Theme: A Theoretical Perspective Based on the Metre-Second System of Units and a Dimensioned Fine Structure Constant

Topic: Derivation of the Higgs Field and the Mass of the Higgs Boson

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Abstract

In this paper we use the Metre-Second System (MS System) of Units to derive a precise theoretical value for the magnitude of the Higgs field and explore its implications.

E_H = 9.638732018E-32 [$m^{-2}s^{-4}$] Higgs field

In addition, we use the value of the Higgs field to derive the mass values for the Higgs boson, the W boson, the Tau lepton, the proton and the electron.

M_H = 2.235682861E-25 kg [m^1s^{-6}] = 125.412616 GeV/c^2 mass of Higgs boson
M_W = 1.433217602E-25 kg [m^1s^{-6}] = 80.397576348 GeV/c^2 mass of W boson
M_τ = 3.168372989E-27 kg [m^1s^{-6}] = 1777.3269 MeV/c^2 mass of Tau lepton
m_p = 1.672621898E-27 kg [m^1s^{-6}] = 938.27211 MeV/c^2 proton rest mass
m_e = 9.109383558E-31 kg [m^1s^{-6}] = 0.51099894 MeV/c^2 electron rest mass

Keywords: Dimensional Analysis, Metre-Second System of Units, Dimensional Shift, Fine structure constant, Higgs Field, mass, Higgs boson, W boson, Tau lepton, proton, electron, gravity

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Introduction

The “Metre-Second System of Units” (MS system) is a novel approach to units of measurement in that it describes all physical properties in terms of two fundamental units of measurement that being distance in metres (m) and time in seconds (s). The kilogram, Ampere (Coulomb), and the Kelvin of the SI system are changed from fundamental units of measurement to derived units.

The MS System reveals that current systems of units such as the International System of Units (SI system) and its precursor the Metre-Kilogram-Second (MKS and later MKSA) are incapable of giving a complete description of electromagnetic phenomena because these systems of units do not provide a proper means by which mass and electric charge can be compared. As a result these systems suffer from an issue referred to as “dimensional shift” which inadvertently causes the incorrect assignment of units of measurement to certain physical properties related to electromagnetism. This detrimentally alters the interpretation of physics, making quantum mechanics difficult to comprehend, and ultimately prevents the unification of physics.

The goal of the MS System is to reveal this issue to the scientific community and provide an alternative system of units which is better able to describe and interpret electromagnetic phenomena without the limitations and inherent difficulties found in other systems of units.

The MS System also features the MS Table which is a distance-time dimensionality matrix which gives a visual perspective of how physical properties relate to one another.

Here is a comparison summary of the two approaches.

Conventional approach:

a) Mainstream physics did not understand the true meaning of the fine structure constant and inadvertently transferred the units of measurement which would have gone to the fine structure constant over to other physical properties related to electromagnetism.
b) As a consequence, the fine structure constant appears dimensionless.
c) On a distance-time matrix the physical properties will appear "dimensionally shifted" and out of position. This makes it difficult if not impossible to form a proper distance-time matrix. Any matrix which is constructed will be disorganized and will not show patterns.
d) Overall, physics appears unnecessarily more complicated than it needs to be.

MS System approach:

a) The MS System has identified the units of measurement of the fine structure constant as $[m^1s^2]$.
b) These units of measurement are removed from the affected physical properties which incorrectly received them and are placed back with the fine structure constant.
c) On the distance-time matrix, the affected physical properties are shifted back to their correct positions thus restoring the organization and pattern of the matrix.
d) A "*dimensioned*" fine structure constant is then used to re-establish the relationships between physical properties.
e) Using a dimensioned fine structure constant greatly simplifies the interpretation of electromagnetic phenomena.

What follows, is an interpretation of the Higgs field, the Higgs boson, and other related phenomena using the MS System of Units and a dimensioned fine structure constant.

This paper uses expressions which are not possible in mainstream physics. In order to dimensionally justify the expressions, it is recommended that the reader print out (Appendix A) which contains the values and the MS units of measurements for all physical constants used in this paper.

The MS Units of Measurement for a Field

In the MS System, the unit for a field is $[m^{-2}s^{-4}]$.

This can be converted to SI units using the following:

electric charge, C = $[m^5s^{-2}]$
mass, kg = $[m^1s^{-6}]$

So $[m^{-2}s^{-4}]$ would be equivalent to $[m^1s^{-6}]\ [m^2s^0]/[m^5s^{-2}]$ and $[m^{-2}s^{-4}] = \{kg\ m^2/C\}$

The current definition of a field in mainstream physics which is the {N/C} or $\{kg\ m/(s^2\ C)\}$ is therefore incorrect and must be modified to $\{kg\ m^2/C\}$ if one is to show the same relationships as the MS System.

The Higgs Field

The value of the Higgs field can be determined in several ways. The easiest calculation involves the Planck constant:

$$E_H = \frac{4\pi \quad h}{\lambda_{c,e}\ \lambda_{c,p}\ c^3} = 9.638732018E\text{-}32\ kg\ m^2/C\ [m^{-2}s^{-4}] \quad \text{Higgs field}$$

Note: Obviously mainstream physics does not recognize this to be a field simply from the difference in the units of measurement: $\{kg\ m^2/C\}$ vs $\{kg\ m/(s^2\ C)\}$. It is hoped that the reader keeps an open mind and notices the simplicity of these calculations versus the complexity of the calculations offered by mainstream physics.

The Relationship between a Field and the Boltzmann Constant

A field on the MS Table, is located at cell $[m^{-2}s^{-4}]$ which is immediately to the right of the Boltzmann constant at cell $[m^{-3}s^{-4}]$. The magnitude of a field is determined by multiplying the Boltzmann constant by a particular radius or wavelength which defines that field.

The radius which defines the Higgs field is:

$$r_H = \frac{4\pi \quad e}{\lambda_{c,e}\ \lambda_{c,p}\ c^2} = \frac{4\pi\ dV_e}{\lambda_{c,e}\ \lambda_{c,p}} = 6.987068108E\text{-}9\ m \qquad \text{Higgs field radius}$$

The Higgs field is said to give rise to the mass of elementary particles so we can see that the Higgs radius incorporates features of both the proton and electron.

Using the Higgs radius and the Boltzmann constant, the magnitude of the Higgs field is:

$E_H = k_B \, r_H = 9.638732018E\text{-}32 \text{ kg m}^2/\text{C } [\text{m}^{-2}\text{s}^{-4}]$ Higgs field

We can relate the Higgs field to the mass of the proton and electron in the following way:

Since, $h = \lambda_{c,e} \, m_e \, c = \lambda_{c,p} \, m_p \, c$ then $\lambda_{c,e} \, m_e = \lambda_{c,p} \, m_p$

$$\frac{1}{\lambda_{c,p}} = \frac{m_p}{m_e \, \lambda_{c,e}}$$

Substituting this into the r_H expression, gives the Higgs field radius in terms of the mass of the proton and the mass of the electron.

$$r_H = \frac{m_p \, 4\pi \, dV_e}{m_e \, (\lambda_{c,e})^2} = 6.987068108E\text{-}9 \text{ m} \qquad \text{Higgs field radius}$$

The Higgs radius can also be defined as follows:

$$r_H = \frac{4\pi \, \alpha^2 \, \lambda_{c,\gamma} \, m_p}{c^2 \, \lambda_{c,e}} = \frac{4\pi \, \alpha^2 \, \lambda_{c,\gamma} \, m_e}{c^2 \, \lambda_{c,p}} = \frac{4\pi \quad m_p}{k_B \, c^2 \, \lambda_{c,e}} = \frac{4\pi \quad m_e}{k_B \, c^2 \, \lambda_{c,p}} = 6.987068108E\text{-}9 \text{ m}$$

The Higgs field expression in its simplest form showing its distinct relationship with the masses of the proton and the electron is:

$$\boldsymbol{E_H = \frac{4\pi \, m_p}{c^2 \, \lambda_{c,e}} = \frac{4\pi \, m_e}{c^2 \, \lambda_{c,p}} = 9.638732018E\text{-}32 \text{ kg m}^2/\text{C } [\text{m}^{-2}\text{s}^{-4}]} \quad \textbf{Higgs field}$$

Clearly we can see the importance of this expression.

There is no other expression in physics which encompasses the relationship between the Higgs field and the two most fundamental particles of nature in such a simple way.

Mainstream physics gives the impression that the Higgs field gives rise to the mass of fundamental particles. This is somewhat misleading because one could argue that it is the mass of the electron and proton which gives rise to the Higgs field. If the Big Bang theory is correct and the universe was in a hotter state in the past, then the Higgs field and Higgs boson would certainly lead to the formation of protons and electrons as the temperature cooled.

Rather than relying on speculation as to whether the Big Bang actually occurred, it might be better to say that the Higgs field supports the creation of the proton and the electron, as the proton and electron supports the creation of the Higgs field.

The MS system reveals that the relationship between the Higgs field (E_H) and the mass of the Higgs boson (M_H) is as follows:

$$E_H = \frac{M_H}{c^2 (G\,\alpha\, m_e)^{1/4}}$$

where,

$(G\,\alpha\, m_e)^{1/4} = 2.580767528E\text{-}11$ m [$m^1 s^0$] (see Appendix B for further details)

This will be used to determine the mass of the Higgs boson.

Mass of Higgs Boson

Having determined the value of the Higgs field, we can now proceed to determine the mass of the Higgs boson. Solving the previous expression for M_H we get:

$$M_H = E_H\, c^2 (G\,\alpha\, m_e)^{1/4} = \frac{4\pi\, h\, (G\,\alpha\, m_e)^{1/4}}{\lambda_{c,e}\ \lambda_{c,p}\ c} = 2.235682861E\text{-}25 \text{ kg } [m^1 s^{-6}]$$

This is equivalent to 125.412616305 GeV/c^2.

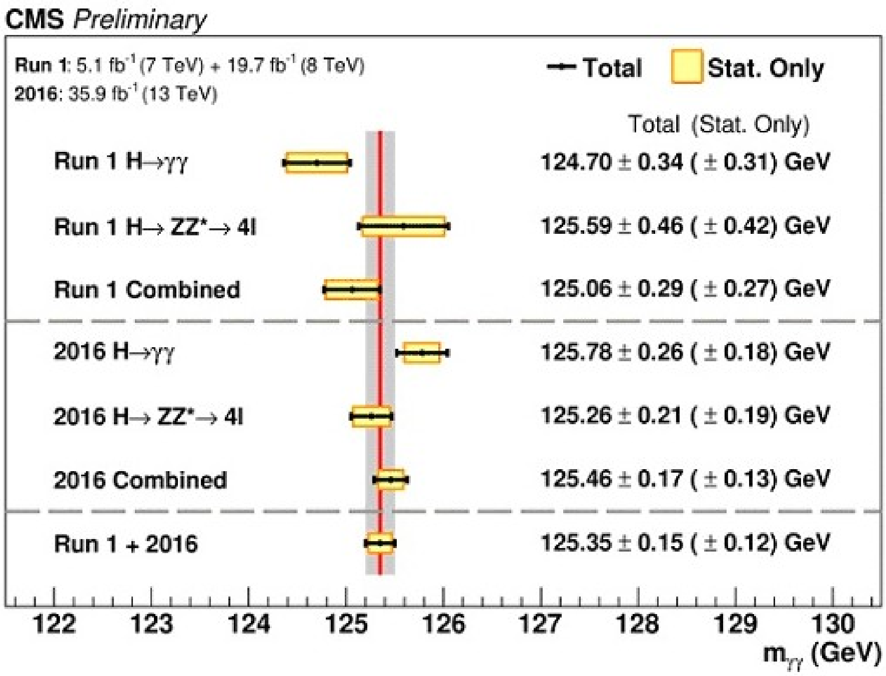
Alternatively we can determine the same mass using the proton mass and the electron Compton wavelength, or the electron mass and the proton Compton wavelength.

$$M_H = \frac{4\pi\, m_p\, (G\,\alpha\, m_e)^{1/4}}{\lambda_{c,e}} = \frac{4\pi\, m_e\, (G\,\alpha\, m_e)^{1/4}}{\lambda_{c,p}} = \frac{4\pi\, h\, (G\,\alpha\, m_e)^{1/4}}{\lambda_{c,e}\ \lambda_{c,p}\ c} = 2.235682861E\text{-}25 \text{ kg}$$

Since the Higgs boson is observed at higher energies, these relationships suggest that the Higgs boson is a quantized manifestation of a proton and an electron which is observed at lower energies.

Referring to Table 1, we can see that this theoretical estimate is in line with experimental results.

Table 1



Different measurements of the Higgs boson mass performed by the CMS collaboration.

Table 1 (Source: https://cms.cern/news/cms-precisely-measures-mass-higgs-boson)

Other Higgs Boson Mass Calculations

One of the advantages of using the MS system is that it allows one to calculate the same value in multiple ways. This is because all physical constants are derived from combinations of only seven fundamental universal parameters: five lengths and two velocities. By understanding which of these components make up the value and units of measurement of a particular physical constant, it is easy to determine which other physical constants are needed to produce the same result both numerically and dimensionally.

The following are additional methods of calculating the mass of the Higgs boson using the MS system of units.

$$M_H = \frac{k_B\, e\, 4\pi(G\, \alpha\, m_e)^{1/4}}{\lambda_{c,e}\, \lambda_{c,p}} = \frac{h}{c}\,\frac{4\pi(G\, \alpha\, m_e)^{1/4}}{\lambda_{c,e}\, \lambda_{c,p}} = 2.235682861\text{E-}25 \text{ kg } [m^1 s^{-6}]$$

Mass of Proton

Knowledge of the Higgs field gives us the opportunity to calculate the mass of the proton in a way which is unique in comparison to other expressions. In almost all other expressions one finds that the mass of the proton and its Compton wavelength appear together at the same time. Thus it is impossible to determine one value without having knowledge of the other. (ie $h = \lambda_{c,p} m_p c$)

The Higgs field expression on the other hand, provides us with a unique opportunity to calculate a precise theoretical value for the mass of the proton or its Compton wavelength using the mass of the Higgs boson or the Higgs field value.

Taking the Higgs field expression, and isolating for the mass of the proton we find that the mass of the proton in terms of the Higgs field is *dependent on the Compton wavelength of the electron*:

$$m_p = \frac{E_H c^2 \lambda_{c,e}}{4\pi} = \frac{M_H \lambda_{c,e}}{4\pi (G \alpha m_e)^{1/4}} = 1.672621898\text{E-}27 \text{ kg } [m^1 s^{-6}] \quad \text{proton rest mass}$$

Mass of Electron

Similarly, the mass of the electron in terms of the Higgs field is *dependent on the Compton wavelength of the proton*:

$$m_e = \frac{E_H c^2 \lambda_{c,p}}{4\pi} = \frac{M_H \lambda_{c,p}}{4\pi (G \alpha m_e)^{1/4}} = 9.109383558\text{E-}31 \text{ kg } [m^1 s^{-6}] \quad \text{electron rest mass}$$

Clearly we can see that the electron and the proton rely on the Higgs field to maintain the close relationship these two fundamental particles have with each other.

Mass of Tau Lepton (τ)

In terms of the Higgs field and the mass of the Higgs boson, the mass of the Tau lepton is:

$$M_\tau = \frac{\alpha^2 \mu_B \, 4\pi h^2}{G \mu_e E_H c^2 e} = \frac{\alpha^2 \mu_B h^2 4\pi (G \alpha m_e)^{1/4}}{G \mu_e M_H e} = 3.168372989\text{E-}27 \text{ kg} = 1777.3269 \text{ MeV}/c^2$$

Alternatively it can be determined by:

$$M_\tau = \frac{\alpha^2 \mu_B h c \lambda_{c,e} \lambda_{c,p}}{G \mu_e e} = \frac{m_\gamma c^2 \mu_B \lambda_{c,e} \lambda_{c,p}}{G k_B \mu_e e} = 3.168372989\text{E-}27 \text{ kg } [m^1 s^{-6}]$$

Electromagnetic Force

In the MS System, what is referred to as electromagnetic or electrostatic force (F_{em}) is not considered to be a true force but instead is considered to be a pseudo force. In reality it has been determined to be a moment of inertia.

For this reason we assign the SI unit {kg m^2} to the pseudo electrostatic force (F_{em}) which in turn modifies the unit of a field *E*.

When an electric charge is placed in an electromagnetic field, the charged particle experiences an electromagnetic force. That force can be calculated by multiplying the electric field by electric charge:

$$F_{em} = E\,q$$

For this expression, the new assignment of SI units are shown in curved brackets,{} and the corresponding MS units are shown in square brackets []:

F_{em} {kg m^2} or [m^3s^{-6}] - moment of inertia or pseudo electromotive or electric force
E {kg m^2/C} or [$m^{-2}s^{-4}$] - electric field
q {C} or [m^5s^{-2}] - electric charge

A *dimensioned* fine structure constant (See Appendix C) is then used to equate the pseudo electromagnetic force (F_{em}) or more correctly moment of inertia with mechanical force (F):

$$F = \frac{F_{em}\{\text{kg m}^2\}}{\alpha\,\{\text{m}^1\text{s}^2\}} = F\ \{\text{kg m/s}^2\} \qquad F = \frac{F_{em}[\text{m}^3\text{s}^{-6}]}{\alpha\,[\text{m}^1\text{s}^2]} = F\ [\text{m}^2\text{s}^{-8}]$$

Electromagnetic Force on a Charged Particle in the Higgs Field

When a particle with elementary charge (e) is placed in the Higgs field (E_H) an electromagnetic force of 1.54429E-50 kg m^2 is produced:

$$F_{em} = E_H\,e = 1.544295109\text{E-50 kg m}^2\ [\text{m}^3\text{s}^{-6}]$$

Additional electromagnetic force calculations:

$$F_{em} = \frac{4\pi\, m_p\, e}{c^2\,\lambda_{c,e}} = \frac{4\pi\, m_e\, e}{c^2\,\lambda_{c,p}} = \frac{M_H \quad e}{c^2\,(G\,\alpha\, m_e)^{1/4}} = 1.544295109\text{E-50 kg m}^2\,[\text{m}^3\text{s}^{-6}]$$

$$F_{em} = E_H\,e = \frac{\alpha^2\,\mu_B\,4\pi\,h^2}{G\ \mu_e\,M_\tau\,c^2} = 1.544295109\text{E-50 kg m}^2\,[\text{m}^3\text{s}^{-6}]$$

The unit {kg m^2} implies that electromagnetic force is equal to the product of the mass of a particle and the area of a Gaussian surface. If we consider the electromagnetic force ($F_{em,H}$) produced by the mass of the Higgs boson interacting with an area defined by the Compton wavelength of the proton and the electron, we find:

$$F_{em,H} = M_H \lambda_{c,e} \lambda_{c,p} = m_e \lambda_{c,e} 4\pi (G \alpha m_e)^{1/4} = 7.167935174E\text{-}52 \text{ kg m}^2 [m^3 s^{-6}]$$

This is also equivalent to:

$$F_{em,H} = m_e \lambda_{c,e} 4\pi (G \alpha m_e)^{1/4} = 7.167935174E\text{-}52 \text{ kg m}^2 [m^3 s^{-6}]$$

The ratio of the electromagnetic force produced from a charged particle in the Higgs field (E_H e) with the force produced by a Higgs boson ($F_{em,H}$) within the Gaussian surface is a ratio of 21.54 times:

$$\frac{E_H \cdot e}{F_{em,H}} = \frac{1.544295109E\text{-}50 \text{ kg m}^2}{7.167935174E\text{-}52 \text{ kg m}^2} = 21.54449045$$

To equate these two forces would require identifying the two particles whose ratio is also exactly 21.54 times.

The particles which satisfy this condition are the W boson and an alpha particle.

An alpha particle is a helium-4 nucleus minus 2 electrons and is comprised of 2 neutrons and 2 protons. A proton has a mass of 1.6726219E–27 kg. A neutron has a mass of 1.6749275E–27 kg. Therefore an alpha particle, He^{2+} has a mass of around 6.6950986E–27 kg minus the binding energy.

The reported CODATA mass value for an alpha particle is, M_α = 6.644657E-27 kg.

$$\frac{M_W^*}{M_\alpha} = \frac{E_H \cdot e}{F_{em,H}} = 21.54449045$$

Mass of W Boson

Since we know the mass of the Helium nucleus or alpha particle, we can now determine the mass of the W boson:

$$M_W^* = \frac{E_H \cdot e \cdot M_\alpha}{F_{em,H}} = 21.54449045 \text{ x } 6.644657E\text{-}27 \text{ kg.} = 1.431557493E\text{-}25 \text{ kg } [m^1 s^{-6}]$$

*Note: When we attempt to equate the W boson with other physical constants (see section on relations to Planck constant), we find that there is a discrepancy in the W boson mass value equivalent to the electron g/2 factor. For this reason we believe that this estimate of the W boson mass value needs to be corrected by this factor.

The ratio between the magnetic moment of the electron and the Bohr magneton is:

$$g/2 = \frac{\mu_e}{\mu_B} = 1.001159652$$

Using the g/2 factor to correct our value, we find that the mass of the W boson is:

$$M_W = \frac{\mu_e\, E_H \cdot e \cdot M_\alpha}{\mu_B\, M_H\, \lambda_{c,e}\, \lambda_{c,p}} = \frac{\mu_e \cdot e \cdot M_\alpha}{\mu_B\, \lambda_{c,e}\, \lambda_{c,p}\, c^2\, (G\, \alpha\, m_e)^{1/4}} = 1.433217602\text{E-}25 \text{ kg} \quad \text{W boson mass}$$

This is equivalent to 80.397576348 GeV/c^2 and is the value we use in all our calculations.

In terms of matching experimental results, it would be safe to assume that experimental results should be somewhere within the range of these two estimates and should be close to the average shown below:

$$\frac{1.431557493\text{E-}25 \text{ kg} + 1.433217602\text{E-}25}{2} \text{ kg} = 1.432387548\text{E-}25 \text{ kg } [m^1 s^{-6}] \quad \text{average}$$

The average value is equivalent to 80.35101372 GeV/c^2.

Equating and Comparing the Two Force Equations

By using the ratio M_α / M_W we can equate the two different electromagnetic force equations:

$$F_{em} = \frac{\mu_e}{\mu_B} \frac{E_H\, e\, M_\alpha}{M_W} = M_H\, \lambda_{c,e}\, \lambda_{c,p} = 7.167935174\text{E-}52 \text{ kg m}^2\, [m^3 s^{-6}] \quad \text{electromagnetic force}$$

Isolating similar masses we get:

$$\frac{(\mu_e\, E_H \qquad e)}{(\mu_B\, M_W\, \lambda_{c,e}\, \lambda_{c,p})} = \frac{M_H}{M_\alpha}$$

1) In this expression, the Higgs boson, M_H which has been experimentally determined to be a particle of neutral charge and of spin zero is being compared to M_α which must be a Helium nucleus of neutral charge and of zero spin by virtue of it being a composite boson.
2) Assuming a similar relationship on the left hand side, the electromagnetic force (E_H e) produced by a charged particle in the Higgs field is being compared to the electromagnetic force ($M_W\, \lambda_{c,e}\, \lambda_{c,p}$) generated by the mass of the W boson. Since (e) represents a particle of elementary charge, we must conclude that the W boson must be a charge carrier as well. This is verified by experiment which shows that the W boson can be of charge W^+ or W^-.

In the next expression, the dimensions of this result (J m) are of the same dimension as the product of the Planck constant (h) and the speed of light (c).

$$\frac{(M_\alpha \;\; e \;\; \mu_e)}{(\lambda_{c,e}\,\lambda_{c,p}\,\mu_B)} = \frac{M_H\, M_W}{E_H} = 3.324316957\text{E-}19 \text{ J m } [m^4 s^{-8}]$$

Joule-metre

Further investigation shows we can equate this with "h c" and other physical constants:

$$\frac{2\alpha^2 \text{ h c } M_\alpha}{\text{G} \quad 2M_\tau} = \frac{(M_\alpha \text{ e } \mu_e)}{(\lambda_{c,e}\,\lambda_{c,p}\,\mu_B)} = \frac{M_H\, M_W}{E_H} = \frac{2m_\gamma\, c^2\, M_\alpha}{\text{G } k_B\, 2M_\tau} = M_W\, c^2\, (\text{G } \alpha\, m_e)^{1/4} = \ldots\ldots..$$

$$\frac{M_W\, (\text{G } \alpha\, m_e)^{1/4}}{\mu_o\, \varepsilon_o} = \frac{M_H\, M_W\, c^2\, \lambda_{c,e}}{4\pi\, m_p} = \frac{M_H\, M_W\, c^2\, \lambda_{c,p}}{4\pi\, m_e} = 3.324316957\text{e-}19 \text{ J m } [m^4 s^{-8}]$$

Relationships with Planck Constant

Solving for Planck constant, h we get these relationships. This greatly increases our understanding of this important constant.

$$h = \frac{m_\gamma\, c}{\alpha^2\, k_B} = k_B \text{ e c} = \frac{2\alpha\, m_e\, c^3}{r_o\, 2\pi r_{c,\gamma}} = \frac{E_H\, c^3\, \lambda_{c,e}\, \lambda_{c,p}}{4\pi} = m_e\, \lambda_{c,e}\, c = m_p\, \lambda_{c,p}\, c = 6.626070041\text{e-}34 \text{ J s}$$

$$h = \frac{\text{G } M_\tau \;\; e \;\; \mu_e}{\alpha^2\, c\, \lambda_{c,e}\, \lambda_{c,p}\, \mu_B} = \frac{\text{G } M_\tau\, M_H M_W}{\alpha^2\, c\, M_\alpha\;\; E_H} = \frac{\text{G } M_\tau\, M_W\, (\text{G } \alpha\, m_e)^{1/4}}{\alpha^2\, M_\alpha\;\; \mu_o\, \varepsilon_o\, c} = 6.626070041\text{e-}34 \text{ J s}$$

$$h = \frac{\text{G } M_\tau\, M_H\, M_W\, c\, \lambda_{c,p}}{\alpha^2\, M_\alpha\;\; 4\pi\, m_e} = \frac{\text{G } M_\tau\, M_H\, M_W\, c\, \lambda_{c,e}}{\alpha^2\, M_\alpha\;\; 4\pi\, m_p} = 6.626070041\text{e-}34 \text{ J s } [m^3 s^{-7}]$$

Gravitational Energy (E_g)

The gravitational energy between an electron and a proton separated by a distance equal to the Compton wavelength of the electron is equal in magnitude to the gravitational attraction between two electrons separated by the Compton wavelength of the proton.

$$E_g = \frac{4\pi \text{ G } m_e\, m_p}{\lambda_{c,e}} = \frac{4\pi \text{ G } m_e\, m_e}{\lambda_{c,p}} = 5.266129382\text{E-}55 \text{ J } [m^3 s^{-8}]$$

Here we pose an equivalent expression involving the mass of the Higgs boson taken to the fourth power which gives the same magnitude of energy as that of the gravitational attraction.

$$E_g = \frac{M_H^4\, \lambda_{c,p}^3}{\alpha\,(4\pi m_e)^3} = \frac{M_H^4\, \lambda_{c,e}^3}{\alpha\,(4\pi m_p)^3} = 5.266129382\text{E-}55 \text{ J } [m^3 s^{-8}]$$

Equating these expressions we get:

$$E_g = \frac{4\pi\, G\, m_e\, m_p}{\lambda_{c,e}} = \frac{4\pi\, G\, m_e\, m_e}{\lambda_{c,p}} = \frac{M_H^4\, \lambda_{c,p}^3}{\alpha\,(4\pi m_e)^3} = \frac{M_H^4\, \lambda_{c,e}^3}{\alpha\,(4\pi m_p)^3} = 5.266129382\text{E-}55 \text{ J } [m^3 s^{-8}]$$

This expression suggests that gravitational energy and therefore gravitational attraction is directly related to the mass of the Higgs boson.

Assuming that the Big Bang theory is true, and the universe was at a much hotter state, these equations suggest as temperatures cooled and the Higgs boson was converted into the fundamental particles (protons and electrons), gravity emerged in the cooling process.

It is therefore possible that the Higgs boson was the initial energy source behind gravity?

Summary

The goal of the MS System is to show an alternative way of doing physics which is much simpler than current methods used by mainstream physics.

In using the MS System, we show that there are simple relationships and expressions which can be used to define and explain phenomena such as the Higgs boson and related particles.

In this paper we derived the following:

E_H = 9.638732018E-32 kg m^2/C $[m^{-2}s^{-4}]$	Higgs field
M_H = 2.235682861E-25 kg $[m^1 s^{-6}]$ = 125.412616 GeV/c^2	mass of Higgs boson
M_W = 1.433217602E-25 kg $[m^1 s^{-6}]$ = 80.397576348 GeV/c^2	mass of W boson
M_τ = 3.168372989E-27 kg $[m^1 s^{-6}]$ = 1777.3269 MeV/c^2	mass of Tau lepton
m_p = 1.672621898E-27 kg $[m^1 s^{-6}]$ = 938.27211 MeV/c^2	proton rest mass
m_e = 9.109383558E-31 kg $[m^1 s^{-6}]$ = 0.51099894 MeV/c^2	electron rest mass

In addition, we show that there may be a link between the Higgs boson and the origin of gravity. Further investigation is required.

Appendix A

Fundamental Parameters of the Universe

c = 2.997924580E+08 m/s [m^1s^{-1}] speed of light in a vacuum
$v_o = (e/(\alpha\, c^2))^{1/2}$ = 1.562974266E-17 m/s [m^1s^{-1}] zero-point velocity
$\lambda_{c,e} = 2\pi r_{c,e}$ = 2.426310237E-12 m Compton wavelength of electron
$r_{c,e}$ = 3.861592676E-13 m [m^1s^0] reduced Compton wavelength of electron
$r_{s,e} = 2G\, m_e/c^2$ = 1.352753926E-57 m [m^1s^0] Schwarzschild radius of electron
$r_o = 2\alpha^2\, m_e/v_o^2 = 2\alpha^2\, m_e/(e/(\alpha\, c^2))$ = 3.971421552E-01 m [m^1s^0] zero-point radius
$\lambda_{c,p}$ = 1.321409854E-15 m Compton wavelength of proton
$\lambda_{c,\gamma}$ = 1.361270434E+27 m Compton wavelength of photon
$r_{c,\gamma} = (2\pi\alpha^2\, k_B)^{-1}$ = 2.166529185E+26 m [m^1s^0] reduced Compton wavelength of photon

Physical Constants derived from the Fundamental Parameters

$E_H = k_B\, r_H$ = 9.638732018E-32 kg m^2/C [$m^{-2}s^{-4}$] Higgs field
k_B = 1.379510242E-23 J/K [$m^{-3}s^{-4}$] Boltzmann constant
r_H = 6.987068108E-9 m Higgs field radius
M_H = 2.235682861E-25 kg Higgs boson mass (125.412616305 GeV/c^2)
$(G\, \alpha\, m_e)^{1/4}$ = 2.580767528E-11 m
$M_W = E_H\, c^2 (G\, \alpha\, m_e)^{1/4}$ = 1.433217602E-25 kg W boson mass (80.397576348 MeV/c^2)
M_α = 6.644657336E-27 kg (CODATA) alpha particle mass (Helium nucleus)
M_τ = 3.168372989E-27 kg Tau lepton mass (1777.3269 MeV/c^2)
$dV_e = e/c^2$ = 1.782661907e-36 m^3 volume element ≈ $(\lambda_{c,e})^3/8$
$\lambda_{c,H}$ = 9.884318787E-18 m Compton wavelength of Higgs boson
μ_o = 1.256637061E-06 [$m^{-7}s^0$] Permeability of free space
ε_o = 8.854187817E-12 [m^5s^2] Permittivity of free space
h = 6.626070040E-34 J s [m^3s^{-7}] Planck constant
G = 6.673308839E-11 C/(kg m^2) [m^2s^4] inverse gravitational field
α^2 = 5.325135448E-05 C/(kg m^2) [m^2s^4] inverse electric field
α = 7.297352566E-03 [m^1s^2] fine structure constant
e = 1.602176621E-19 [m^5s^{-2}] elementary charge
m_e = 9.109383558E-31 kg electron rest mass
m_p = 1.672621898E-27 kg proton rest mass
m_γ = 1.623644356E-69 photon/graviton rest mass
μ_B = 9.274009995E-24
μ_e = 9.284764521E-24
3.326310233E-16 m
$F_{em} = E_H\, e$ = 1.544295109E-50 kg m^2
$F_{em,H} = M_H\, \lambda_{c,e}\, \lambda_{c,p}$ = 7.167935174E-52 kg m^2
ℓ_P = 1.616134996E-35 m

Appendix B

In this section we provided details about ($G\ \alpha\ m_e$).

These details however will be limited in explanation because of the importance of this expression in terms of what it says about gravity and therefore requires a full paper of its own. So the details presented here are for those that have read other MS papers and are already familiar with many of the concepts.

($G\ \alpha\ m_e$) = 4.436040909e-43 [$m^4 s^0$] represents the product of a volume and a length.

The volume is that of the photon, $dV\gamma$ and is related to the volume element $dV_e = e/c^2$.

$$dV_\gamma = \frac{G\ dV_e}{\alpha^2} = 2.233981385\text{E-}42\ [m^4 s^0]$$

The length is the zero-point radius (r_o) which is relevant when converting electromagnetic radiation to mass. This value appears when the temperature is reduced to near absolute zero or when velocity is reduced to near zero.

$$r_o = \frac{2\alpha^2\ m_e}{v_o^2} = 0.3972$$

So in terms of volume and length:

$$(G\ \alpha\ m_e) = \frac{dV_\gamma\ r_o}{2} = \frac{G\ dV_e}{\alpha^2}\frac{r_o}{2} = 4.436040909\text{e-}43\ [m^4 s^0]$$

and in terms of length components:

$$(G\ \alpha\ m_e) = \frac{G\ r_H\ \lambda_{c,e}\ \lambda_{c,p}}{\alpha^2\ 4\pi}\frac{r_o}{2} = 4.43604091\text{E-}43\ m^4\ [m^4 s^0]$$

($G\ \alpha\ m_e$) also relates to a number of masses.

$$(G\ \alpha\ m_e) = \frac{\alpha\ m_e\ r_{s,u}\ c^2}{2\ M_u} = \frac{\alpha\ m_e\ h\ c}{4\pi\ M_u\ m_\gamma} = \frac{\alpha\ m_e\ h\ c}{2\pi\ M_P^2} = 4.43604091\text{e-}43\ m^4$$

M_P = 2.17696e-8 Planck mass

The gravitational energy between an electron and a proton separated by a distance equal to the Compton wavelength of the electron is equal in magnitude to the gravitational attraction between two electrons separated by the Compton wavelength of the proton.

$$E_g = \frac{4\pi\ G\ m_e\ m_p}{\lambda_{c,e}} = \frac{4\pi\ G\ m_e\ m_e}{\lambda_{c,p}} = 5.2670\text{e-}55\ \text{J}$$

Here we pose an equivalent expression involving the mass of the Higgs boson taken to the fourth power which gives the same magnitude of energy as that of the gravitational attraction.

$$E_g = \frac{M_H^4\ \lambda_{c,p}^3}{\alpha\ (4\pi m_e)^3} = \frac{M_H^4\ \lambda_{c,e}^3}{\alpha\ (4\pi m_p)^3} = 5.2670\text{e-}55\ \text{J}$$

Equating the two energy equations we get:

$$E_g = \frac{4\pi\ G\ m_e\ m_p}{\lambda_{c,e}} = \frac{4\pi\ G\ m_e\ m_e}{\lambda_{c,p}} = \frac{M_H^4\ \lambda_{c,p}^3}{\alpha\ (4\pi m_e)^3} = \frac{M_H^4\ \lambda_{c,e}^3}{\alpha\ (4\pi m_p)^3} = 5.2670\text{e-}55\ \text{J}$$

Solving for ($G\ m_e\ \alpha$) we get:

$$G\ m_e\ \alpha = \frac{M_H^4\ \lambda_{c,p}^4}{(4\pi m_e)^4} = \frac{M_H^4\ \lambda_{c,e}^4}{(4\pi m_p)^4}$$

This is also equivalent to

$$G\ m_e\ \alpha = \frac{M_H^4}{(E_H\, c^2)^4} = \frac{(\ h\ \ c\ )^4}{(k_B\ T_G)^4}$$

$T_G = 5.57979602\text{E+}8$ kelvin

$T_G = 5.57979602\text{E+}8$ kelvin

$$\lambda_{c,p}^4 = \frac{(4\pi m_e)^4}{(E_H\, c^2)^4} = \frac{(\ h\ \ c\ )^4}{(k_B\ T_{max,p})^4}$$

$$\lambda_{c,p} = \frac{(4\pi m_e)}{(E_H\, c^2)} = \frac{(\ h\ \ c\ )}{(k_B\ T_{max,p})}$$

$$T_{max,p} = \frac{m_p\ T_{max,e}}{m_e} = \frac{m_p\ c^2}{k_B} = 1.0897\text{E+}13\ \text{kelvin}$$

$$T_{max,e} = \frac{m_e\ c^2}{k_B} = 5.9348\text{E+}9\ \text{kelvin}$$

$$\frac{4\pi\ G\ m_e\ m_e}{\lambda_{c,p}} = \frac{M_H^4\ \lambda_{c,p}^3}{\alpha\ (4\pi m_e)^3}$$

We can isolate for M_H^4:

$$M_H^4 = \frac{G\ m_e\ \alpha\ (4\pi m_e)^4}{\lambda_{c,p}^4}$$

This can be used to determine the mass of the Higgs boson:

$$M_H = \frac{4\pi\ m_e\ (G\ \alpha\ m_e)^{1/4}}{\lambda_{c,p}} = 2.235682861E\text{-}25\ kg$$

$$E_H = \frac{M_H}{c^2\ (G\ \alpha\ m_e)^{1/4}}$$

Appendix C – Defining the Dimensioned Fine Structure Constant

The fine structure constant is defined by two new parameters, the volume element, dV_e and the zero-point velocity, v_o which are both derived from known physical constants using MS units.

$dV_e = e/c^2 = 1.782661907E\text{-}36\ m^3$ – the volume element responsible for electric charge

$dV_e \approx (\lambda_{c,e})^3/8$

$v_o^2 = 2\ \varepsilon_o\ k_B = 2\ \varepsilon_o\ \lambda_{c,e}\ m_e/e$
$v_o = 1.562974266E\text{-}17$ m/s - zero-point velocity,
The zero-point velocity appears when electromagnetic radiation is slowed down to near zero velocity. It represents a minimal velocity which provides a minimum kinetic energy to particles as they approach absolute-zero.

Using these new parameters, we define the *dimensioned* fine structure constant ($\alpha\ [m^1s^2]$, as the quotient of the volume element (dV_e) and the minimum velocity squared (v_o^2).

$\alpha\ [m^1s^2] = dV_e/v_o^2 = 7.297352566E\text{-}3\ [m^1s^2]$ - *dimensioned* fine structure constant