Symmetry group definitions underlying normal and dark matter

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Using a pre-fermion hypothesis, the symmetry groups that underlie the formation of all loops can be constructed. The triple nature of the three different symmetries, from the two lower levels which are common to all loops to the upper level specific to loop size, form a composite symmetry group definition of U1xS(1)G4xSG(2*n*+2), where *n* represents the loop size in terms of number of meon pairs in the loop. The symmetry group for normal matter is found to be when *n*=3 and is U1xS(1)G4xSG8.

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I. INTRODUCTION

Although the underlying hypothesis on the formation of loops has been explained previously [1, 2], the classification of the symmetries by which loops are formed into both matter and dark matter has not been considered.

The previously published hypothesis suggests that normal matter fermions are loops composed of three meon/anti-meon pairs and that other pair-number loops are dark matter. Meons and anti-meons are the only real objects in the universe, having Planck-size properties and exist only as merged pairs or as pairs within loops.

Loops of three pairs are 3-fold asymmetric (quarks) and symmetric (leptons). Loops of other pair-number have different asymmetries and symmetries so cannot successfully bind stably with 3-fold symmetry loops.

II. SIGNIFICANCE and OBJECTIVES

The significance is in explaining, in terms of a physical pre-fermion-based framework of loops, what underlies the similarities and differences between normal and dark matter.

The objective is to produce one overall system for describing all the possible symmetries that can be found in normal matter and dark matter loop systems.

III. OUTLINE

The starting point is the proposal that the composition of the universe is made from only one type of particle/anti-particle – a meon and anti-meon. The meon has adjusted-Planck properties of mass, charge and size. There are only two forms that the meon and anti-meon can exist within in the universe.

One form is as a merged pair where the two overlap and this form is called a zero mass black holes (ZMBH). The other form is as an unmerged pair which chase each other and join other such unmerged pairs to eventually form loops.

The possible combinations of different numbers of meon-pairs in a loop is investigated to uncover the symmetries which underlie all loop formation and the identities of the types of loops formed.

IV. ZMBH ACTIONS

When a meon-pair is fully merged, as a ZMBH, there is nothing observable beyond the radius of the merged pair of meon and anti-meon. When partially merged, there are mass and charge-related fields in action. The action is transmitted by ZMBHs to other ZMBHs. Some ZMBHs will move, some will spin about the axis through the pair, some will rotate around an axis across the pair. These motions do not move either mass or charge, but transmit the effect of mass and charge through the generation of fields. Such a ZMBH is also affected by other adjacent ZMBHs and can align with others to form chains of ZMBHs. A chain of ZMBHs will transmit the effect of gravity, or magnetic/electric fields, as field lines and its motion will itself be slowed by the presence of the myriad other ZMBHs in the volume through which the chain is in motion.

Where an event occurs so that sufficient energy of the correct kind acts on a ZMBH, it will unmerge into a meon and anti-meon. The amount of energy required for unmerging is always the same and always leads to the mass energy, and equivalent-sized charge generated equal to one-sixth the electron charge for each of the pair, being expressed as the spiral rotation of each meon along their path, called ‘twist’. The pair of meon and anti-meon then chase each other, each with either a positive or negative one-sixth electron charge.

A ZMBH unmerging always leads to the creation of both a positive and a negative one-sixth electron charge on the pair. Which meon has which charge depends on the orientation of the twisting of the meons as they start to chase.

A pair of chasing meons will form a meon chain which will catch onto the tail of other such meon-pairs and form a meon loop. Loops of three pairs are our matter and loops of other pair-number are dark matter.

V. ZMBH SYMMETRY – U1

In this hypothesis, ZMBHs are the only force carriers. The transmission of forces, by ZMBHs and ZMBH chains, are for gravity, impact and magnetic/electric fields when there are no loops. Loops add the mass and charge momenta of the meon loops, the latter being the charge equivalent of the mass momenta of the loop and is what is termed the 'spin' of the loop. For every positive mass energy there is a negative mass energy. For every positive charge energy there is a negative charge energy. Overall all meons and loops always have total across all energy types of zero.

Since there is only one force carrier, the ZMBH, this is a U1 symmetry group. The ZMBH has no spin, because it is not a loop, and has no mass.

VI. MEON/ANTI-MEON PAIRS

Although every unmerging results in a positive and negative one-sixth charge being generated by each pair, during the maelstrom following myriad unmergings, there will be meon chains that will be broken and reformed with different meons in place. As long as the chain contains meon alternating with anti-meon, the chase will continue and a loop can form.

The need for some loops to use symmetric meon-pairs (++ and – – each symbol representing a one-sixth electron charge on each meon/anti-meon) means that those pairs will have been broken, separately or within chains or loops, and then reformed with a different partner. These loops will not be as prevalent as loops formed only with unbroken meon pairs. Only neutrino/anti-neutrino loops are formed only from asymmetric meon pairs (being +- and - + one-sixth electron charges) and they do appear to be much more prevalent than other loops.

Once a meon has started twisting, it will not change its spiral twist orientation, meaning it will always have the same one-sixth electron charge. In the following, the initial framework will be that a positive meon in the first pair will be at the starting position of a loop and the other meon pairs will follow in order along a chain that will become a loop.

Although the order of the pairs is not material for pair asymmetry reasons, it is for one-sixth electron charge positions and symmetries.

Changing the initial meon position to a negative meon, with unchanged one-sixth electron charge positions does not alter the overall charge description of the fermion. This change produces a second form of that fermion loop. In the case of the leptons, there is no difference between them, just a rotation of 120^o or 240^o – which is a hidden 3-fold symmetry.

Rotational motion of the loops provides additional degrees of freedom. The initial explanation considers the loops formed to be rotating in a clockwise sense when viewed from above in the plane of the paper and the result is that all the loops listed in Table 1 below would be termed 'spin +½ '. Picking up a loop and turning it over would turn it into a 'spin – ½' loop.

Further degrees of freedom come apparent when considering how to define an anti-loop. This means changing all the properties of a loop. This starts by swapping the sign of meon, its direction of travel and its twist orientation relative to its direction of travel and the initial sense of loop formation. A positive meon twisting clockwise travelling in a spin + ½ loop will become a negative meon twisting anticlockwise in a spin – ½ loop. Both of these generate positive one-sixth electron charge. So the true anti-loop of a charged spin + ½ loop is an oppositely charged spin + ½ loop – although rotated through 60^o to align opposite sign meons across the two loops. A photon is thus a stack of same-rotation loop and anti-loop where each meon in one loop merges with an anti-meon in the other loop, both twisting in the same sense.

The result is that the only differentiator between normal matter and normal anti-matter is the sign of charge. There is no overall matter/anti-matter asymmetry in the universe and an atom is an example of a matter nucleus and an anti-matter electron forming an overall neutral state, or vice versa depending on which charge is considered to represent matter.

VII. MEON-PAIR STATES

There are four different states of meon pairs that can form loops, starting with a positive meon at the first position. These will be, denoting +M for the meon, -M for the anti-meon and + or – for the one-sixth electron charge, the following

(+M)+ (-M)- called W

(+M)- (-M)+ called X (= -W)

(+M)+ (-M)+ called Y

(+M)- (-M)- called Z (= -Y)

W and X meon-pair states are asymmetric and Y and Z states are symmetric.

Considering initially only loops of three pairs (k), the number of combinations of such 3-pair loops capable of formation from four such states (t), allowing repetition and regardless of order, will be

$$_{(k+t-1)}C_{(t-1)} = \quad _6C_3 = 20$$

These loops are our fermions. There are 8 fermion identities when considering only the total charge of each loop. There are 10 loops and 10 anti-loops of 4 different sizes of charge, ignoring sign, of 0, 1/3, 2/3 and 1.

The specific combinations, based on solely the +M at the first position and closing the loop clockwise so that all correspond to spin + ½ loops, are

Table 1 – Combinations of 3-pair loops using 4 meon-pair states

	3 Pairs	1/6 Electron Charges	Total Charge	Loop Identity	Pair Asymmetry	Meon Charge Asymmetry
1	W W W	+ - + - + -	0	neutrino	Symmetric	Symmetric
2	X X X	- + - + - +	0	anti-neutrino	Symmetric	Symmetric
3	Y Y Y	+ + + + + +	1	positron	Symmetric	Symmetric
4	Z Z Z	- - - - - -	-1	electron	Symmetric	Symmetric
5	W W X	+ -+ - - +	0	neutrino	3-fold	2-fold (rotation)
6	W W Y	+ - + - + +	+1/3	anti-down q	3-fold	2-fold (on)
7	W W Z	+ - + - - -	-1/3	down quark	3-fold	2-fold (on)
8	W X Y	+ - - + + +	+1/3	anti-down q	3-fold	2-fold (between)
9	W X Z	+ - - + - -	-1/3	down quark	3-fold	2-fold (on/between)
10	W Y Z	+ - + + - -	0	neutrino	3-fold	2-fold (rotation)
11	X X W	- + - + + -	0	neutrino	3-fold	2-fold (rotation)
12	X X Y	- + - + + +	+1/3	anti-down q	3-fold	2-fold (on)
13	X X Z	- + - + - -	-1/3	down quark	3-fold	2-fold (on)
14	Y Y W	+ + + + + -	+2/3	up quark	3-fold	6-fold (on)
15	Y Y X	+ + + + - +	+2/3	up quark	3-fold	6-fold (on)
16	Y Y Z	+ + + + - -	-1/3	down quark	3-fold	2-fold (between)
17	Z Z W	- - - - + -	-2/3	anti-up quark	3-fold	6-fold (on)
18	Z Z X	- - - - - +	-2/3	anti-up quark	3-fold	6-fold (on)
19	Z Z Y	- - - - + +	-1/3	down quark	3-fold	2-fold (between)
20	X Y Z	- + + + - -	0	anti-neutrino	3-fold	2-fold (on/between)

Considering only the loops with +M at the first place closing clockwise in Table 1, the Pair Asymmetry column considers the symmetry of swapping meon-pairs around the loop. The Meon Charge Asymmetry column considers how the one-sixth electron charges appear around the loop and how they may be rotated, mirrored across the loop along an axis on two meons on opposite sides of the loop or on a line between two adjacent meons and the loop centre of rotation. There may be other meon asymmetries in the asymmetric loops than noted in the column when the three meon-pairs are ordered differently.

Condensing the outcome into the eight fermions, separated by symmetry type, produces

Leptons	
1	symmetric electron/positron pair
1	symmetric neutrino/anti-neutrino pair
2	asymmetric neutrino/anti-neutrino pairs
Quarks	
4	asymmetric down/anti-down quark pairs with charge ±1/3
2	asymmetric up/anti-up quark pairs with charge ±2/3

The symmetry here is complex across all the combinations, but can be simplified by considering only that the meon-pairs result in 8 fermion loops defined only by their overall charges. The underlying symmetry or asymmetry produces many more variants of the loops in terms of meon-pair or one-sixth electron charge positions.

Using that simplification, the group symmetry for normal matter would be SU3 because the result is 8 differently charged loops. This is a satisfying result in that it mirrors the hadron SU3 symmetry that arises from quark combinations. However, this definition is not general enough to encompass all loop pair-number symmetries and this is considered further below.

VIII. HIGGS RELATIONSHIP

The action of ZMBHs as both force transmitters and the background to the universe can be interpreted as acting as a form of both a Higgs particle and field [3], although without that boson's mass. The ZMBH is a zero spin particle because spin is actually the property of rotation of a loop. Although the ZMBH has no mass in total, by stretching the partially merged meon pair that comprise it, mass (gravity) and charge-related gradients will be created. A chain of stretched ZMBHs transmit that gravity, and magnetic/electric field, gradients into the ZMBH background.

The background of ZMBHs is continually in a state of flux, affecting loops passing within it and affected by those loops. The loops experience a form of viscosity as they travel through the ZMBHs that costs energy to overcome and results in a loss of loop frequency. If there were no ZMBH background, the mass and charge of the meons in a loop would not be transmitted anywhere and the loop would not be observable. The isolated loop would be considered to have zero mass, zero charge and zero spin, despite still having a rotational frequency.

Although a loop has a frequency and is composed of meons with positive and negative masses, and charges, the loop itself has no total mass, only a frequency. So, as in a Higgs field, there is a need for something to produce the effect of gravity. That something is the ZMBH background. ZMBH chains that attach to each meon in a loop as it rotates act to slow its rotation rate down but also increase the local density of the ZMBHs through the fields expressed by the chains. This effect is what gravity is. The faster rotating and physically smaller (larger mass) the loop, the steeper the mass field along the ZMBH chain and the greater the gravitational effect. The image is of a smaller area raft sinking deeper into water than a larger area raft of similar weight.

The source of the energy required to replace that lost by a loop when travelling through the background is provided by photons temporarily stacking with the loop and passing frequency to the loop. So a photon is not a force carrier but is a frequency adjuster that serves to keep non-photon loop sizes at least the size that they were locked into during inflation. The frequency lost by the loops against the viscosity of the background ZMBHs acts to speed up the motions, vibrations or rotations of those ZMBHs, which is equivalent to heating the background.

Bosons, including the Higgs, are simply stacks of loops and photons.

IX. 2-PAIR LOOPS

One of the dark matter loop sizes is the 2-pair loop. Any pair number that is not three is dark matter. The symmetry and total charge of non-3-pair loops does not allow other loop pair number to stack stably with 3-pair loops.

Only odd pair-number loops can form atoms because the odd-pair number symmetry of those loops requires an odd number of loops for overall stack balance and means that the total spin of a stack of loops will be ± ½ . To acquire neutrality overall of all energy types, the stack will need to balance its total gravitational effect, charge and spin and so will require an orbiting single spin ± ½ loop of same-sized opposite charge.

The number of combinations for a 2-pair loop (k) using four meon pairs states (t) will be

$$_{(k+t-1)}C_{(t-1)} = \quad {}_5C_3 = 10$$

The same four states of meon-pairs as for the 3-pair normal matter loops are used to form 2-pair loops as shown in Table 2.

Lepton-equivalents	
1	symmetric 2-electron/positron pair - charge ± 2/3
1	symmetric 2-neutrino/anti-neutrino pair
1	asymmetric 2-neutrino/anti-neutrino pairs
Quark-equivalents	
2	asymmetric 2-down/anti-down quark pairs with charge ±1/3

There are only six different total-charge loops, separated by symmetry types.

Table 2 - Combinations of 2-pair loops using 4 meon-pair states

	2 Pairs	1/6 Electron Charges	Total Charge	Loop Identity	Pair Asymmetry	Meon Charge Asymmetry
1	W W	+ - + -	0	2-neutrino	Symmetric	Symmetric
2	X X	- + - +	0	2-anti-neutrino	Symmetric	Symmetric
3	Y Y	+ + + +	+2/3	2-positron	Symmetric	Symmetric
4	Z Z	- - - -	-2/3	2-electron	Symmetric	Symmetric
5	W X	+ - - +	0	2-neutrino	2-fold	2-fold (rotation)
6	W Y	+ - + +	+1/3	2-anti-down q	2-fold	2-fold (on)
7	W Z	+ - - -	-1/3	2-down quark	2-fold	2-fold (on)
8	X Y	- + + +	+1/3	2-anti-down q	2-fold	2-fold (on)
9	X Z	- + - -	-1/3	2-down quark	2-fold	2-fold (on)
10	Y Z	+ + - -	0	2-neutrino	2-fold	2-fold (rotation)

There will be the same type of variations in positions of the one-sixth electron charges around a loop that result in the same total loop charge, but here there will be fewer variations than for the 3-pair loops.

X. OVERALL LOOP SYMMETRY GROUPS

The number of combinations in each set of pair-number loops does not define what the number of fermions, or their equivalents, will be. The largest charge value will always result in a symmetric loop and will be electron/positron-equivalent. There will always be a zero charge symmetric neutrino-equivalent loop. In between there will be all possible charge values between zero and the maximum charge value for the loop set in 1/3 electron charge increments represented by loops which are all asymmetric. Their asymmetries will mirror the pair-number of the loops.

This suggests that the SU type of symmetry grouping is not suitable for defining the overall symmetry of all loop sets. Considering the numbers of lepton and quark-equivalents within each loop set provides a possible alternative symmetry system.

In Table 3 the Combinations line uses the same calculation as previously with k=*n*, where *n* is the number of meon-pairs in a loop, and produces

Table 3 - Loop Set components with fermions-equivalents defined only by total charge

Pair-number *n*	1	2	3	4	5
Combinations	4	10	20	35	56
Symmetric Loops	4	4	4	4	4
Asymmetric Loops	0	6	16	31	52
Fermion-equivalents	4	6	8	10	12

For *n*=1, this is the equivalent of the ZMBH unmerging to become a pair and to form the 4 different meon-pair states. Since this symmetry underlies all the other loop symmetries, it should perhaps be included as part of the wider symmetry group definitions. So the first two parts of the symmetry for loops would be U1xS(1)G4 , where the 1 in brackets denotes the 1 pair starting point and the 4 denotes the number of fermion-equivalents. This treatment is possible despite there being no n=1 form of loop.

It is clear that each increase in loop size by one pair results in one further increase in the number of 1/3 electronic charge increments. Consequently, the number F of fermion-equivalents in any n-pair-number loop will be

$$F = (2n + 2)$$

It is thus preferable to suggest that the symmetry of using 4 states of one pair of unmerged meons in a loop of n pairs generally should be described as a Symmetry Group (2n+2) or SG(2n+2).

Combining the above with the underlying ZMBH symmetry of U1, and the S(1)G4 underlying symmetry suggests that all loops have overall symmetry U1xS(1)G4xSG(2n+2), with the special case of normal matter being U1xS(1)G4xSG8.

XI. CONCLUSION

Starting from meon/anti-meon pairs merged within ZMBHs which are unmerged to form meon-pairs provides the underlying basis for loop formation and one symmetry group.

Treating all loops in the same way, as combinations of the same meon and anti-meon in unmerged pairs that form loops leads to an overall description of all possible symmetries of matter and anti-matter as U1xS(1)G4xSG(2n+2) where n is the number of meon-pairs in a loop.

XII. REFERENCES

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

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

3 Higgs, P.W.: Broken symmetries, massless particles and gauge fields, Physics Letters, 12, 132-133, (1964). https://doi.org/10.1016/0031-9163(64)91136-9