SOME NUMERICAL CURIOSITIES ABOUT THE UNIVERSE

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Abstract .

We try briefly the relationship between numbers and some aspects of physical reality . By means of a simple set of mathematical and physical tools what we wanted to find was dimensionless numbers that could fit with a particular symmetry . In this paper we describe a small sheaf of numerical results .

Keywords . Universe , numerology .

Introduction.

In his book ''Philosophy of Physics '' Mario Bunge states that every physical hypothesis is supposed to be mathematisable .But mathematical form alone won't tell us anything about the physical meaning of the formula .By itself mathematical theories are neutral with respect to any hypotheses about the actual world [1].

Numerology can be defined as the juggling with dimensionless constants with a view to producing significant relations . Number games can ocassionally lead to insights and even spark a theory proper [1].

Also it's known that P.A.Dirac , inspired by Eddington , Milne and others suggested a reconsideration of Cosmology based on the large dimensionless numbers that can be constructed from the fundamental constants of nature . Namely ,that all very large numbers occurring in nature are interconnected [2].

Besides , there is the issue of reality's stuff : is it continuous or discrete ? could imagine an Universe whose fabric is made of space-time *atoms*?[3].

Method .

We'll analyze some physical constants using a simple tool-kit of mathematical and physical concepts described below .

I . Symmetry (ng + mj) , where **n** , **m** are natural numbers . and the ratio $\frac{g}{j} = \sqrt{2}$

II.Series S… = (1+2+16+32) including series having the same symmetry

III.As for the subject of the **discreteness** of space-time , we'll apply Avogadro's number

$N_A = 6.02214\ x\ 10^{23}$ [4]

IV.An item called '**sit'** , associated with the topic III , representing a space-time size , arbitrarily very little .

Define sit = $\frac{1}{10^n}$

(By the way you can obtain a good approximation to the number π using properly topics I and II , as we described in a paper time ago) .

Some selected results .

Without further delay we will describe some examples of the matter at hand.

<u>1.A light beam travels three spatial axes for a specified period of time, the resulting spatial volume is equal to the volume of a particular Torus .</u>

Volume of a Torus :

V = $2\pi^2\ R\ r^2$ [5]

Suppose :

R = N_{AL} = 6.02214 x 10^{23} m

r = $\frac{1}{4}$ R

N_{AL} refers to length dimension associated to Avogadro's number .

Therefore the volume of this particular Torus is defined as follow

$$\Theta_3 = 2\pi^2 \,(N_{AL}) \left(\frac{1}{4}\, N_{AL}\right)^2 \quad (1.1)$$

The distance light travels in one second in vacuum :

$C_L = 29979245$ m

Three spatial axes light will travel :

C_{La} , C_{Lb} , C_{Lc}

Duration of travel in each of the axes : **a** = 10^{17} s , **b** = 10^{17} s , **c** = 10^{12} s .

It's worth to say that according to the most recent data from the cosmic microwave background (CMB) , the age of the universe is around 10^{17} seconds [6]

Consequently :

C_{La} = C_L 10^{17} m

C_{Lb} = C_L 10^{17} m

C_{Lc} = C_L 10^{12} m

Therefore polyhedron's volume :

$$C_3 = (C_{La}\, C_{Lb}\, C_{Lc})\ m^3$$

A simple arithmetic operation shows that :

$$\boldsymbol{\Theta_3} = \boldsymbol{C_3} \qquad (1.2)$$

2.Relationship among Θ_3 ,C_3 and Proton Compton wavelength $\lambda_{c,p}$.

Proton Compton wavelength $\lambda_{c,p}$ is equivalent to the wavelength of a photon whose energy is the same as the rest-mass energy of the particle.

The Compton wavelength of the proton is given by

$$\lambda_{c,p} = \frac{h}{m_p c}$$

Where h is the Planck's constant , m_p is the the proton's rest mass and c is the speed of light . Hence

$\lambda_{c,p} = 1.32141\ x\ 10^{-15}\ m$ [4]

Relationship between $\lambda_{c,p}$ and Avogadro's number reads

$$\lambda_{c,p} = \frac{10^{10}}{4\pi N_A}$$

Now , consider a sphere whose radius is equal to $\lambda_{c,p}$

$$S_{c,p} = \frac{4}{3}\,\pi\,\lambda_{c,p}^3$$

And a Torus volume in wich radii are well defined

$$\Theta_3 = 2\pi^2\,(N_{AL})\left(\frac{1}{4}N_{AL}\right)^2$$

Trying to abreviate symbols

$$\lambda_3 = 3\,S_{c,p}$$

Now will write the resulting formula

$$\Theta_3 = \frac{10^{30}}{(128)\lambda_3} \quad (2.1)$$

3.Black hole entropy

Starts with Bekensteing-Hawking equation describing the entropy of a black hole :

$$S = \frac{1}{4}\,\frac{A\,C^3}{G\,\hbar} \quad [7]$$

Write the values of the physical constants involved [4]

C = 299792458 $\frac{m}{s}$

$G = 6.6735$ x $10^{-11}\ \frac{m^3}{Kg\,s^2}$

$\hbar$ = 1.054572 x 10^{-34} J s

Write the surface's area of a torus

A = $4\pi^2\,Rr$ [5]

Define a certain dimension of length associated to Avogadro's constant

sit = $\frac{1}{10^{35}}$ m , wich is equivalent to the Planck scale .

Assigned to the larger radius of the torus the value

$R = \; N_{A0}$ sit

N_{A0} refers to an Avogadro's number 'collapsed'.(This is intended to symbolize the collapse of a huge star into a black hole)

$N_{A0} = 6.02214 \text{ x } 10^0$

As for the smallest radius

r = $\frac{1}{4}\,R$

Now write the area of this particular torus

$\Theta_2 = 4\,\pi^2(N_{A0}sit)\left(\frac{1}{4}\,N_{A0}sit\right)$ (3.1)

Summarize the formula for entropy

$S_{\Theta_2} = \frac{\Theta_2 C^3}{G\,\hbar}$

Symbol Θ_2 (greek capital letter theta with subscript 2) stands for torus surface as was described above . We found

$S_{\Theta_2} = \frac{1}{\alpha}$

wich in other way reads

$S_{\Theta_2}\alpha = 1$ (3.2)

α is the fine-structure constant , dimensionless value associated to electromagnetic interaction , equal to 0.007297353 (at zero energy)[4]

4.Einstein constant .

Einstein constant denoted **k** (kappa) is a coupling constant that appears in his field equation , whose value is

K = $\frac{8\pi G}{C^4}$

Write the volume of a torus in wich set values of the radii explicitly

$$\Theta_3 = 2\pi^2(N_A)\left(\frac{1}{4}N_A\right)^2$$

Will apply the atomic mass constant

$m_u = 1.66054\ x\ 10^{-27}$ kg

Consider a system whose mass is

$m_{uv} = \frac{1}{2}\ m_u$ x 10^{79}

and whose acceleration is equal to

a = 1.00026 x $\left(\frac{1}{8}\right)^2\ \frac{m}{s^2}$

Therefore the system acquires a force

$F_{uv} = m_{uv}$ a

It's known that Einstein constant units are given by

K = 2.0764 $x\ \frac{1}{10^{43}}\ \frac{s^2}{Kg\ m}$

Apply an arbitrary value to the fourth method's topic

sit = $\frac{1}{10^{32}}$ → $\left(\frac{1}{s^2}\right)\left(\frac{1}{10^{32}}\right)^2$

Now , will arrange all the concepts in the following formula

$$\Theta_3 = F_{uv}K\ (10^{32})^2 \qquad (4.1)$$

5.The evolution of the torus Θ_3 .

Start looking back on the topics I and II . Assign specific values to each

A = $\left(1+\sqrt{2}\,\right)$

$B = \left(2+\sqrt{2}\,\right)$

S… = $1+\frac{1}{2}+\frac{1}{16}+\frac{1}{32}$

Will include two concepts more :

Euler's number **e** = 2.7182818…

And Neutron- Proton mass ratio $\frac{N}{P}$

Obtaining the following equation of evolution

$$A\,B(S\,\ldots)^2\,\frac{N}{P}\;e^{44}\;10^{(32+16+2+1)} = \Theta_3 \quad (5.1)$$

Resulting volume Θ_3 such as was defined in the equation (1.1)

Now , it is easy to see that

$$AB(S\,\ldots)^2 = \Theta_{03}$$

This new volume Θ_{03} is defined as follow

$$\Theta_{03} = 2\pi^2\left(\frac{3}{2}\sqrt{2}\,\right)\left(\frac{1}{\sqrt{2}}\right)^2$$

Therefore the evolution from the Torus Θ_{03} to the Torus Θ_3

$$\Theta_{03}\,\frac{N}{P}\;e^{44}\;10^{(32+16+2+1)} = \Theta_3 \quad (5.2)$$

6.vacuum expectation value of the Higgs field

The Higgs field has a nonzero expectation value

$HEV = 2.462\;x\;10^{11}\;eV$ [10]

The energy of a photon after Planck equation reads

E_v = h ν

where

h = 4.1356675 x $10^{-15}\ eV\ s$

Assign a specific frequency

ν = 64 π x $10^{22}\ \frac{1}{s}$

The resulting equation relates the volume of a particular Torus Θ_{33} with the Higs vacuum value and the energy in eV of a photon at a specific frequency mode of vibration

$$\Theta_{33} = \frac{HEV}{E_v} \quad (6.1)$$

Now it's interesting to see the following numerical equivalence

$$\Theta_{33} = \Theta_{03}\sqrt{2} \text{ x } 10^{22}$$

Therefore rearranging the equation for the evolution described above

$$\frac{\Theta_{33}}{\sqrt{2}}\frac{N}{P}\ e^{44}\ 10^{(29)} = \Theta_3 \quad (6.2)$$

Wich leads us to write the schematic sequence

$$\Theta_{03} \rightarrow \Theta_{33} \rightarrow \Theta_3 \quad (6.3)$$

7.Today energy density

To calculate the energy density of Cosmic microwave background (CMB) will Apply Stefan-Boltzmann law given by

$$\rho_{E0} = \frac{4\sigma T_0^4}{C} = 4.1778\ x\ 10^{-14}\ J\ m^{-3}$$

Where σ is the Stefan-Boltzmann constant = 5.6704 x $10^{-8} w\ m^{-2}\ K^{-4}$ [4]

C is the speed of light and T_0 is the temperature of the CMB = 2.726 K [8]

As for the CMB , the spectral radiance peaks at

$\nu_0 = 1.602 \; x \; 10^{11}$ Hz , in the microwave range of frequencies [8] .

Looking for a dimensionless number , write the following equation

$\rho_{E0} = \frac{h}{\Theta_3} \frac{e}{4^2}$ x 10^{92} (7.1)

h refers to Planck constant = 6.62607 x 10^{-34} J s [4]

The letter **e** refers to the Euler's number = 2.7182818…..

Torus volume :

$$\Theta_3 = 2\pi^2 \, (N_{AL}) \left(\frac{1}{4} N_{AL} \right)^2$$

The quantity 10^{92} could be written differently :

$(10^{23})^4$

We should also mention the equivalence between ν_0 and Euler's number

$1.602 \; x \; 10^{11}$ Hz $x \; 12\sqrt{2} \; = e \; 10^{12}$

Discussion

Since the aims of this papper is only to review some numerical approaches to the physical constants and the physical amounts that defines the universe and reality , nobody should have to wait a theory nor one set of predictions .

We found interesting review the numerical equivalence described by equation (1.1) because the accuracy of significant digits between the constants involved in both volumes . Still more when proton Compton wavelength fits numerically (2.1).

High numerical accuracy shows the matter of black hole entropy . Although we have chosen arbitrarily the type of Surface and the value of the 'sit' . As the values of speed of light and Planck constant are very accurate , we would have a more accurate value of G , the Newtonian constant of gravitation .

The above considerations are also valid for item 4 while recognizing greater freedom (arbitrariness) in the use of the ‘sit’ .

As for the items 5 and 6 , considering the assumptions or theories about cosmic inflation and related matters, we have seen curious the sequence (6.3) Of course always from a numerical point of view .

Finally under the heading 7 , we review two subjects . On one side is the number of photons in the Universe . Although it is still a speculative matter , estimations range around 10^{90} , hence we have seen interesting the value obtained in the equation (7.1) related to the Avogadros number i.e. $(10^{23})^4$, on the other hand it should be noted that Euler’s number come on the scene spontaneously while we operated with other values .

Conclusion

As for the numerology of Physics and Cosmology we have selected a Little set of subjects . In our view they show some numerical interest whether anyone could see in it some theoretical inspiration.

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