

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 $8\pi-1$, 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) = 5.3866×10^{-44} sec (CODATA 5.3910×10^{-44} sec)

Planck length (l_p) = 1.6148×10^{-35} m (CODATA 1.6161×10^{-35} m)

Fine structure constant (∞) = 7.2966×10^{-3} (CODATA 7.2973×10^{-3})

Gravitational coupling constant (proton) (∞_G) = 5.9008×10^{-39} (CODATA 5.906×10^{-39})

Gravitational coupling constant (electron) (∞_G) = 1.7501×10^{-45} (CODATA 1.7518×10^{-45})

Von Klitzing constant (R_k) = 2.5815×10^{-4} Ω (CODATA 2.5812×10^{-4} Ω)

Josephson constant (K_J) = 4.8351×10^{14} Hz.V⁻¹ (CODATA 4.8359×10^{14} Hz.V⁻¹)

Planck constant (h) = 6.6275×10^{-34} J.s (CODATA 6.6260×10^{-34} J.s)

Elementary charge (e) = 1.6022×10^{-19} C (CODATA 1.6021×10^{-19} C)

Electron Compton frequency (ν_e) = 1.2360×10^{20} Hertz (CODATA 1.2356×10^{20} Hertz)

Electron Compton wavelength (λ_e) = 2.4253×10^{-12} m (CODATA 2.4263×10^{-12} m)

Classical electron radius (r_e) = 2.8165×10^{-15} m (CODATA 2.8179×10^{-15} m)

Electron mass (m_e) = 9.1149×10^{-31} Kg (CODATA 9.1093×10^{-31} Kg)

Proton/electron mass ratio (μ) = 1836.19 (CODATA 1836.15)

Proton Compton wavelength (λ_{pr}) = 1.3208×10^{-15} m (CODATA 1.3214×10^{-15} m)

Proton charge radius (R_{pr}) = 0.8408×10^{-15} m (R. Pohl 0.8408×10^{-15} m)

Proton mass (M_{pr}) = 1.6736×10^{-27} Kg (CODATA 1.6726×10^{-27} Kg)

Gravitational constant (G) = 6.6613×10^{-11} m³ kg⁻¹ s⁻² (CODATA 6.6738×10^{-11} m³ kg⁻¹ s⁻²)

Planck mass (m_p) = 2.1787×10^{-8} Kg (CODATA 2.1765×10^{-8} Kg)

Planck charge (Q_p) = 1.8757×10^{-18} C (CODATA 1.8755×10^{-18} C)

Rydberg constant (R_∞) = 1.0975×10^7 m⁻¹ (CODATA 1.0973×10^7 m⁻¹)

Bohr radius (a_0) = 5.2902×10^{-11} m (CODATA 5.2917×10^{-11} m)

Bohr magneton (μ_b) = 9.2709×10^{-24} J.T⁻¹ (CODATA 9.2740×10^{-24} J.T⁻¹)

Permittivity of free space (ϵ_0) = 8.8532×10^{-12} F/m (CODATA 8.8541×10^{-12} F/m)

Permeability of free space (μ_0) = exact (CODATA $4\pi \times 10^{-7}$ 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)

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

(CODATA 5.39106×10^{-44} s)

Planck length:

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

(CODATA 1.61619×10^{-35} m)

Fine structure constant :

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

(CODATA 7.29735×10^{-3})

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

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

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

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

Gravitational coupling constant (proton):

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

(CODATA 5.906 x 10⁻³⁹)

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

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

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

(CODATA 1.7518 x 10⁻⁴⁵)

$$\alpha_G = \left(\frac{m_e}{m_p} \right)^2 = 1.75016175363252306 \times 10^{-45}$$

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 10⁴ Ω)

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 Q³

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 10¹⁴ Hz.V⁻¹)

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 10⁻³⁴ J.s)

Elementary charge :

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

(CODATA 1.60217 x 10⁻¹⁹ 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: (φ has a dimension of Time in sec)

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

(CODATA 1.2356 x 10²⁰ Hertz)

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

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

(CODATA 2.4263 x 10⁻¹² m)

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

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

(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: (φ 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)

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

Proton Compton wavelength:

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

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

Proton charge radius (measured with muon):

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

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

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

Proton mass:

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

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

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

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

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

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

Gravitational constant:

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

(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 x 10⁻⁸ 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 x 10⁻³⁸ 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 : (φ 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 x 10⁷ m⁻¹)

Bohr radius: (φ 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 x 10⁻¹¹ 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: (φ 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 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:

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

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 7.29735×10^{-3})

Conclusion:

It looks like 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.