Calculation of the Universe fundamental constants

3D Universe Theory

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We show that starting with the speed of light, **φ** (the golden ratio) and the ratio **8π-1**, we can recover the Universe fundamental constants, no fudge factors are used.

In some cases, extra equations for the same constant are given to show that the numbers match exactly but also to show the self-similarity of the Universe on different size scales.

The constants recovered are as follows:

Planck time (t_p) = 5.3866 x 10^{-44} sec (CODATA 5.3910 x 10^{-44} sec)
Planck length (l_p) = 1.6148 x 10^{-35} m (CODATA 1.6161 x 10^{-35} m)
Fine structure constant (∞) **=** 7.2966 x 10^{-3} (CODATA 7.2973 x 10^{-3})
Gravitational coupling constant (proton) (∞_G) **=** 5.9008 x 10^{-39} (CODATA 5.906 x 10^{-39})
Gravitational coupling constant (electron) (∞_G) **=** 1.7501 x 10^{-45} (CODATA 1.7518 x 10^{-45})
Von Klitzing constant (R_k) = 2.5815 x 10^{-4} Ω (CODATA 2.5812 x 10^{-4} Ω)
Josephson constant (K_J) = 4.8351 x 10^{14} Hz.V^{-1} (CODATA 4.8359 x 10^{14} Hz.V^{-1})
Planck constant (h) = 6.6275 x 10^{-34} J.s (CODATA 6.6260 x 10^{-34} J.s)
Elementary charge (e) = 1.6022 x 10^{-19} C (CODATA 1.6021 x 10^{-19} C)
Electron Compton frequency (v_e) = 1.2360 x 10^{20} Hertz (CODATA 1.2356 x 10^{20} Hertz)
Electron Compton wavelength (λ_e) = 2.4253 x 10^{-12} m (CODATA 2.4263 x 10^{-12} m)
Classical electron radius (r_e) = 2.8165 x 10^{-15} m (CODATA 2.8179 x 10^{-15} m)
Electron mass (m_e) = 9.1149 x 10^{-31} Kg (CODATA 9.1093 x 10^{-31} Kg)
Proton/electron mass ratio (μ) = 1836.19 (CODATA 1836.15)
Proton Compton wavelength (λ_{pr}) = 1.3208 x 10^{-15} m (CODATA 1.3214 x 10^{-15} m)
Proton charge radius (R_{pr}) = 0.8408 x 10^{-15} m (R. Pohl 0.8408 x 10^{-15} m)
Proton mass (M_{pr}) = 1.6736 x 10^{-27} Kg (CODATA 1.6726 x 10^{-27} Kg)
Gravitational constant (G) = 6.6613 x 10^{-11} m^3 kg^{-1} s^{-2} (CODATA 6.6738 x 10^{-11} m^3 kg^{-1} s^{-2})
Planck mass (m_p) = 2.1787 x 10^{-8} Kg (CODATA 2.1765 x 10^{-8} Kg)
Planck charge (Q_p) = 1.8757 x 10^{-18} C (CODATA 1.8755 x 10^{-18} C)
Rydberg constant (R∞) = 1.0975 x 10^{7} m^{-1} (CODATA 1.0973 x 10^{7} m^{-1})
Bohr radius (a_0) = 5.2902 x 10^{-11} m (CODATA 5.2917 x 10^{-11} m)
Bohr magneton (μ_b) = 9.2709 x 10^{-24} J.T^{-1} (CODATA 9.2740 x 10^{-24} J.T^{-1})
Permittivity of free space (ε_0) = 8.8532 x 10^{-12} F/m (CODATA 8.8541 x 10^{-12} F/m)

Permeability of free space (μ_0) = exact (CODATA 4π x 10^{-7} N.A^{-2})

This model proposes that whatever system of time unit we use, the Planck time numerical value will always be the same, only the scale factor will change. By choosing the scale of our time unit, we set the scale of our reality.

Planck time: (φ has a dimension of Time in sec)

$$t_p = \frac{2\times\varphi\times10^{-40}\times\left(1-\frac{1}{8\pi}\right)}{\pi^2\left((8\pi-1)+\frac{1}{(8\pi-2)}\right)^2} = 5.38662659169695247 \text{ x } 10^{-44} \text{ s}$$

(CODATA 5.39106 x 10^{-44} s)

Planck length:

$l_p = c \text{ x } t_p = 1.61487002625299177 \text{ x } 10^{-35}$ m

(CODATA 1.61619 x 10^{-35} m)

Fine structure constant :

3DUT equations:

$$\alpha = \frac{\left(1-\frac{1}{8\pi}\right)}{\varphi^2\times16\pi} = 7.29661884504513027 \text{ x } 10^{-3}$$

(CODATA 7.29735 x 10^{-3})

$$\alpha = \frac{4\pi\times r_e}{\varphi\times10^{-20}\times c} = 7.29661884504513026 \text{ x } 10^{-3}$$ (φ has a dimension of Time in sec)

Classical equations:

$$\alpha = \frac{r_e\times m_e}{l_p\times m_p} = 7.29661884504513025 \text{ x } 10^{-3}$$

$$\alpha = \frac{2\pi\times r_e}{\lambda_e} = 7.29661884504513026 \text{ x } 10^{-3}$$

$$\alpha = \frac{e^2}{q_P^2} = 7.29661884504513027 \text{ x } 10^{-3}$$

Proton/Electron mass ratio:

3DUT equation:

$$\mu = \left((8\pi - 1) + \frac{1}{(8\pi - 2)} \right)^2 \text{ x } \pi = 1836.19030024681339$$

(CODATA 1836.15)

Classical equation:

$\mu = M_{pr}/me = 1836.19030024681339$

Gravitational coupling constant (proton):

3DUT equation:

$$\alpha_{Gp} = \left(\left(8 - \frac{1}{\pi} \right) \times 10^{-20} \right)^2 = 5.90083630047016870 \text{ x } 10^{-39}$$

(CODATA 5.906 x 10^{-39})

Classical equation:

$$\alpha_{Gp} = \left(\frac{M_{pr}}{m_P} \right)^2 = 5.90083630047016863 \text{ x } 10^{-39}$$

Gravitational coupling constant (electron): (φ has a dimension of Time in sec)

3DUT equation:

$$\alpha_{Ge} = \left(\frac{4\pi \times t_p}{\varphi \times 10^{-20}} \right)^2 = 1.75016175363252306 \text{ x } 10^{-45}$$

(CODATA 1.7518 x 10^{-45})

Classical equation:

$$\alpha_{Ge} = \left(\frac{m_e}{m_P} \right)^2 = 1.75016175363252306 \text{ x } 10^{-45}$$

Von Klitzing constant:

3DUT equation:

$$R_K = \frac{\varphi^2 \times 8\pi \times \mu_0 \times c}{\left(1 - \frac{1}{8\pi}\right)} = 2.58154030971204268 \ \text{x} \ 10^4 \ \Omega$$

(CODATA 2.58128 x 10^4 Ω)

Classical equation:

$$R_K = \frac{h}{e^2} = 2.58154030971204268 \ \text{x} \ 10^4 \ \Omega$$

In the following two equations, the expression $\left((8\pi - 1) + \frac{1}{(8\pi - 2)}\right)$ has got the following dimensions: $M^{-2} L^{-3} T Q^3$

Josephson constant:

3DUT equation:

$$K_J = \frac{\mu_0 \times \left((8\pi - 1) + \frac{1}{(8\pi - 2)}\right)}{2\pi \times 10^{-20}} = 4.83519400017556107 \ \text{x} \ 10^{14} \ \text{Hz.V}^{-1}$$

(CODATA 4.83597 x 10^{14} Hz.V^{-1})

Classical equation:

$$K_J = \frac{2 \times e}{h} = 4.83519400017556107 \ \text{x} \ 10^{14} \ \text{Hz.V}^{-1}$$

Planck constant :

3DUT equation:

$$h = \frac{4}{K_J^2 \times R_k} = \frac{2\pi \times 10^{-40} \times \left(1 - \frac{1}{8\pi}\right)}{\mu_0^3 \times \left((8\pi - 1) + \frac{1}{(8\pi - 2)}\right)^2 \times \varphi^2 \times c} = 6.62755397064811386 \ \text{x} \ 10^{-34} \ \text{J.s}$$

(CODATA 6.62606 x 10^{-34} J.s)

Elementary charge :

3DUT equation:

e = $\sqrt{\dfrac{h\times\left(1-\dfrac{1}{8\pi}\right)}{\varphi^2\times 8\pi\times\mu_0\times c}}$ = 1.60227545973587383 x 10^{-19} C
(CODATA 1.60217 x 10^{-19} C)

Classical equations:

e= $\sqrt{\dfrac{r_e\times m_e\times 4\pi}{\mu_0}}$ = 1.60227545973587383 x 10^{-19} C

e = $\sqrt{\dfrac{2h\times\alpha}{\mu_0\times c}}$ = 1.60227545973587383 x 10^{-19} C

Electron Compton frequency: (φ has a dimension of Time in sec)

3DUT equation:

$\nu_e = \dfrac{2}{\varphi\times 10^{-20}}$ = 1.23606797749978970 x 10^{20} Hertz
(CODATA 1.2356 x 10^{20} Hertz)

Electron Compton wavelength: (φ has a dimension of Time in sec)

3DUT equation:

$\lambda_e = \dfrac{\varphi\times 10^{-20}\times c}{2}$ = 2,42537193307437660 x 10^{-12} m
(CODATA 2.4263 x 10^{-12} m)

Classical electron radius: (φ has a dimension of Time in sec)

3DUT equation:

$r_e = \dfrac{\varphi\times 10^{-20}\times c\times\alpha}{4\pi}$ = 2.81656734409730746 x 10^{-15} m
(CODATA 2.81794 x 10^{-15} m)

Classical equations:

$r_e = \frac{\lambda_e \times \alpha}{2\pi}$ =2.81656734409730746 x 10^{-15} m

$r_e = \frac{e^2 \times \mu_0}{m_e \times 4\pi}$ =2.81656734409730746 x 10^{-15} m

Electron mass: (φ has a dimension of Time in sec)

3DUT equation:

$m_e = \frac{2h}{\varphi \times 10^{-20} \times c^2}$ = 9.11494857118215102 x 10^{-31} Kg

(CODATA 9.109 x 10^{-31} Kg)

Classical equations:

$m_e = \frac{h \times \alpha}{2\pi \times r_e \times c}$ = 9.11494857118215102 x 10^{-31} Kg

$m_e = \frac{h}{\lambda_e \times c}$ = 9.11494857118215102 x 10^{-31} Kg

Proton Compton wavelength:

3DUT equation:

$\lambda_{pr} = \frac{l_P \times 10^{20} \times \pi}{4 \times \left(1 - \frac{1}{8\pi}\right)}$ = 1.32087177061569694 x 10^{-15} m

(CODATA 1.3214 x 10^{-15} m)

Proton charge radius (measured with muon):

3DUT equations:

$R_{pr} = \frac{l_p \times 10^{20}}{2 \times \left(1 - \frac{1}{8\pi}\right)}$ = 0.84089308593612910 x 10^{-15} m

(R. Pohl 0.84087 x 10^{-15} m)

$R_{pr} = \frac{2\lambda_{pr}}{\pi}$ = 0.84089308593612910 x 10^{-15} m

Proton mass:

3DUT equations:

$$M_{pr} = \frac{4h\times\left(1-\frac{1}{8\pi}\right)}{t_P\times10^{20}\times\pi\times c^2} = 1.67367801536532165 \text{ x } 10^{-27} \text{ Kg}$$

(CODATA 1.6726 x 10^{-27} Kg)

$$M_{pr} = \frac{2h}{\pi\times R_{pr}\times c} = 1.67367801536532165 \text{ x } 10^{-27} \text{ Kg}$$

$$M_{pr} = \pi\times\left((8\pi-1)+\frac{1}{(8\pi-2)}\right)^2\times me = 1.67367801536532165 \text{ x } 10^{-27} \text{ Kg}$$

$$M_{pr} = m_p\times10^{-20}\times\left(8-\frac{1}{\pi}\right) = 1.67367801536532165 \text{ x } 10^{-27} \text{ Kg}$$

Classical equation:

$$M_{pr} = \frac{h}{\lambda_{pr}\times c} = 1.67367801536532165 \text{ x } 10^{-27} \text{ Kg}$$

Gravitational constant:

3DUT equations:

$$G = \frac{D_{pr}\times c^2\times\alpha_G}{8\times M_{pr}} = 6.66137451756776190 \text{ x } 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$$

(CODATA 6.67384 x 10^{-11} m^3 kg^{-1} s^{-2})

Classical equations:

$$G = \frac{l_p\times c^2}{m_p} = 6.66137451756776187\text{x } 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$$

$$G = \frac{r_e\times c^2\times\alpha_G}{\alpha\times m_e} = 6.66137451756776187 \text{ x } 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$$

Planck Mass:

3DUT equation:

$$m_p = \frac{M_{pr}}{10^{-20} \times \left(8 - \frac{1}{\pi}\right)} = 2.17878876987638630 \times 10^{-8} \text{ Kg}$$

(CODATA 2.17651 x 10^{-8} Kg)

Classical equation:

$$m_p = \sqrt{\frac{h \times c}{2\pi \times G}} = 2.17878876987638630 \times 10^{-8} \text{ Kg}$$

Planck charge :

3DUT equation:

$$q_p = \sqrt{\frac{R_{pr} \times M_{pr} \times \pi}{\mu_0}} = 1.87575602838162393 \times 10^{-18} \text{ C}$$

(CODATA 1.8755 x 10^{-38} C)

Classical equations:

$$q_p = \sqrt{\frac{r_e \times m_e \times 4\pi}{\alpha \times \mu_0}} = 1.87575602838162393 \times 10^{-18} \text{ C}$$

$$q_p = \sqrt{\frac{l_p \times m_p \times 4\pi}{\mu_0}} = 1.87575602838162393 \times 10^{-18} \text{ C}$$

$$q_p = \frac{e}{\sqrt{\alpha}} = 1.87575602838162393 \times 10^{-18} \text{ C}$$

Rydberg constant : (φ has a dimension of Time in sec)

3DUT equation:

$$R_\infty = \frac{\alpha^2}{\varphi \times 10^{-20} \times c} = 1.09757694982436019 \times 10^{7} \text{ m}^{-1}$$

(CODATA 1.09737 x 10^{7} m^{-1})

Classical equations:

$$R_\infty = \frac{\alpha^2}{2\times\lambda_e} = 1.09757694982436019 \ \text{x}\ 10^{7}\ \text{m}^{-1}$$

$$R_\infty = \frac{\alpha}{4\pi\times a_0} = 1.09757694982436019 \ \text{x}\ 10^{7}\ \text{m}^{-1}$$

Bohr radius: (φ has a dimension of Time in sec)

3DUT equation:

$$a_0 = \frac{\varphi\times10^{-20}\times c}{4\pi\times\alpha} = 5.29025758618675779 \ \text{x}\ 10^{-11}\ \text{m}$$

(CODATA 5.2917 x 10^{-11} m)

Classical equations:

$$a_0 = \frac{\alpha}{4\pi\times R_\infty} = 5.29025758618675777 \ \text{x}\ 10^{-11}\ \text{m}$$

$$a_0 = \frac{h}{2\pi\times m_e\times c\times\alpha} = 5.29025758618675777 \ \text{x}\ 10^{-11}\ \text{m}$$

Bohr magneton: (φ has a dimension of Time in sec)

3DUT equation:

$$\mu_B = \frac{\varphi\times10^{-20}\times c^2\times e}{8\pi} = 9.27099544192066538 \ \text{x}\ 10^{-24}\ \text{J.T}^{-1}$$

(CODATA 9.27400 x 10^{-24} J.T^{-1})

Classical equation:

$$\mu_B = \frac{e\times h}{4\pi\times m_e} = 9.27099544192066538 \ \text{x}\ 10^{-24}\ \text{J.T}^{-1}$$

The above results have been achieved starting with the official value for the speed of light. We believe that the value of the speed of light can also be calculated. (As we set the scale of our unit of length and we set the scale of our unit of time, we set the scale of our reality)

Although the equations below do not comply with conventional dimensional analysis, we believe they are correct if the fundamental dimensions are linked, as suggested by the 3D Universe Theory ($T=L^2$).

Permittivity of free space:

$$\varepsilon_0 = \left(1 - \frac{1}{8\pi}\right)^3 \times 10^{-11} = 8.8532 \text{ x } 10^{-12} \text{ F/m (CODATA } 8.8541 \text{ x } 10^{-12} \text{ F/m)}$$

From this equation we get the speed of light:

$$c = \sqrt{\frac{1}{\mu_0 \times \varepsilon_0}} = \sqrt{\frac{1}{4\pi \times \left(1 - \frac{1}{8\pi}\right)^3}} \times 10^9 = 299809143.311330022 \text{ m/sec}$$

(CODATA 299792458 m/s)

Using the above speed of light, we get slightly different values but all equations still match perfectly and we have a more intuitive equation for the fine structure constant (with c^2 being the inverse of an area), it appears to be the ratio of 3 areas.

$$\alpha = \frac{\left(1 - \frac{1}{8\pi}\right)}{\varphi^2 \times 16\pi} = \frac{1}{(8\pi - 1)^2 \times \varphi^2 \times c^2} \times 10^2 = 7.29661884504513027 \text{ x } 10^{-3}$$

(CODATA 7.29735 x 10^{-3})

Conclusion:

The Universe fundamental constants can be derived simply from φ (the golden ratio) and π, hinting that the Universe is purely mathematical and just pure information.

Universe self-similarity on different size scales:

The 3D Universe Theory describes the Universe as a growing sphere of Universal Bits (UB's). Each UB is a Planck Length in size and the sphere is growing at the speed of light.

If we use the Lambda-CDM concordance model value for the age of the Universe, we have:

Age of Universe:

A_u = 13,798 x 10^9 years = 4.3543 x 10^{17} sec = 8,0769 x 10^{60} Planck times

Radius of Universe:

$R_u = c \times A_u$ = 1.3053 x 10^{26} m

If we call N the number of UB's composing the Universe radius (either as a Time dimension or as a Length dimension), we have:

$$N = \frac{A_u}{t_p} = \frac{R_u}{l_p} = 8.0769 \times 10^{60}$$

with

$A_u = t_p \times N$ = 4.3543 x 10^{17} sec

$R_u = l_p \times N$ = 1.3053 x 10^{26} m

Where t_p = Planck Time and l_p = Planck length

N can be seen as a scale factor for the Universe, and if we follow the same scaling rule for the Mass dimension as for the Time and Length, we get the following equation:

Mass of Universe:

$M_u = m_p \times N$ = 1,7579 x 10^{53} kg

Where m_p = Planck Mass

Grouping together the 3D Universe Theory equations, we can show the self-similarity of the Universe on different size scales as follows:

$$\frac{M_u}{m_p} = \frac{R_u}{l_p} = \frac{A_u}{t_p} = \frac{\lambda_u}{\lambda_p} = \mathrm{N}$$

$$l_p \times m_p = \frac{R_{pr} \times M_{pr}}{4} = \frac{r_e \times m_e}{\alpha} = \frac{R_u \times M_u}{N^2} = \frac{R_u \times m_p}{N}$$

$$\frac{l_p}{m_p} = \frac{R_u}{M_u} = \frac{R_{pr} \times \alpha_{Gp}}{4 \times M_{pr}} = \frac{r_e \times \alpha_{Ge}}{\alpha \times m_e}$$

$$m_p \times \lambda_p = M_{pr} \times \lambda_{pr} = m_e \times \lambda_e = m_n \times \lambda_n = M_u \times \lambda_u = \frac{h}{c}$$