Differentiating between normal matter, anti-matter and dark matter

MICHAEL LAWRENCE
Maldwyn Centre for Theoretical Physics, Park Road, Ipswich, Suffolk, United Kingdom
lawrence@maldwynphysics.org
12 October 2023

Using a pre-fermion hypothesis, the difference between normal matter and anti-matter is defined and then the ratio of normal matter and anti-matter, both being 3-fold, asymmetric and symmetric, 3-pair fermion loops, when compared to the universe's total matter, including dark matter loops of other pair-number, is estimated. The result of 17% is in the approximate region of the observed value of 15% but would benefit from a more detailed treatment or improved methodology. Also explained is why dark matter loops cannot form the dark matter equivalent of atoms and where anti-matter is hiding in plain sight. When protons and positrons, being positively charged, are defined to be matter, then negatively charged electrons, and charge-neutral neutrons, are anti-matter. Other charge-neutral particles could be either matter or anti-matter. Stable nuclei are built by balancing matter and anti-matter components. An overall charge-neutral universe has a balance of matter and anti-matter and their combination does not annihilate on contact.

Keywords: Pre-fermion; Loop; Pairs; Dark Matter; Dark Energy; Cosmology; Normal matter; Anti-matter; Matter;

PACS: 98.80.-k; 95.35.+d; 95.36.+x;

I. INTRODUCTION

The current misinterpretation of an imbalance between normal matter and anti-matter is longstanding. This is due to the wrong definition that is presently used to define which is which. In the pre-fermion hypothesis [1] there are more degrees of freedom in the composite structure of loops, which comprise all matter, than currently perceived. This paper explains how those extra degrees of freedom result in a different definition of which loops are matter and which anti-matter, and thus where anti-matter is hiding in plain sight.

The ratios of dark matter or non-dark matter (the latter meaning both normal matter and anti-matter) to total matter in the universe are of great interest in cosmology [2]. Based on previously published work [3, 4], the ratios of non-dark matter or dark matter to total matter can be estimated approximately, given some reasonable assumptions.

The previously published hypothesis suggests that normal matter and anti-matter fermions are loops composed of three unmerged 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 fully or partially merged pairs or, after unmerger, as unmerged pairs within loops.

Loops of three pairs are our fermions, being 3-fold asymmetric (quarks) and symmetric (leptons). Loops of other pair number have different asymmetries and symmetries so cannot successfully bind stably through frequency matching of inter-loop charge and mass forces (called stacking) with our 3-fold symmetry loops.

The analysis of the different numbers of pairs in any loop that can be formed from the very large number of pairs available in an unmerging event can be approximated. The method employed here is reasonable, but there may be other methods, or adaptations to this method, that provide a better fit to observations.

No account is taken in this analysis of what the mass size of any loop is. The estimation of ratios here is concerned only with loop numbers. Since the mass effect of any loop is due to its rotational frequency, the pair-number of any loop is of no gravitational consequence. On the assumption that inflation along three dimensions affected the increase in radius of all sets of pair-number loops identically and that the distribution of loop frequencies is the same for all sets of pair-number loops, then the loop numbers for each different pair-number set will be a valid substitute for the ratio of masses, and thus the ration of mass-energies, between pair number sets.

II. BACKGROUND

An unmerging event is where the background of the universe, composed of a myriad of moving, vibrating and rotating merged meons and anti-meons (called zero mass black holes, or ZMBHs when fully merged, or partially merged pairs), has a concentration of the right amount of energies to unmerge one ZMBH and then many more – a random big bang inflation of loop sizes within a volume that is part of the pre-existing universe.

Chains of partially merged pairs are the only force carriers and have zero spin. Bosons are just loop combinations in stacks. Partially merged pairs move, twist (spin about their mutual axis of rotation as they translate), rotate and vibrate to transfer forces between meons in loops and other partially merged meons within the background of ZMBHs and partially merged pairs. Partially merged pairs form chains attached to meons in loops and affect other ZMBHs and partially merged pairs that are the background to the universe, producing the effect of gravity due to the rotational rate of the loops and chains, and are slowed by the background in a form of viscosity. The effect of chains of partially merged pairs between loops is visible in iron filings aligned by magnets, evidencing the presence of magnetic field lines due to the motions of charges within the loops within the magnets.

Since a loop and anti-loop have the same types of chains attached to the meons/anti-meons in a loop, those attached chains act as an effectively attractive force on the background, and vice versa, so that loops, whether matter or anti-matter, have the same attractive effect - which we call gravity.

III. 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 matter, anti-matter and dark matter. The further objective is to estimate what proportion of normal 3-pair loop matter and anti-matter is made from the available pairs at the outset of a big bang versus the total of all the loop pair-numbers that formed and to compare that with the latest observed value.

IV. OUTLINE

The paper considers the number of degrees of freedom when forming loops composed of unmerged meons and anti-meons that may form either matter or anti-matter and the number of loops of each pair-number that could be formed from the whole number of pairs available and then how likely it is that these pair numbers are to be formed. This is not a normal permutation or combination calculation.

V. MATTER AND ANTI-MATTER

Currently the basic assumption on matter/anti-matter asymmetry is that somehow there is an excess of matter over anti-matter and after mutual interaction, only the matter excess survives. The currently defined ‘normal’ matter particles include the proton and electron, despite their opposite signs of charge. This is not the case in the hypothesis discussed here.

Consider a chain of pairs of any number travelling across a theoretically-existing flat surface. The chain encounters an obstacle which deflects the chain either right or left so that it catches its own tail. One version will become a clockwise rotating loop and the other an anticlockwise rotating loop. If the clockwise loop, knocked to the right in this thought experiment, is defined to be spin +½ and the anticlockwise as spin -½ it is apparent that the spin energies are the same and the mass energies – the loops’ rotational rates – are also the same. The charges of the loops will also be the same since the meons and anti-meons have not changed twist orientation. How then to define a matter loop or an anti-matter loop?

The underlying difference can only be investigated by switching the time direction for every property of each meon and anti-meon. This means the initial direction of travel of the chain, the twist orientation of each meon/anti-meon and also the underlying identity of each meon which has to become an anti-meon and vice versa.

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

The difference is also that the chain previously deflected right will now 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. However, the last change is that the loop itself must be flipped over to become a spin + ½ loop.

These switches constitute the degrees of freedom for defining matter or anti-matter and are greater in number than currently considered.

The only property that provides an unambiguous definition that can be used to define matter and anti-matter is the sign of charge of the loop. If the positive charge of the proton or positron loop is defined to be matter, then the negative charge of the electron makes it an anti-matter loop, as would be all other negatively charged loops. Thus all stable nuclei are balances of matter and anti-matter, 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 respectively.

The neutrino could then be defined as either matter and anti-matter since it has no overall charge. Even if a specific position for the start of the loop is defined, so that it would be possible to call one matter and the other anti-matter and rotating either loop by 60 degrees would convert one to the other, this would be the same spatial framework change as for spin and so not usable. The anti-loop of a positive charge spin +½ loop is a negative charge spin +½ loop. So a photon, being loop and anti-loop rotating parallel in the same sense (stacked), is a perfectly balanced composite of matter and anti-matter. So matter and anti-matter cannot annihilate on contact.

In the nucleus, the three core quarks in a loop-stack that defines a proton have two positive charge matter loops and one loop of negative charge anti-matter. This supposes that the choice has been made for the positively charged proton or positron to be positive (normal) matter particles, 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 so, although the neutron is charge-neutral, it is an anti-matter particle overall. This means that 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 components are equal.

Since unmerging ZMBHs and partially merged pairs produces a balance of fundamental charges as well as of one-sixth electron charges in the twisting meon and anti-meon pair, there can be no matter/anti-matter particle imbalance in the universe, even though there may not be an exact balance in the number of matter and anti-matter loops subsequently formed.

VI. NUMBER OF LOOPS FORMED

The estimation is based on how many loops of each pair-number can be formed from the number of unmerged ZMBHs and partially merged pairs previously available. Each partially merged pair unmerges into a pair of meon and anti-meon, and each loop always has an equal number of meons and anti-meons, so it is pairs that need to be accounted for.

The 1-pair set is for one single pair. Although it is not possible to form a loop from a single pair, the calculation starts at that base level and the result will be adjusted later to account for there being no 1-pair loops.

The number of 1-pair loops possible from *n* unmerged partially merged pairs will be *n*

The number of 2-pair loops possible from *n* unmerged partially merged pairs will be *n*/2

The number of 3-pair loops possible from *n* unmerged partially merged pairs will be *n*/3

The number of *n*-pair loops possible from *n* unmerged partially merged pairs will be *n*/*n*

Without weighting the sets of pair numbers, the total number of loops across all pair-number sets, each considered to use all available pairs, would be

$$N_{loop-unweighted} = \frac{n}{1} + \frac{n}{2} + \frac{n}{3} + \cdots + \frac{n}{n}$$

$$= n(1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n})$$

However, this infinite series diverges and the value of *n* would be required to produce an answer. This sum also assumes that each pair-number loop is equally likely to form, which is not the case, so weighting of the sets will be required.

The individual set numbers will also not necessarily have integer values of loops formed and there will be remainders where the set pair-number does not divide *n* into integer numbers of loops. The remainders will be considered later.

VII. WEIGHTING OF PAIR-NUMBER SETS

The weighting of each set depends on the probability of forming that loop number from the starting point of the available pairs.

The probability of forming 1-pair loops will be 100% (1) because that is how they start.

The probability of forming 2-pair loops will be 50% (½) because they could either form that size or smaller.

The probability of forming 3-pair loops will be 33.3% (1/3)

The probability of forming an *n*-pair loop will be 1/*n*

Taking these two factors together, for each set of pair-numbers the relationship will be

$$Number\ of\ pairs\ available \\ /(pair\ number\ x\ pair\ probability)$$

The number of pairs available depends on whether remainders are being considered, as discussed later. So each set is based on the number that it is possible to make of that specific pair size, from the total available number of unmerged pairs, which were previously ZMBHs and partially merged pairs, together with the probability of forming such a loop. This will give the following summation across all *n* sets of pair-numbers

$$nN_{loop-weighted} = \frac{n}{1^2} + \frac{n}{2^2} + \frac{n}{3^2} + \cdots + \frac{n}{n^2}$$

$$= n(1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots + \frac{1}{n^2})$$

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.

The infinite summation within brackets is convergent and is called the Basel Problem which was solved by Euler in 1734 for $n = \infty$ with the result being $\pi^2/6$. Since the unmerger results in a big bang, whether successful or failed, the number of available pairs will approach infinity but will not be infinite. So the Euler result will be a good approximation.

Looking at the ratio of 3-pair loops (both matter and anti-matter) to all pair-loop numbers, which is the ratio of normal matter and anti-matter to the total of those plus dark matter, the equation will be

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

The deduction of *n* from the total loop number nN_{loop} is to eliminate the 1-pair loops, which are not loops, but which enabled the infinite series to be calculated. This result, without adjustment for the remainders, is

$$R_{m/-m} = 17.23\%$$

This result, as a first approximation, is not far from the CMB observations [2] of 15.73% as the ratio of baryonic (matter and anti-matter loops and stacks) matter to total matter, based on $\Omega_c h^2 = 0.12 \pm 0.001$ and $\Omega_b h^2 = 0.0224 \pm 0.0001$. The analysis here suggests that dark matter represents 82.77% of total matter versus 84.27% from the CMB data.

VIII. REMAINDER ADJUSTMENTS

Above *n*/2 , there will only be one loop in each set, with the remainder available to form smaller loops. Redistribution of the remainders in each set to form other loop-numbers may seem to be a reasonable method of calculating the ratios better. Although the remainders will be smaller at small pair-number and larger at larger pair-number, the effect overall might be expected to weight the distribution of number of loops towards smaller pair-loop sizes.

There will be an increase the total overall number of loops, but the similarity of the structure of the remainders across the sets between any two number fractions, for example *n*/2 up to *n*, called a number gap, means that, apart from at low *n*, the ratios of loop numbers between any two fractions is approximately the same as the total for all *n* sets.

For the largest number gap between *n*/2 and *n*, all pair-number sets higher than *n*/2 up to *n* will have only one complete loop, plus a remainder. This gap is similar in structure to the overall set from *n*=1 up to *n*, although truncated with only *n/*2 sets. If the pairs remaining in each set are redistributed in the same way as was done for the overall *n* sets, the same Euler summation can be used, but multiplied in each case by the number of sets in each gap.

This effectively treats each gap length of *n*/2, *n*/6, *n*/12 and so on, as substitutes for *n* in the Euler formula and so will overstate the total loop number because, for increasingly smaller *n*, the Euler summation becomes less valid. The summation of the gap lengths will be

$$G_{gap\ total} = \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \frac{1}{n(n+1)}$$

$$\cong 1\ as\ n \to \infty$$

However, even with this increase in loop numbers, both the normal (both matter and anti-matter) and dark matter components are increased by the same factor. The result is an equation for the ratio normal matter and anti-matter to total matter, including remainders, of

$$R_{m/all-m(rem\ inc)} = \{\left(\frac{1}{3^2}\right)(1+1)\}/\{\left[\frac{\pi^2}{6} - 1\right](1+1)\}$$

$$= 0.1723$$

This repeated result of 17.23% normal matter and anti-matter to total matter, and 82.77% dark matter to total matter, may again overstate the loop numbers and a more precise calculation should improve accuracy.

IX. DARK ENERGY

The CMB analysis [2] concluded that dark energy made up the ‘missing’ mass-energy for a flat universe that the matter/dark matter mass-energy does not appear to account for. In the hypothesis promoted in the previous work to which this paper relates [3, 4], dark energy is not necessarily required.

Firstly, all meons, loops, atoms, planets, stars and the universe itself always have total energy of zero when considering both mass and charge related energies, since they are always equal in size and opposite in type. All that is required is to identify where the mass or charge related energies are located. So the requirement for the universe to have some specific mass-related overall energy is not relevant.

Secondly, the existence of failed big bangs, past which our successful big bang is moving, and existing ones beyond its current extent, suggest that the upward curve of the Hubble constant at longer distances may be related to the high red shift of those objects which will have coalesced into black holes and rotating galaxies, many before our own big bang and which have a frequency-independent tired-light redshift based almost solely on distance travelled.

Thirdly, those failed big bangs will provide further normal matter, anti-matter and dark matter which is not directly observable.

In this hypothesis, our big bang occupies only a fraction of the single total universe and all observable structures within it are composed only of loops that are themselves composed of unmerged meon/anti-meon pairs. Those same pairs, when merged as ZMBHs or partially merged pairs, form the background of the universe and transmit all forces.

In the universe, all composites in all big bangs, failed or not, use the same meons and anti-meons as their fundamental building blocks, so physics will be the same everywhere, although chemistries, linked to individual big bang inflation-related loop sizes, may differ. But space cannot expand because the meons and anti-meons are always the same size.

Not explained extensively here is the reason why even-pair number dark matter loops cannot form the dark matter equivalent of atoms. The references explain in detail how odd-pair number loops, which have odd-asymmetries in their quark-equivalent charged loops, need to form maximum-charge (or zero charge) stacks of those loops that balance those rotational asymmetries. These stacks need to be of odd number and so will always have a net spin that needs to be balanced, for a charged stack, by an orbiting symmetric maximum opposite-sign charged loop of same size spin – producing an atom.

Even-pair number loops require an even number of loops in their stack to balance all the loop asymmetries and so can never balance their total stack spin with a single orbital loop of spin ±½ .

X. CONCLUSION

Based on a reasonable set of assumptions, the results lie not too far from the observed value for the ratios of normal and anti-matter, or dark matter, to total matter, although the analysis ignores any dark energy contribution.

The hypothesis suggests that the only difference between normal and dark matter is how many pairs of unmerged meon/anti-meons are in a loop and that three-pair-loop matter and anti-matter are differentiated only by sign of loop charge, or net loop type in a loop-stack.

The main difference to the current definition of three-pair-loop matter and anti-matter is that if a loop or composite particle has a net positive charge, it will be matter, and if it has a net negative charge, then it will be anti-matter. If a three-pair-loop or loop-stack is charge-neutral it may be either matter or anti-matter.

The result is that an overall neutral universe always has a balance of matter and anti-matter as do stable nuclei and photons.

XI. REFERENCES

1 Lawrence, M.: A hypothetical pre-fermion particle theory of everything in diagrammatic form (pre-print) Researchgate (2022)

2 Astronomy & Astrophysics Special Issue; Planck 2018 results, A&A 641, A6 (2020) https://doi.org/10.1051/0004-6361/201833910

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

4 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