More than a Hundred Ways to Get the Large Number N

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Rev. May 6th, 2019

In 1974, Dirac did the hypothesis that certain great numbers [1] *linked to some unit-less ratios seams to constantly coming back. He therefore mentions that one of these great numbers being around 2×10^{39} may be approximately obtained by doing the ratio between the electrical force and the gravitational force between a proton and an electron. In his hypothesis on great numbers, he notices, without being able to explain it, that other great numbers seam to come back.*

In the present document, the author states that all large numbers of Dirac may come from only one large number N to which we apply an integer or rational exponent (1, 1/2, 1/3, 2/3, etc.). This large number, we call it "N", as M. Sidhart did it in his book "The Thermodynamic Universe" [2]. *According to us, this number correspond to the maximum number of photons of the lowest energy (having a wavelength equal to the apparent circumference of the apparent universe) contained in the apparent universe. We evaluate this number to about 6×10^{121}.*

Following the redaction of a few documents, many different equations have been found. All these equations give the same number N. Without performing the demonstrations that we usually do, the goal of the present document is to enumerate these different equations without doing the numerous and fastidious demonstrations that would be required. The reader will understand that if the title of the document states a hundred equations, it is easy to find even more of them. The enumerated equation may all be found from a few basic equations. However, most of them come from a hypothesis that we made about the fine structure constant α that seams impossible to prove for now. So, we made a postulate from this hypothesis which, we hope, will be verified one day.

The goal of enunciating as many equations which all give the number N is to be able to equalize the equations in order to connect some variables with others of our choice.

KEY WORDS: Large numbers, Dirac

1. INTRODUCTION

Like Dirac, the large numbers, and the large number N may intrigue more than one person. The number N which is unit-less is about 6×10^{121}. It seams from more than one point of view to be the largest number corresponding to a physics reality in our universe. From this number, many others may be deduced by simply applying an integer or rational exponent.

Of course, since this document follows a few other ones, the shown equations are based on the models already made. The reader will note, among others, that the β

constant which comes from our researches on the speed of light is often used in many equations. Without this constant, it would be impossible to establish such number of equalities.

Since the goal of this document is to enumerate many different equations giving the large number *N*, it is not necessary to say that the required demonstration would be fastidious and interminable. For this reason, we leave up to the reader to demonstrate them from the known physics equations and from the equation **(24)** that is our basic postulate.

2. DEVELOPMENT

2.1. Value of Physics Parameters Used

Let's start by stating all the fundamentals physics parameters that we intend to use in this article. These values are all available in the CODATA 2014 [3].

- Electron charge $q_e \approx -1.6021766208(98) \times 10^{-19}$ C
- Universal gravitational constant $G \approx 6.67408(31) \times 10^{-11}$ m^3/(kg·s^2)
- Fine structure constant $\alpha \approx 7.2973525664(17) \times 10^{-3}$
- Rydberg constant $R_\infty \approx 10973731.568508(65)$ m^{-1}
- Boltzmann constant $k_b \approx 1.38064852(79) \times 10^{-23}$ J/°K
- Planck constant $h \approx 6.626070040(81) \times 10^{-34}$ J·s
- Mass of the electron $m_e \approx 9.10938356(11) \times 10^{-31}$ kg
- Planck mass $m_p \approx 2.176470(51) \times 10^{-8}$ kg
- Planck length $L_p \approx 1.616229(38) \times 10^{-35}$ m
- Vacuum permeability $\varepsilon_0 \approx 8.854187817 \times 10^{-12}$ F/m
- Vacuum permittivity $\mu_0 \approx 4\pi \times 10^{-7}$ N/A^2
- Classical radius of the electron $r_e \approx 2.8179403227(19) \times 10^{-15}$ m
- Planck time $t_p \approx 5.39116(13) \times 10^{-44}$ s
- Speed of light in vacuum $c \approx 299792458$ m/s

2.2. Some Basic Equations that will Help the Reader to Find the Equations Shown in this Document

Like mentioned in the introduction, we do not have in mind to make the demonstration of the equations that we show. However, it is possible for the reader to find back these equations by using the following equations.

The apparent mass of the universe m_u is given by the following equation [5,6]:

$$m_u = \frac{c^3}{G \cdot H_0} \approx 1.73 \times 10^{53} kg \quad \textbf{(1)}$$

The apparent radius of curvature of the luminous universe is R_u according to our model exposed in [7] is given by the following equation:

$$R_u = \frac{c}{H_0} \approx 1.28 \times 10^{26} m \quad \textbf{(2)}$$

Let's mention that in another document that we made [8], we have shown many other equations which give the same result. The value of what we call the radius of curvature of the universe R_u is equal to what is sometime called, in other documents, the "Hubble radius" [9], the "radius of the universe" [10] or the "radius of curvature of the space-time"[11].

According to our model shown in [7], the luminous universe is in expansion to the speed of light. However, because of the laws of the relativity, the material universe (galaxies, gas clouds and others) move at a speed lower than the speed of light, let's say at the speed $\beta \cdot c$. The apparent radius of curvature of the material universe r_u evaluated to our location in the universe, according to our model shown is [3]:

$$r_u = \frac{\beta \cdot c}{H_0} \approx 9.8 \times 10^{25} m \quad \textbf{(3)}$$

The value of β represents the ratio between the expansion speed of the material universe and the speed of light c. The reader will note that this constant is used in many equations and allows putting an equality sign where Dirac and others did not succeed to do it.

$$\beta = 3 - \sqrt{5} \approx 0.76 \quad \textbf{(4)}$$

The apparent age of the universe T_u [10] is given by the following equation:

$$T_u = \frac{1}{H_0} \approx 13.56 \times 10^9 \, years \quad \textbf{(5)}$$

In his special relativity theory, Einstein showed that there was equality between the mass m and the energy E through his famous equation that involves the square of the speed of light [13,14]:

$$E = m \cdot c^2 \quad \textbf{(6)}$$

On another hand, it is possible to associate the energy E and a wavelength λ using the following equation:

$$E = \frac{h \cdot c}{\lambda} \quad \textbf{(7)}$$

As an electromagnetic wave may be associated to a spinning vector oscillating between an electrical field and a magnetic field, it follows that the wavelength λ corresponds to the circumference of a circle of radius r.

$$\lambda = 2\pi \cdot r \quad \textbf{(8)}$$

Thanks to equations **(6)** to **(8)**, it is possible to associate a mass m_{ph} to lowest energy photons (having a wavelength equal to the apparent circumference of the universe):

$$m_{ph} = \frac{h \cdot c}{2\pi \cdot R_u} \approx 2.74 \times 10^{-69} kg \quad \textbf{(9)}$$

In certain equations, we will use the equality between the energy E and the product of the Boltzmann constant k_b and the temperature T:

$$E = k_b \cdot T \quad \textbf{(10)}$$

In preceding works [15], we found an equation which gives the universal gravitational constant G as a function of the physics constants that have a similar precision than the speed of light in vacuum. We re-evaluate G with the help of the CODATA 2014 [3]:

$$G = \frac{c^2 \cdot r_e \cdot \alpha^{20}}{m_e \cdot \beta} \approx 6.673229809(74) \times 10^{-11} \mathrm{m}^3/(\mathrm{kg} \cdot \mathrm{s}^2) \quad \textbf{(11)}$$

The value of the Hubble constant H_0 is unfortunately a parameter of the universe that is evaluated with a very little precision for now [17]. In previous works, we have shown that the Hubble constant may be precisely determined thanks to the following equation [15,16] that we re-evaluated with the help of the CODATA 2014 [3]:

$$H_0 = \frac{c \cdot \alpha^{19} \cdot \beta^{1/2}}{r_e} \approx 72.09554815(32)\ \mathrm{km/(s \cdot MParsec)} \quad \textbf{(12)}$$

This value is partly verified by the Xiaofeng Wang team [18] which measured a value of $H_0 \approx 72.1(9)$ km/(s·MParsec).

Of course, we find the gravitational force F_g of Newton between the mass m_1 and m_2 when these one are spaced with a distance r. By convention, the force F_g is always negative since there is "attraction" between masses.

$$F_g = \frac{-G \cdot m_1 \cdot m_2}{r^2} \quad \textbf{(13)}$$

We will use the electrostatic force F_e between the charges q_1 and q_2 when they are spaced with a distance r. By convention, the force F_e is negative when there is "attraction" between masses and positive when this force is "repulsive".

$$F_e = \frac{q_1 \cdot q_2}{4\pi \cdot \varepsilon_0 \cdot r^2} \tag{14}$$

Thanks to previous works [4], it is possible to precisely evaluate certain Plank units such the Plank length L_p , the Planck mass m_p , the Plank time t_p , the Plank temperature T_p and the Plank charge q_p. Here are the shown equations, but evaluated with the help of the CODATA 2014 [3]:

$$l_p = r_e \cdot \sqrt{\frac{\alpha^{19}}{\beta}} \approx 1.6161254268(37) \times 10^{-35}\mathrm{m} \tag{15}$$

$$m_p = m_e \cdot \sqrt{\frac{\beta}{\alpha^{21}}} \approx 2.1766088836(27) \times 10^{-8}\mathrm{k}g \tag{16}$$

$$t_p = \frac{r_e}{c}\sqrt{\frac{\alpha^{19}}{\beta}} \approx 5.39081415(12) \times 10^{-44}\mathrm{s} \tag{17}$$

$$T_p = \frac{m_e \cdot c^2}{k_b} \cdot \sqrt{\frac{\beta}{\alpha^{21}}} \approx 1.41689824(81) \times 10^{32}\ {}^\circ\mathrm{K} \tag{18}$$

$$q_p = -q_e \cdot \sqrt{\frac{1}{\alpha}} \approx 1.875546023(11) \times 10^{-18}\ C \tag{19}$$

2.3. The Great Numbers of Dirac

Following observations made on the large numbers, Dirac has been able to see many number ratios having the same unity were ending to give similar values. Some particular ratios seem to come back all the times.

Without having a real proof, he had the intuition that the macroscopic universe (at the universe scale) was intimately linked to the microscopic values.

It may be difficult to see the exact links between the different ratios if these one are not exactly equal. Dirac found only numbers that were about the scale of size without any precise values.

Without using exactly the ratios shown by Dirac, it is possible to notice, after many trials, that there exist a common link between all these numbers. This common link, we name it *N*. This number corresponds to a large integer number representing, among others, the maximum number of photons of wavelength $2\pi\cdot R_u$. This wavelength is the one that has the smallest amount of energy that may exist in the universe.

To do so, let's associate a mass m_{ph} to the photons of wavelength $2\pi\cdot R_u$ thanks to the equation coming from the special relativity of Einstein shown in **(6)**. Knowing the total apparent mass of the universe shown in **(1)** , it is possible to know the value of *N* by doing the masses ratio:

$$N = \frac{m_u}{m_{ph}} \approx 6.30\times 10^{121} \tag{20}$$

Thereafter, it is easy to see that by raising *N* to certain powers, we obtain values for certain physics realities:

$$N^{2/3} = \frac{m_u \cdot \alpha}{m_e \cdot \beta^{1/2}} \approx 1.58\times 10^{81} \tag{21}$$

$$N^{1/2} = \frac{m_u}{m_p} = \frac{m_{ph}}{m_p} = \frac{R_u}{L_p} = \frac{T_u}{t_p} = \frac{c}{\left(\frac{L_p}{T_u}\right)} = \frac{\sqrt{\frac{4\pi \cdot m_u \cdot R_u \cdot \alpha}{\mu_0}}}{q_e} \approx 7.94\times 10^{60} \tag{22}$$

$$N^{1/3} = \frac{R_u}{r_e \cdot \beta^{1/2}} = \frac{q_e \cdot \alpha}{4\pi \cdot \varepsilon_0 \cdot G \cdot m_e^2 \cdot \beta} \approx 3.98\times 10^{40} \tag{23}$$

Apart from the factors α and β, the equation (23) gives also one of the large numbers given by Dirac which was around 2×10^{39}.

2.4. *N* as a Function of the Fine Structure Constant α

The following equation gives the large number *N* strictly as a function of the fine structure constant. Since this latest is known precisely, it allows us to know very precisely the value of the constant *N*. Moreover, it is the most precise method that we found [15] giving *N*. Here, we evaluate it thanks to the value of the fine structure constant α stated in the CODATA 2014 [3]:

$$N = \frac{1}{\alpha^{57}} \approx 6.303419702(84) \times 10^{121} \tag{24}$$

For now, **<u>this method does not come from any know laws</u>**. Thanks to our model of the universe, we have been able to found quite precisely the value of *N*. Precisely enough to notice that a numerical evaluation of *N* had a certain link with the fine structure constant like shown in the equation **(24)**. Furthermore, *N* is a unit-less number, like the fine structure constant α. For these reasons, as long as this method cannot be demonstrated from know equations or from a physics theory, **<u>we postulate that this equation is true</u>**.

2.5. *N* as a Function of Masses Ratios

Here are a few ratios equations given as a function of the apparent mass of the universe m_u , the Planck mass m_p and the mass m_{ph} associated to the photon of wavelength $2\pi \cdot R_u$ which all give the value of *N*:

$$N = \frac{m_u}{m_{ph}} \tag{25}$$

$$N = \frac{m_u^2}{m_p^2} \tag{26}$$

$$N = \frac{m_p^2}{m_{ph}^2} \tag{27}$$

Here are some ratio equations given as a function of the mass of the electron m_e which all give the *N* value:

$$N = \frac{m_u}{m_e \cdot \alpha^{18} \cdot \beta^{1/2}} \tag{28}$$

$$N = \left(\frac{m_u^2}{m_e^2 \cdot \beta} \right)^{\frac{19}{26}} \tag{29}$$

$$N = \frac{m_u^2 \cdot \alpha^{21}}{m_e^2 \cdot \beta} \tag{30}$$

$$N = \frac{m_p^2}{m_e^2 \cdot \alpha^{36} \cdot \beta} \quad \textbf{(31)}$$

$$N = \left(\frac{m_p^2}{m_e^2 \cdot \beta} \right)^{\frac{57}{21}} \quad \textbf{(32)}$$

$$N = \frac{m_e^2 \cdot \beta}{m_{ph}^2 \cdot \alpha^{21}} \quad \textbf{(33)}$$

$$N = \left(\frac{m_e^2 \cdot \beta}{m_{ph}^2} \right)^{\frac{19}{12}} \quad \textbf{(34)}$$

$$N = \left(\frac{m_e \cdot \beta^{1/2}}{m_{ph} \cdot \alpha} \right)^3 \quad \textbf{(35)}$$

$$N = \left(\frac{m_u \cdot \alpha}{m_e \cdot \beta^{1/2}} \right)^{\frac{3}{2}} \quad \textbf{(36)}$$

2.6. *N* as a Function of Length Ratios

Here are ratios as a function of the apparent radius of curvature of the luminous universe R_u , the apparent radius of curvature of the material universe r_u and the Planck length L_p which give all the same value of N:

$$N = \frac{R_u^2}{L_p^2} \quad \textbf{(37)}$$

$$N = \frac{r_u^2}{L_p^2 \cdot \beta^2} \quad \textbf{(38)}$$

$$N = \frac{m_u \cdot R_u}{m_p \cdot L_p} \quad \textbf{(39)}$$

$$N = \frac{m_u \cdot r_u}{\beta \cdot m_p \cdot L_p} \quad \textbf{(40)}$$

$$N = \frac{m_u \cdot R_u \cdot \alpha}{m_e \cdot r_e} \quad \textbf{(41)}$$

$$N = \frac{R_u}{L_p \cdot t_p \cdot H_0} \quad \textbf{(42)}$$

Here are some ratios which imply the classical radius of the electron r_e and give the value of N:

$$N = \left(\frac{R_u \cdot \beta^{1/2}}{r_e} \right)^3 \quad \textbf{(43)}$$

$$N = \left(\frac{r_u}{r_e \cdot \beta^{1/2}} \right)^3 \quad \textbf{(44)}$$

$$N = \frac{r_e^6}{L_p^6 \cdot \beta^3} \quad \textbf{(45)}$$

$$N = \frac{r_e^3}{L_p^3 \cdot \beta^{3/2} \cdot \alpha^{57/2}} \quad \textbf{(46)}$$

2.7. *N* as a Function of the Apparent Age of the Universe T_u and the Planck Time t_p

Here are ratios as a function of the Plank time t_p and the apparent age of the universe T_u which all give N:

$$N = \frac{T_u^2}{t_p^2} \quad \textbf{(47)}$$

$$N = \frac{1}{t_p^2 \cdot H_0{}^2} \quad \textbf{(48)}$$

2.8. *N* as a Function of Ratios between the Electrical Force and the Gravitational Force

Let's consider the electrical force F_e between two elementary electrical charges q_e that are located at a distance equal to the classical radius of the electron r_e:

$$F_e = \frac{q_e^2}{4\pi \cdot \varepsilon_0 \cdot r_e^2} \quad \textbf{(49)}$$

Let's also consider the gravitational force F_g between two electron masses m_e that are located at a distance equal to the classical radius of the electron r_e:

$$F_g = \frac{-G \cdot m_e^2}{r_e^2} \quad \textbf{(50)}$$

Here are ratios between the electrical force F_e and the gravitational force F_g which all give the same value of N:

$$N = \left(\frac{F_e}{-F_g}\right) \cdot \frac{1}{\beta \cdot \alpha^{37}} \quad \textbf{(51)}$$

$$N = \left(\frac{q_e^2}{4\pi \cdot \varepsilon_0} \cdot \frac{1}{G \cdot m_e^2}\right) \cdot \frac{1}{\beta \cdot \alpha^{37}} \quad \textbf{(52)}$$

$$N = \left(\frac{F_e \cdot \alpha}{-F_g \cdot \beta}\right)^3 \quad \textbf{(53)}$$

$$N = \left(\frac{q_e^2}{4\pi \cdot \varepsilon_0} \cdot \frac{1}{G \cdot m_e^2} \cdot \frac{\alpha}{\beta} \right)^3 \tag{54}$$

$$N = \left[\left(\frac{F_e}{-F_g} \right) \cdot \frac{1}{\beta} \right]^{\frac{57}{20}} \tag{55}$$

$$N = \left[\left(\frac{q_e^2}{4\pi \cdot \varepsilon_0} \cdot \frac{1}{G \cdot m_e^2} \right) \cdot \frac{1}{\beta} \right]^{\frac{57}{20}} \tag{56}$$

2.9. *N* as a Function of Ratios between the Planck Temperature and the Temperature of the Cosmic Microwave Background (CMB)

Here are some ratios given as a function of the Planck temperature T_p and the temperature of the cosmic microwave background T which give N:

$$N = \frac{T_p^4}{T^4} \cdot \left(\frac{15 \cdot \alpha^2 \cdot \beta^4}{\pi^3} \right) \tag{57}$$

$$N = \left(\frac{\beta \cdot T_p}{T} \right)^3 \cdot \left(\frac{15}{\pi^3 \alpha^{17}} \right)^{3/4} \tag{58}$$

$$N = \left[\left(\frac{\beta \cdot T_p}{T} \right) \cdot \left(\frac{15}{\pi^3} \right)^{\frac{1}{4}} \right]^{\frac{228}{59}} \tag{59}$$

$$N = \left(\frac{m_u \cdot c^2}{T_p \cdot k_b} \right)^2 \tag{60}$$

2.10. *N* as a Function of the Ratio between Different Electrical Charges

Here are some ratios given as a function of the Planck charge q_p and the electrical charge of the electron q_e which give N:

$$N = \left(\frac{q_p}{q_e}\right)^{114} \quad \textbf{(61)}$$

$$N = \frac{-q_p}{q_e \cdot \alpha^{113/2}} \quad \textbf{(62)}$$

$$N = \frac{-q_p^3}{q_e^3 \cdot \alpha^{111/2}} \quad \textbf{(63)}$$

Here are some other ratios given as a function of the Planck charge q_p or other electrical charges which give N:

$$N = \frac{4\pi \cdot m_u \cdot R_u}{q_p^2 \cdot \mu_0} \quad \textbf{(64)}$$

$$N = \frac{4\pi \cdot m_u \cdot R_u \cdot \alpha}{q_e^2 \cdot \mu_0} \quad \textbf{(65)}$$

$$N = \frac{4\pi \cdot m_u \cdot r_e}{q_p^2 \cdot \mu_0 \cdot \alpha^{19} \cdot \beta^{1/2}} \quad \textbf{(66)}$$

$$N = \frac{4\pi \cdot m_u \cdot r_e}{q_e^2 \cdot \mu_0 \cdot \alpha^{18} \cdot \beta^{1/2}} \quad \textbf{(67)}$$

$$N = \frac{4\pi \cdot m_e \cdot R_u \cdot \beta^{1/2}}{q_p^2 \cdot \mu_0 \cdot \alpha^{39}} \quad \textbf{(68)}$$

$$N = \frac{4\pi \cdot m_e \cdot R_u \cdot \beta^{1/2}}{q_e^2 \cdot \mu_0 \cdot \alpha^{38}} \quad \textbf{(69)}$$

$$N = \frac{4\pi \cdot m_e \cdot R_u \cdot \beta^{1/2}}{q_p^2 \cdot \mu_0 \cdot \alpha^{39}} \quad \textbf{(70)}$$

$$N = \frac{4\pi \cdot m_e \cdot R_u \cdot \beta^{1/2}}{q_e^2 \cdot \mu_0 \cdot \alpha^{38}} \quad \textbf{(71)}$$

$$N = \frac{4\pi \cdot m_{ph} \cdot R_u}{q_e^2 \cdot \mu_0 \cdot \alpha^{56}} \quad \textbf{(72)}$$

2.11. *N* as a Function of Equations that Include the Rydberg constant *R∞*

Here are some equations given as a function of the Rydberg constant which give *N*:

$$N = \left(\frac{4\pi \cdot R_\infty \cdot R_u \cdot \beta^{1/2}}{\alpha^3}\right)^3 \quad \textbf{(73)}$$

$$N = \left(4\pi \cdot R_\infty \cdot R_u \cdot \beta^{1/2}\right)^{\frac{171}{48}} \quad \textbf{(74)}$$

$$N = \left(\frac{4\pi \cdot R_\infty \cdot r_u}{\alpha^3 \cdot \beta^{1/2}}\right)^3 \quad \textbf{(75)}$$

$$N = \left(\frac{4\pi \cdot R_\infty \cdot r_u}{\beta^{1/2}}\right)^{\frac{171}{48}} \quad \textbf{(76)}$$

$$N = \left(\frac{1}{4\pi \cdot R_\infty \cdot r_u} \cdot \sqrt{\frac{\beta}{\alpha^{51}}} \right)^6 \quad \textbf{(77)}$$

$$N = \left(\frac{1}{4\pi \cdot R_\infty \cdot r_e} \right)^6 \cdot \frac{1}{\alpha^{39}} \quad \textbf{(78)}$$

$$N = \left(\frac{\alpha^3}{4\pi \cdot R_\infty \cdot L_p \cdot \beta^{1/2}} \right)^6 \quad \textbf{(79)}$$

$$N = \left(\frac{1}{4\pi \cdot R_\infty \cdot L_p \cdot \beta^{1/2}} \right)^{\frac{114}{25}} \quad \textbf{(80)}$$

$$N = \left(\frac{1}{4\pi \cdot r_e \cdot R_\infty} \right)^{19} \quad \textbf{(81)}$$

$$N = \frac{4\pi \cdot c^4 \cdot R_\infty}{G \cdot H_0^2 \cdot m_e \cdot \alpha^2} \quad \textbf{(82)}$$

$$N = \left(\frac{m_e \cdot c}{2 \cdot h \cdot R_\infty} \right)^{\frac{57}{2}} \quad \textbf{(83)}$$

$$N = \frac{2h \cdot R_\infty}{m_e \cdot c \cdot \alpha^{59}} \quad \textbf{(84)}$$

2.12. *N* as a Function of Equations Including the Plank Constant *h*

Here are some equations given as a function of the Plank constant which all give N:

$$N = \frac{2\pi \cdot R_u \cdot m_u \cdot c}{h} \tag{85}$$

$$N = \frac{2\pi \cdot R_u \cdot m_p \cdot c}{h \cdot \alpha^{57/2}} \tag{86}$$

$$N = \frac{2\pi \cdot R_u \cdot m_e \cdot c \cdot \beta^{1/2}}{h \cdot \alpha^{39}} \tag{87}$$

$$N = \frac{2\pi \cdot r_u \cdot m_u \cdot c}{h \cdot \beta} \tag{88}$$

$$N = \frac{2\pi \cdot r_u \cdot m_p \cdot c}{h \cdot \beta \cdot \alpha^{57/2}} \tag{89}$$

$$N = \frac{2\pi \cdot r_u \cdot m_e \cdot c}{h \cdot \beta^{1/2} \cdot \alpha^{39}} \tag{90}$$

$$N = \frac{2\pi \cdot L_p \cdot m_u \cdot c}{h \cdot \alpha^{57/2}} \tag{91}$$

$$N = \frac{2\pi \cdot L_p \cdot m_e \cdot c}{h} \cdot \sqrt{\frac{\beta}{\alpha^{135}}} \tag{92}$$

$$N = \frac{2\pi \cdot L_p \cdot m_{ph} \cdot c}{h \cdot \alpha^{171/2}} \tag{93}$$

$$N = \frac{h}{2\pi \cdot R_u \cdot m_u \cdot c \cdot \alpha^{114}} \tag{94}$$

$$N = \frac{h \cdot \beta}{2\pi \cdot r_u \cdot m_u \cdot c \cdot \alpha^{114}} \tag{95}$$

$$N = \frac{h \cdot \beta^{1/2}}{2\pi \cdot r_e \cdot m_u \cdot c \cdot \alpha^{95}} \tag{96}$$

$$N = \frac{h}{2\pi \cdot L_p \cdot m_u \cdot c \cdot \alpha^{171/2}} \tag{97}$$

$$N = \frac{h}{2\pi \cdot R_u \cdot m_p \cdot c \cdot \alpha^{171/2}} \tag{98}$$

$$N = \frac{h \cdot \beta}{2\pi \cdot r_u \cdot m_p \cdot c \cdot \alpha^{171/2}} \tag{99}$$

$$N = \frac{h \cdot \beta^{1/2}}{2\pi \cdot r_e \cdot m_p \cdot c \cdot \alpha^{133/2}} \tag{100}$$

$$N = \frac{h}{2\pi \cdot R_u \cdot m_e \cdot c \cdot \alpha^{75} \cdot \beta^{1/2}} \tag{101}$$

$$N = \frac{h \cdot \beta^{1/2}}{2\pi \cdot r_u \cdot m_e \cdot c \cdot \alpha^{75}} \tag{102}$$

$$N = \frac{h}{2\pi \cdot r_e \cdot m_e \cdot c \cdot \alpha^{56}} \tag{103}$$

$$N = \frac{2\pi \cdot r_e \cdot m_e \cdot c}{h \cdot \alpha^{58}} \tag{104}$$

$$N = \frac{h}{2\pi \cdot L_p \cdot m_e \cdot c \cdot \alpha^{93/2} \cdot \beta^{1/2}} \tag{105}$$

$$N = \frac{h \cdot \beta^{1/2}}{2\pi \cdot r_e \cdot m_{ph} \cdot c \cdot \alpha^{38}} \tag{106}$$

$$N = \frac{h}{2\pi \cdot L_p \cdot m_{ph} \cdot c \cdot \alpha^{57/2}} \tag{107}$$

$$N = \left(\frac{2\pi \cdot R_u \cdot k_b \cdot T_p}{h \cdot c} \right)^2 \tag{108}$$

$$N = \left(\frac{2\pi \cdot r_u \cdot k_b \cdot T_p}{h \cdot c \cdot \beta} \right)^2 \tag{109}$$

$$N = \left(\frac{2\pi \cdot r_e \cdot k_b \cdot T_p}{h \cdot c \cdot \alpha^{19} \cdot \beta^{1/2}} \right)^2 \tag{110}$$

$$N = \left(\frac{2\pi \cdot r_e \cdot k_b \cdot T_p}{h \cdot c \cdot \beta^{1/2}} \right)^6 \tag{111}$$

$$N = \left(\frac{2\pi \cdot L_p \cdot k_b \cdot T_p}{h \cdot c \cdot \alpha^{57/2}} \right)^2 \tag{112}$$

$$N = \left[\left(\frac{\beta}{T \cdot k_b} \right) \cdot \left(\frac{h \cdot c^5}{2\pi \cdot G} \right)^{\frac{1}{2}} \cdot \left(\frac{15}{\pi^3 \cdot \alpha^{17}} \right)^{\frac{1}{4}} \right]^3 \tag{113}$$

$$N = \left[\left(\frac{\beta}{T \cdot k_b} \right) \cdot \left(\frac{h \cdot c^5}{2\pi \cdot G} \right)^{\frac{1}{2}} \cdot \left(\frac{15}{\pi^3} \right)^{\frac{1}{4}} \right]^{\frac{684}{77}} \tag{114}$$

2.13. *N* as a Function of the Universal Gravitational Constant *G*

Here are some equations given as a function of the universal gravitational constant G which give N:

$$N = \left(\frac{R_u^3 \cdot H_0^2}{m_p \cdot G} \right)^2 \tag{115}$$

$$N = \left(\frac{r_u^3 \cdot H_0^2}{m_p \cdot G \cdot \beta^3} \right)^2 \tag{116}$$

$$N = \left(\frac{m_p \cdot G \cdot \beta^{3/2}}{r_e^3 \cdot H_0^2} \right)^2 \tag{117}$$

$$N = \frac{m_u \cdot G \cdot \beta^{3/2}}{r_e^3 \cdot H_0^2} \tag{118}$$

$$N = \frac{m_u \cdot G \cdot \alpha^{57/2}}{L_p^3 \cdot H_0^2} \tag{119}$$

$$N = \left(\frac{m_u \cdot G}{L_p^3 \cdot H_0^2} \right)^{2/3} \tag{120}$$

$$N = \frac{m_e \cdot G \cdot \beta^2}{r_e^3 \cdot H_0^2 \cdot \alpha^{39}} \tag{121}$$

$$N = \frac{m_e \cdot G}{L_p^3 \cdot H_0^2} \cdot \sqrt{\frac{\beta}{\alpha^{21}}} \tag{122}$$

$$N = \left[\beta \cdot \left(\frac{m_e \cdot G}{L_p^3 \cdot H_0^2}\right)^2\right]^{19/31} \tag{123}$$

$$N = \frac{m_p \cdot G}{r_e^3 \cdot H_0^2} \cdot \sqrt{\frac{\beta^3}{\alpha^{57}}} \tag{124}$$

$$N = \beta^3 \cdot \left(\frac{m_p \cdot G}{r_e^3 \cdot H_0^2}\right)^2 \tag{125}$$

$$N = \frac{m_p \cdot G}{L_p^3 \cdot H_0^2} \tag{126}$$

$$N = \left(\frac{4\pi \cdot R_\infty \cdot \beta^{1/2}}{\alpha^3}\right)^3 \frac{m_u \cdot G}{H_0^2} \tag{127}$$

$$N = \left(\frac{4\pi \cdot R_\infty}{\alpha^{16}}\right)^3 \frac{m_e \cdot G \cdot \beta^2}{H_0^2} \tag{128}$$

$$N = \left(4\pi \cdot R_\infty \sqrt{\frac{\beta}{\alpha^{25}}}\right)^3 \frac{m_p \cdot G}{H_0^2} \tag{129}$$

$$N = \frac{2\pi \cdot c^5}{h \cdot G \cdot H_0^2} \tag{130}$$

$$N = \left(\frac{G \cdot t_p \cdot m_p}{L_p^3 \cdot H_0}\right)^2 \tag{131}$$

2.14. *N* as a Function of the Speed of Light *c*

Here are some equations given as a function of the speed of light *c* that give *N*:

$$N = \left(\frac{R_u}{t_p \cdot c} \right)^2 \tag{132}$$

$$N = \left(\frac{r_u}{t_p \cdot c \cdot \beta} \right)^2 \tag{133}$$

$$N = \frac{1}{\beta \cdot \alpha^{38}} \cdot \left(\frac{r_e}{t_p \cdot c} \right)^2 \tag{134}$$

$$N = \frac{1}{\beta^3} \cdot \left(\frac{r_e}{t_p \cdot c} \right)^6 \tag{135}$$

$$N = \left(\frac{4\pi \cdot R_\infty \cdot c \cdot \beta^{1/2}}{H_0} \right)^{\frac{57}{16}} \tag{136}$$

$$N = \left(\frac{4\pi \cdot t_p \cdot R_\infty \cdot c \cdot \beta^{1/2}}{\alpha^{63/2}} \right)^3 \tag{137}$$

$$N = \left(\frac{1}{4\pi \cdot t_p \cdot R_\infty \cdot c \cdot \beta^{1/2}} \right)^{\frac{114}{25}} \tag{138}$$

2.15. *N* as a Function of the Beckenstein-Hawking Temperature T_B and of the Hagedorn Temperature T_H

Following a few Beckenstein works, Stephan Hawking found, in 1974, like ideal black bodies, black holes emit a radiation which causes the evaporation of these over time. He discovered a theoretical link ($T_B(m)$ function) that allowed to calculate the surface temperature T_B (at the horizon) of black holes as a function of their mass m.

$$T_B(m) = \frac{h \cdot c^3}{16 \cdot \pi^2 \cdot k_b \cdot G \cdot m} \tag{139}$$

Here is the Hagedorn temperature T_H as a function of the mass m:

$$T_H(m) = \frac{m \cdot c^2}{k_b} \tag{140}$$

It is possible, among others, to find this equation in the different Sidharth's works [2].

The following links have already been shown in a document that we made in 2013 [20]. We remind that despite the equality of certain equations, certain equalities are purely mathematical since in facts, the value of certain temperatures would surpass the Plank temperature T_p, which is physically impossible. For example, the following combinations are impossible: $T_H(m_u)$, $T_B(m_{ph})$, $T_H(m_e)$.

So, taking into account the care notice, here are the different equations:

$$N = \frac{8 \cdot \pi \cdot T_B(m_{ph})}{T_H(m_{ph})} \tag{141}$$

$$N = \frac{T_H(m_u)}{8 \cdot \pi \cdot T_B(m_u)} \tag{142}$$

$$N = \left(\frac{T_B(m_{ph})}{T_B(m_p)}\right) \tag{143}$$

$$N\left(\frac{T_B(m_p)}{T_B(m_u)}\right)^2 \tag{144}$$

$$N = \left(\frac{T_H(m_p)}{T_H(m_{ph})} \right)^2 \tag{145}$$

$$N = \left(\frac{T_H(m_u)}{T_H(m_p)} \right)^2 \tag{146}$$

$$N = \left(\frac{8 \cdot \pi \cdot T_B(m_{ph})}{T_H(m_p)} \right)^2 \tag{147}$$

$$N = \left(\frac{8 \cdot \pi \cdot T_B(m_p)}{T_H(m_{ph})} \right)^2 \tag{148}$$

$$N = \left(\frac{T_H(m_p)}{8 \cdot \pi \cdot T_B(m_u)} \right)^2 \tag{149}$$

$$N = \left(\frac{T_H(m_u)}{8 \cdot \pi \cdot T_B(m_p)} \right)^2 \tag{150}$$

$$N = \left(\frac{T_H(m_u)}{T_H(m_{ph})} \right) \tag{151}$$

$$N = \left(\frac{T_B(m_{ph})}{T_B(m_u)} \right) \tag{152}$$

$$N = \left(\frac{\beta^{1/2} \cdot T_H(m_u)}{8 \cdot \pi \cdot \alpha \cdot T_B(m_e)} \right)^3 \tag{153}$$

$$N = \left(\frac{\beta^{1/2} \cdot T_H(m_e)}{8 \cdot \pi \cdot \alpha \cdot T_B(m_u)} \right)^3 \tag{154}$$

(155)

$$N = \left(\frac{8 \cdot \pi \cdot \alpha^2 \cdot T_B(m_e)}{\beta \cdot T_H(m_e)} \right)^3$$

(156)

$$N = \frac{\alpha^2 \cdot T_B^2(m_e)}{\beta \cdot T_B^2(m_p)}$$

(157)

$$N = \frac{\alpha^2 \cdot T_H^2(m_p)}{\beta \cdot T_H^2(m_e)}$$

(158)

$$N = \left(\frac{8 \cdot \pi \cdot \alpha \cdot T_B(m_e)}{\beta^{1/2} \cdot T_H(m_{ph})} \right)^{3/2}$$

(159)

$$N = \left(\frac{8 \cdot \pi \cdot \alpha \cdot T_B(m_{ph})}{\beta^{1/2} \cdot T_H(m_e)} \right)^{3/2}$$

2.16. Trivial Ways to Obtain *N*

Certain equations are trivial since without their $1/\alpha^{57}$ factor which gives the value of *N*, these equations would give a unit-less unitary value. For example:

(160)

$$N = \frac{q_e^2 \cdot \mu_0}{4\pi \cdot r_e \cdot m_e \cdot \alpha^{57}}$$

(161)

$$N = \frac{4\pi \cdot m_{ph} \cdot R_u}{q_p^2 \cdot \mu_0 \cdot \alpha^{57}}$$

(162)

$$N = \frac{2\pi \cdot R_u \cdot m_{ph} \cdot c}{h \cdot \alpha^{57}}$$

$$N = \frac{2\pi \cdot r_u \cdot m_{ph} \cdot c}{h \cdot \beta \cdot \alpha^{57}} \quad \textbf{(163)}$$

$$N = \frac{2\pi \cdot L_p \cdot m_p \cdot c}{h \cdot \alpha^{57}} \quad \textbf{(164)}$$

$$N = \frac{h}{2\pi \cdot L_p \cdot m_p \cdot c \cdot \alpha^{57}} \quad \textbf{(165)}$$

$$N = \frac{h}{2\pi \cdot R_u \cdot m_{ph} \cdot c \cdot \alpha^{57}} \quad \textbf{(166)}$$

$$N = \frac{h \cdot \beta}{2\pi \cdot r_u \cdot m_{ph} \cdot c \cdot \alpha^{57}} \quad \textbf{(167)}$$

$$N = \left(\frac{h}{2\pi \cdot r_e \cdot m_e \cdot c} \right)^{57} \quad \textbf{(168)}$$

$$N = \frac{m_u \cdot G}{R_u^3 \cdot H_0^2 \cdot \alpha^{57}} \quad \textbf{(169)}$$

$$N = \frac{m_u \cdot G \cdot \beta^3}{r_u^3 \cdot H_0^2 \cdot \alpha^{57}} \quad \textbf{(170)}$$

$$N = \frac{1}{\alpha^{57}} \cdot \left(\frac{L_p}{t_p \cdot c} \right)^2 \quad \textbf{(171)}$$

$$N = \frac{\left(\dfrac{4\pi \cdot m_p \cdot L_p \cdot \alpha}{\mu_0} \right)^{1/2}}{q_e \cdot \alpha^{57}} \quad \textbf{(172)}$$

3. CONCLUSION

Following this enumeration, which is clearly incomplete, of the equations that lead to the large number *N*, we see that it looks like if there are tight links between physics constants that we know. We could think that it is the same for all physics constants which have measurement units. All what we have to do is to find two numbers that have the same measurement units so that one divided by the other, the units are being null out. Then, we have to multiply the result by a given power of the fine structure constant α and of our constant β.

Like we mentioned previously, the equation **(24)** does not come from any known law of physics and we have been obliged to make a postulate on which we base all the equations that we enumerated which lead to the large number *N*. We hope, one day, to find out the tight link existing between the large number *N* and the fine structure constant α. We think that the fine structure constant is maybe linked to relativistic effects of repeated rotations. Indeed, its understanding may reveal the inner matter structure of the universe in its whole.

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