35 Steps to a New Fundamental Mass
IWPD Research Center

Step	Logical or Factual Statement	Resulting Expression	Expansion / Supporting Evidence
1	If G is set to 1, then the relative gravitational force between an electron- electron pair can be expressed using consistent units of $\frac{kg^2}{m^2}$.	$\frac{kg^2}{m^2}_{(Force)} = 1 \times \frac{M_e M_e}{d^2}$	The Gravitational Constant (G) serves as a proportionality constant and if equal to unity, it follows that force can be expressed on a relative basis with the units of $\frac{kg^2}{m^2}$. Further, the relative strength between two forces can be established through a ratio in which both factors are described in $\frac{kg^2}{m^2}$.
2	The relative strength of the electrostatic force may be expressed using the same units of force established in Step 1.	$\frac{kg^2}{m^2}_{(Force)} = \left(4.166 \times 10^{42}\right) \frac{M_e M_e}{d^2}$	Coulomb's constant (k) serves as a proportionality constant that is 4.166×10^{42} times larger than the Gravitational constant. If G is set to unity, then k is equal to 4.166×10^{42}.
3	Step 2 is based on an assumption that the electron mass and charge can be normalized to the physical properties of the electron	NOTE: No claim is made as to the mass or charge of the electron, but only that they are normalized and therefore may be represented by the same dimensionless number	This assumption will be addressed in Step 12 and again in Steps 25 and 26.

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4	For an electron – electron pair, an equality can be defined between G and k such that:	$k = 4.166 \times 10^{42} G$	For equal gravitational and electrostatic forces it follows that: $$\frac{4.166 \times 10^{42} G\left(\frac{M_e M_e}{d^2}\right)}{k\left(\frac{M_e M_e}{d^2}\right)} = 1$$
5	An assumption is made that the Planck Length is the correct intrinsic value for the fundamental unit of distance (within several factors of 2pi).	$1.61 \times 10^{-35} m = Planck_{Length}$	This assumption will be addressed in Step 24
6	As a fundamental unit of distance, all other distances can be viewed as a multiple of the Planck Length. Therefore, any length can be expressed as a dimensionless number	One meter is equivalent to the dimensionless value of: $$\frac{1m}{1.61 \times 10^{-35} m} = 6.21 \times 10^{34}$$	This is a commonly held position. Observationally, the Planck Length is on a quantum scale that allows for it to be a fundamental quantum "building block" unit.
7	The same statement can be made for the Planck Time as being a fundamental quantum unit of time.	One second is equivalent to the dimensionless value of: $$\frac{(1s)\left(3 \times 10^{8} \frac{m}{s}\right)}{1.61 \times 10^{-35} m} = 1.86 \times 10^{43}$$	Planck Time is also of a value that allows it to serve as a fundamental quantum "building block" unit

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8	This statement cannot be made for the Planck Mass which is multiples upon multiples larger than existing particles.	One kilogram is equivalent to the dimensionless value of: $\frac{1kg}{2.18\times10^{-8}kg} = 4.59\times10^{-7}$	The fundamental unit of mass is 2.39×10^{38} times larger than the mass of the electron and therefore difficult to position as a quantum "building block" unit of mass. While it can be mathematically justified, the interpretation that mass can be manifested as only a portion of the fundamental mass seems strained and is less than satisfying.
9	Our motivation and core hypothesis is that the Planck Mass is not a "fundamental" mass. While the Planck Mass has significance and is related to the Compton wavelength and Schwarzschild radius, it is difficult to treat the Planck Mass as a truly fundamental mass due to its large mass relative to the quantum scale.	$Mass_{Planck} = 2.18\times10^{-8}kg$	A. Gleeson, University of Texas, *"the Planck mass is incredibly larger than anything we have been able to use to create a single particle. Thus, in addition to the fact that the elementary particles we know have masses with no obvious relation to each other, if they have any particular relation to the Planck mass, it is for now simply some incredibly small fractional number to which we can assign no particular significance."* C. Bambi and F.R. Urban, *Gravitational Particle Production in Braneworld Cosmology*, Phys. Rev. Lett 99, 191302 (2007) V.A. Rubakov and P.G. Tinyakov, *Ruling out the higher spin field solution to the cosmological constant problem*, Phys. Rev. D 61, 087503 (2000) C. Sivaram, *What is special about the Planck Mass?* Indian Institute of Astrophysics, Bangalore 5609034 T. Feder, *Physics Today, 32* (April 2006)

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10	The inverse fine structure number can be derived from the mks units of h-bar, c, k and e.	$\frac{hc}{2\pi k e^2} = 137$	$\frac{\left(6.63\times10^{-34}\frac{kg\cdot m^2}{s}\right)\left(3\times10^8\frac{m}{s}\right)}{2\pi\left(8.99\times10^9\frac{kg\cdot m^3}{C^2\cdot s^2}\right)\left(1.6\times10^{-19}C\right)^2} = 137$
11	Through substitution from Step 4 it can be shown that:	$\frac{hc}{(2\pi)\left(4.166\times10^{42}\right)Ge^2} = 137$	$\frac{\left(6.63\times10^{-34}\frac{kg\cdot m^2}{s}\right)\left(3\times10^8\frac{m}{s}\right)}{(2\pi)\left(4.166\times10^{42}\right)\left(6.674\times10^{-11}\frac{m^3}{kg\cdot s^2}\right)\left(9.11\times10^{-31}kg\right)^2} = 137$
12	Step 11 requires a unity between the mass of the electron and the electron charge. The electron may manifest itself differently to propagate different forces, but the physical electron is a physical electron whether it is propagating the gravitational force or the electrostatic force	$\left(\frac{Electron_{mass}}{Electron_{charge}}\right)^2 = 1$	This is true is you define $k = 4.166\times10^{42}G$ If you define using Planck Units, then $k = G = 1$ and it becomes the ratio of electron mass to electron charge squared that must be equal to 4.166×10^{42}. While mathematically allowed, it seems inherently strange to state that the essence of an electron in one instance is not equal to the same essence of an electron in a different instance. Particularly if they both play out through the same unified field as required by E Theory.
13	The Planck Length is currently defined as:	$G = \frac{2\pi}{h}$	This provides the substitution for Step 14

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14	Through further manipulation of Step 11 and with the substitution from Step 13 it can be shown that:	$\frac{h^2 c}{(2\pi)^2 (4.166\times10^{42}) e^2} = 137$	$\frac{\left(6.63\times10^{-34}\frac{kg\cdot m^2}{s}\right)^2 \left(3\times10^8\frac{m}{s}\right)}{(2\pi)^2 (4.166\times10^{42})(9.11\times10^{-31}kg)^2 \left(3\times10^8\frac{m}{s}\right)^3 (1.61\times10^{-35}m)^2} = 137$
15	To this point we have made only two assumptions:	1. The Planck Length, as currently derived, does provide a correct (or nearly correct) value for the intrinsic fundamental unit of length. 2. The mass and charge of the electron should be normalized to the physical properties of the electron and therefore may both be expressed by the same dimensionless number.	Using current Planck Values, the electron mass and charge are not equivalent and are expressed as dimensionless value of: $\frac{9.11\times10^{-31}kg}{2.18\times10^{-8}kg} = 4.18\times10^{-23}$ And, electric charge has a dimensionless value of $\frac{1}{e^2} = 137$ Therefore, $e = 0.0854$
16	It is known, and has been shown that:	$G \propto \frac{1}{h}$	Step 13 substantiates an inverse relationship between G and h.
17	It is also known, and often applied, that a fundamental mass would have a Compton wavelength equal to h.	If a fundamental mass is equal to unity, then: $\lambda_{fundamental\ mass} = h$	$\lambda_{fundamental\ mass} = \frac{h}{M_{fundamental}\times c} = \frac{h}{(1)(1)}$
18	Therefore it follows that:	$G \propto \frac{1}{\lambda_{fundamental\ mass}}$	The Gravitational Constant is therefore a function of the Compton wavelength of the fundamental mass

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19	Relative Gravitational Force may therefore be expressed in units of $\frac{kg^2}{m^3}$ by expressing the proportionality constant (G) as a wavelength in units of m^{-1}:	$Force_{gravitational} = \frac{M_e M_e}{(\lambda_{fundamental\ mass})(d)^2}$	This suggests that the fundamental mass is related to the force mitigating properties of gravitational force
20	Relative Electrostatic Force may also be expressed in units of $\frac{kg^2}{m^3}$ by expressing the proportionality constant (k) as a wavelength in units of m^{-1}:	$Force_{electrostatic} = \frac{M_e M_e}{(\lambda_{fundamental\ charge})(d)^2}$	This requires the fundamental charge to be 4.166×10^{42} times larger than the fundamental mass and suggests that the dimensionless value of the charge is directly related to the ratio of (k) over (G).
21	Therefore, it follows that the dimensionless value of charge must be 4.166×10^{42} times larger than the dimensionless value of the fundamental mass, which by definition is unity.	The value of k may be increased only by increasing the value of charge, relative to the value of mass.	This suggests that the value of the constant (k) cannot change without a corresponding change in the value of charge.
22	Combining Step 20 with Step 14 provides:	$\frac{h^2 c}{(2\pi)^2 (4.166 \times 10^{42})(4.166 \times 10^{42})^2} = 137$	$\frac{(2.21 \times 10^{-42}\ kg \cdot m)^2}{(2\pi)^2 (4.166 \times 10^{42})^3 (1.61 \times 10^{-35}\ m)^2} = 137$
23	Solving Step 22 for mass results in:	$2.18 \times 10^{-73}\ kg = 1$	Suggesting that the fundamental “building block” unit of mass is $2.18 \times 10^{-73}\ kg$.

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24	Next, let's examine the assumptions made. Step 23 is not dependent upon the assumption in Step 5. Any Planck Length can be used with its effects canceled out by the resulting change in the relationship between G and h.	If Planck Length = $1.61\times10^{-35}m$ then, $G\cdot h=2\pi$ If a different Planck Length is used, for example $1.01\times10^{-34}m$ then, $2\pi\cdot G\cdot h=1$	The change in Planck Length is completely canceled out by the change in the relationship between G and h. The assumption from Step 5 has no impact on the outcome of Step 23
25	The assumption of normalization between the mass and charge of the electron	This is based on observation	The electron represents the single stable particle of the universe that carries the fundamental charge. While other particles contain charge, they are either not stable and/or associated with the transmittal of nuclear forces. In E Theory, all forces play out through a single unified field; therefore, it is inconsistent to think that the magnitude of force can change without a relationship between the value of k and the value of charge. Therefore, the statement that the charge of the electron is carried via the substance (mass) of the electron is an observational statement.

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26	To further elaborate on the observation from Step 25, assume that the relative strength of the electrostatic force to gravitational force was twice as strong as that observed. In this case:	$\frac{h^2 c}{(2\pi)^2 (8.332\times10^{42})(8.332\times10^{42})^2} = 137$	Solving for the fundamental mass would provide a value of $7.70\times10^{-74}\,kg$ resulting in a fundamental charge of: $(7.70\times10^{-74}\,kg)(8.332\times10^{42}) = 6.42\times10^{-31}\,kg \neq M_e$ Therefore, one must ask whether it is by coincidence or by confirmation that when electron mass and charge are normalized that the calculated mass of the electron exactly matches observation only when the relative electrostatic force to the gravitational force matches the observed value. Note that no claim was made as to the mass of the electron, rather only that mass and charge may be expressed as the same dimensionless number.
27	What then are the benefits in revising the value of the fundamental mass? A mass of $2.18\times10^{-73}\,kg$ serves as a truly fundamental "building block" unit for mass.	The mass of the electron can be expressed as a dimensionless number as: $\frac{9.11\times10^{-31}\,kg}{2.18\times10^{-73}\,kg} = 4.17\times10^{42}$	This revised fundamental mass allows for the possibility that gravity is propagated through the emission of a fundamental quantum mass.
28	This suggests that gravitation may be described as the emission of a quantum particle (QM), or by the warping of space as required by GR.	Unity values have been established for both mass and length. By the definition of unity, they are equivalent. Therefore the emission of a fundamental entity can be interpreted as either the emission of mass or a disturbance in space.	The surrounding area of a mass is disturbed through either the emission of mass or the emission of space creating a fluctuation in the local field that results in gravitation. This suggests a path for the unification of the particle nature of QM with the geometry of GR.

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29	What then is represented by the traditional Planck Mass of $2.18 \times 10^{-8} kg$?	The traditional Planck Mass may well represent the largest possible particle with the smallest possible Compton wavelength. This suggests that the fundamental unit of length is: $\lambda = \frac{6.63 \times 10^{-34} \frac{kg \cdot m^2}{s}}{\left(2.18 \times 10^{-8} kg\right)\left(3 \times 10^8 \frac{m}{s}\right)}$ $= 1.01 \times 10^{-34} m$	This suggests a fundamental length with a value of $1.01 \times 10^{-34} m$ which differs from the traditional Planck Length by a factor of 2π.
30	Based on the fundamental mass and length it is possible to determine the dimensionless value of h	$\lambda = \frac{h}{mc} = \frac{6.63 \times 10^{-34} \frac{kg \cdot m^2}{s}}{\left(2.18 \times 10^{-73} kg\right)\left(3 \times 10^8 \frac{m}{s}\right)}$ $= 1.01 \times 10^{31} m$	Therefore, the dimensionless value for the wavelength of the fundamental mass is: $\frac{1.01 \times 10^{31} m}{1.01 \times 10^{-34} m} = 1 \times 10^{65} = \lambda_{fundamental} = h$
31	An inverse relationship between G and h can therefore be established as:	$G = \frac{1}{2\pi h}$	The dimensionless value of G can therefore be determined as: $\frac{1}{(2\pi)(1 \times 10^{65})} = 1.6 \times 10^{-66}$

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32	The significance of this can be further demonstrated through a new relationship for the velocity of an object in a gravitational field	$$v^2 = 1 - \frac{1}{\left[1 + \left(\frac{1}{2\pi h}\right)\left(\frac{M}{d}\right)\right]^2}$$ Which is equivalent to: $$v^2 = 1 - \frac{1}{\left[1 + G\left(\frac{M}{d}\right)\right]^2}$$	This expression is accurate for both non-relativistic and relativistic velocities where unity represents a background field (the absence of mass) and the term $$\left(\frac{1}{2\pi h}\right)\left(\frac{M}{d}\right)$$ represents a disturbance (either through the propagation of a quantum mass or a quantum change in the local value of length) due to a gravitating mass and resulting in gravitation. J. R. Laubenstein, *Energime, A Theory of Everything – Yet , Almost Nothing at All* (IWPD Publishing, Naperville, 2005); p 34-38
33	By changing the wavelength of the force mitigating particle, the effect of electrostatic force can be represented as:	$$v^2 = 1 - \frac{1}{\left[1 + \frac{1}{2\pi\lambda_{charge}}\left(\frac{M}{d}\right)\right]^2}$$ Which is equivalent to: $$v^2 = 1 - \frac{1}{\left[1 + k\left(\frac{M}{d}\right)\right]^2}$$	This expression utilizes the same unified background field as for gravity. The term: $$\left(\frac{1}{2\pi\lambda_{charge}}\right)\left(\frac{M}{d}\right)$$ represents a disturbance – either through the propagation of a virtual particle (quantum charge) or a change in the local value of length – due to the presence of charge resulting in electrostatic force. J. R. Laubenstein, *Energime, A Theory of Everything – Yet , Almost Nothing at All* (IWPD Publishing, Naperville, 2005); p 47-50

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34	Conclusion: A strong case has been made for a new value of the fundamental unit of mass. We believe the argument has been made that this is exclusive of any other allowable value for the quantum unit of mass and that truly intrinsic values of the fundamental units can be derived with values of:	$T_{fundamental} = 3.37 \times 10^{-43}\, s$ $L_{fundamental} = 1.01 \times 10^{-34}\, m$ $M_{fundamental} = 2.18 \times 10^{-73}\, kg$	Because each of these values represent an intrinsic unity within all the universe, it follows that an equivalence exists between these values and that they may well all be different manifestations of the same fundamental entity, for which the IWPD Research Center has named, the "energime." The energime represents a fundamental particle manifested in different ways, yet responsible for all that we observe and measure. J. R. Laubenstein, *Energime, A Theory of Everything – Yet , Almost Nothing at All* (IWPD Publishing, Naperville, 2005)
35	Further Concluded: This is a new and fresh approach, but it is clearly NOT speculative. We believe that every claim has been substantiated and/or verified through physical observation. While it may not look like the change that many anticipate, it does provide a legitimate path and a potential key for better understanding the physical universe through a long overdue discussion around truly intrinsic and universally accepted values for the physical constants.	The arbitrary assignment for the dimensionless values of physical constants is certainly allowed as long as all agree to the "rules." However, the outcomes from such assumptions may be completely consistent, yet far from representative of what is truly real.	Modern physics may be in danger of developing sophisticated models that are internally consistent to the assumptions made, but that represent an "end-run" around a much simpler reality based on the truly intrinsic values of fundamental constants.