Parameters of the Universe

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Abstract: The limits of mass and distance in the universe are determined by formulas that have mathematical constants and known physical values as input data, the Planck mass, the mass of proton and the Compton wavelength of proton.

Key words: Bošković, Bošnjak, Planck, cohesion, limit, universe

1. Introduction

The upper limit of the mass of the universe can only be one of the following:

• Finite;

• Infinite.

We reject the second assumption because it leads to undefined states and division by zero.

Let's accept the first assumption, and if someone asks the question of a more universes, multiverses, parallel universes or whatever we call them, given the assumption of finite mass, we can consider them all together as a whole, that is: one finite mass. Even Ruđer Bošković, in his book [1], talks about independent universes that cannot come into any contact. Note that in Bošković's time, galaxies and more complex structures were not known. That is why we assume: that, among other things, it also refers to clusters of galaxies that we can consider as independent parts of the same whole of overall existence.

Here, we will consider all independent parts as just that: independent parts of a universal whole, which we will call the Whole of the Universe. Just as we assumed the finite mass of the universe, let's assume that finite masses are relative to each other at finite distances. With time, something is different. Let's consider the Planck time as the lower limit of time and it's oposite time $\boldsymbol{T_u = R_u/c}$ ***(13.7*** billion years) as the Cycle of time and not the age of the universe up to this moment. Let's consider the Whole of the universe as eternal, which after all the supporters of the Big Bang indirectly admit: because they talk about the creation of new universes both before and after universe of ours, which is nothing but the eternity of the existence of the Whole.

Here is what Stevan Bošnjak [2, page 219] says on this topic:

$$„h/c = 2.202 \times 10\text{-}37 c.g.$$
$$m \cdot \lambda = 2.202 \times 10\text{-}37 c.g.$$

The above relationship ultimately prohibits the possibility of completely converting mass into space and vice versa, that is, there is no possibility of the existence of either a singularity or an infinite universe. This universe exists eternally, passing through various forms of existence with ***lower*** *and* ***upper limits****,*

which are uncrossable. It is important to know that the final physical values are in both cases. This universe somehow breathes, contracts and expands countless times throughout eternity, a thread emerges and disappears, it only changes forms, evolves and devolves and is very compatible with the Stoic conception of the universe, with the fact that it does not disappear in a complete collapse, the thread arises in an explosion: ***big bang*** *and similar models. "*

I believe that: the formulas in the following section contribute to the understanding of previous.

Note that we can define natural units, so that the Mass of the Whole universe is $\boldsymbol{M_u = 1}$, and the upper limit of the distance $\boldsymbol{R_u = 1}$, and then all masses and distances are parts of the Whole. This representation of physical parameters is shown in: [3].

2. Formulas for mass and distance limits

Let's show the formulas in relation to known mathematical constants and physical parameters: CODATA [4] in [**kg – m - s**]. Everything is shown in the Table, which is divided into 6 segments: in the first are mathematical constants, in the second are dimensionless physical constants, in the third are physical constants, in the fourth are formulas for the parameters of the universe and in the fifth are rational relationships that satisfy the first five formulas in relation to Planck's values. In the parameters of the universe, we include: Mass of the universe, Spacing of universes (Spacing is a term from [1]) and Fundamental mass and spacing from [5].

To understand the relationship in this paper, it is important to know what the Universe Parameters and Planck values represent, and we will repeat them from [6] as I see them:

The mass of the universe, $\boldsymbol{M_u}$ is the upper limit of mass;
The radius of the universe, $\boldsymbol{R_u}$ is the upper limit of distance;
The Time Cycle of the Universe, $\boldsymbol{T_u}$ is opposite of Planck's time;
The Planck length is the lower limit of the distance;
The Planck mass is the geometric mean of the masses in the universe;
The fundamental particle (mass, mf and radius, $\boldsymbol{R_f}$) is virtual, combines Bošković's non-cohesive and cohesive limits [1] and has properties shown by formulas: here and in [5].

In the Table, some physical constants could have been omitted: because they can be obtained through other constants from the Table, but they are shown for clarity.

Formula (1) is derived from [5, f10 b]: to present it in a form that uses only well-known physical quantities. We omit the derivation and sublimate the presentation in just one Table. I came to the key results before I knew about Bosniak ***opposites***, using which I confirm the previous results. In red are the lesser known quantities: and why they are equal to the known relations can be understood by [1], [2], [5] and [6]. Formulas connect the macro and micro worlds.

Table - Ratios of masses and distances

Constants

2π	*two pi*	6,2831853072
cy	$cy = exp(2\pi) = e^{2\pi}$	535,4916555248
$\acute{\alpha}$	Fine structure constant	137,035999084
μ	Proton/electron mass ratio	1836,15267343
γ	Neutron/proton mass ratio	1,00137841920
m_p	The mass of a proton	1,67262192369E-27
m_{pl}	Planck mass	2,17651009E-08
λ_p	Compton wavelength of protons	1,32140986E-15
c	Speed of light	2,99792458E+08
l_{pl}	Planck length	1,616199E-35
t_{pl}	Planck time	5,391059E-44
$\hbar$	Reduced Planck's constant	1,054571818E-34

Formulas

		[kg - m - sec]	
1	$M_u = 2\pi * (2^{cy} * m_{pl}^4 / m_p)^{1/3}$	1,7394492721E+53	
2	$R_u = 2^{cy/3} * (m_{pl} / m_p)^{\wedge -2/3} * \lambda_p$	1,2916529930E+26	
3	$T_u = 2^{cy/3} * (m_{pl} / m_p)^{\wedge -2/3} * \lambda_p * t_{pl}/l_{pl}$	4,3084906193E+17	
4	$R_f = (2\pi)^{-2/3} * 2^{cy/9} * (m_{pl} / m_p)^{-8/9} * \lambda_p$	3,2313088236E-15	
5	$m_f = (2\pi)^{-1/3} * 2^{-cy/9} * m_{pl}^{8/9} * m_p^{1/9}$	1,0886217114E-28	
6	$m_f * R_f = \hbar / c$	3,51767294E-43	3,51767294E-43
7	$F_{pl} = c^2 * M_u / R_u = c^2 * m_{pl} / l_{pl}$	1,2103398E+44	1,2103398E+44
8	$G = c^2 * R_u / M_u = c^2 * l_{pl} / m_{pl}$	6,6738354E-11	6,6738354E-11
9	$M_u / R_u^2 = m_f / R_f^2$	10,4260561279	10,4260561279
10	$R_u * m_f / R_f^2 = m_{pl} / l_{pl}$	1,3466847E+27	1,3466847E+27
11	Lower mass limit	$m_q = m_{pl}^2 / M_u$	2,723388527E-69
12	Number of Planck oscillations	$N = M_u / m_q$	6,3870772E+121
14	$q = log_2(M_u/m_q) = log_2\gamma * (1+\acute{\alpha}^2 log_2\mu)$	404,6284553660	404,6284553660
15	$q = 3*cy/4 + 3*log_2(2\pi)/2 + 1/(2*\mu/\acute{\alpha}+2)/2 - 1$		404,6284553660
16	$N^{0.5} * M_u / R_u^2 = m_{pl} / l_{pl}^2$	8,33241977E+61	8,33241977E+61

Also: it is a rational assumption that the proton, as the most stable particle in nature, has the simplest relations to the previous parameters as well as others not mentioned here, and that is why it is connected to the key mathematical constant, $cy = e^{2\pi}$.

There are countless masses and distances that satisfy: $m * R = \hbar / c$, and the most significant such pair is the Planck mass and the Planck length: $m_{pl} * l_{pl} = \hbar / c$. A particle that would have these values is called a *Planckion*, which would be a black hole if it existed, [7]: *A Planck particle, named after physicist Max Planck, is a hypothetical particle defined as a tiny black hole ...*

The Fundamental particle is much more important: because it is between the masses of proton and electron. Around the Fundamental particle: all real particles and relationships significant to them are formed. The mathematical uniqueness of this virtual particle in relation to all others is: In addition to satisfying (6), it is the only one that also satisfies (9) and (10). For all other masses and distances, a coefficient is required, for example: (16) applies to the universe as a Whole.

3. Conclusion

The mass of the universe and the ***upper limit*** of the distance in the system [**kg- m - sec**] are determined. Bošnjak's position was mathematically confirmed: - that the universe exists forever, passing through different forms of existence with ***lower*** and ***upper limits***, which are unsurpassed. Because if it were not so: then the mathematical constant $\mathbf{e^{2\pi}}$, important for formulas (1 - 5), would be valid only now and there would be no ***lower*** and ***upper limit*** and everything in between.

Just as there are opposites of phenomena, there are also opposites of processes, i.e. attraction and repulsion, which are best explained in [1]. A pair of such opposing processes are gravity and radiation, which are part of the continuous "Propensity", (Bošković's term in [1]), of points towards motion. The aspiration to reach an equilibrium point without attraction and repulsion is eternal and unattainable because all equilibrium points are virtual and a particle can only move from repulsion to attraction and vice versa, that is, to oscillate.

The formulas also show, on the example of proton, electron and neutron, the connection of particles with the limits of mass and distance, which Bošković clearly states in [1, art. 2]:

Moreover, there is a common point between any of the theories of Newton and Leibniz and my own; namely, that every particle of matter is connected to every other particle, no matter how great the distance between them...

To repeat: the universe recombines itself, but always within its limits:

Lower and ***upper limits***, *are uncrossable*, [2, page 219].

4. References:

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