

## Matter-Antimatter Explained with the Fundamental Particle

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**Abstract:** Based on "Theory of Unity of the Whole and its Parts" [1], and the previously defined fundamental particle, we have solved the matter-antimatter asymmetry [2].

**Keywords:** fundamental particle, generalized radius, elementary particles, classical radius, antimatter, matter-antimatter asymmetry

### Introduction

As in all my articles, for example in [1] Mahov principle [3] is expressed, by the words:

*Parts are dependent on the whole (Universe) and are also an integral part of the whole, therefore, the whole is also dependent on the parts!*

This further led to the attitude:

*"matter dominant universe" and "radiation dominant universe" coexist in every point in time*

All together, it can be placed under relational theories [4]. The previous approach found the base, mostly with Ruđer Bošković and Maks Planck. Some of the views of contemporary authors, Steven Weinberg and Antonio Alfonso-Faus, were particularly useful for this work.

### Fundamental Particle

We shall apply the known values of the constants: the speed of light, the reduced Planck constant, the universal gravitational constant and the inverse fine structure constant, at the measurement system (kg, m, s):

$c, \hbar, G, \alpha = 299792458 \quad 1,054572E-34 \quad 6,67384E-11 \quad 137,0359991$

While the value of the Time cycle of the universe,  $T_u = 4,3085E + 17$  s, is determined in [9].

Using [5], Weinberg [6] and Alfonso-Faus [7], it is defined a hypothetical particle that satisfies:

$$m_f^3 = \hbar^2 / (T_u G c) \quad (1)$$

We named it, the Fundamental particle, whose mass was obtained in [5] and it is:

$$m_f = 1.09 * 10^{-28} kg \quad (2)$$

Note that this is not a real particle, but a hypothetical particle with mass between the mass of protons and electrons, with the characteristic to satisfy (1).

We also use generalized radius from [5], which is similarly described in [7]:

*The generalized radius of any mass m is the geometric mean between its gravitational radius,  $Gm/c^2$ , and the size of the Universe,  $cT_u$ .*

$$r_g = \sqrt{cT_u * Gm / c^2} \quad (3)$$

For any mass of the object, this radius is the limit, beyond which the attraction ends and the repulsion begins. For example, the planets and the stars with their clearly defined shape attract all objects to a radius  $r_g$ . Galaxies that do not have a clearly defined shape also attract all objects to their radius  $r_g$ . But what we see as a galaxy contains objects that the galaxy attracts and those,  $>r_g$  that are moving away from the galaxy.

The body can be aggregate due the attraction, and we know that attraction can not exist without repulsion in its surroundings. This is a general state, described in detail in [8]. The same is true in the micro-world, where we define the real radius:

$$r = const * \hbar / mc \quad (4)$$

We have determined the mass for which  $const = 1$  and  $r_g = r$ , i.e. as in (3):

$$r_g = \sqrt{cT_u * Gm / c^2} = \hbar / mc \quad (5)$$

From (5), by solving m, we obtain:

$$m^3 = \hbar^2 / (T_u Gc) \quad (6)$$

and from (1) and (6), we have  $m = m_f$ .

It follows that the fundamental particle is unique because, for it only the generalized radius of (3) is equal to the real radius of (4),  $r_{gf} = r_f$ .

$$r_f = \hbar / m_f c = r_{gf} = 3.231309 * 10^{-15} \quad (7)$$

For the sake of simplicity we will use the product of mass and the classical radius of elementary particles, P:

$$P = m * r_c = \alpha'^k * \hbar / c \quad (8)$$

We assume that for elementary particles only, the classical radius is by definition:

$$r_c = \alpha'^k * \hbar / mc \quad (9)$$

Where  $\alpha'$  is the inverse fine structure constant and k are discrete values:

$$k [-1, -2/3, -1/3, 0, 1/3, 2/3, 1] \quad (10)$$

We consider that there are classical radius of particles larger and smaller than  $r_f$ , since (7) it has been shown that  $r_f$  is a generalized radius, which is always the limit between attraction and repulsion, but  $r_f$  is also located between the "matter dominant universe" and "radiation dominant universe". The values of k are discrete, it is expected based on Planck's results, and that they are just thirds, the assumption is based on knowledge of elementary particles. Why is the 137,0359991 coefficient in (8), for a long time will not be able to answer accurately.

## Analysis

The above formulas will be shown in Table 1. The products of mass and classical radius of the particle and their relation to the constant,  $\hbar / c$  are shown. They are calculated with the formula  $m * r_c$ , for case the mass and the classical radius are well known and with the formula,  $\alpha'^k * \hbar$  if they are not well known.

**Table 1 – Product of mass and classical radius of elementary particles (kg, m, s)**

c, $\hbar$ , G = 299792458 1,054572E-34 6,67384E-11					
$T_u, \alpha', \hbar/c$ 4,3085E+17 137,0359991 3,5177,E-43					
k	$r_g = \sqrt{cT_u * Gm/c^2}$	m	$r_c = \alpha'^k * \hbar / mc$	P / ( $\hbar/c$ )	P = $\alpha'^k * \hbar / c$
- 1/3				0,193964	6,8230,E-44
1/3				5,155588	1,8136,E-42
2/3				26,580090	9,3500,E-42
- 2/3				0,0376221	1,3234,E-44
0	3,23131E-15	1,08862E-28	3,23131E-15	1,0000000	3,5177,E-43
-1	2,95586E-16	9,10938E-31	2,817940E-15	0,0072974	2,5670,E-45
1	2,95586E-16	9,10938E-31	5,291772E-11	137,0359991	4,8205,E-41

From the Table we conclude:

- The particles and antiparticles are close to the fundamental particle, and they were not formed in the Planck time, the imagined beginning of the universe.
- The same applies to all leptons.

- The product of the mass and classical radius of the leptone is  $\alpha$  times smaller than the mass product and the generalized radius of the fundamental particle.
- The product of the mass and the classical radius of leptons is  $\alpha$  times smaller than the product of the mass and a generalized radius of the fundamental particle.
- The product of the mass and the classical radius of antileptons is  $\alpha$  times grater than the product of the mass and a generalized radius of the fundamental particle.
- Determine the product:

$$P_{particle} * P_{antipartide} = \alpha^k * \hbar / c * \alpha^{-k} * \hbar / c = (\hbar / c)^2 = const \quad (11)$$

This is by definition, the property of “Opposites” [10], it is valid: *the product of the opposites is a constant*. And since the  $P_{particle}$  and  $P_{antiparticle}$  are each Product "mass \* classical radius" of elementary particles, we can say:

***The product "mass \* classical radius" of the elementary particle is the opposite of the same product of the corresponding antiparticle.***

Also, since from (8),  $P_f = \hbar/c$  or  $P_f^2 = (\hbar/c)^2$ , we can say:

***The product "mass \* classical radius" of the fundamental particle is the opposite of itself***

- Baryon asymmetry problem [2], is related to the erroneous and persistent expectation that matter and antimatter were created in “Big Bang”, so their equal amount is expected. The antiparticle is essentially just the opposite charged particle.
- Attraction/repulsion depends on the mass of the object; therefore, is independent of whether the object is of matter or antimatter.
- More generally, it can be said that forces arise as a result of the relationship of the central mass to the whole of the universe and the distance of the observed point from the central mass of the object.
- The property of opposite is crucial for the existence of matter and antimatter, not symmetry.
- Ratio of classical radius of positron and electron is:

$$r_c(positron) / r_c(electron) = \alpha^{11} / \alpha^{-1} = \alpha^{12} = 18778.86504 \quad (12)$$

While the ratio of the surfaces that these radii represent is the square of the previous, i.e. :

$$\alpha^{14} = 3.52646 * 10^8 \quad (13)$$

which means that the positron with space has entered "*the matter dominant universe*" while the electron is in part of "*the radiation dominant universe*". This is the key to explaining a much larger number of electrons than positrons. Similar is the explanation for all other antimatter.

- Why are physical properties, other than charge, for matter and antimatter the same? The answer is that the physical properties depend on the mass and, for this bound generalized radius, formula (3). Classical radii, formula (9) only show the sing of charge, but not other physical properties.

## Conclusion

It is not strange that matter is far more prevalent than antimatter in the universe. The matter and antimatter are related to a hypothetical fundamental particle, defined by (2), and not to Planck's time. Also: "*matter dominant universe*" and "*radiation dominant universe*" coexist in every point in time. „*Opposites*“ are crucial for the existence of matter and antimatter. I am sure that the fundamental particle can also be used to explain many other phenomena.

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