The mass scale law of the Universe

Stergios Pellis
sterpellis@gmail.com
ORCID iD: 0000-0002-7363-8254
Greece
31 August 2023

Abstract

In this paper we will present a new mass scale law of the universe. First from the Dimensionless unification of the fundamental interactions we will find the formulas for the Planck mass. It will be presented as an extended mass relation for fundamental masses. Also we will find the expressions for the minimum mass and the mass of the observable universe.

Keywords

Hubble constant , Dimensionless unification of the fundamental interactions , Fine-structure constant , Proton to electron mass ratio , Dimensionless physical constants , Coupling constant , Gravitational constant , Avogadro's number , Fundamental Interactions , Cosmological parameters , Cosmological constant , Poincaré dodecahedral space

1. Introduction

In theories of quantum gravity, the graviton is the hypothetical quantum of gravity, an elementary particle that mediates the force of gravitational interaction. There is no complete quantum field theory of gravitons due to an outstanding mathematical problem with renormalization in general relativity. It is hypothesized that gravitational interactions are mediated by an as yet undiscovered elementary particle, dubbed the graviton. The three other known forces of nature are mediated by elementary particles: electromagnetism by the photon, the strong interaction by gluons, and the weak interaction by the W and Z bosons. All three of these forces appear to be accurately described by the Standard Model of particle physics. In the classical limit, a successful theory of gravitons would reduce to general relativity, which itself reduces to Newton's law of gravitation in the weak-field limit. Gravitons do indeed have mass,and their motions generate kinetic energy. Thus,they have both energy and mass,and they obey the law of conservation of energy and matter.The great mystery of force at a distance is explained by the mass of gravitons. Gravitons flow on a massive scale among universe bubbles and the matter between. Given enough flowing gravitons in the spacetime foam,on a scale the human mind can hardly comprehend,there is apparent force at a distance, expressed as the bending of space.

Three independent calculations calculate the mass of the universe 1.46×10^{53} kg, 1.7×10^{53} kg and 1.20×10^{53} kg. In this context,mass refers to ordinary matter and includes the interstellar medium (ISM) and the intergalactic medium (IGM). However,it excludes dark matter and dark energy. This reported value for the mass of ordinary matter in the universe can be estimated on the basis of critical density infinite. So to estimate the mass value of the universe we will calculate the average of the three independent calculations that produce relatively close results. So the M_U mass of the observable universe is approximately $M_U \simeq 1.45 \times 10^{53}$ kg.

In [1] J.Forsythe and T. Valev found an extended mass relation for seven fundamental masses. Six of these masses are successfully identified as mass of the observable universe, Eddington mass limit of the most massive stars, mass of hypothetical quantum “Gravity Atom” whose gravitational potential is equal to electrostatic potential , Planck mass, Hubble mass and mass dimension constant relating masses of stable particles with coupling constants of fundamental interactions. The seventh mass is unidentified and could be considered as a prediction of the suggested mass relation for an unknown fundamental mass, potentially a yet unobserved light particle. First triad of these masses describes macro objects, the other three masses belong to particle physics masses, and the Planck mass appears intermediate in relation to these two groups.

2. Dimensionless unification of the fundamental interactions

In [2] we presented exact and approximate expressions between the Archimedes constant π,the golden ratio φ,the Euler's number e and the imaginary number i. New interpretation and very accurate values of the fine-structure constant has been discovered in terms of the Archimedes constant and the golden radio. We propose in [3] , [4] and [5] the exact formula for the fine-structure constant α with the golden angle,the relativity factor and the fifth power of the golden mean:

$$\alpha^{-1}=360\cdot\varphi^{-2}-2\cdot\varphi^{-3}+(3\cdot\varphi)^{-5}=137.035999164... \tag{1}$$

Also we propose in [5] , [6] and [7] a simple and accurate expression for the fine-structure constant α in terms of the Archimedes constant π:

$$\alpha^{-1}=2\cdot3\cdot11\cdot41\cdot43^{-1}\cdot\pi\cdot\ln2=137.035999078... \tag{2}$$

We propose in [8] the exact mathematical expressions for the proton to electron mass ratio μ:

$$7\cdot\mu^3=165^3\cdot\ln^{11}10 \Rightarrow \mu=1836.15267392... \tag{3}$$

Also was presented the exact mathematical expressions that connects the proton to electron mass ratio μ and the fine-structure constant α:

$$9\cdot\mu-119\cdot\alpha^{-1}=5\cdot(\varphi+42) \tag{4}$$

In [9] was presented the unity formula that connects the fine-structure constant and the proton to electron mass ratio. It was explained that $\mu\cdot\alpha^{-1}$ is one of the roots of the following trigonometric equation:

$$2\cdot10^2\cdot\cos(\mu\cdot\alpha^{-1})+13^2=0 \tag{5}$$

The exponential form of this equation is:

$$10^2\cdot(e^{i\mu/\alpha}+e^{-i\mu/\alpha})+13^2=0 \tag{6}$$

Also this unity formula can also be written in the form:

$$10\cdot(e^{i\mu/\alpha}+e^{-i\mu/\alpha})^{1/2}=13\cdot i \tag{7}$$

It was presented in [10] the mathematical formulas that connects the proton to electron mass ratio μ,the fine-structure constant α,the ratio N_1 of electric force to gravitational force between electron and proton,the Avogadro's number N_A,the gravitational coupling constant α_G of the electron and the gravitational coupling constant of the proton $\alpha_{G(p)}$:

$$4\cdot e^2\cdot\alpha^2\cdot\alpha_G\cdot N_A^2=1 \tag{8}$$

$$\mu^2=4\cdot e^2\cdot\alpha^2\cdot\alpha_{G(p)}\cdot N_A^2 \tag{9}$$

$$\mu\cdot N_1=4\cdot e^2\cdot\alpha^3\cdot N_A^2 \tag{10}$$

$$4\cdot e^2\cdot\alpha\cdot\mu\cdot\alpha_G^2\cdot N_A^2\cdot N_1=1 \tag{11}$$

$$\mu^3=4\cdot e^2\cdot\alpha\cdot\alpha_{G(p)}^2\cdot N_A^2\cdot N_1 \tag{12}$$

$$\mu^2=4\cdot e^2\cdot\alpha_G\cdot\alpha_{G(p)}^2\cdot N_A^2\cdot N_1^2 \tag{13}$$

$$\mu=4\cdot e^2\cdot\alpha\cdot\alpha_G\cdot\alpha_{G(p)}\cdot N_A^2\cdot N_1 \tag{14}$$

In [11] we presented the recommended value for the strong coupling constant:

$$\alpha_s = \frac{Euler' \, number}{Gerford's \, constant} = \frac{e}{e^{\pi}} = e^{1-\pi} = 0,11748.. \tag{15}$$

This value is the current world average value for the coupling evaluated at the Z-boson mass scale. In the papers [12] , [13] , [14] and [15] was presented the unification of the fundamental interactions. We found the unity formulas that connect the strong coupling constant α_s and the weak coupling constant α_w. We reached the conclusion of the dimensionless unification of the strong nuclear and the weak nuclear interactions:

$$e \cdot \alpha_s = 10^7 \cdot \alpha_w \tag{16}$$

$$\alpha_s^2 = i^{2i} \cdot 10^7 \cdot \alpha_w \tag{17}$$

We reached the conclusion of the dimensionless unification of the strong nuclear and the electromagnetic interactions:

$$e^{\pi} \cdot \alpha_s \cdot (e^{i/\alpha} + e^{-i/\alpha}) = 2 \tag{18}$$

$$\alpha_s \cdot (e^{i/\alpha} + e^{-i/\alpha}) = 2 \cdot i^{2i} \tag{19}$$

We reached the conclusion of the dimensionless unification of the weak nuclear and the electromagnetic forces:

$$10^7 \cdot \alpha_w \cdot (e^{i/\alpha} + e^{-i/\alpha}) = 2 \cdot e \cdot i^{2i} \tag{20}$$

Resulting the unity formulas that connects the strong coupling constant α_s,the weak coupling constant α_w and the fine-structure constant α:

$$10^7 \cdot \alpha_w \cdot \cos\alpha^{-1} = \alpha_s \tag{21}$$

We reached the conclusion of the dimensionless unification of the strong nuclear,the weak nuclear and the electromagnetic forces:

$$10^7 \cdot \alpha_w \cdot (e^{i/\alpha} + e^{-i/\alpha}) = 2 \cdot \alpha_s \tag{22}$$

Resulting the unity formula that connects the fine-structure constant α,the gravitational coupling constant α_G and the Avogadro's number N_A:

$$4 \cdot e^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = 1 \tag{23}$$

$$\alpha^{-2} \cdot \cos^2\alpha^{-1} = 4 \cdot \alpha_G \cdot N_A^2 \tag{24}$$

We reached the conclusion of the dimensionless unification of the gravitational and the electromagnetic forces:

$$4 \cdot e^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = 1 \tag{25}$$

$$16 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = (e^{i/\alpha} + e^{-i/\alpha})^2 \tag{26}$$

We reached the conclusion of the dimensionless unification of the strong nuclear,the gravitational and the electromagnetic interactions:

$$2 \cdot e^{\pi} \cdot \alpha_s \cdot \alpha \cdot \alpha_G^{1/2} \cdot N_A = 1 \tag{27}$$

$$4 \cdot \alpha_s^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = i^{4i} \tag{28}$$

$$\alpha^2 \cdot (e^{i/\alpha} + e^{-i/\alpha}) \cdot \alpha_s^4 \cdot \alpha_G \cdot N_A^2 = i^{8i} \tag{29}$$

We reached the conclusion of the dimensionless unification of the weak nuclear,the gravitational and electromagnetic forces:

$$4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha^2\cdot \alpha_G\cdot N_A^2=i^{4i}\cdot e^2 \quad (30)$$

$$10^{14}\cdot \alpha^2\cdot (e^{i/\alpha}+e^{-i/\alpha})^2\cdot \alpha_w^2\cdot \alpha_G\cdot N_A^2=i^{8i} \quad (31)$$

Resulting the unity formula that connect the strong coupling constant α_s,the weak coupling constant α_w,the fine-structure constant α and the gravitational coupling constant $\alpha_{G(p)}$ for the proton:

$$4\cdot 10^{14}\cdot N_A^2\cdot \alpha_w^2\cdot \alpha^2\cdot \alpha_{G(p)}=\mu^2\cdot \alpha_s^2 \quad (32)$$

We reached the conclusion of the dimensionless unification of the strong nuclear,the weak nuclear,the gravitational and the electromagnetic interactions:

$$\alpha_s^2=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha^2\cdot \alpha_G\cdot N_A^2 \quad (33)$$

$$8\cdot 10^7\cdot N_A^2\cdot \alpha_w\cdot \alpha^2\cdot \alpha_G=\alpha_s\cdot (e^{i/\alpha}+e^{-i/\alpha}) \quad (34)$$

From these expressions resulting the unity formulas that connects the strong coupling constant α_s,the weak coupling constant α_w,the proton to electron mass ratio μ,the fine-structure constant α,the ratio N_1 of electric force to gravitational force between electron and proton,the Avogadro's number N_A,the gravitational coupling constant α_G of the electron,the gravitational coupling constant of the proton $\alpha_{G(p)}$,the strong coupling constant α_s and the weak coupling constant α_w:

$$\alpha_s^2=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha^2\cdot \alpha_G\cdot N_A^2 \quad (35)$$

$$\mu^2\cdot \alpha_s^2=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha^2\cdot \alpha_{G(p)}\cdot N_A^2 \quad (36)$$

$$\mu\cdot N_1\cdot \alpha_s^2=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha^3\cdot N_A^2 \quad (37)$$

$$\alpha_s^2=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha\cdot \mu\cdot \alpha_G^2\cdot N_A^2\cdot N_1 \quad (38)$$

$$\mu^3\cdot \alpha_s^2=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha\cdot \alpha_{G(p)}^2\cdot N_A^2\cdot N_1 \quad (39)$$

$$\mu\cdot \alpha_s=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha_G\cdot {}_{G(p)}^2\cdot N_A^2\cdot N_1^2 \quad (40)$$

$$\mu\cdot \alpha_s^2=4\cdot 10^{14}\cdot \alpha_w^2\cdot \alpha\cdot \alpha_G\cdot \alpha_{G(p)}\cdot N_A^2\cdot N_1 \quad (41)$$

These equations are applicable for all energy scales. In [16] and [17] we found the expressions for the gravitational constant:

$$G=(2e\alpha N_A)^{-2}\frac{\hbar c}{m_e^2} \quad (42)$$

$$G=i^{4i}(2\alpha_s\alpha N_A)^{-2}\frac{\hbar c}{m_e^2} \quad (43)$$

$$G=i^{4i}e^2\left(2\,10^7\alpha_w\alpha N_A\right)^{-2}\frac{\hbar c}{m_e^2} \quad (44)$$

$$G=\alpha_s^2\left(2\,10^7\alpha_w\alpha N_A\right)^{-2}\frac{\hbar c}{m_e^2} \quad (45)$$

It presented the theoretical value of the Gravitational constant $G=6.67448\times 10^{-11}\ m^3/kg\cdot s^2$. This value is very close to the 2018 CODATA recommended value of gravitational constant and two experimental measurements from a research group announced new measurements based on torsion balances. They ended up measuring 6.674184×10^{-11} $m^3/kg\cdot s^2$ and 6.674484×10^{-11} $m^3/kg\cdot s^2$-of-swinging and angular acceleration methods, respectively.

3. Dimensionless unification of atomic physics and cosmology

In [18] and [19] resulting in the dimensionless unification of atomic physics and cosmology. The relevant constant in atomic physics is the fine-structure constant α,which plays a fundamental role in atomic physics and quantum electrodynamics. The analogous constant in cosmology is the gravitational fine-structure constant α_g. It plays a fundamental role in cosmology. The mysterious value of the gravitational fine-structure constant α_g is an equivalent way to express the biggest issue in theoretical physics. The mysterious value of the gravitational fine-structure constant α_g is an equivalent way to express the biggest issue in theoretical physics. The gravitational fine structure constant α_g is defined as:

$$\alpha_g = \frac{l_{pl}^3}{r_e^3} = \frac{\sqrt{\alpha_G^3}}{\alpha^3} = \sqrt{\frac{\alpha_G^3}{\alpha^6}} = 1.886837 \times 10^{-61} \tag{46}$$

The expression that connects the gravitational fine-structure constant α_g with the golden ratio φ and the Euler's number e is:

$$\alpha_g = \frac{4e}{3\sqrt{3}\varphi^5} \times 10^{-60} = 1,886837 \times 10^{-61} \tag{47}$$

Resulting the unity formula for the gravitational fine-structure constant α_g:

$$\alpha_g=(2 \cdot e \cdot \alpha^2 \cdot N_A)^{-3} \tag{48}$$

$$\alpha_g=i^{6i} \cdot (2 \cdot \alpha_s \cdot \alpha^2 \cdot N_A)^{-3} \tag{49}$$

$$\alpha_g=i^{6i} \cdot e^3 \cdot (2 \cdot 10^7 \cdot \alpha_w \cdot \alpha^3 \cdot N_A)^{-3} \tag{50}$$

$$\alpha_g=(10^7 \cdot \alpha_w \cdot \alpha_G^{1/2} \cdot e^{-1} \cdot \alpha_s^{-1} \cdot \alpha^{-1})^3 \tag{51}$$

$$\alpha_g^2=(10^{14} \cdot \alpha_w^2 \cdot \alpha_G \cdot e^{-2} \cdot \alpha_s^{-2} \cdot \alpha^{-2})^3 \tag{52}$$

$$\alpha_g=10^{21} \cdot i^{6i} \cdot \alpha_w^3 \cdot \alpha_G^{3/2} \cdot \alpha_s^{-6} \cdot \alpha^{-3} \tag{53}$$

So the unity formula for the gravitational fine-structure constant α_g is:

$$\alpha_g^2=10^{42} \cdot i^{12i} \cdot \alpha_w^6 \cdot \alpha_G^3 \cdot \alpha_s^{-12} \cdot \alpha^{-6} \tag{54}$$

The cosmological constant Λ is presumably an enigmatic form of matter or energy that acts in opposition to gravity and is considered by many physicists to be equivalent to dark energy. Nobody really knows what the cosmological constant is exactly,but it is required in cosmological equations in order to reconcile theory with our observations of the universe. Resulting the dimensionless unification of the atomic physics and the cosmology:

$$l_{pl}^2 \cdot \Lambda=(2 \cdot e \cdot \alpha^2 \cdot N_A)^{-6} \tag{55}$$

$$l_{pl}^2 \cdot \Lambda=i^{12i} \cdot (2 \cdot \alpha_s \cdot \alpha^2 \cdot N_A)^{-6} \tag{56}$$

$$l_{pl}^2 \cdot \Lambda=i^{12i} \cdot e^6 \cdot (2 \cdot 10^7 \cdot \alpha_w \cdot \alpha^3 \cdot N_A)^{-6} \tag{57}$$

$$e^6 \cdot \alpha_s^6 \cdot \alpha^6 \cdot l_{pl}^2 \cdot \Lambda=10^{42} \cdot \alpha_G^3 \cdot \alpha_w^6 \tag{58}$$

$$\alpha_s^{12} \cdot \alpha^6 \cdot l_{pl}^2 \cdot \Lambda=10^{42} \cdot i^{12i} \cdot \alpha_G^3 \cdot \alpha_w^6 \tag{59}$$

For the cosmological constant Λ equals:

$$\Lambda = \left(2e\alpha^2 N_A\right)^{-6} \frac{c^3}{G\hbar} \tag{60}$$

$$\Lambda = i^{12i}\left(2\alpha_s a^2 N_A\right)^{-6}\frac{c^3}{G\hbar} \tag{61}$$

$$\Lambda = i^{12i}e^{6}\left(2\,10^{7}\alpha_w a^3 N_A\right)^{-6}\frac{c^3}{G\hbar} \tag{62}$$

$$\Lambda = 10^{42}\left(\frac{\alpha_G\alpha_w^2}{e^2\alpha_s^2\alpha^2}\right)^3\frac{c^3}{G\hbar} \tag{63}$$

$$\Lambda = 10^{42}i^{12i}\left(\frac{\alpha_G\alpha_w^2}{\alpha^2\alpha_s^4}\right)^3\frac{c^3}{G\hbar} \tag{64}$$

In [20] we found the Equations of the Universe:

$$\frac{\Lambda G\hbar}{c^3} = 10^{42}i^{12i}\left(\frac{\alpha_G\alpha_w^2}{\alpha^2\alpha_s^4}\right)^3 \tag{65}$$

$$e^{6\pi}\frac{\Lambda G\hbar}{c^3} = 10^{42}\left(\frac{\alpha_G\alpha_w^2}{\alpha^2\alpha_s^4}\right)^3 \tag{66}$$

For the ratio of the dark energy density to the Planck energy density apply:

$$\frac{\rho_\Lambda}{\rho_{pl}} = \frac{2e^2\varphi^{-5}}{3^3\pi\varphi^5}\times 10^{-120} \tag{67}$$

In [21] , [22] and [23] we proved that the shape of the Universe is Poincaré dodecahedral space. The assessment of baryonic matter at the current time was assessed by WMAP to be $\Omega_B=0.044\pm0.004$. From the dimensionless unification of the fundamental interactions the density parameter for the normal baryonic matter is:

$$\Omega_B=e^{-\pi}=i^{2i}=0.0432=4.32\% \tag{68}$$

From Euler's identity for the density parameter of baryonic matter apply:

$$\Omega_B^{i}+1=0 \tag{69}$$

$$\Omega_B^{i}=i^2 \tag{70}$$

$$\Omega_B^{2i}=1 \tag{71}$$

From the dimensionless unification of the fundamental interactions for the density parameter for normal baryonic matter apply:

$$\Omega_B=e^{-1}\cdot\alpha_s \tag{72}$$

$$\Omega_B=\alpha_w^{-1}\cdot\alpha_s^2\cdot10^{-7} \tag{73}$$

$$\Omega_B=2^{-1}\cdot\alpha_s\cdot(e^{i/\alpha}+e^{-i/\alpha}) \tag{74}$$

$$\Omega_B=2\cdot N_A\cdot\alpha_s\cdot\alpha\cdot\alpha_G^{1/2} \tag{75}$$

$$\Omega_B=2^{-1}\cdot e^{-1}\cdot 10^7\cdot a_w\cdot(e^{i/a}+e^{-i/a}) \tag{76}$$

$$\Omega_B=2\cdot 10^7\cdot N_A\cdot e^{-1}\cdot a_w\cdot a\cdot a_G^{1/2} \tag{77}$$

$$\Omega_B=10^{-7}\cdot a_g^{1/3}\cdot a_s^2\cdot a\cdot a_w^{-1}\cdot a_G^{-1/2} \tag{78}$$

In [24] we presented the solution for the Density Parameter of Dark Energy. From the dimensionless unification of the fundamental interactions the density parameter for dark energy is:

$$\Omega_\Lambda=2\cdot e^{-1}=0.73576=73.57\% \tag{79}$$

So apply:

$$2\cdot R_d^2=e\cdot L_H^2 \tag{80}$$

Also from the dimensionless unification of the fundamental interactions the density parameter for dark energy is:

$$\Omega_\Lambda=2\cdot \cos a^{-1} \tag{81}$$

So the beautiful equation for the density parameter for dark energy is:

$$\Omega_\Lambda=e^{i/a}+e^{-i/a} \tag{82}$$

So apply the expression:

$$\cos a^{-1}=\frac{L_H^2}{2R_d^2} \tag{83}$$

From the dimensionless unification of the fundamental interactions for the density parameter of dark energy apply:

$$\Omega_\Lambda=2\cdot i^{2i}\cdot a_s^{-1} \tag{84}$$

$$\Omega_\Lambda=2\cdot 10^{-7}a_s\cdot a_w^{-1} \tag{85}$$

$$\Omega_\Lambda=2\cdot e\cdot 10^{-7}\cdot i^{2i}\cdot a_w^{-1} \tag{86}$$

$$\Omega_\Lambda=2\cdot 10^{-7}\cdot a_s\cdot a_w^{-1} \tag{87}$$

$$\Omega_\Lambda=4\cdot a\cdot a_G^{1/2}\cdot N_A \tag{88}$$

$$\Omega_\Lambda=i^{8i}\cdot a^{-2}\cdot a_s^{-4}\cdot a_G^{-1}\cdot N_A^{-2} \tag{89}$$

$$\Omega_\Lambda=10^7\cdot i^{4i}\cdot a^{-1}\cdot a_w^{-1}\cdot a_G^{-1/2}\cdot N_A^{-1} \tag{90}$$

$$\Omega_\Lambda=8\cdot 10^7\cdot N_A^2\cdot a_w\cdot a^2\cdot a_G\cdot a_s^{-1} \tag{91}$$

Current observations suggest that we live in a dark energy dominated Universe with density parameters for dark matter $\Omega_D=0.23$. From the dimensionless unification of the fundamental interactions the density parameter for dark matter is:

$$\Omega_D=2\cdot e^{1-\pi}=2\cdot e\cdot i^{2i}=0.2349=23.49\% \tag{92}$$

From the dimensionless unification of the fundamental interactions for the density parameter for normal baryonic matter apply:

$$\Omega_D=2\cdot a_s \tag{93}$$

$$\Omega_D=2\cdot 10^7\cdot e^{-1}\cdot a_w \tag{94}$$

$$\Omega_D=2\cdot(i^{2i}\cdot 10^7\cdot \alpha_w)^{1/2} \tag{95}$$

$$\Omega_D=4\cdot i^{2i}\cdot(e^{i/\alpha}+e^{-i/\alpha})^{-1} \tag{96}$$

$$\Omega_D=10^7\cdot \alpha_w\cdot(e^{i/\alpha}+e^{-i/\alpha}) \tag{97}$$

$$\Omega_D=4\cdot 10^7\cdot \alpha_w\cdot \alpha\cdot \alpha_G^{1/2}\cdot N_A \tag{98}$$

$$\Omega_D=16\cdot 10^7\cdot N_A^2\cdot \alpha_w\cdot \alpha^2\cdot \alpha_G\cdot(e^{i/\alpha}+e^{-i/\alpha})^{-1} \tag{99}$$

The relationship between the density parameter of dark matter and baryonic matter is:

$$\Omega_D=2\cdot e\cdot \Omega_B \tag{100}$$

The relationship between the density parameter of dark energy,dark matter and baryonic matter is:

$$\Omega_D\cdot \Omega_\Lambda=4\cdot \Omega_B \tag{101}$$

From the dimensionless unification of the fundamental interactions the sum of the contributions to the total density parameter Ω_0 at the current time is:

$$\Omega_0=\Omega_B+\Omega_D+\Omega_\Lambda=e^{-\pi}+2\cdot e^{1-\pi}+2\cdot e^{-1}=1.0139 \tag{102}$$

In [25] we proposed a possible solution for the Equation of state in cosmology. From the dimensionless unification of the fundamental interactions the state equation w has value:

$$w=-24\cdot e^{-\pi}=-24\cdot i^{2i}=-1.037134 \tag{103}$$

In [26] , [27] and [28] we presented the law of the gravitational fine-structure constant α_g followed by ratios of maximum and minimum theoretical values for natural quantities.This theory uses quantum mechanics, cosmology, thermodynamics, and special and general relativity. Length l,time t,speed υ and temperature T have the same min/max ratio which is:

$$\alpha_g=\frac{l_{min}}{l_{\max}}=\frac{t_{min}}{t_{\max}}=\frac{\upsilon_{min}}{\upsilon_{\max}}=\frac{\mathrm{T}_{min}}{\mathrm{T}_{max}} \tag{104}$$

Energy E, mass M, action A,momentum P and entropy S have another min/max ratio,which is the square of α_g:

$$\alpha_g^2=\frac{\mathrm{E}_{min}}{\mathrm{E}_{\max}}=\frac{\mathrm{M}_{min}}{\mathrm{M}_{\max}}=\frac{\mathrm{A}_{min}}{\mathrm{A}_{\max}}=\frac{\mathrm{P}_{min}}{\mathrm{P}_{\max}}=\frac{S_{min}}{S_{max}} \tag{105}$$

Force F has min/max ratio which is α_g^4:

$$\alpha_g^4=\frac{F_{min}}{F_{max}} \tag{106}$$

Mass density has min/max ratio which is α_g^5:

$$\alpha_g^5=\frac{\rho_{min}}{\rho_{max}} \tag{107}$$

Length l has the max/min ratio which is:

$$\alpha_g=\frac{l_{min}}{l_{max}} \tag{108}$$

The maximum distance l_{max} corresponds to the distance of the universe $l_{max}==\alpha_g^{-1}\cdot l_{min}=4.657\times10^{26}$ m. In [29] , [30] and [31] we presented the Dimensionless theory of everything. In [32] we presented the New Large Number Hypothesis of the universe. The diameter of the observable universe will be calculated to be equal to the product of the ratio of electric force to gravitational force between electron and proton on the reduced Compton wavelength of the electron:

$$2\cdot R_U=N_1\cdot ƛ_c \tag{109}$$

So apply the expression:

$$R_U=e\cdot\alpha\cdot N_1\cdot N_A\cdot l_{pl} \tag{110}$$

The expressions for the radius of the observable universe are:

$$R_U=\frac{\alpha N_1}{2}\alpha_0=\frac{N_1}{2\alpha}r_e=\frac{1}{2\mu\alpha_G}r_e=\frac{m_{pl}^2 r_e}{2m_e m_p}=\frac{\hbar c r_e}{2Gm_e m_p}=\frac{\alpha\hbar}{2Gm_e^2 m_p} \tag{111}$$

We Found the value of the radius of the universe $R_U=4.38\times10^{26}$ m. The expressions for the radius of the observable universe are:

$$T_U=\frac{R_U}{c}=\frac{N_1 r_e}{2\alpha c}=\frac{r_e}{2\mu\alpha_G c}=\frac{\alpha N_1\alpha_0}{2c}=\frac{\alpha\hbar}{2cGm_e^2 m_p}=\frac{\hbar r_e}{2Gm_e m_p} \tag{112}$$

For the value of the age of the universe apply $T_U=1.46\times10^{18}$ s. The gamma rhythm is a pattern of neuronal oscillations whose frequency ranges from 25 Hz to 100 Hz although 40 Hz is typical. Gamma frequency oscillations are present during wakefulness and REM sleep. The time quantum in the brain t_B,the smallest unit of time that related to the 40 Hz oscillation of the gamma rate:

$$\frac{t_B}{t_{pl}}=\sqrt[3]{\alpha_g^2} \tag{113}$$

For the minimum distance l_{min} apply $l_{min}=2\cdot e\cdot l_{pl}$. So for the minimum time t_{min} apply:

$$t_{\min}=\frac{l_{min}}{c}=\frac{2el_{pl}}{c}=2et_{pl} \tag{114}$$

From expressions apply:

$$\cos\alpha^{-1}=\frac{2t_{pl}}{t_{min}} \tag{115}$$

In the papers [33] was presented the theoretical value for the Hubble Constant. The formulas for the Hubble Constant are:

$$H_0=c\sqrt{\frac{e}{6}\Lambda} \tag{116}$$

$$H_0=\frac{\alpha_g}{t_{pl}}\sqrt{\frac{e}{6}} \tag{117}$$

These equations calculate the theoretical value of the Hubble Constant $H_0=2.36\times10^{-18}$ s^{-1}=72.69 (km/s)/Mpc. Also apply the expression:

$$\frac{G\hbar H_0^2}{c^5} = \frac{e}{6}\alpha_g^2 \tag{118}$$

$$\frac{G\hbar H_0^2}{c^5} = \frac{1}{6e^5\left(2\alpha^2 N_A\right)^6} \tag{119}$$

$$\frac{G\hbar H_0^2}{c^5} = \frac{e}{48\left(e^{\pi}\alpha_s\alpha^2 N_A\right)^3} \tag{120}$$

$$\frac{G\hbar H_0^2}{c^5} = \frac{10^{42}}{6e^5}\left(\frac{\alpha_w^2\alpha_G}{\alpha_s^2\alpha^2}\right)^3 \tag{121}$$

$$\frac{6G\hbar H_0^2}{ec^5} = \left(\frac{10^{14}\alpha_w^2\alpha_G}{e^{2\pi}\alpha^2\alpha_s^4}\right)^3 \tag{122}$$

$$6e^{6\pi}\frac{G\hbar H_0^2}{c^5} = e\left(\frac{10^{14}\alpha_w^2\alpha_G}{\alpha^2\alpha_s^4}\right)^3 \tag{123}$$

$$6e^{5\pi}\frac{G\hbar H_0^2}{c^5} = \frac{1}{\alpha_s^{11}}\left(\frac{10^{14}\alpha_w^2\alpha_G}{\alpha^2}\right)^3 \tag{124}$$

The Equations of the Universe are:

$$6e^{5\pi}\frac{G\hbar H_0^2}{c^5} = 10^{42}\frac{\alpha_w^6\alpha_G^3}{\alpha^6\alpha_s^{11}} \tag{125}$$

$$e^{7\pi}\frac{G\hbar\Lambda^2}{cH_0^2} = 6\cdot 10^{42}\frac{\alpha_w^6\alpha_G^3}{\alpha^6\alpha_s^{13}} \tag{126}$$

4. The mass scale law of the Universe

The fine-structure constant is universal scaling factor:

$$\alpha = \frac{2\pi r_e}{\lambda_e} = \frac{\lambda_e}{2\pi\alpha_0} = \frac{r_e}{l_{pl}}\frac{m_e}{m_{pl}} = \sqrt{\frac{r_e}{\alpha_0}} \tag{127}$$

Also the gravitational coupling constant is universal scaling factor:

$$\alpha_G = \frac{m_e^2}{m_{pl}^2} = \frac{\alpha_{G(p)}}{\mu^2} = \frac{\alpha}{\mu N_1} = \frac{\alpha^2}{N_1^2 \alpha_{G(p)}} = \left(\frac{2\pi l_{pl}}{\lambda_e}\right)^2 = \left(\alpha \frac{l_{pl}}{r_e}\right)^2 = \left(\frac{l_{pl}}{\alpha \alpha_0}\right)^2 \tag{128}$$

For the reduced Planck constant ħ apply:

$$\hbar = \alpha \cdot m_e \cdot \alpha_0 \cdot c$$

So the new formula for the Planck length l_{pl} is:

$$l_{pl} = a\sqrt{a_G}\alpha_0 \tag{129}$$

A smallest length in nature thus implies that there is no way to define exact boundaries of objects or elementary particles. Max Planck proposed natural units that indirectly discovered the lowest-level properties of free space, all born from equations that simplified the mathematics of physics equations. The fundamental unit of length in this unit system is the Planck length l_{pl}. The smallest components of spacetime will never be seen with the human eye as it is orders of magnitudes smaller than an atom. Thus, it will never be directly observed but it can be deduced by mathematics. We proposed to be a lattice structure, in which its unit cells have sides of length $2 \cdot e \cdot l_{pl}$. Perhaps for the minimum distance l_{min} apply:

$$l_{min} = 2 \cdot e \cdot l_{pl} = 2 \cdot e^{\pi} \cdot \alpha_s \cdot l_{pl} \tag{130}$$

From expressions apply:

$$\cos\alpha^{-1} = e^{-1}$$

$$\cos\alpha^{-1} \cdot l_{min} = 2 \cdot l_{pl}$$

$$\cos\alpha^{-1} = \frac{2 l_{pl}}{l_{min}} \tag{131}$$

For the Bohr radius α_0 apply:

$$\alpha_0 = N_A \cdot l_{min} = 2 \cdot e \cdot N_A \cdot l_{pl} \tag{132}$$

Therefore the unity formula that connect the fine-structure constant α,the gravitational coupling constant α_G and the Avogadro's number N_A is:

$$4 \cdot e^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = 1 \tag{133}$$

The unity formula is equally valid:

$$\alpha^2 \cdot \alpha_G = (2 \cdot e \cdot N_A)^{-2} \tag{134}$$

This formula is the simple unification of the electromagnetic and the gravitational interactions.

The Planck mass m_{pl} appears everywhere in astrophysics,cosmology,quantum gravity,string theory,etc. Its mass is enormous compared to any subatomic particle and even the mass of heavier atoms. The mass Planck m_{pl} can be defined by three fundamental natural constants,the speed of light in vacuum c,the reduced Planck constant ħ and the gravity constant G as:

$$m_{pl} = \sqrt{\frac{\hbar c}{G}} = \frac{\hbar}{l_{pl} c} = \frac{\mu_0 q_{pl}^2}{4\pi l_{pl}}$$

The gravitational coupling constant α_G can be written in the form:

$$4 \cdot e^2 \cdot N_A^2 \cdot \alpha^2 \cdot \alpha_G = 1$$

$$\alpha_G = (2 \cdot e \cdot \alpha \cdot N_A)^{-2} \tag{135}$$

Therefore the formula for the Planck mass m_{pl} is:

$$m_{pl} = 2 \cdot e \cdot \alpha \cdot N_A \cdot m_e \tag{136}$$

The gravitational coupling constant α_G can be written in the forms:

$$4 \cdot e^{2\pi} \cdot \alpha_s^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = 1$$

$$\alpha_G = (2 \cdot e^{\pi} \cdot \alpha_s \cdot \alpha \cdot N_A)^{-2} \tag{137}$$

$$4 \cdot \alpha_s^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = i^{4i}$$

$$\alpha_G = i^{4i} \cdot (2 \cdot \alpha_s \cdot \alpha \cdot N_A)^{-2} \tag{138}$$

Therefore the formulas for the Planck mass m_{pl} are:

$$m_{pl} = 2 \cdot e^{\pi} \cdot \alpha_s \cdot \alpha \cdot N_A \cdot m_e \tag{139}$$

$$m_{pl} = 2 \cdot i^{-2i} \cdot \alpha_s \cdot \alpha \cdot N_A \cdot m_e \tag{140}$$

The gravitational coupling constant α_G can be written in the form:

$$4 \cdot 10^{14} \cdot e^{2\pi} \cdot \alpha_w^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = e^2$$

$$\alpha_G = (2 \cdot e^{\pi-1} \cdot 10^7 \cdot \alpha_w \cdot \alpha \cdot N_A)^{-2} \tag{141}$$

$$4 \cdot 10^{14} \cdot \alpha_w^2 \cdot \alpha^2 \cdot \alpha_G \cdot N_A^2 = i^{4i} \cdot e^2$$

$$\alpha_G = i^{4i} \cdot e^2 \cdot (2 \cdot 10^7 \cdot \alpha_w \cdot \alpha \cdot N_A)^{-2} \tag{142}$$

Therefore the formulas for the Planck mass m_{pl} are:

$$m_{pl} = 2 \cdot e^{\pi-1} \cdot 10^7 \cdot \alpha_w \cdot \alpha \cdot N_A \cdot m_e \tag{143}$$

$$m_{pl} = 2 \cdot i^{-2i} \cdot e^{-1} 10^7 \cdot \alpha_w \cdot \alpha \cdot N_A \cdot m_e \tag{144}$$

The gravitational coupling constant α_G can be written in the form:

$$4 \cdot 10^{14} \cdot N_A^2 \cdot \alpha_w^2 \cdot \alpha^2 \cdot \alpha_G = \alpha_s^2$$

$$\alpha_G = \alpha_s^2 \cdot (2 \cdot 10^7 \cdot \alpha_w \cdot \alpha \cdot N_A)^{-2} \tag{145}$$

Therefore the formula for the Planck mass m_{pl} is:

$$m_{pl} = 2 \cdot 10^7 \cdot \alpha_w \cdot \alpha \cdot \alpha_s^{-1} \cdot N_A \cdot m_e \tag{146}$$

In [1] J.Forsythe and T. Valev found an extended mass relation for seven fundamental masses. We found a similar mass relation for seven fundamental masses:

$$M_n = \alpha^{-1} \cdot \alpha_g^{(2-n)/3} \cdot m_e \tag{147}$$

$$n = 0,1,2,3,4,5,6$$

For $n=0$ M_0 is the minimum mass M_{min}:

$$M_0=M_{min}=\alpha^{-1}\cdot\alpha_g^{(2-0)/3}\cdot m_e$$

$$M_0=M_{min}=\alpha^{-1}\cdot\alpha_g^{2/3}\cdot m_e \tag{148}$$

For $n=1$ M_1 is unidentified and could be regarded as a prediction by the suggested mass relation for unknown fundamental mass M_{Un},most likely a yet unobserved light particle:

$$M_1=M_{Un}=\alpha^{-1}\cdot\alpha_g^{(2-1)/3}\cdot m_e$$

$$M_1=M_{Un}=\alpha^{-1}\cdot\alpha_g^{1/3}\cdot m_e \tag{149}$$

For $n=2$ M_2 is a mass dimension constant in a basic mass equation relating masses of stable particles and coupling constants of the four interactions approximately a half charged pion mass M_{pi}:

$$M_2=M_{pi}=\alpha^{-1}\cdot\alpha_g^{(2-2)/3}\cdot m_e$$

$$M_2=M_{pi}=\alpha^{-1}\cdot m_e \tag{150}$$

For $n=3$ M_3 is the Planck mass m_{pl}:

$$M_3=m_{pl}=\alpha^{-1}\cdot\alpha_g^{(2-3)/3}\cdot m_e$$

$$M_3=m_{pl}=\alpha^{-1}\cdot\alpha_g^{-1/3}\cdot m_e \tag{151}$$

For $n=4$ is the central mass of a hypothetical quantum "Gravity Atom" M_{GA}.

$$M_4=M_{GA}=\alpha^{-1}\cdot\alpha_g^{(2-4)/3}\cdot m_e$$

$$M_4=M_{GA}=\alpha^{-1}\cdot\alpha_g^{-2/3}\cdot m_e \tag{152}$$

For $n=5$ is of the order of the Eddington mass M_{Edd} limit of the most massive stars:

$$M_5=M_{Edd}=\alpha^{-1}\cdot\alpha_g^{(2-5)/3}\cdot m_e$$

$$M_5=M_{Edd}=\alpha^{-1}\cdot\alpha_g^{-1}\cdot m_e \tag{153}$$

For $n=6$ is the mass of the Hubble sphere and the mass of the observable universe M_U:

$$M_6=M_U=\alpha^{-1}\cdot\alpha_g^{(2-5)/3}\cdot m_e$$

$$M_6=M_U=\alpha^{-1}\cdot\alpha_g^{-4/3}\cdot m_e \tag{154}$$

The similar mass relation for seven fundamental masses is:

$$M_n=\alpha_g^{-n/3}\cdot M_{min} \tag{155}$$

$$n=0,1,2,3,4,5,6$$

For $n=0$ M_0 is the minimum mass M_{min}:

$$M_0=M_{min} \tag{156}$$

For $n=1$ M_1 is unidentified and could be regarded as a prediction by the suggested mass relation for unknown fundamental mass M_{Un},most likely a yet unobserved light particle:

$$M_1=M_{Un}=\alpha_g^{-1/3}\cdot M_{min} \tag{157}$$

For $n=2$ M_2 is a mass dimension constant in a basic mass equation relating masses of stable particles and coupling constants of the four interactions approximately a half charged pion mass M_{pi}:

$$M_2=M_{pi}=\alpha_g^{-2/3}\cdot M_{min} \tag{158}$$

For n=3 M_3 is the Planck mass m_{pl}:

$$M_3=m_{pl}=\alpha_g^{-1}\cdot M_{min} \tag{159}$$

For n=4 is the central mass of a hypothetical quantum "Gravity Atom" M_{GA}:

$$M_4=M_{GA}=\alpha_g^{-4/3}\cdot M_{min} \tag{160}$$

For n=5 is of the order of the Eddington mass M_{Edd} limit of the most massive stars:

$$M_5=M_{Edd}=\alpha_g^{-5/3}\cdot M_{min} \tag{161}$$

For n=6 is the mass of the Hubble sphere and the mass of the observable universe M_U:

$$M_6=M_U=\alpha_g^{-2}\cdot M_{min} \tag{162}$$

If there is a minimum length in nature, then there is an absolute minimum mass corresponding to a hypothetical particle with radius of the order of the Planck length. The following applies to the minimum mass M_{min}:

$$\mathrm{M_{min}}c^2 = \frac{\hbar}{t_{max}} \tag{163}$$

$$\mathrm{M_{min}}c^2 = \hbar \mathrm{H}_0 \tag{164}$$

$$\mathrm{M_{min}} = \frac{\hbar \mathrm{H}_0}{c^2} \tag{165}$$

$$\mathrm{M_{min}} = \frac{\hbar}{cl_{max}} \tag{166}$$

So apply the expressions:

$$\mathrm{M_{min}} = \frac{\hbar}{c}\sqrt{\Lambda} \tag{167}$$

$$\mathrm{M_{min}} = \frac{m_{pl}^2}{\mathrm{M}_{max}} \tag{168}$$

$$\mathrm{M_{min}} = \frac{m_{pl}^2}{\mathrm{M}_{max}} \tag{169}$$

Therefore for the minimum mass M_{min} apply:

$$\mathrm{M_{min}} = \alpha_g m_{pl} \tag{170}$$

$$\mathrm{M_{min}} = \frac{\alpha_G}{\alpha^3} m_e \tag{171}$$

$$\mathrm{M_{min}} = \frac{\sqrt[3]{\alpha_g^2}}{\alpha} m_e \tag{172}$$

$$M_{min}=(2\cdot e\cdot N_A)^{-2}\cdot \alpha^{-1}\cdot m_e \quad (173)$$

For the value of the minimum mass M_{min} apply $M_{min}=4.06578\times10^{-69}$ kg. Mass M have max/min ratio,which is the square of α_g:

$$\alpha_g^2 = \frac{M_{min}}{M_{max}} \quad (174)$$

For the maximum mass M_{max} applies:

$$M_{max} = \frac{F_{max} l_{max}}{c^2} \quad (175)$$

$$M_{max} = \frac{m_{pl}^2}{M_{min}} \quad (176)$$

The expressions for the mass of the observable universe are:

$$M_U=\alpha^{-1}\cdot \alpha_g^{-4/3}\cdot m_e \quad (177)$$

$$M_U=\alpha^3\cdot \alpha_G^{-2}\cdot m_e \quad (178)$$

$$M_U=(2\cdot e\cdot \alpha^2\cdot N_A)^2\cdot N_1\cdot m_p \quad (179)$$

$$M_U=\mu\cdot \alpha\cdot N_1^2\cdot m_p \quad (180)$$

For the value of the mass of the observable universe M_U apply $M_U=1.153482\times10^{53}$ kg. In astrophysics,the Eddington number, N_{Edd}, is the number of protons in the observable universe. Eddington originally calculated it as about 1.57×10^{79},current estimates make it approximately 10^{80}. The term is named for British astrophysicist Arthur Eddington, who in 1940 was the first to propose a value of N_{Edd} and to explain why this number might be important for physical cosmology and the foundations of physics. The expressions who calculate the number of protons in the observable universe are:

$$N_{Edd} = \frac{M_U}{m_p} = \mu\alpha N_1^2 = 6.9\times10^{79} \quad (181)$$

$$\frac{M_U}{m_p} = \left(2e\alpha^2 N_A\right)^2 N_1 \quad (182)$$

$$\frac{M_U}{m_p} = \frac{N_1}{\alpha_g^{\frac{2}{3}}} \quad (183)$$

$$\frac{M_U}{m_p} = \left(\frac{r_e}{l_{pl}}\right)^2 N_1 \quad (184)$$

The expressions for the relationship between the mass of the observable universe M_U with the radius of the universe R_U are:

$$\frac{M_U}{R_U^2} = 4\alpha\mu^2 \frac{m_e}{r_e^2} \quad (185)$$

$$\frac{M_U}{R_U^2} = 16\frac{m_p}{r_p r_e} \tag{186}$$

$$\frac{M_U}{R_U^2} = \frac{64}{\alpha}\frac{m_e}{r_p^2} \tag{187}$$

$$\frac{M_U}{m_p} = \alpha\mu\left(\frac{2R_U}{r_e}\right)^2 \tag{188}$$

$$\frac{\frac{M_U}{m_p}}{\left(\frac{2R_U}{r_e}\right)^2} = \alpha\mu \tag{189}$$

The expressions for the relationship between the mass of the observable universe M_U with the radius of the universe R_U are:

$$\frac{M_U}{R_U^2} = 4\alpha\mu^2\frac{m_e}{r_e^2} \tag{190}$$

$$\frac{M_U}{m_p} = \alpha\mu\left(\frac{2R_U}{r_e}\right)^2 \tag{191}$$

Also apply the expressions:

$$\frac{l_{max}}{M_{\max}} = \frac{l_{pl}}{m_{pl}} \tag{192}$$

$$\left(\frac{l_{max}}{l_{\min}}\right)^2 = \frac{M_{max}}{m_{min}} \tag{193}$$

5. Conclusions

We presented a new mass scale law of the universe. From the Dimensionless unification of the fundamental interactions we found the formulas for the Planck mass:

$$m_{pl}=2\cdot e\cdot \alpha\cdot N_A\cdot m_e$$

$$m_{pl}=2\cdot e^{\pi}\cdot \alpha_s\cdot \alpha\cdot N_A\cdot m_e$$

$$m_{pl}=2\cdot i^{-2i}\cdot \alpha_s\cdot \alpha\cdot N_A\cdot m_e$$

$$m_{pl}=2\cdot e^{\pi-1}\cdot 10^7\cdot \alpha_w\cdot \alpha\cdot N_A\cdot m_e$$

$$m_{pl}=2\cdot i^{-2i}\cdot e^{-1}10^7\cdot \alpha_w\cdot \alpha\cdot N_A\cdot m_e$$

$$m_{pl}=2\cdot 10^{7}\cdot \alpha_w\cdot \alpha\cdot \alpha_s^{-1}\cdot N_A\cdot m_e$$

We found a mass relation for fundamental masses:

$$M_n=\alpha^{-1}\cdot \alpha_g^{(2-n)/3}\cdot m_e$$

$$M_n=\alpha_g^{-n/3}\cdot M_{min}$$

$$n=0,1,2,3,4,5,6$$

For the minimum mass M_{min} apply:

$$\mathrm{M}_{\min}=\frac{m_{pl}^2}{\mathrm{M}_{\max}}=\alpha_g m_{pl}=\frac{\alpha_G}{\alpha^3}m_e=\frac{\sqrt[3]{\alpha_g^2}}{\alpha}m_e$$

$$M_{min}=(2\cdot e\cdot N_A)^{-2}\cdot \alpha^{-1}\cdot m_e=4.06578\times 10^{-69}\ \mathrm{kg}$$

The expressions for the mass of the observable universe M_U are:

$$M_U=\alpha^{-1}\cdot \alpha_g^{-4/3}\cdot m_e=\alpha^{3}\cdot \alpha_G^{-2}\cdot m_e=(2\cdot e\cdot \alpha^{2}\cdot N_A)^{2}\cdot N_1\cdot m_p=\mu\cdot \alpha\cdot N_1^{2}\cdot m_p$$

For the value of the mass of the observable universe M_U apply $M_U=1.153482\times 10^{53}$ kg. The expressions who calculate the number of protons in the observable universe are:

$$\mathrm{N}_{Edd}=\frac{\mathrm{M}_U}{m_p}=\mu\alpha\mathrm{N}_1^2=\frac{\mathrm{N}_1}{\alpha_g^{\frac{2}{3}}}=\left(2e\alpha^2\mathrm{N_A}\right)^2\mathrm{N}_1=\left(\frac{r_e}{l_{pl}}\right)^2\mathrm{N}_1=6.9\times 10^{79}$$

References

[1] Forsythe, C. J. & Valev, D. T. (2014). Extended mass relation for seven fundamental masses and new evidence of large number hypothesis. Physics International, 5(2), 152-158. https://doi.org/10.3844/pisp.2014.152.158
[2] Pellis, Stergios, Unification Archimedes constant π, golden ratio φ, Euler's number e and imaginary number i (October 10, 2021)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.3975869
[3] Pellis, Stergios, Exact formula for the Fine-Structure Constant α in Terms of the Golden Ratio φ (October 13, 2021)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4160769
[4] Pellis, Stergios, Fine-Structure Constant from the Golden Angle, the Relativity Factor and the Fifth Power of the Golden Mean (September 5, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4247343
[5] Pellis, Stergios, Exact expressions of the fine-structure constant (October 20, 2021)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.3975861
[6] Pellis, Stergios, Fine-structure constant from the Archimedes constant (October 11, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4245208
[7] Pellis, Stergios, Fine-Structure Constant from the Madelung Constant (July 27, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4174644
[8] Pellis, Stergios, Exact mathematical expressions of the proton to electron mass ratio (October 10, 2021)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.3967998
[9] Pellis, Stergios, Unity formula that connect the fine-structure constant and the proton to electron mass ratio (November 8, 2021)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.3963425
[10] Pellis, Stergios, Exact mathematical formula that connect 6 dimensionless physical constants (October 17, 2021)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.3963427
[11] Pellis, Stergios, Theoretical value for the strong coupling constant (January 1, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.3998175

[12] Pellis, S. (2023) Unity Formulas for the Coupling Constants and the Dimensionless Physical Constants. Journal of High Energy Physics, Gravitation and Cosmology, 9, 245-294.
https://doi.org/10.4236/jhepgc.2023.91021
[13] Pellis, Stergios, Dimensionless Unification of the Fundamental Interactions (August 27, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4201780
[14] Pellis, Stergios, Unification of the fundamental interactions (2022)
DOI: 10.13140/RG.2.2.12296.70405
[15] Pellis, Stergios, Unification of the Fundamental Forces (2022)
DOI: 10.13140/RG.2.2.33651.60967
[16] Pellis, Stergios, Theoretical Value of the Gravitational Constant (May 7, 2023)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4442074
[17] Pellis, Stergios, Formula for the Gravitational constant (January 2023)
DOI: 10.13140/RG.2.2.19656.60166
[18] Pellis, Stergios, Dimensionless Solution for the Cosmological Constant (September 14, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4219292
[19] Pellis, Stergios, Unification of atomic physics and cosmology (2022)
DOI: 10.13140/RG.2.2.11493.88804
[20] Pellis, Stergios, The Equation of the Universe (2023)
DOI: 10.13140/RG.2.2.24768.40960
[21] Pellis, Stergios, Poincaré Dodecahedral Space Solution of The Shape of The Universe (December 31, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4316617
[22] Pellis, Stergios, The Shape of The Universe (March 2023).
doi: 10.13140/RG.2.2.16034.09922
[23 Pellis, Stergios,Solution for the cosmological parameters (December 2022)
DOI: 10.13140/RG.2.2.23917.67047/2
[24] Pellis, Stergios, Solution for the Density Parameter of Dark Energy (December 25, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4406279
[25] Pellis, Stergios, Equation of state in cosmology (December 2022)
DOI: 10.13140/RG.2.2.17952.25609/1
[26] Pellis, Stergios, Maximum and Minimum Values for Natural Quantities (December 10, 2022)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4306280
[27] Pellis, Stergios, The coupling constant for the fifth force (April 2023)
DOI: 10.13140/RG.2.2.32481.99686
[28] Pellis, Stergios, Gravitational fine-structure constant (December 2022)
DOI: 10.13140/RG.2.2.34770.43206/2
[29] Pellis, Stergios, Unification of the Microcosm and the Macrocosm (April 24, 2023)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4429653
[30] Pellis, Stergios, Dimensionless theory of everything (June 5, 2023)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4469668
[31] Pellis, Stergios, The Dimensionless Equations of the Universe (June 23, 2023)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4488688
[32] Pellis, Stergios, New Large Number Hypothesis of the universe (August 1, 2023)
Available at SSRN: http://dx.doi.org/10.2139/ssrn.4529088
[33] Pellis, Stergios, Theoretical value for the Hubble Constant (August 2023)
DOI: 10.13140/RG.2.2.24461.10729/3