The Massive Universe
I - Establishing First Principles.

A. Hughmann

Dec 1, 2017

Abstract

Based on a quantitative assessment of the fundamental forces and constants, we demonstrate a solution to the Constant Speed of Light V's Variable Speed of Light question. The solution provides that all physical constants *begin* at a point of fundamental perfection, where their values can be described in the absolute simplest terms, requiring only the numbers $1,\ 2,\ 3, and\ 5$ to do so. We subsequently demonstrate that by inserting a $Mass\ \ Variable$ into the model, to account for the quantity of mass interacting with our locale of space, we can transform these perfect prime based constants, to attain predictive results that are on average 99.94% in agreement with CODATA values. We conclude that the speed of light is indeed variable, as is every other physical constant.

1 Introduction

It is apparent that there are plausible issues with both the concept and values of the features of our Universe we refer to as the fundamental "constants". One of the most striking being that the results we calculate for the constants will depend on the equations used to calculate those values. For example, using only CODATA recommendations to examine the Reduced Planck Constant $\hbar$, we find that of the three equations listed in Table 2, the equation $\hbar = R_K\ e^2/2\pi$ alone returns the recommended CODATA value. Further, the equation $\hbar = l_p^2\ m_p\ /t_p$ returns a result that is 1.23% in variation to the expected CODATA result.

Variable results are entirely contrary to what we might expect from a set of constant values, and this point alone demonstrates there is something amiss in the current perspective. Further, where experimental measurements are viable, the only constancy evident in the results is that there is no constancy in the results. Experiments attempting to place a fixed value on any of the fundamental constants invariably provide variable answers, including results that exist outside the margin of experimental error or uncertainty [1]. It raises the fundamental question: How is it possible to arrive at variable answers for values that we believe are constant? For if the constants truly are constant, shouldn't we have constant results?

We are forced to conclude that we are not in possession of the correct perspective - either the equations we are using, or the values we use in those equations, are incorrect. As evidenced in this paper, the authors belief is that the problems are confined to the values, or more correctly, our perception of how the values function.

While the apparent differences in the measured values are for all intents and purposes irrelevant on the scales that humans exist, this variability does give rise to problems that manifest in a tangible sense in our physical world. One such example is the variability in mass of the International Prototype Kilogram held by the International Committee of Weights and Measurements. Since their creation, the masses of the reference kilogram and its sister copies have been shown to vary. As above, the only consistency in the variability of these standard kilograms has been that there is no evident consistency in the variability. It has been demonstrated that, when compared to the reference kilogram, the apparent weights of some of the sister kilograms had dropped, while others had risen. Stranger still, some kilograms were recorded as first dropping and then gaining mass during subsequent measurements (Girard, G. 1994 [2]).

The most recent evidence we have with regard to the possibility of variation of the fundamental constants, is the 2017 Physics Nobel winning detection of gravitational waves by the LIGO detector teams [3]. During those detection's it was demonstrated that the value we measure for G varies, and that the value of G is therefore demonstrably affected by changes in cosmic conditions at distances of billions of light years, over time. We find ourselves wondering is this not a contradiction in basic terms, if not a logical fallacy, to accept the results of detection of variations in a fundamental constant?

Supplementary evidence of variations of G can be had from Anderson et al. 2015 [1] where they examine experimental measurements of G since 1962. The papers abstract opens with the profound statement that "About a dozen measurements of Newton's Gravitational Constant, G, since 1962 have yielded values that differ by far more than their reported random plus systematic errors. We find that these values are oscillatory in nature..". Not only did the authors conclude that G is indeed a variable, but that this variation can be modeled using a sine wave pattern having a period of 5.9 years.

Anderson is quoted as saying "Once a surprising 5.9 year periodicity is taken into account, most laboratory measurements of G are consistent, and within one sigma experimental error limits"[4]. Therefore, not only does the paper provide direct experimental evidence of variations in a supposed constant, but further proves the existence of gravitational waves in the substrate of space. For if we accept the conclusions of the paper, then we must accept that the Earth exists at a place in the cosmos affected by a continuous gravitational sine wave with a period of 5.9 years, since at least 1962.

2 The Experiment

The authors have been in pursuit of a variable speed of light theory, the core tenant being: The only consequential difference between any two distinct volumes of space is the quantity of mass contained within or tangibly near those volumes. Meaning mass quantity is *the* fundamental variable, and changes in that variable propagate through the cosmos as consequential changes in the values of the fundamental constants. (Here on, we use the term "fundamental values"). Based on that logic, we had cause to ask the question:

If a change in mass quantity in a volume of space affects the fundamental values in that volume, what values do we model in a volume of space with no mass quantity?

Said otherwise, if our measurements of the fundamental values on Earth are evidently affected by the amount of mass in our locale of space, what can we find out about the fundamental values if we model a theoretical *flat space* locale at a great distance from us, past the edge of our matter filled Universe, and therefore unencumbered by the presence of any mass? The tables below are the results of that question.

2.1 Method

The starting point for the experiment supposed that if there were indeed a theoretical place where space is flat and unencumbered by mass, then at that place the fundamental values should be composed of well ordered, simple, and therefore *beautiful* numbers. We first investigated the equation for the Planck length,

$$l_p = \sqrt{\frac{\hbar \cdot G}{c^3}}$$

which required that we assume three values in order to calculate the fourth. We chose to assume values for c, G and l_p, in the expectation that the correct assumptions should result in a similarly well formed value for $\hbar$.

The selection of the values was deduced from reasoning that if the hypothesis was correct, we should be able to describe what the expected effects would be on the values of Gravity and the speed of light, and therefore estimate how to $dial - back$ their values to model flat space.

The hypothesis predicts that the addition of matter to a volume of space increases the appreciable strength of Gravity at that place, and lowers the speed of light at that place. Therefore, moving to a theoretical remote point in flat space, we know that we need to reduce G and increase c to provide the correct resetting adjustment. For c and G two obvious and entirely elegant candidate values were close by that matched the hypothesis and were in close agreement on the quantity of adjustment required, c $300,000,000$, and G $6.6666\bar{6} \cdot 10^{-11}$.

The author had no opinion on whether the Planck Length would increase or decrease under the hypothesis, but there were two values on the horizon that might be suited for use as flat space values. Phi Φ, at ~ 1.618, is extraordinarily close to the CODATA value for the Planck Length, but did not return anything in the way of elegant form for $\hbar$. However the second option $1.6666\bar{6} \cdot 10^{-35}$ was reasonably close to CODATA value, and shared the same basic form as the previous two. This value returned the most elegant, albeit quite surprising, value for $\hbar$ and was therefore selected.

Table 1 contains the initial selections, and the returned result for $\hbar$. The Adjustment Required column displays the percentage adjustment required on CODATA value, to reach the assumed values, or the result returned for $\hbar$.

Table 1: Initial Selections

	CODATA Value	Assumed Value	Unit	Adjustment Required
c	$299,724,580$	$300,000,000$	m/s^{-1}	+0.091891%
G	6.67408×10^{-11}	$6.6666\bar{6} \cdot 10^{-11}$	$m^3kg^{-1}s^{-2}$	-0.111076%
l_p	1.616229×10^{-35}	$1.6666\bar{6} \cdot 10^{-35}$	m	+3.120701%
		Result		
$\hbar$	$1.0545718 \times 10^{-34}$	$1.125 \cdot 10^{-34}$	Js	+6.679482%

Under the conclusion that the returned value for $\hbar$ appeared harmonious with the form of the assumed values, we pursued the calculation of all other fundamental values. To complete the task, it was necessary to make two further assumptions - the mass of the electron m_e, and the electron charge e, for a total of five assumptions.

By comparing the values returned from the various equations in the framework to the original assumptions, it is evident that there are two classifications. First are *self-verifying* assumed values. These assumptions interact with other indirectly dependent formulae to return a self-verifying result. As as example, if we make an incorrect assumption for the value of G, then the two displayed equations (Table 2) to calculate its value return results differing from the assumption. Accordingly, when the assumed value returns a matching value from the various equations, we consider this assumption to be self verifying, and therefore proven correct within the context of the framework. Self-verifying assumed values are denoted with a v in the Assumed column.

Secondly, are assumed values whose interactions with other formulae are circular, and therefore are *non-self-verifying.* For example, when we assume m_e, all related equations return a matching value regardless of what our assumption was. Therefore we consider these values as non self-verifying, and declare them as they are, our best estimate for what the values *should* look like, in the context of established theory and recognised quantities. These values are denoted with an x in the Assumed Column.

Of the five assumptions, e and m_e are not self verifying within the framework, however there is an indirect method to verify m_e. Because the framework demonstrates that the gravitational coupling constant and Newtons constant of gravitation (expressed as $G/\hbar c$) are in fact exponents of the same value (Table 2), we can see that it is only when we assume the value as displayed, that the symmetry becomes exact at a ratio of $1 : 1{\times}10^{62}$. We view this as a logical result, and therefore consider it an indirect verification of m_e.

2.2 The Results

Table 2 displays the initial results, and is a model of our Universe devoid of matter - *Flat Space*. The five original assumptions we have discussed are contained in the *Assumed Group*, and this is where those values are inserted into the framework. The insertion points are denoted by the aforementioned v or x in the Assumed (A) column, and are also notable for lacking a corresponding equation. Once we have inserted these five values we have enough information to gradually construct all other equations.

The prime factor (PF) column demonstrates that all values we have assessed, we did not venture below classical particle size, can be broken down into a set of prime factor constituents. We use the term with some liberty, as the number 1 is also present. For some values π is included in the PF column, this as a temporary measure. For aesthetic reasons and to display of the elegance of the results, the PF values are displayed without their required 10^x exponential

Table 2: Constructing Flat Space

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Assumed Group				
Speed of Light c	v	$3 \cdot 10^8$	m/s^{-1}	
$c = lp/tp$		$3 \cdot 10^8$	m/s^{-1}	3
$c = Z_0/\mu_0$		$3 \cdot 10^8$	m/s^{-1}	
Gravitational Constant G	v	$6.6666\bar{6} \cdot 10^{-11}$	$m^3kg^{-1}s^{-2}$	
$G = l_p^3/m_p/t_p^2$		$6.6666\bar{6} \cdot 10^{-11}$	$m^3kg^{-1}s^{-2}$	$\frac{2}{3}$
$G = F_p\ l_p^2/m_p^2$		$6.6666\bar{6} \cdot 10^{-11}$	$m^3kg^{-1}s^{-2}$	
Planck Length l_p	v	$1.6666\bar{6} \cdot 10^{-35}$	m	
$l_p = \sqrt{\hbar\ G/c^3}$		$1.6666\bar{6} \cdot 10^{-35}$	m	$\frac{5}{3}$
$l_p = c\ t_p$		$1.6666\bar{6} \cdot 10^{-35}$	m	

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Elementary Charge e	x	$1.6666\overline{6} \cdot 10^{-19}$	C	
$e = 2/R_K\ K_J$		$1.6666\overline{6} \cdot 10^{-19}$	C	$\frac{5}{3}$
$e = \sqrt{2\ h\ \alpha/\varepsilon_0\ c}$		$1.6666\overline{6} \cdot 10^{-19}$	C	
$e = \sqrt{2\ h\ \alpha\ \mu_0\ c}$		$1.6666\overline{6} \cdot 10^{-19}$	C	
$e = F/N_A$		$1.6666\overline{6} \cdot 10^{-19}$	C	
Electron Mass m_e	x	$1 \cdot 10^{-30}$	kg	
$m_e = 2\ R_\infty\ h/c\ \alpha^2$		$1 \cdot 10^{-30}$	kg	1
Fundamental Values				
Avogadro Constant N_A				
$N_A = F/e$		$6 \cdot 10^{23}$	mol^{-1}	
$N_A = R/k$		$6 \cdot 10^{23}$	mol^{-1}	$2 \cdot 3$
Bohr Magneton μ_B				
$\mu_B = e\ \hbar/2\ m_e$		$9.375 \cdot 10^{-24}$	$J\ T^{-1}$	$\frac{3 \cdot 5^2}{2^3}$
Bohr Radius a_0				
$a_0 = 4\ \pi\ \varepsilon_0\ \hbar * 2/e^2\ m_e$		$5.0625 \cdot 10^{-11}$	m	
$a_0 = \hbar/m_e\ c\ \alpha$		$5.0625 \cdot 10^{-11}$	m	$\frac{3^4}{2^4}$
Boltzmann Constant k				
$k = R/N_A$		$1.3333\overline{3} \cdot 10^{-23}$	$J\ K^{-1}$	
$k = m_p\ l_p/T_p\ t_p^2$		$1.3333\overline{3} \cdot 10^{-23}$	$J\ K^{-1}$	$\frac{2^2}{3}$
Compton Frequency F_c				
$F_c = m_e\ c^2/h$		$1.273239544735 \cdot 10^{20}$		$\frac{2^2}{\pi}$
Reduced Compton Frequency				
$F_c = m_e\ c^2/\hbar$		$8 \cdot 10^{20}$		2^3

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Compton Angular Freq ω_c				
$\omega_c = 2\ \pi\ F_c$		$8 \cdot 10^{20}$	s^{-1}	
$\omega_c = (1/\hbar)\ m_e\ c^2$		$8 \cdot 10^{20}$	s^{-1}	2^3
Compton Wavelength λc				
$\lambda = h/m_e\ c$		$2.356194490192 \cdot 10^{-12}$	m	$\frac{3\pi}{2^2}$
Reduced Compton Wavelength $\lambda c/2\pi$				
$\lambda c/2\pi = \hbar/m_e\ c$		$3.75 \cdot 10^{-13}$	m	
$\lambda c/2\pi = \alpha a_0$		$3.75 \cdot 10^{-13}$	m	$\frac{3 \cdot 5}{2^2}$
$\lambda c/2\pi = \alpha^2/4\ \pi\ R_\infty$		$3.75 \cdot 10^{-13}$	m	
Coulomb's constant K_e				
$K_e = 1/(4\ \pi\ \varepsilon_0)$		$9 \cdot 10^9$	$Nm^{2C^{-2}}$	
$K_e = (c^2\ \mu_0)/4\ \pi$		$9 \cdot 10^9$	$Nm^{2C^{-2}}$	3^3
$K_e = \alpha(\hbar\ c/e^2)$		$9 \cdot 10^9$	$Nm^{2C^{-2}}$	
Electric Constant ε_0				
$\varepsilon_0 = 1/\mu_0\ c^2$		$8.841941282883 \cdot 10^{-12}$	Fm^{-1}	
$\varepsilon_0 = 1/120\ c\ \pi$		$8.841941282883 \cdot 10^{-12}$	Fm^{-1}	$\frac{5^2\pi}{3^2}$
Electron Mass Energy Equivalent $m_e c^2$				
$m_e c^2$		$9 \cdot 10^{-14}$	J	3^3
Electron Proton Mass Ratio m/mp				
m_e/mp		$6 \cdot 10^{-4}$		6
Electron Charge to Mass Quotient $-e/m_e$				
$-e/m_e$		$-1.6666\overline{6} \cdot 10^{-11}$	$C\ kg^{-1}$	$\frac{5}{3}$
Electron Radius, Classical r_e				
$r_e = (1/4\ \pi\ \varepsilon_0) \cdot (e^2/m_e\ c^2)$		$2.7777\overline{7} \cdot 10^{-15}$	m	
$r_e = \alpha\lambda/2\pi$		$2.7777\overline{7} \cdot 10^{-15}$	m	$\frac{5^2}{3^2}$
$r_e = \alpha^2 a_0$		$2.7777\overline{7} \cdot 10^{-15}$	m	

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Faraday Constant F				
$F = e\ N_A$		$1 \cdot 10^5$	$C\ mol^{-1}$	1
Fine Structure Constant α				
$\alpha = (1/4\ \pi\ \varepsilon_0) \cdot (e^2/\hbar\ c)$		$0.00740740\overline{740}$	$\frac{1}{135}$	
$\alpha = (\mu_0/4\pi) \cdot (e^2\ c)/\hbar$		$0.00740740\overline{740}$		$\frac{1}{3^3 \cdot 5}$
$\alpha = (e^2/4\ \pi) \cdot (Z_0/\hbar)$		$0.00740740\overline{740}$		
$\alpha = c\ \mu_0/2\ R_K$		$0.00740740\overline{740}$		
$\alpha = K_e\ e^2/\hbar\ c$		$0.00740740\overline{740}$		
Gas Constant R				
$R = N_A\ k$		8	$J\ K^{-1} mol^{-1}$	2^3
Gravitation, Constant Of $G/\hbar c$				
$G/h\ C$		$1.975308641975 \cdot 10^{15}$		$\frac{2^5 \cdot 5}{3^4}$
Gravitational Coupling Constant α_G				
$\alpha_G = G\ m_e^2/h\ c$		$1.975308641975 \cdot 10^{-47}$		
$\alpha_G = m_e/m_p^2$		$1.975308641975 \cdot 10^{-47}$		$\frac{2^5 \cdot 5}{3^4}$
Hartree Energy E_h				
$E_h = e^2/4\ \pi\ \varepsilon_0\ a_0$		$4.938271604938 \cdot 10^{-18}$	J	
$E_h = 2R_\infty h\ c$		$4.938271604938 \cdot 10^{-18}$	J	$\frac{2^4 \cdot 5^2}{3^4}$
$E_h = \alpha^2\ m_e\ c^2$		$4.938271604938 \cdot 10^{-18}$	J	
Josephson Constant K_J				
$K_J = 2\ e/h$		$4.715702017538 \cdot 10^{14}$	$H_z\ V^{-1}$	$\frac{2^4 \cdot 5^2}{3^3 \pi}$
Magnetic Constant μ_0				
$\mu_0 = 120\ \pi/c$		$1.256637061436 \cdot 10^{-6}$	NA^{-2}	
$\mu_0 = \pi/\ 2500000$		$1.256637061436 \cdot 10^{-6}$	NA^{-2}	$\frac{2\pi}{5}$
$\mu_0 = 4\pi \times 10^{-7}$		$1.256637061436 \cdot 10^{-6}$	NA^{-2}	
$\mu_0 = Z_0/c$		$1.256637061436 \cdot 10^{-6}$	NA^{-2}	

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Magnetic Flux Quantum Φ_0				
$\Phi_0 = h/2\ e$		$2.120575041173 \cdot 10^{-15}$	Wb	$\frac{3^3\pi}{2^3 \cdot 5}$
Nuclear Magneton μ_N				
$\mu_N = e\ \hbar/2\ mp$		$5.625 \cdot 10^{-27}$	$J\ T^{-1}$	$\frac{3^2 \cdot 5}{2^3}$
Proton Mass mp				
$mp = 4\ \hbar/c/r_p$		$1.6666\overline{6} \cdot 10^{-27}$	kg	$\frac{5}{3}$
Proton Mass Energy $mp\ c^2$				
$mp\ c^2$		$1.5 \cdot 10^{-10}$	J	$\frac{3}{2}$
Proton Radius r_p				
$r_p = 4\ l_p\ m_p/mp$		$9 \cdot 10^{-16}$	m	
$r_p = 4\ \hbar/mp\ c$		$9 \cdot 10^{-16}$	m	3^2
Proton Electron Mass Ratio mp/m_e				
mp/m_e		$6 \cdot 10^{-4}$		$2 \cdot 3$
Rydberg Constant R_∞				
$R_\infty = m_e\ e^4/8\ \varepsilon_0^2\ h^3\ c$		$1.164370868528 \cdot 10^6$	m^{-1}	
$R_\infty = \alpha^2\ m_e\ c/4\ \pi\ \hbar$		$1.164370868528 \cdot 10^6$	m^{-1}	$\frac{2^6 \cdot 5^3}{3^7\pi}$
$R_\infty = (m_e\ c^2 \cdot \alpha^2/2)/h\ c$		$1.164370868528 \cdot 10^6$	m^{-1}	
$R_\infty = m_e\ e^4/\ 32\pi^2\ \varepsilon_0^2\ \hbar^2/h\ c$		$1.164370868528 \cdot 10^6$	m^{-1}	
$R_\infty = \alpha^2/2\ \lambda$		$1.164370868528 \cdot 10^6$	m^{-1}	
$R_\infty = h\ c\ \alpha^2/2\ \lambda/h\ c$		$1.164370868528 \cdot 10^6$	m^{-1}	
Vacuum Impedance Z_0				
$Z_0 = 120\ \pi$		$3.769911184308 \cdot 10^2$		
$Z_0 = (4\pi) \times 10^{-7}\ c$		$3.769911184308 \cdot 10^2$		$2^3 \cdot 3 \cdot 5\pi$
Von Klitzing Constant R_K				
$R_K = h/e^2$		$2.544690049408 \cdot 10^4$	Ω	
$R_K = \mu_0\ c/2\ \alpha$		$2.544690049408 \cdot 10^4$	Ω	$\frac{3^4\pi}{2^2 \cdot 5^2}$
Planck Units				
Planck Charge q				

Fundamental Value	*A*	*Result*	*Unit*	*PF*
$q_p = \sqrt{4\ \pi\ \varepsilon_0\ \hbar\ c}$		$1.936491673104 \cdot 10^{-18}$	*Coulombs*	
$q_p = e/\sqrt{\alpha}$		$1.936491673104 \cdot 10^{-18}$	*Coulombs*	$\frac{\sqrt{5 \cdot 3}}{2}$
Planck Constant h				
$h = \hbar\ 2\pi$		$7.068583470577 \cdot 10^{-34}$	Js	
$h = R_K\ e^2$		$7.068583470577 \cdot 10^{-34}$	Js	$\frac{3^2 \pi}{2^2}$
Reduced Planck Constant $\hbar$				
$\hbar = l_p^2\ m_p\ /t_p$		$1.125 \cdot 10^{-34}$	Js	
$\hbar = E_p\ t_p$		$1.125 \cdot 10^{-34}$	Js	$\frac{3^2}{2^3}$
$\hbar = R_K\ e^2/2\pi$		$1.125 \cdot 10^{-34}$	Js	
Molar Planck Constant $N_A h$				
$N_A h$		$4.241150082346 \cdot 10^{-10}$	$Js\ mol^{-1}$	$\frac{27\pi}{20}$
Planck Mass m_p				
$m_p = l_p^3/G/t_p^2$		$2.25 \cdot 10^{-8}$	kg	
$m_p = \sqrt{\hbar\ c/G}$		$2.25 \cdot 10^{-8}$	kg	$\frac{3^3}{2^2}$
$m_p = l_p/G\ c^2$		$2.25 \cdot 10^{-8}$	kg	
Planck Time t_p				
$t_p = l_p/c$		$5.5555\overline{5} \cdot 10^{-44}$	s	
$t_p = \hbar/m_p\ c^2$		$5.5555\overline{5} \cdot 10^{-44}$	s	$\frac{2 \cdot 5^2}{3^2}$
$t_p = \sqrt{\hbar\ G/c^5}$		$5.5555\overline{5} \cdot 10^{-44}$	s	
Planck Temperature T_p				
$T_p = m_p\ c^2/k$		$1.51875 \cdot 10^{32}$	K	
$T_p = \sqrt{\hbar\ c^5/G\ k^2}$		$1.51875 \cdot 10^{32}$	K	$\frac{3^5}{2^5 \cdot 5}$

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Planck Units, Derived				
Planck Acceleration a_p				
$a_p = c/t_p$		$5.4 \cdot 10^{51}$	m/s^2	$\frac{3^3}{5}$
Planck Angular Frequency ω_p				
$\omega_p = 1/t_p$		$1.8 \cdot 10^{43}$	rad/s	
$\omega_p = \sqrt{(c/\hbar\ G}$		$1.8 \cdot 10^{43}$	rad/s	$\frac{3^3}{5}$
Planck Current I_p				
$I_p = q_p/t_p$		$3.485685011587 \cdot 10^{25}$	A	
$I_p = \sqrt{(4\ \pi\varepsilon_0\ c^6/G}$		$3.485685011587 \cdot 10^{25}$	A	$\frac{3^3\sqrt{\frac{3}{5}}}{2}$
Planck Density ρ_p				
$\rho_p = m_p/l_p^3$		$4.86 \cdot 10^{96}$	kg/m^3	
$\rho_p = \hbar\ t_p/l_p^5$		$4.86 \cdot 10^{96}$	kg/m^3	$\frac{3^5}{2 \cdot 5^2}$
$\rho_p == c^5/\hbar\ G^2$		$4.86 \cdot 10^{96}$	kg/m^3	
Planck Energy E_p				
$E_p = m_p\ c^2$		$2.025 \cdot 10^9$	J	
$E_p = \hbar/t_p$		$2.025 \cdot 10^9$	J	$\frac{3^4}{2^3 \cdot 5}$
$E_p = \hbar\ c/l_p$		$2.025 \cdot 10^9$	J	
$E_p = \sqrt{\hbar\ c^5\ /G}$		$2.025 \cdot 10^9$	J	
$E_p = m_p\ l_p^2\ /tp^2$		$2.025 \cdot 10^9$	J	
$E_p = \hbar\ (1/t_p)$		$2.025 \cdot 10^9$	J	
Planck Energy Density ρ_p^E				
$\rho_p^E = E_p/l_p^3$		$4.374 \cdot 10^{113}$	J/m^3	
$\rho_p^E = c^7/\ \hbar\ G^2$		$4.374 \cdot 10^{113}$	J/m^3	$\frac{3^7}{2^2 \cdot 5^3}$

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Planck Force F_p				
$F_p = m_p\ l_p/\ t_p^2$		$1.215 \cdot 10^{44}$	N	
$F_p = G\ (m_p^2/\ l_p^2)$		$1.215 \cdot 10^{44}$	N	$\frac{3^5}{2^3 5^2}$
$F_p = (1/4\ \pi\varepsilon_0)\ \boldsymbol{\cdot}\ (q_p^2/l_p^2)$		$1.215 \cdot 10^{44}$	N	
$F_p = E_p/l_p$		$1.215 \cdot 10^{44}$	N	
$F_p = \hbar\ /l_p\ t_p$		$1.215 \cdot 10^{44}$	N	
$F_p = c^{4/}G$		$1.215 \cdot 10^{44}$	N	
$F_p = m_p\ c/\ t_p$		$1.215 \cdot 10^{44}$	N	
Planck Impedance Z_p				
$Z_p = \hbar/q_p^2$		30	Ω	3
$Z_p = 1/(4\pi\ \varepsilon_0\ c)$		30	Ω	
$Z_p = Z_0/4\pi$		30	Ω	
Planck Intensity I_p				
$I_p = P_p/\ l_p^2$		$1.3122 \cdot 10^{122}$	W/m^2	
$I_p = c^8/\hbar\ G^2$		$1.3122 \cdot 10^{122}$	W/m^2	$\frac{3^8}{2^3 \cdot 5^4}$
Planck Momentum $m_p c$				
$m_p c = \hbar/\ l_p$		6.75	$kg \boldsymbol{\cdot} ms$	
$m_p c = \sqrt{\hbar\ c^3/G}$		6.75	$kg \boldsymbol{\cdot} ms$	$\frac{3^3}{2^2}$
Planck Power P_p				
$P_p = E_p/t_p$		$3.645 \cdot 10^{52}$	W	
$P_p = \hbar\ /t_p^2$		$3.645 \cdot 10^{52}$	W	$\frac{3^6}{2^3 \cdot 5^2}$
$P_p = c^5/\ G$		$3.645 \cdot 10^{52}$	W	
Planck Pressure p_p				
$p_p = F_p/\ l_p^2$		$4.374 \cdot 10^{113}$	Pa	
$p_p = \hbar/(l_p^3\ t_p)$		$4.374 \cdot 10^{113}$	Pa	$\frac{3^7}{2^2 \cdot 5^3}$
$p_p = c^7/\hbar\ G$		$4.374 \cdot 10^{113}$	Pa	

Fundamental Value	*A*	*Result*	*Unit*	*PF*
Planck Voltage V_p				
$V_p = E/q_p$		$1.045705503476 \cdot 10^{27}$	V	
$V_p = \hbar/t_p\ qp$		$1.045705503476 \cdot 10^{27}$	V	$\frac{3^3\sqrt{\frac{3}{5}}}{2^2 \cdot 5}$
$V_p = \sqrt{c/4\ \pi\ \varepsilon_0\ G}$		$1.045705503476 \cdot 10^{27}$	V	
Planck Volume				
$l_p^3 = (\hbar\ G/\ c^3)^{(3/2)}$		$4.629629629630 \cdot 10^{-105}$	m^3	
$l_p^3 = \sqrt{(\hbar\ G)^3/c^9}$		$4.629629629630 \cdot 10^{-105}$	m^3	$\frac{3 \times 5^2}{2^3}$
$v_p = \frac{4}{3}\pi(l_p/2)^3$		$2.424068405548 \cdot 10^{-105}$	m^3	$\frac{3 \cdot 5^2 \pi}{2 \cdot 3^4}$
Planck Mass Energy Equivalence				
$E_p/m_p c^2 = 1$		1		

3 Observations

The returned values are so well formatted that we have not much choice but to accept that within the context of the framework the assumptions are correct, and that overall the experiment may therefore be revealing the correct perspective from which to view the fundamental values. In reality, only one change has been made to our view of the fundamental values - and that is that they are variables, not constants. The result of accepting this single change is a rebirth of the fundamental values in a manner that seems both as logical and elegant as one might hope.

To add substance to the aesthetics, let us examine the results of Table 2 in a more formal manner. Below we discuss the observations we have thus far made, which provide evidence that the concept of the framework is correct, based on the results it provides.

3.1 Result Equivalence

The most obvious confirmation we might expect from any system is that it agrees with itself. We can see that the framework does indeed provide that ultimate validation, and *all* results agree perfectly with all other results. This is in stark contrast to the current day conundrum, where as discussed in the introduction, differing equations used to calculate the same value provide various results.

3.2 Mass Energy Equivalence

The last equation in Table 2 provides that the framework values retain a perfect mass energy equivalence, wherein $E = mc^2$, or as displayed in Table 2, $\frac{E}{mc^2} = 1$. We have tested the framework extensively, and found that mass energy equivalence holds true under all conditions.

3.3 Gravity Equivalence

As mentioned earlier, we can see that α_G and G are in fact exponents of the same base value. We believe this to be a logical result, in that we are examining two perspectives on the same value and in that sense, an identical base value could be considered a wholly rational conclusion. We therefore consider it a validation for the framework.

3.4 Values containing π

In Table 2 above, all equations that had resulted in a value containing π in the PF column, are further examined in Table 3, below. Table 3 demonstrates that all of these values can further be reduced or increased by factors of π to provide simple results. All of the values can be reduced to a state wherein they can once more be described by an arrangement using only the first four primes.

The column labeled π displays the relevant adjustment of each value, by a factor of π. For example we can see that the Planck Constant becomes the *Reduced* Planck Constant, in that we divide the value by 2π in order to reveal its prime basis. Conversely, the Electric Constant requires a multiplication of 2π in order to reveal the simplicity, and might therefore be considered as the *Increased* Electric Constant.

Table 3: Prime Factorization of the fundamental values containing π

Value	Table 2 Result	π	Result	PF
Magnetic Constant μ_0	$1.256637061436 \cdot 10^{-6}$	$/2\pi$	$2 \cdot 10^{-7}$	2
Electric Constant ε_0	$8.841941282883 \cdot 10^{-12}$	$\cdot 2\pi$	$5.5555\overline{5} \cdot 10^{-11}$	$\frac{2 \cdot 5^2}{3^2}$
Vacuum Impedance Z_0	$3.7699111843 \cdot 10^{2}$	$/2\pi$	60	$2^2 \cdot 3 \cdot 5$
Planck Constant h	$7.068583470 \cdot 10^{-34}$	$/2\pi$	$1.125 \cdot 10^{-34}$	$\frac{3^2}{2^3}$
Molar Planck Constant $N_A h$	$4.241150082 \times 10^{-10}$	$/2\pi$	$6.75 \cdot 10^{-11}$	$\frac{3^3}{2^2}$
Magnetic Flux Quantum Φ_0	$2.120575041 \times 10^{-15}$	$/2\pi$	$3.375 \cdot 10^{-16}$	$\frac{3^3}{2^3}$
Josephson Constant K	$4.715702017 \cdot 10^{14}$	$\cdot 3\pi$	$4.444\overline{4} \cdot 10^{15}$	$\frac{2^3 \cdot 5}{3^2}$
Von Klitzing Constant R	$2.544690049 \cdot 10^{4}$	$/\pi$	8100	$2^2 \cdot 3^4 \cdot 5^2$
Compton Wavelength λ	$2.356194490 \cdot 10^{-12}$	$/2\pi$	$3.75 \cdot 10^{-12}$	$\frac{5 \cdot 3}{2^2}$
Compton Frequency F_c	$1.273239544 \cdot 10^{20}$	$/2\pi$	$2 \cdot 10^{19}$	2^2
Rydberg Constant R_∞	$1.164370868528 \cdot 10^{7}$	$\cdot\pi$	$3.65797896 \cdot 10^{7}$	$\frac{2^6 \cdot 5^3}{3^7}$

4 Transforming the Model

If Tables 2 and 3 are a representation of our Universe at a point in *Flat Space*, and if as asserted, we can transform this space to a model congruent with our measured Universe, then it demands that we insert a variable into the framework as the cause of that transformation. This variable represents the quantity of matter interacting with the space that is being modeled, and will be the catalyst in the transformation of the flat space fundamental values into a form we recognise as describing our local Universe.

When we insert this variable, we expect that it should return via the equations a set of results for the fundamental values that closely match with their CODATA counterparts. We term this value the Mass Variable (Mv).

But how should we choose the variable, what is the correct entry point for it, and how should it interact with the other values? Because it was necessary to assume five values to construct Table 2, we know that we will have to manually insert this variable, or some iteration of it, against each of those five values. We also realise that we can use the self verifying functions of the framework to assess if those choices are correct, in that all equations remain in agreement with each other.

4.1 Assessing the Mass Variable

By comparing the five original assumptions to their CODATA counterparts, we can deduce some important points about the theoretical Mass Variable. We observe that while the flat space values of c and G seem to vary by equal but opposite amounts from our measured local Universe, the changes to our other assumptions are extreme in comparison. This is especially evident in the value of m_e where the variation is almost a full 10% away from its CODATA value. It is therefore evident from Table 4 that we will require an exponential of any one variable for use against all except c and G.

Table 4: Assessing the required Mass Variable

	CODATA Value	Assumed Value	Unit	Difference
c	$299,724,580$	$3 \cdot 10^8$	m/s^{-1}	+0.091891%
G	6.67408×10^{-11}	$6.6666\bar{6} \cdot 10^{-11}$	$m^3kg^{-1}s^{-2}$	-0.111076%
l_p	1.616229×10^{-35}	$1.6666\bar{6} \cdot 10^{-35}$	m	+3.120701%
e	$1.6021766208\times10^{-19}$	$1.6666\bar{6} \cdot 10^{-19}$	C	+4.025152%
m_e	9.10938356×10^{-31}	$1 \cdot 10^{-30}$	kg	+9.776912%

By examining the three equations:

$$c = l_p/t_p \qquad l_p = c\ t_p \qquad t_p = l_p/c$$

and being in possession of two sets of values for c, l_p *and* t_p (those of our measured CODATA Universe and the theoretical flat space values of Table 2), it was possible to calculate the required exponential of any variation in c, that provided that the three equations above held true. It was found that for x variation in c, these equations could only be satisfied by using a variable of x^{32} for the Planck Length, and x^{33} for the Planck Time.

Modeling our Universe, and applying an adjustment variable derived from the speed of light, CODATA c_0 / Assumed value c_1= $0.9990819\bar{3}$, and aforementioned exponentials to l_p and t_p, it was found that the results were in high agreement (See l_p in Table 5) with CODATA values for both Planck values, and therefore the chosen exponentials were deemed correct.

Table 5 shows the exponential adjustment variables chosen to successfully model the CODATA Universe, again using the variable quantity derived from the difference in c_0 and c_1. The final column displays the % match between the framework result and CODATA values, the average of those (excluding the value for c) being 99.974%.

With the framework assembled, we sought to insert exponentials that returned the best overall results when compared to CODATA values. Exponential values for c, G, and l_p are once again self verifying within the framework, while the exponentials required for e and m_e are not. However the exponential values required for e and m_e are evidently the only *sensible* values available for choice. The values were calculated via goal-seeking, but in doing so it was found that using any other exponential resulted in values that were extreme outliers in terms of % match to CODATA. If the framework is correct, then these exponentials are inherently correct, there are no other options.

Table 5: Assessing the required Mass Variable exponentials, and comparing to CODATA values.

	Flat Space Value	Mv	Result (R)	CODATA (C)	C/R
c	$300,000,000$	–	–	$299,724,580$	$0.9990819\overline{3} = Mv$
G	$6.6666\overline{6} \cdot 10^{-11}$	$/Mv$	$6.672792 \cdot 10^{-11}$	$6.67408 \cdot 10^{-11}$	99.983%
l_p	$1.6666\overline{6} \cdot 10^{-35}$	$\cdot Mv^{33}$	$1.616907 \cdot 10^{-35}$	$1.616229 \cdot 10^{-35}$	99.958%
e	$1.6666\overline{6} \cdot 10^{-19}$	$\cdot Mv^{43}$	$1.602124 \cdot 10^{-19}$	$1.602176 \cdot 10^{-19}$	99.999%
m_e	$1 \cdot 10^{-30}$	$\cdot Mv^{102}$	$9.105688 \cdot 10^{-31}$	$9.109383 \cdot 10^{-31}$	99.959%
				Average⇒	*99.974%*

4.2 Constructing a CODATA Universe using the Mass Variable

Finally we present the completed model, assembled from the various components we have explored thus far. In order to construct the model, we needed to decide on a number for the Mass Variable. Obviously, we are trying to choose a number that is a good representation of the amount of matter affecting the locale of our measured CODATA Universe, and therefore we need to assess experimental data to get a perspective on what the variable might be. When attempting to asses if any particular CODATA recommendation or standalone experimental result might be more reliable or relevant than any other, and therefore the natural basis for the Mass Variable, we concluded that we could make no such judgment.

If the premise of the framework is shown to be true, then we must assume that *any* experimental measurement on record, must be subject to the rules of the model while the experiment was being performed. We would need to know the actual results of this model during those experiments, before we could assess the validity of any particular value as being most accurate. It would at least require that we assess at what point in Anderson's sine wave pattern, mentioned in the introduction, the experiments were carried out.

For example, the value of the Boltzmann Constant has been measured to an accuracy of 0.7 parts in a million [5], but as we have no way of determining the *variable* cosmic conditions as they were at the time of measurement, and despite the extremely high degree of accuracy, we cannot rationally say that the result is any more valid a reference point for our Mass Variable than any other.

We are therefore required to *choose* a variable, such that when entered into the framework it returns an average best match for the five values of the original assumptions when compared to their CODATA value counterparts. This means that instead of adopting, for example, the speed of light difference of $0.9990819333\overline{3}$ (as in Table 5) as the basis for the Mass Variable, we instead choose a variable that resulted in the best returned average match to CODATA across the five original assumptions.

We also considered this a practical approach, in that using an average value will naturally smooth out both the accuracy of the experimental data points and the unknown background conditions. The decision resulted in a chosen Mass Variable of 0.99085908727, extremely close to the speed of light value above, and resulting in an average match between the five original assumptions and CODATA values of 99.98218%

The selected Mass Variable is represented in the *Mv* column of Table 5. The variable interacts *only* upon our five assumed flat space values, and subsequently propagates though the other equations to provide the values in the *Model Result* column. Finally, in the % column, we can see a % match comparison of the models predicted result to its 2014 CODATA counterpart.

Table 6: Constructing the CODATA Universe from Prime Factors, Pi, and a local Mass Variable

	PF Base	$\cdot$*Exp.*	π	*Mv*	*Model Result*	%
Assumptions Group						
Speed of Light c	3	$\cdot 10^{8}$		$\cdot Mv$	$299,725,773$	99.999
Gravitational Constant G	$\frac{2}{3}$	$\cdot 10^{-10}$		$/Mv$	$6.672766 \cdot 10^{-11}$	99.980
Planck Length l_p	$\frac{5}{3}$	$\cdot 10^{-35}$		$\cdot Mv^{33}$	$1.617120 \cdot 10^{-35}$	99.945
Elementary Charge e	-$\frac{5}{3}$	$\cdot 10^{-19}$		$\cdot Mv^{43}$	$-1.602398 \cdot 10^{-19}$	99.986
Electron Mass m_e	1	$\cdot 10^{30}$		$\cdot Mv^{102}$	$9.109384 \cdot 10^{-31}$	99.999
					Average %$\Rightarrow$	99.982
Electron						
Charge to Mass Quotient-$e/m_e r_e$	-$\frac{5}{3}$	$\cdot 10^{-11}$			$-1.759063 \cdot 10^{-11}$	99.987
Mass Energy $m_e c^2$	3^3	$\cdot 10^{-14}$			$8.183464 \cdot 10^{-14}$	99.956
Mass Ratio m_e/mp	$2 \cdot 3$	$\cdot 10^{-4}$			$5.445673 \cdot 10^{-4}$	99.991
Proton						
Mass mp	$\frac{5}{3}$	$\cdot 10^{-27}$			$1.672774 \cdot 10^{-27}$	99.991
Mass Energy $mp\ c^2$	$\frac{3}{2}$	$\cdot 10^{-10}$			$1.502746 \cdot 10^{-10}$	99.965
Radius r_p	3^2	$\cdot 10^{-16}$			$8.418783 \cdot 10^{-16}$	99.946

	PF Base	*·Exp.*	π	*Mv*	*Model Result*	%
Fundamental Values						
Avogadro Constant N_A	$2 \cdot 3$	$\cdot 10^{23}$			$6.021988 \cdot 10^{23}$	99.997
Bohr Magneton μ_B	$\frac{3 \cdot 5^2}{2^3}$	$\cdot 10^{-24}$			$9.281163 \cdot 10^{-24}$	99.923
Bohr Radius a_0	$\frac{3^4}{2^4}$	$\cdot 10^{-11}$			$5.294515 \cdot 10^{-11}$	99.948
Boltzmann Constant k	$\frac{2^2}{3}$	$\cdot 10^{-23}$			$1.384275 \cdot 10^{-23}$	99.737
Compton Wavelength λc	$\frac{5 \cdot 3}{2^2}$	$\cdot 10^{-12}$	$\cdot 2\pi$		$2.428385 \cdot 10^{-12}$	99.914
Compton Frequency F_c	2^3	$\cdot 10^{20}$	$/\pi$		$1.234259 \cdot 10^{20}$	99.938
Compton Angular Freq ω_c	2^3	$\cdot 10^{20}$			$7.755080 \cdot 10^{20}$	99.938
Coulomb's constant K_e	3^3	$\cdot 10^{9}$			$8.991773 \cdot 10^{9}$	99.953
Electric Constant ε_0	$\frac{2 \cdot 5}{3^2}$	$\cdot 10^{-6}$	$/2\pi$		$8.839092 \cdot 10^{-12}$	99.830
Radius, Classical r_e	$\frac{5^2}{3^2}$	$\cdot 10^{-15}$			$2.821300 \cdot 10^{-15}$	99.881
Faraday Constant F	1	$\cdot 10^{5}$			$9.649626 \cdot 10^{4}$	99.989
Fine Structure Const. α	$\frac{1}{3^3 \cdot 5}$				$7.299810 \cdot 10^{-3}$	99.966
Gas Constant R	2^3				8.336091	99.740
Gravitation/$\hbar c$	$\frac{2^5 \cdot 5}{3^4}$	$\cdot 10^{15}$			$1.750689 \cdot 10^{-45}$	99.917
G Coup. Const. αG	$\frac{2^5 \cdot 5}{3^4}$	$\cdot 10^{-47}$			$1.750689 \cdot 10^{-45}$	99.939
Hartree Energy E_h	$\frac{2^4 \cdot 5^2}{3^4}$	$\cdot 10^{-18}$			$4.360741 \cdot 10^{-18}$	99.977
Josephson Constant K_J	$\frac{2^3 \cdot 5}{3^2}$	$\cdot 10^{15}$	$/3\pi$		$4.833590 \cdot 0^{14}$	99.951
Magnetic Constant μ_0	2	$\cdot 10^{-7}$	$\cdot 2\pi$		$1.257786 \cdot 10^{-6}$	100*
Magn. Flux Quantum Φ_0	$\frac{3^3}{2^3}$	$\cdot 10^{-16}$	$\cdot 2\pi$		$2.068855 \cdot 10^{-15}$	99.951
Nuclear Magneton	$\frac{3^2 \cdot 5}{2^3}$	$\cdot 10^{-27}$			$5.054219 \cdot 10^{-27}$	99.932

	PF Base	·Exp.	π	Mv	Model Result	%
Rydberg Constant R_∞	$\frac{2^6 \cdot 5^3}{3^7}$	$\cdot 10^7$	$/\pi$		$1.097174 \cdot 10^7$	99.982
Vacuum Impedance Z_0	$2^2 \cdot 3 \cdot 5$		$\cdot 2\pi$		$3.766465 \cdot 10^2$	99.978
Von Klitzing Const. R_K	$2^2 \cdot 3^4 \cdot 5^2$		$\cdot\pi$		$2.582198 \cdot 10^4$	99.964
Plack Units, Base						
Charge q	$\frac{\sqrt{5 \cdot 3}}{2}$	$\cdot 10^{-18}$			$1.875490 \cdot 10^{-18}$	99.997
Constant h	$\frac{3^2}{2^3}$	$\cdot 10^{-34}$	$\cdot 2\pi$		$1.054572 \cdot 10^{-34}$	99.937
Constant, Molar $N_A h$	$\frac{3^3}{2^2}$	$\cdot 10^{-11}$	$\cdot 2\pi$		$3.992736 \cdot 10^{-10}$	99.939
Mass m_p	$\frac{3^3}{2^2}$	$\cdot 10^{-8}$			$2.177130 \cdot 10^{-8}$	99.970
Time t_p	$\frac{2 \cdot 5^2}{3^2}$	$\cdot 10^{-44}$			$5.395331 \cdot 10^{-44}$	99.923
Temperature T_p	$\frac{3^5}{2^5 \cdot 5}$	$\cdot 10^{32}$			$1.412895 \cdot 10^{32}$	99.724
Planck Units, Derived						
Acceleration a_p	$\frac{3^3}{5}$	$\cdot 10^{-51}$			$5.555279 \cdot 10^{51}$	99.923
Angular Frequency ω_p	$\frac{3^3}{5}$	$\cdot 10^{43}$			$1.853454 \cdot 10^{43}$	99.979
Current I_p	$\frac{3^3\sqrt{\frac{3}{5}}}{2}$	$\cdot 10^{25}$			$3.476135 \cdot 10^{25}$	99.988
Density ρ_p	$\frac{3^5}{2 \cdot 5^2}$	$\cdot 10^{96}$			$5.148227 \cdot 10^{96}$	99.978
Energy E_p	$\frac{3^4}{2^3 \cdot 5}$	$\cdot 10^{9}$			$1.955837 \cdot 10^{9}$	99.969
Energy Density ρ_p^E	$\frac{3^7}{2^2 \cdot 5^3}$	$\cdot 10^{113}$			$4.624938 \cdot 10^{13}$	99.979
Force F_p	$\frac{3^5}{2^3 \cdot 5^2}$	$\cdot 10^{44}$			$1.209457 \cdot 10^{44}$	99.979
Impedance Z_p	3	$\cdot 10$			29.972577	99.999
Intensity I_p	$\frac{3^8}{2^3 \cdot 5^4}$	$\cdot 10^{122}$			$1.386213 \cdot 10^{22}$	99.979

	PF Base	*·Exp.*	π	*Mv*	*Model Result*	%
Momentum m_p	$\frac{3^3}{2^2}$				6.525422	99.992
Power P_p	$\frac{3^6}{2^3 \cdot 5^2}$	$\cdot 10^{52}$			$3.625054 \cdot 10^{52}$	99.978
Pressure p_p	$\frac{3^7}{2^2 \cdot 5^3}$	$\cdot 10^{113}$			$4.624938 \cdot 10^{13}$	99.979
Voltage V_p	$\frac{3^3\sqrt{\frac{3}{5}}}{2^2 \cdot 5}$	$\cdot 10^{27}$			$1.042840 \cdot 10^{27}$	99.978
Volume l_p^3	$\frac{3 \cdot 5^2}{2^3}$	$\cdot 10^{-105}$			$4.228893 \cdot 10^{-105}$	99.835
					Average⇒	99.940

*Magnetic Constant %. There is a choice here. As the CODATA value is equal to Flat Space value, we claim the favour of a 100% match

5 The basis for the Mass Variable

We stated in the abstract that it is the addition of matter to a volume of space that effects the changes in the fundamental values. While we have demonstrated above the result of adding this mass variable to a formerly flat space, we have not demonstrated how a change in mass quantity *is* the actual source of the variable.

Under the r^2 rule the force of Gravity between two bodies exists at all distances, reducing asymptotically and never terminating. Therefore, if we were to attempt the calculations to find the actual Mass variable Gravity value we experience on Earth, we would need to model the interaction of the mass of the entire universe in terms of its mass distribution and related distances to Earth. While this is actually somewhat feasible, as a result of the relative homogeneity of the distribution of mass throughout the visible Universe, it is beyond the scope of this paper.

There are other reasons why those calculations are reserved for future discussions. Firstly, it is the authors opinion that not only do we need to account for a Mass Variable in our assessments of the fundamental values but that we will also need a Motion Variable. As one might likely assume, the authors propose that the motion of a body will cause an increase in the Mass Variable relative to its velocity. Further, the authors contend that the reduction of Gravity in an r^2 manner is good only up until a certain distance - we believe that there is a maximum upper limit on the reach of the effects of Gravity, again for reasons we hope to explore in future.

5.1 Earth as the Mass Variable

We do however have the scope to have examine this calculation in the most simplistic terms of the mass of Earth alone. As we will see, and as we might logically suspect, it is the mass of the Earth alone that provides for the vast majority of the gravitational acceleration we experience on Earth.

To demonstrate, firstly, the gravitational acceleration on the surface of the Earth using the CODATA value for G, where m is the mass of the Earth and r its radius.

$$g = G \; \frac{m}{r^2}$$

$$g = 6.67408 \cdot 10^{-11} \frac{5.972 \cdot 10^{24}}{(6.371 \cdot 10^6)^2}$$

$$g = 9.8196497377 \; m \; s^{-2}$$

Secondly, we examine the same equation but with its alternative rendering, this time applying the flat space value for G. In this case we are modeling a volume of space with the presence of Earth being the only matter in the locale. Therefore, we are modeling only the effect of the Earths mass (at rest) on the fundamental values in an otherwise empty (flat) space.

$$g = G \; \frac{m}{r^2}$$

$$g = 6.666\overline{6} \cdot 10^{-11} \frac{5.972 \cdot 10^{24}}{(6.371 \cdot 10^6)^2}$$

$$g = 9.8087424162 \; m \; s^{-2}$$

.

The resulting difference between the two values at 0.0109073216 $m \; s^{-2}$ demonstrates how close the results actually are, and thus that the mass of Earth provides for an amount of gravitational acceleration that is equal to 99.89% of the value we currently experience.

As has already been demonstrated the value of G is variable when in the presence of mass, with a base value of $6.666\overline{6} \cdot 10^{-11} m^3 kg^{-1} s^{-2}$ when unencumbered. Therefore, it now appears erroneous to apply a value of $6.67408 \cdot 10^{-11} m^3 kg^{-1} s^{-2}$ for G, regardless of circumstance, because if we do so we are in effect double counting the effects of the mass of the Earth and its interaction with G.

To wit, as per the two equations above, the mass of Earth alone accounts for 99.89% of gravitational acceleration on the Earths surface, and so we can infer that the mass of the Earth accounts for 99.89% of the difference between CODATA and Flat Space values for G. This means that to reach a figure of $6.67408 \cdot 10^{-11}$ for G , we *mus*t have already included the mass of the Earth, as the mass of the Earth is the cause of almost the entire difference in the two values.

We can examine the above equations and results in reverse to see this. If we start with the first result above, today's expected value for ga, 9.8196497377 $m \; s^{-2}$, and work backwards by taking out the mass and radius of Earth, we know that we must be left with a value of $6.67408 \cdot 10^{-11}$ for G, the CODATA value. Subtracting the flat space value of $6.6666\overline{6} \cdot 10^{-11}$from the CODATA value, leaves a difference of $7.41333 \cdot 10^{-14} m^3 kg^{-1} s^{-2}$.

Of that $7.41333 \cdot 10^{-14}$, we know that the mass of Earth accounts for 99.89% of it, or $7.40517 \cdot 10^{-14}$, and subtracting that majority part leaves a final remainder of $8.1546 \cdot 10^{-17} m^3 kg^{-1} s^{-2}$. Regardless of the component factors, like the presence of mass in our solar system and beyond, or the motion of the Earth, this remainder value *is* the Mass Variable of our locale of space, excluding the mass of Earth.

Therefore, to calculate gravitational acceleration on the surface of the Earth, we first need to add the final remainder value of $8.1546 \cdot 10^{-17}$ to the flat space value of G, $6.666\overline{6} \cdot 10^{-11}$, resulting in a value of $6.66667482133 \cdot 10^{-11} m^3 kg^{-1} s^{-2}$ for the strength of Gravity in our cosmic locale. This value, we term GMv, is the mass variable of Earth excluding the mass of the Earth, stated in terms of Gravity. To see its effects we will add it to the flat space value for G, to get an accurate value for the value for G at our location in the cosmos.

In this last set of equations, we demonstrate the accuracy of this approach by modeling the value of ga on the surface of the Earth. The result at 9.8087544142 $m \; s^{-2}$, is a 99.98% match to its CODATA counterpart.

Table 7: Summing the components of G

Component		*Value*	
Flat Space	G	$6.6666\overline{6} \cdot 10^{-11}$	
Earth Locale Mass Variable,	GMv	$8.15466 \cdot 10^{-17}$	
TOTAL	$G + GMv$	$6.66667482133 \cdot 10^{-11}$	
Earth $ga = (G + GMv)\frac{m}{r^2}$	ga	$6.66667482133 \cdot 10^{-11}$	$\frac{5.972 \cdot 10^{24}}{(6.371 \cdot 10^{6})^2}$
Model Result	ga	$9.8087544142\ m\ s^{-2}$	
CODATA	ga	$9.80665\ m\ s^{-2}$	
Model Vs CODATA		99.97854%	

6 Conclusion

There are so many disruptive elements inherent in our overarching hypothesis, that we considered it best to try and dissect it into its most important subsections, to be presented independently. This paper represents what we believe to be the most important of those most important sections, and we believe establishes solid first principles for future arguments.

While the model upends our current view of physics, it does so in the most gentle of manners. By reconciling rather than ravaging our current perspective on the workings of our Universe, it provides an avenue to marry both Newtons and Einsteins perspectives on gravity, showing the truth of both theories in the process.

In terms of classical Newtonian gravity, we can say that Newton was correct - there is indeed a fixed Gravitational Constant, initially. Further, his famous equations involving G are demonstrated as holding true, providing we have the correct perspective on how to use them subsequently.

In terms of Einsteins Relativity, we can say that he was also correct. The framework clearly demonstrates that in the presence of matter, relativistic effects take hold. The result being that all fundamental values will change from constants to variables in proportion to the quantity of mass interacting. We can envisage this changing process as the warping of time-space that Einstein described.

Einstein wrestled with the concept of variable speed of light throughout much of his career, eventually settling on the perspective we understand to be true today - that if the speed of light varies, then the clocks we use to measure its speed will vary in sync with that change. This is exactly as has been demonstrated throughout this paper, and it means that we should not be able to measure any change as we have no valid frame of reference to measure the change against.

As we will discuss in future papers we contend that this is no longer the case, in that we can now use Flat Space as a valid fixed frame of reference to understand the what and why of any effects we are experiencing. This paper demonstrates that we can reverse engineer highly accurate experimental measurements, and deduce our current conditions with regards to our velocity and the presence of mass, even absent any other fixed point of rererence.

Finally, what we have ultimately demonstrated is the existence of the fine tuned universe, on a healthy dose of steroids. The model demonstrates that the Universe is *always* fine tuned. Regardless of what change is made to any one variable, a synchronous change occurs in all other variables resulting in a Universe where the laws of physics always hold true, and the equations we use to model it always produce equivalent results.

We conclude by noting Jackson et al. 2017 [6], and the papers criticisms of LIGO teams interpretation of their Nobel winning data sets. Jackson's paper points to correlations in the background noise of the two detectors at the time of the detection, and reasons that these could therefore be background noise and not true signals. LIGO representatives responded by saying that there are some unexplained correlations, but that they should not affect the team's conclusions. [7].

We propose that as evidenced in this paper, there should definitely exist a correlation in background noise and that this background noise is in fact signal. The signal is the constant ebb and flow of changing conditions in the Universe, changes that occur at all places at all times. As evidenced by all experimental measurements ever undertaken, it results in a set of fundamental values that vary.

7 Contact

A.Hughmann
a.hughmann@protonmail.com
Email Public PGP key can be downloaded here:
https://mega.nz/#!g6gWUSQK!2yPN_wxPy1jk0Jc3akZwVz8c77K_N7ueBFRCA62TFs4

7.1 Model Download

The spreadsheet model can be downloaded here:
https://mega.nz/#!0jhWAbBT!OrAR0d-J9fBBhRnwWFrrkmeuUSlUwfZrkvPOQ678AJk

References

[1] J. D. Anderson, G. Schubert, V. Trimble and M. R. Feldman. "Measurements of Newton's gravitational constant and the length of day." EPL 110 (2015) 10002, doi:10.1209/0295-5075/110/10002

[2] Girard, G., 1994, "The Third Periodic Verification of National Prototypes of the Kilogram (1988 – 1992)", Metrologia 31 (4), 317-336

[3] Barry Barish, Kip Thorne and Rainer Weiss. www.nobelprize.org 2017 (8PIDR/9·10-11)

[4] Phys Org, April 2015. https://m.phys.org/news/2015-04-gravitational-constant-vary.html

[5] de Podesta M, Underwood R J, Sutton G, Morantz P, Harris P M, Mark D F, Stuart F M, Vargha G and Machin G. "A low-uncertainty measurement of the Boltzmann constant" 2013 Metrologia 50 354-376. iopscience.iop.org/0026-1394/50/4/35

[6] James Creswell, Sebastian von Hausegger, Andrew D. Jackson, Hao Liu, Pavel Naselsky. "On the time lags of the LIGO signals". 2017 arXiv:1706.04191 / 1706.04191v2

[7] https://www.quantamagazine.org/strange-noise-in-gravitational-wave-data-sparks-debate-20170630/