

# Calculation of the Universe fundamental constants

3D Universe Theory

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We show that starting with the speed of light,  $\phi$  (the golden ratio) and the ratio  $8\pi-1$ , 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 ( $t_p$ )** =  $5.3866 \times 10^{-44}$  sec (CODATA  $5.3910 \times 10^{-44}$  sec)

**Planck length ( $l_p$ )** =  $1.6148 \times 10^{-35}$  m (CODATA  $1.6161 \times 10^{-35}$  m)

**Fine structure constant ( $\infty$ )** =  $7.2966 \times 10^{-3}$  (CODATA  $7.2973 \times 10^{-3}$ )

**Gravitational coupling constant ( $\infty_G$ )** =  $5.9008 \times 10^{-39}$  (CODATA  $5.906 \times 10^{-39}$ )

**Von Klitzing constant ( $R_k$ )** =  $2.5815 \times 10^{-4}$   $\Omega$  (CODATA  $2.5812 \times 10^{-4}$   $\Omega$ )

**Josephson constant ( $K_J$ )** =  $4.8351 \times 10^{14}$  Hz.V<sup>-1</sup> (CODATA  $4.8359 \times 10^{14}$  Hz.V<sup>-1</sup>)

**Planck constant ( $h$ )** =  $6.6275 \times 10^{-34}$  J.s (CODATA  $6.6260 \times 10^{-34}$  J.s)

**Elementary charge ( $e$ )** =  $1.6022 \times 10^{-19}$  C (CODATA  $1.6021 \times 10^{-19}$  C)

**Electron Compton frequency ( $\nu_e$ )** =  $1.2360 \times 10^{20}$  Hertz (CODATA  $1.2356 \times 10^{20}$  Hertz)

**Electron Compton wavelength ( $\lambda_e$ )** =  $2.4253 \times 10^{-12}$  m (CODATA  $2.4263 \times 10^{-12}$  m)

**Classical electron radius ( $r_e$ )** =  $2.8165 \times 10^{-15}$  m (CODATA  $2.8179 \times 10^{-15}$  m)

**Electron mass ( $m_e$ )** =  $9.1149 \times 10^{-31}$  Kg (CODATA  $9.1093 \times 10^{-31}$  Kg)

**Proton/electron mass ratio ( $\mu$ )** = 1836.19 (CODATA 1836.15)

**Proton Compton wavelength ( $\lambda_{pr}$ )** =  $1.3208 \times 10^{-15}$  m (CODATA  $1.3214 \times 10^{-15}$  m)

**Proton charge radius ( $R_{pr}$ )** =  $0.8408 \times 10^{-15}$  m (R. Pohl  $0.8408 \times 10^{-15}$  m)

**Proton mass ( $M_{pr}$ )** =  $1.6736 \times 10^{-27}$  Kg (CODATA  $1.6726 \times 10^{-27}$  Kg)

**Gravitational constant ( $G$ )** =  $6.6613 \times 10^{-11}$  m<sup>3</sup> kg<sup>-1</sup> s<sup>-2</sup> (CODATA  $6.6738 \times 10^{-11}$  m<sup>3</sup> kg<sup>-1</sup> s<sup>-2</sup>)

**Planck mass ( $m_p$ )** =  $2.1787 \times 10^{-8}$  Kg (CODATA  $2.1765 \times 10^{-8}$  Kg)

**Planck charge ( $Q_p$ )** =  $1.8757 \times 10^{-18}$  C (CODATA  $1.8755 \times 10^{-18}$  C)

**Rydberg constant ( $R_\infty$ )** =  $1.0975 \times 10^7$  m<sup>-1</sup> (CODATA  $1.0973 \times 10^7$  m<sup>-1</sup>)

**Bohr radius ( $a_0$ )** =  $5.2902 \times 10^{-11}$  m (CODATA  $5.2917 \times 10^{-11}$  m)

**Bohr magneton ( $\mu_b$ )** =  $9.2709 \times 10^{-24}$  J.T<sup>-1</sup> (CODATA  $9.2740 \times 10^{-24}$  J.T<sup>-1</sup>)

**Permittivity of free space ( $\epsilon_0$ )** =  $8.8532 \times 10^{-12}$  F/m (CODATA  $8.8541 \times 10^{-12}$  F/m)

**Permeability of free space ( $\mu_0$ )** = exact (CODATA  $4\pi \times 10^{-7}$  N.A<sup>-2</sup>)

**Planck time:** ( $\varphi$  has a dimension of Time)

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

(CODATA 5.39106 x 10<sup>-44</sup> s)

**Planck length:**

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

(CODATA 1.61619 x 10<sup>-35</sup> m)

**Fine structure constant :**

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

(CODATA 7.29735 x 10<sup>-3</sup>)

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

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

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

$$\alpha = \frac{e^2}{q_p^2} = 7.29661884504513027 \times 10^{-3}$$

**Gravitational coupling constant:**

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

(CODATA 5.906 x 10<sup>-39</sup>)

$$\alpha_G = \left( \frac{M_{pr}}{m_p} \right)^2 = 5.90083630047016863 \times 10^{-39}$$

**Von Klitzing constant:**

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

(CODATA 2.58128 x 10<sup>4</sup> Ω)

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

**Josephson constant:**

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

(CODATA 4.83597 x 10<sup>14</sup> Hz.V<sup>-1</sup>)

**Planck constant :**

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

(CODATA 6.62606 x 10<sup>-34</sup> J.s)

**Elementary charge :** ( $\phi$  has a dimension of Time in sec)

$$e = \sqrt{\frac{h \times \left(1 - \frac{1}{8\pi}\right)}{\phi^2 \times 8\pi \times \mu_0 \times c}} = 1.60227545973587383 \times 10^{-19} \text{ C}$$

(CODATA  $1.60217 \times 10^{-19} \text{ C}$ )

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

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

**Electron Compton frequency:** ( $\phi$  has a dimension of Time in sec)

$$\nu_e = \frac{2}{\phi \times 10^{-20}} = 1.23606797749978970 \times 10^{20} \text{ Hertz}$$

(CODATA  $1.2356 \times 10^{20} \text{ Hertz}$ )

**Electron Compton wavelength:** ( $\phi$  has a dimension of Time in sec)

$$\lambda_e = \frac{\phi \times 10^{-20} \times c}{2} = 2,42537193307437660 \times 10^{-12} \text{ m}$$

(CODATA  $2.4263 \times 10^{-12} \text{ m}$ )

**Classical electron radius:** ( $\phi$  has a dimension of Time in sec)

$$r_e = \frac{\phi \times 10^{-20} \times c \times \alpha}{4\pi} = 2.81656734409730746 \times 10^{-15} \text{ m}$$

(CODATA  $2.81794 \times 10^{-15} \text{ m}$ )

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

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

**Electron mass:** ( $\varphi$  has a dimension of Time in sec)

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

(CODATA  $9.109 \times 10^{-31} \text{ Kg}$ )

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

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

**Proton/Electron mass ratio:**

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

(CODATA 1836.15)

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

**Proton Compton wavelength:**

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

(CODATA  $1.3214 \times 10^{-15} \text{ m}$ )

**Proton charge radius (measured with muon):**

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

(R. Pohl  $1.6817 \times 10^{-15} \text{ m}$ )

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

**Proton mass:**

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

(CODATA  $1.6726 \times 10^{-27} \text{ Kg}$ )

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

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

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

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

**Gravitational constant:**

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

(CODATA  $6.67384 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$ )

$$G = \frac{r_e \times c^2 \times \alpha_G}{\alpha \times m_e} = 6.66137451756776190 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$$

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

**Planck Mass:**

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

(CODATA  $2.17651 \times 10^{-8} \text{ Kg}$ )

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

**Planck charge :**

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

(CODATA  $1.8755 \times 10^{-38} \text{ C}$ )

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

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

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

**Rydberg constant :** ( $\varphi$  has a dimension of Time in sec)

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

(CODATA  $1.09737 \times 10^7 \text{ m}^{-1}$ )

**Bohr radius:** ( $\varphi$  has a dimension of Time in sec)

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

(CODATA  $5.2917 \times 10^{-11} \text{ m}$ )

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

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

**Bohr magneton:** ( $\varphi$  has a dimension of Time in sec)

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

(CODATA  $9.27400 \times 10^{-24} \text{ J.T}^{-1}$ )

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

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 our unit of length, we set our fundamental unit of time and 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:**

$$\epsilon_0 = \left(1 - \frac{1}{8\pi}\right)^3 \times 10^{-11} = 8.8532 \times 10^{-12} \text{ F/m (CODATA } 8.8541 \times 10^{-12} \text{ F/m)}$$

**From this equation we get the speed of light:**

$$c = \sqrt{\frac{1}{\mu_0 \times \epsilon_0}} = \sqrt{\frac{1}{4\pi \times \left(1 - \frac{1}{8\pi}\right)^3}} \times 10^9 = 299809143.311330022 \text{ m/sec}$$

(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.

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

(CODATA 7.29735 x 10<sup>-3</sup>)

**Conclusion:**

It looks like the Universe fundamental constants can be derived simply from  $\varphi$  (the golden ratio) and  $\pi$ , hinting that the Universe is purely mathematical and just pure information.