Currently inflation is considered to be of space and equal in all directions, with subsequent expansion of space following. The masses of the particles are presumed to have been caused by inflation, becoming observable due to the Higgs mechanism.

The pre-fermion model proposes that it is the loops that inflate, not space, and that the sizes of the loops are proportional to the specific inflation along the three spatial axes, with the total inflation for each charge family being the same..

Consideration of the currently accepted masses of the quarks and leptons has generated interest in the Koide formula [9] which relates the sum of the masses of the charge families of particles to the square of the sum of their square roots. The result for the charge leptons gives the seemingly interesting value of 0.6666605, which has prompted speculation that it may mean something more fundamental.

More interesting results are achieved by comparing the inverse radii or inverse areas of the families of loops using the same formulae. Table 1 gives the comparison and suggests that there is nothing intrinsically special about the lepton result. However, the fact that the inverse square radius calculation produces the same value as the mass calculation strongly suggests that the loop structure is correct.

The most interesting results come from using the pre-fermion relationship between the loop radii of families, separating out the individual amounts by which each has been inflated along each of the three spatial axes.

The result, also shown in Table 1, is that if each loop family has its loop area (or mass) adjusted by the square root of the amount of fractional charge that each loop is missing from its maximum possible value (or by the square root of that amount on its mass) then each family has an average total inflation amount of $1.44\ x\ 10^{23}$.

The ‘missing charge’ factor is $(1 - \frac{missing\ loop\ charge}{maximum\ loop\ charge})^{0.5}$ and is multiplied by the Standard Model masses to produce the correct radii and area of each loop, which is the same as the inflation amount by which each loop was inflated in the big bang.

This is consistent with the pre-fermion model that proposes that what is observed as the ‘naked’ mass of a loop is proportional in some way to the charge on that loop. So an electron will show 100% of its size as its mass, whereas the symmetric neutrino will show zero mass. It is the action of the two types of chains, showing the one-sixth charges, attached to the meons and anti-meons in the loops that are either similar or different as they sweep through the background that produces the gravitational mass effect on the background. A change at every meon then anti-meon, as in a symmetric neutrino, will have no average effect on the background.

The underlying relationships are that each family of loops, differentiated only by size of charge, inflates along either axes a, b or c and ends in one of the three planes ab, ac or bc. Therefore the three loop sizes (or inverse masses) represent their ending up in those planes *A*, *B* or *C* respectively.

Table 1 shows the loop masses, the adjustments due to their charges, radii, area and total inflation amounts for each family overall.

The relationships are that $AB/C = a^2$, $AC/B = b^2$ and $BC/A = c^2$ with *A*, *B* and *C* the smallest, medium and largest loop in each family respectively.

Note that in Table 1 the definition ‘Smallest’ in each family refers to the loop mass in each case.

The table suggests that, using current best Standard Model estimates for the masses of the quarks and leptons, if they are adjusted as explained for ‘missing charge’, approximately the same total amount of inflation has affected every loop, even if inflation along each axis for each loop and family is different.

The individual loop inflation amounts along the a, b or c axes are different, but not remarkably so. The maximum difference is $x2.4$ and the minimum $x0.47$ using the charged lepton family as the base.

If the average family inflation is consistent, then it should be the case that the neutrino family will have approximately the same total, and the symmetric neutrino should probably align well with the electron family. Asymmetric neutrinos, with two-fold symmetry, in this analysis, could have effective masses because the ‘missing charge’ multiplier effect might be more like that of the quarks allowing mass to be shown.

For further information on the pre-fermion model see the references. For more detail on the current state of the Standard Model and other concepts outlined here, please see the relevant literature, or Wikipedia, which provides an excellent starting point.

Table 1							
Families	Smallest	Medium	Largest	Smallest	Medium	Largest	
	SI mass	SI mass	SI mass	DAPU mass	DAPU mass	DAPU mass	
Charge 1	9.11E-31	1.88E-28	3.17E-27	2.044E-18	4.226E-16	7.107E-15	
Charge 1/3	7.84E-30	1.55E-28	7.56E-27	1.76E-17	3.48E-16	1.696E-14	
Charge 2/3	3.39E-30	2.35E-27	3.09E-25	7.599E-18	5.28E-15	6.94E-13	
Charge 0	0	0	0	0	0	0	
Families	Charge	Smallest	Medium	Largest			
	Adjustment	Adj. mass *A*	Adj. mass *B*	Adj. mass *C*			
Charge 1	1	2.0439E-18	4.22605E-16	7.107E-15			
Charge 1/3	0.82	1.4369E-17	2.84121E-16	1.385E-14			
Charge 2/3	0.58	4.3876E-18	3.0482E-15	1.385E-14			
Charge 0	0	0	0	0			
Families	Koide	Koide	Koide	Koide	Koide	Koide	Koide
	mass	inverse mass	inverse radius	area	inverse area	on *a, b, c*	*a^2, b^2, c^2*
Charge 1	0.6666605	0.6666605	0.4780326	0.8514487	0.6666605	0.4780326	0.6666605
Charge 1/3	0.7393468	0.7393468	0.4842788	0.6654487	0.7393468	0.4842788	0.7393468
Charge 2/3	0.8472632	0.8472632	0.5958420	0.9236780	0.8472632	0.5958420	0.8472632
Families	Smallest	Medium	Largest	Smallest	Medium	Largest	
	SI radius	SI radius	SI radius	DAPU radius	DAPU radius	DAPU radius	
Charge 1	2.453E-21	1.7057E-22	4.15949E-23	4.946E+08	3.440E+07	8.388E+06	
Charge 1/3	9.25E-22	2.0803E-22	2.97994E-23	1.865E+08	4.195E+07	6.009E+06	
Charge 2/3	1.674E-21	6.3513E-23	5.53985E-24	3.376E+08	1.281E+07	1.117E+06	
Charge 0	-	-	-	-	-	-	
Families	Inflation	Inflation	Inflation	Total	Total	Total	Overall
	values	values	values	inflation	inflation	differences	Average
	a	*b*	*c*	radius	area	to Charge 1	Inflation
Charge 1	45036.763	10982.280	763.749	3.778E+11	1.427E+23	1	
Charge 1/3	44196.775	6330.927	1423.751	3.984E+11	1.587E+23	1.1121493	1.439E+23
Charge 2/3	107752.867	9398.663	356.579	3.611E+11	1.304E+23	0.9138628	
Charge 0	-	-	-	-	-	-	
Families	Inflation	Inflation	Inflation				
	relative	relative	relative				
	a	b	c				
Charge 1	1	1	1				
Charge 1/3	0.9813	0.5765	1.8642				
Charge 2/3	2.3926	0.8558	0.4669				
Charge 0	-	-	-				

V Conclusions

The pre-fermion model shows that the reinterpretation of explanations, for what is observed in the universe, provides an improved understanding of the why and how of physics.

The particle-based foundations of one single type of particle and anti-particle forming only one loop structure, using only two energies, with emergent energies as products of the loop structure, is the simplest system that can be devised.

The pre-fermion model deserves to be considered as a candidate for a theory of everything.

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